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Fascia Iliaca Compartment Block: A Cornerstone Technique for Perioperative Analgesia in Elderly Hip Fracture Patients

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ABSTRACT

***Background*:** Hip fractures represent a major cause of morbidity, mortality, and functional decline in the elderly population. Pain management in this group poses a unique challenge due to altered physiology, multiple comorbidities, and sensitivity to systemic analgesics. The fascia iliaca compartment block (FICB) has emerged as a key regional anesthesia technique that provides effective analgesia while minimizing opioid requirements and preserving physiological stability. By targeting the femoral, lateral femoral cutaneous, and obturator nerves through a single, ultrasound-guided injection beneath the fascia iliaca, the block achieves comprehensive sensory coverage of the anterior hip and proximal femur. Recent advances in ultrasound technology and growing understanding of fascial plane anatomy have transformed the FICB from a landmark-based approach to a highly reliable, image-guided procedure. Both supra-inguinal and infra-inguinal techniques have demonstrated efficacy in preoperative pain control, facilitation of patient positioning for spinal anesthesia, and postoperative analgesia following hip fracture fixation or arthroplasty. The block's simplicity, safety profile, and adaptability make it particularly valuable in geriatric patients where minimizing hemodynamic disturbance and opioid exposure are priorities. Pharmacologically, long-acting local anesthetics such as bupivacaine and ropivacaine provide prolonged analgesia when delivered into the fascia iliaca compartment, allowing effective coverage throughout the early postoperative period. Integration of FICB into multimodal analgesia regimens has been associated with improved functional recovery, earlier mobilization, and decreased postoperative delirium. Furthermore, its compatibility with enhanced recovery after surgery (ERAS) pathways aligns with modern perioperative care standards emphasizing rapid rehabilitation and patient-centered outcomes. This review explores the anatomical foundations, pharmacological principles, and clinical applications of the fascia iliaca compartment block in elderly patients with hip fracture. It highlights recent evidence supporting its perioperative use, outlines practical considerations for optimal performance, and discusses its role in improving both analgesic efficacy and functional outcomes. As a motor-sparing, opioid-sparing, and technically accessible block, the FICB stands as a cornerstone in contemporary regional anesthesia practice for the geriatric population undergoing hip surgery...

Keywords: Fascia Iliaca Compartment Block, Analgesia, Hip Fracture

INTRODUCTION

Hip fractures are a major cause of morbidity and mortality in elderly patients, representing one of the most common orthopedic emergencies worldwide. With advancing age, progressive bone loss, frailty, and postural instability increase the likelihood of such fractures, particularly among those with comorbidities. These injuries are not only painful but are also associated with prolonged immobility, delayed surgical intervention, and a high risk of complications such as pneumonia, thromboembolism, delirium, and cardiac events. Therefore, effective pain management is a central component of perioperative care for hip fracture patients, directly influencing surgical outcomes, rehabilitation potential, and overall survival [1].

Systemic analgesics such as opioids and nonsteroidal anti-inflammatory drugs (NSAIDs) have traditionally been used to control hip fracture pain; however, they present significant limitations in the elderly. Opioids frequently cause respiratory depression, sedation, confusion, and gastrointestinal side effects, while NSAIDs may precipitate renal impairment and exacerbate

cardiovascular risk. These adverse effects make systemic pharmacological strategies less desirable in this vulnerable population. As a result, regional anesthesia techniques have gained growing importance as safer, more effective methods to provide targeted analgesia while minimizing systemic toxicity [2].

Among regional techniques, the **fascia iliaca compartment block (FICB)** has become an essential component of modern perioperative analgesia for elderly patients with hip fracture. First described by Dalens et al. in 1989, this technique is based on the anatomical principle of spreading local anesthetic beneath the fascia iliaca to block the femoral, lateral femoral cutaneous, and obturator nerves—the primary contributors to sensory innervation of the hip joint and anterior thigh. By achieving broad sensory coverage while largely sparing motor function, the FICB enables both preoperative comfort and postoperative mobility [3,4].

The introduction of ultrasound guidance has further enhanced the reliability, safety, and precision of the FICB. Compared with landmark-based approaches, ultrasound allows real-time visualization of fascial planes, neurovascular structures, and needle trajectory, significantly reducing the risks of intravascular injection and block failure. It has also facilitated the evolution of two primary approaches—the infra-inguinal and supra-inguinal techniques—each offering unique advantages in terms of anesthetic spread and clinical efficacy [5].

