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Peripheral Nerve Blocks in Hip Arthroscopy

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Abstract

Hip arthroscopy is a rapidly growing field due to its significant diagnostic and therapeutic value in the management of numerous hip disorders. Adequate control of post-operative pain in patients undergoing hip arthroscopy continues to be a challenging and evolving area in orthopedics. In the absence of standardized protocols for pain management in these patients, a variety of different approaches have been utilized in an effort to find a regimen that is effective at reducing postoperative pain, narcotic consumption, and cost to the patient and healthcare system. We present a comprehensive review of the current literature regarding the utilization of peripheral nerve blocks for pain management in patients undergoing hip arthroscopy.

Keywords: Hip arthroscopy • Pain management • Peripheral Nerve Blocks

Introduction

Hip arthroscopy is gaining relevance and popularity due to its diagnostic capability and minimally invasive therapeutic benefit in the management of numerous hip disorders. Hip conditions treated with hip arthroscopy following the failure of conservative management include snapping hip, chondral lesions, synovial disorders, loose body removal, septic arthritis, tears of the gluteus tendon, labral tear and Femoroacetabular Impingement (FAI). Due to recent advances and the increase in popularity of hip arthroscopy, perioperative pain management has become a relevant area of research.

As the landscape of hospital and physician reimbursement continues to change, pain control is becoming increasingly more important. Mistry and colleagues determined that post-operative pain contributes significantly to patient satisfaction with the orthopedic surgeon and facility [1]. Therefore, adequate control of pain is imperative to achieve high patient satisfaction scores and hospital/physician reimbursement [2,3].

Due to the relative infancy of hip arthroscopy, there is a paucity of studies exploring techniques for perioperative management of pain in patients undergoing this procedure. As a result, there is an absence of standardized protocols for perioperative pain management of these patients. Historically, narcotics have been employed when post-operative pain is uncontrolled. Thus, ineffective pain management techniques can result in increased postoperative opioid consumption [1]. The use of peripheral nerve blocks could reduce postoperative pain resulting in decreased narcotic consumption, earlier discharge and ambulation, decreased readmission for pain control, increase patient satisfaction and reduce costs associated with hip arthroscopy [4]. Therefore, the purpose of this article is to provide a comprehensive review of the current literature regarding peripheral nerve block techniques in the management of post-operative pain in patients undergoing hip arthroscopy.

Femoral Nerve Block (FNB)

It is believed that the femoral nerve is a significant contributor to post-operative pain following hip arthroscopy due to the contribution of femoral nerve articular branches to the hip joint [5]. Effective blockade of these articular branches results in significant anesthesia to the anterior hip capsule. The Femoral Nerve Block (FNB) is performed by accurately locating the femoral nerve immediately lateral to the femoral artery and superficial to the iliopsoas and injecting anesthetic peripherally around the nerve. A common complication of FNB is post-operative falls that could be the result of quadriceps tendon inhibition [6].

In a blinded controlled trial on 50 patients undergoing hip arthroscopy by Xing et al. [6] patients received either a preoperative ultrasound-guided FNB with 20 mL 0.5% bupivacaine (n=27) or normal saline (n=23). All patients received a pre-operative analgesic regimen of 1,000 mg acetaminophen and 400 mg celecoxib 1 hour prior to surgery, and a 3-week course of post-operative medications consisting of celecoxib and oxycodone. While not statistically significant, patients in the FNB group required less opioid intra-operatively than the control group (78.2 vs 94.5 mg). Post-operative pain measured using VAS score was significantly lower in the FNB group compared to the control group at 30 minutes, 1 hour, 2 hours, 4 hours, and 6 hours ($p<0.05$). At 48 hours post-op, morphine-equivalent consumption was significantly lower in the FNB group compared to control (10.9 vs 26.6). Average opioid use between FNB group and control at 24 hours (47.6 vs 59.2), and 7 days (2.9 vs 9.1) following surgery was also lower in the FNB group compared to control, but these findings were not statistically significant. Time spent in recovery in PACU and SDCU was similar between both groups, and patient satisfaction with post-operative pain control was also similar [6].

Importantly, in the first 24 hours post-op, there was a higher risk of falls in patients receiving FNB. Within the first 24 hours of surgery, six of 27 patients (22.2%) in the FNB group fell while no patients (0%) in the control group reported a fall. Patients who fell following the FNB reported weakness and numbness in the operative leg as the primary reason for their fall. Based on

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the results of their trial, Xing et al. concluded that due to the significant increase in postoperative falls and increased risk of further injury; they could not recommend FNB as a perioperative pain management technique in outpatient hip arthroscopy patients [6].

