Abstracts

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1. Disposition and return to duty provided by an Interventional Pain Management service in a forward serving area: the current Iraq experience

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Background: Non-battle-related injuries and chronic pain conditions hamper combat readiness. Prior epidemiologic studies, as in our limited study, have suggested high return-to-duty rates are possible when early and aggressive pain management strategies are used in forward deployed areas.

Methods: We evaluated the benefit of an interventional pain medicine (IPM) service in forward-serving Baghdad, Iraq that included 31 patients. Median age of these patients was <35 years old. Over 80% of patients were active duty soldiers. Radicular symptoms were present in 24 of 31 patients. Severe duty-limiting axial low back pain was present in 9 of 31 patients. All patients were considered for evacuation for a diagnostic MRI or an end to their tour of duty for "conservative state-side management" when they were referred to us. In this subset of patients, we offered TF ESI, intra-articular facet injections, or RF ablation of the lumbar facet joint. Physical therapy was consulted on all cases. Concordance patterns were generated during TF-ESI injections, which in all cases consisted of a two-needle technique as high as L3-L4 or as low as the S1 foramen depending on clinical exam for patients with acute radiculopathy (often with underlying chronic axial low back pain). Medial branch blocks (MBB) were performed for patients with isolated axial low back pain solely as a diagnostic maneuver. When the severity of symptoms was more acute and/or the patients were not interested in RF ablation, intraarticular facet injections were performed. Patients were evaluated over a course of 0-3 days on an outpatient basis to evaluate the effectiveness of their intervention before return to their unit. All patients were specifically prevented from performing outdoor "guard duty" or combat patrols for 1-2 weeks pending follow up evaluation due to the heavy axial loading and physical requirement of these duties. We have excluded from our sample set any patients seen for "sports medicine" type evaluations who were not facing immediate evacuation. Reported elsewhere, this encompasses 8 shoulder injections, 9 SIJ injections, 12 midline ESI (7/12 patients with a diagnosis of spinal stenosis). Also excluded were 12 cervical ESIs performed for various reasons, one patient, from which, was evacuated who had prior neck surgery.

Results: Our presence and aggressive interventional pain management service resulted in a 97% return to duty rate. One active duty soldier who had a prior discectomy 9 months prior to deployment was evacuated. Two TF-ESIs did not provide enough relief to allow him to return to the full duty heavy lifting required of his command. Five patients received diagnostic MBB; three of these patients went on to receive lumbar facet RF ablation with full return to duty. Four patients received intra-articular facet injections and 24 patients received transforaminal epidural steroid injections. SIJ injections were performed on 3 of the 7 patients who did not receive relief from facet intraarticular injections and had a positive FABERE test. MRI exams were deferred unless a patient had bowel or bladder symptoms or did not respond to any of the diagnostic or therapeutic injections mentioned above (0/31).

Discussion: This evaluation of a 5-month experience in a forward deployed combat support hospital in Baghdad, Iraq, agrees with and expands on many of the conclusions from prior studies by White and Cohen which showed a 95% return-to-duty rate when considering all patients seen in their clinic in 2004.1Part of our motivation for aggressive pain management and avoidance of MRI scans in our special situation is the result of previous lessons learned. The option of evacuating patients to Germany or the United States for diagnostic MRI is logistically difficult and potentially dangerous. Perhaps as a result of this fact, prior studies have shown a return to theatre rate from LRMC (the nearest level I facility in Germany) of only 30% for all patients sent for evaluation A recently surveyed subset of 189 patients sent for evaluation and disposition of neck pain had only a 20% return to duty rate in Iraq and Afghanistan. While keeping in mind the high cost ($600-$2,000) with imperfect specificity (66% in the largest studies) of the MRI for diagnostic purposes, this was believed to be unacceptable to many patients and providers alike. Avoidance of second line therapy, namely opiods, in the deployed soldier was avoided in most cases to maintain a soldier's vigilance and awareness while in the unique combat setting.

Measurement of outcome in some studies has been said to be subjective and may fail to capture the morbidity associated with early activity limitation and difficulty of rehabilitation in a motivated patient after an acute exacerbation of low back pain. We believe that return-to-unit rates provide an objective measure of short-term functional improvement provided by an aggressive interventional pain service in a war zone environment, wherein heavy to very heavy lifting is required. We show an improved return-to-duty rate by offering a growing complement of interventional techniques to meet the increasing demands put on soldiers (many required to carry 50+ lbs. in battle gear for prolonged periods) without the aid of additional diagnostic tests Improved return-to-duty rates as an outcome which supersede the civilian "return to work" outcome is somewhat expected. Selection bias exists since soldiers are motivated to return to their units because of strong bonds formed during a deployment. There is also a significant financial incentive to stay in theatre for many soldiers. Additionally, our disposition provided to our referring physician and non-physician colleagues a firm working diagnosis and removed the need to obtain further diagnostic tests or specialty care. This last point was a consideration in 20/24 patients receiving lumbar ESIs as an alternative to immediate evacuation with all of the attendant problems suggested above.

