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Lumbar Facet Joint Pain: Pathology and Treatment Via Facet Joint Injection and Medial Branch Neurology

Andrew L. Schott

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Bachelor of Science in Nursing, Concordia College, 2005

An Independent Study

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

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Abstract

Chronic spinal pain or "back pain" as it is sometimes referred is a serious medical problem with serious financial and social consequences (Manchikanti, 1999). Back and neck pain are the most common cause of chronic pain and disability (Raso, 2010). Certified Registered Nurse Anesthetists are advanced practitioners with the ability to treat lower back pain using advanced interventional procedures; however, they currently are not performing these interventions in North Dakota. A comprehensive literature review was utilized to gather current data and group trends in the treatment of lumbar facet joint pain. History and physicals, while helpful, do not accurately diagnose lumbar facet joint pain. Advanced imaging using x-ray, CT, and MRI also does not correctly diagnose lumbar facet joint mediated back pain. Repeated, controlled diagnostic nerve blocks are the only proven method of diagnosing lumbar back pain of facet origin. Four treatment modalities: intra-articular injection, lumbar peri-articular injection, medial branch block, and medial branch neurotomy are described in this paper. Controlled diagnostic blocks are the best means to diagnose facet mediated lower back pain. Medial branch block and neurotomy provide the highest percentage of relief for the greatest period of time out of the interventions explored. Presentation of these findings to Certified Registered Nurse Anesthetists and Student Registered Nurse Anesthetists will increase their knowledge base and raise awareness of diagnostic and treatment options for lumbar facet joint pain.

Lumbar Facet Joint Pain: Pathology and Treatment via Facet Joint Injection and Medial Branch Neurotomy

Introduction

Chronic low back pain is a significant problem in the United States and worldwide. According to Binder and Nampiaparampil (2009), "low back pain is the most common pain symptom experienced by American adults and is the second most common reason for primary care physician visits" with over one third of the U.S. population experiencing an episode of low back pain in the three months prior to the survey (p.1). The patients who go on to develop chronic low back pain, that is back pain lasting greater than 3 months, account for an estimated $100-200 billion dollars of healthcare spending every year (Binder & Nampiaparampil, 2009). Back pain is a multi-faceted problem with a wide range of etiologies. Currently there are interventions available for the treatment of lower back pain originating from the lumbar facet joint. Certified Registered Nurse Anesthetists (CRNAs) have obtained the skills necessary and are currently treating this problem via advanced interventional techniques. This is a controversial topic among CRNAs and Anesthesiologists.

Purpose

The purpose of this scholarly project is to review facet-mediated lower back pain: its diagnosis and treatment options. This project is a tool to increase awareness of current practice among CRNAs in hopes of bringing new areas of practice to those who are interested. It is also a tool for self-teaching and discovery: to gain knowledge and insight into a practice which is not currently taught at the University of North Dakota.

Significance

Chronic spinal pain or back pain is a serious and widespread medical problem with serious financial and social consequences (Manchikanti, 1999). Research into the role of facet joints in spinal pain has shown that lumbar facet joints cause pain in 15 to 40% of patients with chronic low back pain. Back and neck pain are the most common cause of chronic pain and disability (Raso, 2010). Low back pain is the second most common reason for primary care physician visits. Those patients who go on to develop chronic low back pain (lasting greater than 3 months) account for an estimated $100-200 billion dollars of healthcare spending per year (Binder & Nampiaparampil, 2009). Disability from spinal pain is associated with a nonspecific diagnosis and suboptimal outcomes (Raso, 2010). Despite our enhanced understanding of pain neural pathways and improvements in imaging technology, diagnosing the exact etiology of low back pain and treating it continues to be a challenge (Binder & Nampiaparampil, 2009). Nursing science and practice will be influenced by this study through education, both of the underlying anatomy and pathology of the lumbar facet joint and the disease process of back pain in which lumbar facet joints are involved. The prevalence and treatment rate of low back pain in this country demonstrate the need for further study into this major health problem.

Theoretical Framework

Patricia Benner's theoretical framework "From Novice to Expert" was used for this paper. Benner's model theorizes that nurses develop skills and understanding of patient care over time through a sound education and a multitude of experiences. Benner's theory states that developing knowledge in disciplines like medicine and nursing begins with practical knowledge, which comes from research, and then progresses to the characterization and understanding of the

'know how' of clinical experience (Benner, 1982). She also forms the idea in her writing that nursing skills, as an experience, are a prerequisite for becoming an expert (Benner, 1982). Benner classifies 5 levels of nursing experience: novice, advanced beginner, competent, proficient, and expert.

