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The Role of Gut Microbiota in Neuropathic Pain

Weihua , Ding, MM; Zerong , You, PhD; Jianren, Mao, MD PhD; Shiqian, Shen, MD

Accumulating evidence supports a functional connection between the gut and the brain: 'gut-brain axis'. In this context, many pain conditions are accompanied by GI symptoms. Gut microbiota, consortium of microorganisms residing in the gastrointestinal tract, has recently been implicated in many pain conditions, including inflammatory pain, visceral pain, and human fibromyalgia. We have focused on the role of gut microbiota in the development of neuropathic pain using preclinical animal models of chemotherapy-induced neuropathy and peripheral nerve ligation, using a combination of metagenomics, immunological and behavioral assays. In both animal models, we found that gut microbiota is critical for the development of neuropathic pain. More specifically, for chemotherapy-induced neuropathic pain, the role of gut microbiota is mediated, in part, by Toll-like Receptor 4 on the blood derived innate inflammatory cells, including macrophages. On the other hand, for neuropathic pain associated with peripheral nerve ligation, the role of gut microbiota is largely attributed to its impact on the adaptive immune system, particularly the balance between pro-inflammatory and anti-inflammatory cells. Perturbation of the immunological milieu using genetic tools could reverse the effects of gut microbiota in nerve ligation-induced neuropathic pain. Our results provide experimental evidence that gut microbiota plays a key role in neuropathic pain, and more interestingly, novel mechanistic insights into the pathogenesis of neuropathic pain.

Oltipraz ameliorates mechanical allodynia in paclitaxel-induced neuropathic pain via activating Nrf2/HO-1 signaling pathway

Ya-Qun , Zhou, MD, Ph.D; Fei, Cao, MD PhD; Da-Wei , Ye, MD PhD ; Yu-Ke, Tian, MD PhD

Paclitaxel-induced neuropathic pain (PINP) is a common phenomenon seen in paclitaxel related cancer chemotherapy, and unfortunately there are few effective analgesics available to fully control the issue at present. Previous studies have demonstrated oxidative stress plays a pivotal role in PINP, among which nuclear factor erythroid-2 related factor 2 (Nrf2) is considered to be one of the critical regulators in endogenous antioxidant defense. However, whether Nrf2 activation could attenuate PINP remains elusive. In this study, we investigated the analgesic effect of oltipraz, a Nrf2 activator, in a rat model of PINP. Our results showed that a single dose of oltipraz significantly attenuated established mechanical allodynia in PINP. Moreover, repeated injection of oltipraz markedly reversed the mechanical allodynia in PINP without exhibiting signs of tolerance. In addition, the analgesic effect of oltipraz was blocked by Nrf2 inhibitor trigonelline. Interestingly, early treatment with oltipraz failed to prevent the development of mechanical allodynia in PINP, but indeed delayed its onset. Our western blot and immunofluorescence results showed that Nrf2 and HO-1 were significantly upregulated in the spinal cord of PINP rats. Moreover, repeated injection of oltipraz further upregulated the expression of Nrf2 and HO-1 in the spinal cord of PINP rats, which was reversed by pretreatment with Nrf2 inhibitor. These results suggested that oltipraz ameliorated PINP via activating Nrf2/HO-1 signaling pathway in the spinal cord. Therefore, novel or currently available Nrf2 activator may become an alternative therapeutic choice to manage PINP in clinic.

Patient engagement and opioid use in perioperative pain management

Anping, Xie, PhD; Mariel, Villanueva; Yea-Jen, Hsu, PhD; Irini, Hanna, BS; David, Slupek, BS

Introduction

Opioids are excessively used in perioperative pain management (PPM), which promulgates a gateway for opioid diversion, misuse, and dependency [1]. To improve opioid use and the quality and safety of perioperative care, surgical patients are encouraged to participate in PPM [2]. However, empirical data on the impact of patient engagement in PPM is limited. To address this gap, we conducted a cross-sectional survey study to examine the associations between patient engagement in PPM and their opioid use.

Methods

This study was conducted at the Johns Hopkins Hospital where a group of pain specialists developed a program to manage pain for surgical patients through the perioperative period [3]. During each clinic visit, patients participating in the program were surveyed to assess their engagement in PPM, and their daily opioid consumption (DOC) was documented in milligram morphine equivalent. Multiple linear regression models were used to examine the associations between patient engagement in PPM and the change of post-surgery DOC. The Johns Hopkins Medicine Institutional Review Board approved this study.

Results

The analysis included 115 patients who had more than one visit after surgery. Their mean engagement score was 4.02 (SD=0.82) on a 5-point Likert scale, and their average percentage of reduction in post-surgery DOC was 63% (SD=41%). Significant associations were identified between engagement score and reduction in post-surgery DOC ($p=0.014$).

Conclusion

Better engagement of patients in PPM is associated with greater reduction in opioid use after surgery. To optimize perioperative opioid use, future research is needed to identify strategies for engaging patients in PPM.

Gut Microbiota in Mouse Models of Neuropathic Pain

Pingchuan, Ma, Bachelor of Medicine; Gen-Hao, Wu, BS; Ru-Fan, Mo, BS; Yi-Ran, Zhao, BS; Xue-Jun, Song, MD PhD

Introduction: Chronic pain caused by different forms of injury, stress, diseases, or treatment, may exhibit similar painful symptoms but have distinct pathogenesis. Gut microbiota has been found to impact many neuronal functions as well as neurological disorders. In this study we investigated the role of gut microbiota in the development of different forms of neuropathic pain.

Materials and Methods: Sciatic nerve injury (CCI model), oxaliplatin chemotherapy, and diabetes (STZ model) were used for different forms of neuropathic pain in C57BL/6 mice. The gut microbiota was depleted by continuous feeding of antibiotics cocktail in water. Pain behaviors were tested by Von Frey filaments or Hargreaves for mechanical and thermal pain.

Results: Antibiotics treatment significantly decreased the fecal bacteria colony-forming unit (CFU) counting. Following two weeks' antibiotics feeding, in CCI model, antibiotics treatment inhibited thermal hyperalgesia but not mechanical allodynia; in chemotherapy model, both thermal hyperalgesia and mechanical allodynia were prevented; and in STZ model, however, neither thermal hyperalgesia nor mechanical allodynia was altered by the antibiotics treatment. Oral gavage of fecal bacteria from SPF mice restored part of gut microbiota but fully reversed gut microbiota depletion-induced inhibition of CCI-induced thermal hyperalgesia. Cytokine array assay showed that antibiotics treatment caused significant changes in multiple cytokines in the dorsal root ganglion and spinal cord in CCI mice.

Conclusions: These studies have demonstrated different roles of gut microbiota in the development of chronic pain in different forms of stress and may open up a new avenue of pain therapy by manipulating gut microbiota.

Characteristics of streptozotocin-induced diabetic neuropathic pain in rodents

Xue-Jun, Song, MD PhD; Huabao, Liao, MS; Jiangjian, Hu, MS; Ruizi, Huang, MS; Xiaodan, Zhang, MS

Introduction: Mechanisms underlying diabetic neuropathic pain (DNP) remain elusive and the clinical treatments are limited. The most commonly used experimental animal models of DNP showed a large variation in DNP incidence. We aimed to further elucidate the characteristics of DNP models to provide more reliable and stable parameters for studying DNP.

Materials and Methods: DNP models were made by i.p. injection of streptozotocin (STZ) in Sprague-Dawley (SD) rats (single dose, 70 mg/kg) and C57BL/6 mice (40 mg/kg, daily for 5 consecutive days). The diabetes was evaluated by the persistent high blood glucose (>16.6mmol/L for rats, >13.8mmol/L for mice). DNP was evaluated with painful mechanical allodynia.

Results: 87/96 (90.63%) of the STZ-SD rats developed high blood glucose, which was maintained from 7 days to 7 weeks. 43/87 (49.43%) of the hyperglycemic rats developed mechanical allodynia. In STZ-C57BL/6 mice, high blood glucose was seen in 41/54 (75.93%) of them, which peaked within 14 days. Of those hyperglycemic mice, 35/41 (85.37%) exhibited mechanical allodynia. Thermal hypersensitivity was not seen in these rats and mice. Taken together, there are only approximately 45% (90.63%*49.43%) SD rats and 65% (75.93%*85.37%) C57BL/6 mice classified as DNP animals. Our preliminary clinical survey showed that there were 11/65 (16.9%) type 2 diabetes patients with certain painful experience.

Conclusions: This study indicates that it is necessary to identify the behaviorally expressed painful symptoms in addition to detecting blood glucose and other signs of diabetes in each of the STZ-SD rats and STZ-C57BL/6 mice when we use them to study DNP.

Evoked Compound Action Potentials (ECAPs): Helping to understand Spinal Cord Stimulation (SCS)

Sean, Li, MD; Jason, Pope, MD DABPM FIPP; Steve, Rosen, MD; Christopher, Gilmore, MD

Introduction

Mechanism of action (MoA) of Spinal Cord Stimulation (SCS) is not well understood. Evoked Compound Action Potential (ECAP) recording has many applications and clinical studies evaluating these are on-going[1][2]. As an objective measure of spinal cord (SC) activation, ECAPs can provide insights into SCS effects and MoA (Figures 1-4).

Methods

We summarize literature related to ECAP recording in humans and sheep (methods previously discussed[1][3]) highlighting different ways in which ECAP recording may facilitate improvement and understanding of SCS.

Results

Estimation of chronaxie and rheobase, using ECAP activation threshold, enables an objective approach, which may facilitate tracking neural sensitivity over time. ECAP conduction velocity confirms A β fibers are activated in the dorsal columns[1][3]; recently published work shows conduction velocity changes as ECAPs propagate across vertebral segments. ECAP amplitude depends on lead proximity to the SC, varying with movement, stimulus amplitude, frequency, and recording distance. ECAP amplitude can define a patient's therapeutic range and has intra-operative monitoring applications, whereby the ECAP and a late response (corresponding to dorsal root activation), recorded on implanted leads, help estimate lead laterality. Tracking ECAP amplitude over time provides insights into SCS interaction with activity, physiology, medication, and helps optimize therapy; currently being tested in on-going studies utilizing ECAP recording and closed-loop SCS.

Conclusion

ECAP recording has many applications, one of which is ECAP-controlled CL-SCS. ECAPs provide several insights into SCS effects, including: fiber types stimulated, neural sensitivity and conduction, estimating neural activation, estimating lead location. These have already helped improve understanding, outcomes, and programming.

Provider Communication Preferences for Opioid-Related Clinical Care Programming

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Introduction:

It can be difficult for providers to review expansive patient information. Clinical care teams can serve as facilitators of the most relevant patient-specific diagnostic and treatment information. To account for workflow preferences, clinicians were asked for their preferred communication methods for general contact and patient-level reports provided by a clinical care team.

Methods:

Between March-September 2019, a clinical care team queried clinics on their communication preference for ongoing general contacts related to opioid prescribing and for patient reports on high risk opioid use. Preferences were collected and extracted through an IRB-exempt quality improvement project. Practice preference was assigned to each healthcare professional, then associated with rurality and peer group.

Results:

2043 providers gave general contact preference; 2520 providers gave patient report preference. In both groups, 89% practiced in urban areas (40% generalists, about 25% non-physicians). Overall, general contact preference was phone-79%, email-18%, email or phone-2.2%, or fax-< 1%; patient report preference was fax-59%, email-29%, direct message-3.5%, online portal-2.5%, or multiple-5.8%. Preferences were comparable across practice locations (Table 1). Most preferred phone for general contact (>70%) and fax (>50%) for patient reports, with the exception of emergency physicians (62%, email general contact) and dentists (54%, email patient reports).

Conclusions:

Though advanced options such as direct message were offered to providers, traditional methods of phone and fax dominated provider communication preferences. Preferences were not greatly influenced by provider location or peer group. Future analyses will investigate associations between contact preferences and opioid-related quality metrics.

Pain Registry Biobank: A Protocol for a Novel Approach to Studying Pain

Raymond, Kroma, BS; Nicholas, Giordano, PhD RN; Guinevere, Johnson, BA; Mary, McDuffie, BSN RN; Kalyn, Jannace, MPH; Peter, Bedocs, MD PhD; Krista, Highland, PhD; Chester, Buckenmaier, MD

Introduction

An estimated 25 million Americans experience chronic pain, resulting in related annual expenditures in excess of \$600 billion [1,2]. Biomolecular and epigenetic research on pain remains lacking compared to other less prevalent conditions. The Uniformed Services University (USU) Pain Registry Biobank (PR Biobank) is a clinical data registry and tissue biobank resource for pain-related interdisciplinary research endeavors to move pain science forward.

Methods

Individuals with and without pain who are eligible for care in the Military Health System (MHS) are recruited from clinical settings in military treatment facilities (currently one site; two additional sites in the process of obtaining regulatory approval). Participants are asked to complete a multidimensional assessment battery and provide biospecimens four times in the first year of participation, and annually thereafter. The assessment battery, the Pain Assessment Screening Tool and Outcomes Registry (PASTOR), assesses physical, psychological, social, and behavioral symptoms associated with pain and pain-related treatments. Additional medical record data is extracted and merged with participant-reported and biospecimen data.

Results

Thirty participants are currently enrolled, 88% of whom have also completed their first follow-up survey and biospecimen collections. Researchers who would like to obtain PR Biobank data and biospecimens will be asked to complete a brief application to ensure samples will be used for scientifically-sound studies with regulatory approval.

Conclusion

The USU PR Biobank links biological samples with PASTOR data, providing an opportunity to address research gaps and enhance healthcare while significantly minimizing the resources and time needed to conduct pain research.

Management of Functional Back Pain: A New Curriculum for Nurse Practitioner Residents at a Veterans Affairs Medical Center

Ann, Hansen, MD; Aubree, Argyle, DNP; Donna, Lowther, NP; Paula, Carvalho, MD

Nurse practitioners have an increasing role as primary care providers in our evolving medical system and must be prepared to manage the most common patient complaints, such as “nonspecific” low back pain. We have developed a new curriculum based on an understanding of functional muscle pain (1,2), to prepare nurse practitioner residents at a Veterans Affairs Medical Center to effectively triage patients with low back pain and develop tailored treatment programs and/or timely specialty referrals.

This educational program was added to a previously described musculoskeletal curriculum (3). It was implemented over 1 ½ days and included an examination sequence based on an itemized checklist, video demonstrations, interactive didactic sessions, and hands-on case studies using standardized patients. Didactic Power Point presentations focused on 1) the approach to back pain with a broad differential diagnosis, and 2) a thorough functional evaluation of the patient including social, psychiatric, physiological, and medical factors. The curriculum is unique in the physical examination sequence of 1) a neurovascular screen to identify pathology warranting imaging or specialty referral, 2) lower extremity evaluation to identify joint pain, pes planus, leg length discrepancy or other factors contributing to faulty ergonomics, and 3) the Kraus-Weber tests to assess strength and flexibility of key posture muscles.

The current class of three nurse practitioner residents completed the one-day curriculum. Two residents completed an additional half-day consisting of case studies and objective structured clinical examination (OSCE). Residents reported high satisfaction scores and self-reported benefit from the course. OSCE scores were 90% and 100%.

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Violence in the Pain Clinic: Results from a Survey at the American Academy of Pain Medicine Meeting

Rajat, Moman, MD MA; Dermot, Maher, MD MS MHS; W. Michael, Hooten, MD

Introduction:

In 2015, 51% of chronic pain clinicians reported receiving threats and 2% were assaulted. We sought to determine the prevalence of workplace violence in a group of clinicians who attended a workplace violence education session at a national pain conference.

Materials and Methods:

Our Institutional Review Board did not require review of this project. Eligible clinicians included physicians, physician assistants, nurse practitioners, nurses, and other healthcare practitioners in attendance of a 1-hour education session at the 2019 American Academy of Pain Medicine Annual Meeting entitled “Chronic Pain Patient-Physician Scenarios Which Can Lead to Violence”. Fifty-eight (83%) of attendees completed the survey.

Results:

The average age (SD) of respondents was 47.5 (12) years and 23 (41%) were female (Table 1). Forty-three (80%) practiced pain medicine the majority of the time. Sixty-eight percent were threatened by a patient at least once a year. When threatened, the most common mitigation strategy was patient dismissal (40%); 24% endorsed carrying a weapon or using protective equipment (Table 2).

Conclusions:

Clinicians more commonly withdraw high-risk patient access to facilities in response to perceived risk. In contrast, Hills et al. conducted a large survey of Australian practitioners and found that restricting or withdrawing high risk user access was positively associated with aggression while optimizing comfort in patient waiting areas was associated with less aggression.

It is imperative for clinicians to acknowledge this risk and to recognize high risk clinical scenarios. Future research should be directed towards developing and implementing data-driven risk mitigation strategies aimed at reducing the rate of workplace violence.

Use of Tele-Health for Pain in US Armed Forces- Experience from Walter Reed National Military Medical Center

Christopher, Spevak, MD MPH JD; Taylor, Byrne, MS DO

Objective

The high prevalence of chronic pain within the military health system is compounded by limited access to chronic pain specialists, specifically with regard to patients at remote military treatment facilities (MTFs). The goal of this study is to evaluate an ongoing “Telepain” Service within the National Capital Region (NCR) and report its effects on access to care and patient satisfaction.

Design

Since 2009, Walter Reed National Military Medical Center (WRNMMC) has been utilizing live videoconferencing for initial Pain Medicine consultations at remote Military Treatment Facilities (MTFs) within the NCR. Over a 13 month period, all Telepain patients were asked to complete a survey after the initial consultation.

The questions were designed to gauge impact on patient’s access to care, quality of life, overall patient satisfaction, and privacy concerns.

Setting

Patients at remote MTFs within NCR referred to WRNMMC for Telepain consult.

Subjects

Sixty-six patients evaluated via Telepain.

Methods

Patients were asked to complete a post-visit survey, designed to gauge impact of the Telepain visit on access to care, quality of life, overall satisfaction, and privacy concerns.

Results

Respondents agreed or strongly agreed that Telepain increased access to care (98.5%) and decreased travel time (96.9%). When asked if they would recommend a Telepain visit to others, 93.9% agreed that they would. Regarding satisfaction, 83.3% of patients were completely satisfied or very satisfied.

Conclusions

The current study demonstrates the ability of the Telepain Program at WRNMMC to increase access to care to patients at remote MTFs with an overall positive reception.

Prevalence and Predictors of Periodic Leg Movements in a Real-World Chronic Pain Cohort

Shai, Gozani, MD MPH; Xuan, Kong, PhD

Periodic leg movements (PLMs) are repetitive lower body movements that occur during non-REM sleep. Although the neurologic generator for PLMs is unknown, evidence points to enhanced spinal cord excitability and deficient descending inhibition. Abnormal PLMs are associated with increased risk of hypertension, cardiovascular disease and mortality. Elevated PLMs have been demonstrated in chronic pain. The objective of this study was to evaluate PLMs in a real-world chronic pain population. This cross-sectional study analyzed data collected remotely from individuals with chronic pain using a TENS device. In addition to providing neurostimulation, the device measures PLMs by actigraphy. Participants were included if they reported ≥ 3 months pain and used their device for 3+ nights during an initial 2-week assessment period after starting TENS therapy. PLMs were characterized by the PLM index (PLMI, PLM/hour) during this assessment period. Multivariable regression of $\log(\text{PLMI})$ was used to model the association between covariates and PLMI. A total of 3,727 participants were evaluated. The mean PLMI was 7.9 ± 10.1 (median 4.5). The prevalence of abnormal PLMI at the $\geq 5/\text{hour}$ level was 47.0% and 14.5% at $\geq 15/\text{hour}$. Positive predictors of PLMI were age, BMI, pain interference with sleep (11-point NRS) and self-reported restless leg syndrome. Negative predictors of PLMI were female, pain duration ≥ 4 years, pain throughout the day and self-reported spinal stenosis and fibromyalgia. There was a high prevalence of abnormal PLMs in this real-world chronic pain cohort. PLMs may be a useful phenotype and biomarker in chronic pain.

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Do higher out-of-pocket costs reduce prescription opioid use for acute pain? Evidence from a US commercial insurance claims database.

Rebecca, Harris, MD

Introduction. The Trump administration (and others) have proposed increases in out-of-pocket costs for opioid prescriptions to curb excessive use [1]. However, there is currently no evidence on how opioid consumption responds to cost sharing outside of the Medicare Part D context, where the findings have been inconsistent [2,3]. This study addresses a part of that gap by examining the effects of deductibles and copays on the number of opioid prescriptions dispensed to privately insured individuals in outpatient clinics.

Methods. Retrospective cohort study using a national commercial insurance database. Patients had presented with acute back pain (aBP) and received at least one prescription for opioids; none had an aBP diagnosis or an opioid fill in the year preceding the index visit. Negative binomial regression was used to model the effects of out-of-pocket costs on the number of opioid fills, controlling for physician propensity to prescribe opioids, patient socio-economic characteristics, comorbidities and previous health care utilization (to correct for adverse selection), morphine milligram equivalents, aBP subtypes, and other potential confounders.

Results. 4,300 patients (mean age=56 years, SD=17; 55% female; maximum fills=17) were followed for 270 days in 2016. The effect of cost on the number of fills was minimal (for deductibles: elasticity = -0.02, P=0.004; for copays: elasticity = -0.04, P=0.025); i.e., a 100% increase in out-of-pocket costs corresponded to a 2-4% reduction in fills. The estimates were supported in sensitivity and subgroup analyses.

Conclusion. It is unlikely that raising out-of-pocket costs will meaningfully reduce prescription opioid use among commercially insured patients.

Medical Student Education in Pain and Addiction: Curriculum Development and Preliminary Outcomes

Patricia, Tsui, PhD; Kevin, Zacharoff, MD; Richard, Rosenthal, MD; Christine, Cahaney, MD; Timothy, Friedmann, MD

The intersection of pain and addiction and how to treat both is of national concern. Many physicians report inadequate training in the areas of pain assessment, treatment, and aberrant drug-related behaviors. This presentation will describe the development and evaluation of a pilot course for advanced medical students on these topics. Comprehensive course development included both faculty and senior medical student input. Faculty had experience in a variety of related disciplines including Addiction Psychiatry, Psychology, Anesthesiology and Pain Medicine, and Pharmacology. The intention was to develop an elective course devoted to helping students understand the value and importance of a team-based approach, along with utilization of modalities such as a biopsychosocial approach to pain management along with specific social contexts of pain and addiction. Course length was 32 hours over a four-week period, with each week consisting of two 3-hour didactic sessions and one 2-hour session of interactive clinical case-related content that was student facilitated. Five students have completed the course, and it is anticipated that more will enroll for the fall and spring classes. Students were administered the KnowPain-50, Clinicians' Attitudes and Beliefs About Opioids Survey, and Pain Practice Behavior Scale prior to beginning and upon completion of the course. Qualitative student feedback will also be available for analysis. Preliminary results showed improvement in student knowledge about pain assessment and treatment. Additionally, students acknowledged the social relevancy and importance of understanding opioid use in various medical settings, and that all medical students should benefit from this course.

Predicting Persistent Disabling Low Back Pain in Veteran Affairs Primary Care Using the STarT Back Tool

Jacob, Kneeman, MD; Suri, Pradeep, MD

INTRODUCTION:

Stratified treatment approaches for pain conditions may not translate to the unique environment of the Veterans Affairs (VA) system. Our objective was to examine the validity of the STarT Back tool for predicting future persistent, disabling low back pain (PD-LBP) in VA primary care.

METHODS:

Veterans age ≥ 18 years seeking care for low back pain at VA primary care clinics in Washington state completed surveys at baseline and 6-month follow-up. The VA Puget Sound Institutional Review Board approved the study. The STarT Back tool was used to classify Veterans according to their baseline STarT Back risk group (low vs. medium vs. high). The study outcome PD-LBP was defined as a Roland-Morris Disability Questionnaire score ≥ 7 at 6-month follow-up. We assessed discrimination using receiver operator characteristic curves and calculated the area under the curve (AUC). We assessed calibration by taking the model weights for the STarT Back risk groups from the original STarT Back development study and applying these weights to the current dataset.

RESULTS:

Among 576 participants, the STarT Back risk groups significantly predicted PD-LBP at 6-month follow-up ($p < .0001$). The proportion of participants who developed PD-LBP was 54%, 87%, and 97% in the low-, medium-, and high-risk groups, respectively. The AUC was 0.79. However, the observed frequencies of future PD-LBP by STarT Back risk group were substantially higher than the predicted frequencies (Figure 1).

CONCLUSIONS:

The STarT Back risk groups had useful discrimination for future PD-LBP, but poor calibration. STarT Back may require updating before use in VA primary care.

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NIH HEAL Initiative Preclinical and Clinical Programs Accelerating the Discovery and Development of Non-Addictive Therapeutics for Pain

Barbara, Karp, MD; Rebecca, Hommer, MD; Clinton, Wright, MD; Amir, Tamiz, PhD; Sarah, Woller, PhD; Smriti, Iyengar, PhD

Introduction: The NIH HEAL (Helping to End Addiction Long-term) Initiative is an aggressive, trans-NIH effort to speed scientific solutions to stem the national opioid crisis. Launched in April 2018, the Initiative is focused on improving prevention and treatment strategies for opioid misuse and addiction and enhancing pain management. The trans-agency, multi-institute HEAL Initiative is being led by the National Institute of Drug Abuse (NIDA) and the National Institute of Neurological Disorders and Stroke (NINDS). Together, programs within the HEAL Initiative will reduce the burden of illness due to pain and addiction. Within HEAL, NIDA is focused on understanding, preventing, and treating addiction. NINDS is focused on understanding pain mechanisms and developing effective, non-addictive treatments for pain.

Methods: NINDS is tasked with identifying non-addictive pharmacologic and non-pharmacologic therapeutics targeted to specific pain conditions of high unmet need. Together with other NIH Institutes, NINDS has established programs to enhance understanding of chronic pain development, prevention, and treatment, spanning the discovery process from target validation through clinical trials.

Results: This presentation focuses on two NINDS programs open to applications from researchers, including companies and academic institutions: the Preclinical Screening Platform for Pain (PSPP), focused on identifying and profiling non-addictive/non-opioid pain therapeutics, and the Early Phase Pain Investigation Clinical Network (EPPIC-Net), conducting cutting-edge phase 2 trials of new therapies for pain conditions across the age spectrum.

Conclusions: This presentation describes two NIH programs that further efforts to develop and test novel, non-addictive therapies for pain.

Multiple sclerosis related pain with MRI lesion localization correlation and gender differences: A cohort study

Mirla, Avila, MD; Gyeongmo, Sohn, MD; Smathorn, Thakolwiboon, MD

Introduction

Pain has been estimated to occur in 17% to 86% of multiple sclerosis patients. We evaluated whether there were gender differences in MS related pain and localization of lesions contributed to these symptoms.

Methods

This study was conducted at Texas Tech University Neurology Clinic. Approval by the Institutional Review Board was obtained prior to this study.

A total of 98 patients with Multiple Sclerosis, between the age of 18 to 65, fulfilling the 2010 McDonald criteria were enrolled (72 female; 26 male) with utilization of the Modified McGill pain questionnaire.

Patients with previous diagnosis of headache, acute pain due to optic neuritis, and somatic pain were excluded.

Brain and spinal MRI (1.5 Tesla scanner) were obtained and were evaluated for lesion localizations and lesion counts.

Differences by gender in age and pain were tested using two-sided Student's t-test. Pain groups were compared in MRI findings using chi-squared test.

Result

Moderate to severe pain was found in 92.3% of the patients that had a lesions in the thalamus and in 86% of the patient's with brainstem lesions. We found a higher proportion of thalamus and brainstem lesions in males ($p=0.018$, and $p=0.009$ respectively). Spinal, thalamus, and brainstem lesions combined showed also a higher proportion for males than females ($p=0.043$).

Conclusion

Lesions in the thalamus, brainstem, and spinal cord appear to be associated with an increased risk of pain-type symptoms progressing to chronic pain. Early treatment of these lesions, even in clinically asymptomatic patients, may be justified.

Integrated Interventions to Increase Compliance with Practice Guidelines for Opioid Prescribing for Chronic, Non-Cancer-Associated Pain in an Academic Rheumatology Practice

Eric, Wang, MD; Chadwick, John, MD; Rebecca, Helgesen, MBA; Hannah, Lacko, BA MA; Michael, Ashburn, MD MPH MBA; Peter, Merkel, MD, MPH

Introduction: There is substantial concern regarding the use of opioids in patients with chronic, non-cancer-associated pain. Within the University of Pennsylvania Health System the Division of Rheumatology was the fifth-highest prescriber of opioids in 2016, by number of tablets.

Materials and Methods: Division leadership and providers established shared goals at interdisciplinary meetings involving Rheumatology, Pain Medicine, Nursing, and Pharmacy. Interventions included informational sessions on opioid prescribing, new electronic health record tools (e.g. for opioid agreements), and sharing of individual prescribing patterns. An Opioid Dashboard within the electronic health record allowed providers to see their individual and group profiles of total opioid tablets prescribed alongside prescribing habits (e.g. benzodiazepine co-prescriptions). Baseline data (June 2017-August 2017) were compared with monthly data through December 2018. This analysis was deemed exempt from review by the University of Pennsylvania Institutional Review Board.

Results: At baseline, 1.3% of patients had active opioid agreements, 89% had a provider visit within 3 months of the most recent opioid prescription, 25% had a urine drug screen result within 12 months of the most recent opioid prescription, and 24% had concurrent benzodiazepine prescriptions. Within 16 months from the start of the intervention program these percentages were 80%, 90%, 66%, and 16%, respectively. Opioid tablets prescribed per month decreased from 54,170 to 40,894 (-25%). Provider satisfaction with the program was high.

Conclusions: Shared goals developed through interdisciplinary input and feedback from outcomes data can markedly increase compliance with current guidelines for safe opioid prescribing for patients with chronic, non-cancer-associated pain.

Trends in Evaluation and Management of Back Pain in United States Emergency Departments (2007-2016)

Peter, Mullins, MD MA MPH; John, Merriman, MD; Maryann, Amirshahi, MD MPH PhD PharmD; Scott, Weiner, MD MPH

Introduction: Back pain is the most common pain complaint in the United States and is a common reason for presentation to emergency departments (EDs). This study describes trends in the evaluation and management of back pain in US EDs from 2007-2016.

Materials/Methods: We analyzed the National Hospital Ambulatory Medical Care Survey (NHAMCS), an annual national survey of ED visits administered by the National Center for Health Statistics. Data are publicly accessible and de-identified and this study was exempt from IRB review. Analysis included all visits by patients 18 years and older. Back pain was defined by NHAMCS reason for visit codes. We examined demographics, resource utilization (laboratory testing, imaging), and medications, including opioid and non-opioid analgesics. Tests for trend were conducted using survey-weighted logistic regression.

Results: From 2007 -2016, visits for back pain increased from 8.1 to 10.6 million, representing 9.1-9.3% of all ED visits. There were no significant changes in demographics over the study period. Admissions decreased from 6.4 to 5.0%. Imaging use increased significantly over the study period (51.7-57.6%). Laboratory testing increased from 28.7 to 35.8%. Total diagnostics performed increased significantly, as did mean number of medications. Opioid utilization decreased over the study period (53.5-46.5%), except tramadol, which increased from 4.1 to 8.4%. Acetaminophen increased from 6.5 to 8.1%, while muscle relaxants increased from 35.5 to 38.9%. Benzodiazepine use was stable.

Conclusions: This study demonstrates continuing growth in diagnostic intensity of ED visits for back pain, while also demonstrating decreasing overall opioid utilization but increased use of tramadol.