Lastly, expanding on previous knowledge, we included only the patient subset facing evacuation from referring clinicians and non-clinicians alike and showed an even greater return-to-duty rate (97% vs.95%). Additionally, we performed bilateral L3-I5 lumbar RF ablation on three active duty soldiers who subsequently reported greater than 75% pain relief, were able to wear their battle gear (excess of 35 lbs) and all finished their tour of duty. This intervention, not offered in the previous quoted study, may have contributed to our even lower evacuation rate in the subset of patients at most risk of evacuation. Prospective studies with more sophisticated outcome measures are needed to identify which patients are most likely to benefit from early interventional pain management "in theatre" and the best method of implementation.

2. Does Central Complex Regional Pain Syndrome Influence Development of Subsequent Peripheral Complex Regional Pain Syndrome?

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Introduction: Complex regional pain syndrome can follow both central (c-CRPS) and peripheral (p-CRPS) insults to the nervous system, and has been reported to have a recurrence rate less then three percent. We present a case of c-CRPS with near complete resolution in a patient that developed a subsequent and clinically distinct p-CRPS, following a later injury.

Case presentation: A fifty year old female with pseudomyxoma peritoneum underwent abdominal surgery. In the postoperative period a central line was placed in the right carotid artery which, perhaps coupled with the relative hypercoaguable state from adenocarcinoma, led to an embolic stroke. She subsequently developed CRPS of a central nature in the left upper and lower extremities. Over the next year with conservative treatment and physical therapy her symptoms resolved nearly completely.

The patient then went on to suffer a left ankle sprain and subsequently develop a new discrete CRPS of the distal left lower extremity. This subsequent CRPS was characterized by edema, changes in hair growth, nail dystrophy, but was not associated with an upper extremity finding. These features appeared clinically distinct from her initial c-CRPS episode. She was treated with anticonvulsants and tricyclic antidepressants without any relief. The patient received a series of lumbar sympathetic blocks and has continued to have CRPS related symptoms with a modest improvement in pain.

Discussion: This patient developed a discrete CRPS of the left foot that had clinical findings different and more pronounced than her original symptoms. There was a clear resolution of her initial CRPS finding prior to the second insult. We suggest that CRPS of a central etiology may be a consideration to subsequent development of CRPS at a peripheral site. CRPS of peripheral etiology may predispose to additional p- CRPS. For example, it has been shown that CRPS could reoccur in an extremity following incomplete resolution, but after a new surgery or trauma. The case presented here suggests that c-CRPS may also influence development of a subsequent CRPS of peripheral etiology and has implications in the understanding of the nature and mechanism of central mediated pain. Previous cases of p-CRPS following cerebral injury may be complicated by patients' inherent disuse, or altered biomechanics of the extremity related to the initial cerebral insult. In the case presented, there was no significant altered use of the left upper or lower extremity and her second CRPS resulted from an unrelated trauma to the ankle.

Conclusion: It is possible that CRPS following cerebral insults, even after their resolution, may result in a disposition towards additional CRPS of a peripheral nature. If this is true, there are important implications in the understanding of the mechanisms of CRPS and centrally mediated pain in general. Understanding this apparent diaschisis of cerebral, spinal, and peripheral nervous structures to result in clinically similar pain syndromes would prove valuable. Further studies are needed to determine if larger prospective clinical or animal research is needed.

3. Dynamic Discography: Technique, Indications, and Clinical Follow-Up from the First 100 Patients

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Background: The diagnosis of Axial Low Back Pain is complex and challenging. One of the main causes of axial Low Back pain (LBP) is suggested to be from diseased or damaged spinal discs (discogenic pain). Discogenic pain is thought to be due to both mechanical and chemical irritation of nociceptors. The diagnosis of discogenic pain has been traditionally confirmed by the performance of a provocative discogram. Post discography Computer Tomography (CT) scanning is also often performed to assess any degree of internal disc derangement. A grading system has also been established to quantify internal disc derangement (modified dallas classification). Recently, the use of manometry or intradiscal pressure monitoring has been introduced to reduce the incidence of false positive results. Despite the use of pressure monitoring, there may continue to be an unacceptable risk of false positive results even in low-pressure discs . Provocative discography (PD) is a static test used to diagnose spinal pain of discogenic origin. Dynamic discography (DD) is a dynamic test that may be used to diagnose discogenic pain. Unlike provocative discography, dynamic discography can diagnose discogenic pain produced by postural changes, compressive loading, bending, twisting, or functional activities, and may further provide information regarding discogenic pain, which may be objectively measured by improvement in range of motion. The introduction of Dynamic Discography may provide valuable information in the diagnosis of discogenic pain. To date there has been no clinical study for the evaluation of low back pain with range of motion, using dynamic discography.

Purpose: To localize the source of discogenic pain by assessing changes in functional range of spinal motion and improvement in reported Numeric Pain Rating Scale (NPRS). Theoretically, this should reduce the risk of both false positive and false negative results by using objective measures.

Study Design/setting: Prospective observational study comparing Provocative Discography to Dynamic Discography.