A novice, according to Benner, is a beginning nurse with no experience who is taught rules to perform tasks and then governed by those inflexible rules and guidelines that direct action. An example of this would be for someone to ask for direction and then follow suit (Benner, 1982).

An advanced beginner has slightly more experience. He or she has proven themselves through acceptable performance and gained prior experience from actual situations which helps the practitioner to recognize recurring meaningful components (Benner, 1982). An advanced beginner begins to formulate principals based on experiences, which in turn guide their actions.

A competent nurse would have several years, possibly 2 to 3, of on the job experience in the same area, would be more cognizant of long term goals, and would gain perspective from planning his or her actions based on conscious and analytical thinking, thus achieving greater efficiency and organization.

A nurse who is proficient is able to perceive and understand situations as whole parts, has a greater holistic understanding, improves decision making, and learns from his or her experiences what to expect in certain situations. A proficient nurse is then able to modify their plans accordingly.

An expert no longer relies on principals, rules, or guidelines to connect situations and determine actions, has a much greater background of experience, has an intuitive grasp of clinical situations, and has a performance which is fluid, flexible, and proficient on the highest level (Benner, 1982).

This theoretical framework closely follows the development of a person as they journey through the process of becoming an advanced practice nurse and an expert clinician in a specialized field. CRNAs in a specialty practice build their knowledge and skill on experiences years in the making, eventually reaching a level of intuitive decision making which is at the highest level of clinical practice.

Definitions

Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. The pain system provides information on noxious stimuli that allows the body to respond to the injury. Pain may be somatic, visceral, neuropathic, or sympathetically maintained (Merskey & Bogduk, 2004).

Chronic Pain: Pain which persists a month beyond the usual course of an acute disease or a reasonable time for any injury to heal that is associated with chronic pathologic processes that cause continuous pain or pain at intervals for months or years. It is persistent pain that is not amenable to routine pain control methods. The pain exists beyond an expected time frame for healing. Healing may never occur with this type of pain (Boswell et al., 2005).

Facet Joint aka zygapophysial joint: Paired diarthrodial articulations between posterior elements of adjacent vertebrae (Boswell et al., 2005).

Review of the Literature

Anatomy

The lumbar vertebral column is composed of five vertebral and individual discs. The lumbar vertebral body is large and kidney-shaped. It is wider transversely than anteroposteriorly and is slightly larger comparatively anterior to posterior. The lumbar body and the posterior arch enclose the triangular vertebral foramen which contains the spinal cord. Unlike the bifid cervical and pointed thoracic spinous processes, the lumbar spinous processes are quadrangular and project backward rather than angulating downward. The fifth lumbar spinous process is regularly the smallest one, and its transverse process is the most massive. Facet joints or zygapophysial joints are located bilaterally on the dorsal aspect of the spine, where lateral masses of the adjacent vertebrae overlap (Cohen & Raja, 2007). The lumbar zygapophysial joints are formed by the articulation of the inferior articular processes with the superior ones. Facet joints are present from C1 to S1 (Sibell, 2007). The normal, unimpaired articular facets are enclosed by articular cartilage and are coated by their synovial articular capsule (Loizides et al., 2011). The facet joint is a true sinuarthrodial joint, a connection of two bones which allows movement to occur. Raso (2010) describes the lumbar facet joint as a joint that allows the spine to "flex, extend, and rotate" and is a "true synovial joint" (p. 207). This joint lies at the posterior aspect of the spinal column and is formed by the union of the adjacent articular processes: the inferior articular process of the superior vertebrae to the superior articular process of the inferior vertebrae (Raso, 2010) . Raso (2010) further describe the lumbar facet joint as having a "C shaped configuration" on different imaging views with the "concavity of the C facing inward" (p. 209). The posterior portion of the joint is the most important point for access as it is the most easily entered utilizing a spinal needle with a shallow "straight anteroposterior" angle of 10 to 20

degrees (Raso, 2010 p.208). The posterior portion of the facet joint is enveloped by a fibrous capsule that is thick and tough. Hyaline cartilage lines the articulating surfaces of the superior and inferior articular processes (Raso, 2010). Raso (2010) also illustrates further by describing the joint capsule as being "redundant at the superior and inferior margins of the joint," and that "it is the inferior portion of this posterior recess that is accessible to percutaneous needle puncture" (p. 209). The optimal target for needle placement is the inferior process of the posterior joint recess immediately inferolateral to the inferior articular process (Raso, 2010).

