

Case Series

The management of complex periprosthetic femoral fractures: a case series of plating with wire augmentation, and a review of the literature

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Received: 03 July 2022

Revised: 22 August 2022

Accepted: 25 August 2022

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ABSTRACT

Periprosthetic fractures continue to increase in frequency. This is due, in part, to the increasing number of primary and revision arthroplasties performed annually and to the increasing age and fragility of patients with such implants. All types of periprosthetic fractures can present unique and substantial treatment challenges. Here we present a case series of 3 elderly patients who came to us with periprosthetic hip fractures in previously operated case of hip hemiarthroplasty/total hip replacement done. The injuries were managed with splintage and operative procedures. Postoperatively mobilization was challenging. But patients were successfully mobilized with the help of relatives and physiotherapists. Periprosthetic fractures are becoming quite common in elderly and difficult to treat as the number of hip joint arthroplasty operative has increased in developing countries. The correct procedure is very challenging as every case needs to be treated very individualistically. A good plan always results in much reduction in the operating time and better patient post operative outcome. Postoperatively mobilization of patient and functional outcome is hampered. Proper counselling by operating surgeon, physiotherapy and postoperative rehabilitation with the help of relatives and assisting devices provides good outcome. So that early appropriate treatment and mobilization can be done with good functional outcome.

Keywords: Periprosthetic fractures, Ipsilateral, Hip trauma, Upper limb trauma, Hemiarthroplasty, Arthroplasty

INTRODUCTION

Periprosthetic fractures continue to increase in frequency. This is due, in part, to the increasing number of primary and revision arthroplasties performed annually and to the increasing age and fragility of patients with such implants.¹ All types of periprosthetic fractures can present unique and substantial treatment challenges. In each situation, the presence of an arthroplasty component either obviates the use of, or increases the difficulty of, standard fixation techniques. In addition, these fractures often occur in elderly patients with osteoporotic bone making stable fixation with traditional techniques even more problematic. The difficulty in management of

periprosthetic fractures regardless of location is evidenced by the array of treatment options described in the literature without a clear consensus emerging on the most appropriate method.² Treatment of the most common periprosthetic fractures, those of the femoral shaft and those of the femoral supracondylar region, has focused on open reduction and internal fixation (ORIF) or revision arthroplasty procedures with or without supplementary autologous or allogeneic bone grafting.^{2,3} Most recently, treatment strategies to accelerate weight bearing have suggested benefits about mortality. Successful application of these strategies can be extrapolated to periprosthetic fractures in other anatomic locations but must also consider the fracture location relative to the arthroplasty

component, the implant stability, the quality of the surrounding bone, and the patient’s medical and functional status.^{4,5} Given the predominance of low-energy injury mechanisms associated with periprosthetic fractures, associated injuries are relatively uncommon. Of course, careful assessment is required to avoid missing the occasional associated injury. The purpose of this paper was to show the outcome of peculiar Vancouver type- A1 with B2 periprosthetic femoral fracture treated with open reduction and internal fixation, using a locking compression plate and cable augmentation, in an older patient (Table 1).

Table 1: Vancouver classification.

Type and subtype	Fracture description
Type A	Fracture in trochanteric region
AG	Fracture of greater trochanter
AL	Fracture of lesser trochanter
Type B	Fracture around stem or just below it
B1	Well-fixed stem
B2	Loose stem with good proximal bone stock
B3	Loose stem with poor quality bone stock
Type C	Fracture occurring well below the tip of the stem

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Surgical procedure

The fractures were treated with open reduction and fixation (Figure 2) with a proximal femur locking compression plate (LCP®), with a combination of 3.5 mm nonlocking and locking screws. the greater trochanter fracture was fixed with two cortical (non-locking) screws to gain bi-cortical purchase and a single locking screw to achieve uni-cortical purchase of the fragments. The femoral stem was not perforated because of the previous implant and cement in the peri-implant femoral cavity. thus, the fractures sites were augmented with circumferential cable (three cerclage wires) in three screw position in which there was hindrance to pass screws due to pre-existing. the cerclage wire augmentation was also suited in this case due to spiral orientation of the femoral shaft fracture line; the distal plate was fixed with locking screws. The surgery was performed in the lateral decubitus without the use of a pneumatic tourniquet, and duration of surgery was 3 hours with blood loss of 300 cc the surgery went uneventful, for left distal ulna and radius fracture suave Kapandji procedure was done to salvage wrist joint function, with an attempt to reduce multiple surgeries over the wrist for which patient was non-complaint and no complications were reported in the perioperative course or during the hospitalization period. The postoperative course showed no problems with respect to the hips. The patient was submitted to an intensive rehabilitation protocol included early mobilization and walking with two crutches

as patient had difficulty in holding walker due to fracture of left wrist and stiffness of his right elbow joint. At 3-months follow-up, the patient presented stable hip and the radiographs showed signs of bone union of the fractures. He reported moderate pain, and some limitation of ordinary activity. At 9-months follow-up, the patient presented an asymptomatic hip and sense of satisfaction with surgery outcome. The follow up radiograph showed union at the sites of fracture. The patient was clinically able to walk without any pain and without any external support.