Patient Sample: The sample group consisted of 101 patients with persistent low back pain. Discograms were performed between April 2006 and October 2007. There were 40 men and 61 women.

Outcome Measures: Discs positive for any pain on PD underwent DD. Improvement in pain on Numeric Pain Rating Scale (NPRS) and improvement in spinal range of motion (ROM) using goniometry were the principal outcome measures. Subjects were measured after anesthetic disc block at each symptomatic spinal level, starting with the level which was least suspected to be symptomatic and ending with the level most suspected of being symptomatic. Additionally, CT findings were correlated with discs positive or negative on PD and FAD.

Methods: A traditional provocative discogram was performed on the lower three (in rare cases four) spinal discs using standard technique. Manometric testing was added to further delineate disc pathology. Thereafter, flexible catheters were placed into discs that tested positive for pain during provocative discography. Furthermore, in subjects in whom all three disc levels tested negative on PD, catheters were placed in all three discs to assess whether any of these discs were false negatives on PD, but actually truly positive on DD. After the provocative discogram had been performed, the subjects were then taken off the procedure table and placed in a recovery room for 30 minutes. Thereafter, the subjects had their suspected symptomatic discs individually anesthetized in the order of the least to most suspected symptomatic disc. NPRS scores were taken immediately preceding the anesthetic injection, during injection, and ten minutes after each injection. Forward flexion ROM was also tested immediately preceding each anesthetic injection and ten minutes after each injection. This process was repeated for each disc that tested positive for pain during provocative discogram. Furthermore, subjects in whom all discs testing negative on provocative discography were also subjected to dynamic discography to decipher whether they had tested as false negative during traditional provocative discography. Following provocative and dynamic discography, CT scan of lumbar spine was performed to assess the degree of internal disc disruption using the modified dallas classification.

Conclusions: The Provocative Discogram is a static test and does not provide information regarding pain produced or exacerbated by functional activities. Pain produced solely by postural changes, axial loading, or twisting may not be evaluated properly by the traditional provocative discography even when manometry is used. Pain produced by such dynamic postural movements and functional activities may be evaluated by DD. Improvement in range of motion or reduction in pain may be measured in anesthetized discs, confirming them as pain generators. Unlike PD which is a static test, DD is a real time dynamic test that utilizes objective measures and provides objective information that may be used to properly diagnose the true source of discogenic pain.

4. Efficacy and Safety of Long-Term Tunneled Epidural Catheter Infusions in the Management of Pain and Arthrofibosis following Knee Surgery.

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Introduction: Despite advances in surgical technology and perioperative anesthetic management, poor range of motion after primary and revision total knee arthroplasty (TKA) can result from inadequate postoperative analgesia, which limits patient participation in physical therapy (Surg Technol Int. 2006;15:221-4). Range of motion is an important measure of outcome after TKA (J Bone Joint Surg Br 2007;89:893-900). This study describes the safety and efficacy of prolonged indwelling tunneled epidural catheters to manage post- procedural pain in patients with or at risk for restricted motion after TKA.

Methods: 101 consecutive tunneled epidural catheters were placed in patients with a history of chronic pain and/or poor range of motion prior to a primary TKA or procedures to treat restricted range of motion after TKA. These included either a revision TKA or Arthroscopic lysis of adhesions. Fluoroscopy was used to direct the tip of the tunneled epidural catheter ipsilaterally to permit the use of low concentrations of bupivacaine admixed with and clonidine and fentanyl as tolerated. The tip of the catheter was directed to the ipsilateral L2-L3 nerve root. The catheters were left in place for 4-6 weeks postoperatively. Patients were sent home with home health care nursing and out patient physical therapy. Pre- and post-procedural range of motion, pain scores, and complications were assessed.

Results: Epidural catheters were maintained an average of 39.4 days. Epidural related complications were rare when assessed over a mean follow up of 205 days after the catheter was removed. There was significant improvement in range of motion and decreases in pain scores were achieved with this described protocol for patients with stiff TKA. From a mean preoperative flexion of 84.6°, postoperative improvements were seen during the epidural infusion period (98.5°, $P < 0.0001$), at six weeks (101.4°, $P < 0.0001$) and at the latest follow-up (103.8°, $P < 0.0001$). Pain rating, as measured by a 0-10 verbal rating scale (10 being the worst pain), showed a significant decrease over time ($P < 0.0001$) from a preoperative value of 6.5 ± 2.7 to a value of 3.6 ± 2.6 ($P < 0.0001$) during (average of 6 weeks results) the indwelling catheter period. Patients who underwent revision TKA for preoperative arthrofibosis demonstrated the largest increase in flexion from a mean of 67.1° to a mean of 102.5° degrees at the latest follow-up visit ($P < 0.0001$). There were no instances of catheter related epidural space infections or complaints of spinal headache. Two patients sustained falls in the early post-operative period.

Discussion: Inadequate postoperative pain control following a previous knee surgery can result in arthrofibosis and chronic pain. Simply proceeding with a revision arthroplasty or primary arthroplasty after arthroscopy often leads to another poor outcome similar to the initial surgery. The use of a long-term tunneled epidural catheter technique is a safe and effective method to provide a prolonged delivery of effective analgesia to high risk patients where excellent analgesia is critical for optimizing functional outcomes after TKA.

