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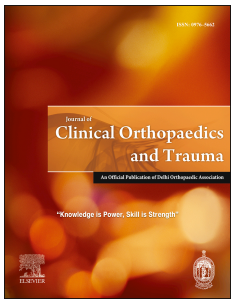

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A simple reproducible technique for the retrieval of broken Proximal femoral blades, a technical note and review of literature.

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Abstract

Despite advances in metallurgy, fatigue failure of hardware in orthopaedics is common especially when a fracture fails to heal. Revision procedures can be difficult, usually requiring removal of intact or broken hardware. Several different methods are usually used to successfully remove the intact or broken hardware. The proximal blade fracture is rare and under-reported in the literature. In our tertiary non-union and limb reconstruction unit, we have developed a technique for an easy and quick removal of a broken proximal femoral blades.

Background

Despite improvements in metallurgy, implant fatigue is prevalent especially in cases of non-union. Revision is always challenging, and regularly demand the extraction of intact or broken implants. Various described approaches are required to remove broken implants. Hardware removal can profess a challengeable surgical problem in revision trauma surgery. The challenge of the retrieval of broken hardware can considerably prolong operative time and complexity.

The use of intramedullary nails is the gold standard for treatment of the proximal and diaphyseal femoral fractures. Nevertheless, the magnitude of bending forces in this region of the femur can often

yield to implant failure before union. Broken proximal femoral blades after femoral interlocking nails are under-reported and a surgically challenging situation. There are different published techniques to remove broken locking bolts[1, 2] which is not the case for removal of broken blade; which is technically challenging. As yet, to the best of our knowledge, only one extraction method has been described to retrieve broken proximal blades[3], which is not successful in our experience. In other situations, a broken implant may be encountered surprisingly throughout regular hardware retrieval, this usually happens in the case of nonunion or delayed union of a fracture following a fracture. Moreover, Broken blades might happen after a tumor resection or reconstruction in the case of absence of healing. Also, intramedullary femoral nails are used for prophylactic fixation of impending pathologic fracture; the proximal blade might break because of improved patient survival.

Despite advances in metallurgy, fatigue failure of hardware is common when a fracture fails to heal. Revision procedures can be difficult, usually requiring removal of intact or broken hardware. Several different methods may need to be attempted to successfully remove intact or broken hardware. The proximal blade fracture is rare and under-reported in the literature. We describe an alternate technique; that we have utilised in our tertiary fracture non-union and limb reconstruction unit. We have developed a technique for an easy and quick removal of a broken proximal femoral blade. The following tips simplify the process and reduce the operative time required.

Methods

CASE REPORT

Surgical Technique

Broken proximal blades often are identified on preoperative radiographs (Figure 1), although it can also occurs during the primary surgery. The patient is positioned on a radiolucent table and standard draping was used.

The original incision is utilised for the proximal blade hole; the incision is extended proximally and distally by two cm. Surgical dissection is extended down to the bone after splitting the vastus lateralis muscle; using the image intensifier the proximal blade is identified. Maintaining a stringently subperiosteal plane, the vastus intermedius and medialis origin are lifted subperiosteally and two curved Hohmann retractors are introduced to aid in retraction.

Under the guidance of the image intensifier, the lateral accessible fragment of the proximal blade is retrieved followed by the removal of the nail. An initial attempt to pull the remaining broken medial part of the proximal blade was undertaken without success especially that the fracture was not united.

A 4mm tap is used (Figure 2) to engage in the central tunnel of the spiral blade. The tap is then rotated clockwise into the tunnel in the blade screw (Figure 3) and it was advanced in the centre of the tunnel. Subsequently, the tap was pulled out with the broken medial part of the blade (Figure 4a). As the fracture was not united, a proximal femoral blade plate was used to fix the fracture (Figure 4a).

Discussion:

The breakage of the proximal blade in femoral nails is techniqually challenging[3]. As yet, to the best of our knowledge, our technique has not been described elsewhere. We report a cost-effective, reproducible, bespoke and safe technique that is effective in our experience. Usually the proimal blade failure happens in cases of non union, thus, pulling on the broken medial part is unsuccessful. It is mandatory to remove the medial broken part so as to undertake revision fixation of the non-united fracture.

