Management of femoral fractures and the main complications: a systematic review

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Guilherme Terra Maia[1], João Paulo Martins Porto e Silva[2], Laura Maria Pereira Bonetti[3], Lavínia Caroline Bastos Garcia[4] and Claudio Ortiz Silveira[5]

ABSTRACT

Objective: The general objective of the present study is to analyze the scientific literature on hip fractures in the elderly, seeking to identify the main risk factors, surgical treatment options and their complications, as well as long-term functional outcomes. Methodology: This is a systematic review focused on understanding the main aspects of the management of femoral neck fractures in the elderly. The research was guided by the question: "What is the best way to manage femoral neck fractures?". To find answers, searches were performed in the PubMed database using three descriptors combined with the Boolean term "AND". This resulted in 115 articles. 27 articles were selected for analysis and 19 articles used to compose the collection. The searches used were: (Femoral Neck Fractures) AND (Surgical Procedures, Operative) AND (Orthopedic Procedures); (Femoral Neck Fractures) AND (Postoperative Care); (Femoral Neck Fractures) AND (Intraoperative Complications). Results: Hemiarthroplasty and total hip arthroplasty (THA) are viable options, each with its advantages and disadvantages. Internal fixation with cannulated screws has a high complication rate, while the femoral neck fixation system shows promising results. The choice between cemented and uncemented prostheses continues to be debated. Conclusion: The choice of treatment should be individualized, considering factors such as age, comorbidities, and type of fracture. Early interventions are crucial to minimize complications and improve functional outcomes.

Keywords: Femoral Fracture, Management, Complications.

[1] Physician from the Federal University of Mato Grosso do Sul
E-mail: drguilherme.maia@hotmail.com
[2] Medical Student at Universidade de Franca (UNIFRAN) - Franca/ SP
[3] Medical Student at Universidade de Franca (UNIFRAN) - Franca/ SP
[4] Medical Student at Universidade de Franca (UNIFRAN) - Franca/ SP
[5] Physician from the Federal University of Uberlândia - Uberlândia / MG; postgraduate degree in Orthopedics and Traumatology
Full Member of the Brazilian Society of Orthopedics and Traumatology

INTRODUCTION

Hip fractures are one of the most frequent injuries in the elderly. The one-year mortality rate varies between 14% and 36%. In 2000, there were more than 1.6 million hip fractures worldwide, representing 20% of all fractures in people over 50 years of age. It is estimated that the total number of annual fractures will reach 4.5 million by 2050 (FILIPPINI et al., 2023). Hip fractures are common in the elderly and cause high morbidity and mortality. In the U.S., between 250,000 and 310,000 hip fractures occur per year, with a forecast to increase to 500,000 between 2040 and 2050. Globally, it is estimated that between 4.5 and 6.3 million hip fractures have been injured. Most fractures occur in women (75%) and in people over the age of 80 (62%) (LIU et al., 2020).

Hip fractures are among the typical fragility fractures in geriatric patients, and more than 90% are caused by low-energy trauma (i.e., falls from one's own height). Known risk factors include osteoporosis, older age, female gender, smoking, and low body mass index (BMI). Frailty describes a state of greater vulnerability to stressors, mainly due to lack of resources. Even minor infections such as a urinary tract infection or minor surgery can result in a marked and disproportionate deterioration in the individual's health status, due to poor resolution of homeostasis. Proximal femoral fracture (PFF) in frail patients is associated with a pronounced risk of cardiovascular, pulmonary, thrombotic, infectious, or hemorrhagic complications, with additional surgical delay increasing the risk of mortality (SCHWARZ et al., 2022).