According to Varlotta (2010), a single zygapophysial joint is innervated by two medial branches from the dorsal primary ramus of the spinal level of the joint and of the level immediately above. Varlotta (2010) describes the segmental nomenclature as being "post-fixed," "whereby the L3 and L4 medial branches innervate the L4-5 facet joint and the L4 medial branch and the dorsal ramus branch of the L5 spinal nerve innervate the L5-S1 facet joint" (p. 151). Boswell et al. (2007) further explain: "facet joints are well innervated by the medial branches of the dorsal rami. Neuroanatomic studies have demonstrated free and encapsulated nerve endings in facet joints, as well as nerves containing substance P and calcitonin gene related peptide" (p. 15). Further describing the innervation and nerve conduction anatomy, Binder and Nampiaparampil (2009) state:

> As each medial branch passes inferiorly, it lies in a groove along the medial-posterior surface of the transverse process. The medial branch courses over the transverse process one level inferior to where it originates. For example, the C6-C7 facet joint is innervated by the medial branches of C6 and C7. However, the C7-T1 facet joint is innervated by the medial branches of C7 and C8. The facet joints of T1 and T2 are innervated by the medial branches of C8 and T1. This

> pattern continues in the lumbar spine. Of note, the anatomy of the L5-S1 facet joint differs from its counterparts. It is innervated by the medial branch of L4 and along the dorsal ramus of L5. The L5 dorsal ramus courses along a groove formed between the base of the S1 superior articulating process and the sacral ala. (p. 16)

Prevalence

The lifetime prevalence of spinal pain has been reported to be as high as 80% with as many as 60% of patients reporting chronic spinal pain 5 years or longer after the initial episode (Boswell et al., 2005). There are many structures in the lumbar spine that may serve as pain generators, and often the etiology of low back pain is multifactorial; however, the facet joint is being increasingly recognized as a key piece in the cause of low back pain (Binder & Nampiaparampil, 2009). Facet joint disease is a contributory factor in 15-52% of patients with chronic low back pain (Schwarzer et al., 1994). Cohen et al. (2010) report the prevalence of facet arthropathy as accounting for approximately 10-15% of all patients presenting with axial low back pain (p. 395). Manchikanti, Singh, Falco, Cash, and Pampati (2010) found "lumbar facet joints have been implicated as the source of chronic pain in 21% to 41% (with an overall prevalence of 31%) in a heterogenous population with chronic low back pain (p. 125). Manchikanti (1999) also reports that "the prevalence of lumbar facet joint pain have ranged from 7% to 75% among patients reporting back pain" (p. 350). Interestingly, upon examination of 647 cadaveric lumbar spines, the prevalence rate of prominent facet arthrosis was 100% by the age of 60. The highest prevalence and the greatest severity was found at the level of L4-L5 (Eubanks, Lee, Cassinelli, & Ahn, 2007).

Pathophysiology of Facet Joint Pain

The facet joint is considered a synovial joint; thus, pain may be induced with any type of motion or pressure. Degeneration, injury, and inflammation can lead to an increased sensation of pain when joint motion is initiated. This in turn leads to an overall physical deconditioning of the affected area. Manchikanti (1999) states "irritation of facet joint innervation itself leads to muscle spasm. It has been assumed that the degeneration of the disc leads to facet joint degeneration and subsequent spinal pain," however this hypothesis has been shown to be untrue when it comes to low back pain (p. 350). According to Dreyfuss, Dreyer, and Herring (1995), the causes of this pain are rheumatoid arthritis and ankylosing spondylitis, small fractures, capsular tears, splits in the articular cartilage, hemorrhage, osteoarthritis, meniscoid entrapment, synovial impingement, joint subluxation, chondromalacia, capsular and synovial inflammation, excessive mechanical injury to the joint capsule, restriction to normal articular motion from varying causes, synovial cysts, and infection.

Diagnosis

Correctly identifying the facet joint as the source of lumbar pain is crucial to ensure a proper treatment modality, as "multiple structures in the lumbar spine including discs, facet joints, and sacroiliac joints have been considered the major sources of pain in the low back and/or lower extremities" (Manchikanti et al., 2010, p.125). Treatment of lumbar pain of facet origin not only requires the correct diagnostic tests but the proper environment in which to perform these tests.

Requirements for a safe environment include a sterile operating room or procedure room, appropriate equipment for monitoring patient vital signs, radiological equipment, sterile preparation, full resuscitative equipment, gowns, needles, intravenous (IV) fluids, anxiolytic and

other injectable drugs, and trained personnel for preparation and monitoring of patients and equipment (Boswell et al., 2007).

