

The Role of Fascia Iliaca Compartment Block in Total Hip Arthroplasty

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CC-BY 4.0**Keywords** Pain management; General
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Abstract

Pain management in patients who have undergone hip surgery is a difficult and challenging aspect of post-operative care. The Fascia Iliaca Compartment Block (FICB), placed either prior to, or after hip surgery, as a means to control post-operative pain, has been well defined in the evidence to be a very successful approach in controlling post-operative pain. The use of this block reduces opioid requirements and incidents of delirium in elderly patients. The evidence compares FICB to alternative approaches such as neuraxial anesthesia and General Anesthesia (GA). Among the benefits for the anesthetist performing the FICB is the relative technical ease of placing the block, and cost the established efficacy. A review of the current evidence regarding the use of FICB demonstrates that the FICB is highly effective in controlling post-operative pain following hip surgeries.

Introduction

Total Hip Arthroplasty (THA) is a frequently performed invasive surgery that is used to relieve the pain and physical limitations caused by injuries or degenerative diseases such as osteoarthritis [1]. "The number of total hip replacements in patients over 45 years old increased from 138,700 to 310,800, that is, from 142.2 to 257 per 100,000 population" [2] from 2000 to 2010. Advances in surgical techniques have increased the frequency of these procedures [3]. Due to the nature of the surgery, rehabilitation time and postoperative pain control are critical factors that play a role in the decision to undergo this procedure.

The most frequent initial response of adult patients' to hip pain is to take a non-invasive approach that involves the use of exercise, weight loss, medications, and steroid injections [2]. If these treatment modalities fail to relieve the joint discomfort, the patient may elect to proceed with a THA at the recommendations of an orthopedic surgeon [3]. Having a THA is an option for patients who want to regain the ability to partake in the daily activities that degenerative progression has rendered nearly or completely impossible.

Background and Significance

Recent research has demonstrated that using the Fascia Iliaca Compartment Block (FICB) is significantly effective in decreasing postoperative pain in patients undergoing THA [4,5]. The FICB is an alternative to a femoral nerve block or a lumbar plexus block, and requires less technology to perform [4]. Some facilities have adopted neuraxial analgesia as the standard for THA surgeries. The use of lumbar epidural analgesia as a neuraxial avenue is considered effective to decrease the need for opioid use and improve pain control. However, spinal anesthesia is also associated with hypotension and urinary retention as side effects, as well as motor impairment [6]. Current clinical practice and guidelines for the preoperative THA include the use of low molecular weight heparins. The addition of this preventative therapy for DVT often eliminates the ability for the anesthesia provider to avoid exposing the patient to the risk of an epidural hematoma formation [3]. The FICB offers equal analgesia and earlier ambulation without the associated side effects of neuraxial analgesia [7].

Johnson et al. performed a systematic review comparing neuraxial anesthesia to general anesthesia. The authors were unable to state for certain that neuraxial anesthesia is superior to general anesthesia and leads to better perioperative outcomes [8]. In contrast, other studies have gathered evidence to support improved perioperative outcomes, such as lower incidence of mortality and respiratory complications, when using regional anesthesia compared to general anesthesia [9].

The older adult population has a higher postoperative morbidity and mortality rate than do patients that are younger. The functional capacity of their organs reduces with age, resulting in a lowered reserve and decreased ability to tolerate stress [10]. Evidence demonstrates that the total opioid requirements needed are decreased and anesthetic requirements are diminished when utilizing the FICB for THA surgeries, perioperatively. Blocking pain signals from neurosensory pain pathways helps decrease stimulatory changes that occur during surgery [10]. Reducing the frequency of dramatic hemodynamic changes that occur in the operating room directly lowers the risk of morbidity and mortality [10].

The analgesic effect gained from a THA is up to 95% at full recovery, assisting patients in gaining increased function and mobility while decreasing chronic joint inflammation [3]. Patients are most likely to have problems in the immediate postoperative period and as they follow through with rehabilitation. In order to function to the best of its ability, the new joint must receive adequate physical therapy. This process is long and requires determination on the part of the patient, but the benefits reaped will last for many years [2].

THA hospitalizations are costly. In addition, intraoperative complications may lead to postoperative complications, DVTs, and delayed ambulation, which can prolong the hospital stay [1]. Use of FICB allows the anesthetist to better administer medications that decrease in pain stimulation without engendering excessive hemodynamic changes, resulting in less postoperative complications [11].