Low-energy falls, which become more frequent with age, are the main cause of hip fractures. During these falls, compressive stress is applied to the superolateral cortical bone of the femoral neck, and is considered the main mechanism of PFF injury. Osteoporosis, loss of dense trabecular networks, an enlarged diameter, and a thinner cortex of the femoral neck increase susceptibility to buckling (SCHWARZ et al., 2022). Although the cortical bone in the proximal femur is primarily responsible for all bone strength, the cancellous bone still contributes about 10% to the total force in support and 35% during a lateral fall. The trauma mechanism of femoral neck fractures can be direct, for example, falling on the greater trochanter or forced external rotation of the leg, or indirect, if the muscle forces overcome the internal force of the femur. As the femoral neck is intracapsular and therefore not covered by the periosteum, periosteal bone apposition is unable to compensate for cortical thinning caused by endosteal resorption (JIANG et al., 2023).

Typically, proximal femoral fractures occur in older people as a result of falling from standing. In younger patients, these fractures often result from high-energy trauma, such as car accidents (REDDY et al., 2023). In the United Kingdom, the latest report from the National Hip Fracture (NHFD) database reveals that 91.6% of hip fractures occur in patients over 70 years of age and 72% of these are female, reflecting the increasing likelihood of falls in those over 65 years of age. On examination, patients report hip pain and inability to bear weight, with the affected leg

shortened and externally rotated. Plain radiographs are adequate for the diagnosis, but when apparently normal, with clinical signs and symptoms suggestive of hip fracture, magnetic resonance imaging (MRI) or computed tomography (CT) may be indicated, in the so-called "occult hip" (MAFFULLI; AICALE, 2022).

Femoral neck fractures can be divided into intracapsular and extracapsular, respectively, inside or outside the hip joint capsule, reflecting the interruption of the blood supply to the femoral head and guiding the decision process whether the patient will undergo hemiarthroplasty or internal fixation. And the choice of which construction to use to stabilize extracapsular fractures is made between intramedullary fixation with a nail or extramedullary fixation with a sliding hip screw. Generally, patients will undergo surgery, obtaining benefits from early fixation/replacement, such as rapid postoperative mobilization, and avoiding the poor outcomes and risks associated with long-term immobilization of nonoperative treatment (MAFFULLI; AICALE, 2022).

Intracapsular fractures are commonly divided into subcapital, mid-cervical and basic-cervical; especially in the elderly, middle cervical fractures are the most common type, accounting for more than 86% of intracapsular fractures (MAFFULLI; AICALE, 2022). The three most commonly used classifications for femoral neck fractures are: Garden, Pauwels and AO classification. The Garden classification is composed of four types: type I describes an incomplete or impacted fracture; type II is a complete fracture without displacement; type III is complete fracture with partial displacement; and type IV is a complete fracture with total displacement. Fracture displacement correlates with interruption of vascular supply, therefore, Garden's classification relates the risk of femoral head necrosis (MAFFULLI; AICALE, 2022) (SCHWARZ et al., 2022) (FU et al., 2023).

The Pauwels classification focuses on the biomechanical forces that add pressure to the fracture line. Type I describes a dominant compressive force, with a fracture line of up to 30° in relation to the horizontal plane. In type II, shear stress is present; The fracture line is between 30° and 50°. Shear stress has a possible negative impact on bone healing. In the third type, with a fracture line above 50°, the shear stress predominates, leading to fracture displacement (SCHWARZ et al., 2022). The AO classification combines the fracture level, the degree of displacement, and the angle of the fracture line, this classification places greater importance on lateral wall integrity, which can play an important role in decision-making and has been identified as an important prognostic factor for predicting mechanical failure after surgery (SCHWARZ et al., 2022). For displaced fractures, hip arthroplasty is usually recommended. However, for non-displaced fractures, percutaneous fixation with cannulated screws is a common option, although associated with an elevated risk of complications such as necrosis of the femoral head and pseudoarthrosis (LIU et al., 2020).

The objective of this systematic review is to analyze the scientific literature on femoral neck fractures in the elderly, seeking to identify the main risk factors, surgical treatment options and their complications, as well as long-term functional outcomes. The rationale for conducting this systematic review lies in the high prevalence and significant impact of femoral neck fractures in the elderly, which are associated with high morbidity and mortality. Understanding risk factors and best practices for surgical management is crucial to improving clinical outcomes and quality of life for patients. In addition, the review aims to provide an updated evidence base to guide clinical practice and assist in therapeutic decision-making, considering the diversity of treatment options and their respective complications.