While magnetic resonance imaging (MRI), x-ray, or computed tomography (CT) scans would seem to be a logical piece of lumbar facet pain diagnosis, research has shown that conventional clinical and radiologic techniques are unreliable (Boswell et al., 2007). Manchikanti (1999) reports "some investigators have reported a correlation between positive results on single photon emission CT (SPECT) and response to local anesthetic and steroid injections," however "the majority of reports indicate no correlation between clinical futures, MRI, CT, dynamic ending fields, SPECT scanning, and radionuclide bone scanning" (p. 351). While not diagnostic, CT scanning paired with ultrasound guidance is being explored as a tool for injection needle placement (Clarke et al., 2010).

Binder and Nampiaparampil (2009) report that the patient history cannot always differentiate the specific etiology of low back pain and that up to 85% of patients with low back pain do not obtain a specific diagnosis even after work up. The history, physical examination, and imaging studies cannot consistently identify facet joint pain. Furthermore, Boswell et al. (2007) state "most maneuvers used in physical examination are likely to stress several structures simultaneously, especially the discs, muscles, and facet joints, thus failing to provide any reasonable diagnostic criteria" (p. 20). Binder and Nampiaparampil (2009) summarized by stating "at this time, accurately diagnosing facet joint mediated pain by noninvasive techniques remains a challenge" (p. 18). Raso's (2010) literature does provide some diagnostic criteria for lumbar facet pain, listing:

- Paravertebral low back pain, which is often aggravated by remaining in any posture

- Pain worsened by twisting or rotation
- Pain increased on extension may be relieved by flexion
- Dull pain limited to the low back, buttock, and hip; can extend to thigh and knee in nondermatomal distribution
- Pain rarely extends below the knee
- Pain exacerbated by moving from a sitting to a standing position
- Pain relieved by standing, walking, rest, or repeated activity
- Morning stiffness
- A normal neurologic examination
- Tenderness to palpitation of the affected joint
- Absence of radicular pain and straight leg raising

(p.213)

Controlled diagnostic blocks featuring the injection of local anesthetic, steroid, or placebo are thus the only means of confirming the diagnosis of facet joint pain (Boswell et al., 2007, p. 21). Manchikanti et al. (2010) validate this by stating "Datta et al. established Level I or II-1 evidence for the diagnostic accuracy of controlled facet joint nerve block based on the United States Preventive Services Task Force (USPSTF) criteria. In addition, Rubinstein and van Tulder concluded that there is strong evidence for the diagnostic accuracy of lumbar facet joint blocks in evaluating low back pain" (p. 125). A two-year follow-up of 152 patients undergoing controlled diagnostic blocks revealed a sustained diagnosis of facet originated pain of 89.5% (Pampati, Cash, & Manchikanti, 2009,).

One can evaluate the etiology of lumbar spinal pain by blocking the nerves innervating the facet joints or by intra-articular injection (injection into the facet joint itself). The techniques

used most frequently as described in the literature include intra-articular injection, peri-articular injection, and medial branch block. Peri-articular injection is the most common technique used in pain management. Intra-articular injection is also used in chronic pain management, and as stated previously, medial branch blocks are used frequently as a diagnostic tool and are considered more accurate than intra-articular facet joint injection for prognosis and outcome (Raso, 2010). Binder and Nampiaparampil (2009) point out that both medial branch and facet joint blocks using local anesthetic have been shown to be equally efficacious. Thus recent research would suggest a bias toward a more stringent standard of pain relief (80%) among controlled diagnostic local anesthetic blocks.

Diagnostic controlled local anesthetic blocks are performed by blocking either the medial branches or the facet joint itself using local anesthetics of varying duration. Both of these techniques have been shown to be equally efficacious (Binder & Nampiaparampil, 2009). Typically, the first injection consists of 0.5mL of 1% preservative free lidocaine, followed by 0.5 mL of 0.25% bupivacaine as Manchikanti et al. (2010) state "on a separate occasion, usually 3 to 4 weeks after the first injection, if the results of the lidocaine block were positive...A response was considered to be positive if there was 80% pain relief of at least 2 hours for lidocaine and 3 hours for bupivacaine and greater than the duration of relief with lidocaine, and the ability to perform multiple maneuvers which were painful prior to the diagnostic facet joint blocks" (p.126). The second injection is referred to as the confirmatory injection. Schwarzer et al. (1994) noted a false positive rate of 38% when a single block was used for the diagnosis of facet-mediated pain. Sehgal, Dunbar, Shah, and Colson (2007) found strong evidence for comparative local anesthetic blocks in the diagnosis of low back pain and concluded that "controlled comparative local anesthetic blocks of facet joints (medial branch or dorsal ramus) are

reproducible, reasonably accurate and safe. The sensitivity, specificity, false-positive rates, and predictive values of these diagnostic tests for neck and low back pain have been validated and reproduced in multiple studies" (p. 213).

