Coll. Antropol. **34** (2010) 3: 937–940
Original scientific paper

The Proximal Femoral Nail Antirotation (PFNA) in the Treatment of Proximal Femoral Fractures

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A B S T R A C T

Proximal femoral fractures, especially in elderly persons with osteoporosis, present a challenge for the traumatologist. While the dynamic hip screw (DHS) became the implant of choice for the treatment of stable fractures, the ideal implant for the treatment of unstable fractures remains an issue. In our experience, Proximal Femoral Nail Antirotation (PFNA) is an excellent device for osteosynthesis as it can be easily inserted, it provides angular and rotational stability and allows early weight bearing on the affected limb. Between February 2007 and August 2009, 76 patents underwent the PFNA fixation for proximal femoral fractures (15 men and 61 women). Forty seven fractures were pertrochanteric, 14 subtrochanteric, 2 pathological and 5 ipsilateral trochanteric and diaphyseal fractures whereas in 8 cases the PFNA was used in reosteosynthesis. The mean age of patients was 73.4 years (range 22–91 years). The fractures were reduced on a traction table and the implant was inserted using minimally invasive technique. Four patients developed superficial postoperative wound infection. No cases of implant breakage have been recorded; there was one cut-out; delayed union was noted in three patients. The majority of patients regained their pre-injury mobility status. The PFNA is an excellent implant for stabilisation of both trochanteric and complex combination fractures as well as an exceptional device for reosteosynthesis. It is easily inserted with few intra- and postoperative complications and allows early weight bearing on the affected limb as well as quicker rehabilitation of patients.

***Key words**: PFNA, trochanteric fractures, intramedullary nailing, reosteosynthesis*

Introduction

Proximal femoral fractures, especially in elderly persons, still present a challenge for the traumatologist. This refers primarily to unstable fractures of the trochanteric area (31-A2 and 31-A3 according to the AO classification) which are extremely difficult to treat in elderly people with poor bone quality and, as is frequently the case, numerous comorbidities.

This paper describes our experience with the Proximal Femoral Nail Antirotation (PFNA), the new implant for stabilisation of femoral fractures in the trochanteric area, but also subtrochanteric and pathological as well as complex combination fractures. We have also used the PFNA for reosteosynthesis after an unsuccessful primary treatment with a different implant.

Materials and Methods

Between February 2007 and August 2009, 76 patients were treated using this method at the Trauma Ward of the Clinical Hospital Osijek Surgical Clinic. After discharging them from the ward, the patients were followed as outpatients. The mean age of patients was 73.4 years (range 22–91 years); however, we would like to emphasise that 65% of them were between the ages of 70–90 years, i.e. in the age group most vulnerable to these kinds of fractures[1,2]. There were 61 women and 15 men (4:1 ratio) which coincides with the ratios reported in literature[3].

According to the type of fracture, there were 6 stable trochanteric fractures (31-A1 according to AO classification), 41 unstable fractures (23 type 31-A2 fractures and 18 type 31-A3 fractures), 14 subtrochanteric fractures

Received for publication January 24, 2010

(according to the Fielding Classification there were 3 type I fractures, 6 type II fractures and 5 type III fractures). There were 5 complex combination fractures (ipsilateral fractures of the trochanteric area and proximal femoral diaphysis) and 2 pathological fractures. There were 8 cases of reosteosynthesis after an unsuccessful primary treatment with an angled plate.

All fractures were treated on a traction table under x-ray control. Closed reduction was performed in 69 cases (90%), open reduction was performed in 3 cases (4%) and semi-open reduction, typically by enlarging the incision for insertion of the blade, in 4 cases (6%).

The PFNA measuring 240 mm in length and 9, 10, 11 or 12 mm in diameter was used except for low subtrochanteric and complex combination fractures when its long version (PFNA long) was used instead. Proximal fixation was achieved with a blade; distal fixation was achieved with a static locking screw (with the standard 240 mm PFNA) while in the case of the PFNA long two static locking screws were inserted using freehand technique.

After removing the drains (48 hours after surgery), patients were erected and mobilised weight bearing on the affected limb. The intensity of weight bearing depended on the quality of reduction and complexity of the fracture.