METHODOLOGY

This is a systematic review that seeks to understand the main aspects of femoral neck fractures in the elderly, as well as to demonstrate the main complications associated with the condition. For the development of this research, a guiding question was elaborated through the PVO strategy (population, variable and objective): "What is the best way to manage femoral neck fractures?".

The searches were carried out through searches in the PubMed database. Three descriptors were used in combination with the Boolean term "AND": Femoral Neck Fractures, Surgical Procedures, Operative, Orthopedic Procedures; Femoral Neck Fractures, Postoperative Care; Femoral Neck Fractures, Intraoperative Complications. The search strategy used in the PubMed database was: (Femoral Neck Fractures) AND (Surgical Procedures, Operative) AND (Orthopedic Procedures); (Femoral Neck Fractures) AND (Postoperative Care); (Femoral Neck Fractures) AND (Intraoperative Complications). From this search, 115 articles were found, which were subsequently submitted to the selection criteria.

The inclusion criteria were: articles in English, Portuguese and Spanish; published in the period from 2019 to 2024 and that addressed the themes proposed for this research, in addition, review, observational and experimental studies, made available in full. The exclusion criteria were: duplicate articles, available in the form of abstracts, that did not directly address the proposal studied and that did not meet the other inclusion criteria.

After associating the descriptors used in the searched databases, a total of 115 articles were found. After applying the inclusion and exclusion criteria, 27 articles were selected from the PubMed database, and a total of X studies were used to compose the collection.

DISCUSSION

In this systematic review, we compared the long-term clinical outcomes between cannulated screw fixation and bipolar hemiarthroplasty in elderly patients with non-displaced femoral neck fractures. The results indicated that screw fixation had a significantly higher incidence of reoperations and implant-related complications. Although screw fixation has shorter operative time and blood loss, there was no significant difference in long-term mortality between the two treatments (LIU et al., 2020). Hemiarthroplasty had a lower rate of implant-related complications, a lower rate of reoperation, and better hip function in the immediate postoperative period. Additional studies found that hemiarthroplasty did not increase long-term mortality and provided better hip function in the early postoperative stage. However, the cost-effectiveness between the two treatments is still controversial, with some studies suggesting that hemiarthroplasty may be more cost-effective in the long term due to lower rehabilitation and reoperation costs (LIU et al., 2020).

Bipolar hemiarthroplasty seems to be a superior alternative for the treatment of non-displaced femoral neck fractures in elderly patients, providing a lower incidence of reoperations and implant-related complications, as well as better hip function in the immediate postoperative period. Although fixation with cannulated screws has some advantages, such as shorter operative time and blood loss, the risks associated with complications and reoperations are significantly higher. More research is needed to validate these results and determine the long-term cost-benefit ratio between the two treatments (LIU et al., 2020).

Hip replacement can significantly reduce postoperative pain and allow for early weight-bearing walking, which is essential for muscle recovery and overall health. Hemiarthroplasty has less surgical trauma, less blood loss, simpler operation and high surgical safety, while total hip arthroplasty (AQT), despite having a higher surgical risk, is becoming safer with technological advances, therefore, it is advantageous in reducing blood loss and surgery time, while THA is preferable to reduce the length of hospital stay and the incidence of pneumonia and renal failure (MAFFULLI; AICALE, 2022) (LIU et al., 2020).

The results indicated that total hip arthroplasty (THA) offers advantages in terms of less erosion of the acetabulum, better total Harris Hip Score (HHS) and lower pain, as well as a better quality of life as measured by the EQ-5D index. However, THA was also associated with a longer operative time and a higher rate of dislocation in the first six months after surgery. These findings are consistent with previous studies suggesting that THA may provide superior hip function, but with an increased risk of early complications (PENG et al., 2020). On the other hand, AH had lower rates of overall complications and a shorter length of hospital stay, which may be beneficial for patients with lower surgical tolerance. The reoperation rate showed no significant difference between the two groups, which suggests that both procedures are viable in the long term (PENG et al., 2020).