The aim of this review is to provide a comprehensive, evidence-based overview of the fascia iliaca compartment block as a cornerstone technique for perioperative analgesia in elderly hip fracture patients. It will explore the anatomical and physiological basis of the block, discuss technical variations and pharmacological considerations, and evaluate its role in multimodal analgesia protocols that prioritize early mobilization, reduced opioid use, and improved functional outcomes. In doing so, this review also highlights current research gaps and potential directions for future clinical investigation [6].

Anatomical and Physiological Basis of the Fascia Iliaca Compartment Block

A detailed understanding of the anatomy of the fascia iliaca compartment is fundamental to the safe and effective performance of the block. The fascia iliaca is a fibrous sheath that lies over the iliacus and psoas major muscles, extending from the thoracic region to the upper thigh. It forms part of the posterior abdominal wall and the posterior wall of the pelvis, enclosing the iliacus muscle and contributing to the formation of the femoral sheath. This fascia creates a potential space between itself and the underlying muscles, known as the **fascia iliaca compartment (FIC)**, which provides a conduit for the spread of local anesthetic to several major nerves of the lumbar plexus [1].

The **fascia iliaca compartment** lies posterior to the fascia iliaca and anterior to the iliacus and psoas muscles. Laterally, it attaches to the iliac crest and anterior superior iliac spine (ASIS), while medially it blends with the fascia covering the psoas major muscle and continues distally to form part of the femoral sheath. As it extends below the inguinal ligament, the compartment passes posterior to the femoral vessels within the femoral triangle. This anatomical configuration allows a single injection of local anesthetic to spread medially and laterally beneath the fascia, effectively enveloping the femoral nerve, the lateral femoral cutaneous nerve, and—depending on volume and approach—the obturator nerve [2].

The **femoral nerve (L2–L4)** is the largest branch of the lumbar plexus and is responsible for the sensory innervation of the anterior thigh and the articular branches to the hip and knee joints. It runs within the groove between the psoas major and iliacus muscles and enters the thigh beneath the inguinal ligament. The **lateral femoral cutaneous nerve (L2–L3)** provides sensation to the anterolateral thigh, whereas the **obturator nerve (L2–L4)** supplies the medial thigh and articular branches to the hip joint. Blocking all three nerves within the fascia iliaca compartment ensures comprehensive analgesia for most hip and femoral procedures [3].

Physiologically, the analgesic effect of the FICB derives from the blockade of both somatic and articular sensory fibers innervating the hip joint capsule. The anterior capsule, which contains the highest density of nociceptors, receives articular branches from the femoral and obturator nerves, while the lateral capsule receives contributions from the lateral femoral cutaneous nerve. This wide sensory coverage explains the block's ability to provide substantial pain relief from hip fractures and during surgical manipulation. Moreover, because the motor fibers of the femoral nerve lie deep and distal to the injection plane, motor function is typically preserved when the block is properly performed [4].

Understanding age-related changes in the musculoskeletal and nervous systems is also important when applying the FICB in elderly patients. Degenerative alterations, such as decreased muscle mass, increased connective tissue stiffness, and reduced

fascial elasticity, can influence the spread of local anesthetic within the compartment. Furthermore, vascular calcification and altered tissue perfusion may modify the rate of systemic absorption. These considerations reinforce the value of ultrasound guidance, which ensures accurate deposition of local anesthetic despite anatomical variability common in geriatric patients [5,6].

Techniques and Approaches of the Fascia Iliaca Compartment Block

The fascia iliaca compartment block (FICB) can be performed using two primary techniques: the **infra-inguinal** and the **supra-inguinal** approaches. Both rely on depositing local anesthetic beneath the fascia iliaca to achieve diffusion toward the femoral, lateral femoral cutaneous, and obturator nerves. The choice between these approaches depends on patient anatomy, clinical context, and practitioner preference. The evolution from landmark-based to ultrasound-guided techniques has significantly improved the safety, reliability, and precision of both methods, particularly in elderly patients with fragile physiology or distorted anatomy [1].

The **infra-inguinal approach**, first described by Dalens et al. in 1989, remains the traditional technique. The patient is positioned supine with the leg extended and slightly abducted. Using anatomical landmarks, the needle is inserted 1 cm distal to the junction between the lateral third and medial two-thirds of the line joining the anterior superior iliac spine (ASIS) and the pubic tubercle. After passing through the fascia lata and fascia iliaca—each producing a characteristic "pop"—local anesthetic is injected into the potential space between the fascia iliaca and the iliacus muscle. When performed under ultrasound guidance, a high-frequency linear probe (10–15 MHz) is placed transversely over the inguinal crease to visualize the femoral artery, femoral nerve, and iliacus muscle. Correct injection produces an anechoic spread beneath the fascia iliaca, displacing it anteriorly [2,3].