Operative technique

The reduction of the fracture was performed on a traction table under the control of image intensifier which was placed between patients' legs so that it wouldn't impede the insertion of the nail and so that at least two different x-ray views could be taken (AP and lateral). The positioning of the patient on the table was standard for intramedullary fixation (unaffected limb abducted to maximum tolerance, affected limb adducted by 10–15 degrees, slightly internally rotated). The fracture was treated by closed reduction, while in cases of inadequate reposition fractured fragments were put in an adequate position intraoperatively. The implant was inserted according to the manufacturer's instructions[4] and the experience of others. Standard nail measuring 240 mm in length and 9, 10, 11 or 12 mm in diameter, depending on the width of the femoral canal, was used in 67 cases (88%), while its long version measuring 380 or 420 mm in length and 10 mm in diameter was used in 9 cases (12%), which does not coincide with data provided in previously published studies (standard 25%, long 75%)[1].

Results

Four patients (5.25%) developed postoperative wound infections while delayed union was observed in 3 cases (3.95%). There have not been any cases of implant breakage and only one cut-out was recorded (1.35%). Radiographs revealed union of the fracture within 6 months in 75% of all patients. 60% of all patients regained their pre-injury mobility status and 25% of them were satisfied with the level of regained mobility.

All patients received antibiotic prophylaxis. Anticoagulant prophylaxis with low-molecular-weight heparin was administered from the admission to the ward to several days before discharge when it was replaced by peroral therapy with warfarin. The duration of anticoagulant therapy depended on patients' mobility level and ranged between 1.5 to 3 months. Almost all patients were operated under spinal anaesthesia.

Discussion and Conclusion

In the last few years, the incidence of proximal femoral fractures has been growing as a result of longer life expectancy owing to better quality of life but also better health care. Increased instability due to muscle weakness is the main cause of falls and fractures in elderly population[5]. Bones weakened by osteoporosis and osteopenia along with numerous comorbidities render fracture treatment considerably more difficult. With that in mind, when stabilizing these fractures, it is necessary to use an implant which will enable early weight bearing on the affected limb and the fastest possible rehabilitation. It is unrealistic to expect that elderly patients will refrain from weight bearing on the affected limb until the fracture has healed before it comes to material fatigue and breakage which has been one of the main problems associated with previous implants. In younger patients with better healing capacity and generally better health status, compliance is high, complications are less frequent and treatment results are better.

Thus far, stable trochanteric fractures (31-A1) have been successfully stabilized using the Dynamic Hip Screw (DHS) which provides controlled compression at the fracture site with a low rate of complications. However, insertion of the DHS requires a relatively larger exposure, more tissue handling and anatomical reduction, which increases the risk of infection and entails larger blood loss. A series of biomechanical and clinical studies have proven that the DHS as an extramedullary implant is inferior to intramedullary implants in the treatment of unstable fractures[6,7]. Relatively high price of intramedullary device such as PFNA or Gamma Nail and good results achieved in stable fractures makes the DHS still the implant of first choice in stable trochanteric fractures. Six patients with stable fractures that we operated using the PFNA were among first patients in which we implanted the PFNA when we were learning the technique. At our Trauma Ward, DHS remains in regularly usage in stable trochanteric fractures with more then satisfactory results.

In our experience, the PFNA enables the use of minimally invasive approach, allows almost full weight bearing on the affected limb and speeds up the recovery considerably. What makes it exceptional is proximal fixation of the nail with a blade whose design enables compaction of cancellous bone, which is especially important in osteoporotic bone, and provides rotational and angular sta-

bility using one single element[8,9]. Comparison with similar implant, Gamma Nail, is topic of large study in Spain. Published studies on this topic are insufficient and inconclusive, so we must wait first data from Spain (estimated completion date is September 2010).