The higher dislocation rate observed in the THA group can be attributed to the higher activity level of the patients undergoing this procedure. However, the absence of dislocations after five years of follow-up suggests that the risk of displacement decreases over time, possibly due to reduced physical activity in older patients. Therefore, both THA and AH are viable options for the treatment of hip fractures in active older adults. THA may be preferred for patients seeking improved hip function and long-term quality of life, while AH may be more suitable for those with higher surgical risk and lower physical demand (PENG et al., 2020).

The choice of surgical method should consider the patient's age, the presence of osteoporosis, the type of fracture, the preoperative situation, and the needs of the patient and their family (FU et al., 2023). Femoral neck fractures can be treated with osteosynthesis, total hip arthroplasty, or hemiarthroplasty. In patients with more than one comorbidity over 70 years of age, there is an 83% risk of fractures, secondary dislocations when treated conservatively, making surgery the treatment of choice for elderly patients. When choosing the implant, two main aspects need to be remembered: older patients are less likely to follow load restrictions, while, on the other hand, the indication for osteosynthesis needs to be carefully evaluated (SCHWARZ et al., 2022).

Elderly patients with unstable femoral neck fractures (Garden III and IV) face various complications, such as pulmonary embolism, pneumonia, lower limb thrombosis, bone nonunion, and urinary infections. Conservative treatment can lead to poor fracture healing, high rate of vicious fracture, and ischemic necrosis of the femoral head, often necessitating hip replacement later (FU et al., 2023). Often, the fracture represents a life-changing event, depriving patients of their already potentially impaired self-sustainability. Within 1 year after a hip fracture, only 40-60% of elderly patients regain the pre-fracture level of mobility and the ability to perform activities of daily living (SCHWARZ et al., 2022).

Surgical management should occur within the first 24 hours, beyond which there is a higher chance of perioperative complications (i.e., pulmonary embolism, pneumonia, DVT, urinary tract infections). In case of delayed surgery for more than 48 hours, mortality can increase significantly, however, if surgery is performed within 48 hours, a 20% lower risk of death has been reported during the next year. Treatment should aim to return patients to previous levels of activities of daily living and total weight bearing. Management depends on the different types of hip fracture, based on the vascular anatomy of the proximal femur and the different chances of bone healing and future complications (MAFFULLI; AICALE, 2022).

By biomechanical aspects, according to the Pauwels classification, any femoral neck fracture classified as type I or II is an indication of internal fixation. Due to the blood supply of the femoral head, femoral neck fractures classified as Garden type III and IV are not, in most cases, suitable for osteosynthesis. Dislocated femoral neck fractures are related to a high incidence of disruption of

blood supply to the femoral head and are therefore predisposed to fixation failure. Existing osteoporosis and age-related changes in bone structure may lead to an increased risk of nonunions in elderly patients. Osteosynthesis is suggested in biologically young patients with non-dislocated fractures or as a salvage option if the patient is bedridden (SCHWARZ et al., 2022).

Femoral neck fractures (FNFs) account for about 50% of hip fractures and usually require surgery, as conservative treatment tends to have poor outcomes. Since the 1960s, fixation with multiple cannulated screws has been a common technique (HOLLENSTEINER et al., 2019). Intertrochanteric fractures and non-displaced fractures of the femoral neck are usually treated with fixation, while displaced fractures of the femoral neck often require joint replacement, either by hemiarthroplasty or total hip arthroplasty. The choice between hemiarthroplasty and total hip arthroplasty depends on several factors, including the patient's life expectancy.