While the infra-inguinal technique is simple and effective for hip and femoral shaft fractures, it has limitations in achieving proximal spread toward the lumbar plexus, particularly to the obturator nerve. To overcome this, the **supra-inguinal approach** was introduced by Hebbard in 2011. In this method, the probe is placed in a sagittal orientation just medial to the ASIS. The needle is advanced in-plane from caudal to cranial direction, targeting the plane deep to the fascia iliaca and superficial to the iliacus muscle. Local anesthetic injection under real-time ultrasound visualization produces cranial spread toward the iliac fossa, facilitating consistent blockade of the femoral, obturator, and lateral femoral cutaneous nerves, including their proximal articular branches to the hip joint [4].

Comparatively, the supra-inguinal FICB offers broader sensory coverage of the hip and proximal femur and has been associated with lower postoperative opioid consumption. However, it requires a slightly higher level of technical expertise and ultrasound proficiency. The infra-inguinal approach remains advantageous in emergency settings or when time is limited, as it can be performed rapidly and safely. In both techniques, typical volumes range from 30 to 40 mL of local anesthetic to ensure adequate fascial plane spread. Reducing the volume may compromise the effectiveness of the block, especially in elderly patients with altered tissue compliance [5].

The FICB can be performed with the patient awake, lightly sedated, or even in the emergency department prior to surgery, facilitating pain-free positioning for spinal anesthesia. Its versatility and adaptability make it a valuable technique for both anesthesiologists and emergency physicians. The routine use of ultrasound has now made FICB one of the safest and most reliable regional blocks in clinical practice, particularly suited for frail geriatric patients with hip fractures [6].

Pharmacology of Local Anesthetics Used in Fascia Iliaca Compartment Block

The efficacy and safety of the fascia iliaca compartment block (FICB) depend largely on the pharmacological properties of the local anesthetic selected. **Bupivacaine**, a long-acting amide-type anesthetic, remains the agent of choice for this block due to its extended duration of action and favorable sensory–motor separation. Its mechanism of action involves reversible inhibition of voltage-gated sodium channels on neuronal membranes, preventing depolarization and conduction of nerve impulses. This results in localized sensory blockade of the femoral, lateral femoral cutaneous, and obturator nerves when appropriately deposited beneath the fascia iliaca [7].

The pharmacokinetic profile of bupivacaine is influenced by several factors including dose, concentration, injection site vascularity, and patient physiology. Elderly patients exhibit altered pharmacokinetics due to reduced hepatic metabolism and plasma protein binding, resulting in a higher proportion of free active drug. This necessitates careful dose adjustment to minimize the risk of systemic toxicity. Typical concentrations used for FICB range from 0.25% to 0.5%, with total doses not exceeding 2.5 mg/kg (maximum 175 mg without epinephrine or 225 mg with epinephrine). The addition of epinephrine delays systemic

absorption, prolongs block duration, and reduces peak plasma concentration, thereby enhancing safety [8].

Ropivacaine and **levobupivacaine** are frequently employed alternatives that offer similar analgesic efficacy with a reduced risk of cardiotoxicity compared to racemic bupivacaine. These agents possess greater sensory selectivity and a lower tendency to induce motor blockade, a desirable feature for facilitating early postoperative ambulation. Their relatively lower lipid solubility also contributes to a wider safety margin, making them particularly suitable for elderly and frail patients [9].

The onset and duration of FICB depend on the anesthetic's physicochemical characteristics and the total volume injected. Large volumes (30–40 mL) are required to achieve effective spread within the compartment. Acidic tissue environments, such as those found in inflamed or traumatized areas, may delay the onset due to reduced lipid solubility of the anesthetic. Buffering the solution with bicarbonate can accelerate onset, while the use of adjuvants like dexamethasone or clonidine has been shown to prolong block duration through vasoconstriction and anti-inflammatory effects, although these adjuncts should be used with caution in the elderly [10].

A critical consideration during administration is the potential for **local anesthetic systemic toxicity (LAST)**, a rare but potentially life-threatening event. It can manifest as neurological symptoms (tinnitus, metallic taste, seizures) or cardiovascular collapse. Strict adherence to maximum dose limits, incremental injection under real-time ultrasound visualization, and continuous patient monitoring are mandatory preventive measures. In the event of toxicity, prompt management following the American Society of Regional Anesthesia (ASRA) guidelines—including lipid emulsion therapy and advanced cardiac life support—is vital [11].

The selection of local anesthetic for FICB in elderly hip fracture patients should therefore balance efficacy, safety, and pharmacokinetic predictability. Long-acting agents such as bupivacaine and ropivacaine remain the standard choices, offering reliable sensory analgesia while preserving motor function and minimizing systemic complications when appropriately dosed and monitored [12].

