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Identifying and Evaluating Pain Management in Hospitalized Older Adults with Hip Fractures: An Integrative Review

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Abstract

Hip fractures are known to have the highest health morbidity and mortality, especially in the aging population. Having a hip fracture comes with insurmountable pain. Older adults experiences pain differently from other populations due to physiological changes, but this population experiences an undertreatment and mistreatment for pain, resulting in negative outcomes. Current methods for pain control include pharmacologic and nonpharmacologic interventions. Exploring different interventions for pain management is necessary so providers can implement methods that are effective in pain relief without inducing complications. The aim of this integrative review is to identify current pain management interventions and determine their effectiveness amongst hospitalized older adults with hip fractures.

Studies included analysis of interventions for pain and secondary outcomes for hospitalized older adult with hip fractures. Populations included cognitive and noncognitive patients. Electronic databases were Medline, CINAHL, and Google Scholar. The integrative

literature review carried out the framework by Whittemore and Knafl's (2005) for data collection, analysis, and synthesis. Analysis of the studies showed three interventions for pain management: Nerve blocks, multimodal, and intravenous acetaminophen. Multimodal management was the most effective in managing pain. Secondary outcomes from the interventions included decrease in opioid use, postoperative complications, and length of stay. For non-cognitive patients, using other interventions, such as a nerve block, aids in pain relief and reduces opioid use. Knowing the interventions and their contributing benefits allows providers to choose interventions that are the most appropriate for this patient population without further compromising the recovery, health, and well-being.
Keywords: older adult, pain, and hip fracture*, analgesia, elderly, and geriatric

Identifying and Evaluating Pain Management in Hospitalized Older Adults with Hip Fractures: An Integrative Review

Each year, approximately 300,000 older adults, those 65 years and older, require hospitalization for a hip fracture (Center for Disease Control [CDC], 2020). North America has one of the highest incidences of hip fractures globally, mainly seen in older adults (Ensrud, 2013). Out of all osteoporotic fractures, hip fractures are known to have the highest health morbidity and mortality, and the annual incidence will continue to rise with the increased aging population (Ensrud, 2013). Having a hip fracture is detrimental to the older adult population due to its severe consequences. The most notable concern is the inability to have pain relief, particularly due to the undertreatment of pain during hospitalization (Abou-Setta et al., 2011). Uncontrolled pain is known to induce delirium, anxiety, depression, disturbances while sleeping, and decreased response to interventions in older adults experiencing a hip fracture (Abou-Setta et al., 2011). Immediately treating pain during the acute phase of the hip fracture and continually managing the pain throughout hospital admission until discharge will enhance recovery after surgical intervention (Abou-Setta et al., 2011). Exploring pain management in hip fracture older adults and evaluating its effectiveness is necessary to improve patient recovery.

Background

The background section presents information on the focused topic of this integrative review. Providing background information allows for a holistic and comprehensive understanding of the research topic. Areas included in the background include information about the research population, hip fractures, pain occurrence resulting from a hip fracture, and pain management for the research population with current methods and considerations.

Hip Fractures in Older Adults

To understand how a large number of hip fractures in older adults occur each year, it is necessary to look at the risk factors that are associated with this initial insult. Determining factors contributing to the risk of fragility fractures in the older adult population are low bone mass and propensity to fall (Ensrud, 2013). For example, osteoporosis is associated with the advancing age of adults ages 65 years and older, and it is a disease characterized by a loss of bone and its structural deterioration (Ensrud, 2013). This bone loss deterioration process results in skeletal fragility that can lead to a high risk of fragility fractures (Ensrud, 2013). However, Guerado et al. (2019) state that having a low bone mass alone is unlikely to result in a hip fracture, and instead, hip fracture occurrence in older adults typically results from traumatism, such as a fall.

Once a hip fracture occurs, the injury in the hip may occur in one or more of four locations (Fischer & Gray, 2020). These areas include the femoral neck, intertrochanteric area, subtrochanteric area, and femoral head (Fischer & Gray, 2020). The most common types of hip fractures are the intertrochanteric and femoral neck, which accounts for approximately 90% of hip fractures (Fischer & Gray, 2020; Dizdarevic et al., 2019). Identifying fracture location by imaging is essential since this determines the type of surgical intervention needed to repair the injury (Fischer & Gray, 2020). For instance, an intertrochanteric fracture may require intramedullary nailing, while a femoral neck fracture may need a hemiarthroplasty (Fischer & Gray, 2020). An older adult who acquires a hip fracture will most likely need surgical intervention, but those who are deemed nonoperative are individuals who have significant comorbidities, or it is suspected that the surgery may reduce life expectancy (Fischer & Gray, 2020). Surgical interventions aim to stabilize the hip (Fischer & Gray, 2020). To prevent risk of perioperative complications and decrease mortality, clinical practice recommendations assert surgical intervention to treat an acute hip fracture within 24-48 hours of admission to the hospital as long as individual is deemed appropriate for surgery. By reducing surgical waiting time, hip fracture patients experience reduced, severe pain during hospital stay (Seong et al., 2020).

Pain Origin of a Hip Fracture

The detrimental consequence for older adult patients who experience a hip fracture is the considerable amount of pain associated with this injury (Sanzone, 2016). To understand the severity of the pain, looking at the anatomical structure in the hip region is important. The anatomy of the hip joint area is known as the ball-and-socket, in which the bones include the head of the femur rotating within the acetabulum of the pelvis (Dizdarevic et al., 2019). A fibrous capsule surrounds the joint with also several ligaments intertwining and surrounding the joint to stabilize the hip during movement and prevent dislocation (Dizdarevic et al., 2019). Several muscle groups are engaged, such as the gluteal muscle, quadriceps, and hamstrings that allow a large range of motion of the hip (Dizdarevic et al., 2019). Then, there is the neurovascular anatomy of the femur and pelvic bones, which are perfused by the femoral artery and several minor arteries along with sensory innervation mostly coming from the femoral and sciatic nerve (Dizdarevic et al., 2019).

Considering the anatomical involvement of the hip joint, any insult to the area resulting in a fracture, such as an older adult experiencing a fall, will result in acute pain response (Fischer & Gray, 2020). Acute pain from a hip fracture may inhibit an individual from mobilizing, bearing weight, or producing the hip joint area (Fischer & Gray, 2020). A patient may be able to bear weight based on the severity of the fracture in the hip area, but attempting to bear weight would be accompanied by severe pain (Fischer & Gray, 2020). Thus, treating the pain with surgical intervention and other pain modalities is the main priority to help the initial injury.

Pain in Older Adults

Pain is an issue that remains to be untreated or undertreated in older adults, and this issue will continue as this population increases (Cavalieri, 2005). Noroozian et al. (2018) conducted research that showed pain is not part of the aging process, but older adults perceive pain differently from other age populations due to physiological changes, such as decreased pain tolerance. Other environmental, cultural, emotional, and cognitive factors can also impact the perception of pain in older adults (Noroozian et al.,

2018). Consideration of these factors is important in the management of pain for older adults. Characteristics of pain are dependent on its manifestations. For instance, types of pain range from acute pain, such as fractures and abdominal pain, to persistent pain from multiple chronic diseases (Booker & Herr, 2016). However, if either kind of pain is not controlled, the results may be decreased functional status, incapacitation, and susceptibility to frailty in older adults (Booker & Herr, 2016).

Types of Pain Management and Barriers for Older Adults

Current practices for pain management are pharmacologic and nonpharmacologic. The commonly used method is pharmacologic medications due to their ability to produce an analgesic effect, which includes paracetamol, NSAIDs, opioids of differing strengths, co-analgesic, or analgesia modulation agents (Hall, 2016). The other approach to pain management is implementing physical and psychological modalities called nonpharmacologic methods (Tang et al., 2019). The interventions in this type of pain management involve cognitive and behavioral techniques, such as physical activity and distraction, and studies show that these activities are typically safe if delivered appropriately (Makris et al., 2014).