Dold et al. performed a retrospective chart review and analysis of 96 consecutive patients who received either a pre-operative FNB with general anesthesia (n=54) or general anesthesia alone (n=40) [5]. There were no significant differences between the two groups regarding sex, age, BMI, ASA classification, and type of procedure performed. Total intraoperative morphine-equivalent doses were significantly different between the two groups. The femoral nerve block group required significantly lower doses than the general anesthesia only group (2.72 compared to 8.05, $p<0.0001$). Patients in the FNB group reported lower mean pain scores compared to the control cohort at 0, 15 and 45 minutes post-op, however, the findings were not statistically significant. At 60 minutes following surgery, patients in the general anesthesia only group had a significantly higher mean pain score than those in the FNB group (3.68 vs 2.48; $p=0.02$). As a result, patients in the general anesthesia only group required significantly higher mean morphine-equivalent doses than the FNB group in PACU (4.0 vs 2.04 mg, $p=0.025$). Despite the lower pain scores and lower narcotic requirements in the PACU by the FNB group, the FNB group spent more time in PACU than the control group (85.9 vs 81.5 minutes). In the Surgical Day Care Unit (SDCU) there was no significant difference in oxycodone consumption between the groups (8.21 in FNB vs 9.88 in control, $p=0.14$). However, patients in the FNB group were in considerably less pain in SDCU than the control group (3.95 vs 4.95, $p=0.18$). Importantly, two patients in the control group had to be admitted overnight due to inadequate pain control, while no patients from the FNB group were admitted due to complications or pain control.

Ward et al. investigated the use of a post-operative FNB versus routine IV narcotics for post-operative pain control in 40 patients following hip arthroscopy with pain scores of 7 or greater [7]. The FNB was performed using 25 mL of 0.25% bupivacaine with 1:200,000 epinephrine. Patient satisfaction pain control scores were significantly higher in the FNB group compared to those that received IV morphine (90% vs 25%, $p<0.0001$). In addition, time to discharge from PACU was significantly longer in patients who received narcotics compared to those that received FNB (177 vs 216 minutes, $p<0.0001$). This study supports the femoral nerve block as a valuable alternative to narcotics in the postoperative period due to decreased discharge time from PACU, increased pain relief, and higher patient satisfaction.

Fascia Iliaca Block (FIB)

Fascia iliac block has proven to be successful at relieving pain and decreasing opioid consumption following total hip arthroplasty and operative fixation of femur fractures; however, its utility in hip arthroscopy has not been well studied [8-10]. Fascia iliaca block provides comprehensive anesthesia of sensory nerves around the hip joint, without compromising the patient's postoperative motor function. This makes Fascia iliaca block an appealing technique for perioperative pain management [11].

Fascia iliaca blockade works to anesthetize the major nerves emerging from the lumbar plexus including the femoral, lateral cutaneous femoral, and obturator nerves. All of which innervate the region of primary portal placement and anterolateral capsule, which is damaged during hip arthroscopy [12,13]. Therefore, the intent of a fascia iliaca blockade is to provide effective analgesia during these procedures by anesthetizing nerves affected by the surgical portal and capsulotomy [14].

Recently, a retrospective cohort study conducted by Purcell et al. sought to determine the efficacy of Fascia iliaca block with a new formulation of liposomal bupivacaine that is contained within liposomal carrier molecules [15]. This new formulation of liposomal bupivacaine has been advertised to extend post-operative analgesia. Their study compared the benefits of liposomal bupivacaine and standard bupivacaine in perioperative pain management following hip arthroscopy. Thirty-four patients received liposomal bupivacaine plus plain bupivacaine, and another 34 patients received plain bupivacaine only. Interestingly, patients in the liposomal bupivacaine group had higher pain scores than the control bupivacaine group at 1, 2 and 3 days postoperatively. There was no statistically significant difference in overall PACU pain scores (3.68 vs 3.85), maximum PACU pain scores (5.59 vs 5.47) and mean pain scores in PACU at discharge (2.41 vs 2.88) in liposomal bupivacaine and control bupivacaine groups, respectively. Therefore, evidence for the use of liposomal bupivacaine in peripheral nerve blocks to control postoperative pain in hip arthroscopy is lacking and may not be worth the extra cost compared to plain bupivacaine.

