Doi:10.47572/muskutd.1126875

91 Year Old Active Patient, Two Proksimal Fractures of The Proksimal Femoral Nail (PFN) Applied Due to Unstable Perthorachanteric Fracture

91 Yaşındaki Aktif Hastada Unstabil Pertorakhanterik Kırık Nedeniyle Uygulanan Proksimal Femoral Çivinin (PFN) Proksimalden İki Kez Kırılması

Murat SAYLIK

Istinye University Department of Orthopaedics and Traumatology / VM Medikalpark Bursa Hospital, Bursa, Turkey

Öz

Toplumda yaşam süresinin uzamasıyla beraber, ileri yaş hasta popülasyonunun artışına bağlı pertorakhanterik kalça kırıkları daha sık görülür hale gelmiştir. Özellikle unstabil pertorakhanterik kalça kırıklarında kırığın internal rijid fiksayonu ve hastanın erken mobilizasyonu için Proksimal Femoral Nail (PFN) sıklıkla tercih edilir. PFN sonrası proksimal kayıcı vidanın geri gelmesi veya kırılması, distal vidanın kırılması, PFN' nin proksimal veya distalden kırılması gibi implant yetmezlik bulguları nadir olarak görülür. Bizim vakamızda unstabil pertorakhanterik kalça kırıklı ileri yaş aktif kadın hastamızın, PFN sonrası iki kez proksimal PFN kırığı gelişimi ve iki kez PFN+ grefle revizyonu sunuldu. Literatürde 91 yaşında, düşme veya yüksek enerjili travma olmadan iki kez proksimal PFN kırığı gelişen ve PFN ile revizyon uygulanan başka vakaya rastlamadığımız için bu olguyu sunduk.

Anahtar Kelimeler: Femur, Kalça, Pertorakhanterik, PFN

Abstract

With prolonged life expectancy in society and an increasing elderly patient population, pertrochanterıc hip fractures have become more common. Particularly in unstable pertrochanteric hip fractures, Proximal Femoral Nail (PFN) is often preferred for internal rigid fixation of the fracture and early mobilization of the patient. Implant failure findings such as relapse or fracture of the proximal sliding screw after PFN, fracture of the distal screw, and fracture of the PFN from the proximal or distal area are rare. We present the case of an advanced-age active female patient with an unstable pertrochanteric hip fracture who developed two proximal PFN fractures after PFN, and we document the two revisions with PFN+ graft we introduced for her. We present this case because in the literature we had not encountered any 91-year-old patient who developed proximal PFN fractures twice without falling or high-energy trauma and who achieved union of the fracture with through revisions performed twice with PFN and graft.

Keywords: Femur, Hip, Pertrochanteric, PFN

Introduction

Pertrochanteric hip fractures have become common in the elderly patient population with prolonged life expectancy in the community. In these fractures, internal fixation is the first surgical method used to mobilize the patient as soon as possible. Intra-medullary (IM) nails are the most commonly used implants, especially in unstable pertrochanteric fractures (1,2).

V developed Proximal Femoral Nail (PFN) to treat unstable pertrochanteric femur fractures. PFN use resulted in earlier weight-bearing and lower reoperation advantages compared to Dynamic Hip Screw (DHS) (3). Yet despite implant design changes and surgical technique development, PFN complications like relapse or fracture of the proximal sliding screw, fracture of the distal screw, and proximal or distal PFN fracture due to implant failure have been reported (4). PFN fracture is atraumatic at a rate of 87%; it occurs proximal to the nail at a rate of 84%; and the mean duration of the fracture has been reported to be 9.4 months (1-84 months) (5).

Few case reports and reports in small case groups related to implant fracture have been presented in the literature. Mechanical failure of IM implants rarely causes fractures, but it poses both surgical risks and economic costs for the patients. (6, 7).

We present our 91-year-old patient, who underwent PFN for unstable perthorachanteric fracture and underwent revisions twice at 6 months and 18 months with PFN and graft due to proximal PFN fracture. We found no other 91-year-old case in the literature who developed proximal PFN fractures twice without falling or high-energy trauma and who achieved fracture union with revisions performed twice with PFN.