5. Hemorrhagic Gastritis and Duodenitis Following Celiac Plexus Neurolysis

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Introduction: Neurolytic celiac plexus block is a well established intervention to palliate pain and improve quality of life in patients suffering from an upper abdominal malignancy, specifically pancreatic cancer.

Methods: We describe a 61-year-old female with history of pancreatic cancer, unexplained transfusion dependent anemia with a normal recent upper endoscopy and abdominal pain who had previously undergone gastrojejunostomy and a Roux-en-Y hepaticojejunostomy as well as chemotherapy and radiation therapy. She suffered from intractable abdominal pain and elected to undergo palliative celiac plexus neurolysis.

Results: The patient initially appeared to tolerate celiac plexus block well, however, forty-five minutes after the procedure, the patient had profuse bright red blood per rectum followed by copious amounts of bloody diarrhea. Her abdomen was soft and non-tender abdomen with minimal distention and positive bowel sounds. The patient's hemoglobin fell from 9.0 g/dl to 7.5 g/dl, requiring a blood transfusion. Upper endoscopy and enteroscopy demonstrated diffuse hemorrhagic gastritis and duodenitis. The

bleeding was controlled and the patient remained hemodynamically stable. Ultimately, the patient did well and was discharged home.

Discussion: We present a patient suffering from abdominal pain secondary to pancreatic cancer, who underwent palliative celiac plexus neurolysis and subsequently developed hemorrhagic gastritis and duodenitis. We believe that the inhibition of sympathetic tone resulting from the celiac plexus block/neurolysis opened the "floodgates" of unopposed parasympathetic activity resulting in an increased blood flow and ultimately profuse bleeding. This allowed for an exacerbation of indolent hemorrhagic gastritis and duodenitis.

Conclusion: In the setting of anemia and history of gastric tumor, it is prudent to recommend careful GI evaluation and risk stratification prior to celiac plexus block which has the potential to cause severe bleeding as a result of the inhibition of sympathetic tone. Without prior thorough workup and monitoring, these signs and symptoms may be considered a relative contraindication to the procedure.

6. Neurotrophin-3 and Tyrosine-Kinase C Have Modulatory Effects on Neuropathic Pain in the Rat Dorsal Root Ganglia

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Neurotrophin-3 (NT3) and its cognate receptor, tyrosine-kinase C (trkC), have recently been shown to modulate neuropathic pain. Another receptor, the transient receptor potential vanilloid 1 (TRPV1), is considered a molecular integrator for nociception. In this study, we evaluated the NT3 and trkC expression in the dorsal root ganglia (DRG) before and after a sciatic nerve injury, followed by selective TRPV1-positive cell elimination by Resiniferatoxin (RTX). NT3 increased in the small and medium size DRG cells of neuropathic animals. In contrast, NT3 was decreased in non-allodynic rat DRGs, as well as allodynic rat DRGs after RTX treatment. TrkC was initially increased after nerve injury in the small DRG cells of allodynic animals, but increased in the large cells of non-allodynic ones. After RTX, the trkC expression gradually decreased, but with persistence in the large cells. We conclude that TrkC has antinociceptive effects in the DRG, and these effects are, at least, partially mediated by NT3.

Summary: In summary, NT3 appears to be involved in neuropathic pain mediation. Following a sciatic nerve injury, NT3 increased in the small and medium size DRG cells, probably as a compensatory mechanism to counteract the effects of TRPV1 and NGF. In contrast, NT3 was decreased in non-allodynic rat DRGs, as well as allodynic rat DRGs after RTX treatment. TrkC was initially increased after nerve injury, in the small DRG cells of allodynic animals, and in the large cells of non-allodynic ones. After RTX, the trkC expression gradually decreased, but with persistence in the large cells. This study suggests that NT3 may have a protective role and may provide insight in new pain control treatments.

7. A Novel Advancement in Spinal Imaging- 3 Dimensional Color Discography.

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Objectives: To develop more advanced images of an intervertebral disc morphology, and advancement of the traditional provocative discography. Using a high powered 3-dimensional color CT Scan similar to those used for Cardiac CT scanning of coronary arteries, the author applied similar imagine technology to the intervertebral disc to obtain color 3-dimensional images.

Summary: Provocative discography is a diagnostic technique that attempts to correlate the patient's symptoms and morphology of the intervetebral disc. Proponents of discography have noted that discography is a technique to diagnose discogenic pain, which also allows for imaging showing intervetebral disc anomalies. Discogenic pain mechanisms are several, but include potential irritation from the nucleus pulposis and pain resulting from annluar tears. Lumbar discogenic pain typically is characterized as being located in the axial low back with occasional radiation to the gluteal regions. Critics of discography have noted that sometimes concordonant pain may be noted in patients who have non-spinal causes of back pain. Currently, discography is traditionally done using fluoroscopic image guidance with a manometer to measure pressures during critical moments of the procedure. Some practioners obtain a post discography CT scan immediately after discography. The author attempted to utilize similar technology that is

utilized by Cardiac CT 64 slice CT scans to obtain 3 dimensional color discography images of the disc. Using the software for 3 D CT scans, manipulation of the images is possible to obtain several unique images to depict discogenic morphology. The images can be rotated in 3 dimensions and portions of the spine can be rotated, removed, and twisted to see subtle changes within the disc itself. This technique enhances and furthers the utility of traditional discography to allow for not only a subjective component of pain response, but objective 3 dimensional color images which allow for better visualization of intervertebral disc morphology.

