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Research Article

Conservative Surgical Treatment of Femoral Neck Fractures in Adults and Elderly Subjects: An Evaluation of Anatomical and Functional Outcomes Based on 22 Fractures Managed in the Orthopedic Trauma Department of Aristide Le Dantec Hospital

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Abstract

Introduction: Femoral neck fractures compromise functional prognosis in young adults and can be life-threatening in the elderly. Their management is primarily surgical. Conservative surgical treatment still retains specific indications.

Materials and Methods: This was a single-center, retrospective, descriptive and analytical study conducted over a 3-year period (January 2017 to December 2019) at Aristide Le Dantec Hospital. All patients who underwent conservative surgical management for femoral neck fractures were included.

Results: The mean age was 44.55 years, with a male predominance (15 men, 6 women). According to Garden's classification, 10 fractures were type IV, 7 type I, 4 type II and 1 type III. At final follow-up, 20 fractures had united. Late complications were observed in 6 cases: 2 non-unions, 1 mechanical failure and 3 cases of avascular necrosis of the femoral head, including one bilateral. According to the PMA functional score, outcomes were excellent in 13 patients, good in 5, fair in 3 and poor in 1. The association between time to surgical management and functional outcomes was highly significant (p = 0.003).

Conclusion: Conservative surgical treatment maintains its indications, providing good anatomical and functional outcomes despite the occurrence of certain complications.

Keywords: Fracture; Femoral Neck; Conservative Treatment; Outcome Evaluation

Introduction

Femoral neck fractures represent a major public health issue. In Senegal, they account for 31% of proximal femoral fractures [1]. Their management may involve conservative surgery (extra- or intramedullary osteosynthesis), radical treatment (arthroplasty), or functional treatment [2]. Conservative surgical treatment refers to osteosynthesis aimed at preserving the patient's femoral head, as opposed to replacing it with a prosthesis. It includes fixation techniques such as: multiple cannulated screws, Dynamic Hip Screw (DHS), plate-screw constructs and Cephalomedullary nailing (in selected combined injuries). Despite advances in osteosynthesis techniques, femoral neck fractures remain a therapeutic challenge and predispose patients to two major complications: nonunion and avascular necrosis of the femoral head [3].

The objective of this study was to evaluate the anatomical and functional outcomes of femoral neck fractures treated with osteosynthesis.

Materials and Methods

Study Period

We conducted a single-center, retrospective, descriptive and analytical study over a 3-year period (January 2017 to December 2019) at Aristide Le Dantec Hospital.

Study Population

All patients who underwent conservative surgical management of a femoral neck fracture were included. Patients lost to follow-up, those with incomplete or unusable medical records and pathological fractures were excluded. A total of 21 patients were enrolled, including one case of bilateral fracture, giving a total of 22 fractures.

The mean age was 44.55 years (range: 22-77 years). Seventeen patients were under 60 years of age, while four were between 60 and 80. There was a male predominance (15 men and 6 women). Eighteen patients had no comorbidities and twenty were previously autonomous. Bone quality assessment showed that 20 patients had a Singh index of 6, indicating good mineralization, while one patient had a Singh index of 4.

According to Garden's classification, 10 fractures were type IV, 7 type I, 4 type II and 1 type III.
All surgeries were performed on a traction table under fluoroscopic guidance. Most interventions were carried out between the 2nd and the 6th day post-trauma.

All surgeries performed on a traction table. Fluoroscopic control ensured reduction quality. Closed reduction was attempted first. Nineteen patients underwent Dynamic Hip Screw (DHS) fixation, including one bilateral case. Dynamic Hip Screw (DHS) consists of a large lag screw inserted into the femoral head and neck, attached to a lateral plate. Allows controlled sliding and impaction to promote union. Two patients were treated with double-screw fixation and one patient received a long gamma nail due to an associated ipsilateral diaphyseal fracture. Postoperative protocol included early mobilization with partial weight-bearing.

