ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 10| Issue: 4| April 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402 || ISI Value: 1.188

PERIPHERAL NERVE BLOCKS IN GERIATRIC ORTHOPEDIC ANESTHESIA FOR HIP FRACTURES: UNVEILING ECONOMIC AND CLINICAL DIMENSIONS

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Article DOI: https://doi.org/10.36713/epra16288
DOI No: 10.36713/epra16288

ABSTRACT

Hip fractures in elderly patients significantly burden health and healthcare costs. Effective pain management is crucial for optimal recovery, prompting the exploration of innovative strategies like peripheral nerve blocks (PNBs). This review investigated the clinical and economic impact of PNBs on geriatric patients undergoing hip fracture surgery. A systematic review identified relevant research on PNB use in this population, searching databases like PubMed, Cochrane, and others for studies published before September 2023. The findings revealed several potential benefits associated with PNBs, including targeted pain control, decreased opioid dependence, and facilitated earlier mobilization. Notably, the analysis highlighted a dual impact, with PNBs demonstrating potential clinical advantages like shorter hospital stays and fewer complications alongside their costs. However, the evidence of their influence on healthcare costs remains inconclusive. Despite the uncertainty surrounding cost-effectiveness, the overall trend suggests positive clinical outcomes associated with PNBs, including improved recovery and reduced opioid reliance. These potential benefits could translate to a positive impact on healthcare resource utilization.

In conclusion, PNBs show promise for improved clinical outcomes and potentially reducing healthcare resource utilization. To solidify cost-effectiveness, future studies should pinpoint economic benefits and refine PNBs use. A more thorough analysis is needed to confirm these financial advantages.

KEYWORDS: *hip fracture, peripheral nerve blocks, elderly, hospitalization duration, healthcare costs.*

INTRODUCTION

Hip fractures exert a substantial toll on healthcare and communities, and are anticipated to surpass other types of fragile fractures globally[1][2]. The prevalence of hip replacement procedures is expected to reach 7–21 million by 2050, driven by population growth and aging demographics[3]. Beyond sheer numbers, the implications are profound, encompassing significant morbidity, mortality, and substantial healthcare costs[4]. The journey from hip fracture to recovery is marked by challenges, with a stark 35% mortality rate within a year[5]. Post-surgical pain further complicates the scenario, affecting a significant number of patients with ongoing moderate to severe pain[6]. This pain not only hampers recovery but also poses the risk of delirium, compounded by the use of opioids in this vulnerable population[7]. Since the 1980s, local anesthesia and opioids have been the mainstay of post-surgical pain management[8]. The effectiveness of opioids in reducing post-surgery pain has been widely proven. Nevertheless, there are still worries about the potential short-term side effects and the risk of long-term addiction [9]. Regional blockade is effective in reducing pain during movement within 30 minutes of placement. It also reduces the risk of pneumonia, allows for quicker mobilization, and lowers costs associated with pain medication, especially with single-shot blocks[10]. Driven by concerns about opioids, particularly their risks in the elderly, pain management is undergoing a shift. PNBs are emerging as a promising alternative, offering a different approach to managing pain[8]. However, studies examining peripheral nerve blocks in elderly hip fracture patients after hip arthroplasty present conflicting findings. While Fu et al. observed a potential decrease in short-term mortality associated with PNBs, they are also associated with higher hospitalization costs. Additionally, the impact on longer-term outcomes such as one-year mortality, walking ability, major complications, and length of stay remains unclear, as no significant differences were observed between PNBs and other anesthesia types[11]. Conversely, Chan et al. emphasized the positive effect of PNBs in significantly reducing opioid use, particularly during hospitalization, suggesting potential benefits for both clinical outcomes and resource utilization[12]. However, Jørgensen et al. found no association between routine PNB use and early discharge or 30-day readmission rates within specific surgical protocols like fast-track THA and TKA[13]. To

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thoroughly evaluate the clinical and financial benefits of nerve blocks in hip surgery for elderly patients, a detailed analysis is necessary to determine their cost-effectiveness and their role in providing sustainable healthcare. This review aims to fill the research gap by focusing on the use of peripheral nerve blocks specifically for anesthesia in hip fractures in older adults. The objective is to assess the economic and clinical implications, postoperative issues, length of hospital stays, pain control, patient recovery, and cost-effectiveness, to provide information for evidence-based decision-making.