Case

Our 91-year-old female patient with no history of fracture presented to the emergency service with hip pain and inability to walk. An unstable pertrochanteric fracture was detected radiographally. Pelvic AP and hip AP radiographs taken in the emergency service revealed that the type of pertrochanteric fracture was type R according to Evans-Jansen classification, type 3 according to

	ORCID No
Murat SAYLIK	0000 0002 1023 4164

Başvuru Tarihi / Received: 06.06.2022
Kabul Tarihi / Accepted : 02.10.2022

Adres / Correspondence : Murat SAYLIK
Istinye University Department of Orthopaedics and Traumatology / VM Medikalpark Bursa Hospital, Bursa, Turkey
e-posta / e-mail : drmuratsaylikster@gmail.com

Boyd Griffin classification, and type 31 A3 according to AO classification (Figure 1a, 1b). The patient had no history of falling or trauma. She weighed 66 kg, was 167 cm tall, and had a Body Mass Index of 23.7 (BMI). She said that because her husband was partially in need of care, she made effort to turn him or make him sit in bed. In the preoperative anesthesia evaluation of the patient, the ASA score was 3 and she did not need intensive care after the operation. There was no need for blood replacement in any of the surgeries, including the revisions.

1st surgery

The patient was hospitalized in the emergency service and the next day, February 3, 2020 underwent closed reduction in the lateral decubitus position with spinal anesthesia; internal fixation was performed with a PFN nail (cytronail proximal femoral nail with a sliding hole, produced in Turkey) (Figure 1c, 1d). The PFN was 200 mm long and 10-11mm in diameter, with proximal slide screws of 100*9 mm and 100*5 mm. No problem followed in wound healing. The day after the operation, the patient was made to walk partially weight-bearing with walker support, stepping as pain permitted ensued for one month. Fracture union was checked with monthly hip radiographs. In the second month, the patient was made to walk almost fully weight-bearing with walker support. In the third month, full steps with a cane were allowed. Since adequate fracture healing was observed in the hip radiography in the fourth month, the monthly controls were terminated, and a follow-up appointment was made for the end of the first year.

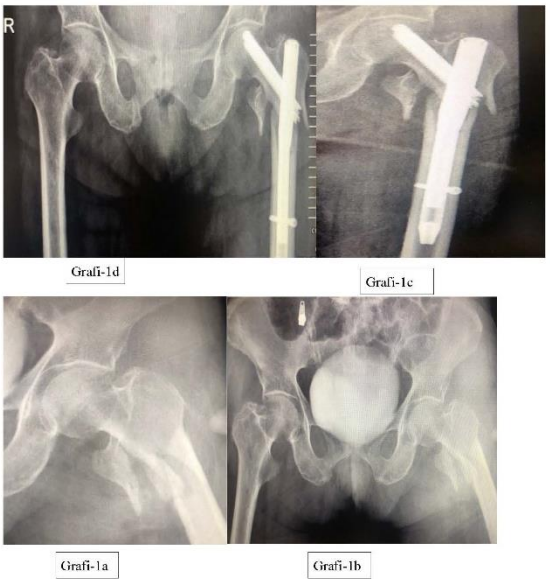

Figure 1. a: AP X-ray of the left hip, pertrochanteric hip fracture. **b:** Pelvis AP X-ray, pertrochanteric hip fracture. **c:** Hip AP X-ray at 1 month after 1st PFN surgery. **d:** Pelvic AP X-ray at 1 month after 1st PFN surgery.

2nd surgery

On August 7, 2021, the patient applied to the outpatient clinic with hip and groin pain. There was no history of trauma. She said that her pain started after she picked up a flowerpot on the balcony. Hip AP and pelvis AP radiographs (Figure 2a) revealed fracture in the proximal PFN (Figure 2a). The patient underwent revision on August 8, 2021. The PFN was removed under spinal anesthesia, and the fracture line was resuscitated by curettage and rongeur. Internal fixation was performed with a PFN nail (cytronail proximal femoral nail with a sliding hole, produced in Turkey) using closed reduction under scopy control. The PFN was 200 mm long and 10-11 mm in diameter, the proximal slide screws were 100*9 mm and 100*5 mm long, the distal static screw was 36*4.9 mm long. Set graft granule was 4-7 mm; the defect at the fracture line was filled with 30 cc granule. During the operation, the proximal screw guide wire was broken distally during drilling and 1 cm of it remained in the joint. In the first month after the operation, the patient was mobilized with a walker without any weight-bearing. Monthly radiographs were taken. In the second month, the patient was made to walk partially bearing weight with a walker. In the third month she was allowed to step with a cane. At the 6th month postoperative follow-up, her pain stopped, and she was capable of stepping fully unsupported. Hip radiograph revealed bone union, and monthly follow-ups were terminated (Figure 2b, 2c). The patient was given a follow-up appointment for 1 year later.

Figure 2. a: Hip AP X-ray, 1st PFN fracture occurring 6 months after the surgery. **b:** Hip AP X-ray, fracture healing at the 6th month after revision with PFN and graft performed following the 1st PFN fracture. **c:** Pelvis AP X-ray, fracture healing at the 6th month after revision with PFN and graft performed following the 1st PFN fracture. About 1 cm of the guide wire remained in the joint.