The administration of these methods for pain management may be separate or in combination. The optimal recommendation for pain management is to use a multimodal approach, encompassing several different treatment modalities (Horgas, 2017). While each treatment is effective in treating pain, the selection of the treatment is based on the individual, especially for the older adults. For instance, though the efficacy of pharmacologic medications is a significant reduction in pain, medications can not completely take away the pain (Hall, 2016). Another concern for administering pharmacologic methods to this aging population is the additional medication to their medication regimen. Polypharmacy is common amongst older adults due to being prescribed medications to treat multiple comorbidities to prolong life (Hoel et al., 2021). Polypharmacy may result in further complications from drug therapy, such as medication interactions, toxicity, delirium, and nonadherence in the older adult population (Hoel et al., 2021). Adding pain medication to the regimen of older adults, who take multiple medications, poses a risk to their health by affecting cognitive status and damage to individual organs and organ systems (Hall, 2016).

Thus, there is a need for the administration of non-pharmacologic pain management in combination with pharmacologic because the non-pharmacologic interventions require individuals to actively participate in physical and psychological modalities (Tang et al., 2019). Nonpharmacologic pain management can reduce pain levels without having side effects that older adults fear when taking pain medications (Tang et al., 2019). However, application and sustainability are an issue for older adults when looking at implementing and continuing nonpharmacologic methods for long periods (Tang et al., 2019). Therefore, appropriate pain management for older adults need to include physiological and psychological changes relating to the aging process, comorbidities, and polypharmacy, making pain management for the elderly complex (Horgas, 2017).

Clinical Problem

When a hip fracture occurs, the result is insurmountable pain especially for older adults. In that case, pain is overwhelming and has a significant impact on the older person's recovery and can also increase morbidity if the pain is not controlled (Dizdarevic et al., 2019). In a study, a questionnaire was given to 152 subjects, who were 65 years and older, asking about their concerns about their hip fracture (Yoo et al., 2018). An identifiable concern by the subjects was pain, which the questionnaire's results were 65.8% were

concerned with pre-and postoperative pain, and 51.3% were concerned about persistent postoperative pain (Yoo et al., 2018). In the preoperative stage, the majority of patients already experienced psychological stress, such as anxiety and fear. The psychological stress may then extend into the post-operative stage, where if the pain was not managed, the recovery process was hindered by provoking postoperative complications (Yoo et al., 2018). Thus, pain management takes precedence for symptom management of hip fracture older adults due to the repercussions that result from inadequate pain control.

According to the United States' Agency for Healthcare Research and Quality (2013), pain interventions for hip fracture patients in hospitals encompass the combination of pharmacologic and nonpharmacologic approaches, which contain systemic analgesia, anesthesia, nerve blocks, multimodal pain management, and rehabilitation. However, there is a layer of complexity when thinking about the effectiveness and appropriateness of current interventions for hospitalized older adults with hip fractures and their pain management. Exploring the effectiveness of multiple interventions and understanding how they produce desired results in the older adult population as well as the roles that they play in pain management are essential. The purpose of this integrative review is to identify current pain management interventions and determine their effectiveness amongst hospitalized older adults with hip fractures.

Scope of the Review

This section will focus on the methodological approach for this integrative review utilizing the Whittemore and Knafl (2005) framework. The framework's process includes five steps; problem identification, systemized literature search, data evaluation, data analysis, and presentation. In addition, the text by Toronto and Remington (2020) was used as a supplement for a more in-depth understanding of how to conduct an integrative review when using the Whittemore and Knafl (2005) framework. Whittemore and Knafl (2005) recommends conducting a thorough search of articles which was done. Articles with diverse research designs relating to the concept of pain in hospitalized older adults admitted with hip fractures were considered in this review. Selected articles were primary studies, either quantitative or qualitative (Toronto & Remington, 2020). Secondary studies that were of grey literature, systematic reviews, and meta-analysis were excluded.

Problem Identification

Research questions were formulated to identify and isolate the problem associated with pain control in elderly patients who have hip fractures. The research questions primarily focused on exploring the research of current pain management interventions for hospitalized hip fracture older adult patients and the effectiveness of the interventions. Research questions considered when conducting this integrative review were as follows:

- What pain interventions are used for hip fracture patients, and how effective are they in reducing pain before and/or after surgical intervention?
- What are the considerations for using certain types of interventions?
- What other effects do these interventions result in besides reducing pain?
- How much of a significant difference between cognitive and non-cognitive impaired older adults in the reduction of pain level?

Systemized Literature Search

A librarian's input guided the process of selecting databases appropriate for this research. Databases included CINAHL and Medline to identify primary research articles addressing pain management among hospitalized older adults with hip fractures. Looking at other databases, such as Google Scholar, Pubmed, and Scopus, helped with finding other relevant research articles in non-nursing disciplines (Toronto & Remington, 2020). A web-based bibliography manager was used to manage and provide organization for bibliographies, citations, and analysis during data search and analysis. MeSH headings and key terms and keyword relevance related to the topic were used when searching for articles in the databases. Key terms included older adult, pain, and hip fracture*. Other search terms encompassed analgesia, elderly, and geriatric.

Each selected study focused on hospitalized older adults (65 years or older) admitted with a hip fracture along with identified and evaluated pain management during hospitalization. The search's date range was six years encompassing articles published between 2015-2021. Inclusion criteria included surgical interventions of the femoral neck, intertrochanteric area, subtrochanteric area, and femoral head. Articles published outside of the United States and written in the English language were also included. Exclusion criteria involved any article published outside of the defined date range and not written in English. Subjects of the published articles who were younger than 65 years of age and did not have a hip fracture were excluded. Articles where studies did not involve hip fractures or more than one fracture were not included in the review. Studies were also excluded if the research did not focus solely on pain management and effectiveness of interventions.

PRISMA Flow Diagram

The documentation and evaluation for data search of articles were done using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Toronto & Remington, 2020). An audit trail of the literature search is seen in figure 1. The initial search for articles using the key terms resulted in 418 articles. Out of the 418 articles, 342 came from CINAHL and Medline and 76 from Google Scholar. After removing 57 duplicates, the remaining amount of articles were 361. Further exclusion of articles was based on screening abstracts and titles for their relevance to this integrative review, resulting in 347 articles being removed. A full-text assessment for eligibility was done on the remaining 14 articles. Seven articles were removed because the population sample included individuals less than 65 years old or had no measurement tool for pain. The final number of articles included in the literature review was six articles: one retrospective study, two prospective observational studies, two randomized control studies, and a cohort study.

Data Evaluation

The data evaluation stage was conducted on the nine articles to justify their inclusion in the integrative review by utilizing a quality appraisal tool, John Hopkins Nursing Evidence-Based Practice Evidence (JHNEBP) appraisal tool (Dang & Dearholt, 2017). The JHNEBP appraisal tools require the researcher to evaluate the research articles for level rating, quality, and credibility (Dang & Dearholt, 2017) (See Appendix E and F.). Using the appraisal tools an assigned level rating and quality appraisal were placed into the matrix to support each article's credibility and data extraction (see table 1). After reading each article, the randomized control studies were of good and high-quality level I evidence. The prospective observational study fit into a level II evidence with good quality, while the prospective, double-blind control study was a level III with good quality. Lastly, the one retrospective study was of level V evidence with good and high quality. In addition to rating articles, data evaluation involved reading each article and extracting the data

into table 1. The data comprised in table 1 included the authors, publication date, study sample, aim, setting, type of intervention, what was measured in the study, major findings, and limitations.