Clinical Applications and Perioperative Use of FICB in Elderly Hip Fracture Patients

The fascia iliaca compartment block (FICB) has become a vital technique for perioperative pain management in elderly patients with hip fractures due to its versatility, safety, and effectiveness across multiple stages of care. It can be applied in preoperative, intraoperative, and postoperative phases, offering consistent analgesia and facilitating patient comfort throughout the perioperative journey [13].

Preoperative Use

Hip fractures cause intense nociceptive pain that severely limits mobility and positioning. Administering FICB in the emergency department or preoperative area provides rapid and sustained pain relief, improving patient tolerance for essential maneuvers such as positioning for spinal anesthesia or imaging. This is particularly beneficial in frail geriatric patients where pain-induced sympathetic activation may precipitate tachycardia, hypertension, or myocardial ischemia. Studies have shown that preoperative FICB significantly reduces pain scores within 15 to 30 minutes and lowers the requirement for rescue opioid analgesia, thereby minimizing associated adverse effects such as confusion, nausea, and respiratory depression [14].

Intraoperative Applications

Although the FICB is primarily an analgesic block rather than a surgical anesthetic, it serves as a valuable adjunct to neuraxial or general anesthesia. When performed preoperatively, the block reduces intraoperative opioid and anesthetic requirements, stabilizes hemodynamic parameters, and mitigates stress response. In patients unable to tolerate neuraxial anesthesia due to coagulopathy or spinal deformity, FICB can provide sufficient analgesia to allow limited surgical procedures such as traction pin insertion or positioning prior to induction. In elderly patients with cardiac compromise, this reduction in sympathetic stimulation and opioid use translates into better intraoperative stability and lower perioperative risk [15].

Postoperative Role

The postoperative phase of hip fracture management is critical for early mobilization and rehabilitation. FICB provides effective pain control during the first 24 hours after surgery, reducing the need for systemic opioids and promoting earlier participation in physiotherapy. Preservation of quadriceps motor function distinguishes FICB from femoral nerve or lumbar plexus blocks, allowing patients to mobilize sooner without significant risk of falls or muscle weakness. Additionally, improved pain control

reduces postoperative delirium incidence—a frequent and serious complication in elderly surgical patients linked to both pain and opioid exposure [16].

FICB is often incorporated into **multimodal analgesia protocols**, combining it with acetaminophen, low-dose NSAIDs, and low-potency opioids. This approach maximizes analgesic efficacy while minimizing the risk of adverse effects. The use of long-acting agents such as bupivacaine or ropivacaine further ensures sustained postoperative pain relief, supporting early transfer from recovery to rehabilitation units. Its simplicity and reproducibility also make FICB suitable for repeated administration or catheter-based continuous infusion in selected cases where prolonged analgesia is required [17].

The block's effectiveness extends beyond the operating room. Administering FICB soon after admission to the emergency department not only reduces pain but also improves preoperative vital signs and overall patient satisfaction. Consequently, many enhanced recovery after surgery (ERAS) protocols now recommend FICB as a standard component of perioperative management for geriatric hip fracture patients [18].

In summary, the clinical applications of FICB span the entire continuum of hip fracture care—from the emergency room to postoperative rehabilitation. Its role in improving analgesia, minimizing opioid use, and promoting early mobilization underscores its value as a cornerstone in the multidisciplinary management of elderly patients with hip fractures [19].