Krych et al. conducted a prospective study examining the use of pre-operative Fascia iliaca block with a multimodal analgesic regimen on pain management in hip arthroscopy patients [14]. They found a mean pain score of 3.5 in PACU, with the highest pain score reaching 3.9 one day after surgery. The average number of opioid tablets taken decreased from 1.5 on day one of surgery to 0.9 five days post-operatively. Overall, 20 patients (67%) were very satisfied and 10 (33%) were satisfied. They report no complications or side effects from the Fascia iliaca block. This study demonstrated that Fascia iliaca block with multimodal analgesia was a safe, effective perioperative pain management technique that resulted in low opioid consumption, low pain scores, and high patient satisfaction following hip arthroscopy.

Lumbar Plexus Block (LPB)

Branches of the lumbar plexus, such as the obturator, femoral and lateral femoral cutaneous nerves provide extensive innervation to the hip joint [12]. Innervation to the area of portal placement is provided by the lateral femoral cutaneous nerve while the anterolateral capsule is innervated by the femoral and obturator nerves [12,13]. Complete blockade of main nerve innervation to the hip joint is achieved by Lumbar Plexus Block (LPB) through the injection of anesthetic directly onto these nerves at their origin in the lumbar plexus. This negates the need for multiple peripheral nerve blocks, which results in a decrease in complications and OR time associated with performing multiple individual blocks [16,17]. A potential complication of LPB is epidural spread, which can result in urinary retention post-operative falls [18].

Yadeau et al. conducted a prospective, blinded randomized controlled trial that included 82 patients who received either the LPB or control block prior to hip arthroscopy [18]. Thirty milliliters of 0.25% bupivacaine with 1:200,000 epinephrine was injected pre-operatively in the LPB group, while both groups received pre-operative spinal-epidural anesthesia, 15-30 mg ketorolac intraoperatively and 5/500 mg oral hydrocodone/acetaminophen in PACU. Patients reported pain on a numeric rating scale 0-10 to assess pain at rest and with movement. The LPB group had significantly lower pain compared to the control group at rest. However, there were no statistically significant differences between analgesic use, pain with movement, or patient satisfaction. The investigators reported 2 post-op falls and 1 hospital readmission due to urinary retention in the LPB group [18].

In a retrospective matched cohort study performed by Schroeder et al., the efficacy of LPB was compared to no regional anesthesia in patients who underwent hip arthroscopy [19]. One hundred and eighteen patients who had a pre-operative LPB with 20 ml-30 ml of 0.5% ropivacaine and 3 mcg/mL of epinephrine were compared with 118 patients who did not receive any regional anesthesia. They found a statistically significant difference in postoperative pain levels using the Visual Analog Scale (VAS) in the Postoperative Care Unit (PACU) of 5.0 in the LBP group versus 5.3 in the control group; however, the clinical difference was not clearly stated. Compared to the control group, patients who received the LBP also required fewer anti-emetics, ketorolac, and postoperative narcotics. Although the less post-operative medication was required by the LBP group, their total post-

operative hospital time prior to discharge was longer compared to the control group (240 minutes vs 217 minutes). Finally, postoperative pain at 1 day following surgery was similar between both groups with no significant differences noted [19,20].

Conclusion

A variety of techniques have been utilized in an attempt to find what is most effective at reducing postoperative narcotic consumption, health care cost and pain associated with hip arthroscopy. Due to the current paucity of high-quality studies, inconclusive evidence and numerous different pain management techniques in the literature, determining which technique is most efficacious and cost-efficient is difficult. While the literature reviewed in the current study indicates great potential for the use of nerve blocks, they also come with significant limitations. All nerve blocks include the potential for iatrogenic nerve injury, the need for specialized equipment, highly trained anesthesiologists, and costs associated with the block. Additionally, certain blocks, such as the femoral block, have demonstrated an increased risk of a patient falls postoperatively.

Future studies are warranted to evaluate the efficacy of peripheral nerve blocks versus other methods of pain management, including intra-articular or peri-articular injections. In addition, future studies should explore which peripheral nerve block would benefit patients most based on demographics and patient-specific variables. Finally, the cost-effectiveness of peripheral nerve blocks should also be studied, as an effort to drive down health care costs is currently underway.

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