Applying Machine Learning to Decrease Research Chart Reviews of Electronic Health Records: a Method of Automated Opioid Medication Classification for Pain Medicine Research

Sean, McDermott, MD; Andrea, Gillman, PhD; Ajay, Wasan, MD

Introduction: Electronic health record (EHR) systems are often constructed for efficient billing and clinical flow, rather than research investigations. This study presents a novel approach to managing the “big-data” within the EHR, utilizing machine learning to minimize time-consuming chart-review, illustrated by a case-example of opioid medication classification for use in pain medicine outcomes research.

Materials and Methods: 4,216 distinct medication entries were obtained from the EHR of approximately 25,000 pain medicine patients, and subsequently labeled by human reviewers as either opioid or non-opioid medications. A supervised machine learning classification algorithm, incorporating natural language processing and web-searches, was created to automatically classify entries as either opioids or non-opioids. A data subset was used to train the algorithm with the remainder used to evaluate performance. The algorithm was never explicitly programmed to “identify opioids”, but rather trained with multiple case-examples, thereby “learning” to classify medications appropriately.

Results: The algorithm achieved 99.6% accuracy, 97.8% sensitivity, 94.6% positive predictive value, and 0.998 AUC of the ROC curve, for a 60% training/40% testing-set. Approximately 15-20 opioid examples were the minimum needed to achieve 90-95% accuracy and sensitivity, with AUC values above 0.95.

Conclusions: The algorithm demonstrated a high level of accuracy, with a practical number of input examples required. This illustrates one possible application of machine learning to organize data in the EHR, saving researchers time performing chart-review. Similar approaches could have a multitude of applications in data structuring, predictive analytics, and pattern recognition, thereby advancing research and clinical care in pain medicine and beyond.

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Systemic Opioid Prescribing Patterns and Total Cost of Care: A Retrospective Analysis of Patients Initiating Spinal Cord Stimulation Therapy

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Introduction: Few studies have evaluated patterns of systemic opioid use among patients initiating spinal cord stimulation (SCS) therapy for chronic pain. Our study evaluated patterns of systemic opioid use and total healthcare cost following start of SCS.

Methods: Using a commercial insurance Database (2008-2017), we selected patients initiating SCS therapy followed for 1 year baseline and 2 year follow-up. All systemic opioid prescriptions were converted into morphine milligram equivalents (MME). The primary endpoint was defined as: discontinuation (≥ 365 -day gap between prescription fills or total days' supply in follow-up ≤ 30 days) OR $\geq 50\%$ reduction in average daily MME. "Costs" were total payer plus patient payments, adjusted in multivariate difference-in-difference regressions.

Results: 5,902 patients met selection criteria, with 153 (2.6%) having no opioid prescription at any point in the study period. Among patients with ≥ 1 prescription, 42.4% met the primary endpoint (21.8% discontinuing and 20.5% with $\geq 50\%$ dose reduction). Indication for SCS was not correlated with probability of meeting the primary endpoint, while age, anticonvulsant or NSAID use, and baseline avg daily MME were. Mean total costs were significantly reduced in years 1 and 2 of follow-up relative to baseline (excluding SCS insertion costs), with the magnitude of reduction greater among those that met the primary endpoint.

Conclusions: This analysis shows that among patients that start and continue SCS therapy for at least two years, a significant proportion were able to reduce and/or discontinue systemic opioid use and SCS does reduce total treatment cost relative to baseline.

Frequency of opiate administration in the Emergency Room according to triage level

Tiffany, Mathias, MD

There has been a 6-fold increase in opioid overdose deaths in 2017 in comparison to 1999 in the US. We investigated whether high utilization of opioids also happened in the emergency room. Our hypothesis was that ED patients designated as lower acuity will experience as frequent administration of opioids for pain control despite reporting similar initial pain scores as their higher acuity counterparts.

A live electronic medical record review of adult emergency medicine patients at a large academic center was conducted from October 1-15, 2017. Acuity was designated by ESI (emergency severity index) triage level documented at time of triage ranging from 2-5. Patients with chief complaints of chest, abdominal, pelvic, extremity, and head pain were included in the study. Parameters recorded included initial triage level, initial pain scale, time to pain medication administration, and pain medication used (opioid or non-opioid).

739 patients were included in the study. 22% of patients received opioids during their ED stay. 69.4% of ESI 2 patients were given opioids during their stay, compared with 21.7% in ESI 3, 8.8% in ESI 4, and The mean pain score was highest at ESI 3 at 5.8 with average mean pain score ranging from 4.9 to 5.8.

The data seems to demonstrate that patients triaged as higher acuity received opiates more frequently than patients who were lower acuity. Future studies should investigate whether this phenomenon is present in community-based EDs, and whether longer length of stay impacts the likelihood of opiate administration.

Overprescribing Opioids for Back Pain

Aakash, Thakral, MD; Nicole, Vendola; Sagar, Parikh, MD

Introduction:

Back pain is the single leading cause of disability worldwide. In the United States, opioid prescription for low back pain has increased, and opioids are now the most commonly prescribed drug class. In a recent study of 26,000 patients with back pain, 61% of patients received opioids, and 19% were chronic users. Not much research has studied opioid use in patients with back pain compared to other pain sources.

Methods and Materials:

A retrospective chart review was performed of 100 patients presenting to a pain management clinic. Data collected from initial visits included demographics, primary pain complaint, and opioid use. Patients were divided into two groups of back pain or other pain source. A Pearson's chi-squared test compared opioid use in each group.

Results:

On initial presentation, 70 patients' primary complaint was back pain, and 51.4% of these patients consumed opioids. Of the 30 patients without back pain, 23.3% used opioids. This finding was statistically significant ($p=0.009$). Patients with back pain were significantly more likely to have tried opiates compared to patients with other sources of pain.

Discussion:

Opioid prescribing rates in the United States are significantly higher than in most European countries. Opioids have not shown to improve functional outcomes for back pain. This research suggests that opiates are being prescribed earlier in the treatment course for back pain compared to other musculoskeletal sources of pain. This brings into question if back pain is being treated appropriately in the primary care setting.

215 | Epidemiology/Healthcare Policy/Education

Developing a COSAM (Core Outcome Set for Acupuncture on Migraine) in Patients Based on the Analytic Hierarchy Process (AHP)

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Background: Migraine is one of the common chronic neurological disorders, for whom the major treatments aim to relieve symptoms. The evaluation for migraine are mainly depended on subjective feelings from patients. Acupuncture is a historic and promising treatment for migraine, while lack of appropriate outcomes to evaluate its clinical efficacy of migraine treatment. The core outcome set (COS) is a potential solving method for evaluation.

Methods: A systematic review was conducted to form an outcome list of acupuncture for migraine treatment. A semi-constructed interview was implemented to replenish and improve the list of outcomes. Physicians and patients Delphi surveys were established for the primary core outcome set for acupuncture on migraine (COSAM). The analytic hierarchy process (AHP) was creative processed to perform the weight analysis. An expert panel meeting was hold on to complete the COSAM.

Results: 57 outcomes were obtained from the results of the SR and Semi-constructed interviews. 10 core outcomes were established primarily after the Delphi survey and the AHP were used to assess each weight factor of the outcome. After the expert panel meeting and outcome synthesis, the final list of COSAM was conducted.

Conclusion: COSAM not only evaluates the relief of acupuncture on pain symptoms and pain degree, but also comprehensive and multi-dimensional assesses patients' quality of life, sleep quality and mental health from the perspective of pain. The list of COSAM will guide the application and the precise evaluation of acupuncture on migraine.

Keywords: Core outcome set, Analytic Hierarchy Process, Migraine, Acupuncture, Systematic review.

Identifying phenotypic subpopulations of chronic pain patients using k-means cluster analysis of body map data.

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Introduction: The distribution of pain regions on a patient-completed body map has been linked to pain syndromes, such as widespread pain/fibromyalgia. We examined whether more detailed cluster analysis of pain body map data could be used to identify subpopulations of chronic pain patients with distinct phenotypes.

Materials and Methods: The completed pain body map data for 37 coded regions in 22,000 patients at the UPMC Pain Medicine clinics were coded as a 0 for no pain, 1 for unilateral pain, or 2 for bilateral pain. A k-means cluster analysis was performed and demographics, baseline characteristics, and 3-month outcomes were examined for pain, mental health, and physical health measures and compared across the clusters.

Results: The analysis identified six distinct clusters: (1) widespread pain, (2) joint pain, (3) low back and leg pain, (4) neck, upper back, and shoulder pain, (5) lower back pain, and (6) a “blank” map containing patients with focal pain. Each cluster had considerable phenotypic differences in pain characteristics, depression, anxiety, and physical function.

Conclusions: Chronic pain patients can be divided into 6 clinically relevant groups based solely on the regions they select on the pain body map. Body map selection cluster membership may provide a rapid screen with important prognostic and therapeutic implications.

Comparing two interdisciplinary care models in chronic noncancer pain management (CNCP)

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Introduction: Interdisciplinary models of care (IM) improve outcomes in patients with CNCP on high-dose opioids. How to structure interdisciplinary interventions effectively is unclear and multiple models have been proposed.

Objective: To compare two IM (“Intensive” versus “Limited” interventions) for high-risk patients.

Methods: A retrospective, observational comparison of 2 IM for CNCP at Kaiser Permanente, Washington DC/Suburban Maryland that includes a pain physician, psychologist, pharmacist, and nurse navigator. Patients using over 90 morphine milligram equivalents (MME) are included in a longitudinal program with multiple encounter types; others opt for only chart review or single assessment from August 2018 to August 2019. All patients are reviewed monthly with ongoing communication with primary providers to convey recommendations and encourage best care.

Results: Of 116 patients, 82 are in the Intensive program, averaging 14 contacts; 34 in the Limited averaging 5. Mean age was 60 years in the Intensive group and 57 years in the Limited group. 61% were female in the Intensive group and 59% were in the Limited. Initial opioid use was higher in the Intensive group (225 versus 185 MME). Intensive group reduced opioid use 58%, benzodiazepine use 16%, and increased naloxone filling 44%. Limited group reduced opioid use 30%, benzodiazepine use 3%, and improved naloxone filling 32%.

Conclusions: Even limited assessments by an interdisciplinary pain management team are effective at reducing opioid use, reducing high-risk concurrent benzodiazepine use, and improving filling of naloxone prescriptions in highest risk patients with CNCP. However, intensive, ongoing interdisciplinary follow up has even better outcomes.

Decrease Adverse Drug Events Related to Opioids by Improving Parent and Nurse Knowledge of Pain Management in Postoperative Infants & Toddlers

Michelle, Felix, DNP MSN CRNP; Sharon , Kozachik, PhD RN FAAN; Emily, Boss, MD MPH FACS

Problem: Lack of knowledge and recognition of age appropriate and paradoxical reactions to opioids in postoperative infants and toddlers by parents and nurses led to continued opioid administration and more severe adverse events.

Methods: This Johns Hopkins Hospital IRB approved QI project utilized pre/post-test design and chart review. The project took place on the Johns Hopkins Children's Center infant and toddler units. Participants included all registered nurses on these units and English-speaking parents of children newborn to 36 months of age admitted directly to the infant and toddler units after elective general pediatric surgery procedure. Parents received an educational handout specific to postoperative infants and toddlers describing causes of postoperative pain, mild to severe and paradoxical responses to opioids, effective nonopioid medication and nonmedication pain therapies. Nurses received, a twenty-minute presentation on literature findings, adverse drug events (ADEs) in the target population, project goals and the parent educational handout. A four scenarios questionnaire that included an ADE with varying levels of pain was administered to both parents and nurses before and after they received education to measure knowledge change.

Results: There was a 35.9 % reduction in opioid administration, 117.95% increase in NSAID, 4.64% increase in acetaminophen and zero rapid response events. No statistically significant change in nurse knowledge. Parent knowledge change could not be evaluated.

Conclusion: Education focused on signs of adverse effects, effective nonopioid and nonmedication therapies can help guide nurses to use nonopioid analgesics decreasing opioid related ADEs. No statistically significant change in knowledge was measured.

301 | Pharmacological

Accelerated Gabapentin Titration with Associated Hepatotoxicity: A Case Report

Ian, Osburn, MD MPH

Abstract

Gabapentin is commonly used for treatment of neuropathic pain. For ambulatory outpatients, titration rate limited by sedation and ataxia. Little is known regarding proper dosing for inpatients who are non-ambulatory suffering from debilitating neuropathic pain. This case report describes an accelerated titration regimen resulting in a Gabapentin induced liver injury, a rarely described adverse event.

Past research in the acute preoperative setting has showed reduced postoperative pain when given $\geq 900\text{mg}$ for a one-time dose. When used for acute alcohol withdrawal, a high dose taper (initial dose $2,800\text{mg/day}$) has shown reduction in daily lorazepam requirements and reduced length of stay. Only a handful of cases of hepatotoxicity associated with gabapentin are documented.

Case Report

46y Female presented to Emergency Department with acute back pain and left leg pain. Imaging showed new disc herniations at L2/3 and L4/5 resulting in mild-mod nerve root impingement on left. Evaluated by Orthopedics and Neurosurgery who felt no acute surgical intervention required and manage conservatively. Hospitalization complicated by difficult to control pain despite high dose narcotics, multimodal analgesics, steroid taper, CT guided TFESI at described levels. Decision made for aggressive titration of Gabapentin. Over 6 days, Gabapentin initiated and titrated to $1,200\text{mg TID}$. Day 10, care complicated by chest pain, diplopia, hallucinations, and transaminitis on blood work. Hepatology consulted, patient had negative liver infectious/autoimmune workup. Day 17, Liver biopsy showed portal inflammatory infiltrate consistent with drug induced liver injury (DILI). Gabapentin weaned down with a resultant downtrend in liver function enzymes.

302 | Pharmacological

Double-masked, placebo-controlled trial of botulinum toxin for endometriosis-associated chronic pelvic pain: 1-month data

Barbara, Karp, MD; Hannah, Tandon, BA; Vy, Phan, BS; Jacqueline, Aredo, BS; Ninet, Sinaii, PhD; Jay, Shah, MD; Pamela, Stratton, MD

Introduction: Despite standard therapy, women with endometriosis often develop chronic pelvic pain (endo-CPP) sometimes with pelvic floor muscle spasm. Botulinum toxin (btx) is widely used for muscle overcontraction and pain. We conducted a double-masked/placebo-controlled trial of btx for endo-CPP.

Methods: Participants aged 18-50 with surgically-diagnosed endometriosis/CPP underwent evaluation including pelvic examination to confirm pelvic floor spasm as a main pain generator, pain rating, medication tracking and Oswestry disability questionnaire. Participants were randomized to 100U onabotulinumtoxinA/placebo transvaginal injection into areas of pelvic floor spasm. Baseline evaluations were repeated at 1-month. Response was rated by patients as none/minimal/mild/moderate/excellent and percent improvement. Adverse effects were recorded. Data were compared by t-tests or non-parametric tests. Categorical data were compared with Fisher's exact test or tests-for-trend if ordinal. Herein, we report 1-month results; longitudinal data are under analysis.

Results: 30 women were randomized. At 1-month, 11 women in the placebo group reported no benefit compared to only 4 in the btx group($p=.027$). The btx group reported a greater degree of benefit($p=.030$) and greater percent improvement($p=.034$). Neither group reported substantial changes in pain rating on VAS. Only the btx group had fewer muscles with spasm. Disability worsened considerably in the placebo group, but didn't change in the btx group. 5 btx patients reduced their pain medication vs. 1 placebo patient. Adverse events were transient and not serious, without a difference between cohorts($p=.11$).

Conclusions: We demonstrate benefit from btx in women with endo-CPP compared to placebo.

304 | Pharmacological

Conversion of CII opioid to buprenorphine buccal film: A retrospective analysis

Amanda, Zimmerman, PA-C

OBJECTIVE: Provide clinical conversion data and education in regard to CII opioid conversion to buprenorphine buccal film. Demonstrate change in NRS and MME.

METHODS: Retrospective analysis of conversion from CII opioid medication to buprenorphine buccal film. Chart review to assess NRS and MME prior to, and following conversion.

RESULTS: A total of 163 patients were successfully converted, and 138 achieved stable dose representing 84.6% transition success rate. 84 patients were converted directly from LAO to buprenorphine buccal film. Of the cohort whose MME was < 90, (n=39) direct LAO conversion to 150 mcg q12h (6); 300 mcg q12h (14); 450 mcg q12h (15); and 600 mcg q12h (4). MME 91-150 (n=35), 150 mcg q12h (1); 300 mcg q12h (9); 450 mcg q12h (13); 600 mcg q12h (9); and 750 mcg q12h (3). MME 151-200 (n=8), 300 mcg q12h (1); 450 mcg q12h (1); 600 mcg q12h (1); and 750 mcg q12h (2). MME >200 (n=2) 300 mcg q12h (1); and 450 mcg q12h (1). Overall average NRS prior to conversion 5.91, after 5.25 (-.66). NRS reduction was demonstrated in all subsets except the 150-199 MME group who remained on BTP medication (+.11). MME reduction of 73.6% in the data set of patients who remained on BTP medication.

CONCLUSIONS: This retrospective analysis provides valuable information regarding clinical conversion data. Demonstration of continued analgesia despite a reduction in MME when comparing CII opioids to buprenorphine buccal film.

305 | Pharmacological

Association Between Traumatic Brain Injuries and Ketamine Infusion Side-Effects Following Combat Injury

Alexandra, Kane, BS; Nicholas, Giordano, PhD RN; Julie, Tran, BS CCRP; Sianna, Burnett, BS; Chester, Buckenmaier, MD; Michael, Kent, MD; Krista, Highland, PhD

Introduction: Ketamine is a vital component in acute battlefield pain management [1-3]. This study examined whether combat-injured US service members sustaining traumatic brain injuries (TBI) experienced increased odds of ketamine side-effects compared to those without TBI.

Materials and Methods: This secondary analysis included combat-injured service members, ≥ 18 years with documented pain scores 24-hours before and 48-hours after receiving a continuous peripheral nerve block (CPNB) ketamine infusion at Walter Reed National Military Medical Center (WRNMMC) between 2007-2014. The WRNMMC IRB approved the original retrospective study. Logistic regressions examined the association between TBI and ketamine side-effects (e.g, hallucinations, nightmares, dysphoria, nausea, decreased oxygen saturation) during hospitalization.

Results: Of the 77 patients, 62% presented with TBI. There was no statistical difference in ketamine dose or proportion of patients experiencing ketamine side-effects between those with and without TBI (18.8% vs 24.4%), even when adjusting for injury characteristics and pre-infusion opioid doses. Patients presenting with TBI and reporting side-effects received their infusion a median of 10 days post-injury compared to those who did not experience side effects, at 15 days ($p=0.045$).

Conclusions: There was a lack of association between TBI and ketamine side-effects in this sample of combat-injured service members. These hypothesis generating findings support the need for future studies to examine the use of CPNB ketamine infusions for pain management, and subsequent care outcomes in patients who experience TBI.

306 | Pharmacological

CGRP receptor antagonist for the treatment of infraorbital neuralgia: a case report

Michael, Fishman, MD MBA; Lexi, Larson, BS

Introduction

Calcitonin Gene-Related Peptide (CGRP) receptor antagonism has been shown to alleviate infraorbital allodynia in a rodent model. (1) This study found that trigeminal-mediated pain was responsive to CGRP antagonism whereas spinal nerve-mediated pain was not.(1) We hypothesized that CGRP antagonism would improve symptoms in a patient suffering from refractory post-traumatic infraorbital neuralgia.

Case

A 44-year-old male patient suffered a traumatic right orbital fracture with persistent infraorbital neuropathic pain refractory to infraorbital nerve blocks, infraorbital pulsed radiofrequency neuromodulation, and multiple medication trials. Partial relief was only achieved with buccal buprenorphine 750mcg twice daily, medical cannabis, and pregabalin 100mg three times daily. Despite this regimen, the patient reported daily chronic persistent pain in the right hemiface averaging 7/10.

Methods

An intramuscular 240mg loading dose of the CGRP antagonist galcanezumab (Emgality - Eli Lilly & Co, Indianapolis, IN) was administered in clinic, followed by a 120mg intramuscular maintenance dose 30 days later. The PROMIS-29 (Patient Reported Outcomes Measurement Information System) battery was assessed at baseline and regular intervals after galcanezumab treatment.

Results

Prior to the loading dose, subject reported a pain score of 5/10 on average and a month after treatment he reported a pain score of 4/10 on average. 6-month results will be presented.

Conclusion

CGRP antagonism may symptoms related to post-traumatic infraorbital neuralgia.

307 | Pharmacological

Novel Targeted Dual Drug Delivery Using Microneedle Patch for Treating Chronic Post-Surgical Pain

Alyssa, Zhu, MD; Barbara, Ogrodniczak, MS; Miguel, Ramírez; Fernando, Soto, PhD; Ithipon, Jeerapan; Joseph, Wang, PhD; Krishnan, Chakravarthy, MD, PhD

Introduction: Chronic postsurgical pain (CPSP) affects over 10%-50% of patients after surgery. Treatment options for CPSP include oral analgesics and transdermal patches. Microneedles are a novel form of drug delivery to the skin that enhance skin permeability through creation of microchannels (Park et al. 2010) (Praunitz et al, 2008). We present a novel transdermal patch with dual drug release of both lidocaine and gabapentin.

Materials and Methods: We compare commercial lidocaine 4% transdermal patch with Carboxymethyl-cellulose (CMC) and Poly lactic-co-glycolic acid (PLGA) designed microneedle patches. Both in vitro experiments done on phantom gel and ex vivo experiments done on pig skin using screen printed electrodes for measuring diffusion capabilities were conducted.

Results: We compared passive diffusion of lidocaine in phantom gel compared to commercial lidocaine patch at 15, 30, 60 minutes as presented in figure 1. Overall, there was a significant increase in delivery of lidocaine at the 15- and 30-minute time points compared to commercial patches that required one hour prior to reaching similar concentrations of delivery. We also compared Lidocaine diffusion from the MN and commercial patches through 3 mm of pig skin in the PBS solution under over 1h and 2 hours as shown in figure 2. Overall the MNs had delivered over 10 times the amount of Lidocaine compared to commercial patches using an ex vivo skin model.

Conclusions: We found that use of microneedle technology leads to an increased release of lidocaine in both in vitro and ex vivo studies compared to commercial patches

308 | Pharmacological

Memantine Leads to Relief of Lipoedema Related Pain Syndrome

Matthew, Hamilton, MD; Puneet, Mishra, MD; Rebecca, Donald, MD; Jenna, Walters, MD

A 58-year-old female with a complicated past medical history significant for Ehlers-Danlos Syndrome, fibromyalgia, postural orthostatic tachycardia syndrome, obstructive sleep apnea, irritable bowel syndrome, and lipoedema presented for chronic pain management. The patient experienced hyperalgesia secondary to her EDS and previous chronic opioid use. However, her main source of pain was her lipoedema deposit sites. She described the sites as electric bands of pain around her legs, arms, buttocks and thighs. She had failed multiple modalities to control her lipoedema pain and was actively participating in an integrated health and physical therapy program. The patient was treated on memantine 5mg twice a day. This regimen immediately led to a reduction in her pain after one dose. She was titrated up to 10mg twice a day over the next month. Her overall pain level decreased from an 8/10 to a 3/10 and she was pain-free in the lipoedema regions. Six months after the initiation of memantine her lipoedema pain remains well controlled with an improvement in her functional status without further escalation of her medications.

309 | Pharmacological

CGRP antagonism improved quality of life in a chronic CSF leak patient

Michael, Fishman, MD MBA; Ashley, Scherer, BA MA; Ashley, Karatsakes, BA; Lexi, Larson, BS

Intro:

Calcitonin Gene Related Peptide (CGRP) is a neurotransmitter which affects the smooth muscle in blood vessels and directly causes vasodilation. CGRP promotes inflammation secondary to vasodilation which is implicated in migraine pathogenesis. CGRP antagonists are now available on-label for migraine and cluster headaches.

Cerebrospinal fluid (CSF) leaks are caused by a tear in the dura (iatrogenic, spontaneous, or traumatic), resulting in positional headaches. Patients with chronic CSF leaks may experience migrainous features related to intracranial vasodilation secondary to low CSF pressure. We hypothesized symptomatic confirmed or suspected chronic CSF leaks may benefit from CGRP antagonism.

Case:

The patient in this case experienced persistent positional headaches after a traumatic fall and head injury, with MRI evidence of a CSF leak.

Methods:

Galcanezumab (Emgality; Eli Lilly & Co) was administered intramuscularly as a loading dose of 240mg and subsequently as monthly 120mg maintenance doses.

Results:

The Patient Reported Outcomes Measurement Information System (PROMIS)-29 was administered using an electronic platform (Celeri Health; Wilmington, DE) to quantify multidimensional effects. Quality of life was noted to improve across multiple domains: pain impact (20%), fatigue (65.5%), anxiety (61%), depression (54%), and social participation (20.8%).

Conclusions:

CGRP antagonists are currently available for primary headache syndromes. In this case, we present a positive impact on quality of life in a patient with a chronic CSF leak, a type of secondary headache. These results suggest that symptoms resulting from a secondary headache may be improved through CGRP antagonism. Further exploration in this patient population is warranted.

The Effect of the Initial Dose of Methylnaltrexone in Advanced-Illness Patients With Opioid-Induced Constipation

Frank, Peacock, MD FACEP FACC FESC; Neal, Slatkin, MD; Robert, Israel, MD; Nancy, Stamber, DrPH

Introduction: We studied the efficacy and safety of a single methylnaltrexone (MNTX, Relistor®) dose for opioid-induced constipation (OIC) in laxative-treated, advanced-illness patients.

Materials and Methods: This post-hoc analysis pooled data from 3 placebo (PBO)-controlled, double-blind IRB-approved studies. Study 1 (NCT00401362) compared subcutaneous (SC) MNTX 0.15 or 0.30 mg/kg versus PBO (1), study 2 (NCT00402038) compared SC MNTX 0.15 mg/kg versus PBO (2), and study 3 (NCT00672477) compared weight-based SC MNTX 8 mg (38–< 62 kg) or 12 mg (≥62 kg) versus PBO (3). Endpoints were rescue-free laxation (RFL) within 4 or 24 hours after the first dose based on baseline patient functional level (assessed by the World Health Organization [WHO] or the Eastern Cooperative Oncology Group [ECOG] performance status scales), time to RFL, pain intensity, and treatment-emergent adverse events (TEAEs).

Results: There were 518 patients (MNTX=281; PBO=237). Mean (SD) age was 66.2 (13.8) years for MNTX and 65.8 (14.4) for PBO; 50% were men. The most frequent primary diagnosis was cancer (MNTX=70.5%; PBO=66.2%). All but 8 receiving MNTX and 3 receiving PBO used laxatives at baseline. A single dose of MNTX increased RFL rates within 4 and 24 hours regardless of baseline ECOG/WHO status and decreased median time to RFL without changes in pain scores. Most TEAEs were gastrointestinal in nature and decreased by day 2.

Conclusions: Following MNTX, RFL response was rapid and increased versus PBO in advanced-illness patients with OIC, regardless of baseline ECOG/WHO status. MNTX was well tolerated with transient gastrointestinal TEAEs, most of which may be associated with laxation.

311 | Pharmacological

Assessment of Efficacy and Patient Global Impression of Change in Two Clinical Studies of Buprenorphine Buccal Film in Subjects With Chronic Low Back Pain

Joseph, Pergolizzi, MD; Mancina, Ko, PharmD MBA; Gary, Cutter, PhD

Purpose: Buprenorphine buccal film (Belbuca®; BBF) is a partial μ -opioid receptor agonist approved by the US Food and Drug Administration for the treatment of chronic pain. Two pivotal phase 3 clinical trials were conducted in opioid-experienced (Study 3071) and opioid-naïve (Study 3082) patients with chronic low back pain (CLBP) to determine the efficacy of BBF.

Methods: Both clinical trials were multicenter, double-blind, placebo-controlled, enriched-enrollment, randomized-withdrawal studies. For the 12-week double-blind treatment phase, responders to BBF were randomized 1:1 to twice-daily BBF or placebo. The primary efficacy measure was an 11-point numeric rating scale (NRS) of pain. Patient Global Impression of Change (PGIC) was used to assess change in activity limitations.

Results: In Study 307, from baseline (at randomization) to week 12, mean (SD) NRS pain scores increased significantly more for placebo (N=257; 1.92 [1.87]) than for BBF (N=254; 0.88 [1.79]; $p < 0.001$). In Study 308, mean (SD) NRS scores increased significantly more for placebo (N=232; 1.59 [2.04]) than for BBF (N=229; 0.94 [1.85]; $p=0.0012$).

In Study 307, at the end of double-blind treatment, the mean (SD) PGIC score was significantly higher for BBF (N=231; 4.5 [1.86]) than for placebo (N=230; 3.2 [1.98]; $p < 0.001$). In Study 308, the mean (SD) PGIC score was significantly higher for BBF (4.5 [1.75]) than for placebo (3.9 [1.99]; $p=0.0011$).

Conclusions: These results provide evidence that BBF is effective in reducing CLBP and activity limitations in both opioid-experienced and opioid-naïve patients.

312 | Pharmacological

A Pooled Subgroup Analysis From Two Phase 3 Randomized Placebo-Controlled Trials Evaluating the Efficacy and Safety of Naldemedine for the Treatment of Opioid-Induced Constipation by Opioid Dose

Martin, Hale, MD; Todd, Kunkel, MD

Purpose: Naldemedine 0.2 mg was evaluated for its efficacy and safety in the COMPOSE-1 and COMPOSE-2 clinical trials for the treatment of opioid-induced constipation (OIC) according to opioid (morphine milligram equivalent; MME) dose.^{1,2}

Methods: Pooled data were analyzed for spontaneous bowel movement (SBM) responder rates and treatment-emergent adverse events (TEAEs) between two subgroups according to opioid dose strata.

Results: In the pooled population (naldemedine, n=549; placebo, n=546), the percentage increase in SBM responders was higher for naldemedine (difference, 95% CI) than for placebo, with greater efficacy in lower opioid dose groups in both the opioid dose strata (30 to ≤100 MME, 15.9%, CI: 8.3%–23.5% and >100 MME, 16.1%, CI: 7.3%–25.0%) and the average total daily dose (TDD) groups (30 to ≤100 MME, 14.7%, CI: 7.0%–22.5%; >100 to ≤200 MME, 14.9%, CI: 3.7%–26.1%; >200 to ≤400 MME, 18.5%, CI: 3.0%–34.0%). The overall incidence of TEAEs was higher in the naldemedine group than the placebo group, with fewer incidences observed in patients taking lower opioid doses for both opioid dose strata (30 to ≤100 MME, 44.9% vs 43.8%; >100 MME, 47.1% vs 39.8%) and the average TDD groups (30 to ≤100 MME, 45% vs 43.7%; >100 to ≤200 MME, 46% vs 40.7%; >200 to ≤400 MME, 52.9% vs 42.5%).

Conclusions: This pooled data analysis showed more pronounced efficacy and safety of naldemedine 0.2 mg in OIC patients taking lower opioid doses that are consistent with Centers for Disease Control and Prevention recommendations.

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Acute analgesic response to intravenous ketamine is independent of depression symptoms in patients with chronic pain: a retrospective study

Theresa, Lij, MD; Boris, Heifets, MD PhD; Vafi, Salmasi, MD; Sean, Mackey, MD PhD

Introduction: Although chronic pain and depression are frequently comorbid[1], it is unclear whether pre-existing depression influences the analgesic response to ketamine, a dissociative anesthetic with antidepressant properties[2].

Objective: To characterize the association of pre-infusion depression symptoms with acute analgesic response in patients undergoing ketamine infusions for chronic pain.

