The Pseudo $A_{LT}$ Periprosthetic Fracture: It’s Really a B2

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abstract

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Periprosthetic fracture of the proximal femur involving the lesser trochanter (the Vancouver type $A_{LT}$) is an uncommon occurrence. As it is basically an avulsion fracture of the attachment of the iliopsoas, it does not destabilize the stem and can be treated nonsurgically. In contrast, there is a so-called type “new B2” periprosthetic fracture of the lesser trochanter, which includes a segment of the proximal medial femoral cortex. This is usually seen within 6 weeks of the index procedure, typically following insertion of a tapered, cementless stem within a demineralized femur. This may be due to an unrecognized intraoperative fracture that subsequently displaced under load, or it may occur soon after, during rehabilitation. It is important to distinguish this fracture from the type $A_{LT}$ because it is associated with destabilization of the stem and requires early reintervention. The principles of treatment depend on the timing of the fracture and the size of the medial fracture fragment. If recognized intraoperatively as a nonpropagated cortical crack, then extraction of the broach or stem followed by cerclage cable fixation and reinsertion of the stem is adequate in most cases, with protected weight bearing for 6 weeks. If diagnosed postoperatively, or if the fracture fragment is larger, then management with a stem that gains fixation distal to the fracture is required. This distinction between the pseudo type $A_{LT}$ and the type “new B2” is important to recognize if appropriate treatment is to be prescribed and a satisfactory outcome is to be assured.

Figure 1: AP radiograph of the left hip on postoperative day 3 after the patient sustained a slip and fall while mobilizing in the hospital and a significant axial load was placed across the hip joint. Notice the distal extension of the fracture line down the medial cortex; this leads to destabilization of the stem because the medial buttress is lost. The implant has subsided. Figure 2: Postoperative radiograph following revision with a longer stem, along with reduction and fixation of the fracture.
Total hip arthroplasty (THA) is a highly successful procedure in relieving pain and disability for patients with arthritis. It has been shown to have excellent long-term results and a relatively low risk of complications. However, with the increasing number of primary hip replacements in service and the aging population, complications such as periprosthetic fractures are occurring with increasing prevalence. This article focuses on 2 specific types of proximal femoral periprosthetic fractures that occur either intraoperatively or in the early postoperative period (ie, the first 6 weeks). It is important that the surgeon distinguish between these 2 types of fractures, which can appear similar on standard radiographs, as the treatment principles for each fracture type are different.

**Risk Factors**

Several risk factors have been associated with periprosthetic femur fractures. There is an increased risk in association with press-fit, cementless stems. While this risk is much higher for revision stems, the increasing use of tapered, proximally porous-coated, cementless stems in primary THA may also predispose the patient to periprosthetic fracture. Female sex and more advanced age have been identified to be independent risk factors; however, these factors may be confounded by osteoporosis. Other patient factors including medical comorbidities such as rheumatoid arthritis or metabolic bone diseases have been suggested as risk factors. Altered bone morphology or deformity, as that seen in Paget’s disease, may also increase the risk of fracture.

**Classification**

Accurate classification of periprosthetic femur fractures is important, as proper identification of the fracture type is central to management. The Vancouver classification system was developed based on the 3 most relevant features: fracture location, stem stability, and quality of the remaining bone stock. The classification system further divides the femur into 3 anatomic zones based on the level of the periprosthetic fracture: A, the trochanteric region; B, the diaphysis around or just distal to the stem; and C, the diaphysis well distal to the tip of the implant. The validity and reliability of this classification system has been confirmed.

The 2 proximal femoral periprosthetic fracture patterns that will be the focus of this review are the Vancouver type A<sub>LT</sub> fracture, which involves only the lesser trochanter, and the Vancouver type B2 fracture, where the hallmark is a loose femoral implant and adequate proximal femoral bone stock. The key distinguishing feature between the 2 lies in the distal extension of the fracture to involve the medial cortex of the proximal femur which would destabilize the stem in a B2 fracture.

**Type A<sub>LT</sub> Fracture**

Type A fractures are subclassified into fractures of the greater trochanter (AGT), and fractures of the lesser trochanter (ALT). Type A<sub>LT</sub> fractures typically result from an avulsion injury of the insertion of the iliopsoas tendon. As an isolated injury, these fractures can usually be ignored, as in most cases the fracture is small enough that it does not compromise implant stability. However, in type A<sub>LT</sub> fractures where the fragment is large and involves distal extension down the medial cortex, this leads to destabilization of the stem because the medial buttress is lost.

**Type B2 Fracture**

As mentioned above, type B fractures are subdivided depending on the stability of the femoral implant and the remaining proximal femoral bone stock. For B2 fractures, the hallmark is a loose femoral implant and adequate proximal femoral bone stock. The reason these fractures can be mistaken as type A<sub>LT</sub> fractures is due to the common location of these type B2 fractures when they occur either intraoperatively or in the earlier postoperative period. The tapered design of many press-fit, cementless femoral stems used in primary THA can cause a split of the proximal medial femoral cortex during broaching or stem insertion, which, on a postoperative radiograph, can resemble a type A<sub>LT</sub> fracture. During insertion of the stem, any sudden change in resistance is highly suggestive of a femoral fracture. The key to prevention and recognition of this fracture type is adequate exposure of the proximal femur. A thorough intraoperative assessment and/or supplementary intraoperative radiographs should be performed to rule out fracture when a concern is raised. The stability of the femoral component must be ensured prior to wound closure.

**Management**

The key to successful management of these periprosthetic fracture patterns is to accurately recognize which fracture subtype you are dealing with. The isolated type A<sub>LT</sub> fractures involving a stable stem can be treated nonoperatively. If one is dealing with a pseudo type A<sub>LT</sub> fracture, or a so-called “new B2,” the treatment is much different. Prompt recognition of an impending or established intraoperative B2 fracture often means the fracture may be stabilized with the use of cerclage cables. The typical sequence in this scenario is recognition of the undisplaced cortical crack, extraction of the broach or stem, followed by cerclage cable fixation and reinsertion of the stem, with protected weight bearing for 6 weeks. Missed diagnosis or fractures that occur in the early postoperative period with associated fracture displacement and implant subsidence often require revision of the stem to a longer femoral component that gains distal fixation, along with reduction and stabilization of the fracture (Figures 1-4). This is usually accomplished with cerclage cables and/or proximal femoral plating.

More importantly, fracture prevention is important, and recognizing patients who are at risk for this type of fracture is the
key. We recommend the placement of a prophylactic cerclage wire before broaching and the insertion of the stem to prevent propagation if a proximally coated stem is used in an elderly, demineralized femur. The addition of this cerclage wire adds little morbidity and is a rapid procedure that does not compromise outcomes. Consideration should also be given to using a cemented femoral stem in the setting of a significantly demineralized femur in an elderly patient. It is prudent to supplement these intraoperative measures by also recommending the patient mobilize with at least a cane and a walker.

CONCLUSION

The principles of management of the pseudo type A LT or so-called type “new B2” periprosthetic fracture include early recognition, achievement of fracture and stem stability, avoidance of fracture propagation, and maintenance of the component position and alignment. Prompt recognition and appropriate treatment of these periprosthetic fractures does not compromise the long-term results of the THA unless the bone damage precludes stable fixation of the implant.

REFERENCES