Methodology

Data were collected from hospitalization registries, clinical charts and operative reports. Data entry and statistical analysis were performed using Sphinx Plus software. The chi-square test was used to assess correlations and statistical significance was defined as $p \leq 0.05$. Functional outcomes were evaluated using the Postel-Merle d'Aubigné (PMA) score (Table 1) [4]. Outcome categories were defined as follows:

- Excellent: score = 18
- Good: score 16-17
- Fair: score 14-15
- Poor: score ≤ 13

Score	Pain	Mobility	Walking ability
0	Very severe, continuous pain	Ankylosis in a poor functional position	Walking impossible
1	Very severe pain preventing sleep	Clinical ankylosis without deformity	With two crutches
2	Very severe pain during walking, preventing any activity	Flexion 40°, abduction 0°, mild deformity	With two canes
3	Severe pain after 15 minutes of walking	Flexion 40–60°	Limited walking with a cane; impossible without
4	Pain after 4 hours of walking, disappearing at rest	Flexion 60–80°, able to put on shoes	Prolonged walking with cane; limited without cane
5	Pain at start-up	Flexion 80–90°, abduction 25°	Walking without cane, slight limp
6	No pain	Flexion 90°, abduction 40°	Normal walking

Table 1: Postel-Merle d'Aubigné scoring system.

Results

Anatomical Results

Twenty (20) fractures progressed to union, corresponding to a consolidation rate of 90.9%.

Late complications were observed in six cases, distributed as follows:

- 2 cases of non union
- 1 case of mechanical failure
- 3 cases of femoral head osteonecrosis, including one bilateral case

Correlation Between Anatomical Results and Radiological Osteopenia According to the Singh Classification

All late complications occurred in patients without radiological osteoporosis (Singh index 6).

No statistically significant association was found ($p = 0.9$).

Fracture Displacement According to the Garden Classification and Anatomical Results

One case of cephalic osteonecrosis and one mechanical failure occurred in Garden type I fractures ($n = 7$). Two cases of nonunion and one case of bilateral femoral head osteonecrosis were observed in Garden type IV fractures ($n = 10$). The association was not statistically significant ($p = 0.8$).

Correlation Between Anatomical Results and Delay to Management

Most patients were operated between day 2 and day 6 of hospitalization, with extremes ranging from 2 to 12 days. Osteonecrosis and nonunion were observed in patients managed between day 2 and day 6. Mechanical failure occurred in a patient operated after day 10. The association was not statistically significant ($p = 0.7$).

Functional Results (PMA Score)

Functional results were as follows:

- Excellent: 13 patients
- Good: 5 patients
- Fair: 3 patients
- Poor: 1 patient

Correlation Between Radiological Osteopenia (Singh) and Functional Results

The patient with a Singh index of 4 achieved an excellent functional outcome.

Among patients with good bone mineralization (Singh index 6):

- 12 had excellent outcomes
- 3 had fair outcomes
- 1 had a poor functional result

The association was not statistically significant ($p = 0.86$).

Delay to Management and Functional Outcomes

When the delay was between day 2 and day 8, functional outcomes were excellent in 13 patients. A poor functional result was observed in a patient operated after the tenth day of hospitalization. The association between the two variables was statistically significant ($p = 0.003$) (Fig. 1-4).