Data Analysis

After completing the screening process, there was conduction of data analysis. The process of data analysis included the constant comparison method (Whittmore & Knafl, 2005). The constant comparison method is a four-phase process: data reduction, display, comparison, and verification (Whittmore & Knafl, 2005). First, data reduction and display were done simultaneously. With data reduction, the abstracted data from the selected studies was of findings of both qualitative and qualitative aspects (Whittmore & Knaffl, 2005). Other methods of helping reduce the data included color-coding the data, which each research question had a designated color, and writing in the margins. The display of the data was a matrix with subclassifications focused on the key ideas from the research questions (Whittmore & Knaffl, 2005). Considering the depth of data needed to answer the research questions, two tables were created. Table 1 encompassed data that focused on general findings of the primary studies. Table 2 displayed subclassifications for abstracted data that answer the research questions. A written summary of each article was also provided to highlight the article's findings.

After creating the matrices, there was the iterative process of comparing the data to find patterns, similarities, or differences amongst the studies, which resulted in conclusions on what ideas emerged from the abstracted data (Whittemore & Knafl, 2005). This stage of the integrative review was tedious due to the necessity of breaking down and critically analyzing the data of primary resources and compiling the abstracted data into an integrated conclusion. The verification process included a second reviewer to read the articles and examine the data displayed to ensure the truthfulness of the data (Whittemore & Knafl, 2005).

Presentation

The last stage of the integrative review process is data presentation. This review encompassed two matrices that displayed the abstracted data from the primary sources (Table 1; Table 2). Readers can see how the researcher came to integrated conclusions based on explicit details displayed in the matrices to support the review. Findings were synthesized into a final summation that explored current pain management interventions and their effectiveness in pain control for hospitalized older adults with hip fractures.

Results

The results of the primary sources of this review encompasses findings about the interventions used to manage pain for hospitalized older adults with hip fractures. This section includes the research populations of the primary studies, the pain interventions, the benefits and special circumstances associated with the use of the interventions. These findings helped the researcher understand the various interventions used for this patient population and develop a conclusion about the effectiveness of the interventions.

Research Population

Considering the population of interest for this research was older adults, all participants in each of the studies were older than 65 years. One article did choose patients with an age range of 70 years and older (Unneby et al., 2017). Two studies included cognitively impaired older adults if a caregiver was able to provide consent for treatment with a nerve blocks (Unneby et al., 2017; Garlich et al., 2020). Differentiation of ethnicity/race was in two articles, of which the majority were Caucasian participants (Garlich et al., 2020;

Girardot et al., 2020). The majority of articles had mostly female participants (Giradot et al., 2020; Bollinger et al., 2015; Unneby et al., 2017; Uysal et al., 2020) yet one study encompassed a higher percentage of male participants (Garlich et al., 2020). One article did not differentiate ethnicity/race and sex (Zhou et al., 2029).

All participants included in the studies were admitted with a hip fracture and deemed appropriate for surgical intervention. All six studies included participants who had a type of trochanteric fracture that was isolated (Zhou et al., 2019; Unneby et al, 2017; Uysal et al., 2020; Garlich et al., 2020; Bollinger et al., 2015; Giradot et al., 2020). Three articles also included femoral fractures (Bollinger et al., 2015; Zhou et al., 2017; Garlich et al., 2017), and two articles had participants with cervical fractures (Unneby et al., 2027; Girardot et al., 2020).

Pain Interventions

All articles had at least one intervention for evaluation. Four articles had a femoral nerve block of varying types: femoral nerve block (FNB), fascia iliaca block (FIB) or fascia iliaca compartment block (FICB), and femoral nerve obturator block (FNOB) (Zhou et al., 2019; Unneby et al., 2017; Uysal et al., 2020; Garlich et al., 2020). One article looked at multimodal pain management, which included specifically adding intravenous acetaminophen as part of the management (Giradot et al., 2020). Another article examined intravenous versus oral acetaminophen in a pain management protocol (Bollinger et al., 2015). Two articles compared the effectiveness of the FONB against another intervention for pain relief. Zhou et al. (2019) compared the effectiveness of FONB to the FICB, and Uysal et al. (2020) looked at pain relief between the FNOB versus paracetamol.

Though interventions were specific for reducing pain, results varied based on when the intervention was administered and how long it was evaluated. Practice settings of where the participants received the interventions were in the hospital, but the phase of care of which the participants received the intervention varied. With four of the studies having nerve blocks, the administration of the blocks was in the emergency department, on the orthopedic ward, or preoperatively (Zhou et al., 2019; Unneby et al., 2017; Uysal et al., 2020; Garlich et al., 2020). One article indicated providers can give a second block if there was a delay in surgery or a patient requires additional pain relief (Unneby et al, 2017). Otherwise, participants received one type of block in those four studies (Zhou et al., 2019; Unneby et al., 2017; Uysal et al., 2020; Garlich et al., 2020).

Interventions, such as multimodal management and intravenous acetaminophen, were administered in all phases of care (Giradot et al., 2020; Bollinger et al., 2015). The article that specifically focused on intravenous acetaminophen allowed participants to receive 1,000 mg of the medication every eight hours for a minimum of 24 hours upon admission until surgery (Bollinger et al., 2015). Participants could receive the medication until surgery even if the surgery was beyond 24 hours, (Bollinger et al., 2015). Participants in the study with the multimodal intervention that encompassed acetaminophen received the multimodal regimen with 1,000 mg acetaminophen as priority medication for pain control (Giradot et al., 2020). Participants received one dose preoperatively, and up to three doses after surgery, which could be oral or intravenous depending on toleration of an oral diet (Giradot et al., 2020)

All articles showed pain scores in their results and most stated the use of the visual analog scale (VAS) to measure the effectiveness of pain, with results showing as a mean pain score (Zhou et al., 2019; Unneby et al., 2017; Uysal et al., 2020; Garlich et al., 2020; Bollinger et al., 2015). However, the article for multimodal pain management did not indicate the measurement tool for pain scoring

and only displayed the mean pain scores of the intervention (Giradot et al., 2020). Other measurements were assessed from the interventions. Four of the studies looked at opioid consumption when intervention was administered, and the tools of measurement included Oral morphine equivalent (OME), Morphine milliequivalent, or mean opioids received (Giradot et al., 2020; Unneby et al., 2017; Bollinger et al., 2017; Garlich et al., 2020; Zhou et al., 2019). Uysal et al. (2020) investigated the neuroinflammatory responses, interleukin-6 and -8 when administering the femoral nerve block, and measured the responses to see if there was a decrease in postoperative delirium. Three studies looked at other secondary outcomes, such as length of stay, rehabilitation sessions, prevalence of adverse effects, and delirium when using interventions (see Table 2); Zhou et al., 2019; Bollinger et al., 2015; Garlich et al., 2020; Girardot et al., 2020).

Effectiveness of Interventions in Reducing Pain

All articles explored an intervention that reduced pain in hospitalized hip fractures in older adult patients and recognized other benefits associated with the designated pain intervention. Interventions found amongst the primary articles were nerve blocks, multimodal management with acetaminophen, and acetaminophen, which each intervention showed a reduction in pain. However, reduction of pain varied amongst the interventions and which phase of care the intervention was used.

