# Injury to the deep femoral artery during proximal locking of a distal femoral nail—a report of 2 cases

**Lauri Handolin, Jarkko Pajarinen and Ilkka Tulikoura**

Department of Orthopaedics and Traumatology, Helsinki University Central Hospital, Topeliuksenkatu 5, P.O. Box 266, FI-00260 Helsinki, Finland. Correspondence: lauri.handolin@hus.fi
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### *Case 1*

An 87-year-old man, with a previous total knee arthroplasty (TKA), sustained a left distal femoral periprosthetic fracture as a result of fall on the same level (Figure 1). Surgical stabilization was delayed until the 6th day after the trauma due to cardiac insufficiency. An open reduction of the fracture was performed on 16 March 2000 through an extension of the previous TKA approach, and the fixation was done with a 12 × 240 mm retrograde femoral nail (Distal Femoral Nail, DFN, Stratec Medical, Oberdorf/BL, Switzerland). The nail was introduced through the intercondylar space, next to the posterior rim of the TKA femoral component. It was locked distally with a spiral blade and one locking screw, and proximally with two 34 mm screws placed in a lateromedial direction. Transient moderate bleeding occurred in the area of proximal locking peroperatively. The bleeding diminished after the operation.

Postoperatively, the patient was hemodynamically unstable, and needed 2 units of red blood cells (400 cc/unit) a day. Acute atrial fibrillation developed on the 3rd postoperative day, and the patient was transferred to a cardiac care unit. A successful cardioversion was performed, and the patient was transferred back to the orthopedic unit on the 5th postoperative day. An angiography of the operated extremity, performed on the next day because of increasing swelling of the thigh, showed on-going bleeding from one of the anterolateral branches of the deep femoral artery 3 cm above the most proximal locking screws (Figure 2). The bleeding vessel was successfully embolized with four 2–4 mm fiber coils. The patient recovered without complications.

Figure 1. Pre- and postoperative radiographs in case 1. The distal periprosthetic fracture of the left femur was fixed with a Distal Femoral Nail (DFN).

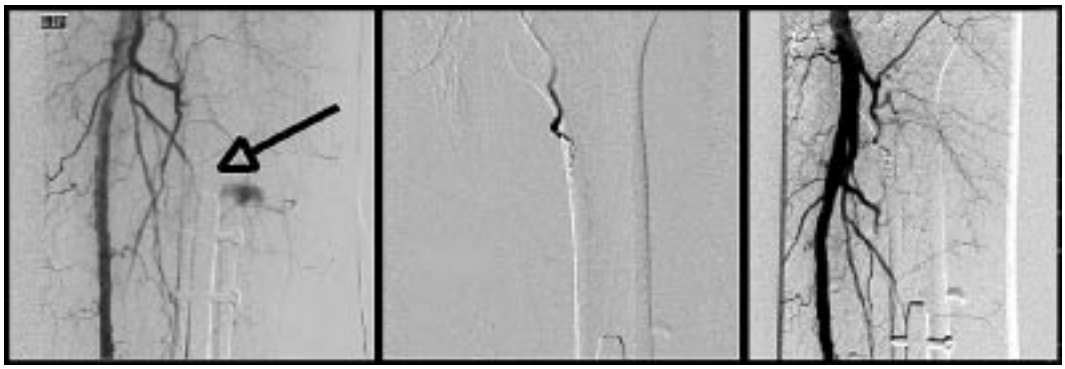

Figure 2. Angiography of the left thigh in case 1, showing bleeding from one of the branches of a deep femoral artery, several centimeters distal from the drill hole of the proximal locking screws. The bleeding was embolized with four 2–4 mm fiber coils. The subsequent angiography shows that the procedure was successful.

### *Case 2*

An 88-year-old woman, with a previous bilateral total knee arthroplasty, sustained a distal diaphyseal femoral fracture on the right side as a result of a fall on the same level. Because of to hyperpotassemia, the operation was delayed until the 3rd day after her fall. On 5 October 2001, the fracture was reduced by closed manipulation, and fixed with a 10 × 300 mm retrograde femoral nail (Distal Femoral Nail, DFN, Stratec Medical, Oberdorf/BL, Switzerland), which was inserted through the femoral intercondylar space, close to the posterior rim of the femoral TKA component. Distal locking of the nail was done with a spiral blade and one locking screw. While drilling holes for proximal locking screws in a lateromedial direction, severe bleeding suddenly occurred from one of the holes. An immediate angiography showed bleeding from the main trunk of the deep femoral artery at the level of the drill hole (Figure 3). This was successfully embolized with three 2–4 mm fiber coils, and the hematoma was removed at the same time as an anterior fasciotomy of the thigh was performed. 4 days later, final proximal locking of the nail was done with 2 screws in an anteroposterior direction. The patient recovered without complications.

