

PROXIMAL FEMORAL NAIL (PFN) - A NEW STAGE IN THE THERAPY OF EXTRACAPSULAR FEMORAL FRACTURES

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Abstract

The research was aimed at referring to contemporary problems concerning fractures of the proximal femur that, particularly in older patients, represent not only medical, but also social and nursing difficulties. Within November 2004 to March 2006, 83 patients with proximal femoral fractures were treated using PFN. Except for two cases, the post-operative course was favourable and patients could start early rehabilitation. A careful surgical approach and technique with a stable osteosynthesis have markedly contributed to a more rapid mobilisation of a patient and, thus, to the decrease of post-operative complications. The implantation of a short reconstruction nail produced by Medin company has caused an evident qualitative shift in the therapy for proximal femoral fractures.

Key words

Fracture, Stable osteosynthesis, Rehabilitation

Abbreviations used

PFN, proximal femoral nail; DHS, dynamic hip screw; DCS, dynamic condylar screw; LMWH, low-molecular-weight heparin

INTRODUCTION

Fractures of the proximal femur are a big challenge in traumatology. Patients of all age groups are affected but the group in the 5th - 7th decades of life has been involved most. Older patients withstand badly their immobilisation in bed; they are threatened with hypostatic pneumonia, catheter sepsis, cardiorespiratory failure, and decubitus. Moreover, nursing care is also aggravated by psychological changes due to arteriosclerosis. All the circumstances mentioned above require using an urgent surgical solution for a vital indication because early rehabilitation and mobilisation of the patient can only be possible in this way. However, there is often a problem when - after pre-operative examination - a surgical intervention is contraindicated by the physician, and a cardiac compensation or restoration of the inner environment is demanded. However, it is necessary to mention that at the time of his/her admission, a patient is relatively in the best condition and his/her general

condition becomes worse due to idle delay of surgery. According to Ewans, 30 % mortality rate occurs in conservative treatment using a long-term immobilisation (2). An active surgical approach decreases the mortality rate to less than 15 %. In productive-age patients there also appear social problems, long-lasting elimination from the working process, or even loss of job.

CLASSIFICATION:

Fractures of the proximal femur involve:

fractures of the femur collum that, according to their location, are divided into mediocervical (intracapsular) and laterocervical (extracapsular)

pertrochanteric fractures

The forms of these fractures range from simple pertrochanteric and intertrochanteric (*14*) fractures (according to AO classification 31A1, 31A3) up to multifragmental (*16*) ones (according to AO classification 31A2). To estimate mechanical properties and to choose a suitable type of osteosynthesis it is necessary to decide whether the problem is a stable or an unstable fracture. Here, the main role is played by medial cortex and, particularly, the area of the lesser trochanter (the so-called Adam's arch), whose reconstruction is decisive for the optimal biomechanical properties (3).

- isolated fractures of trochanters
- subtrochanteric fractures, i.e. fractures in the zone of transition between the proximal end and the femur diaphysis (about 5 cm distal of the lesser trochanter).

MATERIAL AND METHODS

At present, several methods of surgical solution of fractures at the proximal femur have been available. When choosing a certain method, the type of the fracture, age and biological condition of the patient, the degree of osteoporosis, the state of the hip joint and, last but not least, the period elapsed from the accident up to the patient's admission must be taken into consideration (6).

Osteosynthesis is chosen for mediocervical (intracapsular) fractures in biologically younger patients, alloplasty is preferred in older subjects (5). In these types of fractures, anatomical situation must be respected, especially nutrition of the femoral head. The risk of head necrosis has been unfavourably affected even by increased intra-articular pressure with intracapsular haematoma. The later is reduction and stabilisation of the fracture, the greater is the risk of head necrosis. Among the osteosynthetic methods, lag screws, 130-degree angle splints supplemented with compression screws, dynamic hip screws (DHS), and alloplasty using cervicocapital or total hip replacement (11) can be applied.

In pertrochanteric fractures, three methods best meet the requirements of stable osteosynthesis at present:

DHS

gamma nail

PFN

In multifragmental fractures treated with DHS, medialisation can be prevented by applying a trochanteric stabilising splint. Angle and T-shaped splints are less reliable as they fail in such types of fractures where a medial support is missing (9).

In the case of subtrochanteric fractures, PFN is chosen in a high-positioned breakage line, a reconstruction nail is used when a breakage gets more into the diaphysis. Splint techniques (DCS, condylar or angle splints) are less suitable because of a wide surgical approach, blood losses, greater risks of infection, and possible failure of the implant. Complications such as refracture at the site of breakage after removing the osteosynthetic material are not exceptional (7).