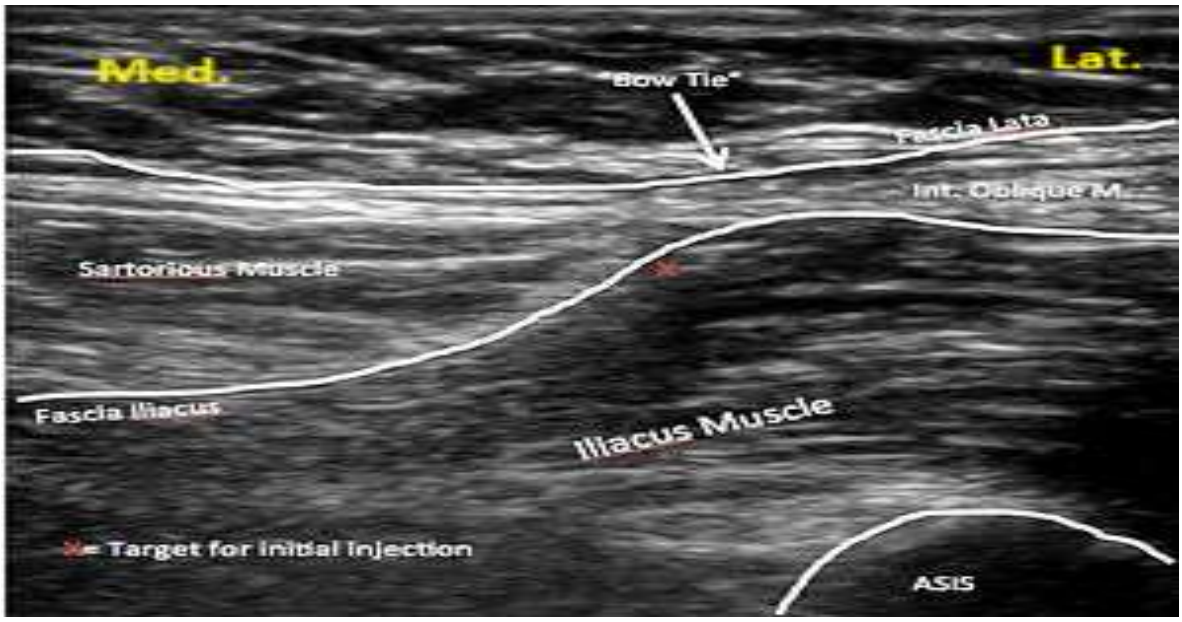

Fig. 1: Ultrasound view for suprainguinal fascia iliaca block [19]

Geriatric Considerations and Physiological Implications in FICB Use

Elderly patients represent a highly heterogeneous population with wide variations in physiology, pharmacology, and comorbidity burden. Age-related changes in organ function, altered drug distribution, and diminished physiological reserves profoundly influence both the safety and efficacy of regional anesthesia techniques, including the fascia iliaca compartment block (FICB). Understanding these factors is critical for optimizing block performance, minimizing complications, and ensuring tailored analgesic management [20].

With advancing age, musculoskeletal changes such as **osteopenia, sarcopenia, and connective tissue fibrosis** alter anatomical landmarks and the elasticity of fascial planes. These modifications can affect the spread of local anesthetic within the fascia iliaca compartment, occasionally necessitating larger injection volumes or real-time ultrasound adjustments to ensure adequate diffusion. Furthermore, spinal deformities and joint contractures may complicate patient positioning, making the FICB an attractive alternative to neuraxial anesthesia due to its ease of administration in the supine position and minimal patient movement [21].

Cardiovascular changes are among the most relevant physiological considerations in elderly patients. Reduced cardiac compliance, diminished beta-adrenergic responsiveness, and frequent coexistence of ischemic heart disease or heart failure

increase the risk of hemodynamic instability during surgery. Unlike central neuraxial blocks, FICB has negligible effects on sympathetic tone or systemic vascular resistance, making it particularly suitable for this population. The absence of significant hypotension or bradycardia following FICB contributes to its superior safety profile in comparison with spinal or epidural anesthesia for fragile patients with limited cardiac reserve [22].

Respiratory and renal physiology also influence anesthetic management in geriatrics. Reduced pulmonary elasticity, decreased functional residual capacity, and impaired ventilatory response to hypoxia elevate the risk of respiratory complications when opioids are used. FICB reduces opioid requirements, thereby lowering the incidence of postoperative hypoventilation, atelectasis, and pneumonia. Similarly, reduced renal blood flow and glomerular filtration rate prolong the elimination of local anesthetics and their metabolites. Careful dose calculation—based on lean body weight and adjusted for renal and hepatic function—is essential to avoid systemic toxicity, particularly with long-acting amide agents like bupivacaine [23].

Neurological vulnerability in the elderly further emphasizes the importance of minimizing sedatives and opioids. Postoperative delirium and cognitive dysfunction are closely linked to both uncontrolled pain and systemic analgesic exposure. The sensory-specific analgesia achieved by FICB effectively alleviates pain while preserving cognitive clarity, enabling better communication, cooperation during physiotherapy, and earlier restoration of baseline function. This effect has been directly correlated with shorter hospital stays and improved discharge outcomes in elderly hip fracture patients [24].

Lastly, the pharmacodynamic response to local anesthetics in geriatric patients is often exaggerated due to reduced receptor density, impaired homeostatic mechanisms, and altered protein binding. For these reasons, conservative dosing strategies and strict adherence to safety protocols—including aspiration before each injection and fractionated dosing under ultrasound visualization—are mandatory. The FICB's peripheral nature and distance from major neurovascular structures add an additional margin of safety, making it one of the most geriatric-friendly regional techniques available [25].