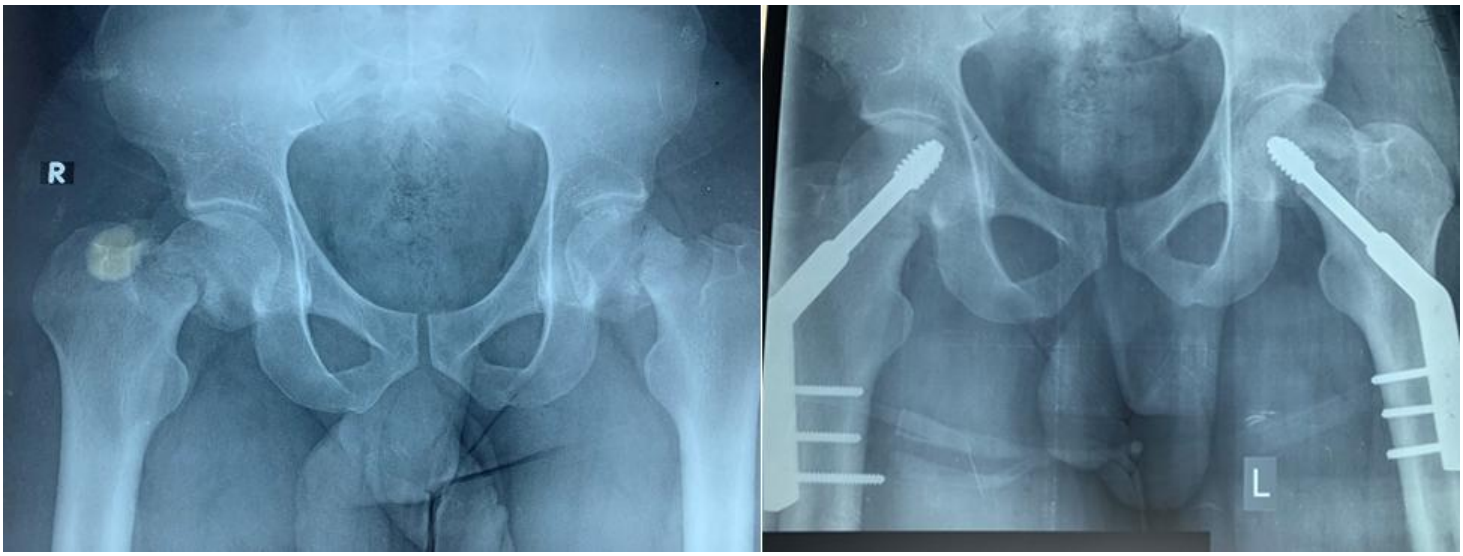

Figure 1: Bilateral femoral neck fracture treated with DHS plate-screw fixation.

Figure 2: Bilateral osteonecrosis of the femoral heads.

Figure 3: Garden type I femoral neck fracture treated with screw fixation.