Methods: IRB approval was obtained for this retrospective study, which includes 65 patients at an academic pain management center who have undergone at least one ketamine infusion and completed at least one PROMIS Depression measure before any ketamine infusion. The primary outcome was Spearman's rank correlation coefficient between the most recent Depression score preceding each infusion and percent change in pain severity recorded immediately prior to and after each treatment. Secondary variables include infusion setting (i.e. inpatient versus outpatient) and highest lifetime Depression score. Differences between continuous variables were identified by t-tests.

Results: No significant association exists between pre-infusion PROMIS Depression scores and subsequent acute changes in pain severity after intravenous ketamine. For outpatients, $r(52)=0.0066$ ($p=0.9632$) and for inpatients, $r(72)=0.0249$ ($p=0.8357$). Outpatient infusions were preceded by slightly higher PROMIS Depression scores (mean 56.4 vs 51.7, $p=0.0026$). Outpatient infusions were also associated with slightly greater reductions in pain severity (mean 69.6% vs 55.4%, $p=0.0249$).

Conclusion: Our study suggests that the acute analgesic response to intravenous ketamine is independent of pre-infusion depression symptoms. Because post-infusion depression was not uniformly assessed, we cannot rule out a relationship between ketamine's antidepressant and analgesic response. Future prospective collection of other pain-related outcomes are indicated in this population.

Opioid Stewardship for Optimal Management Across Care Transitions: Adult Inpatient Rehab

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Patterns of inpatient use and prescribing practices at hospital discharge contribute to prolonged opioid use. Inpatient rehabilitation settings with pharmacists on interprofessional teams and longer lengths of stay (LOS) may facilitate opioid management. We characterized opioid prescribing in a large inpatient rehabilitation hospital across transitions in care.

This was a retrospective chart review at Toronto Rehab, University Health Network (UHN), Toronto, Canada. Inclusion criteria were patients with admission orders for any opioid from November 2017-February 2018. Complex continuing care and palliative care patients were excluded. The UHN Research Ethics Board approved this study.

We included 448 patients, representing 47% of all admissions during the study period. A reduction in total daily morphine equivalent dose (MED) was seen in 219 patients (49%) during their rehab stay, whereas 229 (51%) patients' MED remained unchanged or increased. Eighty-two patients (18%) had their opioid therapy discontinued before discharge. Of the 311 patients (70%) who received an opioid prescription at discharge, 226 (73%) were provided ≤ 7 -day supply. Regression analysis showed that increased rehab LOS was correlated with MED decrease during rehab ($p < 0.01$). Patients with opioid use prior to acute care admission ($p=0.01$), and those who started extended-release opioids ($p=0.02$) were significantly less likely to discontinue opioids during rehab stay.

Although many patients received opioid prescriptions at discharge, almost three-quarters were for ≤ 7 day supply. LOS was a significant factor in decreasing opioids during rehab stay. Areas for improvement are identifying strategies for opioid tapering and discontinuation during shorter stays.

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Paravertebral block is more strongly associated with decreased opioid consumption after surgery

Arissa, Torrie, MD MHS; Ying Wei, Lum, MD MPH; Kara, Segna, MD

Introduction: Adequate control of postoperative analgesia after first rib resection for thoracic outlet syndrome (TOS) is important for reducing length of hospital stay and morbidity and mortality^{1,2,3}. Pain leads to decreased patient satisfaction and is associated with increased risk for postoperative complication^{1,2}. Typical patient management, at our institution, involves the use of intravenous patient-controlled analgesia (PCA) pumps and a 1 night minimum hospital stay.

Objective: To determine if non-opioid multimodal analgesia with or without a paravertebral nerve block (block) decreased postoperative morphine milligram equivalents (MME) and perceived pain over and above PCA use alone after first rib resection.

Design: Primary analyses were performed on a prospective cohort of patients with TOS undergoing first rib resection. Participants were randomly divided into three groups: PCA, PCA + block, PCA + block + non-opioid multimodal therapy. Preoperative questionnaires to assess pain (Quality of Recovery-15 (QoR-15) and Visual Analogue Scale (VAS)) were administered and repeated on postoperative days 1, 3, and 7. Perioperative opioid consumption, non-opioid pain medication, pain scores, ASA ratings, surgical duration and length of hospital stay were extracted from medical records.

Results: 95 patients were enrolled, mean age of 35 (SD=10.2), 69% women. Decrease in perioperative MME was statistically significant for the block and the block + multimodal groups compared to PCA alone group intraoperatively ($p < 0.01$) and day1 postoperatively ($p < 0.05$). No difference day3 ($p=0.38$), or day7 ($p=0.16$).

Conclusion: Paravertebral blocks with or without the addition of multimodal analgesia is more strongly associated with decreased perioperative MMEs, but not decreased pain scores.

Benefits of Incorporating Clinical Pharmacologists for Medication Reconciliation when Prescribing Pain Medications

Kimberly, Haller, MSN MS RN; Kjersten, Evans, BSN RN

Adults age 65 and over have a higher rate of comorbidities, pain being one of them, and are at an elevated risk for polypharmacy leading to potential adverse events (Sarwar et al., 2018). Pain medications can suppress mental awareness and contribute to drug-drug interactions. Medication reconciliation (MR) can be overlooked by specialty providers which in turn contributes to increased adverse events such as falls, hospitalizations, and even death. Historically the gold standard for MR is provider-led with tools such as American Geriatric Society Beers Criteria, but we question if the added incorporation of a clinical pharmacist (CP) could aid in improved patient outcomes. Newer research has aimed to evaluate the efficacy of provider collaboration with a CP with findings of overall decreased patient risk (Ammerman et. al, 2018). We performed a systematic review with the focus of deprescribing for adult patients 65+ with multiple comorbidities and the benefits of providing MR by CP in collaboration with general providers as well as specialists. Search engines PubMed and CINAHL with “elderly AND polypharmacy ” as search terms were used. We measured better patient safety outcomes with decrease in falls, hospitalizations, and death. Tool-guided MR is best evidence-based practice in patient safety. Patients with multiple comorbidities are at high risk for adverse events. Deprescribing tools are highly useful in medication management yet collaboration with a CP in an interdisciplinary team can reduce patient safety errors.

Anatomic Challenges Associated with Intrathecal Nusinersen Administration

Emily, Pollard, MD; Tim, Lamer, MD

Introduction: Nusinersen is a new antisense oligonucleotide approved by the FDA to treat spinal muscular atrophy (SMA) via intrathecal administration.¹ SMA includes a group of inherited degenerative neuromuscular disorders. Disease severity ranges from onset during infancy with rapid progression and death (type I) to limited motor neuron loss and normal life expectancy (type IV).² Many patients with SMA have scoliosis which contributes to significant morbidity; thus, many patients with SMA have had complex spinal surgeries.

Methods: We present two cases of patients with complex spinal anatomy and technically difficult intrathecal access.

Results: Our first patient is a 34 YO man with SMA type 1 and a history of thoracolumbar posterior spine fusion. Intrathecal administration of nusinersen has successfully been performed with an interlaminar approach under fluoroscopy to carefully navigate existing hardware (Figure 1). Our second patient is a 53 YO woman with SMA type 1 and a history of spine surgery with rod placement (Figure 2a). Upon review of her spine imaging (Figure 2b), she was noted to have dense posterior fusion of bone with no identifiable posterior entry point amenable to intrathecal access under fluoroscopic guidance. Therefore, she required transforaminal approach under CT guidance for successful administration of nusinersen (Figure 2c).

Conclusion: Both of these patients presented challenges for successfully administering a high-cost and time-sensitive medication. Careful review of spine imaging prior to procedure scheduling led to optimal procedure location and imaging guidance, and ultimately successful administration of nusinersen.

Gastrointestinal side effects of spinal cord stimulation

Ben, Habibi, MD; Vlad, Suric, MD; Maria, Grabnar, MD; Chong, Kim, MD

We present a case report of gastrointestinal side (GI) effect to spinal cord stimulation. A 78 yo male with history of back surgery with continued back and leg pain underwent a successful 5-day spinal cord stimulator (SCS) trial using BurstDR programming and subsequent implantation, with the lead placements, midline at the top of T8. 6 weeks after implantation, patient continued to note pain relief of 80% in the back and legs. He had decreased his opioid medications and was doing well. However, he complained on frequent bowel movements with urgency, several times a day. Patient had no previous or relevant history and was evaluated by his primary care provider and a GI specialist. The work up was negative. On his 3-month post implant visit, he continued to complain of GI symptoms. The SCS was turned off to eliminate the SCS as the cause despite the pain relief. He noted resolution of his GI symptoms the following day. Various attempts, after Xray verification of the electrodes, to modify the programming, from change to paresthesia based to adjustment of the electrodes used, did not provide sustained relief from his GI symptoms.

Reports of GI symptoms have been reported with traditional paresthesia based SCS programming. SCS has been shown to block the parasympathetic outflow in the GI system.

Medial Tibiofibular Ligament Acupuncture Treatment for Medial Tibial Stress Syndrome: A Case Series

David, Riegleman, MD; Julie, Creech, MD

Introduction: Medial tibial stress syndrome (MTSS), better known as shin splints, is an overuse injury affecting up to 35% of the physically active population. To date, conservative management with physical therapy has been the mainstay of treatment, with insufficient evidence to support using alternative therapies. This case series of two patients at a military training facility (MTF) with MTSS demonstrates the efficacy of KB2 acupuncture in treating MTSS.

Materials and Methods: Patients who received the diagnosis of MTSS were consented for acupuncture intervention, per clinic protocol. Patients were then treated with KB2 acupuncture therapy, consisting of two sterile 75-mm acupuncture needles inserted into the affected leg's medial tibiofibular ligament and irregularly stimulated for five minutes. Following treatment, the patient vigorously moved the affected leg. Pre-intervention and post-intervention perceived pain was measured on a standard pain scale. A clinically significant decrease in pain was defined as a two-point decrease in pain.

Results: Of the two patients in this case series, both noted a clinically significant decrease in pain after KB2 intervention. Notably, both patients had an immediate decrease in perceived pain by four points, with duration of symptom relief lasting for greater than three weeks.

Conclusions: KB2 acupuncture therapy is a clinically significant, effective means to decrease MTSS-associated pain in physically active adults. The limitations of this study include a small population size and short interval follow-up. This case series demonstrates the need for further evaluation of KB2 as an effective therapy for treating MTSS as compared with conservative therapy.

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Retrospective Analysis of Lumbar Radiculopathy Treatment: Do Care Pathways Emphasizing Conservative Measures Really Work?

Ashley, Duncan, MBA RN CNOR; Devender, Singh, PhD; Lee, Moroz, MD; Enrique, Pena, MD; David, Truumees; Eric, Mayer, MD; Eeric, Truumees, MD

Introduction

Emphasis on exhausting all conservative treatments before resorting to surgical intervention is becoming more ubiquitous, especially when seeking authorization for invasive procedures from health insurance payors. We analyzed the treatments and outcomes, along with perception of improvement for lumbar radiculopathy patients who presented to an interdisciplinary spine clinic, which emphasizes conservative care first.

Methods

Institutional review board approved chart audits were conducted on patients treated in 2018 for lumbar radiculopathy. Demographics, number of visits, prescribed therapies, if epidural steroid injection was recommended, how many injections were performed, referral to surgeon and if surgery was performed was aggregated and analyzed. Patients were then contacted via phone and email and asked what percent improvement they felt was gained from the prescribed therapies.

Results

628 charts were audited, and attempted contacts made, with a 32% patient response rate (n=200). Injection therapy was recommended for 71.5% of patients, with the mean number of injections performed at 2.2 ± 1.7 , with an overall improvement rate of $53 \pm 38.5\%$. All age groups were prescribed other treatments, 48% receiving a combination of prescribed therapies. Global surgery rate was 15.1%, significantly below the national surgical intervention average of 33%. This below average surgical rate is associated with a cost avoidance upwards of \$536,000 for the fiscal year. Overall, 65% of patients reported improvement from the treatments and therapies prescribed.

Conclusion

A multifocal conservative approach including epidural steroid injections provides significant improvement for lumbar radiculopathy. A conservative approach to spine care prevents unnecessary surgeries and promotes care pathways that provide quality care with fiscal responsibility.

Trigger Point Injections as a Successful Replacement for Narcotics in a Case of Myofascial Neck Pain: A Case Study

Daniel, Sainburg, DO; Nevin, Vijayaraghavan, DO; Michael, Ingraham, MD

Introduction:

The opioid epidemic in the United States has led to interventions and programs being implemented to reduce opioid prescribing(1). Because of this, it is imperative to find alternative solutions for chronic pain. Trigger point injections offer a low-risk alternative to opioids that can provide immediate relief for musculoskeletal pain in the appropriate setting(2). Here we present a patient with chronic neck and shoulder pain who successfully weaned off narcotics through serial trigger point injections.

Methods:

This is a 35-year-old female referred for chronic neck and shoulder pain. At the time of referral the patient was on hydrocodone-acetaminophen 5-325mg, methocarbamol 10mg, and in physical therapy. Despite taking both medications daily, she was frequently missing work due to pain and was reporting side effects from her medications. Cervical spine X-rays showed mild lateral curve. Exam revealed palpable trigger points in bilateral trapezius muscles. She underwent 4 trigger point injections (TPI) along bilateral trapezius muscles with a total of 10cc of 1% lidocaine.

Results:

Immediately following TPI the patient reported that her pain decreased from 8/10 to 3/10 intensity. At follow-up she reported being able to completely stop her narcotics. We repeated TPI as needed, achieving about 6 weeks of relief with each procedure and she has remained off of narcotics for over 10 months.

Conclusions:

This case demonstrates success in using TPIs to transition a patient off chronic narcotics and back to her activities of daily living. It can serve as a reminder not to overlook safe and readily available therapies.

Auricular Acupuncture: Five Lessons learned From the US Military in Afghanistan- Implications for Civilian Care

Melanie, Johansson, MD FACEP; Jacob, Glaser, MD FACS; Christopher, Spevak, MD MPH JD

Pain is the most common chief complaint in American Emergency Departments and a common presentation in the deployed setting. As stated above, 65% of ED visits at the NATO Role 3 Multi-national Medical Unit in Kandahar Afghanistan are for pain related complaints. In state-side emergency departments, physicians need to consider the growing overuse of prescription pain medication (generally narcotics) for non-cancer related pain. In the deployed setting there are additional challenges. Opioid pain medications have readiness and mission implications. The use of narcotics prevents service members from handling weapons, making critical decisions, and being exposed to combat risks. This becomes more critical the further forward the member is. This can create the problem of choosing between accepting pain or treating it when both choices can degrade mission readiness. Providers must consider alternative pain-relieving strategies to keep the military members in the fight. Acupuncture presents an attractive option to address this gap. This is the first report of lessons learned with Auricular Acupuncture in the deployed setting that are translatable to civilian care given many similarities between deployed settings and civilian Emergency Departments.

Lesson #1. Pain complaints are common in the deployed setting.

Lesson #2. Opioids keep Sailors, Marines, Soldiers, and Airmen out of the fight and Civilian workers out of their work.

Lesson #3 providers need to consider alternative pain-relieving strategies in the deployed setting.

Lesson # 4 Auricular acupuncture is safe in the deployed setting.

Lesson #5 Auricular Acupuncture is effective in the deployed setting.

The Effectiveness of Radiofrequency Ablation of Medial Branch Nerves for Chronic Lumbar Facet Joint Syndrome in Patients Selected by Guideline-Concordant Dual Comparative Medial Branch Blocks.

Aaron, Conger, DO; Taylor, Burnham, DO; Fabio, Salazar; Quinn, Tate, MD; Mathew, Golish, MD; Russell, Petersen, MS; Shellie, Cunningham, BS; Masaru, Teramoto, MPH PhD; Richard, Kendall, DO; Zachary, McCormick, MD

Objectives: While the effectiveness of lumbar medial branch radiofrequency ablation (RFA) for the treatment of zygapophyseal joint (z-joint)-mediated low back pain has been characterized, minimal literature describes outcomes in patients selected using a guideline-concordant paradigm of $\geq 80\%$ pain relief with dual comparative medial branch blocks (MBBs). We investigated long-term treatment outcomes of patients selected according to this paradigm.

Design: Cross-sectional cohort study.

Methods: Medical records of 111 consecutive patients were reviewed; 85 met inclusion criteria. A standardized telephone survey was used to capture current numerical rating scale (NRS) and Patient Global Impression of Change (PGIC) scores. The primary outcome was the proportion of patients reporting $\geq 50\%$ reduction of index pain. Binary logistic regression analysis was performed to explore associations between the primary outcome and covariates including age, duration of pain, presence of scoliosis, degenerative spondylolisthesis, and $>75\%$ disc height loss.

Results: At 6-12, 12-24, and >24 months, 63.2% (95% CI 41%-85%), 65.6% (49%-82%), and 44.1% (95% CI 27%-61%) of patients reported $\geq 50\%$ pain reduction ($p=0.170$), respectively. At a minimum of six months, 70.6% of patients reported pain reduction by ≥ 2 points (minimally clinically important change), and 54.1% reported a PGIC score consistent with "much improved" or better. Older age and a smaller Cobb angle were associated with pain $\geq 50\%$ pain reduction ($p < 0.05$).

Conclusion: Lumbar medial branch RFA is an effective, durable treatment for a significant proportion of patients with recalcitrant lumbar z-joint pain when candidacy is determined by the guideline-concordant paradigm of $\geq 80\%$ pain relief with dual comparative MBBs.

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**Fluoroscopy guided obturator internus botulinum toxin injection
to treat refractory chronic pelvic pain: a case report**

Jinpu, Li, MD

Case Description: 60yo female presented with left vaginal wall pain for 1 year. Crampy in nature, 5-8/10 VAS, radiates to the vulva and bladder, reported dyspareunia and pain after defecation. No urinary symptoms. She had chronic pelvic pain and endometriosis diagnosed at 30yo, s/p TAH/BSO at age 42, which relieved the pain until one year ago. Current pain is different from her previous endometriosis pain.

Assessment/Results: She tried intravaginal baclofen and hyoscyamine, pelvic floor PT, pudendal nerve and superior hypogastric block, ganglion impar blocks, which did not help. She had methylprednisolone and ropivacaine injection to the obturator internus, which gave her temporary relief. She then received a 50 unit of onabotulinumtoxin A injection to the obturator internus, which gave her 3 months of good relief with minimal pain.

Discussion: Studies showed that 14-22% of chronic pelvic pain has myofascial dysfunction of the pelvic floor. The fascia of the obturator internus contributes to the formation of the pudendal canal and when thickened might compress the passing pudendal nerve. Fluoroscopic guided injection of the intrapelvic obturator internus was developed in the past decade. Steroid plus local anesthetics, and less commonly Botulinum Toxin, are used. The precise mechanism of action of Botulinum and its action on the muscle and pudendal nerve remains unclear. A randomized control study is needed to confirm its efficacy in the future.

Conclusion: Obturator internus injection could be a therapeutic option for chronic pelvic pain that is refractory to other therapies.

Diagnostic Local Anesthetic Block to the Anterior Scalene for Thoracic Outlet Syndrome: A Case Series

Charonn, Woods, MD; Thomas, Pittelkow, DO MPH

Purpose: To describe the expected outcomes (advancement to surgery, no surgery, conservative management, complications) for individuals who undergo local anesthetic block of the anterior scalene muscle as a means to facilitate diagnosis and treatment of thoracic outlet syndrome.

Materials and Methods: With IRB approval, cases were reviewed by a single reviewer. Procedures were performed at a Tertiary Academic Medical Center. 5 patients (4 female, 1 male) aged 24-53 underwent anterior scalene block with local anesthetic block under sonographic guidance as a means to diagnose neurogenic thoracic outlet syndrome.

Results: A total of 6 cases including 5 patients were reviewed. The mean duration of symptoms was 3.7 (+/- 2.2) years with 2 cases involving the left upper extremity/chest, 2 cases involving the right upper extremity/chest, and 2 cases involving the bilateral upper extremities/chest/neck. The mean pre-injection VAS score was 4 (+/- 2.8) and mean post-injection score was 1.5 (+/- 2.6). The injection was diagnostic in 83% (5/6) cases, defined as presence or absence of 50% pain reduction. Four cases proceeded to surgery and 2 cases either experienced complete relief or was managed conservatively. Two cases did not experience 50% reduction in pain post block and were further evaluated with pectoralis minor block and underwent pectoralis minor release surgery.

Conclusions: Sonographic guided block of the anterior scalene muscle with local anesthetic is a safe and effective procedure for facilitating diagnosis and treatment of neurogenic thoracic outlet syndrome. Furthermore, appropriately placed blocks with poor response can have a role in treatment and diagnosis.

Real-world Outcomes of Genicular Nerve Radiofrequency Ablation for Chronic Knee Pain

Neal, Shah, MD; Semerjit, Bains, MD; Ajay, Wasan, MD; Benedict, Alter, MD PhD

Introduction:

Osteoarthritis (OA) affects >40 million Americans¹. Radiofrequency ablation (RFA) of genicular nerves which provide sensory innervation to the knee has been shown to improve pain and function in randomized-controlled trials in uniform groups of patients meeting study entry criteria^{2,3}. However, there is limited knowledge of outcomes in real-world pain management practice and predictors of improved pain/function is unknown. This study aims to characterize outcomes of genicular RFA and identify predictors of treatment success.

Materials and Methods:

The University of Pittsburgh Division of Pain Medicine Patient Outcomes Repository for Treatment (PORT)³ which incorporates patient-reported outcomes collected with the Collaborative Health Outcomes Information Registry software (CHOIR), was queried to identify patients who underwent genicular RFA and had completed PROMIS surveys capturing pain, function, mood etc prior to the procedure and ~3 months afterwards at a follow up visit. Putative cases were identified with the CPT code for genicular RFA and confirmed using chart review of electronic medical records (Epic). Change in pain intensity (baseline – follow-up) and impression of change were the primary outcomes. Univariate and multivariate regression analyses were performed to identify associations between baseline predictors and outcomes

Results: Baseline and follow-up data were extracted for 58 patients. Analysis is ongoing, and complete results will be presented at the meeting. Additional cases are anticipated, since 116 patients completed baseline surveys, but follow-up data were not available at this time.

Conclusions:

Our study design allows for a rigorous evaluation of a genicular RFA in the real-world setting of a multidisciplinary pain management clinic.

Peripheral nerve stimulation of the saphenous nerve as a potentially effective treatment for chronic knee pain: a retrospective case series

Kwo Wei, Ho, MD PhD; Anuj, Aggarwal, MD; Vafi, Salmasi, MD; Einar, Ottestad, MD FIPP CIPS

Chronic knee pain is a common pain condition. The lifetime risk of osteoarthritic pain alone is estimated to be ~45% in the general population. Typical interventional treatments include genicular nerve block or infrapatellar saphenous nerve block for post-surgical knee pain, which can be followed by pulsed radiofrequency ablation for more prolonged relief. However, these treatments may not provide adequate or sustained pain relief for patients. For knee pain, peripheral nerve stimulation provides a unique avenue where pain can be relieved by stimulating peripheral nerves without nerve destruction or motor dysfunction. Here we present a retrospective case series of five patients with intractable chronic knee pain who underwent implantation of peripheral nerve stimulator at the saphenous nerve. Four out of the five patients had knee surgery before presenting with chronic knee pain, and all patients included in this study had >50% pain relief from diagnostic saphenous nerve block. The average pain intensity was 7.8 out of 10 on the visual analog scale before the peripheral nerve stimulation implant. Post stimulator implantation, the average pain intensity was 1.4 at 6 months ($P=0.019$, $N=5$), 1.5 at 1 year ($P=0.0032$, $N=4$), 2.75 at 2 years ($P=0.12$, $N=2$). This study provides preliminary evidence that stimulation at the saphenous nerve may be an effective treatment for selective patient population with chronic knee pain.

Notalgia Paresthetica Successfully Treated with Cervical Epidural Injection and Occipital Nerve Block: A Case Report.

Fabienne, Saint-Preux, MD; Justin , Mendoza, DO; Salvador, Portugal, DO

Case description: 46-year-old female presented with severe pruritus in her periscapular and occipital region for one year. Pruritus started in the neck and progressed cephalad and caudad. With neck pain radiating down the left arm mostly resolved with medrol dose pack physical therapy. Pruritus persisted and was constant. Gabapentin conferred no relief. Physical exam revealed mild pain with cervical rotation at end range, negative spurlings but with scattered scarring across medial scapular region bilaterally. X-ray showed evidence of disc space narrowing at C5-6, MRI showed evidence of disc bulging at C4-5, C5-6. Dermatology suspected an allergic reaction with residual irritation, 4 weeks of Allegra was prescribed with minimal relief. Patient then underwent interlaminar C7-T1 epidural steroid injection with significant improvement of pruritus in the scapular region but ongoing symptoms in occipital region. Patient then underwent bilateral occipital nerve block x2 with 70% improvement in symptoms.

Discussion: Notalgia Paresthetica (NP) is a common cutaneous dysesthesia that is largely underrecognized and underdiagnosed. It is characterized by neuropathic pruritus occurring in the scapular region resulting in pain, discomfort and scarring from persistent itching and decreased quality of life. The etiology of NP is thought to be secondary to nerve entrapment and association with cervical and thoracic spinal pathology.

Conclusion: Notalgia Paresthetica (NP) can be successfully treated with epidural steroid injections and occipital nerve block conferring greater and quicker relief than the more commonly used treatment modalities. Intervention with invasive methods may be warranted earlier rather than later if NP is suspected.

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GREAT Knee Pain Reduction Trial: Is Genicular Radiofrequency Ablation Pre-Total Knee Arthroplasty Effective at Reducing Postoperative Pain

Puneet, Mishra, MD; David, Edwards, MD PhD; Christopher, Sobey, MD; John, Corey, MD; Rebecca, Donald, MD; Stephen, Bruehl, PhD

Introduction:

Over the past 45 years, there has been a pronounced increase in the number of total knee arthroplasty (TKA). The number of TKAs is projected to increase to 3.48 million procedures per year by 2030, a 673% increase from 2005. However, approximately 17-20% of patients are not satisfied post-TKA. A primary contributing factor to dissatisfaction is postoperative pain. 44% of TKA patients have reported persistent postsurgical pain (PPSP) at 3-4 years postoperatively.

Methods:

We present a prospective, randomized, double-blinded trial to assess the efficacy of preoperative genicular nerve thermal radiofrequency ablation (RFA) in patients undergoing TKA. Patients are assigned to one of two groups: RFA or control (placebo). The primary outcome measure is the reduction of knee pain on postoperative day 1 and 2 as well as at 2, 6, 26, and 52 weeks. Additional outcome measures include functional measures and total postoperative opioid use in morphine equivalents.

Results:

The study has completed enrollment. We will analyze the data in the upcoming month. We will report 6 week outcomes for the full sample (60 patients) and 6 month outcomes for 30 patients.

Conclusion:

Given the benefits of genicular nerve RFA in improving pain and functionality in non-surgical patients as well as the high prevalence of postoperative pain in TKA, this study is designed to determine the efficacy of presurgical genicular nerve RFA in reducing postoperative pain. If this data demonstrates that genicular nerve RFA is effective, these results would touch millions and decrease the overall healthcare burden.

Improving Prognostication of Genicular Nerve Blocks

Nicholas, Mata, BS MD; Chong, Kim, MD; Maria, Grabnar, MD; Richard, Wilson, MD MS; Travis, Cleland, DO

Genicular nerve block (GNB) is used to predict if radiofrequency ablation (RFA) of genicular nerves will provide adequate relief of knee pain. Some institutions require positive responses to two GNB's prior to performing RFA. Anecdotal evidence has indicated that when one GNB is positive, the second is frequently positive. No formal evidence of this exists; therefore the purpose of this retrospective chart review is to determine the probability that a patient with a positive response to a single GNB will have a positive response to a second GNB (i.e. the positive predictive value [PPV]). We predict that the PPV of a single GNB is high. The electronic medical record of 354 patients from one academic medical center who had a positive response to a single GNB were reviewed for a positive response to a second GNB. Patients who were positive for two subsequent GNB's were labeled as True Positive. Patients who were positive for the first GNB and negative for the second GNB were labeled as False Positive. PPV was calculated. Results showed that the PPV of a single GNB with 50% and 80% pain improvement thresholds was 85% and 81% respectively. This study is limited by its retrospective nature, absence of data on RFA outcomes, and lack of uniformity in imaging modality, outcome documentation, and interventional technique. Nevertheless, this study provides compelling evidence that the PPV of a single GNB is high enough to consider forgoing the need of a second GNB prior to RFA.

High Frequency Spinal Cord Stimulation for Chronic Pelvic Pain in a 73-yr-old male

Amanda, Greene, MD; Braeden, O'Neill, MD ; Stacy, Peterson, MD

Chronic Pelvic Pain is a complex condition that is challenging to treat. Often the exact pathophysiology remains elusive. The use of spinal cord stimulation in the treatment of chronic pelvic pain is not an original concept. However, many of the reports out there are limited to use of traditional or paresthesia-based stimulation. In addition, many case reports with male patients are limited to rectal or testicular pain. We present a case of chronic pelvic pain in a 69-year-old male that was partially responsive to amitriptyline and pudendal nerve blocks. Despite some improvement with conservative modalities, he remained limited in terms of activities and continued to have pain that was 3-7/10 on a numeric rating scale. After considering and presentation to our Spinal Cord Stimulation (SCS) work group, we decided to proceed with an SCS trial which was effective with > 80% relief. During the trial, the electrodes were staggered from T8-T12 vertebral body and high frequency stimulation at 1000 HZ stimulation was utilized for programs over T9/T10 and T12 with good efficacy at both levels. The patient went on to have SCS implant and continues to have excellent pain relief 6 months post implant with improved pain scores to 0-1/10 (prior scores 3-7/10). In addition, he has been able to return to previously enjoyed activities such as golf that previously were limited due to pain. Additionally, he has not required any further pudendal nerve blocks and has been weaning his amitriptyline with no detriment to his pain control.

Management of Myofascial Inflammation due to Intervertebral Disc (IVD) Herniation: A Case Study

Robalee, Wanderman, MD; Tim, Lamer, MD; John, Wald, MD

A 30-year-old female was evaluated for persistent non-traumatic left thoracolumbar paraspinous pain which started during her second trimester of pregnancy. On MRI, she was found to have a large T12-L1 anterolateral calcified disk protrusion with associated significant iliopsoas muscle inflammation. She underwent fluoroscopic-guided left psoas muscle injection with lidocaine/dexamethasone. She noted immediate pain relief with sustained improvement at 3-month follow-up.

Intervertebral disc (IVD) herniation has been shown to expose surrounding tissues to pro-inflammatory mediators and cytokines of the nucleus pulposus leading to profound hyperalgesia and inflammation [1,2]. Multiple pro-inflammatory mediators, including IL-1B, IL-6, IL-8, TNF-a. and phospholipase A2 have been implicated [1-3]. Studies have also shown upregulation of degradative enzyme IL-1 in degenerate IVDs, leading to destruction of normal IVD matrix [3]. Since most disc herniations occur within the spinal canal, inflammation commonly involves the affected nerve root resulting in radicular pain. In this case, the herniation occurred outside the spinal canal leading to marked inflammation of the adjacent muscle, manifesting as myofascial pain syndrome.

Given the evidence for a pro-inflammatory driven response to IVD herniation, targeted myofascial steroid injection may be effective in patients with MRI findings consistent with localized inflammation secondary to IVD herniation.

