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Vancouver type-b1 periprosthetic fracture managed with locked compression plate: A case report

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Abstract
The incidence of periprosthetic fractures around the femoral stem is increasing. These are very challenging fractures and need adequate surgical expertise. There is no clear consensus regarding the management of these fractures, especially Vancouver type-B fractures. We report a case of Vancouver type-B1 fracture managed only with locked compression plate in a 70-year-old man. Fracture united at 3 months and at one year the patient had excellent functional and radiological outcome.

Keywords: Periprosthetic fractures, vancouver classification, locking compression plate

Introduction
The number of cases of periprosthetic fractures are increasing as the incidence of hip arthroplasty for fracture neck of the femur or hip arthritis is increased because of the increased survivorship of the arthroplasty population [1]. Generally, patients with periprosthetic fractures are elderly, frail and have osteoporosis [2]. The choice of treatment depends on various factors: patient condition, location of fracture, stability of the prosthesis, and quality of the bone. No clear consensus exists regarding optimal management as there is limited high quality research [3].
Nonoperative management is rarely done and is reserved for stable trochanteric fractures around well-fixed implant (Vancouver type-A) or those patients who are unable to undergo surgical treatment which can lead to decreased functional status, longer rehabilitation and increased incidence of systemic and local complications. Operative management has the advantage of early mobilization, reduced hospital stays and reduction in complications. The Vancouver classification facilitates treatment decisions [4, 5].
Surgical stabilization of fracture with plates, strut grafts or combination of them is recommended in periprosthetic fractures with a stable prosthesis (types B1 and C fractures). For fractures with loose femoral prosthesis (type B2 and B3) the recommendation is revision using longer stem with or without additional fracture fixation [6].
The purpose of this case report was to show the outcome of a Vancouver type-B1 fracture treated with open reduction and internal fixation, using only a locking compression plate in a 70-year-old patient with multiple comorbidities.

Case Report
A 70-year-old man presented to our emergency department with pain, swelling and deformity in his left thigh after a fall from a standing height. He had undergone left hip hemiarthroplasty with uncemented bipolar prosthesis two years back (Fig. 1). His medical history included hypertension for 3 months and diabetes mellitus diagnosed 3 years back that was being treated with oral hypoglycaemic agents (Glimepride and Metformine). There was no history of pain or dysfunction in the left hip before the history of fall. On admission patient was unable to bear weight on the affected limb, there was swelling, tenderness and deformity at the proximal one third of the thigh. X-rays (Fig. 2) showed Vancouver type-B1 periprosthetic fracture of the femur at the level of the distal end of the bipolar stem [7]. The fracture pattern was long oblique with medial cortical spike, there was no obvious thickening of the lateral cortex, there was no comminution at the fracture site. After blood investigations which were within normal limits and informed consent patient was taken up for the surgery.
Patient was positioned in right lateral position after spinal anaesthesia, fracture was approached by lateral approach. Intraoperatively our diagnosis was confirmed as any kind of

loosening of prosthesis was ruled out. As it was a long oblique fracture the fracture site was reduced and was fixed by a 4.5mm lag screw. Insertion of lag screw was a challenging as we had to bypass the tip of the stem. Locking compression plate (4.5mm, broad) was used to fix the fracture. Our next challenge was to prebend the plate to the shape of the trochanteric flare and the greater trochanter, which was done using a bench plate bender. Plate position and the placement of screws were confirmed under fluoroscopy (Fig. 3). Postoperatively intravenous antibiotics and deep vein thrombosis prophylaxis were given. Postoperative period was uneventful. Patient was discharged after suture removal with the advice of bedside mobilization and static quadriceps strengthening exercises.

Patient was followed up at 6 weeks, 3 months and one year. Fracture united uneventfully and full weight bearing mobilization with support was started at 3 months. At one-year follow-up patient had no pain, used cane for support, walked comfortably; there was no limp; climbed stairs normally without using railing; was able to sit comfortably in ordinary chair for one hour; patient had no marked physical deformity and the Harris Hip score was 92% (Fig. 4 & 5). Radiological evaluation at one year showed excellent outcome according to Beals and Towers criteria for radiological evaluation [8].

Fig 1: X-rays showing fracture neck of femur for which hemiarthroplasty with uncemented bipolar prosthesis was done

Fig 2: X-rays at the presentation showing periprosthetic fracture at the level of the distal femoral stem. It is a long oblique fracture with good bone stock and no signs of loosening of the stem. Hence, classified as Vancouver type-B1 fracture

Discussion

Periprosthetic fractures around the femoral stem post hip arthroplasty epitomizes a significant challenge for orthopaedic surgeons. The incidence of such fractures is on a rise as the number of patients undergoing hip arthroplasty following neck femur fracture or arthritis is increasing along with their life span [6].