Opioids have historically been the primary means of analgesia management both intraoperatively and postoperatively. However, opioids have unwanted side effects that can be costly to payers and detrimental to the patient. There is a potential need for revision surgery associated with adverse side effects [12]. Kuchalik et al. showed that patients receiving FICB for a THA had a decreased need for additional opioids, thereby significantly lowering the risk of opioid overdose and possible respiratory depression [13-16]. In a randomized, double blind study, researchers demonstrated that when comparing intrathecal anesthetics to peripheral nerve blocks for analgesia, in the THA patient, the latter was preferred due to the significantly lower incidence of side effects [17].

In 2015 the British Journal of Anesthesia compiled various researches that were done to determine the use of regional anesthesia and improved outcomes. The researchers found that the use of regional anesthesia is trending upward, while neuraxial anesthesia is declining [17]. With significant differences in outcome and prognosis based on the type of anesthesia, more research is needed to determine if best practice needs to be standardized. Research also needs to be conducted to determine if the choice of regional rather than neuraxial anesthesia may be based on sociological, rather than medical, factors [17].

Review of Evidence

A growing body of literature reflects the successful applications of regional anesthesia in a variety of techniques and surgical procedures. In many studies, patient satisfaction levels are higher than those observed for general anesthesia, regional anesthesia being regarded particularly useful in elderly patients, who are especially vulnerable to falls and hip fracture. Technological advancements in ultrasonography and ambulatory surgery have expanded the applicability and efficacy of regional anesthesia techniques.

Fascia Iliaca Block vs. Femoral Nerve Block

The Fascia Iliaca Block (FIB) was studied in the administration of analgesia and reduction of pain prior to performance of subarachnoid block (SAB) in patients with proximal femoral fracture. Study parameters included duration of the SAB performance and patient acceptance and positioning quality, while pain levels were determined with analog scale values prior to block, as well as during the SAB position [18]. Patients were moved into a seated position in the operating room after the blocks were administered. SAB performance

proved shorter in FIB, while the quality of patient positioning was comparable to Femoral Nerve Block (FNB). Patient acceptance was higher with FIB, leading to the conclusion that FIB is superior in the administration of analgesia than femoral nerve block for SAB in the treatment of femoral fracture patients. The authors noted that this conclusion was not surprising because femoral nerve block does not affect sciatic and superior gluteal nerves [18].

The analgesic potency and opioid avoidance capacity of FIB and FNB were studied in a controlled trial. This randomized methodology compared the two blocks in more than 100 patients about to undergo surgery for fractured neck of femur [19]. In this study, pain reduction proved greater with FNB, regardless of factors such as age-range and gender [19]. Patients who were given a FNB required less morphine than the FIB group [19]. This is a significant finding given that this type of surgery is often performed on the elderly, in whom opioids can lead to increased morbidity. In spite of the study's results, the study's authors noted that FIB offers advantages, such as lower cost and less time to perform; it is also worth noting that it is "quicker to teach" and "easier to learn" [19].

Regional vs. General Anesthesia

Hip fractures are a persistent health problem, particularly post-op, with morbidity, disability and mortality representing a threat to patient recovery. About five percent of the patients die during their stay in the hospital [9]. A 2007-2008 study conducted in 126 New York hospitals tested the application of regional versus general anesthesia in patients with primary outcomes of mortality, and those with secondary results including pulmonary and cardiovascular complications [9]. In tests of more than 18,000 patients undergoing surgery for hip fracture, results showed that patients who were given regional anesthesia had a mortality rate of just over two percent; regional anesthesia also produced fewer pulmonary-related complications. Thus, it was concluded that regional anesthesia in hip fracture patients is associated with a significantly lower rate of mortality and fewer complications than general anesthesia [9].

Post op complication includes mentation alterations. Rade et al. found similar results in their study, in that the occurrence of delirium in the elderly was significantly lower following a THA with the use of regional anesthesia. The study focused on an adult population over 70 years, having a THA, divided into two groups. Both groups received neuraxial anesthesia and postoperative patient-controlled analgesia, as well as oral opioids. The group that received general anesthesia was noted to have several episodes of delirium following their anesthetic, as opposed to the regional group, which were noted to have very few.

Ultrasound Techniques

Regional anesthesia is used with post-op patients in a wide range of surgical procedures with new technologies, such as ultrasound, opening new possibilities for anesthetists. A narrative study of relevant literature from March 2009 to March 2011, involving more than 4,800 patients, focused on regional anesthesia techniques used to manage pain in the knees, abdominal and shoulder surgery. The study led to the conclusion that the regional application of analgesia in surgical patients produces positive results with relatively fewer complications [20]. Furthermore, the literature that the authors examined underscores the utility of ultrasound technology in regional procedures, as well as catheterization in the administration of pain block [20].