Total hip arthroplasty is a more complex and expensive procedure with a higher risk of postoperative dislocation, but it offers better function and long-term longevity. In contrast, hemiarthroplasty is less complex and may be more suitable for patients with shorter life expectancy. In one of the studies evaluated, a systematic review revealed that only 43 studies reported survival rates of at least two years after surgical intervention for hip fracture in patients aged 65 years and older. Of these, 12 studies reported survival rates for at least five years. Most of the studies were conducted in Europe, with a pooled population of approximately 200,000 patients. Age and sex were the most frequently reported variables, but other variables such as nutritional status and social support were underreported (MIEDICO et al., 2023).

Hemiarthroplasty offers benefits such as shorter surgical time and lower incidence of dislocations. However, in young patients, there is a high rate of acetabular erosion, often requiring conversion to total hip arthroplasty (THA) due to secondary osteoarthritis. A multicenter randomized controlled trial compared displaced femoral neck fractures treated with THA or hemiarthroplasty, finding that, although there was no difference in the incidence of secondary interventions, THA had a better WOMAC score (MAFFULLI; AICALE, 2022). Hemiarthroplasty is commonly used to treat femoral neck fractures, improving postoperative hip function. There is, however, debate about the use of cemented versus uncemented prostheses. Some studies indicate that cemented prostheses are superior in restoring joint function, while others find no significant difference between the two types. Regarding postoperative complications, the incidence of implant-related problems, such as periprosthetic fractures and prosthesis loosening, is higher in the cementless group, although the occurrence of common complications is similar between the groups. (MAFFULLI; AICALE, 2022) (EHLINGER et al., 2020).

Total hip arthroplasty (THA) is indicated for patients with high levels of pre-injury activity, able to walk independently, without cognitive impairment, and clinically fit for a longer operation. In

young, active patients, THA remains the implant of choice due to optimal outcomes and lower long-term reoperation rate. For patients at high risk and adequate bone quality, an uncemented femoral component is recommended to reduce the risks of cement implantation syndrome during surgery. On the other hand, hemiarthroplasty is a viable option for the treatment of femoral neck fractures in elderly patients, presenting a lower dislocation rate compared to THA, due to the simpler learning curve and less complexity of the procedure. The choice between cemented and cementless hemiarthroplasty continues to be a topic of debate (MAFFULLI; AICALE, 2022) (XU et al., 2019) (ZHOU et al., 2023). The main complications associated with total hip arthroplasty include a higher risk of periprosthetic femoral fracture in patients over 60 years of age with cementless nails compared to cemented nails. In addition, THA may be associated with a higher rate of dislocation, which is related to component positioning, surgeon experience, and soft tissue tension. In elderly patients, factors such as sarcopenia, loss of proprioception, and increased risk of falls need to be considered (XU et al., 2019).

In the case of hemiarthroplasty, the use of bone cement can cause cardiorespiratory and hemodynamic reactions, which, although rare, can be fatal, especially in older patients with comorbidities and general frailty. Studies show that mortality within 48 hours after hip hemiarthroplasty is higher in patients treated with cemented implants compared to uncemented implants (ZHOU et al., 2023) (XU et al., 2019).

In terms of mortality, hemiarthroplasty in one of the studies showed a higher rate, possibly due to the higher average age of patients who received this treatment. The age difference between the groups may have introduced a selection bias, influencing the results. In addition, the surgeon's experience and surgical approach may also have contributed to this difference. In that same study, the reoperation rate showed no significant difference between the two groups at the one-year follow-up. This suggests that both treatments are equally effective in terms of the need for reoperations. However, hemiarthroplasty had a lower risk of hip instability, while THA was associated with a higher incidence of revisions due to dislocations (XU et al., 2019). Regarding infection and thromboembolic events, there was no significant difference between the two approaches mentioned above. Factors such as age, gender, high body mass index, and preoperative health conditions have been identified as influencing the risk of infection and thromboembolism, regardless of the type of treatment. These findings suggest that the choice of treatment should be individualized, taking into account the patient's age, the surgeon's experience, and preoperative health conditions (XU et al., 2019).