Methodology

A comprehensive literature search was conducted to identify relevant studies published up to September 2023, encompassing PubMed, Ovid Medline, Google Scholar, and Cochrane databases. The search strategy included clinical trials, review articles, observational studies, case reports, and meta-analyses, focusing on senior hip fracture patients. The search terms strategically combined keywords like "hip fracture," "femoral neck fracture," "postoperative pain," ''cost savings," "analgesia," "coeffective," "pain management," and "peripheral nerve block" with relevant medical subject headings terms for enhanced precision. By reviewing various study types, researchers hoped to gain insights into both clinical effectiveness and potential financial benefits associated with different nerve blocks in managing pain in this population. The outcomes of nerve blocks on both clinical and economic dimensions are elucidated through narrative description.

Anesthesia Selection in Total Joint Arthroplasty

In total joint arthroplasty, spinal anesthesia, and general anesthesia are common modalities, with varying preferences based on surgery type, patient demographics, and outcomes. The choice between these two approaches, particularly in hip fracture surgeries, is crucial due to its implications for postoperative mortality and considerations for patients on anticoagulants[14]. Research by Chowdary et al. suggests that spinal anesthesia, especially in elderly hip hemiarthroplasty patients, is associated with reduced complications, shorter surgery times, and overall mortality[15]. Further evidence supports the advantages of spinal anesthesia, such as decreased pneumonia, infections, critical care utilization, and falls, making it a recommended choice for total hip and knee replacements[16][17].

Challenges in Traditional Pain Management

The multifaceted landscape of hip fracture pain management involves non-opioid and opioid strategies (Table 2). Non-opioid analgesics, despite their use in managing post-surgery pain, prove ineffective for dynamic pain, necessitating exploration of alternative approaches[18]. Postoperative pain management after hip replacement surgery traditionally involves medications such as acetaminophen, Nonsteroidal Anti-Inflammatory Drugs (NSAIDs), and opioids (figure 1). However, drowsiness can hinder recovery[19]. The elderly population, facing the dilemma of excruciating discomfort and potential complications from pain medications, requires careful consideration of pain management strategies[20](Table 1).

Opioids in Perioperative Pain Management

Opioids, though historically effective in surgical settings like hip replacement, present concerns due to side effects, particularly in the elderly. The opioid crisis has highlighted the significant dangers and expenses linked to opioid misuse, prompting a reevaluation of prescribing patterns and a shift towards opioid-free and sparing techniques for effective alternatives[21][22]. Peripheral nerve blocks emerge as a viable option, offering pain relief for limb surgeries, improving patient satisfaction, and reducing opioid dependence[8][23].

Table 1. Medications to avoid in elderly patients due to the complications associated[24]

Drug	Complications
Benzodiazepines	Cognitive dysfunction, delirium, falls that lead the Fractures
Tramadol	Unpredictable negative effects, variable metabolism
Diphenhydramine	Confusion, dry mouth, constipation, delirium
Morphine	Neurotoxicity, Delirium