3rd surgery

On August 14, 2021, the patient was brought to the outpatient clinic in a wheelchair with complaints of hip pain and inability to step. She said that after her husband fell at home, she had to carry him to bed and her hip pain started. Radiographs of the hip and pelvis revealed a fracture in the proximal PFN and a fracture in the proximal locking screw head (Figure 3a, 3b). The patient underwent revision on August 15, 2021. Under general anesthesia, the fractured PFN was removed using the previous incision site and the fracture line was resuscitated with curettage and rongeur. Closed reduction was performed with internal fixation with PFN (trauma proximal femoral nail with sliding hole, produced in Turkey). The PFN was 200 mm long and 10-11 mm in diameter, the proximal sliding screws were 8*95 mm and 8*75 mm, the distal static screw was 4.9*36 mm long. Corticospongiosis graft was taken from the spine iliac anterior superior on the same side. The defect at the fracture line was filled with graft laterally to medially. The first month after the operation, the patient was not allowed to step. In-bed exercises were given accompanied by a physiotherapist. Monthly radiographies were taken. In the second month, she was mobilized with a walker without weight-bearing. In the third month, she was made to walk with a walker with partial weight-bearing. Since the fracture line was healed in the fourth month, the patient was allowed to step fully with a cane (Figure 3c, 3d). The patient was allowed to step without any support in the fifth month.

Written informed consent to publish her medical data was obtained from the patient on February 15, 2022.

Discussion

PFN fracture is a rare complication seen in elderly patients with unstable pertrochanteric fractures (3). A 92.9% correlation has been reported between delayed union or nonunion unstable pertrochanteric fractures and PFN fracture due to metal fatigue developing in the implant (5). It has been reported that inadequate fracture reduction and inappropriate IM nailing in unstable complex pertrochanteric fractures may cause delayed healing or non-healing of the fracture, leading to nail breakage (8, 10). The rate of IM nail breakage has been reported between 0.87-0.88 and 2.9-5.7 (8.9). In our literature review, we found 70 cases of PFN fractures after PFN applied in unstable trochanteric fractures, with an average of 0.38% (Table 1).

A study of factors increasing implant fracture risk in pertrochanteric fractures associated subtrochanteric fractures, pathological fractures, and low American Society of Anesthesiologists (ASA) scores with increased fracture of the IM nail, with young patients with low ASA scores constituting the highest risk group (11).

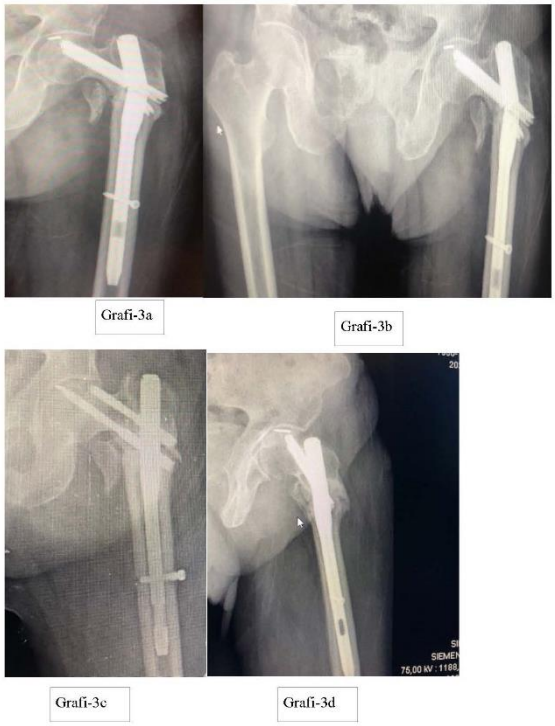

Figure 3. a: Hip AP X-ray, Proximal PFN fracture occurring 12 months after the 1st PFN fracture revision, and the proximal fracture of the screw locking the sliding screw. **b:** The trochanter minor was seen to be displaced on the pelvic AP X-ray. **c:** On the 2nd hip AP X-ray, 5 months after the 2nd PFN fracture revision, the fracture healed but the trochanter minor was seen to be displaced. **d:** Callus development at the fracture line was seen on the hip lateral radiograph, 5 months after the 2nd PFN fracture revision

Table 1. The fracture incidence of PFN applied to unstable pertrochanteric fractures, which we found in the literature, was 70 and the total rate was 0.38%.