Considerable research has found that perioperative mortality was higher in patients with femoral neck fractures treated with cemented prostheses versus those who received uncemented implants. Although we cannot prove a cause-and-effect relationship due to the observational nature

of the studies, it is likely that cement use contributed to these deaths, given what is known about the cardiovascular pathophysiology associated with cement-related complications. However, it is well known that cemented prostheses have a lower rate of periprosthetic fractures than uncemented prostheses and have a favorable long-term functional outcome. Several large national registry studies, as well as randomized trials, have found that cemented femoral implants have a lower risk of revision after hip fracture surgery. The immediate stability provided by bone cement may explain the shorter postoperative hospitalization time observed in patients undergoing cemented bipolar hemiarthroplasty. Bone cement fixation fills the gap between the trabecular bone and the prosthesis, creating an internal microfixation that promotes early out-of-bed activities and quick recoveries. The analysis showed that cemented bipolar hemiarthroplasty is associated with a lower incidence of wound infections compared to cementless bipolar hemiarthroplasty. This can be attributed to the immediate closure of the medullary cavity by bone cement, which can reduce the risk of infection. However, deep wound infection showed no significant difference between the two groups, corroborating previous studies. The analysis revealed that cemented bipolar hemiarthroplasty is associated with lower incidences of periprosthetic fractures, aseptic loosening of the prosthesis, intraoperative fractures, and postoperative wound infections. The immediate stability provided by bone cement may explain these lower incidences. (19 21 24)

Considerable research has found that patients with hip fractures who receive cementless implants are at substantially increased risk for periprosthetic fracture and revision surgery, which can also lead to death. Another important limitation is the inability to control for confounding variables such as medical comorbidities, patient age, ASA score, practice setting, or surgeon volume. The excess risk of periprosthetic fracture and revision surgery associated with cementless femoral implants must be balanced against the increased risk of early death associated with cemented implants. Therefore, it is essential that future studies based on national registries weigh the risk of early death associated with cement against the long-term harms associated with cementless implants. In contrast, cementless prostheses rely on the growth of bone tissue to form a biological fixation, which takes longer and offers less initial stability. Perioperative mortality (within 72 hours) and 30-day postoperative mortality were significantly higher for cemented bipolar hemiarthroplasty than for cementless bipolar hemiarthroplasty. This can be explained by bone cement implantation syndrome, which includes symptoms such as hypoxia, drop in blood pressure, and arrhythmias. Bone cement implantation syndrome is a potentially fatal complication of cemented bipolar hemiarthroplasty, significantly increasing the risk of death in the immediate postoperative period. In contrast, the initial stability of cementless prostheses depends on the close contact between the prosthesis and the medullary cavity, which can be difficult to achieve in elderly patients with severe osteoporosis (CAI et al., 2024) (CUI et al., 2022). Reoperation rates were lower for cemented bipolar hemiarthroplasty

than for cementless bipolar hemiarthroplasty, possibly due to the lower incidences of wound infections and greater initial stability of the cemented prosthesis. Reoperations included revisions for periprosthetic fracture, aseptic prosthesis loosening, deep infection, prosthesis dislocation, and acetabular wear (CUI et al., 2022).

To treat intertrochanteric and subtrochanteric fractures, intramedullary nailing is the preferred surgical option, as it reduces soft tissue injuries and allows for early weight bearing. The choice of implant for intertrochanteric fractures depends on the stability of the fracture, as determined by the lateral cortical wall. Extramedullary devices, such as the hip sliding screw (SHS), are indicated when the lateral cortical is intact. However, intramedullary devices offer biomechanical advantages due to their proximity to the force of gravity vector and a shorter lever arm. A recent meta-analysis compared several treatment options for intertrochanteric fractures, including dynamic hip screw, hip compression screw, percutaneous compression plate, Medoff sliding plate, less invasive stabilization system, gamma nail, proximal femoral nail, and anti-rotating proximal femoral nail (PFNA). PFNA was identified as the option with the lowest blood loss and best functional outcomes (MAFFULLI; AICALE, 2022) (SCHWARZ et al., 2022).

