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PERIPROSTHETIC FEMORAL FRACTURE TYPE B1 WITH NARROW MEDULLARY CANAL: A CASE REPORT

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ABSTRACT

The number of hip and knee replacements is increasing with better life expectancy and so is the burden of revision surgery due to periprosthetic fractures. The incidence of intraoperative periprosthetic fractures in cementless total hip arthroplasty ranges from 1 to 20%, whereas in postoperative periprosthetic fractures, the incidence ranges between 1 and 4%. Periprosthetic fractures are associated with factors such as osteolysis, osteopenia and aseptic loosening of the implant and usually require operative treatment. A 61-year-old man presented in emergency with displaced fracture of neck of femur right, patient was operated and hemiarthroplasty was done. Three months after surgery the patient again had a fall from height. A diagnosis of Periprosthetic fracture Vancouver's classification type B was made from the radiographs. It could not be made out whether the implant was stable or unstable hence could not be classified as B1 or B2, which was later done intraoperatively. The fracture was initially undisplaced which was later found to be displaced in serial radiographs. The recommended treatment according to Duncan and Masri for type B1 fractures is revision with long stem. The recommended treatment, bypass with longer stem, was impractical in this patient owing to his narrow medullary canal. Hence, open reduction internal fixation by locking compression plate and cerclage was successfully completed on the patient. The economic constraints of the patient had restricted the use of cable plate.

INTRODUCTION

The true incidence of periprosthetic fractures about the hip is difficult to estimate from the literature for a variety of reasons including differences in the length of follow-up, demographics, whether revision surgeries are included, and whether the fractures occur intra- or postoperative[1,2,3]. The number of hip and knee replacements is increasing with better life expectancy and so is the burden of revision surgery due to periprosthetic fractures[4]. The incidence of intraoperative periprosthetic fractures in cementless total hip arthroplasty ranges from 1 to 20% [5]. whereas in postoperative periprosthetic fractures, the incidence ranges between 1 and 4% with higher rates in revision surgery in both cases[6,7]. Periprosthetic fractures are associated with factors such as osteolysis, osteopenia and aseptic loosening of the implant and usually require operative treatment. The treatment is based on the site of fracture, implant stability, and bone stock. The Vancouver classification offers a reproducible description of these factors with the subsequently easy formation of a treatment plan [8,9]. Vancouver classification helps distinguish stable from unstable fractures requiring fixation as well as stable from unstable implants requiring revision. Fractures involving the trochanteric area are categorized as type A (Ag and Al for the greater and lesser trochanter, respectively), fractures about the stem or tip of the implant are type B, and fractures distal to the tip of the stem are type C. Type B fractures are further divided into subtype B1 when adjacent to a well fixed stem, B2 in presence of a loose stem, and B3 when associated with marked osteopenia or loss of bone substance. According to this classification system, most of these fractures require surgical treatment. Vancouver's classification for intraoperative fractures is given in table A [10].

These fractures are difficult to treat with various surgeries. The choice of treatment is based upon the type of fracture, the integrity and quality of the bone stock, and the stability of the original implant [11,12] .In our patient, we had a B1 type fracture. The use of allograft struts and cerclage wire, possibly augmented by plate fixation, for the treatment of Vancouver type-B1 peri-prosthetic fractures around a total hip replacement has been strongly advocated. In our patient, we had performed Locking Compression Plate with Encerclage wires owing to the narrow medullary canal in the patient (8mm).

CASE REPORT

A 61-year-old man presented to our emergency department with severe pain, swelling of right hip with inability to bear weight following fall from height. Radiographs obtained at that time showed displaced fracture of neck femur right side (Figure 1). A thorough history and physical examination were performed on the patient and was planned for cemented hemiarthroplasty. A modified lateral approach was taken to approach the hip joint. Intraoperatively the patient had very narrow medullary canal.

The canal was progressively reamed to accept the smallest size implant available starting from size 8 mm in 0.5 mm increment. Reaming was done under image intensifier and care was taken to avoid any intraoperative femoral fracture. The smallest size implant was negotiated with difficulty after broaching because of the narrow medullary canal and the press fit was found to be stable without cementing. (Figure 2 and 3) Stability was checked after surgery which was found to be satisfactory. The image intensifier was used to rule out any intraoperative fracture. Walking with full weight bearing was permitted at three weeks after the operation. A superficial infection of the stitch line with persistent serous discharge occurred on postoperative day 7. It was treated with debridement under anaesthesia, drain and antibiotics. The patient was able to ambulate normally with the help of a walking aides without any pain at the time of discharge.