Ablation of a Gray Ramus Communicans for the Treatment of Discogenic Back Pain: A Case Report

Adam, Dinoff, MSc; Christopher, Lore; Nitin, Sekhri, MD

The authors present a case of a 38-year-old female patient with refractory discogenic back pain. The patient initially presented with refractory back pain who failed multiple conservative treatments (including but not limited to facet blocks, epidurals, adhesiolysis, and medications). A provocative lumbar discography was performed at L4-5 (with a control disc) which confirmed discogenic back pain. Subsequently, a biaculoplasty at the L4-5 disc was performed with minimal pain relief. A dorsal root ganglion pulsed radiofrequency at the level of L2 was performed with no significant effect on the patient's subjective pain level and function. Finally, a block of the gray ramus communicans at L2 was performed that provided 50% pain relief with increased function lasting nearly two weeks. A pulsed radiofrequency ablation of the gray ramus communicans was done next with longer duration of success. At six-week follow-up after the ablation, we observed significant improvements in the patient's functional outcomes as a result of reduced back pain. These included an increase in mobilization from 1000 to 3000 steps per day, renewal of the patient's ability to walk her dog, attending a wedding, and the ability to begin a core-strengthening program. She remained at a 50% reduction in pain from baseline. As a result of her improvement in function, we observed a subjective reduction in depressive symptomatology at follow-up. Based on the success of this case, the authors recommend the consideration of a gray ramus communicans block and/or ablation in the treatment of refractory discogenic back pain.

Parallel Two Needle Radiofrequency Ablation of Ganglion of Impar: A Novel Approach

Vivek, Nagar, MD MBA; Shayan, Senthelal, MD; Sayed , Wahezi, MD

Introduction:

Coccydynia is a condition that commonly is refractory to conservative management and is routinely treated with radiofrequency ablation (RFA) of the ganglion of impar (GOI). General consensus of the anatomic location of GOI is the anterior aspect of the sacrococcygeal disc. However, recent cadaveric dissections suggest that GOI may be located more inferiorly than previously thought, specifically anterior to the first coccygeal joint.

Method:

We present a technique using two RFA needles via modified trans-sacrococcygeal approach. Two RFA needles were inserted at lateral sacral locations at oblique angles with medial direction under fluoroscopic guidance. Needles were passed lateral to the sacrococcygeal disc, ventral to the body of the distal sacrum and placed no more than 1cm apart. RFA was then performed at 80 degrees C for 120 seconds using a parallel dipole configuration to direct lesion from anode needle to the cathode.

Discussion:

This technique works by 1) improving needle tip accuracy to the location of GOI and 2) increasing the ablation area of GOI.

By placing two needles in oblique/coronal dipole configuration with AP and lateral separation, we increase the ablation surface area, accounting for the suspected variability of GOI in the coronal axis commensurate with the anatomy of the GOI.

This novel technique incorporates the concept that GOI may be larger and more unpredictable in its anatomic location, requiring larger ablation size which is achieved with this approach.

(word count: 232)

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Efficacy in the Treatment of Lumbar Facet Pain with Thermal Radiofrequency Neurotomy, 18 gauge versus 16 gauge Cannula

Michael, Alvarado, MD; Milton, Landers, DO PhD; Felecia, Lee, PhD; Vinh, Pham, MD; Hai, Nguyen, DO MPH

Objective: This is a study of thermal radiofrequency neurotomy (RFN) of lumbar zygapophysial innervating nerves to determine whether differences between size of cannula can be correlated with post-procedure efficacy.

Design: A retrospective chart review of 298 consecutive lumbar RFN procedures on patients referred for low back pain to a single physician in private practice. Two groups with comparison of RFN cannula size used versus percent relief of the index pain.

Methods: All patients had index low back pain with a NRS of >4. The diagnosis of zygapophysial joint pain was secured using dual diagnostic local anesthetic blocks of the indicated medial branches and L5 dorsal ramus evidencing $\geq 80\%$ relief. Patients early in the series underwent RFN with 18ga and later ones with 16ga. Techniques for both the diagnostic and treatment procedures were as per International Spine Intervention Society (ISIS) Guidelines. All patients were re-evaluated 4-6 weeks post procedure. IRB approval was obtained.

Results: A total of 298 RFNs were studied, 124 (41.6%) utilizing 18ga cannula and 174 (58.4%) utilizing 16ga, both with 10mm angled active tip. A statistical difference was noted between gauge size and relief noted. Good to excellent relief (51-100%) was noted in 74% of patients with the 16- gauge versus 58% with the 18-gauge cannula.

Discussion: Lumbar pain due to a facet etiology can be treated effectively with good to excellent relief expected in up to 74% of patients when validated anatomic techniques are utilized for both the diagnostic blocks, and RFN treatment with 16ga cannula.

Successful Management of Postdural Puncture Headache with Epidural Blood Patch in Patient with Arnold Chiari Malformation

Amanda, Greene, MD; Gwynne, Kirchen, MD

Postdural puncture headache (PDPH) is often treated conservatively. [1] If conservative treatment fails, the standard of care is offering an autologous epidural blood patch (EBP). [1,2] The safety of this practice had not been delineated in all disease types, including Arnold Chiari Malformation (ACM). Patient's with ACM have successfully undergone labor epidurals, though this is a highly debated topic. Concerns regarding potential complications of patient's with ACM undergoing any neuraxial procedure include consequences of a dural puncture. [3]

We present a case of a 24-year-old female with a history of Arnold Chiari Malformation, chronic occipital migraines and Ehlers-Danlos Syndrome with postdural puncture headache that resolved with an uncomplicated epidural blood patch. Patient had presented to her neurologist with intractable headache and simultaneous new gait abnormality. CT myelogram showed no evidence of CSF leak but shortly after procedure patient complained of a positional headache. After failed conservative treatment and bilateral sphenopalatine blocks, patient underwent a fluoroscopically guided epidural blood patch with resolution of symptoms.

The success of an EBP in treating patients with postdural puncture headaches ranges from 37%-84%. With a new study showing that the efficacy of fluoroscopy guided EBP approaching 85%. [1] Thus far, safe neuraxial anesthesia has been provided to laboring patient's with ACM. Here we present a case of successful management of a postdural puncture headache with EBP in a patient with ACM.

An Effective Treatment For Painful Peripheral Neuropathy Exists Today

Peter, Carney, MD FAANS

Introduction: By definition, an effective treatment for painful peripheral neuropathy (PPN) will regenerate nerves, reduce pain and restore function without side effects. Currently our treatments for PPN are “inadequate.” Experts claim that “patients with neuropathic pain have irreversible nerve damage.”

METHODS: Six consecutive PPN patients received on average 21.5 Combined Electrochemical Treatments (CET). They had ENFD (Epidermal Nerve Fiber Density) biopsies done before and, on average, 6 months after treatment and followed on average for 26 months after treatment. Their highest Pain Scores and Functioning Indexes during treatment, at the end of treatment and when last seen were compared and side effects recorded.

RESULTS: Five patients regenerated their nerves, doubling the average number of nerves per positive biopsy site (2.77 nerves/mm to 5.54 nerves/mm). Followed on average for 30.4 months post treatment, at the end of treatment they had reduced their pain scores by 85% (6.8 to 1) and restored their function by 67% (57.2 to 18.6). When last seen they had reduced their pain scores by 90% (6.8 to 0.7), and restored their function by 74% (57.2 to 14.6). One patient with no growth reduced his pain by 44% and restored his function by 34% but was lost to follow-up four months post treatment.

None had any side effects.

CONCLUSION: The fact that five of six patients who received CET regenerated their nerves by 100%, reduced their pain by 90%, restored their function by 74% and had no side effects powerfully indicates that an effective PPN treatment exists today.

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“Somewhere Under the Joint Line”: Needle Misadventures Associated with Sacroiliac Joint Injection

Christopher, Bailey, MD; Natalie, Strand, MD; Christopher, Wie, MD

Case Report

The patient is a 73 year-old, 47.9 kg female who presented to our clinic for bilateral sacroiliac joint injections. Local anesthesia with 1% lidocaine was administered subcutaneously, and bilateral SI joint injections were performed using a 22 gauge, 3.5 inch needle. After negative aspiration, an injection of 2 mL bupivacaine (0.25 %) and 0.5 mL methylprednisolone (80 mg/mL) was administered on each side. Immediately following the procedure, upon standing up, the patient reported lightheadedness. During transfer from wheelchair to the recovery room chair, she was noted to have right lower extremity weakness and required assistance from nursing. Physical examination revealed focal weakness of hip abduction on the right.

Discussion:

Some studies have described the incidence of adverse events during sacroiliac injection to be as high as 5%. Immediate adverse events associated with SIJ injections in a recent study include: vasovagal reaction (2.1%), steroid-clogged needle (0.5%), weakness (0.5%), weakness: (0.5%). Sciatic nerve involvement has been described in the literature and is most likely due to inferior extravasation from the joint due to joint capsular tears. If injections are too anterior, contrast may pool at needle tip, and this can be verified with lateral radiograph imaging. Weakness of the hip abductor muscles can result from superior gluteal nerve injury or blockade. Inferior gluteal nerve injury would result in hip extensor weakness.

Conclusions

Sacroiliac joint injection is a commonly performed procedure, but the incidence of adverse effects may be under appreciated, resulting in unexpected complications and hospital admissions.

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A unique approach to treating severe bilateral lower extremity phantom limb pain from traumatic amputations and severe arachnoiditis

Devin, Larsen, DO; Joshua, Beckman, MD; Brandon, Goff, DO

Introduction: Dorsal Root Ganglion (DRG) Stimulation is FDA approved for treating complex regional pain syndrome in the lower extremities. It has also been used successfully to treat phantom limb pain.

Case: We present a case of a thirty-two-year-old male treated at a military ACGME accredited pain fellowship program. He was involved in a motorcycle collision in December 2017 suffering traumatic bilateral lower extremity amputations ultimately leading to a left hemipelvectomy and right transfemoral amputation. He subsequently developed severe bilateral lower extremity phantom limb pain previously treated with nortriptyline, pregabalin, dronabinol, ketamine and methadone. MRI revealed severe lumbar arachnoiditis with multiple loculated CSF collections with clumping and compression of nerve roots in the cauda equina. Due to severe bilateral phantom limb pain and associated severe arachnoiditis this patient was in a very unique situation. He was evaluated by neurosurgery and offered L1-L5 laminectomies and cord detethering. Due to the laminectomies, his ability to obtain percutaneous DRG stimulation would have been lost. Thus, the patient was offered bilateral open DRG lead implantation in conjunction with his laminectomies which he agreed to.

Results: In August 2019, the patient had L1-L5 laminectomies, durotomy with cord detethering and open placement of bilateral L2-L5 DRG leads and generators. Three weeks postoperatively, the patient was noted to have a 70% reduction in his phantom limb pain overall.

Conclusion: This is a unique case involving a very unique surgical approach utilizing open DRG lead implantation to treat bilateral lower extremity phantom limb pain.

Peritoneal defect discovered during pump exchange: a complication of intrathecal drug delivery systems and approach to management.

Tigran, Kesayan, MD; Neal, Shah, MD; Devang , Padalia, MD

Introduction/Objective: Intrathecal drug delivery systems (IDDS) are an important treatment option for chronic pain and muscle spasticity. There have been incidences of IDDS eroding through the fascia and migrating from the abdominal soft tissue into the peritoneal cavity. The specific reason for this migration is unclear, and peritoneal defects without pump migration are not described.

Case: A 34 year-old man with chronic spasticity from a cervical cord trauma had a baclofen IDDS implanted submuscularly fourteen years ago, exchanged six years prior, and was to undergoing another pump replacement for battery end of life. A 2.5 cm peritoneal tear was discovered underneath the pump, which was outside the area of any cautery or dissection. A general surgeon confirmed no bowel damage was present, repaired the defect, and the pump exchange was completed.

Discussion: As no dissection or cautery took place near the defect during the pump removal, it is unlikely it was created during this procedure. It is possible it originated during the initial implant or the previous pump exchange. Another theory is perhaps it was caused by the pump itself as there was scarring noted anterior to the defect. Although very rare, a peritoneal tear with or without pump migration should be considered as complication of IDDS therapy, and if one is discovered it should be inspected and repaired by a general surgeon. Discovery of such complication at a facility without the availability of a general surgeon may be problematic.

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Dorsal column stimulation for complex post-surgical abdominal, thoracic, and flank pain

Derek, Bradley, MD; Alexander, Timchenko, MD

Introduction: Dorsal Column Stimulation (DCS) is FDA approved in the treatment of complex pain syndromes. It has been successfully utilized for chronic pain of the trunk, limbs, low back pain and in failed-back-surgery-syndrome. There is much less success in post-surgical abdominal pain syndromes.

Case: We present a case of a fifty-seven-year-old female treated at a level 1 trauma center at an ACGME accredited Pain Fellowship. She suffered from chronic severe post-surgical right abdomen, rib, and flank pain. Previously underwent multiple abdominal surgeries, including Whipple-procedure, and complicated AICD placement. She failed multiple celiac-plexus blocks, scar deactivations, and various peripheral-nerve blocks. This pain location has historically been difficult to treat with DCS. Her case was further complicated by possible interference of DCS with existing AICD.

Results: She underwent a DCS trial with the leads placed in a non-traditional fashion. After her AICD was placed in an asynchronous mode; leads were placed at T5 level (case reports successful for chronic pancreatitis), but the right lead was placed in the lateral gutter. She had appropriate coverage in her painful areas. The AICD was tested to ensure no interference. A combination of tonic and sub-perception-microburst was used and she experienced >75% reduction in her pain scores. She proceeded with implantation and continues to receive >75% relief with discontinuation of opioids.

Conclusion: Complex post-surgical abdominal pain is notoriously difficult to treat. Utilization of non-traditional placement of DCS can provide an effective alternative treatment, and can be safely done even in the presence of AICD.

Postoperative MRSA Epidural Abscess in Spinal Cord Stimulator Trial After Negative MRSA Nares Screen

Sahna, Reddy, MD MPH; Jeffrey, Mojica, DO; Brian, Boies, MD

Surgical site infections (SSI) following spinal cord stimulator (SCS) trials are a rare postoperative complication. We present a case of a 43 year old never-smoking female who developed an epidural abscess following a SCS trial. The patient's medical history was significant for anxiety, depression, and chronic axial low back pain with right lower extremity radiculopathy. Her pain persisted despite undergoing a microdiscectomy, laminectomy, and interventional pain procedures. She underwent a percutaneous SCS trial for failed back syndrome. Perioperative infection reduction strategies were employed as per NACC recommendations, which included a negative MRSA nares screen, prophylactic cefazolin administered within 60 minutes of incision, sterile precautions throughout the procedure performed in an OR environment, and patient compliance with appropriate postoperative care resulting in an intact dressing throughout the trial. The leads were discontinued POD#5 after the patient reported a greater than 50% reduction in pain. The patient was reevaluated POD#6 for pain at the surgical site and demonstrated no signs of systemic or localized infection. She presented to an outside emergency department on POD#9 with worsening back pain radiating to her bilateral lower extremities. Workup revealed MRSA positive blood cultures and an epidural abscess on MRI. The abscess was percutaneously drained by interventional radiology and treated with 6 weeks IV antibiotics. The patient made a full recovery without neurological sequelae. Despite adherence to best practices, postoperative infections can still occur with the potential for catastrophic neurological consequences. A high index of suspicion should prompt further investigation when patients develop new postoperative symptoms.

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Ketamine with Neurocognitive Testing: A Novel Interdisciplinary Outpatient Treatment Protocol for Chronic Pain

Adam, Soto, MD; Aubrey, Verdun, MD; Timothy, Brearly, PsyD; Cassandra, Sanders, RN; Connie, Kurihara, RN; Gregory, Horn, MD; Michael, Bowdren, PhD; Richard, Liu, MD; Christopher, Spevak, MD MPH JD; Laura, Wandner, PhD

Background:

Ketamine affects chronic neural pathways and has been used for decades to treat chronic pain via its NMDA receptor antagonism. Evolving data exists establishing the efficacy of ketamine for outpatient treatment of chronic pain however neurocognitive changes post-ketamine remain unclear. The Pain Management Clinic (PMC) recently established a novel interdisciplinary ketamine protocol within the Military Healthcare System (MHS) to enhance patient-centered care by standardizing the processes regarding referrals, candidate selection, dosing, and follow-up care. This project assesses the efficacy of outpatient ketamine infusions for patients with chronic pain.

Methods/Participants:

Patients undergo an evaluation to assess readiness to engage in and appropriateness for the ketamine protocol. A unique feature of this protocol is that it includes pre- and post-infusion neurocognitive and pain assessments. To date, 13 patients completed the protocol and 4 completed pre- and post-infusion neurocognitive testing. Of the 13, the mean age was 41.5 years, mean duration of pain was 9.3 years, and mean pain score pre-infusion was 6.6/10.

Results:

Qualitative findings suggest that the interdisciplinary protocol is both safe and effective. Initial qualitative findings also suggest that patients report a reduction in pain after completing the ketamine infusion. Valid neurocognitive assessment across 3 patients revealed improvements in attention/processing speed in 2 patients and unchanged cognitive function in one patient.

Discussion:

Our findings support the utility of developing a standardized protocol for referrals, candidate selection, dosing, and follow-up care that emphasizes an interdisciplinary model for successful patient-centered care. Preliminary data suggests beneficial effects on pain intensity and cognition.

Incidence of Thrombotic Events After Intrathecal Drug Delivery System Placement

Chiamaka, Esomonu, MD; Nafisseh, Warner, MD; Patrick, Harper, MD; Susan, Moeschler, MD; Thomas, Pittelkow, DO MPH; Rebecca, Sanders, MD

Intrathecal drug delivery systems (IDDS) have become a mainstay in management of intractable pain and spasticity. Patients with malignancy or spasticity are hypercoagulable and are at increased risk for thrombotic events that may necessitate therapeutic anticoagulation. The objective of this study was to determine the incidence of thrombotic events in patients undergoing IDDS implantation or revision.

This study was a retrospective chart review which identified patients 18 years or older who underwent IDDS placement or revision from 2004-2016. Informed consent was obtained for each participant. Data regarding patients' medical comorbidities, pre-operative anticoagulation and bridging, aspirin/NSAID use, and peri-operative platelet counts were collected. The primary outcome was to determine the incidence of thrombotic events occurring within 30 days of IDDS placement or revision. Thrombotic events were defined as myocardial infarction, cerebrovascular accident pulmonary embolism or venous thromboembolism identified via EKG, MRI, CT angiography or lower extremity ultrasound, respectively.

There were 242 IDDS placements, with 192 (79.7%) initial implantations and 50 (20.3%) revisions. Forty patients (16.5%) were on pre-operative therapeutic anticoagulation. A total of 6 (2.5%) thrombotic events were identified in 6 individual patients, all of whom underwent IDDS implantation for malignant pain. Two patients (33.3%) were anticoagulated pre-operatively with warfarin; only one (16.7%) was bridged with anticoagulation prior to IDDS implantation. Platelet counts were $< 100 \times 10^9/L$ in one patient.

Future studies will need to assess the importance of bridging anticoagulation to guide appropriate perioperative anticoagulation management to minimize the incidence of thromboembolic events for patients undergoing IDDS implantations or revisions.

Utility of the Retching/Vomiting Index in Measuring Retching

Tong, Gan, MBA MD MHS; Bernard, Schachtel, MD

Purpose: Retching is a medically worrisome condition that can adversely affect post-operative pain management and recovery. Unlike nausea and vomiting, retching is not commonly documented or reported in analgesic trials. We developed the Retching/Vomiting Index (RVI), a 0-7 categorical Likert scale, to measure the occurrence and frequency of retching and vomiting and assessed the RVI in a double-blind, placebo-controlled trial comparing opioid-induced nausea and vomiting (OINV) associated with hydrocodone 7.5 mg/acetaminophen 325 mg (HC/APAP) and CL-108 (HC/APAP/rapid-release promethazine 12.5 mg).

Methods: Following orthopedic surgery, patients who signed an IRB-approved consent form and reported moderate-to-severe pain on a 0-10 Pain Intensity–Numeric Rating Scale (PI–NRS) were queried about nausea on a 0-10 Nausea Intensity Scale (NIS) and retching/vomiting on the RVI. After randomization, patients were dosed every 4-6 hours for pain and completed the PI–NRS, NIS, and RVI at regular intervals over a 48-hour inpatient treatment period.

Results: Sixty-five (26.0%) of 250 HC/APAP-treated patients reported retching (at least once) on the RVI, compared with 38 (15.1%) of 252 CL-108-treated patients, indicating a 42% relative reduction in opioid-induced retching ($p < 0.004$). HC/APAP and CL-108 were effective analgesics compared with placebo, and OINV was reduced by 73% for CL-108-treated patients relative to HC/APAP-treated patients (both $p < 0.001$).

Conclusions: The RVI is an easy-to-use, sensitive instrument for documenting the occurrence and frequency of retching, demonstrating here that CL-108 reduces the incidence of retching compared with HC/APAP. These results indicate the RVI may be a useful measurement instrument for retching and post-operative pain control.

Treatment of Supraspinatus Calcific Tendinitis using Percutaneous Ultrasonic Tenotomy

Steven, Wang, MD MPH; Shayan, Senthelal, MD; Sayed , Wahezi, MD

Shoulder calcific tendinitis is a frequent cause of shoulder pain in adults, most commonly seen in females and ages 40-60. Common clinical features include shoulder pain, decreased range of motion, and decreased functional activity of the shoulder. Ultrasound-guided Percutaneous Ultrasonic Tenotomy is an evolving treatment approved by the US FDA for shoulder tendinopathy in 2006. The TENEX Tx2 instrument utilizes an 18 gauge hollow-tip needle and low amplitude and high frequency oscillations to emulsify and debride diseased tissue around tendons to enable healing. We did not find any studies or case reports examining the role of the Tx2 instrument in shoulder calcific tendinitis; below we present such a case.

57 year old female presented with 7+ years of achy right shoulder VAS 9/10 worsened by sleeping on affected side and overhead activity. She denied neck pain and radiating pain. MRI demonstrated supraspinatus calcific tendinitis. Orthopedics has seen her multiple times and she has failed physiotherapy, NSAIDs, and local injections. She had tenderness to palpation of right anterior shoulder with positive Hawkins test and negative O'Brien's and Speed test. Range of motion of shoulder was limited to 60o with external rotation and 80o with firm stop with shoulder abduction. Using the Tx2 machine, we were able to improve the patient's shoulder range of motion to 90o with external rotation and 130o with abduction without firm stop.

Ultrasound-guided Percutaneous Ultrasonic Tenotomy has potential to help patients with calcific tendinitis and should be considered as a potential option for patients.

Spinal Epidural and Retropharyngeal Abscesses following Spinal Cord Stimulator Implantation

Allan, Probert; Yuri, Gordin, MD; Jennifer, Hubbell, CRNP; ToNhu, Vu, MD

Spinal epidural abscess (SEA) is a rare complication of spinal cord stimulator (SCS) placement associated with high morbidity and a mortality rate of 2-20%. Risk factors include diabetes mellitus, alcohol abuse, degenerative joint disease, spinal trauma/interventions, and infectious sources including HIV and intravenous drug use. Nonspecific symptoms, including worsening back pain, paraspinal muscle tenderness and symptoms of systemic infection, make timely diagnosis and treatment a significant challenge. Less commonly, neurological deficits such as weakness, bowel and bladder dysfunction, and radiculopathy can occur. Diagnosis with contrast-enhanced MRI carries specificity and sensitivity greater than 90%. Surgery is often indicated and prompt treatment with broad-spectrum antibiotics is imperative.

A 55-year-old female with history C4-C6 anterior cervical discectomy and fusion status six weeks post-SCS placement at an outside facility presented with two-week history of fevers, paravertebral muscle spasms, and drainage from implantation sites. Given bacteremia and concern for sepsis, the patient was started on broad-spectrum antibiotics. Contrast-enhanced MRI revealed C4-C6 retropharyngeal and T6-T9 epidural abscesses. Subsequently, she underwent incision and debridement of the abscesses, T6-T8 laminectomies with removal of SCS leads and battery pack. Upon intraoperative and culture identification of MSSA, she was started on IV cefepime, then switched to nafcillin with significant symptomatic improvement.

As functional neurological outcomes correlate strongly with duration and severity of deficits prior to surgery, early recognition of this rare complication of SCS implantation and a cohesive surgical and infectious disease co-management approach is imperative to prevent overwhelming sepsis and lasting neurological deficits.

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Atypical Knee Pain Secondary to Arachnoiditis

Min, Yoo; Hassan, Aboumerhi, MD; Geeta, Nagpal, MD

Case Description:

70-year-old male was referred from orthopedic surgery clinic for unilateral genicular nerve ablation after failing conservative treatments. Imaging showed mild tricompartmental osteoarthritis and chondral loss. Patient underwent genicular nerve block with 50% pain relief and returned to the clinic a week later for subsequent radiofrequency ablation when he complained of pain so severe that he was barely eating or performing ADL's on his own. Water-cooled radiofrequency ablation of the knee was completed, however, the patient complained of malaise and weakness following the procedure, and was also hypotensive. He was transported to the emergency department, where a duodenal ulcer likely secondary to excessive NSAID use for pain was discovered. MRI of the lumbar spine was ordered shortly after to assess for possible spinal etiology and revealed advanced degenerative changes causing moderate to severe spinal stenosis at L2-L3 and L3-L4, as well as compressive arachnoiditis.

Case Discussion:

Arachnoiditis is an inflammation of the arachnoid that may be caused by a direct injury to the spinal cord, injection of chemicals, infection, or chronic compression of the spinal nerves. The patient in our case report presented with an atypical knee pain out of proportion to the imaging findings especially considering that the asymptomatic side had similar radiographical findings, and only had partial response to the genicular nerve blocks. Prompt diagnosis of this condition as the source of lower extremity pain may prevent further medical complications.

Conclusion:

Arachnoiditis may present as atypical lower extremity joint pain without significant axial back pain.

Neuromodulation in Meningitis Induced Phantom Pain

Kyle, Kalra, DO; Shereef, Girgis, MD; Rita, Mezzatesta, MD; John, Kirkland, PhD MD

Introduction/Background:

Phantom limb pain (PLP) describes the feeling of pain sensation in a surgically removed limb or portion of limb (1). The onset of PLP is usually within 24 hours after amputation, but onset can vary from days to years (2). Pharmacological agents such as sodium channel blockers and TCAs are considered first line management (3). The purpose of this case report is to present the case of a 41-year-old Caucasian male who developed bacterial meningitis when he was 19-years-old which led to bilateral foot then below knee amputations causing severe phantom pain that was finally controlled with spinal cord stimulation (SCS) decades later after failure with pharmacologic agents.

Treatment Modalities Attempted:

Patient underwent epidurals, radiofrequency ablations, and opiate therapy to control his PLP with no significant improvement. Patient took up to 200 MME before SCS therapy. Sympathetic block was performed with no improvement in symptoms. Patient then underwent a successful stimulator trial with over 50% pain relief. After the successful trial, the SCS therapy was implanted.

Results:

Patient reports 0-2 episodes of PLP a day after SCS from the initial 20+ episodes. Patient is now on 7 MME a day from original 200 MME a day. Sleep reported significantly better since SCS implantation. Patient able to ambulate with his bilateral lower extremity prosthesis, which patient was not able to do before SCS implantation.

Conclusion:

SCS should be considered in the management of patients with uncontrolled phantom limb pain caused by bacterial meningitis with no improvement in symptoms with pharmacotherapy.

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Superior Cluneal Nerve Block for Refractory Low Back and Buttock Pain: A case-report

Aakash, Thakral, MD; Sagar, Parikh, MD; Craig, Van Dien, MD

Introduction:

The superior cluneal nerves (SCN) are the terminal branches of the posterior rami of the first three lumbar nerves and provide cutaneous innervation to the upper buttocks. They are susceptible to entrapment as they pass through a tunnel formed by the thoracolumbar fascia and superior rim of the iliac crest. Entrapment of the SCN is an uncommon and underrecognized cause of low back and buttock pain.

Materials and Methods:

A 50-year-old morbidly obese woman presented with chronic low back pain radiating to the posterior right thigh. Initial examination was consistent with sacroiliac joint (SIJ) dysfunction. After failed response to physical therapy, a right SIJ injection was performed with one week of relief. She underwent subsequent diagnostic L5-S3 lateral branch blocks, followed by radiofrequency ablation, with two months of pain relief. In follow-up, direct pressure applied over the posterior iliac crest resulted in a sharp, shooting pain into the right buttock. SCN entrapment was considered and she underwent a right SCN block.

Results:

One month after the block, she reported 80% pain relief, with continued effect after two months.

Conclusions:

SCN entrapment is a rare and underrecognized cause of low back and buttock pain. It is often misdiagnosed as lumbar radiculopathy, sacroiliac joint pain, gluteal bursitis, or primary hip pathology. SCN entrapment should be considered in the differential diagnosis of patients with back and buttock pain refractory to conventional conservative intervention. If suspected, SCN block serves as both a diagnostic and therapeutic maneuver.

Sacral Radiofrequency Ablation: An Effective Opioid Sparing Technique

Daniel, Adams, PA-C MSHS; Dmitri, Souza, MD PhD; Samer, Narouze, MD PhD; Timothy, Sable, MD; Judy, Knight, MLS AHIS; David, Gothard, MS; Nicholas, Capaldo, MD; Tyler, Greathouse, DO; Gabriel, Frato, OMS-III; Kelly, Kubiak, DPM; Michael, Hudok, OMS-IV

Background:

Chronic low back pain is the second leading cause of disability worldwide and a major welfare and economic problem costing about 83 million well-years of life annually. Sacral pain disorders are increasingly recognized as a contributor with some estimates that it comprises approximately 15-30% of all lower back pain. (1) Conservative management with physical therapy and non-steroidal anti-inflammatory medications are considered first line treatment. (2) If pain is not adequately reduced with this approach, a diagnostic injection of local anesthetic is appropriate. When the result is positive (>75% reduction in pain), radiofrequency ablation, also known as rhizotomy or denervation, is indicated. (3)

Materials & Methods:

After obtaining a waiver of IRB to perform this retrospective review, we screened the charts of all patients who underwent RFA of the S1-S4 joints at our clinic between 1/1/2016 and 5/1/2019. This resulted in a randomized sample of 250 procedures which met the inclusion and exclusion criteria. The subsequent review collected data including changes in morphine equivalent dosage (MED), percentage of reported pain relief, Pain Disability Index (PDI) scores and adverse events.

Results:

There was an average reduction in MED of 30%. Subjects reported very significant pain relief, PDI scores improved, and there were no adverse events other than temporarily increased pain post-procedure. Our sample size resulted in an estimated confidence interval of 95%.

Discussion:

This is the first study which demonstrates a significant reduction in daily opioid use after RFA in a large population. However, more randomized controlled trials should be conducted to verify or disprove these findings.

Spinal Accessory Nerve Palsy During Radiofrequency Ablation: A Case Report

Jason, Roth, DO; Tomas, Salazar, MD; Sagar, Parikh, MD

Case:

A 75-year-old male presented after bilateral cervical radiofrequency ablation (RFA) for facet-mediated pain. He endorsed 80% pain reduction, but complained of new-onset left shoulder weakness. Left shoulder exhibited weakness in all planes and noticeable atrophy. There was concern over injury of the spinal accessory nerve (SAN) during the procedure. MRI cervical spine was unchanged and MRI left shoulder revealed infraspinatus tear. EMG revealed isolated incomplete left spinal accessory neuropathy affecting all three portions of the trapezius. Physical exam was remarkable for atrophy of the left trapezius. Patient received physical therapy with subsequent improvement in upper trapezius weakness, and eventual full strength and bulk of the entire trapezius.

Background:

The SAN is located in the ventral horn of C1-C5. The nerve supplies the sternocleidomastoid and trapezius muscles. Due to this location in the posterior triangle, it can be injured in surgeries. Patients with SAN palsy present with lateral scapular winging, decreased shoulder abduction, neck and shoulder pain. EMG can be used to confirm the diagnosis.