The implantation of short reconstruction nails was introduced into practice in November 2004 after obtaining instruments produced by the Medin company. This method is indicated in pertrochanteric fractures 31A1 – A2, intertrochanteric fractures 31A3, and in high subtrochanteric fractures, alternatively even in laterocervical fractures (1,5,10). Our group consisted of 83 patients with proximal femoral fractures, 25 men and 58 women. The average age was 63.7 years (men 61.9 years, women 65 years). According to AO classification, there were 27 cases with 31A1, 41 with 31A2, 13 with 31A3, and 2 cases were of 31B2 fracture type.

Reduction is carried out immediately after the patient's admission using an elastic extension with a limb placed on Braun's splint for analgetic reasons and as prevention of ischemia of the head in these types of fractures. An operation is performed urgently, if possible, due to a relatively vital indication after a necessary pre-operative examination and the patient's preparation. The operation under spinal anaesthesia is preferred; the method of anaesthesia is determined by the anaesthetist after consulting the surgeon. The definite closed reposition is completed on a traction table. The patient is in supine position, a C arm is placed between his/her lower limbs in the angle of about 45 degrees to the operated extremity (6).

The healthy extremity is flexed in the hip and knee joints and put to the side so that there is enough space for the C arm with the possibility of projection in two reciprocally vertical planes. The operation is carried out under antibiotics (as a standard, one perioperative dose). Antibiotics are chosen on the base of epidemiological situation in the hospital and after consulting an antibiotic centre. At present, ceftazolin at a dose of 1 gramme has been administered i.v.

The instruments used for implant insertion differ somewhat from the standard sets used for nailing. The difference is seen particularly in the proximal locking option that is supplied for 130-degree and 135-degree nails and is quite compatible with the set of new long reconstruction nails. However, it cannot be used for the implantation of an original reconstruction nail made by Medin.

The operation approach is highly careful, a skin incision being led from the trochanter top proximally in the length of about 3 cm, slightly bent dorsally. With a longitudinal blunt intersection of the fascia, the major trochanter top is reached where the entrance into the medullary cavity is formed for the insertion of a conductor; in the case of comminution, the conductor is inserted directly, without a trepanation tool. A drill with a diameter of 16.5 mm is used to make the entrance for a nail. An assembled proximal femoral nail is inserted directly without previous drilling. Two diameters of a nail are available – 11 and 13 mm, each of them in 130 and 135 degrees. Preference is given to 135-degree nails, although there is no clear difference in their insertion or in the osteosynthesis stability. As the first, a distal cervical screw is always inserted, and it should be placed as near as possible to the medial cortex, which enables to maintain optimal biomechanical properties and provides enough space for a proximal cervical screw. An incision of about 1 cm is performed on the skin in a given place. The distal locking of the nail makes no problems due to the length of a horse-shoe and conductors as well as a skin incision about 1 cm long. If the removal of the osteosynthetic material is supposed, the nail end is closed with a seal. The operation is completed by suture of the wound and by a final radiological examination in two levels – still performed on the operating table.

RESULTS

Within November 2004 to March 2006, 83 patients with proximal femoral fractures were treated using PFN. The group consisted of 25 men and 58 women. The youngest patient was 46 years old, the oldest female patient had 97 years. The average age was 63.7 years. Twenty-seven fractures were stable pertrochanteric, 41 fractures unstable pertrochanteric, 13 intertrochanteric and high subtrochanteric fractures, and 2 were transcervical fractures.

| | |
|------|----|
| 31A1 | 27 |
| 31A2 | 41 |
| 31A3 | 13 |
| 31B2 | 2 |

| | |
|----------------------|---|
| Implant displacement | 0 |
| Infection | 0 |
| Bronchopneumonia | 1 |
| Phlebothrombosis | 1 |
| Exitus | 1 |

In the period of applying a short Medin reconstruction nail there occurred no complications in the sense of osteosynthesis failure or implant dislocation. Except for two cases, the post-operative course was favourable, the wound was always healed, the stitches were removed on the 7th - 10th day after the surgery. No case of superficial or deep infection was observed. Oedema of the operated leg developed in one case on the 3rd post-operative day; Doppler examination confirmed phlebothrombosis of the deep crural veins, although a preventive dose of LMWH had been administered. Pneumonia occurred in one case and ended by death of a polymorbid female patient whose general health condition had been very serious even in the pre-operative period. Rehabilitation started on the 1st post-operative day - fitness exercises in the bed and in standing position. Ten days later, patients were mostly transferred to our department of rehabilitation for a period of 14 days (6). Those patients who were not able to manage physically intensive rehabilitation were referred to an after-care and rehabilitation institute. The operated extremity was loaded with respect to the osteosynthesis stability, mostly with 50% of weight for the first post-operative month. An outpatient follow-up with x-ray check-ups was carried out at one-month intervals. The removal of the metal was not performed due to the short period of application of this method.