In recent years, technological advances in ultrasound-guided anesthesia have benefited the U.S. military, having proven successful in the battlefield surgery environment and in aiding the recovery of soldiers post deployment [12]. The first continuous peripheral nerve block performed on a soldier took place in Iraq in October 2003 [12]. Since that time, anesthesiologists, surgeons, along with various other healthcare providers, have employed ultrasonography in a wide range of surgical applications for treating combat injuries [12]. In 2006, Col. Randall J. Malchow was granted permission to use ultrasound techniques in the administration of regional anesthesia at a combat hospital in Mosul, Iraq. An anesthesiologist used ultrasound-guided regional anesthesia on 44 patients, strategically repositioning the needle periodically after the initial injection to maximize effectiveness. This yielded an overall success rate of 95 percent and 100 percent patient satisfaction, with no evident complications, [12] leading to the conclusion that there is a decided benefit to using ultrasonography in combat surgery.

Total Opioid Reduction

The use of regional techniques in the administration of perioperative multimodal anesthesia has shown promise in the treatment of the elderly, whose age-related vulnerabilities heighten the onset of a range of postoperative complications [21]. Opioids have traditionally been used with older patients; however, they often produce negative effects and are not always a reliable means of controlling pain. The perioperative use of regional anesthesia has been shown to inhibit postoperative complications and is effective in controlling pain [21]. A meta-analysis of randomly controlled trials showed that a mortality rate in elderly patients was reduced by one-third when they were administered regional anesthesia. Patients who received an epidural for pain control showed a reduced rate of myocardial infarction, a common complication among elderly surgical patients [21]. Nordquist and Halaszynski concluded that perioperative regional anesthesia could be the most efficacious means of controlling perioperative pain in elderly patients [21].

Cost Efficiency

The effective and cost-efficient management of acute pain holds great promise in a rapidly aging society that spends heavily on healthcare. Patients, particularly among the elderly, look carefully at pain management strategies in selecting health care providers [22]. In recent years, a consortium of healthcare-focused consumer awareness organizations has monitored patient satisfaction levels across a spectrum of expectations, including staff responsiveness, communication with doctors and other factors [22]. Consequently, there is a market-driven, performance-based need for well-conceived and technologically advanced approaches to regional anesthesia and pain control strategies, which utilize all available therapeutic, pharmacological and technological resources. Incorporating regional anesthesia techniques into perioperative care, for example, has ramifications for cost control, patient satisfaction and healthcare outcomes [22].

Patient Satisfaction

According to the findings of a 1995 study, a variety of factors affect the performance of regional anesthesia, among them, being the ability to talk with family members immediately following procedures, and lack of pain in the immediate postoperative period

[23]. The study followed 154 patients, ranging in age from 13 to 96 years, who received different regional anesthesia techniques with orthopedic and trauma surgery [23]. A questionnaire was handed out the day after surgery, in which impressions of regional anesthesia proved positive or indifferent, with just over six percent indicating dissatisfaction with regional pain control [23]. It was concluded that the patients' experience with regional anesthesia convinced them to ask for this method of anesthesia for future surgeries.

Postoperative Benefits

By nature, a peripheral nerve block inhibits signals from stimuli reaching the brain. Depending on the nature of the block and the medications used, proprioception may be blunted as well. Thus, patient falls has been made a concern. A study published in 2014 found no relationship between peripheral nerve blocks and inpatient falls; although a number of inpatient fall risk factors were identified [24]. Total knee arthroplasty patients were gleaned from a national database, the primary outcome being inpatient falls. The rate of falls was less than two percent; the average age of those who fell was nearly 69 years. The patients that had fallen had a higher rate of comorbidity and greater complications [24].

A regimen that includes regional anesthesia as part of a multimodal pain management is conducive to the objectives of ambulatory surgery, which include post-op pain control, few complications and rapid patient discharge times [25]. Regional anesthesia has proven effective as an aid in reducing side effects like nausea, and minimizing the need for postoperative monitoring. These are encouraging outcomes, given the prevalence of ambulatory surgery in the United States, accounting for as much as 70 percent of all surgeries performed [25]. Despite the benefits of ambulatory surgery, converting from a general anesthesia to a predominantly regional anesthesia environment would present situation/practice-specific challenges, based on the number of procedures, investment and other factors.

Length of Stay and Mortality Risk

In an attempt to decrease time to surgery, and essentially, decrease length of stay, consideration of the type of surgery to be performed should be made. Kopp and Horlocker note that regional anesthesia techniques are particularly efficacious in the arm and hand, shoulder and lower extremity surgeries, and may reduce the induction time of peripheral nerve blockers through the establishment of a dedicated regional anesthesia block room [26].