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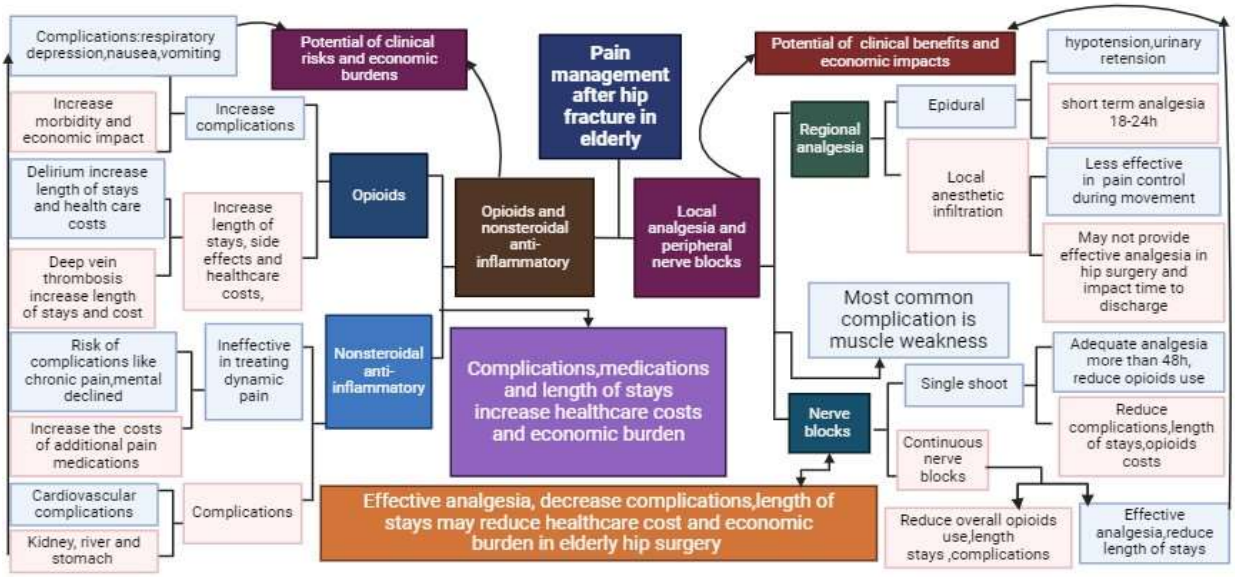
Figure 1. Pain management in elderly hip fractures: Mechanisms Impacting Clinical Outcomes and economic implications



Epidural Analgesia: Benefits and Limitations

While initially providing better pain control than systemic opioids, epidural analgesia comes with limitations, including a diminishing effect within 18-24 hours[25][26]. Studies exploring the impact of postoperative epidural analgesia on pain and rehabilitation in hip fracture patients suggest varying outcomes, emphasizing the need for careful consideration of its application[27]. Combining peripheral nerve blocks with epidural anesthesia offers additional benefits, particularly in elderly patients with cardiac comorbidities[28].

Local Anesthetic Infiltration and its Comparative Efficacy

Local infiltration analgesia (LIA) or periarticular analgesia (PAI) during joint replacement surgery provides pain relief at rest comparable to peripheral nerve blocks or epidurals but exhibits limitations in managing pain during movement. Evidence from meta-analyses suggests varying outcomes for knee and hip surgeries, indicating the need for further investigation regarding hospital stay and time to discharge[29].

Peripheral nerve blocks.

Geriatric orthopedic anesthesia for hip fractures necessitates precise pain management strategies to enhance outcomes. Regional anesthesia techniques offer benefits compared to general or spinal anesthesia. Peripheral nerve blocks (PNBs) have emerged as innovative alternatives, exhibiting benefits in hemodynamic stability, reduced complications, and shorter hospital stays[30][31][32].

1. Analgesic efficacy

1. Femoral nerve block (FNB)

A study by Unneby et al. found that preoperative femoral nerve blocks reduced acute pain and opioid use in elderly hip fracture patients compared to conventional management. This benefit extended to patients with dementia[33]. Additionally, Xing et al. found that pre-operative femoral nerve block (FNB) led to a significant reduction in postoperative pain and opioid use compared to controls undergoing hip arthroscopy, supporting the potential benefits of FNB for pain management in lower extremity surgeries[34].

2. 3-in-1 block

Deniz et al. conducted a study comparing the analgesic efficacy of ultrasound-guided 3-in-1 nerve block and fascia iliaca compartment block (FICB) in hip prosthesis surgery. Both blocks demonstrated similar analgesic effects, evidenced by comparable reductions in tramadol use (33.2% for FICB, 27.4% for 3-in-1) at 24 hours postoperatively. Additionally, both groups exhibited decreased stress hormone levels at 60 minutes after block administration[35].

3. Psoas component block (PCB)

Becchi et al. conducted a study investigating the efficacy of continuous psoas compartment block (cPCB) for pain management after total hip arthroplasty (THA). Compared to patients receiving systemic analgesic injections, the cPCB group demonstrated significantly lower pain scores and reduced requirements for additional pain medication, suggesting superior analgesic efficacy of cPCB for post-THA pain management[36].