Nerve Blocks

Two articles evaluated the effectiveness of pain after receiving femoral nerve blocks. Unneby et al. (2017) found that those who received the FNB, which included cognitive and dementia patients, showed a statistical significance ($p< 0.001$) in pain reduction over 12 hours from the block administration. Uysal et al. (2020) also evaluated the administration of FNB but excluded non-cognitive populations and compared the intervention to the administration of intravenous (IV) paracetamol. The results showed that during the preoperative phase at the fourth hour and during positioning, the pain was significantly lower in the FNB group ($p<0.001$) (Uysal et al., 2020). However, there was not a statistical difference in the VAS mean scores between the two interventions in pain reduction during the postoperative phase ($p>0.05$) (Uysal et al., 2020).

For the FIB, the researchers of one article only evaluated this block for pain management in cognitive and non-cognitive patients if a caregiver could consent for the patient to receive the block (Garlich et al., 2020). Results showed no statistical difference in mean pain scores preoperatively for both the FIB group and no FIB group (Garlich et al., 2020). Also, VAS mean pain scores were higher in the group receiving the FIB than the nonintervention group on postoperative day (POD) 2 than POD 1 (Garlich et al., 2020). Zhou et al. (2019) compared the FICB to the FNOB and found that there was a statistical significance ($p<0.05$) in VAS scores for both blocks after administration compared to before administration, but there were no differences on the second day after the blocks. Moreover, the FNOB VAS scores were significantly lower than the FICB when evaluating during rest and exercise at the 30 minute and one-day mark after surgery ($p<0.05$) (Zhou et al., 2019).

Multimodal and Acetaminophen

One article discussed the use of multimodal management, which was a combination of opioid medications along with intravenous and oral acetaminophen (Giradot et al., 2020). The researchers implemented this combination of interventions in a provider's order set, preoperatively and postoperatively, for pain management of hospitalized older adults with hip fractures (Giradot et al., 2020). The

result of using multimodal approach with acetaminophen was a reduction of mean pain scores postoperatively at the 6, 24, and 48-hour mark (Giradot et al., 2020). There was no statistical significance compared to the group who had the preorder set of multimodal pain management with acetaminophen (p=0.53, 0.10, & 0.99) (Giradot et al., 2020). Bollinger et al. (2015) also looked at scheduled intravenous acetaminophen but did not discuss the use of multimodal management. The results showed that participants who received the scheduled IV acetaminophen had lower VAS mean pain scores than the group who did not have scheduled IV acetaminophen (<0.001) (Bollinger et al., 2015).

Pain Intervention Considerations

Although pain reduction was the main issue of interest for this review, there were other considerations that arose from the studies. The major considerations other than pain reduction included looking at the cognitively impaired population, opioid consumption, and other secondary outcomes. Analyzing these three considerations helps with understanding the unique circumstances surrounding pain management in hospitalized hip fracture older adult population.

Cognitively Impaired Group

When looking at the populations of cognitive patients and patients with cognitive impairment, two articles evaluated the intervention use between the two populations (Unneby et al., 2017; Garlich et al., 2020). There were no significant statistical differences in opioid consumption, pain scores, or rates of delirium for the cognitively impaired subgroups of both FIB and no FIB (Garlich et al., 2020). For the FNB group versus the no FNB group, the VAS pain scores of the cognitively impaired group (self-rated and proxy VAS score) were statistically significant over the 12 hours after block administration (p<0.05) (Unneby et al., 2017). Unneby et al. (2017) also found that the FNB group, especially the cognitively subgroup, consumed less opioids than the control group(p<0.001).

Opioid Consumption

Among five of the studies that looked at opioid consumption as an intervention, four articles showed statistical significance in reduction of opioid consumption from intervention use (Giradot et al., 2020; Unneby et al., 2017; Bollinger et al., 2017; Garlich et al., 2020; Zhou et al., 2019). Unneby et al. (2017) found that patients who had the FNB received significantly less oral and IV opioids than those who did not get the FNB (oral p<0.001; IV p<0.001), and this was evident in the cognitive and cognitively impaired groups. As for the cognitively impaired, FNB sub-group, there was statistical significance for a decreased amount of IV opioid use preoperatively (p<0.001) (Unneby et al., 2017). Though mean pain scores had no statistical difference, Garlich et al. (2020) found that with the FIB, the MME consumption was less preoperatively, specifically in patients with the femoral neck fracture (p<0.001). However, there were no significant differences in MME postoperatively for both cognitive and cognitively impaired groups (Garlich et al., 2020). Zhou et al. (2019) found that when observing the FONB and FICB groups, the FONB group required significantly fewer opioids postoperatively than FICB group (p= 0.031 & p=0.034).

For multimodal pain management with IV acetaminophen order set, the mean postoperative OME was significantly lower with the intervention than those without intervention (45.1 mg & 63.4 mg, respectively, p=0.03) (Giradot et al., 2020). The results also noted a percentage decrease of 22.6% from the order set before surgical intervention group when looking at the total OME and postoperative OME (Giradot et al., 2020). Bollinger et al. (2015) also found a decreased MME (41.3 vs. 28.3 mg) when comparing the group with

no scheduled intravenous acetaminophen and the group who had the IV acetaminophen.

Other Secondary Outcomes

Several of the studies looked at other secondary outcomes when evaluating pain reduction. Uysal et al. (2020) investigated the neuroinflammatory responses, interleukin-6 and -8, which are associated with delirium. After obtaining cerebral spinal fluid during the administration of spinal anesthesia, the authors found that participants who received the FNB had lower IL-8 levels but not in IL-6 (Uysal et al., (2020). Further findings indicated less delirium in the FNB group but there was no statistical significance when comparing the intervention and control groups (Uysal et al., 2020).

Zhou et al. (2019) found that nausea and vomiting were significantly lower in the FONB than the FICB groups after measuring drug-related complications. The authors also found that quality of postoperative function was greatly improved in the FONB group (Zhou et al., 2019). Garlich et al. (2020) noted no significant differences when evaluating delirium, opioid adverse effects, or length of stay when comparing the FIB and no FIB groups.

Girardot et al. (2020) also noted, with the multimodal management with acetaminophen, no statistical differences in naloxone, antiemetic, and laxative administration along with complications. However, Bollinger et al. (2015) saw that with scheduled intravenous acetaminophen, there were statistical differences in length of stay, missed physical therapy sessions, and discharge locations when compared to the group with no intervention (all outcomes $p<0.001$).

Discussion

The aim of this integrative review is to identify current pain management interventions and determine their effectiveness amongst hospitalized older adults with hip fractures. After completing a thorough process of data collection, there were six articles deemed appropriate for this review. Results showed findings that allow health care professionals to understand the various pain management interventions for hospitalized older adults with hip fractures.

Not a One-Size Fits All

This review did not explore opioid medications since the focus was to look at other non-opioid interventions. For hip fracture patients admitted to the hospital, opioid medications are the most common treatment for immediate pain relief (Sanzone, 2016). Though effective in providing rapid pain relief, opioids have several adverse effects, such as causing heavy sedation and confusion, that can prolong the recovery process and may induce several complications for patients with hip fractures (Sanzone, 2016). These adverse outcomes from opioid administration are more detrimental to older adult patients admitted with a hip fracture (Sanzone, 2016). Based on the six articles in this review, providers need to use one or more interventions that are non-opioid for hospitalized older adult patients with hip fractures to provide maximum pain relief without relying on opioid use and inducing adverse effects from pharmacological use.