Subtrochanteric fractures, which are less common, are preferably treated with a long intramedullary nail, which is considered the gold standard for reducing operating time, fixation failure, and hospital stay compared with extramedullary devices. Sliding hip screws are ideal for extracapsular fractures of the hip, especially those of the AO/OTA A1 and A2 type, providing good mechanical stability and preventing fracture collapse. However, in more complex unstable fractures (type A3) with comminution and/or deficient bone, varus collapse may occur, resulting in mechanical failure (SCHWARZ et al., 2022) (MAFFULLI; AICALE, 2022).

Initially, crossed screws were used, but since the 1980s, parallel screws have been preferred because they allow collapse at the fracture site. Recent studies indicate that the triangular configuration is more effective against failure. The effectiveness of parallel screws compared to non-parallel screws is still debated, with conflicting results. A pooled analysis of studies on the fixation of proximal femoral fractures (FNF) with cannulated screws found no significant differences in the risks of nonunion or the incidence of osteonecrosis of the femoral head (HFNO) due to screw positioning. While parallel screws may theoretically offer advantages, such as compression in the fracture space, more high-quality studies are needed to confirm these benefits. Limitations include the small number of studies and the retrospective nature, which may introduce bias into the results (HOLLENSTEINER et al., 2019) (LI; LUO, 2021).

The choice of implant for fixation of femoral neck fractures is one of the greatest controversies in the treatment of these fractures. Commonly used implants include Multiple Cannulated Screws (MCS), Dynamic Hip Screws (DHS), and the new minimally invasive femoral

neck implant (FNS) system. Each of these implants has its advantages and disadvantages, and the choice may vary depending on the surgeon's preference and the specific characteristics of the fracture. Data show that the use of Dynamic Hip Screws is associated with longer operation time, greater blood loss, and longer hospital stay compared to the FNS and MCS groups. However, the cost of the minimally invasive femoral cervical implant system is significantly higher. In terms of femoral neck shortening, there was no significant difference between the three groups studied, indicating that all methods are effective in maintaining fracture reduction (IL; LUO, 2021).

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Internal fixation surgery is widely used, especially in young and middle-aged patients. Common methods include the cannulated compression screw, the dynamic hip screw, and the medial steel plate combined with the cannulated compression screw. Although the cannulated compression screw is popular, it can cause complications such as osteonecrosis of the femoral head and failure of internal fixation. DePuy Synthes has recently developed the femoral neck fixation system, which offers advantages such as shorter operating time, less trauma, and mechanical stability. However, there is still debate about its efficacy and safety compared to the traditional cannulated compression screw, and robust clinical evidence is lacking (REDDY et al., 2023).

A recent meta-analysis and systematic review compared the effectiveness of the femoral neck fixation system and the cannulated compression screw, including 21 retrospective studies with 1,347 patients. The results indicated that the femoral neck fixation system had better results in terms of fracture healing time, lower incidence of bone nonunion and necrosis of the femoral head, and better hip function. Specifically, the femoral neck fixation system had a significantly shorter consolidation time compared to the cannulated compression screw, fewer complications such as internal fixation failure and shortening of the femoral neck, greater blood loss during the operation but lower frequency of fluoroscopy due to the use of guide equipment, and better Harris hip scores and Barthel index, indicating better recovery and daily activities for patients treated with the femoral neck fixation system (REDDY et al., 2023).

The choice of surgical treatment for geriatric hip fractures should consider the patient's life expectancy. The current literature is insufficient to guide evidence-based practice, especially for survival beyond two years. There is an urgent need for more detailed collection, analysis, and reporting of data on medium-term survival (MIEDICO et al., 2023).