Three months after surgery the patient again had a fall from height while going down the stairs from his bathroom. He complained of severe pain and swelling in the right thigh and inability to bear weight. A diagnosis of Periprosthetic fracture Vancouver's classification type B was made from the radiographs. It could not be made out whether the implant was stable or unstable hence could not be classified as B1 or B2, which was later done intraoperatively. The fracture had a long spiral geometry extending from below the lesser trochanter down to below the tip of the stem. The proximal femoral cylinder including the lesser trochanter with the implant was found to be intact. The fracture was initially undisplaced which was later found to be displaced in serial radiographs. (Figure 4 and 5).

The recommended treatment according to Duncan and Masri for type B1 fractures is revision with long stem prosthesis. Most authors recommend internal fixation of the fractures in well-fixed implants (Vancouver type B1). The surgical dilemma in the patient was the narrow medullary canal which was confirmed by templating to be approximately 8 mm. The standard uncemented long stem implants were unavailable in this small size. A custom long stem cemented implant was ordered for this patient. The risk with this custom implant was the small cementing column on a narrow diameter prosthesis which could have predisposed it to early failure. Further cement extravasation between the fracture segments in the proximal femur could have interfered with the bony union.

The fracture was opened with minimum soft tissue trauma and preserving muscular attachments to the fracture segments as much as possible. The implant was not subsiding because of the intact proximal femoral sleeve including the lesser trochanter. The proximal femoral sleeve was reconstructed with the help of encerclage wires passed below the lesser trochanter. Because of the long spiral geometry the fracture was reduced to nearly anatomical position. A decision was taken to stabilise the fracture with long locking compression plate spanning from greater trochanter down to below the fracture. The plate was applied and 4 locked screws were applied distal to the fracture. The proximal part was stabilised with unicortical screws passed around the greater trochanter and encerclage wires. After reduction the whole construct was found to be stable through the functional range of motion.

The wound was closed and a knee brace applied postoperatively. The radiographs after the procedure. The patient was kept non weight bearing and followed up monthly with serial radiographs. Weight bearing was withheld till signs of callus formation and fracture union were seen on radiographs.

Strut allograft could not be used because of unavailability and a cable plate because of economic constraints of the patient.

The patient was allowed to walk with walking aides. Full weight bearing was allowed after around 3 months. The patient visited us regularly for follow up. At around one and a half month follow up, he had a healthy stitch line, was able to stand and sit comfortably. The radiographs at that time revealed proper alignment without any abnormality (Figure 6).At around six months follow up, the patient was able to walk without any walking aides. The radiograph showed no abnormality, though there was no callus formation seen (Figure 7).

Table A. Vancouver's Classification

Location		**Metaphyseal**			**Diaphyseal**		
Stability		Undisplaced crack	Displaced or unstable	Cortical perforation	Undisplaced crack	Displaced or unstable	Cortical perforat-ion
Classification	A1	A2	A3	B1	B2	B3	C1
Treatment options	Bone graft	cerclage	Diaphyseal stem	Bypass with longer stem	Cerclage and bypass with longer stem	Reduction, cerclage, cortical strut	Bone graft and bypass with cortical strut
	Observe		Trochanteric fixation	Cortical strut if tip of longest stem	Cortical strut or plate & screws		

Figure 1. x-ray post fracture pelvis with both hip-AP view.

Figure 2. x-ray post primary fracture fixation- pelvis with both hip-AP view.

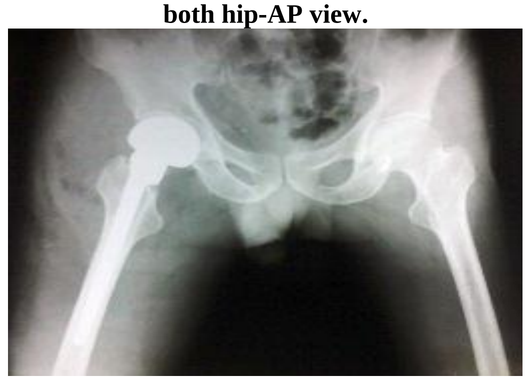

Figure 3. x-ray post primary fracture fixation- right thigh-AP and lateral view.

Figure 4. x-ray post-fracture pelvis with both hip-AP view.

Figure 5. x-ray post-fracture right thigh-AP and lateral view.

Figure 6. x-ray post peri-prosthetic fracture fixation at 3 months.