DISCUSSION

The nail implantation itself as well as the instrumentarium caused no principal problems. However, some problems appeared while drilling the cavity for the first cervical screw - the drill, due to its shape, was scraping against the hole edge in the nail. But this problem can be solved by a transient adequate loosening of traction. In our opinion, in the course of strong pulling of the limb and inserting a nail, the nail becomes slightly deformed, which results in a slightly eccentric leading of the drill. Cannulated nails are used, which may be a possible cause of this problem due to nail reduction. We have no experience with full nails; therefore, such a situation cannot be judged. However, the problems mentioned above may be explained by the

fact that such situations always occurred in high dislocated fractures when strong pulling at the extremity was needed for reduction, and by the fact that after inserting the first screw the drilling for the second screw was without any problems.

CONCLUSION

The introduction of a short reconstruction nail into practice has caused an evident qualitative shift in the therapy for fractures of the proximal femur. In accordance with the literature and indication schemes (5,8,9,10), this method was applied especially in unstable pertrochanteric fractures. These types of fractures have shown no post-operative instability (17) or dislocation that occurred when using DHS, even with the application of a trochanteric stabilising splint (5,9,13). The method was also used advantageously in laterocervical and stable pertrochanteric fractures, particularly due to its mini-invasiveness. The mini-invasive surgical approach (15) without exposing the fracture region causes a minimal trauma to soft tissue, and decreases the risks of infection; moreover, the advantages of primary haematoma are retained. This solution brings less post-operative pain to the patients and enables early rehabilitation. The minimal blood loss in the course of the operation has positive effects on the post-operative course without the necessity of blood transfusions, which is also reflected in the economical aspects of the treatment.

Our preliminary experience has confirmed the advantages of PFN if compared with other present osteosynthetic methods.

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KRÁTKÝ REKONSTRUKČNÍ HŘEB (PFN) - NOVÁ ETAPA LÉČBY EXTRAKAPSULÁRNÍCH ZLOMENIN HORNÍHO KONCE STEHENNÍ KOSTI

S o u h r n

Cílem práce je poukázat na stále aktuální problematiku zlomenin horního konce stehenní kosti, která zejména u pacientů ve vyšším věku představuje problém nejen medicínský, ale i sociální a ošetrovatelský. Autoři popisují použití krátkého rekonstrukčního hřebu k osteosyntéze jak stabilních, tak zejména nestabilních pertrochanterických zlomenin, včetně zlomenin intertrochanterických a subtrochanterických. Šetrný operační přístup a technika se stabilní osteosyntézou výrazně přispívají k rychlejší mobilizaci pacienta a tím ke snížení rizik a pooperačních komplikací. Ve svém souboru pacientů se autoři neseťkali se selháním osteosyntézy či implantátu. Předběžné zkušenosti potvrzují výhody PFN v indikovaných případech před ostatními osteosyntetickými metodami.

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Fig. 1
Unstable pertrochanteric
Fracture 31 A2



Fig. 2
Unstable pertrochanteric
Fracture 31 A2
Lateral projection

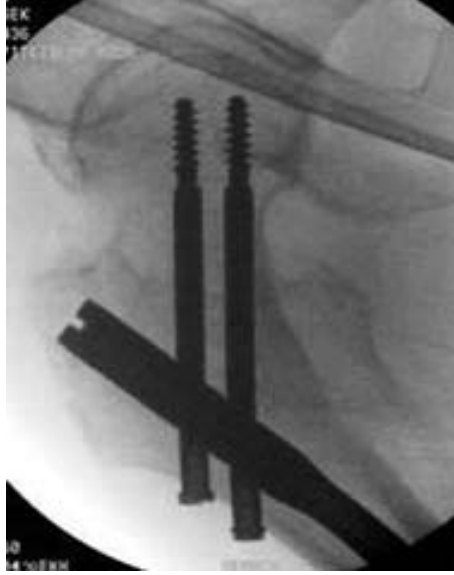


Fig. 3
Fracture reduction and stabilisation with PFN.
Peroperative X-Ray in AP



Fig. 4
Peroperative X-Ray in axial projection

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