Another possible complication is osteonecrosis of the femoral head (HFNO) after femoral neck fractures (IFFNF). This review indicated that Garden classification and retention of internal fixators (FI) are critical risk factors for the development of HFNO after femoral neck fractures. The Garden classification, which evaluates the degree of fracture displacement, showed a strong correlation with the incidence of avascular necrosis, especially in displaced intracapsular fractures. This finding is consistent with previous studies highlighting the importance of anatomical reduction to maintain blood supply to the femoral head (WU et al., 2021).

Retention of internal fasteners has also been identified as a significant risk factor. Studies suggest that the prolonged presence of screws may increase intraosseous pressure in the femoral head, exacerbating ischemia and contributing to the pathogenesis of femoral head osteonecrosis. Improper removal of screws can alter the biological stress at the fracture site, increasing the risk of complications. On the other hand, factors such as gender, age, injury-operation interval, fracture reduction mode, preoperative traction, and injury mechanism did not show a significant correlation with osteonecrosis of the femoral head after femoral neck fractures. These results suggest that while these factors may influence other aspects of recovery, they are not critical determinants for the development of osteonecrosis of the femoral head (WU et al., 2021).

Early and accurate prediction of osteonecrosis of the femoral head (FHPO) is crucial for choosing the appropriate treatment and preservation of the hip joint. Methods such as superselective angiography, although invasive and risky, allow the visualization of the vascularization of the femoral head. Bone scan (SPECT and SPECT/CT) is a non-invasive technique that uses radioactive tracers to assess blood supply and mineral metabolism. Dynamic magnetic resonance imaging, despite its high cost and incompatibility with metal implants, is promising for predicting HFNO. Microcomputed tomography (Micro-CT) offers detailed images of intraosseous arteries, but its clinical application is still limited. Intraoperative methods, such as femoral head perforation and Doppler-laser hemodynamics, allow for immediate interventions, but they are invasive and require specialized equipment. Each method has its advantages and limitations, and it is important for choosing the most appropriate treatment (HU et al., 2023).

In one of the studies analyzed in this review, it showed the efficacy of the use of pedicle muscle bone flap transplantation in the treatment of femoral neck fractures. The results indicated an average efficacy rate of 73.4%, with relatively low rates of complications such as nonunion (9.0%), avascular necrosis (6.7%), collapse (4.7%), and reoperation (7.3%). These findings are promising,

especially considering the devastating complications associated with femoral neck fractures, such as osteonecrosis and pseudoarthrosis. The muscular pedicle bone graft approach appears to provide an additional blood supply to the femoral head, which may improve stability and osteosynthesis. However, the study also highlighted several limitations. Most of the included studies had a small sample size and poor methodological quality. In addition, there was a wide variation in reported complication rates between studies, which may be attributed to differences in surgeons' skills and surgical techniques used (LEE et al., 2021).

Skin traction is widely used in different countries. However, its effects are still not completely clear, and the literature presents contrasting results. Analysis of studies reveals that skin traction may be beneficial for patients who cannot undergo early surgery due to organizational issues or pre-existing comorbidities. However, the potential skin damage and additional complexity in patient care are significant drawbacks that need to be considered. The need for specific education and training for nurses who care for patients with skin traction is evident (BUTLER et al., 2023).

CONCLUSION

In conclusion, hip fractures in the elderly represent a significant challenge due to the high morbidity and mortality. The systematic review highlights the complexity of management, addressing risk factors such as osteoporosis and advanced age, and treatment options such as hemiarthroplasty and total hip arthroplasty (THA). Hemiarthroplasty is associated with shorter surgical time and lower incidence of dislocations, whereas THA offers better long-term function but with a higher risk of initial dislocations. Internal fixation with cannulated screws has a high complication rate, while the femoral neck fixation system shows promising results. The choice between cemented and uncemented prostheses continues to be debated, with each having specific advantages and disadvantages. Early interventions are crucial to minimize complications and improve functional outcomes. The management of hip fractures in older adults requires a multidisciplinary and individualized approach, and more research is needed to optimize long-term outcomes.

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