In summary, the fascia iliaca compartment block is ideally suited for elderly patients because it combines simplicity, hemodynamic stability, and motor-sparing analgesia. By accounting for the unique physiological and pharmacological characteristics of the aging body, clinicians can maximize its benefits while minimizing risks, making it a cornerstone in the tailored perioperative management of geriatric hip fracture patients [26].

Comparative Efficacy and Clinical Advantages of FICB Over Other Analgesic Techniques

Regional anesthesia options for hip fracture pain include femoral nerve block, three-in-one block, lumbar plexus block, periarticular infiltration, and neuraxial techniques. The fascia iliaca compartment block (FICB) distinguishes itself by reliably covering the femoral, lateral femoral cutaneous, and—depending on approach and volume—the obturator nerves through a single injection beneath a continuous fascial plane. This broad sensory coverage targets the principal nociceptive input from the anterior hip capsule while typically preserving quadriceps strength, an advantage over femoral nerve or lumbar plexus blocks that more frequently induce motor weakness and delay mobilization [27,28].

Evidence from ultrasound-era studies indicates that supra-inguinal FICB achieves more proximal cranial spread along the iliacus fascia, translating into more consistent obturator involvement and superior hip analgesia compared with infra-inguinal approaches or isolated femoral blocks. Clinically, this has been associated with lower early postoperative pain scores, reduced rescue opioid consumption, and improved tolerance of physiotherapy and transfers in the first 24 hours after surgery—critical endpoints in geriatric enhanced recovery pathways [29,30].

Compared with neuraxial techniques, FICB offers meaningful hemodynamic and safety advantages in frail elders. Because it is a peripheral fascial plane block, sympathetic tone is largely preserved, minimizing hypotension and bradycardia—complications that are more common after spinal or epidural anesthesia, particularly in patients with diastolic dysfunction or autonomic blunting. FICB can also be performed safely in many anticoagulated patients when guideline timing is respected, providing an effective bridge to surgery or a supplement to general anesthesia without the risks inherent to neuraxial puncture in coagulopathy [31,32].

From a workflow perspective, FICB is practical across care settings—emergency department, preoperative area, or ward—using portable ultrasound with rapid set-up and minimal repositioning. The block facilitates pain-free positioning for spinal anesthesia, decreases peri-induction opioid needs, and streamlines transitions to postoperative rehabilitation. Its reproducibility, favorable motor-sparing profile, and alignment with multimodal, opioid-sparing protocols make FICB a high-value, geriatric-friendly

technique that integrates seamlessly into modern perioperative pathways for hip fracture care [33,34].

Integration of FICB into Multimodal Analgesia and Enhanced Recovery Pathways

Modern perioperative medicine emphasizes **multimodal analgesia**, which combines different pharmacologic and regional techniques to control pain through multiple mechanisms while minimizing opioid exposure. The fascia iliaca compartment block (FICB) aligns perfectly with this philosophy. When integrated with acetaminophen, low-dose NSAIDs (if renal function allows), and judicious opioid supplementation, FICB provides a balanced analgesic regimen that maximizes comfort and minimizes side effects. This approach is particularly advantageous in elderly patients, who often exhibit increased opioid sensitivity, reduced metabolic clearance, and heightened vulnerability to respiratory and cognitive complications [35].

The **enhanced recovery after surgery (ERAS)** framework advocates for early mobilization, reduced opioid use, and preservation of physiological stability—all of which are facilitated by FICB. By targeting sensory fibers while sparing major motor branches, the block allows patients to participate in early physiotherapy and ambulation programs soon after surgery. Early movement not only reduces the risk of thromboembolic events and pulmonary complications but also accelerates return of bowel function and shortens hospital stays. Studies have shown that patients receiving FICB as part of ERAS protocols achieve higher functional scores and greater independence at discharge compared with those receiving systemic analgesia alone [36].

From a systemic standpoint, FICB's **opioid-sparing effect** directly contributes to a reduction in postoperative delirium—a major source of morbidity among elderly surgical patients. Delirium arises from a multifactorial interplay of pain, sedative medications, and underlying frailty. By providing stable analgesia without sedation, FICB preserves cognitive clarity and enables better communication, cooperation with rehabilitation staff, and reduced risk of falls or confusion-related injuries. This contributes not only to improved patient outcomes but also to a safer and more efficient postoperative environment [37].

Intraoperatively, when performed before induction, FICB reduces the requirement for volatile anesthetics and intraoperative opioids, promoting hemodynamic stability and smoother emergence. Postoperatively, the block can be extended using continuous catheter techniques to maintain steady-state analgesia for up to 48–72 hours. This method allows titration according to pain intensity and rehabilitation milestones, though it requires careful monitoring for local anesthetic toxicity and catheter dislodgement. Continuous FICB catheters are especially valuable for patients undergoing complex fixation procedures or with severe preexisting pain syndromes [38].