Controversy does exist regarding the methodology of diagnostic controlled local anesthetic blocks. The controversy exists specifically in the level of pain relief provided by a diagnostic local anesthetic block. Binder and Nampiaparampil (2009) recapitulate by stating "although the value of a confirmatory block is recognized, the definition of a successful block is controversial" (p. 19). It has been suggested by several authors that a reduction of pain 50% or greater than baseline pain level should be classified as a positive block (Schwarzer et al., 1994). Binder and Nampiaparampil (2009) cite Gofeld et al., Revel et al., and Lord et al. as having suggested pain relief parameters of 70%, 75%, and 100%, respectively. Binder and Nampiaparampil (2009) summarize that there was no significant difference between success rates of subsequent radiofrequency lesioning in a 50-80% pain relief vs. a >80% pain relief group. Binder and Nampiaparampil (2009) also suggest that "the use of more strict criteria may be counterproductive and may lead to the withholding of a potentially therapeutic treatment from patients with treatable facet joint-mediated pain" (p. 19). In a recent study Manchikanti, Pampati, and Cash (2010) found:

> This (his) observational report of diagnostic evaluation with long-term follow-up utilizing 2 diagnostic criteria with controlled diagnostic blocks with ≥ 50% or ≥ 80% pain relief illustrated superiority of 80% pain relief with 89.5% of patients continuing to have a diagnosis of facet joint pain at 2 year follow-up; compared to 51% of the patients in those with the diagnosis of facet joint pain based on ≥ 50% pain relief, a significant difference. Thus, in the ≥ 80% pain relief group,

> the accuracy of diagnosis was ≥ 90% at one and 2 years with only 9 of 152 patients at one-year follow-up and 16 of 152 patients at 2-year follow-up either changed to a different diagnosis or failed to respond to therapeutic facet joint interventions. In contrast, in the group with ≥ 50% pain relief (some of whom are expected to have ≥ 80% relief), 27 patients at the end of one year and 54 patients at the end of 2 years (from a total of 110 patients) were judged to be negative for facet joint pain due to either a changed diagnosis or failure to respond to therapeutic facet joint interventions. (p. 138)

It should be of note that all procedures in the research were performed in sterile operating procedure rooms with intermittent fluoroscopic visualization. Manchikanti et al. (2010) specified the use of intravenous access and light sedation with midazolam offered to all patients.

Treatment and Outcomes

There are several forms of treatment described in the literature for lumbar facet joint pain. A thorough history and physical exam is always recommended and a multidisciplinary approach is recommended as it has been associated with improved outcomes (Binder & Nampiaparampil, 2009). Simple analgesics such as acetaminophen and nonsteroidal anti-inflammatory drugs constitute first line therapy, and acetaminophen has a more favorable side-effect profile since it has not been associated with cardiovascular or gastrointestinal side effects (Binder & Nampiaparampil, 2009). Skeletal muscle relaxants of the benzodiazepine and non-benzodiazepine variety may provide symptomatic improvement in acute low back pain; however, there is significant controversy regarding the use of controlled substances in chronic low back pain (Van Tulder, Touray, Furlan, Solway, & Bouter, 2003). Interestingly, the use of antidepressants, specifically tricyclic antidepressants has shown moderate symptom reductions in

patients with chronic low back pain (Binder & Nampiaparampil, 2009). Lumbar intra-articular injection, lumbar peri-articular injection, lumbar medial branch block, and lumbar facet radiofrequency denervation (ablation) will be discussed in this paper.