4. Fascia iliaca compartment block (FICB)

Chen et al. conducted a study demonstrating that ultrasound-guided supra-inguinal fascia ilia compartment block (US S-FICB) provided effective and rapid pain relief for senior patients with hip fractures who arrived at the emergency department. Additionally, US S-FICB improved tolerance to movement and promoted better sleep quality[37].

5. The Sacral Nerve Block (SNB)

In a study by Shah et al., combined lumbosacral plexus block (CLSPB) emerged as a safe and effective anesthesia option for high-risk patients undergoing unilateral lower limb surgery. This technique offered several advantages compared to traditional approaches, including stable hemodynamics during surgery (potentially reducing cardiovascular complications), improved

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postoperative pain management (potentially leading to faster recovery and reduced need for painkillers), cost-effectiveness through reduced resource utilization, and shorter hospital stays contributing to improved healthcare efficiency and potentially better patient outcomes[38]

7. Quadratus lumborum block (QLB)

Acharya et al. conducted a double-blinded, placebo-controlled trial to evaluate the efficacy of ultrasound-guided anterior quadratus lumborum block (US-guided Ant. QLB) in managing pain after total knee arthroplasty (TKA). Patients receiving US-guided Ant. QLB demonstrated significantly lower Visual Analog Scale (VAS) pain scores ($p<0.05$) compared to controls. Additionally, they required significantly less rescue pain medication (chi-square value 5.9341, $p=0.0148$) and reported higher overall satisfaction. These findings suggest that US-guided Ant. QLB may be a valuable tool for improving pain management and patient experience following TKA[40].

8. Erector Spinae Plane Block (ESPB)

In a study of anesthesia options for elderly patients undergoing hip surgery with medical comorbidities, the Lateral Erector Spinae Plane Block (LESPB) showed promising results. LESPB, combined with minimal sedation and analgesia, provided effective anesthesia for all participants. All patients reported postoperative pain scores below 2 on a 10-point scale upon arrival in the recovery room, indicating well-tolerated pain management in this vulnerable population with potential medical complexities[41]. Tulgar et al. found that LESPB and QLB-T provided better pain relief than standard injectable analgesia in hip and proximal femoral procedures. Patients receiving nerve blocks reported lower pain and needed less tramadol and fewer additional medications within 24 hours. This indicates that LESPB and QLB-T offer more effective and sustained postoperative pain management in these procedures[42]

2. Clinical Efficacy of Nerve Blocks

1. Potential Complications Associated with Nerve Blocks

Peripheral nerve blocks present potential complications, including local anesthetic systemic toxicity, nerve damage, infection, and motor block (Table 1)[43][44]. Research indicates that FNB increases the risk of falls after hospital discharge. Additionally, Perioperative FICB improves recovery after spinal anesthesia for elderly THA patients but may also reduce muscle strength[34][45]. In contrast to traditional blocks, motor-sparing techniques like anterior iliopsoas space block and pericapsular nerve group block (PENG) focus on sensory nerves, preserving motor function. Studies indicate the potential advantages of these techniques in managing perioperative pain without compromising mobility [32][46][47].

2. Impact on Mortality and high-risk patients

Numerous studies highlight the potential of nerve blocks in reducing mortality after hip fractures. One by Pederson et al. suggests continuous femoral nerve block catheters can lower twelve-month mortality by 6%, potentially due to various contributing factors. Another study by Lees et al. found significantly lower mortality rates (5.5% vs. 15%, $p=0.0024$) in patients receiving femoral nerve blocks[48]. In the elderly, where hip fractures often present significant risks, research also demonstrates the success of peripheral nerve blocks, even in high-risk patients. A 96-year-old with severe aortic stenosis underwent successful hip surgery using this method[49].

