Case Report

Outcomes of Subcapital Femoral Fracture after a Fixation of an Intertrochanteric Fracture with a Proximal Femoral Nail: Case Report

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Keywords

Hip · Trauma · Intertrochanteric fracture · Subcapital femoral fracture · Proximal femoral nail · Postoperative complications

Abstract

Proximal femoral fractures are a common injury that represents an important cause of hospitalization, morbidity, and mortality in elderly patients. Subcapital femoral neck fracture after fixation of an intertrochanteric fracture with a proximal femoral nail is an extremely rare complication. However, because of the large and steadily increase in the number of patients undergoing to proximal femoral nail fixation in recent years, we believe that the number of these cases could increase over time. We present a 78-year-old woman with a subcapital femoral fracture 11 months after a fixation of intertrochanteric fracture with a proximal femoral nail in the same hip. Five years of follow-up was presented. Also through our case report a review of literature of these rare cases was done, trying to evaluate the associated risk factors, the difficulties in their treatment and the final follow-up of these patients.

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Introduction

Hip fractures are devastating injuries often resulting in long-term disability that can lead to premature death in elderly people [1]. Due to the high incidence and rapidly expanding of elderly population, these fractures are one of the most challenging and fastest-growing public health concerns [2]. The fractures affecting the neck or head of the femur are normally treated

with an arthroplasty or osteosynthesis with cannulated screws. Nevertheless, extra-articular fractures are more commonly treated with osteosynthesis, mostly with an intramedullary nail or a dynamic hip screw. While both systems are recommended for stable fractures, intramedullary devices are preferable for unstable fractures because of their biomechanical advantages, and however, complications are not excluded [3].

Failed treatment of an intertrochanteric fracture typically leads to severe functional disability and pain [4]. Subcapital femoral neck fracture is an uncommon complication after fixation of an intertrochanteric fracture with a proximal femoral nail, to our knowledge; only 4 cases have been reported in the literature [5–7]. However, because of the large and steadily increase in the number of patients undergoing to proximal femoral nail fixation in recent years, we believe that the number of these cases could increase over time [1, 2]. The aim of this manuscript is to analyze and discuss the management of this aforesaid complication, through a case report and literature review.

Case Report

A 78-year-old woman was transferred to the emergency room after a fall from her high. She referred a severe pain in her left hip, inability to walk, and shortening of her left limb. On admission, a radiographic study was performed, showing an intertrochanteric fracture (AO 31.A3) of her left hip, with no femoral neck fracture (Fig. 1a). Medical history only revealed Alzheimer, hypertension, and dyslipidemia. She underwent closed reduction and internal fixation with a proximal femoral nail (TFN; DePuy Synthes, West Chester, PA, USA). Antero-posterior and lateral radiographs showed satisfactory positioning and good seating of the nail and screws. The proximal screw was inserted in the center of the femoral head, with a tip-apex distance of 24.6 mm (Fig. 1b). After surgery, the patient progressed satisfactorily, allowing an immediate weight-bearing. Three months after surgery, full bone healing was confirmed clinically and radiologically.

Fig. 1. Radiographs showing an intertrochanteric fracture of the right hip (a), fixation with a proximal femoral nail, with a tip-apex distance of 24.6 mm (b).

Eleven months after surgery, she fell down again and began to complain of an acute left hip pain and inability to walk. Radiographs showed a displaced subcapital femoral neck fracture and a healed intertrochanteric fracture (Fig. 2a). The proximal screw had not damaged the acetabular cartilage. Her plain pelvis radiograph revealed a Singh's index grade of 2 on her right hip. Laboratory exams showed normal levels of calcium, phosphate, and alkaline phosphatase. A dual-energy x-ray absorptiometry scan showed her bone-mineral density lower than expected for her age. Her T-score at total lumbar vertebra was -2.9 , and total hip T-score was -2.8 .

After preoperative preparation, a hardware removal and a bipolar hemiarthroplasty were performed (Fig. 2b). Three days later, the patient was mobilized with relief of pain. Anaerobic and aerobic cultures of the left hip taken at surgery were negative. Histological evaluation of the femoral head showed osteoporosis with no evidence of osteonecrosis, osteomalacia, or neoplasia. Later on, the patient had an acute superficial wound infection. She underwent irrigation and debridement. Cultures were positive for *S. aureus*, for which she took antibiotics for 6 weeks. At the final follow-up, 5 years after the fracture, the patient presented a successful follow-up without signs of infection. Functional outcome was poor, Harris Hip Score (HHS) 52 points, despite she was able to ambulate using a walker.

Discussion

Hip fractures in elderly people pose a substantial challenge to patients, surgeons, and healthcare systems [1]. Subcapital femoral neck fracture after fixation of an intertrochanteric fracture with a proximal femoral nail is an uncommon complication [5–7]. Subcapital femoral neck fractures have been reported after fixation of intertrochanteric fractures using fixed-angle devices like McLaughlin nail plates or AO blade plate fixation, or dynamic hip screws [8]. These devices have a different biomechanics from proximal femoral intramedullary nails. The biomechanical advantage of the nail with regard to the extramedullary devices is related to its position which is nearer to the weight-bearing axis. When the intramedullary system is compared with the extramedullary device, there is up to a 30% reduction of bending stresses [9]. For this reason, we do not think that we can compare these cases with our case.