Methods: A 54-year-old white female presented to the outpatient pain center with complaints of low back pain that occasionally radiates to the bilateral buttocks and never extends below the thighs. The patient tried and failed NSAID's, physical therapy, and lumbar traction. She also underwent DTS Decompression via a chiropractor. A presumptive diagnosis of discogenic pain was made by a neurosurgeon and a provocative discography was requested by a neurosurgeon. The patient underwent traditional discography using fluoroscopy and immediately from the fluoroscopy suite was sent to obtain CT scan form the "Cardiac CT Scanning Suite." The CT scan was a high-powered 64 slice CT scan and the images were then reconstructed using color 3 Dimensional technology. The images were then manipulated to rotate the images, remove spinal tissue to obtain color images of the epidural space to visualize epidural leakage in color 3 and 3 dimensions, the intervetebral disc, and the morphology of the spine. Additionally, movie animations whereby the entire disk can be seen as well as the spine were created. These images represent advancement from traditional 2 dimension fluoroscopic or black and white CT scan. The ability to twist and rotate the image in multiple planes allow for imaging of subtle findings within the disc.

Discussion: Although this is an early description of the technique of 3 dimensional color discography, it does open the door for further study and advancement of the technique. The possibilities of utilizing the technology to visualize subtle differences and pathological changes in intervertebral disc morphology are intriguing, and may provide superior information regarding discogenic pain than that obtained from a traditional MRI or CT scan. Additionally, this techniques allows for more targeted and directed percutaneous techniques to repair annular tears and defects using real time 3 dimensional color CT guidance to accurately repair potential damaged portions of the disc using techniques such as cobaltion, thermal or pulsed radiofrequency, or other techniques to further advance incisionless spine surgery. It may also enhance the diagnostic utility of an otherwise controversial technique by obtaining more objective data.

8. Reduction in Disc Extrusion Size Annulus Using Percutaneously Implanted Mesenchymal Stem Cells and Platelet Supernatant

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Disc protrusions and extrusions of the Intervertebral Disc (IVD) are commonly treated via surgical or minimally invasive discectomy. However, the focus of treatment has been the removal of disc material, which can weaken the structure of the annulus and increase the risk of re-herniation. Animal models have used culture expanded mesenchymal stem cells (MSC's) to repair the IVD. This IRB approved, small prospective case series was undertaken to determine if MSC's could reduce the size of disc protrusions and extrusions in human subjects. Three patients with either a disc protrusion or contained extrusion (subligamentous) and at least 75% normal disc height were recruited with informed consent. Bone marrow mesenchymal stem cells were isolated from a marrow aspirate at the PSIS and then culture expanded to a pure MSC line. Platelets were also isolated from whole blood to produce a VEGF rich platelet supernatant which was used both as a carrier for MSC's and for post-op epidural supplementation. The patient returned approximately 2-3 weeks after the cell harvest and MSC's were implanted via fluoroscopy into the posterior disc annulus. High field 3.0T MRI's were taken before, at 1-2 months, and at 4-6 months after the procedure. Post op MRI's showed a 50% or greater reduction in disc size in 2/3 patients with concomitant reductions in back and leg symptoms. No complications were observed.

9. A Rare Complication of Epidural Steroid Injections: Zosteriform Lesions Arising from Herpes Simplex Virus Reactivation

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Background: Epidural steroid injections (ESI) have become a popular non-surgical treatment for such disorders as neck and back pain with radicular symptoms caused by the chemical or mechanical irritation of spinal nerve roots. ESIs have also demonstrated some modest efficacy in the treatment of postherpetic neuralgia (PHN).1 Thus, it is surprising when it appears that one of the current therapies for the sequelae of a herpes virus infection may itself induce a recrudescent herpes infection. We present the first report of a culture-confirmed case of cutaneous herpes simplex virus two (HSV-2) reactivation temporally associated with ESI.

Case: A 44-year-old African-American woman presented to our pain management clinic in January, 2009 for an epidural steroid injection to treat her chronic low back pain (LBP) and parasthesias that radiated into her bilateral lower extremities (Right>Left) in an S1 dermatomal distribution.

Her past medical history was significant for an L5-S1 right-sided foraminotomy and discectomy in June, 2004 and multiple ESIs each containing 80mg triamcinolone. Between February, 2004 and January, 2009 she had received a total of 12 ESIs (averaging 2-3 per calendar year), none of which resulted in any notable post-procedure complications. However, four days after her 13th ESI she noted a painful sensation over her sacrum described as "sharp," "burning," and "pins and needles." Over the next two days the sensation increased in intensity and she noted "bumps" in the same location as her pain with a concomitant increase in her baseline back pain. Six days after the caudal ESI she presented to her primary care provider who examined her and noted ">20 grouped pustules in the gluteal crease. No cellulitis no induration." She was instructed to contact our pain management clinic and was given a prescription for Cephalexin 500mg by mouth twice a day for 10 days.