Discussion:

Multiple case reports involving SAN stretch injury while performing heavy lifting have been documented, however there were no case reports of SAN injury from an interventional procedure. After reviewing needle positioning, it was highly unlikely to have been caused by the ablation. We propose a mechanism of injury of stretch palsy due to the positioning of his neck during his RFA procedure, which was done under anesthesia and in the prone position. We believe his muscular build may have contributed to his nerve palsy.

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Multi-disciplinary approach to Epidural Spinal Abscess : An uncommon cause of Acute Radicular Back Pain

Ratnakar, Veeramachaneni, MD; Kishan, Sitapara, MD; Vivek, Nagar, MD MBA; Kristen, Devries, MD; Maria, Castro, MD

Case

62 y/o male with HTN, T2DM presented to ED with severe back pain(BP) with left foot radiation. Patient was examined and discharged home with opioids and muscle relaxants. BP worsened and he presented to ED 1 week later with bilateral leg tingling. MRI revealed herniated discs at L3-L4 and L5-S1. He was admitted, underwent epidural steroid injection(ESI) and was discharged home with mild improvement in pain and ambulation. However, he returned to ED 1 day later with worsening BP, new onset numbness. Repeat MRI showed spinal epidural abscess(SEA) at L3-S1. He underwent emergent L2-S1 laminectomy with IV antibiotics with significant improvement in pain and neurological symptoms.

Discussion

SEA is uncommon with an estimated incidence of 0.2-2.0/10,000 which peaks in the sixth and seventh decades of life(1). The classical triad of BP, fever and neurological deterioration, is present only in 10-15% of patients(3). The most important predictor of final neurologic outcome is patient's neurologic status immediately before surgery(2). Duration of pre-operative neurological symptoms determine post op recovery, with pre-op paralysis and sepsis predisposing to poor outcomes.

Conclusion

Diagnosis of SEA remains challenging(3). 30% of patients with SEA do not have a good outcome. 5% of patients with SEA die(2). Every patient with BP, fever and risk factors should be evaluated for SEA with MRI(2). Increased awareness, high index of suspicion and early intervention improve mortality and morbidity. Assessment of neurological and functional capacity should be continued for up to a year with benefit from rehabilitation.

The diagnosis and treatment of a painful thoracic perineural cyst: A case report describing an unusual cause of periscapular and chest wall pain

Nick, McKernan, MD; Kelly, Gully, PA-C

Reports of painful thoracic perineural cysts are rare in the medical literature. We present the case of a 36 year-old woman with left sided periscapular and chest wall pain initially presumed to be myofascial. Her symptoms failed to respond to treatment with topical analgesics, NSAIDS, heat, physical therapy (PT), pregabalin and trigger point injections. The pain worsened when supine at night and caused early morning insomnia due to intensified pain, numbness and paresthesias. These symptoms improved throughout the day while she was upright and ambulatory. In preparation for a possible procedure, advanced imaging of the cervical spine was obtained. It was unremarkable for disc or facet pathology, however a “left sided T1 nerve root sheath cyst” was noted. Neurological examination revealed sensory deficits in the left sided T1 dermatome. Neurosurgical consultation confirmed the diagnosis of painful T1 perineural cyst but referral to a subspecialty provider for potential excision was declined. The patient instead discontinued her aggressive PT regimen and neuropathic in favor of a course of daily oral NSAIDS, gentle stretching and modification of her sleeping position. After several weeks the pain subsided without the need for additional interventions. Two additional episodes have occurred in the past 4 years which again responded to conservative therapy. She has experienced no residual neurological deficits from these episodes. In conclusion, a perineural cyst is a potential cause of unilateral neuropathic pain in a dermatomal distribution for which a variety of treatment options are available.

Lumbar Sympathetic Nerve Block for Restless Leg Syndrome: A Case Series

Juliet, Gaisey, MD; Daniel , Ezidiegwu , DO; Margaret, Kott, MD; Andrew, Nava, MD

Introduction: Restless leg syndrome (RLS) is the uncontrollable urge to move the legs, often due to associated dysesthesias, which improves with movement. Two cases of coexisting RLS and CRPS demonstrated improvement of RLS symptoms after treatment with lumbar sympathetic blockade, suggesting a possible role of sympathetic overactivation in the pathophysiology of RLS. Materials and Methods: Two patients with suspected CRPS and RLS were treated at an academic interventional spine practice. The first is a 51 year old female with bilateral burning leg pain associated with erythema, allodynia, and muscle cramps, who derived minimal relief with usual CRPS medications. The second is a 50 year old male with long-standing RLS; he was believed to have a CRPS component to his RLS. After trialing usual medications, symptoms were only controlled with oxycodone and pramipexole, but he suffered headaches due to pramipexole. Both patients underwent bilateral lumbar sympathetic blocks using 1.5 mL of 1% lidocaine as a test dose, followed by 1.5 mL of 0.5% marcaine, the former at L3-L5 and the latter at L2-L4. Results: The first patient reported 100% relief of both pain and RLS symptoms for several hours. The second reported 80-100% relief of pain and RLS for one week. Conclusion: In addition to temporary relief of CRPS pain, both patients reported improvement in RLS symptoms after lumbar sympathetic blocks. This case series suggests underlying sympathetic nervous system overactivation may contribute to the pathophysiology of RLS. Further study of patients with co-existing CRPS and RLS is needed.

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Dorsal Root Ganglion Neurostimulation for Chronic, Refractory Neuropathic Pain of the Pelvis and Lower Extremities: A Systematic Review

Nathan, Clements, MD; Ameet , Nagpal, MD MS MEd; Brian, Boies, MD

Objectives: To determine if published human subject literature supports the use of dorsal root ganglion neurostimulation (DRGS) for the treatment of refractory, focal neuropathic pain in the pelvis and lower extremities.

Methods: Evidence based review of data currently available in the literature. Extensive literature search was conducted and articles were evaluated using the Spine Intervention Society assessment tool. True intention to treat (ITT) analysis was performed for evaluation of available data from randomized controlled trials. Evidence was assessed using Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria.

Results: Several studies, including ACCURATE, a randomized controlled trial, demonstrate statistically significant improvement in VAS scores over baseline at short term (< 6 months) and long term (> 6 months – 3 years) follow up post implantation. Intention to treat (ITT) analysis of the data for the treatment of CRPS and causalgia confirmed that the percentage of subjects receiving $\geq 50\%$ pain relief was significantly greater in the DRG arm ($73.7\% \pm 9.9\%$) than the SCS arm ($51.3\% \pm 11.2\%$) at 3 months ($P = 0.004$). At 12 months were $64.5\% \pm 10.7$ for DRG and $46.1\% \pm 11.2\%$ for SCS (49/76 subjects having success for DRG and 35/76 for SCS, $P = 0.022$). Studies also report promising results regarding improved function, mood, quality of life and decreased opioid usage.

Conclusion: There is moderate quality evidence that DRGS, as defined by the GRADE criteria, is effective in the treatment of pain and dysfunction due to CRPS and causalgia of the lower extremity and pelvis.

Delayed Paraplegia Following a Spinal Cord Stimulator Trial: A Case Report

Eric, Liu, DO; Tomas, Salazar, MD; Beverly, Hon, MD

Case Description: This is a 70-year-old male with a past medical history of lumbar spinal fusion, left sided foot drop, and gout, who initially presented to the acute care hospital for lower extremity weakness with bowel and bladder incontinence. History was significant for a spinal cord stimulator (SCS) trial five days prior to presentation. Three days later he started developing gait abnormalities with associated bowel and bladder incontinence. Upon presentation, the spinal cord stimulator leads were removed by neurosurgery and CSF leakage was noted. Steroid taper was initiated and there was noted improvement in his lower extremity strength. Pt was eventually discharged to acute inpatient rehabilitation hospital.

Discussion: Documented complications related to SCS implants include lead migration, lead fracture, hardware malfunction, infection, CSF leak, and hematoma. Although the risk for neurological deficits remains rare, providers are still obligated to educate patients regarding warning signs and symptoms that necessitate immediate evaluation. While this patient experienced delayed onset of neurological decline, prompt evaluation resulted in improvement of his neurological and functional status. Further delay in treatment could have led to more permanent disability.

Conclusion: Early identification of neurological deterioration following spinal cord stimulator implantation can be critical for patient outcomes. Detection of acute changes in strength, sensation, bowel and bladder continence warrants immediate evaluation. This case highlights the importance of patient education as awareness of serious complications following SCS procedures and recognition of symptoms can have a significant effect on a patient's functional outcome.

Bone Marrow Aspirate Harvesting Using Fluoroscopic Guidance

Revik, Vartanian, DO; Kelly , Bruno, MD; Jeffrey , Chen, MD

The utility of bone marrow aspirate concentrate (BMAC) for the treatment of several orthopedic and musculoskeletal degenerative conditions has gained increased popularity over recent years. As more physicians incorporate BMAC-based interventions in their practices, the need for safe harvesting technique of bone marrow aspirate (BMA) from the iliac crest has become imperative. In the absence of a single standardized approach in harvesting bone marrow, many physicians rely on palpation and bony landmarks to identify their harvesting needles' entry point. Despite relative low risk for adverse events, numerous complications of neurological, vascular, osseous, muscular and ligamentous injuries have been reported. The use of image guidance, particularly fluoroscopy, for harvesting BMA can potentially minimize these risks. Fluoroscopy allows for detailed visualization of the bony pelvis which permits safe placement and advancement of the harvesting trochar. It also allows for safe penetration of the trochar to the depths of 4-8 cm, eliminating the need for multiple harvest sites and potentially reducing procedure time and pain. We propose a technique using a posterior approach to the posterior superior iliac spine (PSIS) at L5-S1 with contralateral oblique angulation to approach the iliac crest at the widest point. Proficiency in this technique will allow for quick and reproducible bone marrow harvest with increased safety and decreased potential for pain.

Hyperbaric oxygen effects on pain and withdrawal symptoms in adults with opioid use disorders

Trevor, Roush, BS; Marian, Wilson, PhD MPH RN-BC; Tamara, Odom-Maryon, PhD; Karen, Stanek, PhD MD; Joseph, Muriungi, AS; Alvina, Jesse, AS; Matthew, Layton, MD PhD; Raymond, Quock, PhD

Introduction/Problem: Pain and withdrawal symptoms are often undertreated in adults receiving medication-assisted treatment for opioid use disorders.[1] Pharmacological solutions, such as sedatives or added opioids, can have deadly synergistic consequences when prescribed along with daily opioid therapy.[2] Preclinical research finds that hyperbaric oxygen therapy (HBOT) suppresses naloxone-precipitated withdrawal symptoms in morphine-dependent mice [3]. Materials/Methods: HBOT was piloted to address pain and withdrawal symptoms for adults in medication-assisted treatment for opioid use disorder. An IRB-approved protocol allowed 31 adults to be randomized into HBOT (n=17) or attention control (n=14) arms while undergoing a voluntary taper of daily methadone. HBOT was administered for five consecutive days in 90-min sessions at 2.0 atmospheres absolute with 100% oxygen in a pressurized chamber. PROMIS pain intensity and pain interference scales were administered with the Adjective Rating Scale of Withdrawal (ARSW) at baseline and post-treatment at 1 week, 1 month, and 3 months. Withdrawal symptoms were assessed immediately pre and post-intervention sessions with the Clinical Opioid Withdrawal Scale (COWS) and the ARSW. Results: Opioid withdrawal symptoms were reduced after Day 1 of HBOT by twice as much, on average, compared to the control condition. At 3-months, the treatment group maintained on average 4.3 mg methadone dose reduction compared to average reduction of 0.25 mg for control group participants. Pain intensity and interference were positively, significantly related to withdrawal symptoms. Conclusions: Effects on withdrawal and pain in this sample warrants fully powered trials to determine if symptoms associated with opioid dose tapering can be reduced using HBOT.

Radiofrequency Ablation as a Treatment for Bertolotti's Syndrome: A Case Report

Sabrina, Oukil, MD; Jia, Tang, BS; Aaron, Przybysz, MD PhD

INTRODUCTION

Bertolotti's syndrome is characterized by low back pain secondary to lumbosacral transitional vertebrae (LSTV). These vertebrae are congenital spinal anomalies that involve partial or complete L5 sacralization or S1 lumbarization and are associated with increased risks of nerve root compression, scoliosis, sacroiliitis, disc herniation, and spinal canal stenosis [1]. In refractory cases, local anesthetic or corticosteroid injections often provide immediate relief, but these effects are usually only temporary. Radiofrequency ablation [RFA] is a treatment modality that has shown promising potential in providing long-term alleviation.

CASE

We present a 25-year-old male with chronic, axial low back pain and radiologic evidence of bilateral pseudoarticulations of the L5 transverse processes with the sacrum, as well as, associated L4-5 facet changes consistent with the LSTV seen in Bertolotti's syndrome. After failing to improve with conservative treatment, we performed diagnostic medial branch blocks at the L4-5 and L5-S1 joints bilaterally. The patient experienced a significant and > 80% decrease in pain after the procedures. Subsequently, the patient underwent successful bilateral lumbar 3,4,5 medial branch radiofrequency ablations for more lasting pain relief.

CONCLUSION

Radiofrequency ablation may be a promising therapeutic option in patients with Bertolotti's syndrome. One study described pain relief lasting an average of 6 months in 16/16 Bertolotti's syndrome patients who underwent RFA [2]. Additionally, two case reports have documented over 80% pain relief lasting for 7-10 months after RFA [3]. Further research on the long-term efficacy of this technique is needed to further investigate its role in treating patients with this condition.

Pain management in a unique case of split cord malformation type 2 with spinal cord tethering.

Renuka, Rudra; Vitaly, Gordin, MD

Split cord malformation (SCM) is a rare congenital abnormality in which the spinal cord is split longitudinally. In type 1 SCM the hemicords have two dural sheaths and in type 2 SCM hemicords are surrounded by one dural sheath. Symptoms of SCM include back pain with or without radicular symptoms, abnormal skin around the lumbosacral region, asymmetry in gluteal folds or in muscle development between limbs, bowel or bladder incontinence, and limb weakness. Treatment ranges from conservative management to surgical intervention; surgical intervention typically being necessary when neurologic deficits are present.

This case presents a 48-year-old female with history of tandem type 2 SCM (L1 to L3, and T8 levels) associated with spinal cord tethering. At the age of 31, she underwent spinal cord untethering and surgical repair of SCM, which temporarily improved her symptoms of back pain and lower extremity numbness. Over several years, her back pain, paresthesia and lower extremity weakness slowly returned. Follow-up MRI showed evidence of tethered cord recurrence, however the patient was hesitant to undergo another release procedure. She was referred to pain management where we discussed intrathecal pain pump or spinal cord stimulator for pain management, though our patient opted to pursue oral medication management for the time being.

This case highlights a rare congenital abnormality and its associated complications such as cord tethering. More importantly, it shows that surgery is not necessarily curative, and symptoms may persist or recur. Finally, we discuss pain management options when patients do not opt for surgical repair.

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The effect of Prolotherapy for Joint Pain on Pain Control and Quality of Life Improvement - A 6 years Retrospective comparative Observational Study in Allevio Pain Management Clinic

Ramin, Safakish, MD; Imrat, Sohanpal, MD; Shadi, Babazadeh, MD

Prolotherapy is not a new treatment in medicine. However, the results of prolotherapy at the effect of this intervention on the patient's quality of life and reduction of the total consumption of narcotic had not been appropriately shown in the past. This is a retrospective single center cohort study. Study population comprised of patients at Allevio Pain Management over a 6-year period.

Total number of patients was 246, 213 patients (86.6%) had pain in back due to sacro-iliac joints instability. The minimum sessions for treatment was 1 and maximum 7. Age distribution was 3.6% 20-29 years, 14.6% 30-39 years, 18.7% 40-49 years, 29.4% 50-59 years, 14.6% 60-69 years, 13.4% 70-79 years, 5.7% 80 years and older. Pain improvement was significant with a (P.V= 0.000), and BPI has shown significant improvement with a (P.V= 0.000). 99.5% of patients were satisfied with their pain control and management.

156 patients were not retired and 99 of them (63.5%) were able to go back to work after treatment.

92.6% of 68 patients who were taking narcotics to control their pain, had taking less narcotics (P.V= 0.000). Among them 69.8% completely stop taking narcotics, 7.3% did not show any changes in narcotic consumption.

Only one patient had to visit ER after the treatment due to excruciating pain.

Patients had statistically and clinically significant improvement in changes of mood, walking ability, normal daily work, and enjoyment of life, general activity, and decreased of consumption of analgesic medication including opioids. Image guidance improved accuracy, results and avoided complications.

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Spinal cord stimulation for neuropathic pain in a patient with recurrent tethered cord syndrome : a case report

Bram, Bourgonjon, BB; Kim, Van Elsen, MD; Stefaan, Goossens, MD

INTRODUCTION:

Spinal cord stimulation (SCS) is a well-accepted therapy for the treatment of neuropathic pain in the lower legs in failed back surgery syndrome. Tethered cord syndrome (TCS) is a clinical syndrome caused by stretching of the lower part of the spinal cord. Tethering of the cord is inherently associated with lipomyelomeningocele as the lipoma tethers the cord to the adjacent dura and soft tissues. We found one adult and one pediatric case report of a patient with neuropathic pain due to tethered cord syndrome, successfully treated with SCS.

MATERIALS AND METHODS:

The authors present the case of a 35-year-old female patient with lipomeningocele who underwent surgery for detethering at the age of five. Sensory changes in the lower legs caused important chronic wounds in her left leg, which eventually lead to a transtibial amputation in 2011. Due to recurrent tethering of the cord, she experienced an important neuropathic pain in the lower back and right leg. A trial of spinal cord stimulation has been offered.

Written informed consent has been obtained.

RESULTS:

Since 2018 every patient eligible for SCS in Belgium is registered in an online interactive platform (Neuro-Pain®) where they score pain, sleep and activity levels before and during trial SCS. The trial was considered positive as the patient reported important lowering of pain and an increase in sleep and activity levels (Figure 1). A definitive spinal cord stimulator was implanted.

CONCLUSION:

Successful treatment of neuropathic pain in a patient with TCS, objectified on the basis of an online interactive platform.

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Management of seroma after SCS placement: case series

Owais, Qureshi, DO; Thomas, Cheriyan, MD; Anterpreet, Dua, MD; Paramvir, Singh, MBBS; Zhuo, Sun, MD

Introduction:

Our study investigates the incidence of seroma after SCS implant and its management.

METHODS:

A retrospective chart review of patients who underwent SCS implantation at our institution from 2016 to 2019 was performed. We describe management and outcome of seromas in these patients. IRB approval in process.

RESULTS:

We identified five patients among 175 during the study period. Incidence of seroma after SCS implantation was 2.8%. Seroma was diagnosed between 6 days and 2 months postoperatively. In two of the five patients, trauma to generator site was identified as a possible inciting factor to development of seroma and three were idiopathic.

Conservative management was successful with resolution of the seroma within one month in one patient whose seroma was less than 2 cm. One patient underwent aspiration of fluid which resulted in accumulation of seroma. This patient underwent exploration, washout and relocation of generator to new location.

Two patients who failed conservative treatment had wound exploration and removal of SCS done due to infected tissue observed on exploration. SCS re-implantation was done after 6 months in these patients. The final patient had exploration and relocation of generator. All patients had resolution of seroma and continued SCS therapy.

CONCLUSION:

Seroma presentation and management varies. Conservative management may be beneficial. For seromas that do not respond to conservative treatment, wound exploration is warranted. Relocation of generator or removal of the SCS implant can be required. Based on our cases, early exploration may be advisable in select patients with seroma.

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Gadolinium as a Contrast Agent for Kyphoplasty in Patients with Allergy to Iodine: A Case Report and Evidence-Based Review

Afrin, Sagir, MD; Jijun, Xu, MD PhD

Introduction:

Iodinated contrast agents are widely used in interventional pain procedures for diagnostic precision and therapeutic safety (1). With the incidence of hypersensitivity reactions to iodinated contrast being surprisingly high, estimated between 3 -13%, the use of non-iodinated contrast agent gadolinium is not uncommon. We report the use of gadolinium as an alternative to iodinated contrast in two patients with documented allergy to the latter, undergoing kyphoplasty.

Case Presentation:

81-year-old male, with chronic low back pain from closed compression fractures of L2 and L3 lumbar vertebrae, underwent L2 and L3 kyphoplasty. The second patient is 71-year-old with acute thoracic back pain from compression fracture at T8 thoracic vertebra, underwent T8 kyphoplasty. Both the patients had history of hives and convulsions with iodine. After considering the risk-benefit ratio, we decided to use gadolinium as the contrast agent for both the procedures.

Discussion:

Gadolinium is less visible with radiography, which has been implicated to cause neurological complications from accidental steroid injection into intrathecal or intravascular space during ESI (2,3). Gadolinium is known to accumulate in skin, bone, liver and CNS, with concerns of tissue toxicity and DNA damage. Macrocyclic gadolinium has less CNS accumulation than the linear form. Gadolinium can cause nephrogenic systemic fibrosis in renal failure patients. The dose-dependent accumulation of gadolinium raises concerns in patients who need repetitive interventions (1). Also, gadolinium is more expensive than iodinated contrast agents. To conclude, the decision to substitute gadolinium must be made only after careful assessment of its risk-benefit ratio.

Treatment of Malignant Pain in Patient Living Out of the Country

Michael, Chi, MD; Rebecca, Donald, MD; Matthew, Hamilton, MD

Introduction:

End-stage cancer pain is one of the few strong indications for opioid therapy. While the risks are well known, less often do the logistical issues that accompany opioid prescribing need to be considered. For patients who spend a significant amount of time traveling, opioids pose difficulties due to the need to return home for monthly refills as well as issues accompanying travel with significant quantities of pills. In such cases, interventional strategies can be a very useful adjunct to provide long term pain relief and diminish the reliance on opioids.

Methods

Patient informed consent was obtained for submission of this case report.

Case Report:

A 66 year old male with metastatic melanoma of his left chest wall presented for management of his malignancy related pain. With the goal of reducing his reliance on pain medications in order to facilitate his missionary work, we describe our interventional approach. We progressed from intercostal blocks and pulsed radiofrequency ablation to percutaneous cervical cordotomy and ultimately intrathecal pump implantation, with which were successful in reducing his pain, increasing his functionality, and reducing his oral opioid requirement.

Discussion:

In cases such as this where patients spend months at a time abroad, the logistics of opioid prescribing are a significant drawback to opioid therapy. Fortunately, there are several interventional pain management approaches for malignant pain etiologies that can be beneficial for these patients. It is crucial that they be considered, especially in the context of a well-rounded multi-disciplinary team approach.

Dorsal Root Ganglion Stimulation in the treatment of primary knee pain from osteoarthritis.

Daniel, Jacobs, DO; John, McCallin, MD

Introduction: Dorsal Root Ganglion (DRG) Stimulation has been used successfully to treat chronic neuropathic post-surgical knee pain and complex regional pain syndrome. Case reports of this therapy in the treatment of primary knee pain are infrequently reported.

Case: We present a case of a sixty-eight-year-old female with chronic bilateral knee pain from primary osteoarthritis and concomitant chronic low back pain. Her knee pain treatment consisted of bilateral intraarticular steroid injections, which progressed to hyaln G-F 20 injections, then platelet rich plasma injections, and ultimately genicular radiofrequency ablation over a period of five years. In an attempt to delay total knee arthroplasty as long as possible, the patient was considered for DRG Stimulation. After successful trial she underwent implant of bilateral stimulator leads at L3 for her knee pain and T12 for her low back pain in December 2018.

Results: DRG Stimulation reduced the patient's bilateral knee pain by ninety percent post implant. Pain control of her knee pain has persisted for nine months with current Visual Analog Score of one and three in her left and right knees.

Conclusion: DRG Stimulation at L3 is effective for control of primary knee pain from osteoarthritis in this patient. Further research may identify a role for DRG Stimulation in the treatment algorithm of primary knee pain from osteoarthritis.

Durable Relief of C1-C2 Facet Arthropathy After Pulsed Radiofrequency Treatment: Report of Six Cases

Farshad, Ahadian, MD; Ryan, Fraiser, DO; Yi, Cai, MD

INTRO

C1-C2 facet arthropathy is a rare but disabling cause of neck pain and headaches. It may be misdiagnosed as occipital neuralgia or myalgia and may present as torticollis. The most common interventional treatment is intra-articular corticosteroid injections, but relief is short-lived. We present six subjects with C1-C2 arthropathy, with durable relief after pulsed-radiofrequency(PRF) treatment.

METHODS

Subjects with C1-C2 arthropathy treated with PRF were retrospectively identified from the author's practice at UCSD Center for Pain Medicine from 2010-2019. Treatment consisted of 22-gauge insulated RF cannulas inserted using a dorsal parasagittal approach under fluoroscopic guidance with the 10 mm active tips positioned to span the posterior capsule of each joint and the needle tip resting within the synovial space. PRF was applied at 5Hz, 50msec, 42 degrees Centigrade, 6 minutes duration.

RESULTS

Six subjects with unilateral C1-C2 arthropathy (4R, 2L) treated with PRF were identified. Mean age 70 years (48-93), 5F, 1M. 5/6 subjects reported 80-100% and 1/6 reported 50% improvement in pain lasting 8-12 months. Physical exam demonstrated marked improvements in range of motion and function. One patient experienced complete resolution of severe spasmodic torticollis. 4/6 subjects repeated the PRF treatment annually 2-6 years. No adverse events were noted.

CONCLUSION

C1-C2 facet arthropathy should be considered in the differential diagnosis for neck pain and cervicogenic headaches. PRF can be a durable, effective treatment option when conservative measures fail. Proximity of the vertebral artery to the target poses technical challenges and additional risk. Proper technique and experience are critical for success.

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Vectors Study Results: Assessing pain relief and functional outcomes using Spinal Cord Stimulation (SCS) with High Dose (HD) stimulation parameters

Matthew, Kelly, PhD; Michael, Verdolin, MD; John, Hathaway, MD; Michael, Fishman, MD MBA; Katherine, Stromberg, MSc; Kelly, Hendrickson, MSc

Background

For newer stimulation parameters there is an ongoing need for long-term data on safety and efficacy. The Vectors study evaluates whether there is significant improvement in pain and function starting with HD stimulation at 1000Hz at or around T9/T10.

Methods

Post-market, single-arm study evaluating the efficacy of SCS (Intellis™ implantable neurostimulator) starting with HD stimulation, targeting the T9-T10 disc space following paresthesia mapping (EvolveSM workflow). Subjects with chronic intractable low-back and leg pain (VAS ≥50 mm) were enrolled. After permanent SCS implantation high and lower frequency parameters were allowed.

Outcomes include: Change in pain (VAS), quality of life and disability, satisfaction at 3-, 6-, and 12-month follow-up. Primary objective analysis included all implanted subjects; additional analyses were complete case.

Results

Ninety-eight of 103 implanted subjects completed the 3-Month Visit and 96 completed the 6-Month Visit. At 3 months, overall pain decreased 45.4 on the VAS from 77.2 at baseline, and 87% of subjects had ≥ 50% improvement in at least one pain domain (Overall, Back or Leg). Benefits were observed in the ODI and EQ-5D. Seventy percent of subjects achieved a personal activity goal and 81.6% reported therapy satisfaction. See Table 1 for 3- and 6-months results.

Conclusion

Vectors provides long-term evidence for SCS starting with 1000 Hz and 90 us (HD) stimulation (the EvolveSM workflow). A statistically significant reduction in pain was achieved at 3 months and these results were sustained through 6 months. Benefits were also observed in quality of life and function. Twelve-month results will be presented.

Efficacy of radiofrequency in reducing knee pain: A meta- analysis of randomized controlled studies

Thomas, Cheriyan, MD; Owais, Qureshi, DO; Zhuo, Sun, MD; Paramvir, Singh, MD; Anterpreet, Dua, MD

Introduction

Radiofrequency ablation of the genicular nerve has shown promising results in the management of symptomatic knee osteoarthritis. However randomized controlled studies (RCTs) have been limited by small sample size and conflicting results. The purpose of this meta-analysis was to consolidate data on the efficacy of radiofrequency for osteoarthritic knee pain.

Methods

RCTs which investigated radiofrequency therapy (RT) (thermal, pulsed and cooled) vs control for osteoarthritic knee pain were included. Outcome measures included pain scores at 1 week, 1 month, 3 months, and 6 months. Secondary outcome measures included complications associated with procedure. Jadad scoring was used to assess risk of bias. Meta-analysis was performed using Revman.

Results

Five studies were included in this meta-analysis which included a total of 236 patients with 119 in the RT group and 117 in control group. Sample size varied from 35 to 73 with an average of 47 per study. Studies had low-medium risk of bias. Pain score in RT group was significantly lower at 1 week (2 studies, n= 73; SMD -1.51[95% CI(-2.90, -0.12)]; p=0.01), 1 month (5 studies, n=236; SMD -0.94[95% C(-1.57, -0.30, -0.12)]; p=0.0004), 3 months (4 studies, n=196; SMD -0.66[95% C(-1.24, -0.80)]; p=0.01). Only one study reported on 6 month pain. No procedural complications were noted in any study.

Conclusion

RT significantly reduces osteoarthritic knee pain for at least up to 3 months when compared to controls. However RCTs investigating longer term benefit are required.

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Efficacy and Performance Time with Ultrasound-Guided Cervical Blocks Versus Fluoroscopy and CT-Guided Cervical Medial Branch Blocks

Daniel, Adams, PA-C MSHS; Stephania, Paredes, MD; Roderick, Finlayson, MD; Sameh, Hakim, MD; Nebojsa Nick, Knezevic, MD PhD; Alexander, Feoktistov, MD; Lynn, Kohan, MD; Patrick, Connell, MS-IV; Dmitri, Souza, MD PhD; Samer, Narouze, MD PhD; Antoun, Nader

Objective:

Cervical medial branch blocks (CMBB) are useful in the diagnosis and treatment of upper back pain.

The purpose of this study was to compare the efficacy, performance time and pain reduction with ultrasound-guided (US-guided) CMBB vs. other methods such as fluoroscopy and CT guidance.

Methods:

The protocol of this systematic review and meta-analysis was performed following the PRISMA recommendations for data assessment. The following will be discussed in this presentation: protocol and registration, inclusion criteria, exclusion criteria, information sources and searches, study selection, data collection process, and risk of bias in individual studies.

Statistical analysis was done using Comprehensive Meta Analysis© (CMA©) version 2.2.046 (Biostat© Englewood, NJ). Comparison of binary outcomes was done by estimation of the odds ratios (OR) with their 95% confidence interval (CI). Continuous outcomes were compared by calculation of the standardized mean differences (SMD) and their 95% CI. Estimates from included studies were pooled using the DerSimonian and Laird Random-Effects Method (REM) or the Mantel-Haenszel Fixed-Effects Method (FEM) depending on the presence or absence of significant heterogeneity, respectively.

Results:

The results demonstrate that US-guided CMBB is a reliable alternative to the fluoroscopy and CT-guided CMBB with demonstrated advantages in efficacy. The meta-analysis and discussion will be discussed more fully in the presentation.

Conclusion:

This study demonstrated benefits of US-guided CMBB compared to fluoroscopy and CT Scan.

Disclosure of Interests: None.