Intra-articular injection may be the preferred method of treatment in certain situations; however, Datta, Lee , Falco, Bryce, and Hayek (2009) provided level III (limited) evidence for lumbar intra-articular injection efficacy. Varlotta et al. (2010) describe this technique as a very controversial one. Previous studies have shown an inconsistent pattern of relief utilizing this treatment. Inflammation resulting in discomfort has been the basis for intra-articular injections (Manchikanti et al., 2010). Candidates for this procedure are patients who cannot undergo rhizotomy because of an indwelling cardiac pacemaker or defibrillator, patients who have already undergone rhizotomy with inadequate pain relief, and patients needing the rupture and drainage of a synovial cyst. Intra-articular injection involves patient placement in the prone position, the use of x-ray (C-arm), and confirmation of intra-articular needle placement by arthrogram via the use of 0.1-0.3 ml nonionic contrast. N. Senoglu, M. Senoglu, Safavi-Abbasi, Shedd, and Crawford (2010) describe that an ultrasound guided approach is also becoming a method of needle placement. Once intra-articular needle placement is confirmed, 0.5-1.0 mL of local anesthetic with or without steroid is injected. Patients are then typically held for observation 30 minutes prior to discharge (Raso, 2010).

When a lumbar peri-articular injection is used, the initial approach is identical to an intra-articular injection, however an arthrogram is not performed. While utilizing x-ray guidance, Raso (2010) describes: "the needle is advanced until bone is contacted at the level of the joint capsule. The injection is then performed after negative aspiration. A larger volume of injectate is used for this technique (2.0-2.5 mL). The needle may be repositioned multiple times during

injection to different points along the joint capsule, and the injectate may be deposited at multiple sites. It is important to keep in mind that, although one is using a larger volume, the maximum dose of steroid is not to exceed 80-120 mg" (p. 217).

Lumbar medial branch block may be implemented as a purely diagnostic technique to confirm facetogenic pain or it may be utilized as a treatment modality. It is usually performed as a pre-operative workup to medial branch neurotomy. A positive response to this diagnostic block is reassuring in that it provides an indication "that the patient may respond to rhizotomy with prolonged pain relief" (Raso, 2010). The medial branch runs over the base of the transverse process, where it joins with the superior articulating process. The primary target for this nerve lies caudad to the superior margin of the medial aspect of the transverse process (Dory, 1981).

This procedure also involves the use of a sterile procedure room, C-arm x-ray, aspiration and, according to Raso (2010), injection of 0.3-0.5 mL of 1% xylocaine. Confirmation of needle placement via oblique, anteroposterior and lateral fluoroscopy is recommended (Cohen et al, 2010). Before injection of 0.5 mL local anesthetic (lidocaine or bupivacaine), an injection of 0.5 mL radiopaque contrast should be administered under real-time fluoroscopy to ensure the absence of uptake by the surrounding vasculature (Cohen et al, 2010). Cohen et al (2010) further describe the recovery for these patients:

> In the recovery area, patients were instructed to engage in their normal activities, discount procedure related pain, and maintain a written pain diary every 30 min for the ensuing 8 h after discharge. In addition to 0-10 numerical rating scale pain scores, diaries were used to monitor postblock activities. To control for the presence of concomitant spinal pathology, ≥ 50% pain relief was predesignated to be a positive result. In blocks performed with bupivacaine, pain relief lasting ≥

> 3h was necessary for a block to be deemed positive. For blocks done with lidocaine, the threshold criterion was ≥ 1 h. (p. 397).

When lumbar facet joint nerve blocks are utilized as a treatment modality, recent studies suggest an injectate consisting of bupivacaine, steroid, and Sarapin, an analgesic with an unknown mechanism of action derived from the pitcher plant. Manchikanti et al. (2010) demonstrated a similar efficacy with and without steroids. These injections utilize the same fluoroscopic guidance and methods as the diagnostic blocks. Patients who demonstrate a pain reduction of >50% following controlled diagnostic nerve blocks are candidates for this procedure. Manchikanti et al. (2010) also demonstrated an average relief of 19 weeks per this procedure. Patients averaged 5-6 treatments, resulting in a total relief of 82-84 weeks (Manchikanti et al., 2010). The exact mechanism of relief is unknown. Thus the evidence demonstrates lumbar facet joint pain diagnosed by controlled, comparative local anesthetic blocks may be treated with lumbar facet joint nerve blocks with or without steroid (Manchikanti et al., 2010).