Case 1

A 47-year-old HbsAg seropositive male patient brought by relatives with pain over left thigh and pain and swelling over left hip for 3 days with alleged history of slip and fall in the bathroom 3 days ago. Patient had history of bilateral sided total hip replacement arthroplasty done in 7 years ago. Patient also is a known case of hypertension for 1 year on medication tab. Amlodipine 5 mg OD. Patient also had history of chronic alcohol and tobacco intake since last 15 years. On admission, he had no history of head trauma, abdomen/chest trauma. On local exam of left hip, he had tenderness over lateral aspect of the 1/3rd of thigh with visible deformity present, no wound and all distal sensation and distal pulsation palpable (Figures 1 and 2).



Figure 1: Preoperative X-rays-case 1.

Case 2

A 69-year-old roadsider male patient brought by police with pain over left thigh and pain and swelling over left hip for 14 hours with alleged history of slip and fall 14 hours ago. Patient had history of left sided bipolar hemiarthroplasty done in 6 months ago. Patient also had history of chronic alcohol and tobacco intake since last 35 years. On admission, he had no history of head trauma, abdomen/chest trauma. On local exam of left hip, he had tenderness over lateral aspect of the 1/3rd of thigh with visible deformity present, no wound and all distal sensation and distal pulsation palpable.

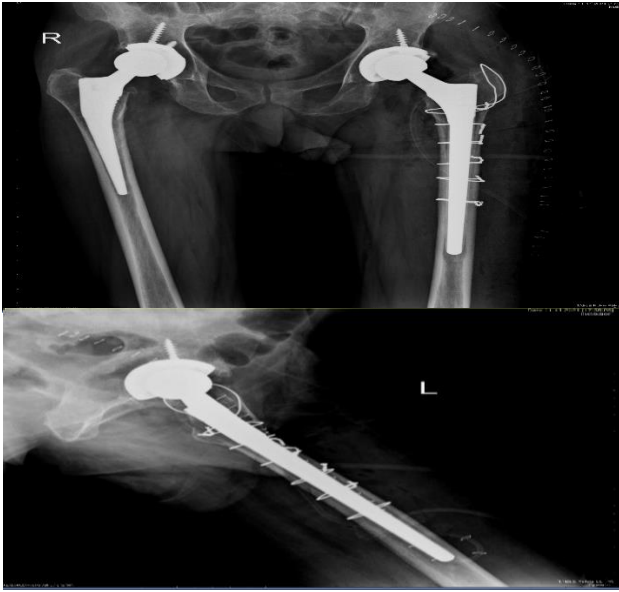


Figure 2: Postoperative X-rays-case 1.



Figure 3: Preoperative X-rays-case 2.



Figure 4: Postoperative X-rays-case 2.

Case 3

A 69-year-old female patient brought by relatives with pain over left thigh and pain and swelling over left hip with alleged history of slip and fall at home 4 days ago. Patient had History of left sided bipolar hemiarthroplasty done in 2003. Patient also is a known case of diabetes mellitus and

hypertension for 1 year on medication tab Tenelegliptin 20 mg and tab Atenolol 25 md. On admission, she had no history of head trauma, abdomen/ chest trauma. On local exam of left hip, she had tenderness over lateral aspect of the 1/3rd of thigh with visible deformity present, no wound and all distal sensation and distal pulsation palpable.



Figure 5: Preoperative X-rays-case 3.



Figure 2: Postoperative X-rays-case 3.

DISCUSSION

Periprosthetic femoral shaft fractures are increasing in frequency because of the increasing number of patients with hip arthroplasties. The incidence of periprosthetic femur fracture after primary hip arthroplasty has been less than 1% but has been reported to be as high as 2.3%.⁵ A recent survivorship analysis on 6,458 primary cemented femoral hip prostheses revealed a fracture incidence of 0.8% at 5 years and 3.5% at 10 years. Another series of 354 hips in 326 patients all treated with the same uncemented, straight, collarless tapered titanium stem and followed for a mean of 17 years showed a cumulative incidence of periprosthetic fracture of 1.6% at 10 years that increased to 4.5% at 17 years.⁶ The rate of fracture was low in the first 8 years after THA then increased into the second decade. In a comparison to the rate of aseptic loosening, the cumulative occurrence of periprosthetic fracture became equivalent to aseptic loosening at 17 years indicating the relative importance of periprosthetic fracture in the long term.⁶ After revision arthroplasty, the incidence of periprosthetic femoral shaft fractures climbs