MultiModal

After reviewing all six articles, the studies showed three kinds of interventions: nerve blocks, intravenous acetaminophen, and multimodal pain therapy (Zhou et al., 2019; Unneby et al, 2017; Uysal et al., 2020; Garlich et al., 2020; Bollinger et al., 2015; Giradot et al., 2020). Nerve blocks and intravenous acetaminophen were beneficial in reducing pain in the hospitalized older adults with hip

fractures (Zhou et al., 2019; Unneby et al, 2017; Uysal et al., 2020; Garlich et al., 2020; Bollinger et al., 2015). The authors from the studies in this review researched the interventions individually for their effectiveness alongside other interventions, such as opioids and non-opioid medications (Zhou et al., 2019; Unneby et al, 2017; Uysal et al., 2020; Garlich et al., 2020; Bollinger et al., 2015). With the primary studied intervention, such as the nerve block and intravenous acetaminophen, and other accompanying intervention for pain relief, such as opioid and non-opioid use, the combination of these pain interventions is known as multimodal pain management

Multimodal pain management is the preferred method when managing pain. Kehlet and Dahl (1993) found that the method of "balanced analgesics" or multimodal approach for treating postoperative pain allows different analgesics to induce a synergistic effect with a reduction of side-effects. Interventions within a multimodal approach include pharmacologic analgesics, such as opioids, nonopioids, adjuvant, nerve blocks, and neuraxial injections that can target and inhibit pain in different areas of the pain pathway (Gritsenko et al., 2014). Though opioids have the ability to immediately diminish acute pain without using additional interventions, their side-effects compromises patient recovery outcomes (Goode et al., 2019). In the past several years, providers prefer the multimodal approach due to its effectiveness in reducing pain while decreasing opioid consumption for pain relief, especially for older adults (Brooks et al., 2017). In this integrative review, one article discussed multimodal pain therapy as being effective in pain management while reducing opioid use (Giradot et al., 2020). However, all studies in this review revealed that the use of one of the interventions or more provided the best pain management for hospitalized older adults with hip fractures.

Another important element of multimodal management is that it is both patient- and procedure- specific (Barker et al., 2020). Schwenk and Mariano (2018) described multimodal management as a checklist rather than a recipe that is specific to the type of surgery being done. When analyzing the articles in this review, the researchers discussed the intervention in the context of being safe and appropriate for older adult patients with hip fractures and its effectiveness in managing pain throughout hospitalization. For instance, the administration of nerve blocks was either on admission or pre-operatively for surgical patients to control the severity of pain in the hip region (Zhou et al., 2019; Unneby et al., 2017; Uysal et al., 2020; Garlich et al., 2020). Zhou et al. (2019) discussed that some patients may not have complete pain relief from the nerve block, which requires analgesic drugs to help manage pain, such as opioids and nonopioids. Administration of intravenous acetaminophen were in all phases of care, particularly in the preoperative and postoperative phases, which allowed for better management of pain (Giradot et al., 2020; Bollinger et al., 2015).

Pain Intervention Considerations

This integrative review explored the secondary effects of pain interventions in the older adults hospitalized with hip fractures. Areas explored with intervention use included opioid consumption, nausea and vomiting, quality of postoperative function, delirium, opioid adverse effects, length of hospital stay, administration of naloxone, antiemetic, and laxative, missed physical therapy sessions and discharge locations (Zhou et al., 2019; Garlich et al., 2020; Girardot et al., 2020; Bollinger et al., 2015). Although some areas lacked statistical significances, interventions that were not of opioid origin, such as the nerve blocks, acetaminophen, and multimodal approach, were beneficial in reducing opioid consumption and minimizes adverse surgical outcomes. Shellito et al. (2021) described the use of multimodal pain management in older adult patients who undergone a surgical procedure as a way to provide high quality

and safe care since this population is prone to specific complications such as delirium and functional decline. Shellito et al. (2021) discussed that regional or neuraxial anesthetic techniques are appropriate for older adults depending on the surgical intervention, and the outcomes of these techniques include reduction of opioid use, early ambulation, maintenance of cognitive function, absence of urinary retention, hemodynamic stability, and early return of bowel function. The administration of non-opioid interventions, such as intravenous acetaminophen, can be around-the-clock without reliance of opioid doses to reduce pain (Shellito et al., 2020; Schewenk & Mariano, 2019). In addition, non-opioid interventions come with minimal side effects that do not compromise patient recovery. For example, acetaminophen does not cause gastrointestinal disturbances, helps maximize functional outcome, and has a low risk of toxicity for older adults, with the exception of those with liver impairment (Shellito et al., 2020; Bollinger et al., 2015).

Cognitive versus Non-Cognitive

When exploring the various interventions for pain management of hospitalized adults with hip fractures, the results of the integrative review indicate improved pain control for this patient population However, part of this integrative review was to see if there was significant difference between cognitive and cognitively impaired older adults in the reduction of pain level. Shellito et al. (2021) stated in their review that older adults with cognition can influence pain management. Achterberg et al. (2020) discussed that assessing and treating pain in patients with cognitive impairment is challenging and can lead to the under treatment for pain control, resulting in various behavioral symptoms, such as aggression, agitation, depression, and functional impairment. Undertreatment of pain in older adults with a hip fracture who had surgical interventions can lead to negative outcomes. The inability to adequately assess and treat pain for cognitively impaired older adults with hip fractures may result in exacerbation of pain and increased likelihood of developing complications than their cognitive counterparts.

Unneby et al. (2017) was the only study in this review that distinguished the older adult population into two subgroups. The results of this study found that patients who received a femoral nerve block had less pain and consumed less opioids than those who did not receive the block (Unneby et al., 2017). At the time of publication, Unneby et al. (2017) was the first study to use nerve blocks with cognitively impaired patients. The authors attributed the improved pain score and decreased opioid consumption from cognitively impaired patients based on the tools in the study, which several cognitively patients were able to self-report, and on the "fair" assessments by the nurses who were not blinded from the study (Unneby et al., 2017). Alcorn and Foo (2017) discussed similar ideas of adequately assessing pain using tools that address the different levels of cognitive impairment. Though there is an agreeance amongst providers to minimize opioid use due to its adverse effects, prescribing analgesic medications to this population should be similar to those who are not cognitively impaired, which is scheduled administration of analgesia and utilization of various interventions for pain management that are well tolerated for the older adult population (Alcorn & Foo, 2017).

Limitations

There were several limitations to the studies in this integrative review. A significant limitation was the research only included a narrowly focused population. The research population included individuals who were 65 years of age and older who had a hip fracture requiring surgical intervention. In addition, this integrative review focused on pharmacologic approaches for pain management. Research that explored non-pharmacological interventions for pain management in this patient population were not found in the

literature search. Though the discussion addressed pain interventions for the non-cognitive older adults with hip fractures, there was an exclusion of non-cognitive individuals in four of the articles, which resulted in not enough data to provide a clear picture about the effectiveness of the interventions between non-cognitive and cognitive patients. Since there was one primary researcher to review and analyze the literature, there was also an increased risk of bias despite using a credible appraisal tool.

Implications

The findings of this integrative review indicate the need for further research to maximize the utilization for effective pain management in older adults with hip fractures. Researchers should explore non-pharmacologic pain management for hospitalized older adults with hip fractures since there was no studies pertaining to these kinds of interventions. The information in this review a helps guide nursing practice in understanding various interventions for pain management in this patient population, which influences how nurses determine the most appropriate intervention without comprising recovery. The inclusion of older adults with cognitive impairment addresses the importance of recognition and assessment of pain in this vulnerable population. Future studies need to encompass cognitive and cognitive impaired older adults to develop tools that ensures these patient receive the most appropriate intervention.

Conclusion

The purpose of this integrative review was to explore interventions for pain management for hospitalized older adults with hip fractures. This review presented vital information to healthcare professionals about the current interventions for pain management, their effectiveness in pain control, and additional benefits for this patient population. Based on the findings of this review, reducing pain through using a multi-modal approach is the most effective and has numerous benefits, such as minimizing adverse outcomes after a surgical procedure, in treating pain of older adult hip fracture patients. Implementation of pain management interventions that do not solely focus on opioids is imperative to prevent further complications or not potentiate disability to the point of demise. Knowing the current interventions and their effectiveness for pain relief and contributing benefits enables providers to develop a better pain management plan for this patient population.