The “Deflatable” Dangers of Chest Wall Blocks: When a Classic in Plane Approach to Serratus Anterior Block Goes Wrong

Elizabeth, Chimah, MD; Annie, Philip, MD; Courtney, Kime, MD; Mark, Williams, MD

Serratus plane blocks have proven to provide adequate analgesia of the chest and abdominal wall. It is increasingly being performed for many reasons: simplicity and safe side effect profile. Along with the Pecs blocks (pectoralis major and minor,) these injections of local anesthetics directly into the appropriate fascial plane is an ideal alternative to other more invasive modalities, such as epidural, paravertebral, intercostal or intrapleural blocks. Here, we demonstrate the use of a serratus anterior block as a means to provide analgesia for a patient with post-mastectomy syndrome. Unbeknownst to the providers, the placement of a pre-existing breast implant was deflated secondary to its proximity to the procedural plane.

64 year old female with left-sided post-mastectomy syndrome presents for initial evaluation of left sided intercostal neuritis with allodynia along her mastectomy scar. Patient is status post left latissimus dorsi flap implant reconstruction and saline implant 5 years ago. She has been maintained on opioid therapy for several years and exhibits psychological dependence behaviors. She is currently on Fentanyl 25mcg/hr, Oxycodone 5mg PRN Q6, Cymbalta 60mg Qdaily, Meloxicam 15mg Qdaily, Baclofen 10mg PRN. The plan was to potentially decrease her use of opioids by implementing an appropriate regional anesthetic technique that would ensure adequate coverage of her most painful areas. The procedure was performed under ultrasound guidance using an in-plane approach. Once relevant structures were identified, patient was administered 20mL of 0.25% Bupivacaine and 40mg of Depo-Medrol. Several days later, patient reports concerns with possible deflation of left saline breast implant.

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Patient Activity Goals, and Pain Relief with Spinal Cord Stimulation (SCS): 6 Months of follow-up and a single-center case study from the Vectors Study

Matthew, Kelly, PhD; Tristan, Weaver, MD; Steven, Severyn, MD; Michael, Verdolin, MD; Lisa, Johaneck, PhD; Katherine, Stromberg, MSc; Kelly, Hendrickson, MSc

Introduction

The Vectors Study investigated pain relief in patients with chronic low-back and leg pain after they followed a standardized approach to SCS therapy (with options of High and Low Dose therapy). While pain relief has traditionally been the primary focus of SCS, additional measures in the study included achievement of individually defined goal(s) and satisfaction.

Methods

An analysis was completed on subjects from a single center in the study to compare goal attainment with subject-reported pain scores at each defined visit through the 3-Month Visit, as well as subject assessments of pain relief and therapy satisfaction at the 6-Month Visit.

Results

Five subjects from The Ohio State University Wexner Medical Center were evaluated for goal achievement, pain relief and subject satisfaction. At 3 months, 80% of subjects had achieved at least one activity goal and were responders ($\geq 50\%$ reduction in pain) in the 3 pain domains assessed (Overall, Low-Back, and Leg) (Table 1) and were very satisfied with the therapy. One subject failed to achieve a goal or achieve a pain reduction of $\geq 50\%$ through 6 months but was still somewhat satisfied with therapy at 6 months.

Conclusions

Pain relief is the core objective of SCS therapy; however, pain patients can have therapy/activity goals that may impact their definition of therapy success. In this single-center case series, divergence exist between pain relief, patient goals and therapy satisfaction, which suggests therapy effectiveness could benefit from an assessment of outcome metrics including therapy/activity goal attainment in addition to pain relief.

The comparison of the efficacy of lumbar nucleoplasty and intradiscal electrothermal therapy in patients with internal disc derangement

Yongjae, Yoo, MD; Chang-Soon, Lee, MD; Jungsoo, Kim, MD; Jee Youn, Moon, MD PhD FIPP CIPS; Yong-Chul, Kim, MD PhD

- BACKGROUND: Nucleoplasty and intradiscal electrothermal therapy (IDET) are useful interventional treatment for internal disc derangement or disruption (IDD) of lumbar disc. We compared the efficacy of the two procedures and evaluated predictive factors associated with the successful outcome.

- METHODS: Lumbar nucleoplasty or IDET guided by fluoroscopy was conducted for lumbar IDD by one pain physician. Successful outcome was defined as more than 50% pain relief on the numerical rating scale pain score during the 6-month follow-up period. The relationship between outcomes and independent variables, including patient demographics, comorbid diseases, pain duration, numbers and level of the affected disc, Dallas Discogram Description, presence of other spine disease such as disc herniation, were investigated using multivariable analyses.

- RESULTS: Of 142 patients, 86 experienced a successful outcome after intradiscal procedure. Nucleoplasty showed more successful outcome than IDET. The Modified Dallas Discogram Scale was a positive predictor for successful treatment. No serious complications related to nucleoplasty occurred.

- CONCLUSIONS: In this study, percutaneous lumbar intradiscal procedure was found to be safe and effective for the management of LBP from IDD. 70% of the included patients with nucleoplasty showed more than 50% pain reduction, without any complications during the 6-month follow-up period.

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Efficacy of Medial Branch Blocks in Pediatric Outpatients with Spinal Pain

Meredith, Brooks, MD MPH; Hayley, Holbrook, BS; Ryan, Reichert, BS; Tyler, Hamby, PhD; Artee, Ghandi, MD

Background: While medial branch blocks (MBB) are relatively common for pain relief in adults with spinal pain, they are rarely performed on children. To our knowledge, this is the largest study examining the effectiveness and safety of using MBB as an intervention for spinal pain in pediatrics.

Methods: A retrospective chart review was conducted on a population of pediatric patients who underwent MBB at Cook Children's Medical Center between June 1, 2012 and May 31, 2019. Demographics, diagnoses, overall functional improvement, complications, and pre-/post-intervention pain scores on 0-10-point scales were reviewed. Only the first MBB was analyzed. Patients missing a pain score or lost to follow-up were excluded from analyses. Change in pain scores was assessed with Wilcoxon's signed-rank test.

Results: There were 52 patients (39 females; 42 white; median age 15.84 years, range 9.36-18.86) with a total of 66 MBB; 17 patients had repeat interventions. Common diagnoses included back pain (48%), spondylolysis (31%), lumbago (29%), and facet pain (23%). Pain scores improved for 87% of patients, 12% were unchanged, and 2% worsened. The pain score change was statistically significant (median = -4.5, range = -9 to 5, $p < 0.0001$). Post-intervention, 81% of patients had overall improvement in functionality. Procedural complications (e.g., weakness, numbness) occurred in 15% of patients; side effects (e.g., muscle spasms, bruising) occurred in 12% of patients.

Conclusion: These results suggest that MBB may improve pain and function in pediatric patients with spinal pain. Future research should be done to determine long-term effectiveness of MBB in children.

500 | Psychosocial

Mental Health Predictors of Functioning in an Active Duty Military Pain Specialty Clinic

Christopher, Phillips, MD; Emmanuel, Espejo, PhD

Background:

Emotional distress plays a role in the experience of chronic pain and chronic pain disability. Recent meta-analyses indicate that emotional distress accounts for up to 30% of the relationship between pain and disability. Thus, addressing emotional distress in patients with chronic pain may be critical to their successful treatment.

Objective:

To characterize emotional distress symptoms, including anxiety, depression, anger, fatigue, and sleep impairment, endorsed by a sample of patients seeking treatment in a pain specialty clinic for active-duty military. To identify specific dimensions of emotional distress most predictive of disability.

Results:

71.5% of patients reported clinically elevated levels on at least one of the five symptom scales, with sleep impairment and fatigue being the most common complaints. Regression analysis revealed that sleep impairment, fatigue, and depression were significant predictors of pain interference and physical and social functioning even while controlling for reported average pain level.

Conclusions:

Clinically elevated levels of emotional distress are highly common in active-duty military members seeking treatment for pain. Sleep impairment, fatigue, and depression likely influence patient functioning beyond reported pain levels. Psychosocial and psychiatric interventions targeting sleep impairment, fatigue, and depression may help improve functional outcomes in this treatment population.

Disclosure:

The views expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the U.S. Government.

502 | Psychosocial

Brief Cognitive Behavioral Therapy for Chronic Pain: Perspectives of VA Integrated Care Providers

Gregory, Beehler, MA PhD; Katherine, Dollar, PhD; Lisa, Kearney, PhD ABPP; Jennifer, Murphy, PhD; Paul, King, PhD; Wade, Goldstein, MA

Introduction: Psychological interventions for chronic pain are effective but patients often face barriers in accessing treatment. Brief Cognitive Behavioral Therapy for Chronic Pain (Brief CBT-CP) was designed for Primary Care Behavioral Health (PCBH) settings in order to improve access to brief treatment (i.e., ≤6, 30-minute sessions). This project evaluated the experiences of Veterans Affairs PCBH providers with limited pain management backgrounds who received initial training in Brief CBT-CP. Method: Following institutional approval as a quality improvement project (IRB exempt), 23 PCBH providers were trained in the protocol by attending a didactic webinar and three technical assistance calls. A web-based survey collected provider self-report data at project close (61% response rate) on their experiences with Brief CBT-CP. Results: Providers evaluated Brief CBT-CP favorably overall (79% were satisfied or very satisfied) and 86% noted they would continue to use it in the future. Protocol materials (e.g., therapist manual, patient handouts) were rated as above average or excellent (85%). Specific protocol strengths included its clarity, flexibility as a modular treatment, and emphasis on self-management skills. Although 93% of providers felt confident using Brief CBT-CP, the most common request for additional training was in the pathophysiology of pain (50%). Identified barriers to local implementation included limited referrals from the primary care team (50%) and patient complexity (29%). Conclusions: Overall, results suggested that a modest level of training promoted uptake of Brief CBT-CP in everyday VA practice settings while generating positive evaluations among PCBH providers who were new to pain management in primary care.

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Predictive Factors for Voluntary Opioid Cessation or Continuation in a Chronic Back Pain Rehabilitation Program

Desimir, Mijatovic, MD; Brittany, Lapin, PhD MPH; Sarah, Rispinto, PhD; Sara, Davin, PhD

Introduction/Statement of the Problem:

Opioid use is a major public health concern. Referral to an interdisciplinary pain program (IPP) is a strategy that may reduce opioid use¹. There is a need to further understand factors that predict treatment response in an IPP, including opioid use and its relation to other psychosocial risk factors (PSRF).^{2,3,4} This study aims to analyze opioid cessation outcomes and predictors among patients participating in an IPP for patients with chronic back pain (CBP), in which opioid cessation is encouraged but not required.

Materials and Methods:

This IRB approved retrospective study reviewed all participants with CBP enrolled in the IPP from August 2016 to December 2018. Opioid use and PSRF data informed from past research⁵ was obtained from clinical interview and chart review. Predictors of opioid cessation were determined using univariate logistic regression models.

Results

369 patients were enrolled in the IPP. Of these, 108 patients (27.7% Male) were on opioids (29.3%). 72 (66.7%) patients remained on opioids and 36 (33.3%) discontinued opioids after the IPP despite a high withdrawal rate in both groups (70.8% and 50.0% respectively). Predictive factors for opioid cessation include overprotective partners and job dissatisfaction. Predictive factors for remaining on opioids include withdrawal from the IPP and rigid ideas of treatment.

Conclusions

With recent concerns over opioids, it is important to reduce unnecessary opioid use in patients. Decreasing opioid use can have multiple long-term benefits for patients⁶. These findings can help clinicians triage patients appropriately as well as guide interventions more appropriately.

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Quality of Life Outcomes for Graduates of a Chronic Back Pain Rehabilitation Program

Desimir, Mijatovic, MD; Brittany, Lapin, PhD MPH; Sarah, Rispinto, PhD; Sara, Davin, PhD

Introduction/Statement of the Problem:

Chronic back pain (CBP) is a major public health concern. It has up to a 13.1% prevalence¹ and causes significant healthcare burden². The biopsychosocial approach to CBP has been shown to be beneficial³. The Cleveland Clinic operates an interdisciplinary pain program (IPP) for patients with CBP. This study aims to look at outcomes for graduates of this program.

Materials and Methods:

This IRB approved retrospective study reviewed all participants with CBP enrolled in the IPP from August 2016 to August 2019. NIH task force recommended patient reported outcomes on quality of life metrics⁴ were obtained through questionnaires at initiation and 3 months later at graduation. Outcomes were compared using paired t-test statistics.

Results

309 patients (32% male, mean age 54.5 ± 13.3) graduated from the program. These patients showed statistically significant improvements in all outcomes measured including the Modified Oswestry Disability Index, Patient Health Questionnaire-9, and multiple Patient Reported Outcomes Measurement Index Scores (PROMIS) (Table 1). Clinically significant improvement was seen for PROMIS Social Role Satisfaction in 57%, ODI in 54%, PROMIS Pain Interference in 54%, and between 30%-45% of patients in the other outcomes measured (Figure 1).

Conclusions

An IPP can be a beneficial tool to address CBP. Using the biopsychosocial approach in this manner can have clinically significant outcomes for patients who graduate with significant improvements in social role satisfaction, disability, pain interference, functional status, global physical and mental health.

505 | Psychosocial

Borderline personality features among patients with chronic non-cancer pain, barrier versus unexploited targets for effective pain management: a systemic review

Fei, Cao, MD PhD; Jaskirat, Sidhu, MD; Haitham, Salem, MD PhD ; Da-Wei, Ye, MD PhD ; Yu-Ke, Tian, MD PhD

Objective:

Borderline personality disorder (BPD) is common in patients with chronic non-cancer pain (CNCP). BPD patients with CNCP often report worse severity and are more likely to abuse opioids, which further complicates their pain assessment and management. This study would systemically check association between BPD and CNCP, to provide some unexploited targets for effectively managing CNCP.

Method:

a comprehensive literature search was performed through multiple databases, including Pubmed, PsychINFO and Google Scholar. Combination of following search terms were used: borderline personality disorder, chronic pain, chronic non-cancer pain, headache, fibromyalgia, and arthritis. The reference lists of relevant articles were also searched for appropriate studies.

Results:

Our results showed the pool prevalence of BPD among CNCP was 23.3% (including 11.3% in chronic headache, 27.5% in arthritis, and 24.3% in chronic spinal pain), which suggested there was a significant portion of CNCP patients had co-occurring BPD.

Conclusions:

Our results emphasize approximately one fourth of individuals with CNCP could have co-occurring BPD, which necessitates paying extra attention to manage BPD in patient with CNCP. A growing literature showed that in patients with BPD and co-occurring mood and/or anxiety disorders, treatment should focus principally on BPD, because effective treating BPD, rather than co-occurring disorders, is more likely to lead to remission of both mood and anxiety disorders. Similarly, for CNCP co-occurring BPD, CNCP should be treated through multiple approaches, but not to the exclusion of BPD treatments if patients exhibit some BPD features.

506 | Psychosocial

Factors related to chronic pain patients' decision to initiate behavioral pain treatment following their pain specialist referral.

Ronit, Lyon, MD; Nathaniel, Schuster, MD

Introduction: Many patients referred by pain physicians to pain psychology do not proceed to establish care with pain psychology. This study investigated factors that may influence whether chronic pain patients' initiate behavioral pain treatment following pain physician referral.

Methods: This is an IRB approved, retrospective study of 150 consecutive referrals of unique patients from UCSD Pain Medicine to UCSD Pain Psychology.

Results:

74/150 (49.3%) of patients referred to pain psychology established care with pain psychology.

58/98 of patients who had previously seen mental health (MH) services established care with pain psychology (59.2%, 95% CI 46-72%) versus 16/52 (30.8%, 95% confidence interval 18-43%) who hadn't (OR 3.26, 95% CI 1.6-6.66).

Among the patient subset with depression and/or anxiety, of those who had previously seen MH services, 47/82 (57.3%, 95% CI 47-68%) established care with pain psychology versus 3/20 (15%, 95% CI 1-31%) of those who had not (OR 7.61, 95% CI 6.94-8.27).

43/96 (45%, 95% CI 35-55%) referred for general pain psychology evaluations established care versus 24/38 (61%, 95% CI 45-96%) referred for implantable device pre-procedure evaluation.

Discussion: Patients are significantly more likely to establish care with pain psychology if they have previously seen a MH professional. This was even more marked among patients with a history of depression and/or anxiety. Whether referral was for general psychological evaluation or implantable device pre-procedure evaluation did not significantly influence whether patients established care. Targeted interventions are needed to improve likelihood of patients who are naïve to MH services engaging with pain psychology services.

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Analysis of the Validity of Factors Predicting Performance in a Multidisciplinary Pain Medicine Fellowship Program

Robert, Bolash, MD; Hersimren, Basi, MD; Beth, Minzter, MD; Richard, Rosenquist, MD; Jianguo, Cheng, MD PhD

Introduction:

Identifying candidates best suited for multidisciplinary pain fellowships is a key component of building high performance teams. We sought to evaluate if our interview assessments were concordant with post-training ranking of the same house officers following completing their fellowship, and to analyze the validity of the historically used predictors in assessing postgraduate applicants.

Materials and Methods:

We retrospectively reviewed predictors for fellowship performance over three successive fellowship classes. Candidates underwent independent evaluations generating a match list positioning applicants from most to least desirable. Using linear regression, correlations were evaluated between post-fellowship rankings and match-ranking parameters (USMLE scores, personal statements, reference letters, research achievements).

Results:

Among more than 700 applicants, 200 were interviewed and 30 were matched. There was no correlation between match and post-fellowship ranks ($r=0.096$; $P>0.05$). Associations between post-fellowship rank and USMLE scores ($r=0.411$; $p < 0.05$), personal statements ($r=0.412$; $p < 0.05$) and reference letters ($r=0.404$; $p < 0.05$) were strongly correlated. In-fellowship training scores were not correlated ($r=0.108$; $P>0.05$). Surprisingly, research accomplishments were inversely correlated, ($r = -0.476$; $p < 0.01$).

Conclusions:

USMLE performance, reference letters and applicants' personal statements are positively correlated to fellowship performance and should be considered in the selection process. The lack of correlation between positioning on a match list and post-fellowship rank uncovers significant opportunities to improve our selection process. The surprising finding of an inverse correlation with research achievements remains an area for further study.

508 | Psychosocial

Improved Pain Coping and Arrhythmia Mitigation with Heart Rate Variability Biofeedback Training: A Case Report

Jared, Gilman, MD; Raouf, Gharbo, DO

Introduction: Heart rate variability (HRV) is an established whole health biomarker and reduced HRV is associated with chronic pain. Emerging evidence demonstrates HRV biofeedback (HRV-B) not only modulates the whole health biomarker, but also reduces pain perception. In this case, these concepts are exemplified in a 40 year old female who has chronic abdominal and musculoskeletal pain. Her medical history is significant for vascular Ehlers-Danlos Syndrome, two total hip arthroplasties and two prior cardiac ablations.

Case: Prior to initial consultation a Holter study demonstrated 11,927 PVC's over 24 hours and a cardiac ablation was scheduled 10 weeks later. After consultation, four 1-hour HRV biofeedback training sessions were completed and a home program of resonant breathing 10 minutes BID and PRN was prescribed with a smartphone application (HeartMath Inner Balance) that could be monitored remotely to ensure compliance. She developed improved pain coping, PVC awareness and the skill to mitigate that sensation. This was confirmed in her primary care office cancelling an in-office emergent transfer. During the scheduled ablation, a limited number of PVC's were observed and the procedure was cancelled after one hour. Now 2.5 years later PVC's are still not problematic despite continued electrolyte difficulties.

Conclusion: With only four HRV-B sessions and a verifiable objective home program this case demonstrates HRV-B can improve pain coping and cardiovascular health long term. This case has translational health implications that HRV-B skill acquisition is a low resource healthy objective method to increase pain coping and improve health. Further study is warranted.

509 | Psychosocial

PROMIS-29 as the fifth vital sign to define spinal cord stimulator trial success: a case report

Ashley, Scherer, BA MA; Michael, Fishman, MD MBA

Background

Pain is a complex individual experience that can permeate every aspect of ones' life. Quantifying this with a numerical score does not adequately capture the pain experience. The PROMIS-29 is a multidimensional outcomes tool recommended by the NIH Research Task Force (RTF) for Chronic Low Back Pain (cLBP) that cross-talks to legacy instruments.(1) PROMIS-29 assesses patient-reported physical function, anxiety, depression, fatigue, sleep disturbance, social participation, pain interference, and pain intensity.(2,3) Our group collects detailed device data along with PROMIS data to define success in SCS trials.

Methods:

A computerized platform (Celéri Health, Inc.; Wilmington, DE) was utilized to automate collection of PROMIS-29 data, overlay SCS trial data, and display outcomes compared to patient baseline data.

Results:

PROMIS-29 data for a successful SCS trial is presented for a patient who underwent a trial of SCS for postlaminectomy syndrome, noting robust improvement in all domains. (Fig 1)

Discussion:

Payors and policies refer to percent pain relief or change in pain score as the primary outcome measure of success, and as such documentation typically reflects this measure. Percent pain relief is an imperfect marker of treatment success that does not describe many outcomes of a 'successful' pain therapy. Furthermore, percent pain relief does not identify or quantify psychosocial factors contributing to or arising from chronic pain. Evaluating the impact of SCS trial on multiple dimensions using the PROMIS-29 meaningfully illustrates treatment success in the context of the biopsychosocial model of pain.

510 | Psychosocial

Pain Intensity and Pain Impact Trajectories in the Acute Postoperative Period

Bryanna, Canales, BS; Matthew , Millington, BS; Nicholas, Giordano, PhD RN; Michael, Kent, MD; Krista, Highland, PhD

Optimal patient-centered care and research must leverage multidimensional assessment to characterize the dynamic experience of both pain intensity and its impact acutely after surgery. This analysis sought to identify pain intensity and impact trajectories utilizing multidimensional assessment.

In this prospective, observational study, participants undergoing one of six surgeries at Walter Reed National Military Medical Center completed the Defense and Veterans Pain Rating Scale (DVPRS), prior to and on postoperative days (POD) 1-3. The DVPRS is a validated self-reported scale and measures two dimensions: pain intensity and impact on activity, sleep, mood, and stress. K-means longitudinal cluster analyses identified four trajectories for each pain dimension. Bivariate analyses explored differences. WRNMMC IRB approved this study.

Pain intensity and impact trajectory groups were well-distributed. Intensity groups were characterized as: moderate-high/stable, moderate-high/decreasing, moderate/increasing, low/stable. Impact groups were characterized as: all high/stable, high/increasing physical + moderate/stable psychological, high/decreasing activity + low/stable other, moderate/stable sleep + low/stable other. Exploratory analyses indicated some pairwise differences in age and presurgical DVPRS scores for both trajectory sets; and in hospital duration across impact groups. Neither groups differed in other factors (e.g., surgery type).

Distributions of pain intensity and pain impact trajectories were more variable at moderate score ranges, but more uniformly overlapped at high pain intensity and impact. Clinical characteristics were not associated with trajectories, indicating unmeasured processes. Further research is needed to elucidate patterns of additional biopsychosocial outcomes across time and determine treatment algorithms based on multidimensional trajectories.

600 | Rehabilitation

“It’s opening my eyes at literally everything that I do:” integrating the biopsychosocial model in an intensive outpatient program for U.S. military service members with persistent pain.

Barbara, Bujak, PT DPT PhD; Chrisine, Blake, RD PhD; Paul, Beattie, PhD; Shana, Harrington, PT PhD; Courtney, Monroe, PhD EP-C; David , Wilkie, MD; Mary, Earwood, MD

Introduction: Persistent pain is one of today’s most complex healthcare issues. It affects more military service members and veterans than the general population. The purpose of this study was to gain insight into the process of biopsychosocial integration for managing persistent pain in participants of an intensive outpatient program (IOP). Methods: This was a qualitative study in a military pain management center approved by Army IRB. Twenty-two patients and 4 staff were interviewed and observed between September and December 2018. Patient participants were interviewed four times; staff members were interviewed once, and a researcher participated in and observed the program. Iterative coding and categorization of participants, using NVivo12, resulted in themes addressing changes in pain perception, barriers and enablers, impact of various experiences and effectiveness of the program. Staff interviews and observation notes were used to triangulate the data. Results: Five categories emerged: (1) participants well-versed in the biopsychosocial aspects of pain, fine-tuning skills; (2) participants with life-altering realizations; (3) participants with partial buy-in focused toward physical function and performance; (4) participants with partial buy-in focused on psychosocial changes; (5) participants for whom the biomedical model prevailed and despite some positive changes, the result was considered unsatisfactory. Conclusion: The evolution of persistent pain symptoms and understanding varied among participants in the IOP. Individuals who did not integrate all components of the biopsychosocial model for pain management reported lesser changes in their lives. Future studies should address the ongoing process of change in persistent pain after completion of the program.

601 | Rehabilitation

A Novel Sub-Perception Spinal Cord Stimulation Therapy Enabling Clinically Significant Pain Relief and Fast Onset

Clark, Metzger, MD; M. Blake, Hammond, PA; William, Newton, DO MS; Jose, Paz-Solis, MD; Simon, Thomson, MBBS; Roshini, Jain, MS; Lilly, Chen, MD; Luca, Anecchino, PhD; Que, Doan, BS

Introduction/Statement of the Problem:

Sub-perception Spinal Cord Stimulation (SCS) is a modality associated with long wash-in times and sometimes requires lengthy evaluations to determine settings that provide analgesia. Achieving a more rapid onset of sub-perception pain relief therefore represents an unmet patient need. Here, we describe a case-series evaluation of a novel, paresthesia-guided, sub-perception SCS therapy.

Materials and Methods:

This is a multi-center, retrospective, observational case-series of permanently-implanted patients up to 3-months post-implant (up to N=40). Patients were implanted with a neurostimulator (Spectra WaveWriter/Spectra, Boston Scientific) capable of providing multiple independent current control (MICC) and a novel, paresthesia-guided, fast-acting sub-perception SCS algorithm, per standard of care. Data collected and reported was based on study sites' usual practice which included pain scores and functional mobility. Institutional Review Board (IRB)-approved waivers of consent were obtained.

Results:

A previous assessment using this SCS algorithm reported a mean NRS change from 6.1 to 1.4 (n = 24) from start of the therapy programming session to the immediate conclusion of the session (1). Preliminary results (n = 20) in this current evaluation demonstrate a mean improvement of 5.0 ± 1.8 points (6.5 to 1.5) in overall pain score occurring within an average of 12 minutes.

Conclusions:

This clinical study seeks to further evaluate a novel, fast-acting sub-perception algorithm that can provide the benefits of MICC-based SCS (efficient/precise neural targeting) and sub-perception SCS (pain relief without paresthesia) while mitigating potential drawbacks associated with these modalities (i.e. paresthesia, inefficient targeting, slow analgesia onset, high patient charge burden). Additional controlled studies will be needed.

602 | Rehabilitation

Outcomes Using an SCS Device Capable of Delivering Combination Therapy and Advanced Waveforms/Field Shapes

Clark, Metzger, MD; M. Blake, Hammond, PA; Stephen, Pyles, MD; Edward, Washabaugh, MD; Anthony, Berg, MD; Romanth, Waghmarae, MD; J. Rafe, Sales, MD; Yu, Pei, MPA; Roshini, Jain, MS

Introduction/Statement of the Problem:

Developing “all-in-one” spinal cord stimulation (SCS) systems with capability for multiple types of neurostimulation paradigms likely will empower patients to identify the best treatment approach suitable for their needs. Here, we provide real-world outcomes in patients who used an SCS system designed to combine multiple waveform availability, both sequentially and simultaneously, with an algorithm designed to enable highly manipulatable control of field shape.

Materials and Methods:

This is a consecutive, multi-center case-series based on retrospective chart review as part of an ongoing real-world evaluation of SCS outcomes for chronic pain (Clinicaltrials.gov identifier: NCT01550575). Patients were implanted with an SCS system (Precision Spectra WaveWriter, Boston Scientific) capable of combination therapy (sequential or simultaneous), multiple waveforms and advanced field shapes for low back and/or leg pain. Institutional Review Board (IRB)-approved waivers of consent were obtained.

Results:

To date, 420 patients have been analyzed. A statistically significant improvement in overall targeted pain scores at last follow-up was reported (Baseline NRS: 7.2; mean last follow-up [137±145 days] NRS: 2.2; $p < 0.0001$). Twenty-three percent of patients indicated being free of pain at last follow-up. Updated data from this on-going real-world observational study will be reported.

Conclusion:

These results provide support for the postulate that an SCS system designed to provide combination therapy, multiple waveform options, and enhanced anatomical targeting capabilities, allows for highly effective pain relief outcomes in a patient-specific manner within the real world clinical setting.

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Exploration of High and Low Frequency Options for Sub-Perception Pain Relief: The HALO Study

Jose, Paz-Solis , MD; Simon, Thomson, MBBS; Roshini, Jain, MS; Lilly, Chen, MD; Ismael, Huertas, PhD; Que, Doan, BS

Introduction/Statement of the Problem:

Effective sub-perception Spinal Cord Stimulation (sub-p SCS) can be delivered at 10 kHz (1). Moreover, a Level I RCT demonstrated that effective and equivalent analgesia can be achieved at lower kHz frequencies (1-10 kHz) at the appropriate neural dose, thereby enabling significant energy savings (2). We sought to determine if a clinical difference exists when using sub-p SCS at frequencies from 1 kHz down to 10 Hz and if “sweet spot” identification and targeting is improved using a novel field shape designed to preferentially engage neural elements within the dorsal horn.

Materials and Methods:

This is a consecutive, multi-center case-series of patients implanted with an SCS system (Precision Spectra or Precision Spectra WaveWriter, Boston Scientific) for chronic pain. Patients underwent a “sweet spot” search using broad fields at 1 kHz and a novel Dorsal Horn targeting field shape algorithm. Frequency of sub-p stimulation was titrated, and pulse-width and amplitude adjusted. Charge-per-second was also determined. Institutional Review Board (IRB)-approved waivers of consent were obtained.

Results:

Baseline NRS score in 30 patients evaluated to date was 8.2. All frequencies assessed provided similarly equivalent low back pain relief [NRS range: 2.5-3.1]. Similar results were obtained when assessing for leg and overall pain. Charge-per-second significantly decreased following frequency reduction and dose titration, from 346.9 to 8.9 $\mu\text{C}/\text{s}$, at 1,000Hz and 10Hz, respectively.

Conclusion:

Results of this on-going observational case series demonstrate that if appropriately dosed at frequencies from 10-1000 Hz, effective pain relief equal to currently available methods of sub-perception SCS can be achieved.

604 | Rehabilitation

Outcomes of a Prospective Randomized Controlled Trial Utilizing a Spinal Cord Stimulation System Capable of Multiple Neurostimulation Modalities (COMBO Study)

Mark, Wallace, MD; Lilly, Chen, MD; Roshini, Jain, MS

Background and Aims:

Spinal Cord Stimulation (SCS) devices that enable personalized fine-tuning of stimulation parameters or waveforms offer the potential to address the variability among chronic pain patients. We endeavored to clinically investigate this system by evaluating the outcomes associated with use of multiple neurostimulation modalities as compared with conventional SCS settings alone in a prospective, randomized controlled trial.

Methods:

COMBO is a prospective, multicenter, IRB-approved (all patients consented prior to study participation), randomized controlled trial with an adaptive design (Clinicaltrials.gov identifier: NCT03689920). The primary endpoint of the study is based on the proportion of subjects, permanently implanted with an SCS system capable of multiple neurostimulation modalities (Spectra WaveWriter, Boston Scientific), demonstrating $\geq 50\%$ reduction from Baseline in average overall pain intensity at 3-month follow up. Additional endpoints will assess quality of life, disability etc. Adverse events will also be collected.

Results

Data collection and analysis using the same SCS system in this RCT are ongoing at up to 15 centers. Preliminary analysis to be presented.

Conclusions:

Outcomes of a prospective, randomized controlled trial offer the opportunity to provide Level 1 evidence related to the use of an SCS system capable of multiple neurostimulation modalities in the treatment of chronic pain, while minimizing bias and confounding effects resulting from differences in patient selection, demographic variables, investigator technique and/or patient management. The COMBO randomized controlled trial will evaluate the clinical effectiveness of multiple neurostimulation modalities of SCS (versus conventional SCS settings) used in treatment of chronic pain.