Most commonly used classification for periprosthetic fractures around the femoral stem is Vancouver classification which was developed by Duncan and Masri in 1995. Fractures are categorised in three types as type A, B and C depending upon the level of the fracture. Type-B fractures include the fractures around or just below the stem and they are sub-classified depending on the stability of the stem and the bone stock [5]. The type-B fractures are most common, the Swedish Hip Register reported more than 80% of periprosthetic fractures are type-B fractures. Further, in primary stems approximately 75% fractures are associated with loose stems (type B2 and B3) and in revision stems about 49% fractures have loose stems. Overall, type-B3 is the least common type (about 4%) [9]. Our patient had type-B1 fracture as the patient had no signs of femoral stem loosening and had good bone stock.

Most important disadvantage of Vancouver classification is in its complete reliance on preoperative x-ray evaluation of stem stability to differentiate between type B1 and B2 fractures [10]. In one of the studies involving 45 radiographic type-B1 fractures, when the hip joint was opened and dislocated, 20% of stems were found to be loose, requiring revision. Accurate assessment of stem stability is key to a good outcome, leading some authors to recommend routine intraoperative stem stability tests before fixation [11]. Therefore, we had to reconfirm our diagnosis intraoperatively by evaluating the stability of the stem.

There are several risk factors known to predispose the periprosthetic fractures which include: female gender, presence of rheumatoid arthritis, osteolytic lesions and advanced age (mostly due to osteoporosis). Most of the periprosthetic fractures are due to low energy falls from sitting or standing heights [9]. In a study involving 71 cases of postoperative periprosthetic fractures recorded minor trauma in 87% cases, spontaneous fractures in 9% and remaining 4% were due to major trauma [12]. Our patient was elderly male and had a minor fall from standing height.

Type-B periprosthetic fractures are typically managed surgically unless there is a medical contraindication. The aims of fixation include accurate fracture reduction, fracture union, and early mobilization of the patient so that hip and knee function are preserved [13]. The main stay of operative management for type-B1 fractures is open reduction and internal fixation (ORIF); however, it is essential to identify the patients for whom osteosynthesis may have a poor outcome [11]. It is very clear that type B2 and B3 fractures should be treated with revision hip arthroplasty. Sometimes patients with type-B1 fracture too may need revision in the following instances: patients with history of hip pain prior to the fracture, fractures with minimal trauma, difficult to treat fracture patterns (transverse, short oblique, comminuted), poor bone quality and cemented femoral stems [14, 15].

Our patient had none of the above-mentioned problems, hence, it was decided to go ahead with osteosynthesis using locking plate with a lag screw as it was a long oblique fracture. Bryant *et al*. in their study described ORIF of Vancouver type-B1 fractures with lateral locked plate that spans the full extent of the femur as the solitary method of stabilisation as an efficacious treatment modality with minimum soft-tissue dissection and also provides adequate fixation strength to maintain fracture alignment to fracture union [16]. In another study, Serocki *et al*. demonstrated that compression plating can be effective method of treating femoral fractures about hip prosthesis [17].

Various studies indicate a high failure rate for osteosynthesis of type-B1 fractures and many authors contribute it to the unrecognized femoral stem loosening

which lead to increased motion and strain at the fracture site. Other causes of failure can be due to; poor biological environment for fracture healing due to presence of intramedullary prosthesis, prior reaming contribute to endosteal ischemia, periosteal devascularization during fracture reduction and fixation using plates and cables [12, 18]. Our patient was managed with good soft tissue handling, minimal periosteal stripping without cables or wiring and as there was no loosening of the prosthesis the fracture went on to unite without any complications.

Fig 3: Immediate postoperative x-rays showing anatomic reduction of the fracture fixed with a 4.5mm lag screw and a 4.5mm locking plate contoured to the shape of the greater trochanter. The fixation criteria of minimum 4 unicortical screws proximally and 4 bicortical screws distal to the fracture is also fulfilled

Fig 4: X-rays at one-year follow-up showing fracture union without any subsidence of the femoral stem

Fig 5: Clinical pictures of the patient at one year follow up. Patient is able to stand comfortably without any support

Conclusion

Periprosthetic fractures are extremely challenging and require adequate surgical expertise. Type-B1 fractures can be tricky and misleading. Adequate intraoperative assessment of the femoral stem stability in all cases is very critical. Open reduction and internal fixation with locking plate is the main stay of treatment around a well-fixed stem with good bone stock.

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