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Educational Corner

The Importance of Length of the Cephalomedullary Nails for Fixation of the Proximal Femoral Fractures: An Educational Corner

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Background

Fractures of the proximal femur (Figure 1) are the third most common fracture type in the general population and one of the most common age-related fractures in the elderly (1). Although there are many fixation methods for trochanteric fractures, the intramedullary nail (IMN) has been routinely used (2-9). Among the IMN devices, the proximal femoral nail antirotation (PFNA) is highly preferred, because it has the advantageous biomechanical design of the IMNs, while the helical blade design has increased its fixation stability (10, 11).

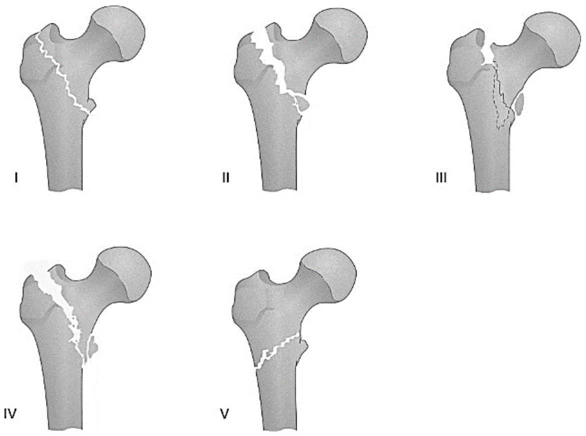

Figure 1. The Tronzo classification scheme for fractures of the trochanteric area

The PFNA has been introduced by the Arbeitsgemeinschaft Osteosynthesefragen/Association for the Study of Internal Fixation (AO/ASIF) in 2003 (7). As an intramedullary device, it has a higher fixation ability, especially in osteoporotic bones. The PFNA has a 6-degree proximal angulation and is available in four different lengths: standard (240 mm), small (200 mm), very small (170 mm), and extended (300-420 mm). Other characteristics of this device are as follows: 17 mm proximal diameter, 10 mm distal diameter, 85-125 mm helical blade length, and a 130-degree caput-collum-diaphysis (CCD) angle. For locking purposes, there is an oval hole on the distal part of the nail (12). The PFNA-II device is generally smaller than PFNA and has shown to be more suitable for Asian ethnicity with smaller femurs (12).

In a study on the curative effect of PFNA, Wei et al. reported that the device had the advantages of stable fixation and shorter operation time. Additionally, the long PFNA amplified fracture distal action length and increased the contact between the nail and femur; dispersion of stress levels lead, according to the authors, significantly decreased the complication rate (13). In a biomechanical study, Hong et al. evaluated the stability of the PFNA (lengths: 200 mm, 240 mm, and 280 mm) in unstable intertrochanteric fractures by assessing the distribution of stress within the femur. They found that the femur fixation medial stress peak was significantly reduced in 240 mm and 280 mm PFNAs (14).

Here, we briefly review the previous studies to present a comparison between the short and long PFNA in pertrochanteric femoral fractures in terms of biomechanical stability and treatment outcome.

Operative Procedure

The patients are operated under spinal anesthesia using a fracture table and image intensifier. A 3- to 5-cm skin incision is made from the greater trochanter's tip to the proximal. Before the reaming, a guidewire is passed into the medullary canal from the tip of the trochanter using a bone awl. Under image intensifier guidance, the PFNA is introduced into the medullary canal using a bone cutting Jig. Screws are used for proximal locking and bolts for distal locking. The wound is closed in layers after a saline wash (15).

Outcome

In the study by Hong et al., the 240 mm and 280 mm PFNAs significantly reduced the medial stress peak compared to the 200 mm PFNA ($P < 0.050$). They reported that no difference was observed between the 240 mm and 280 mm PFNAs. Moreover, there was no difference among the three lengths of PFNAs in both medial and lateral stress peaks for Evans type IV and V fractures (Figure 1) (14).

Comparing the outcome of short versus long PFNA (Figure 2) in trochanteric fractures, Raval et al. showed that the amount of blood loss was significantly greater in the long PFNA group (341 ml vs. 172 ml; $P = 0.042$) (16). Furthermore, the short PFNA procedure had a shorter duration on average with a mean of 58 minutes (range: 46-70 minutes) compared to the long PFNA (mean: 87 minutes; range: 55-119 minutes; $P = 0.016$). No significant difference was detected in the postoperative outcome of both groups such as blood transfusions, hospital stay, postoperative infection, reoperations, mortality rate, and hospital discharge (16).

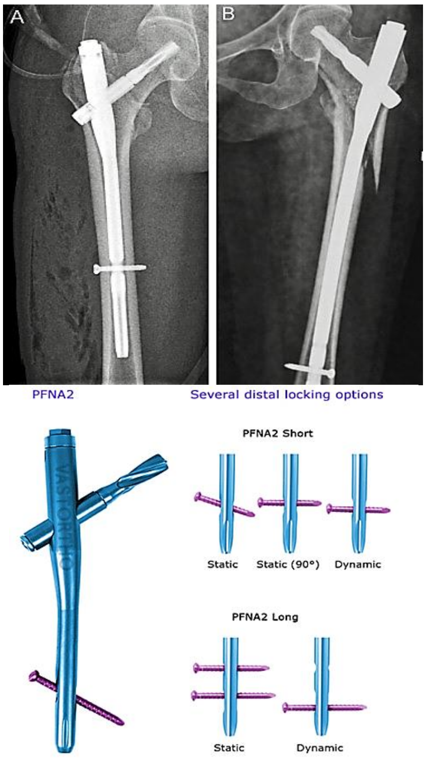

Figure 2. The types of proximal femoral nail antirotation (PFNA): A) PFNA; B) PFNA-II (No permission required)

In the study by Raval et al., the mean surgical time in the PFNA-II group was significantly shorter than PFNA (66 vs. 79 minutes; $P < 0.050$). The PFNA-II had a significantly lesser blood loss ($P < 0.050$). There was not any differences between the two groups in terms of the amount of transfused blood, overall fluoroscopy time, postoperative drainage, and hospital stay ($P > 0.050$) (16).

Selecting the appropriate length and type of the PFNA is critical for surgical outcomes. The long PFNA may be used in unstable fractures to reduce the stress on the medial femoral cortex. The surgeon should consider the surgical time, stress distribution, and fracture type in choosing the appropriate PFNA. In an old and medically compromised patient, the surgical time is an important factor, and thus, it is recommended to use devices with shorter surgical duration.

Conflict of Interest

The authors declare no conflict of interest in this study.

Acknowledgments

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