Compared with other implants, cephalomedullary nails provide biomechanical superiority due to their shorter lever arms and reduced deforming forces[4, 5]. Intramedullary nails are the preferred surgical option for the management of proximal femoral fractures, especially in the case of closed reduction procedure[4-6]. Additionally, intramedullary nailing is correlated with reduced soft tissue injury, reduced blood loss, and decreased infection rates and wound complications[4-6]. Ma et al[6] published decreased blood loss and decreased the length of hospitalisation. Besides, they reported no significant difference in the rate of fixation failure between the intramedullary nails to dynamic hip screw. Thus, femoral intramedullary nailing is regularly utilised to treat unstable geriatric trochanteric hip fractures[7, 8].

On the other hand, several complications might develop in the intraoperative and postoperative periods with the use of intramedullary nails. The reported complications include cut out/back out of the blade and non-union of the fracture[8-12]. There are

reported complications in the literature; these include cut out/back out of the blade and non-union of the fracture. The complications for utilising cephalomedullary nails' fixation for proximal femoral fracture also include shortening, malrotation, malunion, non-union and implant failure or malposition. Proximal blade failures are under-reported in the literature[9, 12-23]. Hypothetically, this risk can be avoided by satisfactory reduction before nail insertion, precise assembly of the implant and frequent check of components using fluoroscopic views.

The complication rate of proximal femoral nails that requires revision ranges from 3% to 28% in the literature[3-5, 8, 9, 16, 19-22, 24-30]. Paraschou et al[21] reported outcomes of 257 trochanteric fractures managed with intramedullary nailing. they reported two malunions, one nonunion, one screw cut out and one screw migrated medially. Also, they reported that 2 out of 275 distal locking screws were misplaced using a commercially prepared jig. Fogagnolo et al[5] found mechanical failures in 23.4% patients; Akan et al[31] reported 10% mechanical failure in a cohort of 80 patients, while Boldin et al[32] reported a complication rate of mechanical failure 21.8% in 55 patients treated with intramedullary nails compared to 4.6% only by Simmermacher et al[8]. Although the rate of implant failure is variable in different studies[4-6, 8, 20, 26, 31, 32] but this might be because of the variability in the clarity of the definition of failure. It is reported to be around 5%, 2% to 10% with Sliding Hip screws, 2% to 12% with lag screw Cephalomedullary nails, and 1% to 8% with blade Cephalomedullary nails[7-9, 33, 34]. In the meantime, the implant-related

complication rate of basicervical fracture in previous studies showed remarkable variations.[24, 28].

The removal of broken blade can be technically challenging, yet, a crucial step in revision surgery, especially that they occur in cases of non union where refixation is planned. Preoperative planning is mandatory to make sure that the required removal instruments are available. Trauma surgeons should be knowledgeable of accessible instruments and possible techniques to remove broken blade in theatres as assuming the unexpected would prevent failure. There are multiple reports on the use of conversion to total hip arthroplasty for failed proximal fixations of intertrochanteric fractures, which would be another successful option[26, 30, 35, 36]. The removal of broken implants is a challenging task[2, 3]. There is a variation in the metal breakage rate, in orthopaedic surgery, between elective and trauma work – ranging from 0.3 to 7.9 per 1,000 cases respectively[37]. There are various techniques in the literature described for removal of broken locking bolts[2, 37], broken drill bits, broken interlocking screws[38], broken cannulated screws[39] and broken intramedullary nails[1, 37].

As yet, to the best of our knowledge, only one extraction method has been described to retrieve broken proximal blades[3], which may fail. Stover et al[3] reported a surgical technique that entails connecting a T handle to the reverse threaded conical extraction bolt, from the AO broken screw extraction bolt, after locking it to the spiral blade. This has failed in our experience as there is no room for striking the

blade like the described case in this study especially when displaced medially.

In conclusion, there is not a single removal technique that is extensively successful, the surgeon should be aware of various different techniques to remove broken blades. The described technique is successful in our hands and reproducible in our experience.

Disclosure: All authors report no conflicts of interests.

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FIGURES LEGEND

Figure 1: Broken femoral blade held in the medial femoral cortex.

Figure 2: Size 4 mm standard tap is used

Figure 3: The tap is rotated clockwise into the tunnel in the proximal blade and subsequently pulling on the drill bit retrieves the broken part.

Figure 4. A) Successful removal of the broken blade. B) revision fixation of the non-united fracture using proximal femoral blade plate.