3. Economic Implications of Nerve Blocks

1. Reduction in Analgesic Use (Opioids)

Peripheral analgesia, particularly through techniques such as peripheral nerve blocks (PNBs) and femoral nerve blocks, demonstrates promising outcomes in minimizing the reliance on opioids during surgical interventions. Joanne Guay et al. revealed that a one-time peripheral nerve block not only decreased pneumonia incidence but also expedited post-surgery mobilization and reduced expenses for pain relief medications[50]. In a prospective study by John M et al., fascia iliaca blocks were associated with a diminished need for preoperative opioids and a low incidence of opioid-related adverse events in elderly hip fracture patients[51]. Intraoperative morphine usage was the least common among individuals undergoing FNB, and its absence was a predictor of increased morphine consumption postoperatively and 48 hours thereafter[52].

Morrison et al. conducted a randomized controlled trial, highlighting a 33% reduction in injectable morphine equivalents in the intervention group receiving a single-dose FNB in the emergency department [53]. Peripheral nerve blocks in elderly hip fracture patients contribute not only to reduced discomfort during mobility but also to a lowered risk of severe confusion (RR 0.67, 95% CI; 0.50 to 0.90) and pulmonary infection (RR 0.41, 95% CI; 0.19 to 0.89). Additionally, PNBs result in cost savings for analgesic medications and expedite the time to initial movement[54]. Preoperative FNB has demonstrated improved pain control and reduced opioid reliance post-hip arthroscopy, particularly with decreased opioid use observed 48 hours after surgery[34]. Furthermore, studies, including that by Deniz et al., suggest comparable analgesic efficacy for hip prosthesis surgery with both ultrasound-guided 3-in-1 and FICB, leading to significant reductions in tramadol consumption and decreased stress hormone levels at 60 minutes postoperatively [35].

2. Reduced Complications

Nerve blocks, by minimizing complications have the potential to reduce healthcare costs associated with prolonged hospital stays. Utilizing peripheral regional anesthesia in hip surgeries is linked to enhanced hemodynamic stability and a decreased incidence of complications, presenting a favorable alternative to general or spinal anesthesia[30]. Within this patient population, localized anesthesia, specifically peripheral and neuraxial nerve blocks, is associated with a reduced risk of pulmonary complications, postoperative cognitive dysfunction, and shorter intensive care unit stays[31]. Postoperative challenges, including hypostatic pneumonia, delirium, and deep vein thrombosis, often arise due to immobilization linked to pain, leading to extended hospital stays and increased healthcare costs. Initiating analgesia as early

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EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
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as possible, even before surgery, is crucial to address these challenges effectively [55]. A comprehensive review by Guay et al. suggests that nerve blocks, compared to traditional pain management approaches, significantly reduce pain, decrease the risk of confusion, potentially lower chest infections, and expedite mobilization time [56].

Effect of Nerve Blocks on Delirium

Delirium risk in hip fractures varies widely (4-61%). Pain and opioid use are major causes, especially in intermediate-risk patients (Table 1). Regional anesthesia like nerve blocks can be a powerful tool, offering better pain control, reducing opioid reliance, and potentially lowering delirium risk[57][7]. Ultrasound-guided iliac fascia block using radionics improves postoperative pain, reduces fentanyl dosage, C-Reactive Protein(CRP), and Neuron-specific enolase (NSE) levels, decreases the incidence of postoperative cognitive dysfunction(POCD), and improves nerve block effectiveness in elderly patients undergoing hip surgery[58]. Nerve blocks contribute to reducing delirium risk by providing better pain control and decreasing opioid reliance[58][57][7].

Effect of Nerve Blocks on Deep Venous Thrombosis (DVT)

Delayed rehabilitation is associated with complications like pulmonary infections and deep venous thrombosis[59]. However, the use of nerve blocks, a form of regional anesthesia, is correlated with increased chances of early ambulation and a lower risk of DVT[60].