On the following day the patient was seen in our clinic and was noted to have a severely antalgic gait, difficulty changing into a gown, and maneuvering into a prone position on the exam table. On exam the patient was noted to have 3 irregularly shaped lesions approximately one centimeter in diameter that were comprised of grouped vesicles of different sizes on an erythematous base over her sacrum. Two were on the right in roughly the S2 dermatome and one was on the left at the same level. The patient also noted the recent onset of severe pain in an S2 distribution down her left lower extremity.

Upon questioning, the patient recalled having had Chickenpox as a 7-year-old child but no other dermatologic symptoms consistent with herpes virus infections that she was aware of. Given the presentation of classic herpetiform lesions in a roughly bilateral dermatomal distribution over the buttocks, a presumptive diagnosis of varicella zoster with an atypical presentation was entertained. It was further hypothesized that the epidural injection of 80mg of triamcinolone may have caused significant localized (or possibly systemic) immunosuppression that may have contributed to reactivation of Herpes Zoster virus in the S2 dorsal root ganglia.

To reduce the pain, spread, and length of the infection the patient was started on Valacyclovir 1000mg by mouth three times a day for 7 days. For symptomatic relief she was also prescribed Celecoxib 200mg by mouth per day, Lidocaine cream 4% applied to the affected area as needed, and Gabapentin in an upwardly titrating dose schedule.

Suspecting that this might be a complication of the ESI, the decision was made to more adequately confirm the diagnosis. Therefore, serology for Varicella Zoster Virus (VZV) IgM and IgG antibody isotypes were obtained in addition to viral cultures. To rule out the possibility of an epidural abcess formation a lumbosacral MRI was performed.

The MRI results were consistent with her previous studies with no evidence of epidural, neuraxial, or bony infections.

Three weeks after the epidural steroid injection a telephone consult with the patient revealed complete resolution of both the new radicular symptoms and increased back pain. Additionally, all previously ordered lab tests had been completed. The results demonstrated an antibody response consistent with a current or recent HSV-1 or 2 infection as well as culture-verified HSV-2.

Our findings were discussed with the patient and she was counseled on all relevant risks associated with HSV-1 and HSV-2 infection whether or not she is asymptomatic.

Discussion: Thus far, 8 herpes viruses have been isolated from humans: alpha-herpesvirinae (herpes simplex viruses 1 and 2 and varicella-zoster virus), beta-herpesvirinae (cytomegalovirus, human herpes viruses 6 and 7), and gamma-herpesvirinae (EBV, HHV-8).

One of the key features of human infection with alpha-herpesvirinae is the ability of these viruses to cause a latent (asymptomatic) infection in their host after initial exposure. During latency, viral DNA does not integrate itself into the host cell genome, but rather exists as a circularized episome in the human host cell nucleus that can reactivate transcription and production of new virions through incompletely understood mechanisms.

An increased rate of reactivation of alpha-herpesviruses has been observed when the immune system is weakened. In the literature this has been most commonly described in immunocompromised individuals with AIDS, patients requiring systemic immunosuppressants including corticosteroids,6 as well as the very young and the very old.

Cutaneous infections by HSV-1 or 2 and VZV can usually be distinguished by clinical features alone, but laboratory studies are sometimes required for definitive diagnosis of atypical presentations of these infections. The gold standard for diagnosis remains viral culture, but serology looking at IgG and IgM levels in patients can strongly suggest the presence or absence of an active infection by specific viruses.

There are 3 reports in the literature that make the case for a temporal relationship between epidural steroid injections and the recrudescence of herpes zoster infections: Szokol and Gilbert10 reported the case of a 52-year-old woman who developed herpetic lesions in the S-3 distribution after a 120 mg methylprednisolone epidural injection for right-sided radiculopathy associated with an L5/S1 disc herniation. Four days later, the patient developed pruritis around her "tailbone" and was found to have "skin changes typical of a herpes zoster outbreak in the S-3 distribution." Over the next several weeks the skin went through changes consistent with healing herpes lesions that concluded with the skin returning to normal. No serology or viral cultures were obtained.