to between 1.5% and 7.8%. The risk further increases after an increasing number of revision surgeries. The lapsed time from an index primary hip arthroplasty to periprosthetic femur fracture averages 6.3 to 7.4 years and is reduced to an interval of 2.3 years after a third revision procedure. Risk factors for periprosthetic femoral shaft fractures about hip arthroplasty femoral stems are related to the age of the patient, gender, index diagnosis, presence, or absence of osteolysis, presence or absence of aseptic loosening, primary or revision status, the specific type of implant utilized, and whether cemented or non-cemented technique was utilized. Identifying risk factors can both improve patient counselling and potentially improve efforts at fracture prevention. Age, although commonly cited as a risk factor for periprosthetic femur fracture, is not clearly an independent risk factor. Coexisting medical comorbidities, osteoporosis, increased activity level, and fall risk also contribute. A recent report revealed a doubled risk of fracture in patients with higher medical comorbidities. Furthermore, the number of years after arthroplasty must be considered as each year after arthroplasty has been associated with a 1.01 additional risk ratio per year. Although a higher proportion of periprosthetic femur fractures among female patients (52% to 70%) has been reported in many series, associated osteoporosis and a higher percentage of procedures being performed in female patients makes gender less clear as an independent risk factor. Accordingly, reports that account for such biases indicate no or even reduced risk for females. The index diagnosis leading to arthroplasty may also be a risk factor with rheumatoid arthritis (RA) and arthroplasty for hip fracture each being identified as having increased risk ratios for fracture: RA having an increased ratio of 1.56 to 2.181, and hip fracture having a reported risk ratio of 4.4. Patients with periprosthetic femur fractures have increased mortality. In multiple recent series, 7% to 18% of patients with periprosthetic fractures died within 1 year following surgical treatment. In one study, this mortality rate approached that of hip fracture patients (16.5%) treated during the same time and was significantly higher than the mortality of patients undergoing primary joint replacement (2.9%). Data from the New Zealand National Registry indicated the 6-month mortality after revision THA associated with periprosthetic fracture (7.3%) was significantly higher than in a matched cohort undergoing revision for aseptic loosening (0.9%).

Although current surgical treatment guidelines, commonly suggest open reduction and internal fixation (ORIF) solely for fractures with a stable femoral stem in our patient we considered the osteosynthesis of the fractures as the most optimal treatment route.⁷ The implantation of long revision hip prostheses is a prolonged and major operation for an older patient with pre-existing health condition and other co-existing injuries, which can contribute to higher risk of medical and prosthetic complications, and difficulties at early rehabilitation and physiotherapy.^{8,9} Modern internal fixation is frequently achieved with locking plates, which provide relative fracture stability, and do not impede the

periosteal blood supply to the fractured bone.¹⁰ Patients treated with ORIF had a significant shorter skin-to-skin surgical time and fewer perioperative blood transfusions. There were more complications reported in the revision arthroplasty cohort compared to patients that were treated with ORIF.¹¹ In the other hand, open reduction and internal fixation utilizing locking compression plates (LCP®) might be an effective treatment with a reduced surgical time and less complex procedure in a typically elderly patient with multiple comorbidities. Rigid fixation for periprosthetic femoral fractures with screws and plates is challenging due to interference of a pre-existing femoral stem.¹¹ In our case, it was not possible to perforate the implant, and bi-cortical fixation of the stem was obtained cerclage wire passing through screw holes of the locking plate. The distal part of the plate was fixed with at least eight cortices as recommended by other authors, encircling wires associated with metallic plate can reduce stress shielding, increases the probability of fracture consolidation, makes the system more stable, reduces complications, and improves patient quality of life due to a shorter functional recovery, compared to internal fixation with a simple plate.

CONCLUSION

Periprosthetic hip fractures are becoming quite common in elderly and difficult to treat as the number of hip joint arthroplasty operations has increased in developing countries. the corrective procedure is very challenging as every case needs to be treated very individually. A good plan always results in much reduction in the operating time and better patient post operative outcome.

Preoperative planning in this difficult case can seem very time consuming and labour extensive, however the preoperative discipline and familiarity of the procedure case help the operative team of surgeons greatly navigate the intraoperative shortcomings and reduce the chances of intraoperative and postoperative complications. by far the most significant step in planning of these periprosthetic fractures is thinking through the surgical management in details in a formal organised manner. Postoperatively mobilization of patient and functional outcome is hampered. Proper counselling by operating surgeon, physiotherapy and postoperative rehabilitation with the help of relatives and assisting devices provides good outcome. So that early appropriate treatment and mobilization can be done with good functional outcome.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Mahajan NP, Chaudhari K, Patel R, Bagimani P, Gund A. The management of complex periprosthetic femoral fractures: a case series of plating with wire augmentation, and a review of the literature. *Int J Res Orthop* 2022;8:711-5.