Lumbar radiofrequency denervation procedures described by Cohen et al. (2010) were performed within 4 weeks of the final diagnostic block, provided extenuating circumstances did not dictate otherwise. Subjects who experience a prolonged duration of relief from a diagnostic block were asked to wait until their pain returned to baseline. Analgesia lasting more than 3 months was classified as a positive outcome (Cohen et al., 2010). Cohen et al. (2010) continue, describing their radiofrequency procedure technique:

> With the C-arm intensifier positioned… to maximize the lesion size in an orientation parallel to the course of the target nerve, 20 gauge curved radiofrequency needles… were inserted in coaxial views until bone was contacted

> between the superomedial border of the transverse and superior articular processes, and the inferior portion of the lateral neck of the superior articular process. At each level, needles were adjusted to optimize sensory and motor stimulation. For each nerve lesion, correct placement was confirmed using electrostimulation at 50Hz, with concordant sensation achieved at ≤ 0.5V. Before denervation, multifidus stimulation and the absence of leg contractions was verified with electrostimulation at 2 Hz. After satisfactory electrode placement, 0.5 ml lidocaine, 2%, mixed with 5 mg depomethylprednisolone was injected through each cannulae in attempt to minimize procedure related pain and enhance lesion size and to prevent post procedure neuritis. The radiofrequency probe was then reinserted, and a 90-s, 80°C lesion was made using a radiofrequency generator (p.397).

Studies have shown that a successful radiofrequency denervation procedure often lasts for more than 8 months (Cohen et al., 2010). Successful radiofrequency denervation procedures may be reproduced with an equal likelihood of success after the beneficial effects wear off (Cohen et al., 2010).

Methods

This scholarly project was written utilizing a comprehensive literature review on the topic of lumbar facet pain. Utilizing the Harley French Library at the University of North Dakota, searches were made into Ovid, PubMed, and Google Scholar in order to accumulate current research papers for review and ultimately inclusion into this paper. Search terms used included pain, lumbar facet, zygapophysial joint, chronic pain, facet joint injections, CRNA, lumbar pain,

pain management, research, and nurse. Articles were read online, printed for further review, and organized into topics in order to present current research and practice.

Discussion

Interpretation

Lumbar facet mediated back pain is a widespread problem, and doesn't discriminate based on one's location. Certified Registered Nurse Anesthetists, while able to perform these interventions, are not being fully utilized in many areas of the county, including South Eastern North Dakota and North Eastern South Dakota, to provide these services. The literature has shown that these interventions do treat chronic lumbar facet mediated back pain for extended periods of time and are repeatable. Patients who have received this type of treatment successfully often experience a life changing event when their pain is relieved. The interventions discussed within this paper could be and are valuable skills for a CRNA working in a rural anesthesia practice. This scholarly project has been an invaluable tool and experience for the writer, both to learn about current research and treatments for this type of pain, but also to meet CRNAs who are performing these interventions.

This scholarly project has shown that best practice for lumbar facet mediated back pain involves cooperating medical practitioners who are willing to obtain the skills necessary to perform invasive interventions. It has detailed what type of facility needs to be available to perform these interventions. In the case of this author, it has been stated from rural hospital administrators and practitioners that a large gap exists in patient care in the realm of pain management. Often times these patients need to travel 2.5 hours or more in order to get treatment, taking their business out of the community. This inconveniences the patient and is a

and from the rural clinical sites at which student nurse anesthetists are able to obtain clinical learning opportunities. Rural hospitals are interested in offering pain management services but are largely unaware of the scope of pain management practice. Rural hospitals that were contacted for this project currently limit their pain management practices to epidural steroid injections if any pain management is performed at all. Rural administrators are interested in recruiting a pain management practitioner and rural nurse anesthetists are, for the most part, interested in increasing their scope of practice. A primary benefit obtained following this project is that it facilitated discussion with rural hospital administrators and ultimately may provide future opportunity for employment in pain management in a rural setting.

References

Benner, P. (1982). From novice to expert. *American Journal of Nursing*. 82(3):402-407.

Binder, D. S., Nampiaparampil, D. E., (2009) The provocative lumbar facet joint. *Current Review in Musculoskeletal Medicine*. (2):15-24. doi:10.1007/s12178-008-9039-y

Boswell, M. V., Rinoo, V. S., Everett, C. R., Sehgal, N., Mckenzie-Brown, A., Abdi, S., … Manchikanti, L. (2005). Interventional techniques in the management of chronic spinal pain: evidence-based practice guidelines. *Pain Physician*. (8):1-47.

Boswell, M.V., Trescot, A. M., Datta, S., Schultz, D. M., Hansen, H. C., Abdi, S., …Manchikanti, L. (2007) Interventional techniques: evidence-based practice guidelines in the management of chronic spinal pain. *Pain Physician*. (10):7-111.

Clarke, C., Moore, J., Wedlake, C., Lee, D., Ganapathy, S., Salbalbal, M., ... Bainbridge, D. (2010). Virtual reality imaging with real time ultrasound guidance for facet joint injection: a proof of concept. *Anesthesia Analgesia*. (110)5:1461-1463.