Length of stay is an important element in healthcare, one that holds significance for factors such as cost, patient satisfaction and operational efficiency. A seven year study of more than 56,000 hip fracture patients revealed that the administration of regional anesthesia resulted in a 0.6 day shorter length of stay than in patients who were given general anesthesia [27]. Patient discharge data came from acute care hospitals between January 2004 and December 2011. Subject criteria included age – patients were at least 50 years of age, and procedure, which was hip fracture surgery. The primary outcome was mortality after 30 days. It was determined that the use of regional anesthesia in hip fracture patients did not produce a lower than 30 day mortality rate, but did show a somewhat shorter length of stay [26]. It was therefore concluded that regional anesthesia did not produce a mortality benefit.

These findings were further supported with similar results that were found by Lenart et al. [27] in a retrospective study, the authors reviewed the records of four hundred and ninety-four patients who had undergone orthopedic surgeries, performed with postoperative pain management with the use of peripheral nerve blocks, and without. This was to determine what pain modalities could have on the time spent in the hospital [27]. They concluded that those patients that received peripheral nerve blocks, had a decreased length of stay, compared to those that did not, in turn resulting to an earlier discharge [27].

Recommendations for Practice

The time to use the FICB is in isolated hip and femur fractures primarily in the elderly population, and those that require a THA. Pain in this population can be difficult to manage, due to preexisting co-morbidities or dementia.

For smaller patients (~50 kg), 20-30 ml of Ropivacain 0.5% and 10 ml of NS is recommended. For patients 80-100 kg or above, 30-40 ml of Ropivacain 0.5% is appropriate. As per ASA guidelines, the maximum dose of Ropivacain should not exceed 2 mg/kg. Bupivacaine is another local anesthetic option. However, its use may result in a denser motor blockade.

Consent by the patient before performing any block is required. Prior to placing the block, it is advisable to administer analgesic drugs such as Tylenol/NSAIDs or opioids. It is also important to obtain a baseline assessment of distal pulses, as well as motor and sensory function. Reassessment should be done within fifteen minutes after injection of the local anesthetic. Baseline assessment is imperative to assure there are no adverse effects.

The risks involved with the administration of any regional anesthetic are LAST (local anesthetic systemic toxicity). Symptoms include seizures and hypotension, and in later stages, cardiac and respiratory arrest. According to ASRA guidelines, the treatment for LAST is a 20% lipid emulsion bolus of 1.5 ml/kg, followed by an infusion of 0.25 ml/kg/min [28]. It is also important that when placing the needle cephalad, caution is taken to avoid placing the needle too deep into the abdominal cavity. The main benefit to placing the FICB is postoperative analgesia. Its quick onset time of 15 minutes and a duration lasting 8 hours provides sufficient analgesia.

The FICB covers the obturator, femoral and lateral femoral cutaneous nerves, which lie under the fascia iliaca. It is a volume dependent block, so the greater the spread of local anesthetic under this layer, the greater its ability to reach these nerves. Ultrasound technology is preferred as it provides visualization of the internal landmarks and spread of local anesthetic [29]. The FICB is used primarily for postop pain control, as opposed to the FNB which is useful for surgical anesthesia. An advantage of using the FICB is that it is less likely to create a motor block sparing the femoral artery and nerve. This also reduces the potential complications of inadvertent needle trauma. In opposition the FNB block will result in motor nerve blockade leaving the patient more susceptible to complications.

Conclusion

In regards to a decrease in general opioid consumption and avoiding significant hemodynamic changes intraoperatively, use of the FICB has been discussed in the literature to be a safe and effective

peripheral nerve block. The FICB as an effective analgesic adjunct that aids in the decrease of both intraoperative and postoperative opioid and anesthesia requirements, due to the cephalad spread of the local anesthetic in a FICB, it covers more cutaneous pain resulting from femur fracture compared to the FNB, and allows for faster rehabilitation compared to neuraxial anesthesia. This factor is related to the motor sparing effects of the FICB. Rehabilitation time is parallel to recovery time. Therefore, short recovery time is related to the ability of the patient beginning physical therapy. The sooner their rehabilitation can start the faster their recovery will be. In addition, the use of the FICB for postoperative analgesic may lower hospital costs due to a decreased length of stay, and risk of iatrogenic complications from being an inpatient. Finally, FICB should be considered a preferred analgesic approach for THA surgeries in patients with femur fractures, as opposed to standard opioid analgesia, as documented by a significant decrease in pain postoperatively, decreased opioid consumption, and decreased opioid induced delirium in the elderly [30]. The final result is improved anesthetic outcomes overall.

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