3. Length of Hospital Stays and Resource Impact

Lenart et al.'s investigation into peripheral nerve blocks for orthopedic surgery showcased their efficacy. Single-injection PNBs resulted in shorter hospital stays, while continuous PNBs reduced overall hospitalization duration. Both techniques exhibited a potential for earlier recovery compared to conventional pain management approaches (figure 1) [61]. In total hip arthroplasty for the elderly, continuous fascia iliaca compartment block (FICB) demonstrated superior recovery quality and lower pain levels after 24 hours. However, it did not significantly impact the time for the first postoperative ambulation and hospital stay length[62]. Houserman et al.'s retrospective analysis demonstrated the impact of nerve block analgesia on hip fracture patients. Those receiving fascia iliaca compartment block experienced significantly shorter hospital stays and lower pain levels on postoperative days 2 and 3. Moreover, Verbeek et al.'s findings highlighted the advantages of continuous FICB (CFICB) over single-shot FICB, including extended pain relief, the potential for faster recovery, reduced opioid reliance, and shortened hospital stays. CFICB may also be associated with lower mortality rates and reduced delirium, representing a promising tool for enhancing pain management and outcomes in hip fracture patients[5][63].

5. Resource Impact and Cost-Effective Care in Hip Surgery

1. Resource Impacts

Continuous Peripheral Nerve Block (CPNB) suggests a comprehensive approach using diverse pain relief methods and advanced regional anesthesia techniques to reduce both hospitalization time and costs[52]. Prioritizing patient satisfaction and resource efficiency, recommendations include minimizing the length of hospital stays after hip surgery and concurrently decreasing readmission rates[64]. Administering a single preoperative dose of Femoral Nerve Block (FIB) is proposed as a strategy to decrease opioid use and enhance the likelihood of home discharge for hip fracture surgery patients, contributing to resource optimization[65]. Chan et al.'s retrospective study establishes a strong correlation between peripheral nerve block use and significantly reduced opioid consumption during inpatient care, advocating for wider adoption of this pain management technique to improve clinical outcomes and resource allocation within healthcare systems [12].

2. Potential for Cost-Effective Care

Perioperative delirium in elderly individuals undergoing hip fracture surgery significantly impacts hospital stay duration and associated costs. Measures to diminish perioperative delirium incidence, particularly in low-energy hip fractures, are crucial[57]. Simic et al.'s study identifies severe pain and opioid use as major contributors to delirium, highlighting the effectiveness of regional analgesia via peripheral nerve blocks in reducing these risks. Compared to traditional approaches, nerve blocks offer advantages such as improved pain relief, decreased opioid need, and reduced delirium incidence[7]. A comparative analysis across five healthcare systems demonstrates the clinical and economic efficacy of structured core treatment programs in hip fracture cases. Integrating these programs into established clinical pathways proves more efficient in utilizing healthcare resources and improving primary care delivery [66].

With the European Union addressing the challenges of hip fractures in the elderly, substantial costs and prolonged hospitalizations are projected. Research by Melton et al. suggests that nerve blocks could potentially reduce these costs and hospital stays[67]. Duncan et al. contribute to understanding cost-effectiveness in nerve block (NBs) utilization, highlighting potential savings through reduced hospital stays, especially during prolonged admissions. This finding introduces complexity to the discourse on NBs' economic impact, emphasizing the need for further exploration of anesthesia choices[50]. Advocacy for shortening hospital stays after hip surgery, balancing resource conservation and patient satisfaction without increasing readmission rates, underscores the importance of delving into the economic dimensions of anesthesia choices[61].

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Table 2. Comparison of Various Multimodal Analgesia Techniques Used in Pain Management,