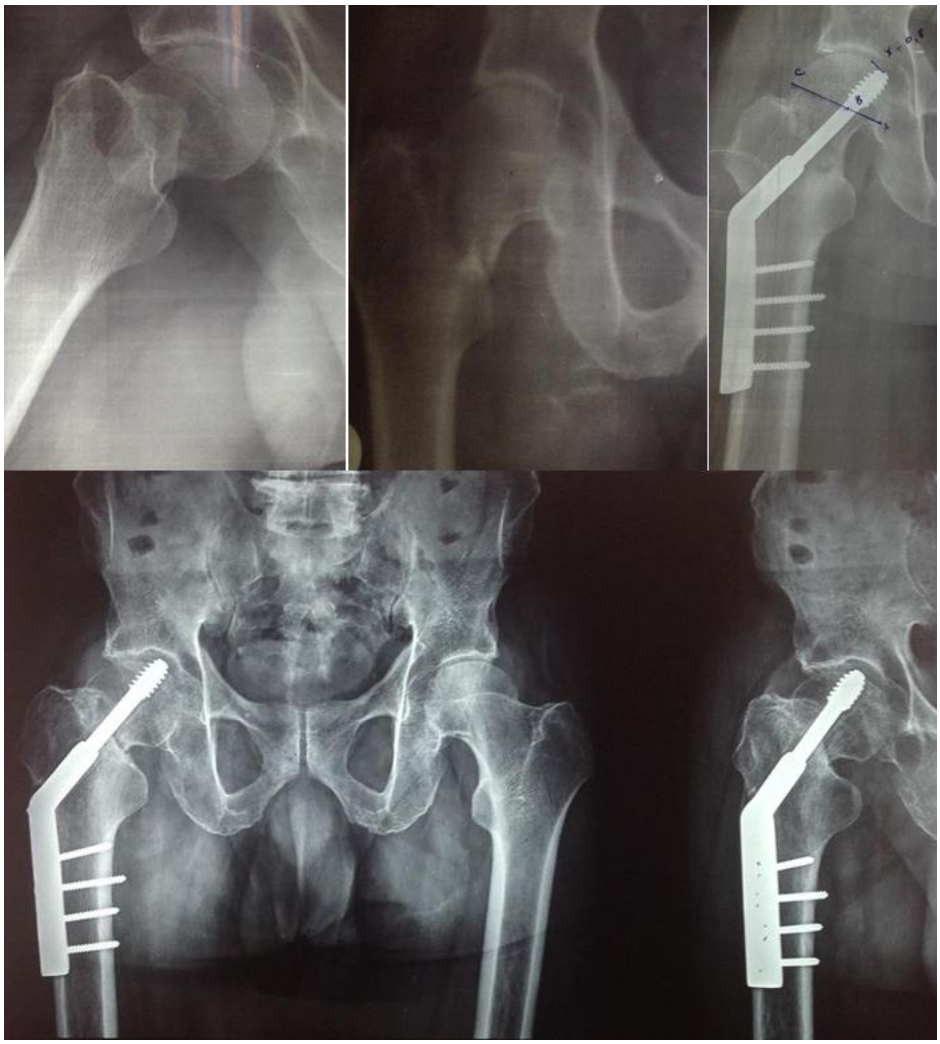

Figure 4: Non-union of the femoral neck with intra-articular migration of the screw.

Discussion

Evaluation of Anatomical Results

Most authors agree that bone quality must be considered when selecting the appropriate surgical treatment for femoral neck fractures. In active elderly patients with adequate bone stock, reduction and internal fixation are beneficial, as a consolidated femoral neck fracture yields significantly better outcomes than any type of arthroplasty [4,5]. Conversely, in osteoporotic patients for whom internal fixation is unlikely to provide reliable stability, femoral head replacement is preferred. Several studies have demonstrated the relationship between osteoporosis and postoperative complications [6,7]. In osteoporosis, alterations in the bone remodeling cycle and reduced osteoblast sensitivity to cyclic mechanical loading may lengthen healing time [6,7]. Osteoporotic patients are at high risk of aseptic femoral head necrosis and nonunion due to implant failure [9]. The more fragile the bone, the poorer its capacity to support osteosynthesis hardware, compromising fracture stabilization and increasing the likelihood of mechanical complications [10]. In our study, only one patient had a Singh index of 4-related to reduced limb use (disuse osteoporosis)-and no correlation was found between osteoporosis and anatomical outcomes.

Garden's classification is the most widely used among authors [10-13] because of its prognostic and therapeutic relevance. Simon, et al., emphasized the relationship between fracture displacement and anatomical outcomes [14,15]. Stable fractures tend to consolidate with fewer late complications, whereas displaced fractures (types III and IV) carry higher risks of nonunion and femoral head necrosis, as demonstrated by Skinner, who reported nonunion rates of 30.5% in Garden IV and 10.3% in Garden III fractures [16]. Parker reported nonunion rates of 16% and 18% for Garden III and IV fractures, respectively [17].

In our series, we observed an 8.3% nonunion rate, occurring exclusively in type IV fractures. As reported by most authors, we believe that nonunion is more strongly associated with fracture type than with patient age. Several authors have also noted a markedly higher incidence of osteonecrosis in displaced fractures, likely due to more severe vascular disruption. Our findings align with these observations. Schwartsmann reported 23.1% osteonecrosis in type III and 76.9% in type IV fractures [18]. We observed a higher rate of late complications in unstable fractures.