Parsons and Hawboldt described a 42-year-old man who had developed a complex regional pain syndrome limiting weight bearing and ambulation. The patient was scheduled for a 6-month series of six epidural blocks using 8 ml of 0.125%–0.25% bupivacaine and varying doses of methylprednisolone (10–80 mg). One week following the fifth epidural injection, the patient developed burning pain in the right L-2 dermatome and what were described as "classic herpes zoster lesions." He was treated with antiviral therapy. As the lumbar lesions were resolving, he developed a second outbreak of similar lesions involving the left C-6 dermatome of his arm. Again, no serology or viral cultures were procured. Schuchmann and McAllister12 presented the case of a 76-year-old white male who presented to his primary care doctor with a 5-year history of right-sided lower chest wall/upper abdominal pain after implantation of a pacemaker. A thoracic ESI consisting of 6 ml of 0.08% bupivacaine and 80 mg of triamcinolone was performed at the T6–7 level. The patient developed an abdominal wall bulge in his right upper abdomen approximately 7 days after the epidural steroid injection. A CT scan of the thoracic spine revealed mild multilevel degenerative disc disease without significant central canal stenosis or neural foraminal narrowing at any of the affected myotomal levels. Serum levels of VZV IgG obtained near the time the bulge developed revealed a titer of 1:256. Antiviral therapy was started. Nineteen days later, the sample was redrawn and an antibody titer of 1:32 was noted. An electromyography study of the abdominal muscles was consistent with the presence of lower motor neuron dysfunction (denervation) in the area of the bulge. A diagnosis of Zoster sine herpete with thoracic motor paralysis was made based on these results.

Conclusion: We believe that this is the first reported case of serologically and culture-confirmed cutaneous herpes simplex virus 2 reactivation temporally related to epidural steroid injection. It is of note that the first two referenced case reports were based on clinical diagnosis alone and did not have confirmatory serology or viral culture results. Thus, one cannot exclude the possibility that one or both of those cases may have actually been a form of HSV and not VZV.

If clinical diagnosis of VZV infections alone is inadequate to exclude atypical presentations of cutaneous HSV, are a significant number of cutaneous HSV infections being misdiagnosed as VZV? In one large zoster study, published in the NEJM 2005, there were 1,274 suspected cases of VZV with only 931 cases confirmed with laboratory studies. In other words, only 73.1% of suspected cases (in a VZV-related study with well-trained staff performing the clinical exams) had laboratory confirmation of VZV infection. 13 In a smaller study consisting of 111 patients with a clinical diagnosis of herpes zoster, 13% were actually infected with HSV as demonstrated by viral culture.

Unlike VZV, HSV and other causes of herpetiform lesions are not thought to induce post-herpetic neuralgia as they appear to result in significantly less damage to infected neurons. This raises an important question: Is the incidence of post-herpetic neuropathy from VZV infections significantly higher than we think due to HSV infections and other diseases being misdiagnosed as VZV? Further research specifically designed to answer this question will be required.

10. The Use of Percutaneous Osteoplasty (PO) for the Palliative Management of Metastatic Carcinoma to Non-Vertebral Bone

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Introduction: The skeleton is a common site of metastatic disease, with the vertebra, pelvis and hip as the most common sites of metastatic involvement. Metastatic lesions to the axial or appendicular skeleton can cause significant morbidity including pain, decreasing weight bearing and ambulation. While vertebral augmentation is a widely accepted technique for treatment of vertebral compression fractures, non-vertebral PO is a new approach for management of oseteolytic lesions outside the vertebral column. PO is an image- guided minimally invasive outpatient procedure that involves the injection of polymethylmethacrylate (PMMA) cement into an osseous lytic lesion.

Materials and Methods: We performed PO to the acetabulum on three men and one woman who had metastatic lesions from the following primary lesions: prostate, renal cell, multiple myeloma and breast cancer, and PO to the calcaneus on one woman with metastatic breast cancer. Median patient age was 63 (range: 52-86). Two patients had prior external beam radiation therapy to the metastatic lesion and two patients had concurrent radiofrequency ablation (RFA).

Results: With median follow-up of nine months (range: five months-one year), all five patients had excellent pain control and improvement in ability to ambulate. Patient one (86 year old woman with metastatic breast cancer) reported meaningful pain control and ability to return to independent activity. Patient two (67-year-old man with multiple myeloma) had combined RFA and PO and achieved good pain control and marked improvement in weight bearing ability. Patient three (52 year old man with metastatic renal cell cancer) had combined RFA and PA and reported excellent pain control and return to full weight bearing activities. Patient four (60-year-old man with metastatic prostate cancer) After PO, he reported excellent pain control referable to his acetabular metastasis, and improvement in weight bearing ability. Patient five (52-year-old woman with metastatic breast cancer) reported complete pain resolution and normal ability to bear weight following calcaneoplasty.

Conclusions: PO is a minimally invasive procedure which appears to significantly alleviate refractory bone pain. In the short term, PO appears to be a reasonable palliative procedure for painful metastatic bone disease and is a promising technique for pain relief, restoration of function and ambulation. Further study on non-vertebral PO is warranted to confirm these findings.

11. A Proposed Grading Scale for Epidural Adhesions: Lessons Learned from a Pragmatic Clinical Trial of Caudal Epidural Adhesiolysis

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Introduction: Epidural adhesiolysis for adhesions is effective therapy for a wide number of indications. However, results of therapy may vary based on disease duration and severity, concomitant pathophysiology and no consensus on standardized nomenclature for grading epidural adhesions in the lumbar area.