To our knowledge, only 4 cases of this complication have been reported in the literature [5–7] (Table 1). In our case, similarly to the other cases, patients were elderly women. The mean age of all the cases was 82 years (± 2.94), and all of them had an unstable intertrochanteric

Fig. 2. Radiographs showing a subcapital fracture and a healed intertrochanteric fracture after 11 months after a closed reduction and internal fixation of intertrochanteric fracture with a proximal femoral nail (a) and nail removal and hemiarthroplasty of the hip (b).

Table 1. Summary of patients with a subcapital femoral neck fracture after fixation of an intertrochanteric fracture with a proximal femoral nail

Study [Ref.]	Age	Sex	Affected limb	Type of fracture (AO)	Treatment	Tip-apex distance, mm	Interval between trochanteric and subcapital fractures, months	Treatment	Histological evaluation of the femoral head
1 Ekström et al. [5]	NM	NM	NM	NM	PFN	NM	2	Total hip arthroplasty	NM
2 Kaneko et al. [6]	85 83	F F	Right Right	31-A2 31-A2	PFN PFN	23.6 18.3	3 4	Total hip arthroplasty Total hip arthroplasty	Osteoporosis Osteoporosis
4 Kayali et al. [7]	82	F	Right	31-A2	PFN	NM	15	Total hip arthroplasty	Osteomalacia
5 Present case	78	F	Left	31-A3	TFN	24.6	11	Bipolar Hemi-arthroplasty	Osteoporosis

F, female; NM, no mentioned; PFN, proximal femoral nail; TFN, titanium trochanteric fixation nail.

fracture before this complicated. Also, this complication happened, in all the cases, after a new fall from their stand high. The mean time between intertrochanteric and subcapital fractures was 7 months (± 3.02). The tip-apex distance was measured only in 2 cases reported, mean value 20.95 mm (± 2.65). It had been shown that the correct insertion and positioning of both intra- and extramedullary devices prevent complications such as implant failure or cutout [10]. Nonetheless, this complication can occur despite the proper positioning of the implant, like in the cases reported in this article. Similarly, to other 2 cases reported, our histological evaluation of the femoral head showed osteoporosis. Also like in the other cases reported, we did not start anti-osteoporotic treatment at discharge after the proximal femoral nail surgery. There was point that only 10% of patients with low-energy hip fractures were prescribed anti-osteoporotic drugs at the time of discharge [11]. Even a clear risk factor cannot be postulated, because of the epidemiological characteristics of these patients (elderly women with unstable fractures), and the anatomopathological findings, we can suggest that a new fall after a fixation of an intertrochanteric fracture with a proximal femoral nail in osteoporotic patients could be an important predisposing factor in the development of these complications. That's why, alike some other authors we emphasize the role of the orthopedic surgeon in the treatment of osteoporosis after surgical treatment of an osteoporotic fracture. After the hemiarthroplasty surgery, the patient began osteoporosis treatment with calcium, vitamin D, and bisphosphonates. Her last dual-energy x-ray absorptiometry scan, after 3 years of osteoporosis treatment, showed a better bone-mineral density (T-score at total lumbar vertebra was -2.0 , and total hip T-score was -1.8).

In 3 cases reported, the patients were treated using a total hip arthroplasty; however, in our patient because of her medical diseases, we prefer to use a bipolar hemiarthroplasty. We think that the treatment decision should be individualized depending on the patient age and functional demand, as well as the surgeon criteria. It is also known that the revision of an intertrochanteric fracture has been associated with increased morbidity and mortality [12, 13]. These revisions are technically more difficult than routinely primary hip arthroplasty, with a longer operation time due to the fact that first, we have to remove the nail [3, 14]. In our case, we did not have any incident during revision surgery. However postoperative, our patient had an acute superficial wound infection. She underwent irrigation and debridement and had to take antibiotics. Nevertheless, at the final follow-up, our patient showed no signs of infection. Functional outcome after 2 years of follow-up was poor (HHS: 52 points); however, it was acceptable functional because, despite her comorbidities, she was able to ambulate using a walker. In the other cases reported, they do not mention the follow-up either the functional outcome. We think that this is an important measurement that should be included in the following cases.

A subcapital femoral fracture following closed reduction and internal fixation of intertrochanteric fracture with a proximal femoral nail is an uncommon complication. Yet, given that the number of intertrochanteric fractures is increasing, as well as its complications, surgeons should be aware of ways to prevent and treat this complication. Even a clear risk factor cannot be postulated, osteoporosis could be an important predisposing factor. That's why; with these cases, we emphasize the role of the orthopedic surgeon after surgical treatment of an osteoporotic fracture.

Statement of Ethics

Written informed consent has been obtained from the patient for the publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

All the authors have made a significant contribution to the paper. Jorge H. Nuñez was involved in collecting the data, wrote, and the edition of the manuscript. F. Moreira Borim reviewed the manuscript. Jordi Teixidor, Vicente Molero, and Jordi Tomas are members of the trauma unit; they were involved in the clinical evaluation of the patient, surgical planning, intervention, and follow-up. Jordi Tomas was the principal surgeon and made the follow-up of the patient.

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