Institutional implementation of FICB as part of standardized perioperative protocols requires multidisciplinary collaboration among anesthesiologists, orthopedic surgeons, and nursing teams. Education on ultrasound anatomy, aseptic technique, and monitoring protocols ensures consistency and safety. When integrated within multimodal and ERAS pathways, the FICB not only optimizes pain control but also reflects a **paradigm shift toward function-preserving, patient-centered anesthesia** for elderly hip fracture patients—promoting recovery, autonomy, and quality of life [39].

Safety Profile, Complications, and Prevention of Local Anesthetic Systemic Toxicity (LAST)

The fascia iliaca compartment block (FICB) is widely regarded as one of the safest peripheral nerve blocks in clinical practice, particularly when performed under ultrasound guidance. Its favorable safety profile is attributed to the relatively superficial location of the injection site and its distance from major blood vessels and critical neural structures. However, as with any regional anesthetic technique, a detailed understanding of potential complications and strict adherence to safety protocols are essential to maintain its low risk profile [40].

Safety Profile and Common Minor Complications

When conducted with correct technique, complications associated with FICB are rare. Minor adverse effects may include localized pain, bruising, or transient paresthesia at the injection site. Occasionally, block failure occurs due to incorrect needle placement or insufficient volume of local anesthetic, which can be mitigated by real-time ultrasound guidance. Accidental intramuscular injection may lead to inadequate analgesia due to limited fascial plane spread, emphasizing the importance of recognizing fascial "separation" during injection [41].

Transient quadriceps weakness can occasionally occur, particularly when high concentrations of local anesthetic are used or the spread extends to the femoral nerve trunk. Although this weakness is generally short-lived, clinicians should always assess motor power before encouraging ambulation to minimize the risk of falls. Hematoma or infection at the injection site is extremely rare,

provided aseptic technique and ultrasound guidance are used [42].

Serious Complications and LAST

The most serious, albeit infrequent, complication associated with FICB is **local anesthetic systemic toxicity (LAST)**. LAST can result from inadvertent intravascular injection or excessive systemic absorption of local anesthetic, particularly in elderly patients with altered hepatic metabolism and reduced protein binding. The clinical presentation typically progresses from neurological symptoms such as tinnitus, perioral numbness, metallic taste, and agitation to seizures, cardiovascular depression, and cardiac arrest if unrecognized [43].

To prevent LAST, all injections should be performed incrementally with frequent aspiration and continuous patient monitoring. The use of ultrasound allows real-time visualization of the needle tip and local anesthetic spread, substantially decreasing the risk of intravascular administration. Adhering to recommended maximum dose limits—such as 2.5 mg/kg for bupivacaine or 3 mg/kg for ropivacaine—is crucial, especially in geriatric and frail patients. If systemic toxicity occurs, immediate management should follow the **American Society of Regional Anesthesia (ASRA) guidelines**, emphasizing airway management, seizure control with benzodiazepines, and early administration of **20% lipid emulsion therapy** [44].

Prevention Strategies and Monitoring

Proactive risk assessment is central to preventing complications. Elderly patients should undergo a pre-block evaluation of coagulation status, medication history, and potential allergies. In anticoagulated patients, adherence to current ASRA timing guidelines ensures safe needle insertion without hematoma formation. Continuous hemodynamic and neurological monitoring during and after the procedure enables early detection of adverse events. Establishing institutional protocols for FICB administration—including checklists, dosage tables, and emergency response algorithms—further enhances patient safety [45].

In summary, when performed using ultrasound guidance, appropriate dosing, and standard safety precautions, the FICB offers a remarkably low incidence of complications. Awareness of potential adverse effects and prompt management of rare events such as LAST ensure that this technique remains one of the safest and most effective regional anesthesia options for elderly hip fracture patients [46].

Functional Recovery and Postoperative Outcomes

Functional recovery following hip fracture surgery is a crucial determinant of long-term prognosis, independence, and quality of life in elderly patients. Effective pain control, early mobilization, and preservation of muscle strength are key contributors to successful rehabilitation. The fascia iliaca compartment block (FICB), by providing targeted sensory analgesia with minimal motor impairment, has demonstrated significant benefits across these domains, establishing itself as a cornerstone in postoperative recovery pathways [47].