Technical	Advantages	Disadvantages	Potential Complications
Non-opioid analgesics (NSAIDs)	Provide pain relief and reduce inflammation.	May cause stomach ulcers, and kidney problems, and are not effective for all types of pain.	Gastrointestinal bleeding, kidney damage
Opioid analgesics	Offer potent pain relief for moderate to severe pain.	Can lead to serious side effects like respiratory depression, drowsiness, constipation, and vomiting, increasing the risk of falls after surgery. They may also contribute to delirium, blood clots, and longer hospital stays.	Respiratory depression, drowsiness, constipation, vomiting, increased delirium, and DVT risk, longer hospitalization, decreased quality of life, potential mortality
Spinal anesthesia	Provides rapid pain relief during surgery, reducing the need for systemic opioids.	Has a limited duration of action and carries potential complications like post-dural puncture headaches and low blood pressure	Post-dural puncture headache, low blood pressure, nausea, vomiting
Local anesthetic infiltration:	Controls pain at the surgical site.	Offers limited effectiveness for pain control after total hip arthroplasty.	Limited area of action, potential for local anesthetic toxicity
Epidural analgesia	Delivers continuous pain relief, reducing systemic opioid use.	Has a limited duration of action and can lead to complications like low blood pressure, difficulty urinating, and infection at the insertion site.	Low blood pressure, difficulty urinating, infection
Patient-controlled analgesia (PCA)	Empower patients to manage their pain with individualized dosing.	Carries a risk of overmedication and respiratory depression. May increase the risk of delirium.	Overmedication, respiratory depression, the potential increase in delirium risk
Single-shot nerve blocks	Offer effective pain relief with minimal systemic effects. May reduce delirium, DVT, and mortality risks, improve quality of life, decrease opioid use, and shorten hospital stays.	May not provide complete pain relief, and technical or anatomical challenges can arise. Can cause temporary muscle weakness, nerve injury, bleeding, block failure, or infection.	Incomplete pain relief, motor blockade, local anesthetic toxicity, muscle weakness, nerve injury, bleeding, block failure, infection
Continuous catheter nerve blocks (CCNB)	Provide prolonged pain relief, and reduce opioid use and hospital stay duration. May decrease delirium, DVT, and mortality risks.	Carries a risk of catheter dislodgement and infection.	Infection, bleeding, catheter-related complications

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Table 3: Impact of nerve blocks on elderly hip surgery

Internship	The nerve blocks	Clinical benefits and economic implications
Immediate	Effective analgesia	Minimized pain and decreased reliance on additional pain medications, such as opioids, resulting in a potential reduction in healthcare expenses
	Early mobilization	Enhanced ability to move and engage in physical therapy sooner, promoting better mobility
	Faster ambulation	Speedier resumption of independent walking, facilitating improved performance in daily activities
	Prevent complications (delirium, DVT)	Diminished chances of confusion and blood clot formation by reducing opioid dependence and promoting increased mobility
	Reduce hospital stays and enhance recovery	Decreased hospitalization duration and accelerated recovery for a quicker return to normal health
Long term	Enhance functional independence	Heightened capability to carry out daily tasks without assistance, fostering greater self-sufficiency
	Improved quality of life	Alleviated pain, enhanced mobility, and greater independence collectively contribute to an improved overall sense of well-being
	Decrease readmissions and healthcare resource utilization	Lowered risk of complications and reduced hospital stays may potentially decrease readmissions and associated healthcare expenditures

DISCUSSION

The study's results reveal that peripheral nerve blocks in geriatric orthopedic anesthesia for hip fractures offer clinical advantages such as reduced opioid use and improved patient outcomes, along with potential cost savings. This dual impact underscores the value of PNBs in optimizing perioperative care by minimizing

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opioid-related complications and enhancing healthcare resource allocation. Incorporating PNBs in pain management strategies for elderly hip surgery patients can lead to better clinical outcomes and more efficient use of healthcare resources.

The retrospective analysis of 65,271 hip fracture surgeries unveils compelling evidence for the positive impact of peripheral nerve blocks (PNBs) on both patient outcomes and healthcare costs. Administration of PNBs is linked to a statistically significant decrease in median hospital length of stay (7 days shorter) and a substantial reduction in healthcare costs (approximately $1,421 less) compared to cases without PNBs[68]. Duncan's findings underscore the pivotal role of hospitals in achieving cost savings, particularly in room and board and medical supplies, with shorter stays demonstrating significant cost reductions, especially towards the end of prolonged admissions[61]. Anesthetic techniques, specifically pain management through nerve blocks, emerge as influential factors impacting healthcare costs and hospital admission rates[61]. The recognition of continuous peripheral nerve blocks (CPNB) for decreasing both hospital length of stay and overall hospitalization costs highlights the potential economic implications of advanced regional anesthesia and multimodal analgesia [64].