Methods: Epidural adhesiolysis was carried out using Manchikanti et al's modification of the Racz adhesiolysis protocol. Inclusion criteria included patients with symptoms suggestive of epidural scar on either imaging or clinical findings. Then, a Racz catheter was directed to the epidural space and success of placement of the Racz catheter into the ventral epidural space was noted. Next, an epidurogram was performed. A grading system was formulated using the following epidurography findings: Grade 0: epidurogram spreads to all areas (L5- S4); no evidence of epidural scar; Grade 1: epidurogram spreads to 8-10 nerve roots; Grade 2: epidurogram spreads to 5-8 nerve roots; Grade 3: 2- 5 nerve roots visualized; Grade 4: 1 or no nerve root visualized. Subgrades (a) catheter placed successfully in ventral and lateral epidural space; (b) unable to place the catheter in ventral epidural space. Adhesiolysis was carried out with upto 10 mL of normal saline, followed by 10 mL of 0.2% ropivacaine on the nerve roots at suspected site of pathology. This was followed by 3000 units of ovine hyaluronidase (Vitrase®). Patients were transported to the recovery room; absence of motor block was documented and 6 mL of hypertonic (10%) saline was injected. Mann-Whitney test was used to analyze data.

Results: 24 patients (15 females, 9 males) were identified from April 2007-March 2009. Cases included failed laminectomy syndrome (n=12); spinal stenosis with vertebral fracture (n=2); disc extrusion (n=1); spondylolisthesis (n=5). 12 patients had grade 2 (n= 21 grade 2 a; n=1 grade 2b); 5 patients had grade 3a; 3 patients had grade 4 (grade 4a 1 patient; grade 4b 2 patients). In 2 cases we were unable to analyze the epidurograms due to absence of stored films. Epidurogram grading using this scale was effective in identifying patients with poor outcomes. Patients with the higher grades on the epidurogram, particularly those with grade b (inability to access the ventral epidural space) were the ones associated with failures of adhesiolysis. In cases where the epidurogram was relatively of a lower grade (for example, grade 2) poor outcome was associated with relatively distant site of pathology (vertebral fracture).

Conclusions: The results of this small study suggest the usefulness of a simple grading scale for classification of epidurograms. Adoption of such a scale may lead to standardized protocols for grading adhesions in the lumbar epidural space. Such a grading scale considers the three dimensional anatomy of the epidural space. This information, when combined with a standardized protocol, and consideration of both the condition producing the adhesiolysis along with local mileau (adhesions at the site of catheter placement) will lead to a more rationale approach to predicting outcomes following epidural adhesiolysis procedure

Human Subjects declaration: This retrospective review has received IRB approval from Vanderbilt University.

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12 Percutaneous Non-Instrumented Facet Joint Fusion is a Successful, Minimally Invasive Option for Patients with Facetogenic Low Back Pain

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Patients with axial low back pain of facet joint origin now have an intermediate option between radiofrequency denervation (rhizotomy) and instrumented lumbar fusion. TruFUSE is performed percutaneously with the aid of fluoroscopy and under conscious sedation. After the target lumbar facet joint is identified, a Steinmann pin is introduced into the joint followed by a drill guide advanced over the pin. A small (8 mm) hole is then drilled into the joint and an allograft bone dowel is inserted into the joint. The same procedure is then repeated for the contralateral side to achieve bilateral lumbar facet joint stabilization. The patient is then discharged to home with a lumbar brace that must be worn when weightbearing for at least 6 weeks.

The indications for this procedure are axial low back pain secondary to symptomatic lumbar spondylosis; chronic lumbar sprain/strain refractory to radiofrequency denervation; and in general, patients who may have had successful denervation of the lumbar facet joints but have experienced recurrence of symptoms after re-enervation.

We have performed 20 bilateral L4-5 and L5-S1 lumbar facet joint stabilization procedures (TruFUSE) for a total number of 80 treated joints within the last 7 months. The longest follow up to date is 6 months and the shortest 3 weeks. Our patient population is comprised of 12 females and 8 males with an average age of 55 years old. 8 patients had previously undergone radiofrequency denervation. All patients had had confirmatory diagnostic medial branch blocks and facet injections. Preoperative numeric pain scores were 7/10 (mean +/- 2). Postoperatively, 18 out of the 20 patients have reported greater than 70% improvement in pain scores (2/10 mean +/-1) with at least 5 patients reporting complete resolution of symptoms (mean followup 4.2 months). Other outcome measures demonstrating good results with TruFUSE were: return to work, improvement in activities of daily living, decrease in amount of narcotic medication required, improvement in sexual life and others. 90% of the patients reporting greater than 70% improvement were "extremely satisfied" or "very satisfied" with the procedure. There was only one complication consisting of bilateral L4-5 allografts migrating outside the facet joint into the lumbar paraspinal musculature. The L5-S1 allografts stayed in the joints though.

In summary, percutaneous lumbar facet joint non-instrumented fusion appears to be a promising intermediate option for those patients with facetogenic axial low back pain. Diagnostic medial branch blocks and facet injections are required for adequate patient selection. We propose future research comparing safety and effectiveness of this procedure when compared to radiofrequency ablation of lumbar facet joint medial branches.