Van de Brink (1995), Wozasek (2002), Karladani (2006), Yoshino (2006), Wee (2009), Giannoudis (2013), Iwakura (2013), Maniscalco (2013), Sbiyaa (2016), Zheng (2017), Rollo (2018)	1 PFN fracture
Gaebler (1999),Rappold (2001), Kasimatis (2007)	2 PFN fracture
Álvarez (2004)	4 PFN fracture
Li Pengfei (2021)	6 PFN fracture
Cruz-Sánchez (2015)	8 PFN fracture
von Rüden (2015), Lambers (2019)	11 PFN fracture
Tomás-Hernández (2018)	13 PFN fracture

Differently designed IM nails may be associated with implant fracture. It has been reported that even in the Gamma nail, considered to have a very high metal density and production quality, displays weakness where the proximal screw passes into the nail at the narrowest cross-sectional diameter of the nail; a this region may be damaged during drilling, causing proximal fracture (9). In addition, it has been reported that the dynamization of the distal screw in the PFN caused by breakage or loosening negatively affects fracture healing and may lead to proximal PFN fracture (8, 10). These articles explain why the implant breaks in the proximal region. In our case, none of the radiographs showed insufficiency of the distal screw.

A proximal PFN fracture, which develops simultaneously with the healing of the pertrochanteric fracture, can only be detected during sensitive radiological examination or during removal of the implant (9).

A study on the duration of IM nail fracture reported that 12.9% of fractures were seen in the first 3 months, 32.9% of the fractures were seen between 3-6 months and 54.3% of the fractures were seen after 6 months (5). In our case, the first proximal PFN fracture was seen 6 months after the surgery, and the second proximal PFN fracture was seen 12 months after the second surgery. For this reason, we think that the follow-up period should be extended to 12 months, even if the fracture appears healed in the first 6 months after the surgery.

In cases of PFN fracture revision with IM or EM fixation, a second failure rate of 15.2% was reported in both. Fracture of the distal screw or PFN dynamization on direct X-ray have been reported as evidence that the fracture has not healed, indicting the need for PFN revision (5). After a PFN fracture, the individual characteristics of the patient, type of fracture, quality of bone stock in the trochanteric region and the femoral head, age and functional expectations of the patient, and the surgeon's experience with internal fixation methods determine the type of revision surgery to be performed (1, 8).

In conclusion, proximal PFN fracture is a rare complication that may occur with insufficient reduction and/or inappropriate PFN application in unstable pertrochanteric fractures, resulting in delayed union or nonunion of the fracture. In our case the fact that the fracture was subtrochanteric and serious bone loss would occur if we applied the revision with a prosthesis, we performed revision with PFN nail and graft twice. We observed callus formation at the fracture line in the roentgenograms after the revisions.

Written consent: Written consents of the patients were obtained on 15.02.2022.

References

1. Bhandari M, Swiontkowski M. Management of acute hip fracture. N Engl J Med. 2017;377(21):2053–62.
2. Roberts KC, Brox WT. AAOS clinical practice guideline: management of hip fractures in the elderly. J Am Acad Orthop Surg. 2015;23:138–40.
3. Hoffman MF, Khoriaty JD, Sietsema DL, et al. Outcome of intramedullary nailing treatment for intertrochanteric femoral fractures. J Orthop Surg. 2019;14:360.
4. Koyuncu S, Altay T, Kayalı C, et al. Mechanical failures after fixation with proximal femoral nail and risk factors. Clin Interv Agin. 2015;10:1959–65.
5. Pengfei L, Zhishan Z, Fang Z, et al. Characteristics of intramedullary nail breakage in pertrochanteric femur fractures: a summary of 70 cases. J Orthop Surg Res. 2021;16(1):676.
6. Lambers A, Rieger B, Kop A, et al. Implant fracture analysis of the TFNA proximal femoral nail. J Bone Joint Surg Am. 2019;101:804–11.
7. Rollo G, Rinonapoli G, Pichierri P, et al. Breakage in two points of a short and undersized "affixus" cephalomedullary nail in a very active elderly female: a case report and review of the literature. Case Rep Orthop. 2018;2018:9580190.
8. Tomas-Hernandez J, Nunez-Camarena J, Teixidor-Serra J, et al. Salvage for intramedullary nailing breakage after operative treatment of trochanteric fractures. Injury. 2018;49(Suppl 2):S44–50.
9. Von Ruden C, Hungerer S, Augat P, et al. Breakage of cephalomedullary nailing in operative treatment of trochanteric and subtrochanteric femoral fractures. Arch Orthop Trauma Surg. 2015;135:179–85.
10. Giannoudis PV, Ahmad MA, Mineo GV, et al. Subtrochanteric fracture non-unions with implant failure managed with the "Diamond" concept. Injury. 2013;44(Suppl 1):S76–81.
11. Johnson NA, Uzoigwe C, Venkatesan M, et al. Risk factors for intramedullary nail breakage in proximal femoral fractures: a 10-year retrospective review. Ann R Coll Surg Engl. 2017;99:145–50.