PNBs offer safe and effective alternatives to spinal anesthesia for surgeries like total knee and hip arthroplasty, potentially avoiding associated side effects and complications[49] . The consideration that single-injection blocks may reduce drug costs adds to the promising outlook for better patient outcomes and potentially reduced overall costs[64]. Combining PNBs with neuraxial anesthesia is advantageous for perioperative care, particularly for elderly patients[69]. Supporting studies underline the economic and clinical benefits of PNBs across diverse patient cohorts. In anterior cruciate ligament(ACL) surgery outpatients, PNBs significantly reduced resource use and expenditures, with a majority avoiding post-anesthesia care unit (PACU) and hospitalization[70]. Similar positive outcomes are observed in hip fracture patients, where PNBs led to reduced analgesic costs, faster mobilization, shorter stays, and lower overall costs[54][7].

Addressing perioperative delirium, a significant risk factor, becomes crucial in light of associated cost burdens[57]. The emphasis on cost-effective interventions to mitigate the impact of perioperative delirium is underscored. A study of 242 patients seniors underwent hip surgery revealed that 48% developed perioperative delirium. Patients with delirium experience longer hospital stays (7.4 days), longer post-surgical stays (7.4 days), and increased healthcare expenses ($8,286). Delirium resulted in a $961,131 additional cost. It is for this reason that perioperative delirium must be addressed in the elderly with hip fractures. Furthermore, it emphasizes the necessity of cost-effective interventions to mitigate its impact[57]. The use of FNB can still be beneficial to patients with dementia because it reduces pain and reduces systemic analgesia[71]. Total joint arthroplasty's high-cost burdened Medicare in 2013, exceeding $33,000 per surgery and totaling $6.5 billion. Longer hospital stays further inflate costs, highlighting the need for cost-containment strategies[16]. Hospital et al.'study considered $3,500 as the median price for the analysis. They found that routine utilization of PNBs for anesthesia resulted in a 12% reduction in expenditures ($420/patient), and the reduction in hospital admissions resulted in an 11% reduction in hospital costs ($385/patient)[70]. The PNB not only reduces the price of analgesics but also reduces the mobilization time, resulting in a reduction in hospital days as well as the cost of the hospitalization itself[54]. Optimal selection of a multimodal analgesic regimen is vital for individuals undergoing total hip arthroplasty, as it has the potential to minimize side effects, optimize recovery, reduce opioid consumption, and decrease overall postoperative morbidity and mortality[72]. In elderly THA patients, Continuous Femoral Infusion Catheter Block (CFICB) improved the quality of recovery at 24 hours and reduced pain scores compared to Patient-Controlled Intravenous Analgesia (PCIA), while the time of first postoperative ambulation and length of hospital stay was not significantly affected[62]. Additionally, patients with femoral neck fractures after total hip arthroplasty experienced less pain and demonstrated superior hip mobility and walking ability during hospitalization compared to those with trochanteric fractures, irrespective of factors such as early vs. late mobilization and full vs. partial weight-bearing[4]. This study supports prior research on nerve blocks for elderly hip surgery, suggesting benefits for both patient recovery and cost. However, it acknowledges limitations: while shorter stays and less medication are seen, specific cost savings and resource use weren't directly measured.

CONCLUSION

Peripheral nerve blocks emerge as a compelling alternative to existing pain management practices. They show promise for improved clinical outcomes, potentially reducing healthcare resource utilization through less opioid use, decreased postoperative complications, and shorter hospital length of stays. This review highlights the potential cost-effectiveness of nerve blocks for hip surgery in elderly patients. While upfront costs exist for materials and training, potential savings from shorter stays, less medication, and fewer complications might outweigh them. However, the review doesn't delve deep into specific cost data and acknowledges the need for further research on factors like hospital stay length and resource use. A more detailed analysis considering all cost components and their relationship to nerve blocks is needed for optimal resource allocation.

Competing Interests

The authors have declared that they have no competing interests in this article.

Authors' Contributions

Xu Zhang conceptualized the study design. The first draft of this review was written by Emery NIYONKURU. Peng Ma revised the manuscript. The final manuscript has been read and approved by all of the authors before it is submitted to the journal.

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EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 10| Issue: 4| April 2024|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2024: 8.402 || ISI Value: 1.188

Acknowledgment
We extend our heartfelt appreciation to the authors for their invaluable contributions and dedication to this study.

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