CASE REPORT

A simple removal method of a broken Proximal Femoral Nail (PFN)

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Accepted 7 March 2006

Introduction

In 1997, the Proximal Femoral Nail (PFN®) (Synthes) was introduced for the treatment of unstable peri and subtrochanteric fractures. The Proximal Femoral Nail uses two screws for fixation into the femoral head and neck. The larger screw is intended to carry the majority of the load and the smaller screw provides rotational stability. There have been a relatively low percentage of complications reported, but the occasional nail breakage is a serious complication requiring revision surgery.1

Intramedullary extraction methods for a broken hollow nail have been described, using hooks, screws or guide wires wedged into the nail cavity. However, if one of the newer solid nails breaks, these techniques cannot be applied and more radical surgery may be needed for nail removal.1,2,6,8,9

We present a case of fracture of a solid femoral nail through the proximal interlocking screw hole after a subtrochanteric femoral fracture, and a method for the relatively atraumatic intramedullary removal of the broken distal fragment by using an AO/ASIF Universal Femoral Nail® (Synthes).

Case report

An 82-year-old female sustained an isolated subtrochanteric fracture in her right femur in a fall from her own height. An open reduction was first performed with two Dall-Mails cables (Howmedica®), and the construct was then stabilised with a 10 mm PFN, distally locked with two screws. The patient was unable to partially weight-bear as she was blind and lived alone. At one month the nail was noted to be broken just above the most proximal of the distal locking screws (Fig. 1).

Revision surgery was performed with the patient in a supine position. The two proximal screws and the more proximal of the distal locking screws were removed, and the proximal fragment of the nail was easily extracted. The medullary canal was then reamed 4 mm larger than the diameter of the removed nail until just above the proximal part of the distal fragment of the broken nail. We tried to use the Synthes solid nail extraction kit (Synthes), but we could not create a clean space around the distal fragment of the nail due to the fact that the
Figure 1  (A) Initial subtrochanteric fracture. (B) Radiograph after the first operation. (C) Refracture associated with a broken solid femoral nail.

Figure 2  Removal technique of a solid nail: (A, B) we could not create a clean space around the distal fragment of the nail with the trephine system. (C) An AO/ASIF Universal Femoral Nail (Synthes) was cut at its distal part and manoeuvred easily over the broken solid nail. (D) The fragment was gently removed using twisting movements.
trephine system was not stiff enough to control the unstable bony fragments and allow us to guide it to the proximal part of the broken nail segment (Fig. 2).

A 13 mm Universal Femoral Nail (Synthes) was cut at its distal part with a high-speed saw as its stiffness, cloverleaf cross section and longitudinal slot allowed us to cross the unstable fracture, controlling the displaced fragments, and then jam it onto the broken solid nail. After that, the distal screw was removed and the nail was gently removed using twisting movements. A 12 mm PFN was then inserted with two distal interlocking screws (Fig. 3).

**Discussion**

Intramedullary nailing for stabilisation of subtrochanteric fractures has many advantages compared with other surgical options, including small surgical incisions distant to the zone of injury, the ability to stabilise the skeleton without directly accessing the fracture and physiological load transmission down the mechanical axis of the bone. However, excessive weight-bearing may lead to fatigue breakages as happened in our case.

Although several techniques have been described in the literature for the intramedullary extraction of hollow nails, there is little written on how to remove fragments of solid nails. Retrieval of the distal fragment of a solid broken nail without destructive surgery can be a challenge.

Giannoudis et al. presented two cases of intramedullary extraction of a broken solid nail using the Synthes solid nail extraction kit (Synthes). In our case this method could not be employed due to the fact that the breakage was at the level of the more proximal of the distal locking holes. Consequently, the fragment was tilted so that it was abutting against the cortex and it was not possible to create a clean space around the distal fragment of the nail with the trephine system.

Hellemondt and Haeff described the extraction of a broken solid tibial nail at the level of the proximal distal locking screw by means of a slotted nail, which was modified to glide on the 8 mm solid nail.

Kretteck et al. described the removal of a broken solid femoral nail through the proximal distal locking screw by using a simple push-out technique, that is, opening a lateral working channel and using a narrow Hohmann retractor. This technique was not suitable in our case due to the greater length of the distal nail fragment.

Milia et al. presented a case in which a solid titanium spiral-blade intramedullary nail was broken through the proximal interlocking screw hole. The nail was extracted through the fracture site by means of a retrograde push-out technique and without requiring any special instrumentation.

Figure 3  (A) The removed fragment jammed in the Universal Femoral Nail (B) Radiographs showing the final result with a larger 12 mm PFN.
The simple technique described here for removing a solid nail removal needs no special devices and removes the nail distal fragment via the intramedullary route without disturbing the fracture site. The cloverleaf cross section and longitudinal slot of the Universal Femoral Nail make it an excellent tool for extracting solid nail fragments because it can be forced onto the fragment strongly enough so that they may be extracted together.

Furthermore, the AO/ASIF Universal Femoral Nail is stiffer than the trephine system of the Synthes solid nail extraction kit, which makes us easier to control the displaced fragments.

References