We did not have any major problems during insertion of the PFNA device. After a successful reduction, the surgery itself lasted not more than 30 minutes. However, we encountered difficulties with insertion of the guide wire in the case of destructed tip of the greater trochanter. After reaming in such cases nail was positioned in to lateral position.In one of the cases the distal screw missed the nail as a result of inadequate attachment of the aiming device to the nail, which was noticed and corrected intraoperatively. The only case of blade migration was observed in a patient whose unstable pertrochanteric fracture had first been treated with a Gamma nail and then a few weeks later she suffered another fall which caused implant displacement and further comminution of the fracture site. Gamma nail was repositioned but inadequately and finally a re-reostesynthesis was performed with the PFNA, although arthroplasty might have been a better solution.

Postoperative wound infections in four patients were resolved with adequate wound management (irrigation) and antibiotic administration.

The long version of the PFNA (PFNA long) is an especially good implant for the treatment of low subtrochanteric and complex combination fractures (ipsilateral fractures of the trochanteric area and proximal femoral diaphysis) because it enables adequate stabilisation of these kinds of fractures using as minimally invasive a technique as possible with a significant reduction of blood loss[10,11]. The only issue there is the exposure of surgical staff to x-ray radiation in the operating room.

Delayed healing was observed in 3 patients (2 with type II subtrochanteric fracture and one with type III fracture according to the Fielding classification). In all three patients, the distraction of fracture fragments after the surgery was above 2 mm. The fractures united after dynamization, i.e., removal of distal screw.

The treatment of repeat fractures and fracture nonunion with implant breakage presents a special problem[12]. In such cases the PFNA proved to be indispensable. In eight cases a previously inserted angled plate broke (implant fatigue before fracture union was achieved) so it was removed and a reosteosynthesis was performed using the PFNA. Union was achieved in all patients.

Two women with metastatic pathological fractures (breast carcinoma) bear weight after operation without major complaints although fracture union is not achieved.

In conclusion we can say that the PFNA is an excellent implant for a wide variety of indications. It allows the use of minimally invasive procedures, provides angular and rotational stability, which is especially important in osteoporotic bone, and allows early mobilisation and weight bearing on the affected limb. However, adequate knowledge and experience of operative technique is imperative.

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PROKSIMALNI FEMORALNI ČAVAO ANTIROTACIJSKI U LIJEČENJU PRIJELOMA PROKSIMALNOG OKRAJKA BEDRENE KOSTI

S A Ž E T A K

Prijelomi proksimalnog okrajka bedrene kosti, posebice u starijih osoba s osteoporozom predstavljaju izazov za traumatologa. Dok se dinamički vijak za kuk (DHS) etablirao kao implantat za zbrinjavanje stabilnih prijeloma, ostaje pitanje idealnog implantata za zbrinjavanje nestabilnih prijeloma. Po našim iskustvima proksimalni femoralni čavao antirotacijski (PFNA) je izvrsno osteosintetsko sredstvo koje se lagano postavlja, omogućava kutnu i rotacijsku stabilnost te dozvoljava rano opterećenje ozlijeđene okrajine. Od veljače 2007. do kolovoza 2009. stabilizirali smo prijelome proksimalnog okrajka bedrene kosti s PFNA u 76 pacijenata (15 muških i 61 ženskih). Radilo se o 47 pertrohanternih prijeloma, 14 subtrohanternih, 2 patološka loma, 5 slučajeva ipsilateralnih trohanternih i dijafizarnih prijeloma te u 8 slučajeva koristili smo PFNA kao sredstvo reosteosinteze. Prosječna dob pacijenata bila je 73,4 godine (22–91). Prijelom je reponiran na trakcijskom stolu,a implantat plasiran minimalno invanzivnom tehnikom. U četiri pacijenta došlo je do površne infekcije postoperativne rane. Do sada nismo imali puknuća implanta, zabilježen je jedan »cut-out«, kod tri pacijenta zamijećeno je odgođeno cijeljenje. Većina pacijenata povratila je prijeoperacijsku mobilnost. PFNA predstavlja izvrstan implantat za stabilizaciju kako trohanternih prijeloma tako i kompleksnih dvoetažnih lomaova te vrsno reosteosintetsko sredstvo. Jednostavno se implantira, sa malo intra i postoperativnih komplikacija, omogućava rano opterećenje ozlijeđene okrajine te bržu rehabilitaciju pacijenata.