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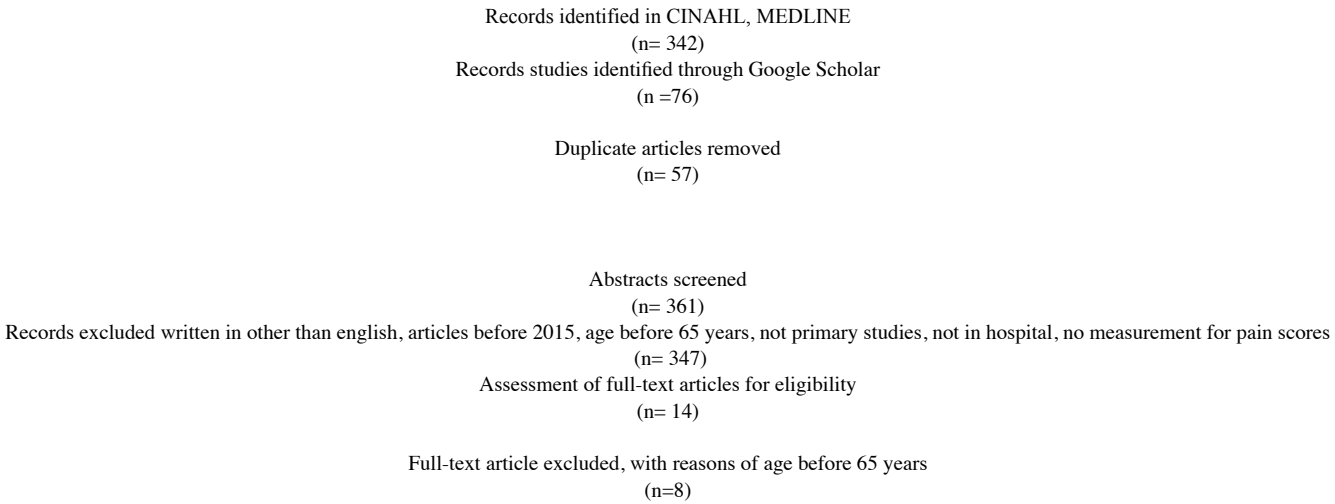
Appendix A

Figure 1



Included in integrative review
(n=6)

Records identified in CINAHL, MEDLINE
(n= 342)
Records studies identified through Google Scholar
(n =76)

Duplicate articles removed
(n= 57)

Abstracts screened
(n= 361)
Records excluded written in other than english, articles before 2015, age before 65 years, not primary studies, not in hospital, no measurement for pain scores
(n= 347)
Assessment of full-text articles for eligibility
(n= 14)

Full-text article excluded, with reasons of age before 65 years
(n=8)

Included in integrative review
(n=6)

Appendix B

Table 1- IR Matrix

Study	DOI	Aim/Sample/ Setting	Type of Pain Intervention	Measurements (what is being measured)- must indicate reduction in pain	Major Findings	Limitations	John Hopkins Rating

Garlich et al. (2020). Pain management with early regional anesthesia in geriatric hip fracture patients. *Journal of the American Geriatrics Society, 68(*9), 2043–2050.	https://doi.org/10.1111/jgs.16547	Preoperative FICB to reduce opioid consumption, pain score, delirium, and LOS; 725 patient included (92 in prospectively collected cohort); in ED on way to preop	FICB (single shot and continuous) in ED on the way to ward or preop	VAS score for pain; CAM for delirium; MME intake; ORAE	Suggesting preop analgesia necessary to improve outcomes; FICB reduce preop opioid consumption with equivalent pain control and no increase risk of complications; no difference in postop opioid consumption; FICB to placed as soon as possible; controversial with delirium; location of fracture may affect efficacy of FICB	Evaluated complications retrospectively; no sole use of single shot or continuous FICB (majority of FICB was single shot); nurses and physicians knew patients were receiving the blocks, affecting prescribing opioid patterns; no standardization of type of anesthesia	Level II B (prospective observational study)
Girardot, K., Hollister, L., Zhu, T. H., Hoeppner, S., Opoku, D., Heisler, J., & Bane, T. (2020). Effectiveness of multimodal pain therapy on reducing opioid use in surgical geriatric hip fracture patients. *Journal of Trauma nursing: The Official journal of the Society of Trauma Nurses*, *27*(4), 207–215.	https://doi.org/10.1097/JTN.0000000000000516	Multimodal therapy (new order set) could decrease opioid use without increasing pain scores in surgical geriatric hip fracture patients; age > or = 65 years; 248 patients (131 preorder set 117 postop order set); In-hospital setting	Multi-modal approach (initiation of acetaminophen)	OME; average pain score measurements postoperatively compared to preoperatively (admitted) pain score	Oral and IV Acetaminophen effective in minimizing opioid use postop ; IV expensive to place in order set; decrease in opioid use from multimodal orderset but did not increase pain; Obesity, chronic anticoagulation, or three or more comorbidities may contribute to increase opioid consumption	Not randomized patients (convenience sample); pain scores from medical record, not from patient; limitations to order sets	Level V B (Cohort Study)

Uysal, A. İ., Altıparmak, B., Yaşar, E., Turan, M., Canbek, U., Yılmaz, N., & Gümüş Demirbilek, S. (2020). The effects of early femoral nerve block intervention on preoperative pain management and incidence of postoperative delirium geriatric patients undergoing trochanteric femur fracture surgery: A randomized controlled trial. *Turkish Journal of Trauma & Emergency Surgery, 26*(1), 109–114.	https://doi.org/10.14744/tjtes.2019.78002.	Patients over 65 years of age admitted to the Emergency Department due to trochanteric femur fracture were included in this study (110 patients- 55 treatment with paracetamol and 55 for FNOB block actual patients 45 and 46 respectively); Emergency in hospital and then admitted for surgery	FONB vs Parecetamol	VAS scores; delerium with interleukin levels (ILL)	FONB to help with preoperative pain than paracetamol; no differences in postop delirium	relation to delirium (cytokine levels (neuroinflammatory response) and delirium) influences in ILL-7 and 8	Level I A (randomized controls)

Bollinger, A. J., Butler, P. D., Nies, M. S., Sietsema, D. L., Jones, C. B., & Endres, T. J. (2015). Is scheduled intravenous acetaminophen effective in the pain management protocol of geriatric hip fractures?. *Geriatric Orthopaedic Surgery & Rehabilitation*, *6*(3), 202–208.	https://doi.org/10.1177/2151458515588560	Greater or equal age 65 years; group 1 (1 year before acetaminophen) and group 2 (1 year after acetaminophen)	scheduled acetaminophen IV in protocol for geriatric patients	LOS, mean pain score (VAS), narcotic usage, missed PT sessions, likelihood of discharge home	Group 2 showed decreased LOS, Pain score, narcotic use, bowel motility agents, missed PT compared to group 1	retrospective; process of geriatric hip fracture program	Level V A (retrospective review)
Unneby, A., Svensson, O., Gustafson, Y., & Olofsson, B. (2017). Femoral nerve block in a representative sample of elderly people with hip fracture: A randomised controlled trial. *Injury*, *48*(7), 1542–1549.	http://dx.doi.org/10.1016/j.injury.2017.04.043	patients aged 70 years and older with hip fracture (trochanteric and cervical), including those with dementia; Orthopedic ward; given intervention (129) versus control (137)	FONB	VAS pain score; opioid use	Elderly patients including those with dementia reduced pain preoperatively and required less opioids	nurses not blinded to treatment allocation; nurses not performing VAS assessments prior to study (only for this study)	Level I B (randomized control)