## Discussion

Retrograde intramedullary nailing of both shaft and distal fractures of the femur is becoming increasingly common. Several reports have shown that this method is associated with a high union rate of the fracture, without damaging the knee joint (Moed et al. 1998, Ostrum et al. 1998, Ostrum et al. 2000). Moreover, the biomechanical value of the Distal Femoral Nail (DFN, Stratec Medical, Oberdorf/BL, Switzerland) in osteoporotic bone has also been shown (Ito et al. 2001). At present,

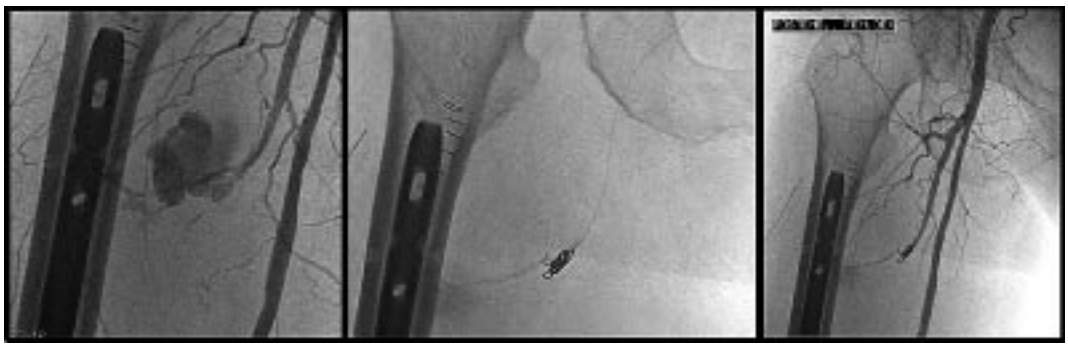

Figure 3. Angiography of the right thigh in case 2, showing bleeding from the main trunk of a deep femoral artery at the level of the drill hole of proximal locking screws. The bleeding was embolized with four 2–4 mm fiber coils. The subsequent angiography shows a successful procedure.

we use the DFN in our department in distal diaphyseal and supracondylar femoral fractures.

To our knowledge, no reports have been published on life-threatening complications associated with the DFN (Grass and Zwipp 1998, Walcher et al. 2000). However, Coupe and Beaver (2001) recently reported a vascular injury during proximal locking of a long retrograde nail. In their case, the locking was done in an anteroposterior direction with 2 screws and the complication involved a branch of the deep femoral artery at the level of the lesser trochanter. In our department, we have performed 107 distal femoral nailings (DFN) since 1999. During the period of 17 months between cases 1 and 2, we used the DFN in 52 operations.

Riina et al. (1998), in a cadaveric study, showed that the deep femoral artery closely follows the medial side of the femur throughout its course, and that the area of closest contact is usually within 4 cm distal to the lesser trochanter. They found an average of 15 branches of the femoral artery, all of which crossed the femur distal to the lesser trochanter at a level more than 10 cm from the piriformis fossa. They recommended that proximal locking of an intramedullary nail should be done above the level of the lesser trochanter, and that care should be taken to avoid penetrating the medial soft tissues with a drill bit or a screw.

Coupe and Beaver (2001) warned that a muscle fiber might become entangled around the drill bit, and cause an avulsion injury of the surrounding neurovascular structures several cm from the tip of the drill bit. In our case 1, the mechanism of the arterial injury was apparently such an avulsion, which might have been avoided by using a drill bit sleeve, as was also suggested by Coupe and Beaver (2001), or an oscillating drill bit. In our case 2, the mechanism of the vascular injury seemed to be a direct lesion of the main arterial trunk, 3 cm distal from the inferior margin of the lesser trochanter. This was caused by inappropriate penetration of the dulled drill bit into the medial soft tissues during free hand drilling.

In conclusion, the 2 cases in this paper indicate that an arterial lesion during proximal locking can be due to 2 mechanisms: an avulsion several centimeters distant from the drilling, which is presumably caused by a muscle fiber that becomes entangled around the drill bit, and by a direct lesion. There is no relation between a higher risk of an arterial lesion and DFN. Such a risk always exists with proximal locking of a retrograde femur nail, regardless of the implant. One should use only a long retrograde femur nail for a long oblique distal femoral fracture just because it is long and oblique. In other types of fractures, one should choose a shorter nail. Proximal locking is safer when it is distal to the lesser trochanter.

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