605 | Rehabilitation

Outcomes Following Utilization of a Device Adaptor in Previously-Implanted Patients Using SCS for Chronic Pain

Thomas, Yearwood, MD PhD; J. Rafe, Sales, MD; Anne, Christopher, MD; Yu, Pei, MPA; Roshini, Jain, MS

Introduction/Statement of the Problem:

Patients experiencing problems with Spinal Cord Stimulation (SCS) system device longevity and/or loss of efficacy may achieve better outcomes utilizing newer technologies that offer a variety of waveforms and programming options to address their chronic pain. Here, we report outcomes of previously-implanted patients using a commercially-available adaptor enabling connection to an SCS system offering multiple neurostimulation-based treatment approaches to regain and maintain efficacious therapy.

Materials and Methods:

This is a retrospective study of patients previously implanted with an SCS system (commercially-available SCS device, Abbott) who then went on to utilize an adaptor (Precision S8, Boston Scientific) to connect to a new SCS system capable of multiple modality stimulation and/or combination therapy. Pain relief and other associated outcomes with both previously-implanted SCS systems and newly connected commercially-available systems (Boston Scientific) are being collected. Institutional Review Board (IRB)-approved waivers of consent were obtained.

Results:

Data from 8 patients who provided all pain scores have been collected and analyzed to date. Six of 8 patients utilizing a device adaptor reported better pain relief after connection to and use of a multiple waveform SCS system (i.e. pain scores after using current versus previous system at post-baseline follow-up assessment). A mean 4.7 ± 1.9 point improvement was reported using the current system versus a 2.3 ± 2.8 point improvement using the previous system. Additional data to be presented.

Conclusion:

The results of this preliminary study suggest offering previously-implanted SCS patients a system capable of providing multiple waveforms can improve pain relief.

606 | Rehabilitation

Clinical Experience Using Multiple Available SCS Waveforms and Field Shapes for Focal Lower Limb Pain

Louis, Raso, MD; Lilly, Chen, MD; Kristen, Lechleiter, MS; Roshini, Jain, MS

Introduction/Statement of the Problem:

Data on chronic focal pain relief has been reported using Dorsal Root Ganglion (DRG) stimulation (1). However, a high incidence of adverse events associated with this technique has been documented (2). Here, we present our early clinical experience using multiple waveforms as an alternative method for treatment of focal lower limb pain.

Methods:

This is a retrospective, case-series evaluating patients with chronic focal lower limb pain, some of whom previously failed DRG stimulation. Patients were implanted with a neurostimulator capable of multiple field shapes and waveforms at variable amplitude, pulse width, and frequency (Precision Spectra WaveWriter, Boston Scientific). Institutional Review Board (IRB)-approved waivers of consent were obtained.

Results:

Recent reports using SCS to target focal pain using leads placed through the sacral hiatus (L5/S1) demonstrated a 6.7-point reduction in NRS ($p < 0.0001$) at last follow-up (mean=247 days) in a cohort of 13 patients (3). Outcome measures from our early clinical experience using standard SCS techniques for focal pain will be presented.

Conclusions:

DRG stimulation may be associated with complication risks in addition to a more complex procedure. This small case-series assesses whether neurostimulation using an SCS device capable of advanced waveforms and field shapes is a viable, alternative option to treat focal lower limb pain. Additionally, larger studies are warranted to further evaluate efficacy in this patient population.

607 | Rehabilitation

Is the Effectiveness of Wearable Transcutaneous Electrical Nerve Stimulation Impacted by Generalized Pain?

Shai, Gozani, MD MPH; Xuan, Kong, PhD

Generalized chronic pain is common and challenging to manage. Wearable TENS (wTENS) is a non-invasive treatment for chronic pain in which the device is designed for a predetermined location. Because TENS produces local and remote analgesia, it may be feasible to treat generalized pain from a single location. The aim of this study was to evaluate if wTENS effectiveness is dependent on pain distribution. This retrospective study analyzed real-world data collected remotely from individuals with chronic pain using wTENS on the upper-calf. Participants were included if they reported ≥ 3 months pain, ≥ 4 pain intensity prior to starting wTENS and utilized TENS $\geq 80\%$ days during assessment period. Generalized pain was defined as pain in each of the following three regions: (i) feet or legs, (ii) hips or low-back, (iii) hands/wrist, arms, shoulders or neck. The outcome measure was baseline to follow-up (92 ± 14 days) change in pain intensity and pain interference with function (average of sleep, activity and mood). One-way ANOVA was used to model the dependence of outcomes on generalized pain with adjustment for demographic factors, baseline pain, medical history and pain characteristics. A total of 1,278 participants were evaluated. Generalized pain prevalence was 57.4%. The change in pain intensity was -1.08 (SE 0.08) in participants with generalized pain compared to -0.88 (SE 0.09) without generalized pain, $p=0.123$. The change in pain interference with function was -1.34 (SE 0.09) compared to -1.16 (SE 0.10), $p=0.209$. wTENS effectiveness appears to be independent of the presence of generalized pain.

608 | Rehabilitation

Decreased Opioid Consumption with Patient Education in Acute Inpatient Rehabilitation

Tomas, Salazar, MD; Shrut, Patel, MD; Stephanie, Chan, MD; Eric, Liu, DO; Lei, Lin, MD PhD

Introduction/Statement of the Problem: Opioid overdose is now the leading cause of injury-related deaths in the United States. Patients' lack of basic medical knowledge is believed to contribute to this crisis. Many patients do not have adequate education on pain management, opioid usage, and medication side effects, leading to increased consumption of opioids. The objective of this study was to evaluate the efficacy of patient education on opioid usage in an acute rehabilitation hospital.

Materials and Methods: This is a prospective cohort study that examined opioid consumption before and after medical education in patients on an opioid pain regimen in an acute rehabilitation hospital. A pamphlet containing current guidelines on pain management and basic opioid information was distributed and explained to the patient. The primary outcome was the difference between opioids consumed before and after the education.

Results: The opioid consumption was calculated for 26 patients. The mean morphine equivalents were 37.7 and 31.3 for pre- and post-education, respectively. A Shapiro-Wilk test showed that the data did not fall under the normal distribution. Therefore, a Wilcoxon Signed-Rank Test was utilized to further analyze the non-parametric data, which demonstrated $p = 0.0397635$.

Conclusions: The p-value supports rejecting the null hypothesis, therefore the data demonstrated a statistically significant decrease in opioid consumption after educating patients on basic information regarding pain management and opioid use. Our study is significant in the setting of the opioid crisis and one that should be further examined in larger inpatient cohorts.

609 | Rehabilitation

Predictors of treatment outcome in veterans with chronic pain: Results from Outpatient and Residential Functional Restoration Pain Programs

Lauren, Hollrah, PsyD; Brooke, Smith, PhD; Bernard , Canlas, MD

Introduction: Chronic pain impacts veterans at higher rates than non-veterans. It is a complex condition with no medical solution. Functional Restoration Programs (FRP) are comprehensive interdisciplinary rehabilitation programs shown to increase function and return to work, reduce provider visits and surgeries, and improve pain and depression. This study looked at both outpatient and residential FRP settings to investigate the effectiveness of the FRPs and identify predictors of treatment outcome in each program.

Methods: Participants were veterans seeking chronic pain treatment in an outpatient FRP (N = 156) from Sept. 2014 – April 2019 and a residential FRP (N = 116) from March 2016 – May 2019 at VA Puget Sound, American Lake. IRB approval for QI research was obtained for this project. Data were collected at pre, post, and 3-month follow-up for program evaluation and quality improvement purposes. Both programs include: A multidisciplinary, biopsychosocial approach to care emphasizing rehabilitation and self-management, de-emphasis on passive biomedical approaches (e.g., medication), individualized treatment planning based on co-disciplinary medical and psychological evaluations. They have chronic pain education, psychological treatment emphasizing ACT, physical therapy focused on physical re-activation and Mind-body approaches to care (e.g., meditation, Mantram, tai chi)

Results: For both residential and outpatient FRPs, outcomes significantly improved from pre to post measurement. Gains were maintained at 3 months in the outpatient program and residential gains included those in the areas of fear and mobility.

Conclusions: Outpatient and Residential FRPs appear to be effective programs for improving functional outcomes in chronic pain patients

610 | Rehabilitation

Program Development and Quality Improvement For Restoring Function in U.S. Military Veterans with Complex Chronic Pain Through Participation in An Outpatient Functional Restoration Pain Program at the VA Puget Health Care System: A 5-year Experience

Bernard , Canlas, MD; Erik, Clarke, PhD; Brooke, Smith, PhD; Lauren, Hollrah, PsyD; Pearl, McGranaghan, RN; Timothy, Dawson, MD

Introduction: Chronic pain has a higher prevalence in the U.S veteran population. Nahin (1) reported that veterans experience a much higher prevalence of severe pain than the general population.

Materials/methods: The VA Puget Sound Health Care System has established a CARF-accredited outpatient functional restoration pain program at the American Lake campus. The program is based on the biopsychosocial model of pain care (2). Veterans attend weekly pain education classes prior to participation in the program. Veterans participate twice a week for 8 weeks. Veterans have to complete the Pain Outcomes Questionnaire (POQ), Insomnia Severity Index (ISI), Pain Catastrophizing Index (PCS), Tampa Scale for Kinesiophobia (TSK) and Pain Self Efficacy Questionnaire (PSEQ) prior to the start and completion of the program. In the past 5 years, 156 veterans who have graduated from the program have completed their 12 month follow up survey. This is an IRB-approved study. We used paired t-test and Cohen's D to assess for magnitude of effect. 0.2 for small effect, 0.5 for medium effect and 0.8 and greater for a large effect. This study reports the immediate post participation assessment upon completion of the program.

Results: We noted medium effect (greater than 0.5) on total POQ, PCS, TSK, PSEQ measures. There was small effect on ISI. We have previously published our initial results of our program (3).

Conclusion: In the past 5 years, more veterans living with chronic pain who have participated in our unique program have continued to obtain similar and significant improvements in their functionality

611 | Rehabilitation

The preview of NIH project : Attempting to create an objective scale for pain

Maryam, Hosseini, MD; Loren , Fishman, MD

Volunteer subjects have at least 5/10 pain for MRI confirmed rotator cuff syndrome. Exclusion criteria: previous shoulder surgery, neuromuscular disease, conditions causing pain with shoulder flexion/abduction, paralysis/limitations in movement of the face/limbs. Qualified subjects randomized to be either sham plus intervention maneuver or simply intervention maneuver.

Facial expressions and bodily movements were videotaped during arm abduction/flexion. Sham group subjects were taught a share maneuver, followed by repetition of videotaping them while they abduct and flex their arms. Next both groups were thought a simple yoga maneuver known as the Triangular Forearm Support (TFS), Followed by another video taping of the abduction and flexion. Both subjects and a physiatrist rate subject's pain and 10 point scale after each abduction and each flexion.

Artificial Intelligence Analysis at Carnegie Mellon University determines the algorithms that properly predict the amount of subjective pain and the basis of the subjective video data. We have so far completed 160 of 200 subject, and have not yet submitted the data to the artificial intelligence analysis. However, we have done a preliminary investigation on the TFS maneuver, and it does significantly reduce the pain according to the subjects' and the physicians' 10-point scale reports.

There are already objective means to determine the vast majority of forest or manufactured facial expressions for pain. If successful, the Objective Quantification of pain will help physicians decide about medical/ interventional management, enable pharmaceutical firms to determine how helpful their medications actually are, and objectively evaluate the effect of various pain relieving surgeries.

612 | Rehabilitation

Effects of Service Dog Training on Post-Traumatic Stress Symptoms in a Military Population: A Preliminary Analysis

Sophia, Thompson; Kiara, Buccellato, MA; William, Roddy, BS; Paul, Pasquina, MD

Background: Pain, elevated heart-rate and blood pressure, and sleep dysfunction are common symptoms associated with Post-Traumatic Stress Disorder (PTSD) in the military population. Given the prevalence of military PTSD (11-30%), adjunct therapies like the Service Dog Training Program (SDTP)—which already have anecdotal reports of effectiveness—to improve social, physical, and psychological well-being are imperative.

Methods: Military healthcare beneficiaries with PTSD or PTS symptoms are recruited from the National Capital Region (NCR) to participate in this 10-week study. Biological, psychological, and social measures are collected weekly. Blood pressure and heart-rate are taken before and after each training session (2x per week), as well as self-reported measures of sleep and perception of pain (DVPRS).

Results: A total of n=7 participants had completed all 12 sessions at the time of the analysis.

Almost all recorded vital signs that are telling of stress (BP, HR) decreased throughout both the duration of the study and within the individual sessions. Further, stress resulting from pain experienced in the first half of the study to the last half decreased by an average of .2 points on a 10-point scale. In the same time frame, pain's contribution to sleep dysfunction decreased (by 1 point or more) or remained the same in all but two patients, which bears notable clinical significance.

Conclusion: Preliminary physiological response data from the SDTP shows promise in lowering vitals in PTSD patients. Additionally, qualitative gauges of mental wellness (stress and sleep) also indicate an alleviation of PTSD symptoms. Further clinical research is warranted.

613 | Rehabilitation

Program Development and Quality Improvement Outcomes of an Interdisciplinary Pain Rehabilitation Program for U.S. Military Veterans with Complex Chronic Pain in a Residential Behavioral Health Setting: A 3-year Evaluation

Erik, Clarke, PhD; Bernard , Canlas, MD; Brooke, Smith, PhD; Pearl, McGranaghan, RN; Timothy, Dawson, MD

Military veterans report a higher prevalence of pain than the general U.S. population (1). The department of Veterans Affairs currently houses 20 interdisciplinary pain rehabilitation programs (2) to target this widespread concern. The current analysis is a 3-year follow-up on primary outcomes of the first residential pain rehabilitation program housed in a VA domiciliary, which is CARF accredited under behavioral health standards. The Residential Functional Rehabilitation Pain Program (rFRPP), located at the VA Puget Sound Healthcare System is an interdisciplinary 5-week program consisting of pain psychology, physical therapy, medical, social work, and pharmacy. Within the 5 weeks, veterans receive 120 hours of programming which includes individualized physical therapy, psychosocial interventions, mind-body interventions, education on pain physiology, and education on pain medication. Interventions are primarily delivered in a group setting, with individualized interventions as needed. At the time of this analysis, 116 veterans had completed the program and outcome measures were analyzed at pre, post, and 3-month follow-up. Primary measures consisted of the Pain Outcome Questionnaire (POQ), Tampa Scale for Kinesiophobia (TSK), Pain Catastrophizing Scale (PCS), Pain Self-Efficacy Questionnaire (PSEQ), and Insomnia Severity Index (ISI). Results demonstrated improvements on the POQ, TSK, PCS, PSEQ, and ISI ($p < .05$) at post evaluation ($n=116$). Results at the three-month follow-up ($n=27$) demonstrated continued improvements for the POQ, TSK, PCS, and PSEQ ($p < .05$). These findings suggest the effectiveness of a residential interdisciplinary pain rehabilitation program in a behavioral health setting. Continued analyses are needed to further understand improvement sustainability from this interdisciplinary pain rehabilitation program.

614 | Rehabilitation

Improving fall risk screening in community dwelling patients with chronic pain by assessing lower extremity function with a wearable sensor

Michael, April, MD; Howard, Hoffberg, MD

Study design: consecutively chosen, community dwelling, ambulatory patients from an outpatient chronic pain management practice with a Timed Up and Go Test (TUG) < 12 seconds and >4/5 strength of knee extensors

Objective: Improve sensitivity of fall risk assessment by evaluating lower extremity (LE) function in patients that were not found to be at risk for a fall using the TUG alone

Hypothesis: By assessing knee extension function with a wearable inertial motion unit (IMU), the false negative rate of the TUG can be reduced significantly

Methods: After obtaining patient consent, thirty community dwelling ambulatory chronic pain patients (CP) with TUG < 12 seconds and >4/5 strength of the knee extensors, underwent testing with an IMU to assess knee extension angular velocity

Results: 70% of community dwelling ambulatory CP with a negative TUG were found to have significant LE dysfunction putting them at increased risk for a fall

Conclusions: Up to 90% of CP are at increased risk of falling. Outpatient office screening should be done routinely in this population. Testing must be quick and easy, but also accurate. The TUG test is quick and simple but has a high false negative rate. Adding assessment of LE function with an IMU enabled identification of a significant number of community dwelling ambulatory patients who were at risk for falling that were not identified with the TUG alone.

615 | Rehabilitation

Femoral Neuropathy Secondary to Retroperitoneal Hematoma

Allison, Glinka Przybysz, MD MPH; Thomas, Hudgins, MD

Setting: Outpatient PM&R clinic

Patient: 74 yo M with right lower extremity (RLE) weakness and pain

Case Description: Patient presents 6 weeks after a fall with progressive RLE weakness. Past medical history significant for chronic back pain status post right S1 epidural steroid injection 5 weeks prior. Patient had been seen and evaluated previously by orthopedic surgery and neurosurgery. EMG studies showed diffuse nerve denervation. X-ray and MRI of the lumbar spine showed no acute changes with previously noted multilevel degenerative changes with grade 2 spondylolisthesis at L5-S1. MRI of the hip: s/p right hip arthroplasty without evidence of pathology; new edema in the right iliac and poses muscle consistent with a grade 1 strain.

Assessment/Results: Examination of the RLE showed significant quadriceps atrophy, decreased hip flexion and knee extension strength 3-/5. Hip adduction was 5/5 bilaterally. Decreased right patellar reflex. MRI of the plexus/pelvis, repeat EMG and PT were ordered. Patient followed up two weeks later. MRI revealed a retroperitoneal hematoma compressing the femoral nerve. Repeat EMG was consistent with a right femoral neuropathy with decreased but significant recruitment. Patient's diagnosis was most consistent with a RLE femoral neuropathy secondary to retroperitoneal hematoma s/p strain after a fall.

Conclusions: It is important to consider retroperitoneal hematoma as a cause of femoral neuropathy even in patients not on anticoagulation or post-operative status.

700 | Translational

Change Agent Impact on Pain Management Experience through Lavender Aromatherapy: Evidence-Based Practice Project

Karen, Mack, DNP MBA APRN RN-BC CCNS ACPNC ACNP-BC; Mercedes, Echevarria, DNP APN; Kate , Malliarakis, PhD ANP-BC FAAN

Problem Statement

Nurse-directed lavender aromatherapy (NDLA) is a feasible and effective non-pharmacological pain management intervention (NPPMI) for acute pain. A community hospital, including its surgical-orthopedic unit (SOU), reported low patient pain management experience (PPMES) scores. The purpose of this evidence-based practice project was to fortify the hospital's planned NDLA implementation with change agents to improve PPME.

Methods

A quality improvement design with a logic model guided NDLA implementation. The population included: SOU nurses, nurse Pain Champions (PCs), and adult SOU patients. Interventions included: Doctor of Nursing Practice student-led SOU Lunch & Learn sessions and Rounding for Results sessions; and two nurse PC NDLA implementation discussions that led nurse PCs to conduct unit-based education and peer coaching.

Patient outcomes included: documentation of nurses' screening of patients for aromatherapy and inhaler offers, correct patient inhaler use, and PPME scores. Nurse outcomes included: aromatherapy education completion and attendance, willingness to offer aromatherapy, and nurse leaders' mention of aromatherapy during patient rounds.

No patient intervention other than nurse-directed lavender aromatherapy, a hospital-approved NPPMI, was provided and no identifiable patient data was recorded. The hospital's Institutional Review Board determined the project was not research involving human subjects.

Results

SOU PMES increased from 43rd percentile to 78th percentile. In five of six project weeks, all appropriate SOU patients were offered aromatherapy. Percentage of SOU patients screened for aromatherapy was greater than percentage of all inpatients screened.

Conclusion

Use of a logic model and change champions is an effective strategy to adopt for future practice changes.

701 | Translational

The value of catechol-O-methyltransferase (COMT) genetic testing as a predictor for outcomes in chronic pain such as pain type and severity, quality of life, function, mood, and quality of rapport between patient and provider

Stephanie, Van, MD; Byungkwan, Hwang, MD; Ashley, Balentine, MD; Faye, Weinstein, PhD; Adam, Swenson, PhD; Doerte, Junghaenel, PhD; Steven, Richeimer, MD

Introduction:

Genetic individualization of pain management is becoming increasingly feasible. Recent evidence suggests that certain polymorphisms of catechol-O-methyltransferase (COMT) are associated with a higher sensitivity to pain. We hypothesize that higher pain sensitivity index as represented by COMT genetic markers is predictive of a chronic pain patient's likelihood of experiencing neuropathic pain more than nociceptive or visceral pain, and poorer outcomes in the domains of pain severity, mood, quality of life, and quality of rapport with providers, compared to those with low or normal pain sensitivity index.

Methods:

This is a cross-sectional study at a single tertiary academic pain center involving 265 adults with chronic pain who, in 2016, underwent genetic testing and then completed surveys on average pain severity (NRS), quality of life (SF-12), functional disability (ODI for LBP), anxiety (GAD-2, GAD-7), depression (PHQ-2, PHQ-9), and their rapport with providers after a pain clinic visit (Session Rating Scale). This study was approved by the hospital university's institutional review board as an observational study (IRB#:HS-15-00191).

Results/Conclusion:

Data collection is complete, data organization and analysis are ongoing through fall 2019. Patients will be divided into 3 groups according to their COMT enzyme effectiveness (Pain Sensitivity Index 1-2 = low, 3 = average, and 4-5 = high). Comparative analysis between groups will characterize any differences in demographic data, pain severity and type, and self-reported functional and psychosocial outcomes. The authors will have the results and conclusion of this study available by early 2020 in preparation for the AAPM Annual Meeting.

703 | Translational

Perioperative Pain Program Minimize Opioid use in Trauma Patient, a case report.

David, Slupek, BS; Nancy, Fru, MD

Introduction:

Trauma patients often undergo several procedures and develop chronic opioid dependency. Appropriate and timely pain management has been shown to promote function, lower costs of care, decrease risk of developing chronic pain, and reduce the rate of morbidity and mortality.

Methods:

A 26-year-old male with past medical history of tobacco and marijuana use sustained multiple gunshot wounds to the abdomen, arm, and leg. He underwent an exploratory laparotomy for small bowel resection and iliac vein repair, right elbow open reduction and internal fixation, and external fixation of radial and olecranon fracture. The patient participated in the outpatient perioperative pain (PPP) clinic, designed to minimize opioid usage and promote the use of multimodal analgesia to improve function.

Results:

Regional anesthesia and multimodal regimen is utilized for postoperative analgesia.

Patient discharged home on 180mg milligram morphine equivalents (MME) per day.

Patient's opioid requirement reduced to 37.5mg MME/day four months following his injury.

Patient returned for another surgery. His opioid requirement increased temporary to 360mg MME.

Patient continue treatment in the PPP clinic; 75% decrease in opioid consumption ten weeks after second procedure and remain at 30mg MME 8 month after initial injury.

Patient have significant increase in functional outcomes measured by the Short Form Physical Health Composite Scale.

Conclusion:

The PPP is essential for safely reduce the patient's opioid requirement in an outpatient setting while optimizing functional recovery and maintaining pain control.

704 | Translational

A Cross-Sectional Study of the Effects of Music on Experimental Pain Sensitivity in Healthy Adults

Amy, Likamwa; Roger, Fillingim, PhD; Staja, Booker, PhD RN; Josue, Cardoso, MS; Jill, Sonke, MA

Introduction/Statement of the Problem

Musical interventions are an effective pain management strategy; however, few studies have investigated the effect of active vs. passive music participation on pain response. The primary purpose of this study was to determine differences in the effects of active (singing) versus passive (listening) music participation on experimental pain sensitivity.

Materials and Methods

After IRB approval from the University of Florida, 40 healthy adults (ages 18-45) consented to and completed the study in the Pain Clinical Research Unit from September 2018-January 2019. During the cold pressor pain test, participants rated pain intensity (0-100) at pain threshold and pain tolerance while singing, listening, and sitting silently (i.e., control group) in counterbalanced order. Descriptive statistics and ANOVA summarize our results, with significance set at .05.

Results

57.5% of our participants were female, with an average age of 26. Significant effects of music condition emerged for threshold ($p=.002$) and tolerance ($p<.0001$) times, but not for mean pain intensity ratings ($p's > 0.05$). The average pain tolerance rating for the silence condition was slightly higher ($M=61.25$, $SD=23.49$) than for listening ($M=58.63$, $SD=25.14$) and singing ($M=56.1$, $SD=27.13$). Questionnaires revealed that 82.5% of participants found that singing provided the greatest distraction, and 67.5% would prefer singing to help manage pain compared to silence and listening.

Conclusions

Active music participation increases pain threshold and tolerance and provides preliminary support for the potential utility of musical interventions in the repertoire of non-pharmacological pain management strategies.

705 | Translational

Long-Term Robustness of Evoked Compound Action Potentials (ECAPs) as a Physiological Monitoring Tool

Lawrence, Poree, MD MPH PhD; Jason, Pope, MD DABPM FIPP; Robert, Levy, MD PhD; Leonardo, Kapural, MD PhD; Timothy, Deer, MD

Introduction: This abstract demonstrates the effect of maintained pain relief over time using Closed-loop spinal cord stimulation (CL-SCS) on patients' overall wellbeing and clinical support.

Methods: Fifty chronic pain patients were implanted with a CL-SCS system after a successful trial (ACTRN12615000713594). Patient ratings of pain (visual analogue scale [VAS] and Brief Pain inventory [BPI]), function (Oswestry Disability Index [ODI]), sleep (Pittsburgh Sleep Quality Index [PSQI]), and quality of life (EuroQol instrument [EQ-5D-5L]) were collected at baseline and follow-up visits. Pain medications and the programming burden were recorded too.

Results: At 24 months, 32 of 36 (88.9%) patients experienced $\geq 50\%$ reduction in overall VAS pain, and 66.7% had $\geq 80\%$ reduction (Table). The sustained high-levels of pain relief led to clinically important improvements in QoL and BPI in $\geq 80\%$ of patients. The number of patients with minimal or moderate disability increased from 18% (baseline) to 74.4% at 12 months and remained almost unchanged (75%) at 24 months. The improvements in sleep quality were maintained from 12 to 24 months. As a result of stable pain relief, 81.5% of patients at 24 months and 68.8% at 12 months reduced or eliminated opioid intake. The programming visits decreased from 0.52 visits/patient/month at 3-months to 0.07 at 24-months.

Conclusions: Maintaining high levels of pain relief over an extended period provides profound and lasting improvements in patient wellbeing, with reduced need for supplementing pharmacotherapy. Coupled with a low programming burden in the long-term, CL-SCS is poised to become an important tool in treating chronic neuropathic pain.

Acknowledgements: The support of Saluda Medical for this project is gratefully acknowledged.

706 | Translational

Therapeutic Levels and Variability of Spinal Cord Activation: Closed-Loop v. Open-Loop Spinal Cord Stimulation (SCS)

Leonardo, Kapural, MD PhD; Lawrence, Poree, MD MPH PhD; Peter, Staats, MBA MD; Corey, Hunter, MD; Sean, Li, MD; Timothy, Deer, MD

Introduction: A challenge with all spinal cord stimulation (SCS) therapies is maintaining effective SC activation. As SC to electrode distance varies constantly, SC activation is lower (no benefit) or higher (side-effects) than required. For >50 years, this open-loop, fixed-output therapy (OL-SCS), relied purely on subjective patient paresthesia interpretation to program/adjust, possibly contributing to variable success rates[1]. Closed-loop stimulation (CL-SCS), using Evoked Compound Action Potentials (ECAPs, objective measure of SC activation), adjusts stimulation amplitude to maintain ECAP amplitude at a patient-preferred level, possibly providing better outcomes[2].

Methods: Data was collected in the Evoke Study (NCT02924129)[3] comparing CL-SCS to OL-SCS. OL-SCS patients could adjust stimulus amplitude. CL-SCS patients could adjust the target ECAP amplitude, while stimulus amplitude adjusted automatically to maintain this target. ECAP amplitude histograms were collected, tracking SC activation over time; histogram statistics were calculated for a 7-day period preceding the 12-month visit (Figure 1).

Results: Mode CL-SCS ECAP amplitude was 6x greater than OL-SCS and OL-SCS CoV was 2x greater than CL-SCS (Table 1). CL-SCS patients reported greater overall leg and back pain reduction (VAS) compared OL-SCS patients (mean: 72% vs 56%, $p=0.012$).

Conclusions: While OL-SCS and CL-SCS patients reported comparable therapeutic levels in-clinic, OL-SCS patients experienced lower SC activation out-of-clinic, as higher SC activation variability causing more stimulation near and above Maximum (Figure 1). Presumably, OL-SCS patients decreased stimulation, avoiding potential side-effects, with mode SC activation being below perception threshold. CL-SCS patients experienced less variability, choosing higher SC activation and reporting better outcomes.

707 | Translational

DEFINING THE THERAPEUTIC WINDOW FOR SPINAL CORD STIMULATION USING EVOKED COMPOUND ACTION POTENTIAL (ECAP) RECORDINGS

Kasra, Amirdelfan, MD; Jonathan, Carlson, MD; Corey, Hunter, MD; Lawrence, Poree, MD MPH PhD; Shrif, Costandi, MD; Timothy, Deer, MD

Background: Spinal cord stimulation (SCS) is an established treatment for chronic pain; however, long-term success remains suboptimal [1,2]. Current SCS therapies are fixed-output and do not account for large variation in electrical field strength due to changes in distance between the electrode and spinal cord (SC) [3].

Objective: We report data from two prospective studies: Evoke and Avalon.

Methods: In Avalon, 50 subjects were implanted and programmed in closed-loop; in Evoke, 134 subjects were randomized into open-loop (OL-SCS) or closed-loop (CL-SCS). ECAPs, a measure of SC activation, are recorded following each stimulation pulse in both groups. Each subject's therapeutic window (TW) is determined individually as the ECAP amplitude range between sensation perception threshold and discomfort. Without a measure of SC activation (eg, ECAPs), TW can only be based on perception of intensity; however, stimulation can produce variable SC activation (ECAP amplitude) as the electrode to SC distance varies with movement .

Results: In the Evoke Study, each subjects' TW was determined in the clinic, along with the clinician prescribed level. There was no statistical difference between the two groups' TWs (Figure 1); however, CL-SCS subjects spent significantly more time in the TW despite having equivalent therapeutic ranges (Figure 2). Long-term data showed a similar percentage of stimuli in the TW (83%-97%; Figure 3).

Conclusion: TW can be individually defined by ECAP amplitudes (measure of SC activation), removing the need to rely on subjective reports of intensity, which can vary over time and with movement.

708 | Translational

“High Responders” to Neurostimulation Show Greater Clinical & Overall Meaningful Response in Patient Reported Outcomes

Corey, Hunter, MD; Kasra, Amirdelfan, MD; Jason, Pope, MD DABPM FIPP; Lawrence, Poree, MD MPH PhD

Introduction

Technological advancements in spinal cord stimulation (SCS), combined with increased patient expectations and new literature on minimal clinically important differences (MCIDs) (Dworkin, 2008; Olsen, 2018), have increased the focus on defining clinically meaningful improvements.

Methods:

Patient-reported-outcomes (PROs), including emotional/physical functioning and sleep quality, were collected in a double-blind, randomized controlled trial (NCT02924129) (Levy, 2019) comparing closed-loop to open-loop SCS. The Evoke Study identified $\geq 80\%$ VAS reduction in overall pain as “high responders”. A post-hoc, subgroup analysis comparing PROs at 12 months in subjects (treatment groups combined) with responder rates $\geq 50\%$ and $< 80\%$ (N=32) versus $\geq 80\%$ (N=58) was conducted to evaluate the clinical meaningfulness of the high responder rate.