Zhou, Y., Zhang, W.-C., Chong, H., Xi, Y., Zheng, S.-Q., Wang, G., & Wu, X.-B. (2019). A prospective study to compare analgesia from femoral obturator nerve block with fascia iliaca compartment block for acute preoperative pain in elderly patients with hip fracture. *Medical Science Monitor : International Medical Journal of Experimental and Clinical Research, 25*, 8562–8570.	https://doi.org/10.12659/MSM.915289	compare FONB with FICB in the management of acute preoperative pain in elderly patients with hip fracture.; in hospital; Beijing; Patients 365 years (n=154) diagnosed with hip fracture who had surgery within 48 hours of hospital admission included two groups who received ultrasound-guided nerve block, the FONB group (n=77), and the FICB group (n=77).	FONB and FICB	tools of comparison between FICB vs FONB blocks (VAS pain score; analgesic drug requirement; postop complications; rehabilitation; nursing care requirements after hospitalization)	FONB and FICB blocks significantly reduced pain but FONB improved analgesia with reduced need for analgesic drugs	small sample size; anesthetist could not be blinded to which blocks given (resulting in bias)	Level III B (prospective, double blinded controlled study)

Table 1 Acronyms

Confusion Assessment Method (CAM)
Fascia Iliaca Block (FICB or FIB)
Fascia Obturator Nerve Block (FONB)
Femoral Nerve Block (FNB)
Emergency Department (ED)
Intravenous (IV)
Length of Stay (LOS)
Morphine Milligram Equivalents (MME)
Opioid-Related Adverse Events (ORAE)
Oral Morphine Equivalent (OME)
Physical Therapy (PT)
Preoperative (Preop)
Postoperative (Postop)
Visual Analog Scale (VAS)

Appendix C

Table 2- Coding Sheet

Article	Type of Pain Management Intervention	Population: Cognitive impairment or Non-cognitive impairment	Phase of Care when receiving intervention	Measurement for effectiveness of intervention	Pain Results	Contributing to pain results	Other Results	Contributing to other results	Considerations for using intervention	Summary
Bollinger, A. J., Butler, P. D., Nies, M. S., Sietsema, D. L., Jones, C. B., & Endres, T. J. (2015). Is scheduled intravenous acetaminophen effective in the pain management protocol of geriatric hip fractures?. Geriatric Orthopaedic	Intravenous acetaminophen in pain management protocol (Group 2- IV acetaminophen 1000 mg Q 8 hrs for min of 24 hours from time of admission or until taken to surgery if greater than 24 hours; can have IV pain med for break through and can transition to PO acetaminophen); Group 1 PO or IV	No distinguishing mentioned in population sample between cognitive impairment and non	(given from admission until surgery and then post op)- pain measured admission, post op (6 and 24 hours), and before discharge	Pain score (visual analogue with word descriptors)	No statistical significance in total use of acetaminophen in both groups, but significance in route. Group 2 used more IV route than oral while Group 1 used more oral than IV; Mean pain score between the 2 groups showed statistic significance,	Pain score affected by age (younger age)	LOS, total narcotic usage, PT sessions missed, discharge location, Adverse effects; Statistical significance shown in LOS narcotic use using the (OME), daily narcotic use, missed PT sessions, and discharge location (more to	LOS- early surgery and increased use of narcotics; Narcotic use- age (younger age- increase use), time to OR, and BMI (increased BMI); discharge home than facility- age (younger),	IV acetaminophen has high cost than PO acetaminophen and narcotics (PO and IV) at this institution; Narcotic use contributes to slower gastric absorption and emptying which may relate as to why PO acetaminophen is absorbed more slowly; IV acetaminophen more	IV acetaminophen is effective in a pain management protocol. Besides bowel motility and antiemetic agents used, the outcome variables by treatment group showed statistical significance that was consistent with IV acetaminophen use. (Reduction in pain, LOS, narcotic use, missed PT sessions and dc to

Orthopaedic Surgery & Rehabilitation, 6(3), 202–208.	acetaminophen 1000 mg PRN Q8 plus oral narcotics trama dol 50 mg Q6 and/or oxycodone 5-10 mg Q4 hrs and IV morphine 2-4 mg Q2hrs)				where group 2 had a lower mean pain score; correlation between more IV acetaminophen use and reduction in pain		home); Also evident that IV acetaminophen played a part in influencing these variables	male sex, time to OR, and decreased narcotic use	effective because it does not have to pass through the GI system and can reach peak plasma concentration earlier than PO acetaminophen	home.). Though IV acetaminophen is associated with higher cost, there are many benefits utilizing this type of pain intervention for pain management of older adults with hip fractures.

Garlich, J. M., Pujari, A., Moak, Z., Debbi, E., Yalamanchili, R., Stephenson, S., Stephan, S., Polakof, L., Little, M., Moon, C., Anand, K., & Lin, C. A. (2020). Pain management with early regional anesthesia in geriatric hip fracture patients. Journal of the American Geriatrics Society, 68(9), 2043–2050.	FIB- single shot and continuous depending on anesthesia team	65 years or older w/ hip fx (dementia not excluded if caregiver could give consent for block)	placed in ED and on ward	pain score (VAS) (0-10), every 4-6 hours, mean pain scores; MME; CAM (once per shift); ORAE included	Post op pain higher in FIB than no FIB (POD 1 and 2) ; not much statistical difference in pain scores for Dementia	explained nurses entering score; fx location affecting pain level and efficacy of FIB; anesthesia team determined FIB continuous versus single shot (single shot amount of analgesia effect varies); Most patients received single shot	LOS; delirium; opioid consumption ;Patients who received FIB consumed less opioids by 40% preoperatively; Post op not much difference; not much difference in delirium, ORAE, or LOS; for dementia not much statistical difference; Between difference fx, less MME in femoral neck preoperatively; In intertrochanteric statistical significance in postop day 1 and 2 in mean pain scores	opioid prescribing patterns at the time when FIB administered (giving less opioids with FIB versus actual consumption and asking); nurses and physicians aware which patients received block leading to prescribing patterns	Single shot vs continuous shot; location of fracture when receiving block and its effect on efficacy	Pain control was adequate with FIB and does decrease in opioid use. However findings in the study were lacking. no statistical differences in other findings; inclusion of dementia patients with no statistical difference in pain scores and MME consumption ; difference in fx affected opioid consumption (ex. those with FIB and fem neck consumed less opioids); Does fx location matter in pain severity?
										Using multimodal

Girardot, K., Hollister, L., Zhu, T. H., Hoeppner, S., Opoku, D., Heisler, J., & Bane, T. (2020). Effectiveness of multimodal pain therapy on reducing opioid use in surgical geriatric hip fracture patients. Journal of Trauma nursing: The Official journal of the Society of Trauma Nurses, 27(4), 207–215.	Multimodal: 1,000 mg acetaminophen included in geriatric fracture order set with opioids and oral acetaminophen	No distinguishing mentioned in population sample between cognitive impairment and non-	Emergency department; preop (1x dose of acetaminophen IV 1,000 mg); periop; and postop (up to 3x postoperatively- oral or IV); All areas evaluated effectiveness but intervention received in preop and postop	Pain scores retrieved from Epic (mean scores of admitting score, postop: 6hr, 24hr, 48 hr); opioid amount (OME)	mean pain score reduced in post order set at 6 and 24 hr but not significant; At 48 hr, no difference of pain score	Patients taking oral acetaminophen at 48 hour mark; Intravenous higher peak concentration and faster than acetaminophen	Opioid amount-decrease OME score contributed to more pain relief	admitting pain, score, age, BMI, and chronic anticoagulation therapy	IV acetaminophen higher cost	is effective in reducing opioid use; other contributing factors related to increased opioid use such as increase age, increased BMI, increased pain preoperatively, and specifically post-op, chronic anticoagulation increases pain due to bruising or trauma to tissue; pain was managed but did not show statistical difference in the mean pain scores; mean score at post op 6 hr and 24 hr showed reduction of pain score against admitting score
										FNB