Impact on Early Mobilization and Rehabilitation

The principal advantage of FICB lies in its ability to deliver robust analgesia while maintaining quadriceps strength. Unlike femoral nerve blocks that can cause motor paralysis, FICB selectively blocks the sensory fibers supplying the hip and proximal femur while largely sparing motor branches. This selective blockade facilitates **early ambulation**, allowing patients to stand and begin physiotherapy within the first 24 hours post-surgery. Early mobilization has well-documented benefits, including prevention of deep vein thrombosis, reduction in pulmonary complications, and improved muscle preservation. Studies have shown that elderly patients receiving FICB ambulate sooner and achieve higher mobility scores compared with those managed with systemic opioids alone [48].

Reduction in Opioid Consumption and Cognitive Preservation

Postoperative opioid sparing is a major clinical advantage of FICB. The elderly are particularly vulnerable to opioid-induced side effects such as sedation, constipation, nausea, and respiratory depression. Importantly, excessive opioid use has been directly linked to postoperative delirium—a serious complication associated with prolonged hospitalization, higher mortality, and delayed functional recovery. By substantially reducing or eliminating the need for systemic opioids, FICB contributes to **cognitive preservation**, improved participation in physiotherapy, and smoother rehabilitation trajectories [49].

Pain Control and Patient Satisfaction

Consistent postoperative pain control is a key predictor of rehabilitation success and patient satisfaction. FICB provides sustained analgesia for 8–12 hours when using long-acting local anesthetics like bupivacaine or ropivacaine. When supplemented by multimodal oral analgesics, it can maintain adequate pain relief well into the postoperative period. Patients frequently report greater comfort during movement, repositioning, and participation in physical therapy sessions. These subjective improvements translate into measurable functional gains, including faster return to baseline activities of daily living and shorter hospital stays [50].

Impact on Length of Hospital Stay and Long-Term Function

The improved pain control, mobility, and cognitive stability associated with FICB directly contribute to reduced hospital length of stay. Early mobilization and reduced opioid-related complications allow for earlier discharge and transition to rehabilitation or home care. Furthermore, patients managed with FICB are more likely to regain pre-fracture levels of independence and ambulation within 30–60 days postoperatively, a major milestone in geriatric recovery. These long-term outcomes highlight the broader role of regional analgesia not just in pain control but also in **functional restoration and quality of life** after hip fracture surgery [51].

Institutional and Systemic Benefits

From a healthcare system perspective, integrating FICB into perioperative care pathways for hip fracture patients reduces the need for high-dependency unit admissions and shortens rehabilitation duration. The block's low complication rate and rapid onset make it feasible for routine use in both high-volume centers and resource-limited hospitals. Consequently, institutions adopting standardized FICB protocols report not only improved patient outcomes but also **cost savings** and enhanced workflow efficiency [52].

In conclusion, the fascia iliaca compartment block plays a pivotal role in promoting rapid functional recovery, minimizing complications, and restoring independence in elderly patients after hip fracture surgery. Its physiological benefits, coupled with patient-centered advantages, make it an indispensable element of modern perioperative care [53].

Conclusion

The fascia iliaca compartment block (FICB) has established itself as one of the most important and clinically valuable regional anesthesia techniques for elderly patients undergoing hip fracture surgery. Its anatomical precision, simplicity, and safety make it ideally suited for this vulnerable population, in whom pain control, hemodynamic stability, and preservation of function are critical to recovery. By targeting the femoral, lateral femoral cutaneous, and obturator nerves beneath the fascia iliaca, the block provides extensive sensory analgesia of the hip and proximal thigh while largely sparing motor fibers—allowing for effective pain relief without compromising mobility.

Within the perioperative setting, the FICB contributes to every phase of care. Preoperatively, it facilitates pain-free positioning for spinal or general anesthesia and alleviates the physiological stress of acute fracture pain. Intraoperatively, it reduces the requirement for systemic opioids and anesthetic agents, thereby enhancing hemodynamic stability. Postoperatively, its long-lasting analgesic effect promotes early ambulation, decreases opioid consumption, and lowers the incidence of delirium, constipation, and respiratory complications—key factors in improving outcomes and reducing mortality among geriatric patients.

When integrated into multimodal analgesia and enhanced recovery after surgery (ERAS) pathways, FICB embodies the principles of modern perioperative medicine: opioid-sparing, function-preserving, and patient-centered care. Its effectiveness, reproducibility, and minimal risk profile allow it to be safely administered by trained anesthesiologists, emergency physicians, and acute pain teams, making it a practical and scalable solution across diverse clinical environments.

In conclusion, the fascia iliaca compartment block represents a cornerstone of regional anesthesia in geriatric orthopedic practice. It bridges the gap between effective analgesia and functional restoration, supporting not only the surgical process but also the broader goals of recovery and independence in elderly patients with hip fractures. Continued research and protocol standardization will further enhance its utility and reinforce its status as an essential element in the comprehensive care of the aging surgical population.

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