Figure 7. X-ray post peri-prosthetic fracture fixation at 6 months.

DISCUSSION

Diagnosis of periprosthetic fractures relies upon one or more techniques: direct observation, clinical suspicion, and radiographic evaluation. Markedly displaced fractures about implants are obvious through the abrupt onset of pain and deformity, but clinical suspicion of a periprosthetic fracture is necessary in patients with nondescript complaints of pain about a component, especially one associated with osteolysis. Traumatic events, while often cited as a leading cause of periprosthetic fractures, are generally the last factor in a long chain of events leading up to the fracture. The majority of periprosthetic fractures about the hip are reported to occur after relatively minimal trauma, such as a fall or a twisting motion. Revision surgery of total hip prostheses and osteolysis are other factors that have been implicated.

The current gold standard for the treatment of post-traumatic periprosthetic femoral fractures is surgery. Selected simple fractures having a stable implant can be treated conservatively with bed rest, traction, casts or braces. Safe, cost-effective treatment of Vancouver type-B1 fractures can be performed by plate fixation without the addition of cortical struts. This allows earlier weight-bearing than allograft strut fixation alone [13]. Therefore, it is crucial to correctly identify the type of fracture and the stability of the implant for correct surgical planning. The Vancouver system is always helpful to guide treatment choices, though the most reliable way to ascertain stability is by intraoperative evaluation. The use of plates, proximally hooked in an anatomical configuration to the greater trochanter and accepting screws, cerclage wires or cables for transcortical fixation are of great utility when ORIF is indicated.

To augment the fixation in cases of severe comminution or insufficient cortical bone stock structural cortical auto- and allografts are also indicated. Implant revision is mandatory in selected fractures adjacent to an unstable stem. The use a non-cemented, modular long stem, with distal cortical fixation and antirotational slots is preferred for this purpose, which allows reconstruction of the proximal femur around the stem. It is particularly helpful when the proximal femur is comminuted from a traumatic event or osteotomized for the revision of a previously inserted cemented stem. In addition, the modularity of this implant allows adoption of any last minute changes to correct leg length discrepancies, and to achieve the necessary articular stability by balancing the soft tissues therefore a cementless surgery[14]. The implant was not subsiding because of the intact proximal femoral sleeve including the lesser trochanter. The proximal femoral sleeve was reconstructed with the help of encerclage wires passed below the lesser trochanter. Because of the long spiral geometry the fracture was reduced to nearly anatomical position. The fracture was stabilised with long locking compression plate spanning from greater trochanter down to below the fracture. The plate was applied and 4 locked screws were applied distal to the fracture.

The proximal part was stabilised with unicortical screws passed around the greater trochanter and The most common type of peri-prosthetic fracture after THR occurs in the region surrounding and immediately distal to the tip of the stem, a Vancouver type-B fracture. In our patient, there was an early post-op fracture as is expected in cementless prosthesis which tend to fracture in the first six months. The fracture in our patient was around the distal end of the prosthesis and was classified as Type B1 as per Vancouver's classification,and occured following a fall, that is,the fracture was traumatic in nature As per the Vancouver Postoperative Classification, in our patient, with a Type B1 fracture, bypass with longer stem was recommended. When the femoral stem remains well fixed (Vancouver type-B1), reduction and internal fixation are recommended in most cases [1,2,8,12,15-17].

The use of long allograft struts with cerclage wires has been advocated and supported by the results of a multi-centre study [18]. Various studies have suggested the use of different prosthesis for type B1 fractures .There have been studies using open reduction internal fixation of Vancouver Type B1 periprosthetic femoral fractures using a lateral locked-plate that spans the full extent of the femur as the sole method of stabilisation. It minimises soft-tissue dissection and provides adequate fixation strength to maintain fracture alignment to fracture union.

CONCLUSION

The recommended treatment, bypass with longer stem, was impractical in this patient owing to his narrow medullary canal. We had adopted open reduction internal fixation by locking compression plate and cerclage wire. This procedure, which is actually adopted for Periprosthetic fracture Vancouver's classification type B3, had to be adopted because the patient had a narrow medullary canal measuring only 8mm. Bipolar Hemiarthroplasty, in itself, had been difficult procedure owing to the narrow medullary canal and was encerclage wires. Hence, open reduction internal fixation by locking compression plate and cerclage was successfully completed on the patient. Chance of implant failure was reduced because of use of LCP with cerclage. The economic constraints of the patient had restricted the use of cable plate.

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