Unneby, A., Svensson, O., Gustafson, Y., & Olofsson, B. (2017). Femoral nerve block in a representative sample of elderly people with hip fracture: A randomised controlled trial. Injury, 48(7), 1542–1549.	FNB- for older adults (both cognitive or cognitive impairment/ dementia	Both populations studied due to increase in older patients with dementia; 70 yrs or older and includes cognitive impairment and dementia	Admitted to Ortho ward and administration of block prior to surgical intervention	Pain level assessed by nurse on VAS (10 cm), with self-reported and proxy (unable to selfrate pain- based on expressions and behaviours related to pain); other measurements- preoperative opioid consumption (in ambulance, ED, and ortho ward) measured in mg	Between intervention and control group- statistical significance in pain reduction for self-rated (baseline to 12 hour- all time points); for proxy- statistical significance in time points at 6 hr and 12 hr	*Note further analysis which included patients who could report at all time points; proxies included nurses and not all patients who could not report pain had cognitive impairment or dementia	No significant difference in opioid use (IV or PO) in ambulance or ED; Statistical significance in IV and oral for intervention group (significantly receiving less in control group); For dementia- intervention received less prop IV opioid in ward than control group	Nurses as proxies and assessing pain (no observational or behavioral scale used- transferred to VAS scoring); Nurses not blinded to study which may affect amou;nt of opioids given to patient; how pain was reported by patients between both populations studied; time of surgery	Use of second block if surgery time is longer than expected (continuous block with catheter) but would require more resources and time; administering block earlier (in ambulance or ED); block use was routine in hospital but adds benefit for pain relief asides opioid use	significantly reduces pain and opioid use (IV and PO) in the older adult population prior to surgery; measurements of pain using VAS for both populations (proxy included visitor or nurse for patients who were cognitively impaired or had dementia); study included cognitively impaired or had dementia due to the increase of these patients in the older adult population; However; study does not look at efficacy of block postoperativ

										ely, only door to surgery with block given in between that time and as soon as patient was admitted in the ward;

Uysal, A. İ., Altıparmak, B., Yaşar, E., Turan, M., Canbek, U., Yılmaz, N., & Gümüş Demirbilek, S. (2020). The effects of early femoral nerve block intervention on preoperative pain management and incidence of postoperative delirium geriatric patients undergoing trochanteric femur fracture surgery: A randomized controlled trial. Turkish Journal of Trauma & Emergency Surgery : TJTES, 26(1), 109–114.	preoperative FNB on trochanteric femur fracture vs preoperative paracetamol	Older adults 65 yrs or older; no distinguishing between groups (did exclude patients with dementia prior)	Both performed in emergency room; Paracetamol tx repeated Q8 in surgical ward; Fem nerve cath bupivacaine Q8 in another group on sx ward (if analgesic not improved, given tramadol IV in both groups)	Pain level assessed by 100-mmVAS and recorded at 4th hour after initial pain tx; Other measurement was IL CSF fluid and post op delirium for 3 days	statistical significance in group 1 at 4th hour preop and position . No need for preoperative rescue analgesic need; Grp one showing need for preop rescue analgesic; No significant changes in pain in postoperative period between the two groups	Not much stated on what affected pain scores; possible with delirium but not sure	Delirium showed less in 2nd group than 1st (5:9); IL (neuro inflammatory response that affects delirium?); IL8 lower in 2nd group than 1st group. The mean of IL8 for delirium group was slightly lower. For IL6 between both groups was similar	If effective pain control as early as possible maintained; "delirium prevention program" in the hospital system'; For IL, affected by effected pain management , in this case the FNOB, but there may be other external / internal factors that may affect this and erythrocyte transfusion	helps with severe pain preoperatively; pain may not be from hip joint (after sx pain is from the soft tissue , which IV analgesic may not be able to help with the pain so much); use of FNOB block helps decrease opioid use; preoperative cognitive function	FNB effective with preoperative pain control than paracetamol (no rescue analgesic and lower pain scores with positioning and in 4 hour). Not much statistical significance in delirium between both groups though group 2 had less patients showing delirium. Also IL8 significant in group 1 than group 2 but not much different in IL 6. (not enough data still to say that IL increases with delirium)
										FONB and FICB are effective blocks.

Zhou, Y., Zhang, W.-C., Chong, H., Xi, Y., Zheng, S.-Q., Wang, G., & Wu, X.-B. (2019). A prospective study to compare analgesia from femoral obturator nerve block with fascia iliaca compartment block for acute preoperative pain in elderly patients with hip fracture. Medical Science Monitor : International Medical Journal of	Femoral nerve obturator nerve block (FNOB) vs Fascia iliaca compartment block (FICB); other analgesics used to help with pain; focus on block effectiveness	No distinguishing mentioned in population sample between cognitive impairment and non-cognitive impairment	Received preoperatively; postoperative pain also managed by oral pain medications and pethidine hydrochloride IM	VAS score (pain at rest and passive leg motion before and after nerve block administration, and first and second morning after admission)	Significant difference in VAS scores in the FONB vs FICB- mostly in 30 min after block and first day after admission; no statistical difference after second day between blocks; However, no statistical difference between 30 min and first day of rest VAS	Block administration went well for both groups	Study also looked at VS, Nursing quality, sleep rhythm and quality, angiography studies, cerebral function, any complications associated, rehability ation data. No much statistical difference between versus between two groups; increased use of oral pain meds in FICB group and increase nausea and vertigo in FICB; Not much statistical	Rehabilitation- depended on patient (some info could not be obtained however focus of study is about preoperative pain management rather than rehabilitation)	anatomy of obturator nerve and positioning of needle when administering anesthesia resulting in efficacy of analgesic	Patients with hip fractures benefit from having a block rather than not having one at all. There are other adverse effects from the other pain management methods. FONB is a block that helps with pain relief by blocking the obturator nerve, the nerve responsible for a lot of the pain. FICB is the standard block, but only mostly covers pain in certain areas of the hip region, not particularly the obturator nerve. The study showed that FONB is more effective in

Experimental and Clinical Research, 25, 8562–8570.							difference in other areas that were looked at			management pain after 30 minutes and after day 1 admission. FONB also resulted in less nausea, vertigo, other pain medications, and nursing quality indicated patients were more likely to turn and sit up as opposed to the FICB.

Table 2 Abbreviations and Acronyms
Body Mass Index (BMI)
Confusion Assessment Method (CAM)
Fascia Iliaca Block (FICB or FIB)
Fascia Obturator Nerve Block (FONB)

Table 2 Abbreviations and Acronyms Continued
Femoral Nerve Block (FNB)
Fracture (fx)
Emergency Department (ED)
Intramuscular (IM)
Intravenous (IV)
Length of Stay (LOS)
Morphine Milligram Equivalents (MME)
Opioid-Related Adverse Events (ORAE)
Operating Room (OR)
Oral Morphine Equivalent (OME)
Hour (hr)
Every hour (Q#)
Physical Therapy (PT)
Preoperative (Preop)
Postoperative (Postop)

As needed (PRN)
Oral (PO)
Visual Analog Scale (VAS)
Vital Signs (VS)