Cohen S.P, Raja S.N. (2007). Pathogenesis, diagnosis, and treatment of lumbar zygapophysial (facet) joint pain. *Anesthesiology*. 106:591–614.

Cohen, S.P., Williams, K.A., Kurihara, C., Nguyen, C., Shields, C., Kim, P. & Strassels, S.A. (2010). Multicenter, randomized, comparative cost-effectiveness study comparing 0, 1, and 2 diagnostic medial branch (facet joint nerve) block treatment paradigms before lumbar facet radiofrequency denervation. *Anesthesiology*. (113)2:395-405.

Datta, S., Lee, M., Falco F. J. E., Bryce, D. A., Hayek, S. M. (2009). Systematic assessment of diagnostic accuracy and therapeutic utility of lumbar facet joint interventions. *Pain Physician*. 12:437-60.

Dory, M. A. (1981). Arthrography of the lumbar facet joints. *Radiology*. 140:23–27.

Dreyfuss, P. H., Dreyer, S. J., Herring, S. A. (1995). Contemporary concepts in spine care: lumbar zygapophysial (facet) joint injections. *Spine*, 20:2040–2047.

Eubanks, J. D., Lee, M. J., Cassinelli, E., Ahn, N. U. (2007). Prevalence of lumbar facet arthrosis and its relationship to age, sex, and race: an anatomic study of cadaveric specimens. *Spine*. 32(19):2058–62.

Loizides, A., Peer, S., Plaikner, M., Spiss, V., Galiano, K., Obernauer, J., Gruber, H. (2011). Ultrasound guided injections in the lumbar spine. *Medical Ultrasonography.* (13):54-58.

Manchikanti, L., Singh, V. Falco, F. J. E., Cash, K. A., Pampati, V. (2010). Evaluation of lumbar facet joint nerve blocks in managing chronic low back pain: a randomized, double-blind, controlled trial with a 2-year follow up. *International Journal of Medical Sciences*. 7(3):124-135

Manchikanti, L., Pampati, S., Cash, K. (2010). Making sense of the accuracy of diagnostic lumbar facet joint nerve blocks: an assessment of the implications of 50% relief, 80% relief, single block or controlled diagnostic blocks. *Pain Physician,* 13:133-143.

Manchikanti, L. (1999). Facet joint pain and the role of neural blockade in its management. *Current Review of Pain*. 3: 348-358

Merskey, H., Bogduk, N. (1994). Part III: Pain Terms, A Current List With Definitions and Notes on Usage. *Classification of Chronic Pain: Second Edition.* 2:206-209.

Pampati, S., Cash, K., Manchikanti, L. (2009). Accuracy of diagnostic lumbar facet joint nerve blocks: a 2 year follow-up of 152 patients diagnosed with controlled diagnostic blocks. *Pain Physician.* 12:855-866.

Raso, L. J. (2010). Facet joint injections and sacroiliac joint injections. *Image-Guided Spine Interventions*. 10:207-228

Schwarzer A. C., April C. N., Derby R., Fortin, J., Kine, G., Bogduk, N. (1994). The false-positive rate of uncontrolled diagnostic blocks of the lumbar zygapophysial joints. *Pain*. 58:195–200.

Sehgal, N., Dunbar, E. E., Shah, R. V., Colson, J. (2007) Systematic review of diagnostic utility of facet (zygopophysial) joint injections in chronic spinal pain: an update. *Pain Physician.* 10:213-228.

Senoglu, N., Senoglu, M., Safavi-Abbasi, S., Shedd, S., Crawford, N. (2010). Morphologic evaluation of cervical and lumbar facet joints: intra-articular facet block considerations. *Pain Practice*. 10:4:272-278.

Sibell, D. (2007). Facet joint procedures for chronic back pain. *Encyclopedia of Pain*. Springer-Verlag Berlin Heidelberg. doi:10.1007/978-3-540-29805-2_1450

Van Tulder M. W., Touray T., Furlan A. D., Solway S., Bouter L. M., Cochrane Back Review Group. (2003). Muscle relaxants for nonspecific low back pain: a systematic review within the framework of the cochrane collaboration. *Spine*. 28(17):1978–92.

Varlotta, G. P., Lefkowitz, T. R., Schweitzer, M., Errico, T. J., Spivak, J., Bendo, J. A., Rybak, L. (June 2010). The lumbar facet joint: a review of current knowledge: Part II: diagnosis and management. *Skeletal Radiology*. Published online. doi:10.1007/s00256-010-0984-3