Results:

More high responders compared to responders achieved ODI MCID (≥ 15 ; ODI Scoring Instructions) (86.2% vs. 65.6%, $p=0.031$), POMS TMD MCID (≥ 10 ; Dworkin, 2008) (72.4% vs. 50.0%, $p=0.041$), and PSQI remission (good sleep quality [score ≤ 5] and MCID [≥ 3]; Buysse, 2011) (39.7% vs. 12.5%, $p=0.008$).

Conclusion:

High responders had statistically significantly greater proportions of subjects with clinically meaningful changes in all PROs. The concomitant improvements observed in these other PROs at this threshold support the robustness of the high responder rate and its use to evaluate SCS outcomes. The incidence of $\geq 80\%$ reduction in VAS overall pain was statistically superior for closed-loop (55.9%) compared to open-SCS (37.3%) in the Evoke study at 12 months ($p < 0.039$). Thus, utilization of objective neurophysiological measurements to optimize outcomes through programming and closed-loop SCS may offer a greater probability of a high response.

709 | Translational

Avalon Study: Long-Term Impact of ECAP-Controlled Closed-Loop SCS on Pain, Patient Wellbeing and Clinical Practice

Marc, Russo, MD; Lawrence, Poree, MD MPH PhD

Introduction: This abstract demonstrates the effect of maintained pain relief over time using Closed-loop spinal cord stimulation (CL-SCS) on patients' overall wellbeing and clinical support.

Methods: Fifty chronic pain patients were implanted with a CL-SCS system after a successful trial (ACTRN12615000713594). Patient ratings of pain (visual analogue scale [VAS] and Brief Pain inventory [BPI]), function (Oswestry Disability Index [ODI]), sleep (Pittsburgh Sleep Quality Index [PSQI]), and quality of life (EuroQol instrument [EQ-5D-5L]) were collected at baseline and follow-up visits. Pain medications and the programming burden were recorded too.

Results: At 24 months, 32 of 36 (88.9%) patients experienced $\geq 50\%$ reduction in overall VAS pain, and 66.7% had $\geq 80\%$ reduction (Table). The sustained high-levels of pain relief led to clinically important improvements in QoL and BPI in $\geq 80\%$ of patients. The number of patients with minimal or moderate disability increased from 18% (baseline) to 74.4% at 12 months and remained almost unchanged (75%) at 24 months. The improvements in sleep quality were maintained from 12 to 24 months. As a result of stable pain relief, 81.5% of patients at 24 months and 68.8% at 12 months reduced or eliminated opioid intake. The programming visits decreased from 0.52 visits/patient/month at 3-months to 0.07 at 24-months.

Conclusions: Maintaining high levels of pain relief over an extended period provides profound and lasting improvements in patient wellbeing, with reduced need for supplementing pharmacotherapy. Coupled with a low programming burden in the long-term, CL-SCS is poised to become an important tool in treating chronic neuropathic pain.

Acknowledgements: The support of Saluda Medical for this project is gratefully acknowledged.

710 | Translational

Sleep Quality Improvements Observed in the Evoke Study of ECAP Measurement and ECAP-Controlled Closed-Loop SCS

Shrif, Costandi, MD; Mena, Mekhail, DO; Lawrence, Poree, MD MPH PhD; Jijun, Xu, MD PhD

Introduction: Chronic pain patients commonly report concomitant sleep disturbance. Chronic sleep deprivation drives changes in pain sensitization, increasing vulnerability to chronic pain. Spinal cord stimulation (SCS) is an effective therapy for chronic pain, but literature on the effect of SCS on sleep are scarce and conflicting.

A novel SCS system utilizes recording of evoked compound action potentials (ECAPs in the spinal cord (SC) dorsal column to monitor SC activation. Using this system, we compared Closed-loop to fixed-output, open-loop SCS, in which stimulus amplitude is fixed, but ECAPs are still measured to support programming.

Methods: The Pittsburg Sleep Quality Index (PSQI) was collected in chronic pain patients enrolled in the Evoke and compared at 3 and 12-months.

Results: At baseline, only 1.6% of Closed-Loop and 3.2% of Open-Loop patients reported good sleep quality. At 3-months, this increased to 32.8% and 28.3%, respectively, and was maintained at 12-months. Additionally, approximately 30% or more patients in both groups improved to normative levels. The change in PSQI at 3 and 12-months was 5.7 and 4.5 for CL and OL, respectively. At 3-months, 75.9% of CL patients reported a clinically significant change from baseline versus 66.0% of OL. This trend was maintained at 12-months.

Conclusions: Marked improvements in sleep quality were observed in both groups in the Evoke study, with greater improvement trending in the CL group. ECAP measurement may contribute to improved outcomes by confirming the activation of the dorsal column and maintaining activation within a therapeutic window.

711 | Translational

ECAP-Controlled Closed-Loop SCS: Double-Blind, Randomized Trial for the Treatment of Chronic Pain – 12-month Outcomes

Timothy, Deer, MD

Introduction: Evoked compound action potential (ECAP) recording provides an objective measure of spinal cord activation and can assist in the programming of the SCS system. ECAP-controlled closed-loop SCS (CL) has been shown to provide effective pain relief in an open-label study (ACTRN12615000713594) (Russo, 2017). A double-blind RCT was conducted under an IDE to compare the safety and efficacy of ECAP-controlled CL stimulation and open-loop to treat chronic back and leg pain (NCT02924129) (Levy, 2019).

Methods: See Evoke Protocol Manuscript (Levy 2019)

Results: Primary endpoint demonstrated statistical superiority of CL compared to OL at 12 months (83% vs. 61% subjects, respectively; $p=0.006$). 56% of CL subjects compared to 37% of OL subjects reported $\geq 80\%$ reduction in back and leg pain ($p=0.039$). CL provided greater improvement in all other PROs compared to OL. Opioids were reduced or eliminated in 55% and 40% of CL and OL subjects, respectively. The most frequent level of SC activation level was six times greater for CL (median ECAP Amplitude: $27.0\mu\text{V}$ CL vs. $4.5\mu\text{V}$ OL). Furthermore, SC activation was better maintained within the therapeutic range with CL (median: 95% CL vs. 48% OL). There were no differences in the safety profiles between treatment groups.

Conclusion: ECAP-controlled CL provided superior pain relief and greater improvement in other PROs compared with OL SCS at 12 months. CL delivered greater levels of SC activation and better maintained in therapeutic range. This suggests that the level and consistency of SC activation may be mechanistically important for outcomes with SCS.

712 | Translational

Understanding the Effect of Titrating Medication with SCS Using Evoked Compound Action Potentials (ECAPs)

Steve, Rosen, MD; Chong, Kim, MD; Nagy, Mekhail, MD PhD; Shrif, Costandi, MD

Introduction: Spinal cord stimulation (SCS) with Evoked compound action potential (ECAP) recording, as a measure of spinal cord (SC) activation, has been reported[1]. ECAP recording can be used to define a patient's therapeutic window (TW) for SCS. The effects of medication on SCS and the TW are still not well understood. Previous work presented a case study on effects of medication[2]; herein we present data for 2 additional patients.

Methods: Data collection (described previously[2]) occurred during or between set medication adjustments (see figures). Neurophysiological data collection included ECAPs for the full range of the TW (threshold, comfort, and maximum), strength-duration curves, and ECAP conduction velocities. This case series only focuses on how medication affected the TW.

Results: As Gabapentin and/or Oxycodone dose decreased, so did the TW, and vice versa. Stimulus amplitude variation was not correlated to medication, ECAP amplitude was. Both Subject A (Figure 1) and Subject B (Figure 2) showed TW decrease as medication dose decreased. For Subject C, TW increased as medication dose increased, with Meloxicam having no effect (Figure 3).

Conclusion: Data from this case series correlate with previous work[3]. Lack of correlation between stimulus amplitude and medication dose suggests a measure of SC activation is required. Medications may affect patient tolerance to paresthesia sensation, thereby affecting measured TW. Determining whether medications affect neural excitability, and/or the level of Sc activation needed to maintain pain relief requires further investigation. ECAP amplitude may facilitate titration and optimized dosing of anticonvulsants and opioids. Research is currently ongoing.-

LB001 | Basic Science

Feasibility and Acceptability of Heart Rate Variability Biofeedback as a Treatment for Fibromyalgia-Related Symptoms In a Group of Veterans

Marcelaine Reneau, APRN, PhD

BACKGROUND: Research suggests autonomic dysfunction and diminished heart rate variability may explain the pain, fatigue, depression, decreased functional status, and poor quality of life (QOL) associated with fibromyalgia (FM).

OBJECTIVES: 1) Investigate feasibility and acceptability of a heart rate variability biofeedback (HRVB) protocol as a nonpharmacological treatment of FM

2) Investigate a signal of efficacy of improvement of FM-related symptoms.

METHODS: Using IRB approved methods, enrolled 10 Veterans for 8 weekly visits of HRVB training and data collection to determine feasibility to adhere to an HRVB protocol consisting of home practice twice daily for 20 minutes, and to examine treatment acceptability and satisfaction. Practice frequency and duration data examined adherence to the treatment protocol. Psychometric data from the Fibromyalgia Impact Questionnaire (FIQR) was evaluated for a signal of efficacy for pain and FM-related symptoms. A focus group discussion evaluated treatment acceptability and satisfaction.

FINDINGS: Data suggest practicing for 20-minutes is feasible (mean time/minutes 19.36), however practicing twice daily is not (mean daily frequency 0.8). Data suggest HRVB contributed to an improvement in functional status and QOL. Veterans reported treatment satisfaction and pain reduction.

CONCLUSION: Limitations were a small size (n=10) and lack of a control group. Although the prescribed HRVB protocol may not be feasible, a modified HRVB may improve functional status and QOL related to FM. Further studies will focus on a modified HRVB protocol to determine if HRVB can improve functional status and QOL. This study creates the foundation for future studies implementing HRVB as a treatment modality for FM-related symptoms.

LB003 | Epidemiology/Healthcare Policy/Education

Older adults' pain persistence in a 10-year follow-up – a population-based study

Maiju Marttinen, MD; Hannu Kautiainen, BA

INTRODUCTION Physical and psychological disability are important mediators in the relationship between quality of life and pain chronicity in older adults (1,2,3). The objective herein was to examine factors associated with persistence of SF-36 pain intensity and interference in older adults.

MATERIALS AND METHODS An extensive questionnaire and clinical data of 1,954 community-dwelling older adults (mean age 62.6) were collected in 2002, 2005, 2008 and 2012. Four pain Categories (I-IV) with combined SF-36 pain intensity and interference reports were formed using a foursquare model.

RESULTS Sample's mean SF-36 bodily pain remained stable: 68 in 2002, 69 in 2005, 71 in 2008, 70 in 2012. One third of sample changed their Category each year. Musculoskeletal diseases, metabolic syndrome and analgesic use associated with persistence of pain interference and intensity, and high age, low household income, high BMI, and several morbidities with persistence of pain interference. According to multivariable logistic regression, musculoskeletal diseases (OR 0.22 [CI 0.16 to 0.30], $p < 0.001$), BMI (OR 0.93 [CI 0.90 to 0.97], $p < 0.001$) and better childhood home environment (OR 1.03 [CI 1.00 to 1.05], $p < 0.05$) associated with permanence in the Category I (minor pain intensity and interference) throughout the follow-up.

CONCLUSIONS Overall pain scores remained stable throughout the follow-up period. However, plenty of variation in pain status occurred on an individual level. Several factors affect older adults' pain persistence. Interestingly, psychological resources and pain coping skills that do develop during the early childhood seem to affect later life pain situation.

LB004 | Epidemiology/Healthcare Policy/Education

Drug Misuse in America 2019: Physician Perspectives and Diagnostic Insights on the Evolving Drug Crisis

Jack Kain, PharmD; Jeffrey Gudin, MD

Introduction

The analysis of objective clinical laboratory data can provide insights on patient care, population health management and public health policy.

Methods

Analysis of more than 4.4 million de-identified clinical drug monitoring tests (2011 and 2018) from a national laboratory, Quest Diagnostics, along with findings from a new survey of 500 primary care physicians (PCPs) on drug misuse and the current challenges of treating pain. Patients were represented from all 50 states and the District of Columbia.

Results

The majority of physicians surveyed agree because of the opioid crisis, treating patients suffering from chronic pain is considerably harder now. Most PCPs also fear we will be trading the opioid crisis for another prescription drug crisis. Seventy-eight percent of PCPs say that in an effort to avoid prescribing opioids they often prescribe gabapentin as an alternative pain therapy for chronic pain, yet lab testing shows misuse of nonprescribed gabapentin misuse has increased 40% in just the past year. Four of five PCPs were reluctant to take on patients currently prescribed opioids.

Conclusions

To our knowledge, this report is the first to juxtapose insights from both objective laboratory data and survey responses from physicians about pain and drug abuse in the United States. In response to the uncertainty, physicians have identified prescription drug monitoring as part of the solution and called for additional education and training about substance use disorders.

LB005 | Pharmacological

Cannabis Satisfaction Rates in Chronic Pain Patients

Alyson Engle, MD; Ankur Patel, MD; Andrea Gillman, PhD; Cheryl Bernstein, MD; Ajay Wasan, MD

Introduction:

High quality care in pain medicine emphasizes a reduction in opioid medications and use of multimodal regimens (1). Despite claims of cannabis' and cannabinoids' benefits, there is a lack of good scientific evidence for treatment protocols (2-3).

UPMC Pain Medicine collected data on patient satisfaction and outcome measures of patients using medical cannabis for chronic pain. This research project examined the response to medical cannabis in terms of satisfaction, impression of change, mood, sleep, pain and medication weaning.

Methods:

A total of 194 patients were recruited from May 2018 through July 2019. Both informed consent and medical marijuana contracts were signed by each patient enrolled in the study. Baseline data and urine drug screens were collected at each visit.

Results:

Forty-six percent of patients were initially on opioids, and 76% of those patients were able to taper their opioid dose. Patients who stayed on opioids had higher pain satisfaction rates than those who tapered their opioid. Patients who were not on opioids initially or who tapered opioids had lower pain satisfaction scores, but still scored their overall satisfaction as highly satisfied.

Conclusion:

Patients' overall impression of change was disproportionate to their change in score for mood, sleep and pain. These results demonstrate that patient satisfaction is high amongst medical cannabis users despite the evidence for clinically non-significant changes in pain scores. It is possible that the clinically meaningful reported improvements in sleep was a key driver of both increased patient satisfaction and successful opioid tapering.

LB006 | Pharmacological

Comparison of the Comfort and Ease of Use of Five Treatment Regimens for CNTX-4975 (Capsaicin) Intra-articular Injection in Subjects With Moderate-to-Severe Osteoarthritis Knee Pain: Results From the Open-label, 8-Week VICTORY-3 Study

Randall Stevens, MD; Peter Hanson, DVM, PhD ; Paul Tiseo, PhD; Kimberly Guedes, RN, BSN; James Campbell, MD; James Connolly, BA, MA; Stephanie Ruggiero, BS; Valerie Smith, MStat; Meg Corliss, PhD; Charles Argoff, MD

Introduction: We report results from a phase 3 study (NCT03661996) evaluating cooling/administration procedures for CNTX-4975 intra-articular injection.

Materials and Methods: Subjects (40–95 years, Kellgren-Lawrence grade 1–4, BMI \leq 45 mg/kg²) with stable, moderate-to-severe osteoarthritis knee pain after \geq 2 failed therapies were assigned to unilateral/bilateral CNTX-4975 1 mg intra-articular injections as determined by osteoarthritis pain/joint replacement status (Figure). Primary endpoint: assessment of Breg versus other cooling as an acceptable treatment regimen (day 1) using a primary combined outcome: sum of 1) procedural pain (0 [none] to 4 [severe]) 30 minutes post–CNTX-4975 injection; 2) subject satisfaction (SS) with cooling/administration procedures; and 3) investigator satisfaction (IS) with procedures. SS and IS were measured on a 1–7 scale (1, completely dissatisfied; 7, completely satisfied); pain was reverse scored and normalized (1, severe; 7, none) for equal weighting of the composite score. GMR with 95% CIs were constructed for each regimen versus control (ANCOVA); lower 95% CI $>$ 0.7 was considered clinically acceptable. Safety assessments included TEAEs. Protocol approved by independent IRB.

Results: The intent-to-treat population comprised 848 subjects. All CNTX-4975 procedures were clinically acceptable; evaluated cold gel-based wraps were at least as effective as the circulating ice-water wrap in reducing post-injection pain and had similar SS and IS scores (Table). TEAEs were reported in 22% of subjects, $<$ 1% serious. TEAEs $>$ 2%: procedural pain (2.9%), arthralgia (2.2%), and nausea (2.1%), with no meaningful differences across groups.

Conclusion: All CNTX-4975 intra-articular administration regimens for moderate-to-severe knee osteoarthritis pain were clinically acceptable and well tolerated.

LB007 | Pharmacological

A Phase I Placebo-Controlled Trial Comparing the Effect of Buprenorphine Buccal Film and Oral Oxycodone Hydrochloride on Respiratory Drive

Lynn Webster, MD; Erik Hansen; Jacqueline Cater, PhD; Thomas Smith, MD

Introduction: Buprenorphine is a partial μ -opioid receptor agonist that, unlike full μ -opioid receptor agonists, has been shown to have a ceiling effect on respiratory depression.¹ This placebo-controlled study compared the effects of buprenorphine buccal film (BBF) and oral oxycodone hydrochloride (a full μ -opioid receptor agonist) on respiratory drive.

Materials and Methods: Subjects (N=19) were males and females self-identifying as recreational drug users and determined via naloxone challenge to not be physically dependent on opioids. Effect on respiratory drive was assessed using a double-blind, double-dummy, 6-treatment, 6-period, placebo-controlled, randomized crossover design. Treatments were 300 (BBF300), 600 (BBF600), and 900 μ g (BBF900) BBF; 30 (Oxy30) and 60 mg (Oxy60) oral oxycodone; and placebo (each separated by a 7-day washout). Respiratory drive was evaluated by measuring the ventilatory response to hypercapnia through assessment of the decrease in maximum minute ventilation (E_{max}) after administration of each study drug. Statistical analyses were performed using a linear mixed-effects model.

Results: The least square mean differences in E_{max} (versus placebo) were as follows: Oxy30 (-828.5, $P=0.668$); Oxy60 (-5188.6, $P=0.008$); BBF300 (+1206.9, $P=0.533$); BBF600 (+245.4, $P=0.896$); and BBF900 (+1473.3, $P=0.440$).

Conclusions: Administration of oxycodone resulted in a dose-dependent decrease in respiratory drive (reduction in E_{max}). BBF did not reduce respiratory drive at any dose, including the maximum available prescription dose of 900 μ g. These data suggest that BBF may be a safer treatment option than a full μ -opioid receptor agonist for patients with chronic pain.

LB008 | Pharmacological

Sweat as a Biofluid for the Monitoring of Pain Management Drugs

Timothy Tracy, PhD

Management of pain and prescription of opioids continues to pose challenges for both clinicians and their 57 million patients. Clinical guidelines continue to evolve in an effort to provide clinicians with the appropriate tools and knowledge to ensure the safety and efficacy of prescription opioids for their patients. Unfortunately, many of these tools fall short of providing convenient, rapid, and quantitative patient information at the time treatment decisions are made. Urinalysis testing in pain management is typically conducted from urine samples, but sampling of urine is inconvenient, tamper prone, and results are subject to misinterpretation. Sweat is one potential alternative biofluid but limited information exists as to the range of drugs excreted in sweat and the clinical utility of these drug concentrations in this alternative matrix. The current work evaluated drug appearance in sweat in an ambulatory clinic population taking their normal medications and the correlation to plasma concentrations, as well as a clinical pharmacokinetic study of a model drug monitored in sweat and plasma. Sweat was collected from ambulatory clinic patients at a single timepoint, concurrently with acquisition of a blood sample. In the clinical pharmacokinetics study, acetaminophen was administered at two dosage strengths and in repeated doses, and pharmacokinetics was monitored in both sweat and plasma. Of the 18 drugs and two metabolites monitored in the exploratory study, all were found to be present in both sweat and plasma though the sweat/plasma ratio varied substantially across the drugs. Oxycodone, hydrocodone, tramadol and morphine reached sweat in the highest concentrations, sometimes exceeding the plasma concentrations. Select antidepressants and muscle relaxants appeared in sweat, but at a 2-10 fold dilution to plasma, whereas others, such as gabapentin, pregabalin and ibuprofen reached sweat in the lowest concentrations. In the clinical pharmacokinetics study, acetaminophen pharmacokinetics were reliably monitored in sweat and were correlative with plasma pharmacokinetics, albeit at lower concentrations. These findings demonstrate that a wide variety of drugs appear in sweat at measurable concentrations and that sweat may be an alternative biofluid for pain management quantitative testing.

LB009 | Procedures

Evaluation of Quality of Life Improvement in Patient with Sacroiliac Joints Pain after Modified RF Technique- A 4 Years Retrospective Study

Ramin Safakish, MD; Shadi Babazadeh, MD; Tina Emadi, MD

Background:

Sacroiliac joint (SIJ) is one of the most common cause of low back pain (1-2).

In Allevio Pain Management, there are two different methods for SIJ- RF, Standard Quadripolar RF, and the Modified Quadripolar RF techniques (3).

Method:

This is a retrospective observational study in Allevio Pain Management, Toronto, Canada.

266 patients who had been diagnosed with SIJ pain and had modified RF ablation from 2015-2018 were included.

To evaluate quality of life improvement we used Brief Pain Inventory (BPI) questionnaire.

Results:

After SIJ-RF, 48% of the patients were pain free from 1-5 months, 27%, 6-11 months, 19% , 12-24 months, and 13 patients (6%) didn't have any pain up to 40 months.

98 patients reported use of narcotics before treatment.

There was a significant reduction of narcotics usage (15.85 units) (p-value=0.002).

139 patients (52%) had shown less nonnarcotic consumption, 127(48%) patients didn't have any changes, and no one had shown increase.

All reported BPI items indicated a statistically significant improved. There was not any statistical relation between changes in BPI, age or sex.

From the 266 patients in the sample, 141 (53%) were retired. Only 47 patients (38.2%) of remaining return to work after treatment.

None of the patients had to go to ER for pain control after the treatment.

Conclusion:

SIJ Modified RF technique is an innovative technique by Dr.Ramin Safakish. This technique produces significantly larger lesions in area compared to the standard Quadripolar technique, and It is producing a thermal lesion within the interosseous ligaments (3).

LB010 | Procedures

Pterygopalatine Fossa Blockade: a novel, narcotic-sparing Treatment for Headache in Patients with Aneurysmal Subarachnoid Hemorrhage

Cameron Smith, MD, PhD; Katharina Busl, MD; W. Christopher Fox, MD

Background:

Severe headache is a hallmark of aneurysmal subarachnoid hemorrhage (SAH), plaguing up to 90% of patients. Opioids remain the mainstay of therapy, despite side effects and potential for tolerance/addiction. Many patients report inadequate pain control with conventional medication regimens. Pterygopalatine fossa (PPF) blocks are used for headache disorders and anesthesia for midface procedures, but have not been used for SAH-related headache. We report our initial experience using a PPF block as novel treatment strategy for refractory headaches in SAH.

Methods:

We conducted a retrospective review of patients with SAH who received PPF block as adjunct means of pain control after SAH. Patient demographic and clinical characteristics, and pain scores were extracted from the medical record.

Results:

Six patients received bilateral PPF block. Mean age was 56 ± 10 years, 2 were male. Average pain scores for the 24-hour period before versus after block placement was 5.5 ± 1.4 vs. 3.4 ± 2.2 ($p=0.0395$). Pain relief was sustained for an average of 20 hours after block placement (range 5-48 hours). All patients tolerated the block well without major side effects.

Discussion:

We report a novel strategy for pain control after SAH utilizing a PPF block. PPF blocks, shown effective in midface procedures and headache disorders, target nervous structure involved in headache generation in SAH. In our case series, all patients who received a PPF block experienced significant reduction of pain scores post block. PPF blocks may present a safe, effective treatment strategy for headache after SAH. Larger studies are planned.

LB011 | Procedures

Risk Factors for Developing Unpleasant Paresthesia after Implantation of Permanent Spinal Cord Stimulators

Nebojsa Nick Knezevic, MD PhD; Alvaro Camacho Ortega, MD; Tabish Aijaz, MD; Kenneth Candido, MD

Background: Spinal Cord Stimulators (SCS) have become a promising option to treat chronic pain syndromes[1], nevertheless, there are challenges that might compromise the effectiveness and lead to higher healthcare costs, and unpleasant paresthesia/dysesthesia is one of them.[2] The aim of our study was to determine the incidence of unpleasant paresthesia after implantation of permanent SCS and finding the risk factors for its development.

Material and Methods: After approval from the Advocate Healthcare IRB, a retrospective analysis was conducted of prospectively collected data of patients that had permanent percutaneous SCS implanted.

Results: We had a total of 103 patients that had at least 24 months follow up after implantation of permanent SCS. The mean age of patients was 56.99, and an average BMI of 29.7. The mean pain score measured via NRS before implantation was 8.05, which was reduced to 3.6 after 24 months. The most common complication in our study sample was the development of unpleasant paresthesia/dysesthesia, which was reported by 27% of participants. There was no association between paresthesia and age, gender, or BMI. We found a statistically significant correlation between current tobacco use and cases of uncomfortable paresthesia/dysesthesia in patients that received the permanent SCS ($p=0.001$) and 38.46% of the cases required or requested explantation of the device ($p=0.028$).

Discussion: Unpleasant paresthesia seems to be more common than originally thought.[3] According to our study findings, long-standing tobacco users being treated with SCS are more prone to develop unpleasant paresthesia/dysesthesia when compared with non-tobacco and former tobacco users.

LB012 | Procedures

Sex-specific Differences in the Efficacy of Traditional Low Frequency versus High Frequency Spinal Cord Stimulation, a Cohort Study

Christina Cui; Zabrina Reyes, BS; Jacob Caylor, MD; James Proudfoot, MSc; Sopyda Yin, BS; Imanuel Lerman, MD

The purpose of this study was to determine efficacy of spinal cord stimulation (SCS) stratified by paradigm, low-frequency SCS (LF-SCS) versus high-frequency at 10kiloHertz SCS (HF10kHz)(1), and sex(2,3). A retrospective cohort study was conducted via chart review on patients undergoing implantation between 2004-2018 at the University of California San Diego Health System (UCSD-HS). Morphine equivalents (MED) and VAS scores, the primary outcome, were collected at zero, three-, six- and twelve-months post-permanent implantation and analyzed with paired t-tests and linear models. This study was approved by UCSD-HS IRB protocol 190643. HF10kHz patients were older than LF-SCS patients ($p=0.034$)(Fig1). Both HF10kHz and LF-SCS exhibited a decrease in VAS scores at three-months (-1.34, $p < 0.001$; -3.18, $p=0.001$) and six-months (-0.64, $p=0.034$; -2.33, $p=0.022$). HF10kHz patients had greater VAS decrease than LF-SCS at three-months ($p=0.029$)(Fig2). Amongst HF10kHz patients, females had significant decrease in VAS scores at three-months (-3.75, $p < 0.001$) and six-months (-3.00, $p=0.035$) while males only had significant decrease at three-months (-2.86, $p=0.041$)(Fig3). There was no sex differences in MED amongst HF10kHz patients. Among LF-SCS patients, female MED trended up while male MED trended down and this difference was significant at six-months ($p=0.023$) and twelve-months ($p=0.043$)(Fig4). In conclusion, HF10kHz was more effective than LF-SCS for all comers. For females, HF10kHz saw greater pain relief than LF-SCS. LF-SCS males required lower MED than females.

LB013 | Procedures

Transforaminal vs interlaminar ESI for axial vs radicular or claudication pain

Sterling Haring, DO, MPH; Byron Schneider, MD; DJ Kennedy, MD

Introduction

Epidural steroid injections (ESI) are a safe treatment commonly used for radiculopathy and axial back pain.⁽¹⁾ We sought to identify the relative effect of transforaminal vs interlaminar ESI on pain among patients presenting with radicular pain, axial pain, or claudication.

Methods

We reviewed the charts of 73 consecutive patients referred for ESI to providers within the Vanderbilt Health Affiliated Network. Type of pain (radicular, axial claudication) and route of ESI delivery (transforaminal vs interlaminar) were recorded, as well as pain scores on an 11-point NRS. The primary endpoint was $\geq 50\%$ pain reduction on NRS. The VUMC IRB approved this study.

Results

Of the 73 patients included in the study, 59 (81%) reported radicular pain, 48 (65%) reported axial back pain, and eleven (15%) reported claudication. Fifty-one (69%) underwent TFESI, while 22 (31%) underwent ILESI. Of the 42 patients with radicular pain undergoing TFESI, 24 (57%) achieved $\geq 50\%$ pain reduction, vs. six (35%) who received ILESI ($p=0.128$). In the combined radicular and claudication groups, those undergoing TFESI tended to have $\geq 50\%$ pain reduction more frequently than the ILESI group (56% vs 32%, $p=0.08$). There was no outcome difference between approaches among those with axial pain (31% vs 37.5%, $p=0.665$). Logistic regression showed higher success rates in both unadjusted (OR 3.1, $p=0.04$) and adjusted (OR 3.2, $p=0.038$) models. There was no significant correlation for back pain (OR 0.76, $p=0.665$).

Conclusion

TFESI was more effective at reducing leg pain from radiculopathy or claudication than ILESI. Neither was effective at reducing axial back pain.

LB014 | Translational

A Multicenter, Open-Label, Phase 1b Study to Assess the Safety and Define the Maximally Tolerated Dose of Epidural Resiniferatoxin Injection for the Treatment of Intractable Pain Associated with Cancer

Srdjan S. Nedeljkovic, MD; Sanjeet Narang, MD; Xiang Bai, PhD; Harold Minkowitz, MD; Daneshvari Solanki, MD; David Leiman, MD; Roy Levitt, MD; Danielle Horn, MD; Monica Luchi, MD, MBA; Janet Ahern, BS

Introduction

Resiniferotoxin (RTX) is a capsaicin analog and TRPV1 (transient receptor potential vanilloid-1) receptor agonist that causes neurolysis of sensory neurons responsible for pain. The potential for this targeted ablation leaving other important sensory, motor, or cognitive function intact may provide a novel approach to address intractable cancer pain.

Materials and Methods

IRB approval was obtained. “3+3” rule-based design was used for dose escalation. 14 subjects with intractable cancer-related pain received a single epidural injection of RTX up to 15 mcg.

Results

No DLT’s were reported. Serious adverse events (AE) were attributed to progression of underlying cancer. The most common treatment related AE was transient procedural pain. Painful symptoms were described as burning sensation in the lower extremities that diminished over several hours and disappeared afterwards. At higher doses of RTX, positive outcomes were observed in 3 subjects. 1 of 3 who received 8 mcg: a 58-year-old woman with gastrointestinal stromal tumor with severe lower back pain reported a decrease in NPRS scores from >4/10 to 2/10, and 2 of 3 subjects who received 15 mcg: a 62-year-old man with rectal cancer noted significant improvement in pain, physical strength, mood, and appetite with pain scores reduced from 7-8/10 to 3/10, and a 57-year-old man with multiple myeloma and severe pain in his back, hips, and lower extremities reported mild pain after RTX injection.

Conclusions

Optimal therapy for intractable cancer pain would improve analgesia and reduce burdens associated with treatment. RTX has the potential to alleviate severe pain in this population.