Although a correlation appears likely between fracture displacement and complications, this association was not statistically significant in our study. Femoral neck fractures are considered orthopedic emergencies, especially in young patients [20-22]. Early management is essential to prevent complications such as osteonecrosis and nonunion. Several authors [21-23] advocate surgery within the first 6 hours, or at most within 24 hours. Early intervention preserves microvascular integrity, ensuring sufficient arterial supply to promote consolidation and maintain femoral head viability. Some authors recommend urgent anatomical reduction and stable fixation to maximize chances of vascular restoration. This recommendation is supported by the known anatomical characteristics of femoral head vascularization, which is easily compromised during fracture.

In our series, all patients were treated after 24 hours, most between day 2 and day 6. The delay was generally related to financial constraints, anesthetic preparation requirements, or comorbidities in older patients. Manninger reported that 37.5% of patients were operated within 6 hours and 45.3% within 6-24 hours, with significantly higher complication rates in those treated after 24 hours. Similar results were reported by Khoo [23,24]. In line with the literature, we believe that earlier intervention reduces complication rates.

Evaluation of Functional Results

According to several studies, the degree of osteoporosis influences functional outcomes: as the Singh index decreases, the proportion of fair and poor outcomes increases [9]. In Hachimi's study, 75% of patients with moderate osteoporosis (SI = 3) had satisfactory results, whereas only 35.7% with severe osteoporosis (SI = 1 or 2) achieved satisfactory outcomes. In our series, patients with Singh index 6 achieved 58.3% excellent and 20.8% good functional results, with only 4.2% poor outcomes. We believe that osteoporosis may indirectly lead to fair or poor outcomes by promoting mechanical complications due to insufficient implant fixation. A more extensive study of osteoporotic patients would help clarify the relationship between bone density and functional outcomes.

Most authors also stress that conservative surgical treatment should be performed early. Early management is associated with better anatomical and functional outcomes [15,24,26,27]. A short interval between trauma and surgery improves functional results [15,28]. Manninger, found significantly better functional outcomes in patients operated within 6 hours versus those treated later [23]. In our series, the only poor functional result occurred in a patient operated after the tenth day of hospitalization. We observed a statistically significant correlation between delay to surgery and functional outcome ($p = 0.003$).

In our setting, early management remains challenging due to delayed presentation, reliance on traditional medicine, anesthetic limitations and financial constraints. The findings of this study confirm that conservative surgical management of femoral neck fractures remains a relevant option in young patients and in older individuals with adequate bone quality. With a union rate of 90.9% and predominantly excellent or good functional outcomes, internal fixation provides satisfactory results when optimal mechanical and biological conditions are met. However, the occurrence of complications such as nonunion and avascular necrosis highlights the inherent limitations of this therapeutic strategy. Our observations are consistent with previous studies indicating that prognosis is strongly influenced by:

- The degree of fracture displacement, with Garden III-IV fractures carrying higher risks of mechanical and vascular complications
- Delay to surgical intervention, as prolonged management time correlates with poorer functional recovery
- The quality of reduction and fixation, which is essential to restoring femoral head vascularity and ensuring mechanical stability
- Bone quality, although no statistically significant association was found in our cohort, likely due to the low representation of osteoporotic patients

Conclusion

The primary complications of conservative surgical management of femoral neck fractures are nonunion and femoral head necrosis. Based on our evaluation, conservative surgical treatment provides good anatomical and functional outcomes despite the occurrence of certain complications. The central message of this study is that osteosynthesis can produce excellent outcomes when optimal conditions are met.

Conflict of Interests

The authors declare that there is no conflict of interest related to this study.

Author Contributions

MD: Study conception, data collection, data analysis, manuscript drafting.
MDa, BD, MS, ADS: Clinical management of patients, data acquisition, critical revision of the manuscript.
CD: Supervision, methodological guidance and final approval of the manuscript.
All authors read and approved the final version of the manuscript.

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