



# Evaluation of Gamma Nails in Intertrochanteric Fractures of Femur and Modified Technique for Removal

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## Abstract

**Intertrochanteric fractures of femur (IFF) that comprise 8% - 10% of all fractures are most commonly seen in people over 65 years old. Fractures of this region not only affect general state of health of patients, but also affect their lives mentally, socially and economically. Sufficient reduction and rigid internal fixation are still the best method for unstable IFF. Because of its biomechanical and anatomical design, proximal femoral nail (PFN) is a fixation material that has started to be increasingly used by orthopedic surgeons recently. In orthopedic traumatic surgery, implant failure is one of the most serious complications. To avoid these complications, many surgical techniques have been reported. Break of intramedullary nails especially in case of a nonunion requires to be extracted, which is a very difficult and challenging procedure for the surgeon. Many methods and materials have been described for this procedure. In this study we aim to review these topics.**

## Keywords

Gamma Nails, Intertrochanteric, Femur, Removal

**Subject Areas:** Surgery & Surgical Specialties

## 1. Introduction

Intertrochanteric fractures of femur (IFF) that comprise 8% - 10% of all fractures are most commonly seen in people over 65 years old [1]. The most common causes of intertrochanteric femur fractures in this population

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can be outlined as: simple falls, osteoporosis and the propensity of older patients to fall due to decline in physical capacity, accompanying systemic diseases, visual and auditory losses, weakening of reflexes at that age group; function of avoidance behavior against environmental dangers is getting weakened. Elder people are exposed to simple falls due to loss of balance, faltering, slipping and stumbling which are caused by drugs that are taken together and simple traumas such as fall while standing up from seat, fall while going downstairs. Additionally, decrease in bony mass elderly leads to segmental unstable intertrochanteric fractures of femur even by simple traumas [1] [2].

## 2. Distribution and Evaluation

Fractures of this region not only affect general state of health of patients, but also affect their lives mentally, socially and economically. Despite the developed patient care and operational techniques recently, results of these fractures may be worse than expected. Intertrochanteric fractures of femur are among important causes that increase the mortality and morbidity in elder patients [3].

Bone quality not to be good and presence of accompanying systemic disorders can be controversial in choice of appropriate treatment in these patients [4]. Aim of the treatment of pelvic fractures occurring in elder people is to turn them back to their lives before the fracture by making them walk as soon as possible and to prevent development of complications due to physical inactivity that can lead to death [1] [3] [4].

Sufficient reduction and rigid internal fixation are still the best methods for unstable IFF. Because of its bio-mechanical and anatomical design, proximal femoral nail (PFN) is a fixation material that has started to be increasingly used by orthopedic surgeons recently. However, the use of rigid fixation methods and problems with implant following operation are troublesome because of accompany of osteoporosis in unstable fractures in elder patient group [5] [6].

In many studies, treatment results of fractures of intertrochanteric region by using different internal fixation methods have been compared [7] [8]. As a result of these studies, inefficacy rates varying between 7% - 53% have been reported. Whereas the least inefficacy has developed in AO and dynamic sliding nails, the most inefficacy has been observed in Mc Laughlin and Jewett plates. As various technical difficulties can be encountered in osteoporotic cases which are applied proximal femoral nailing, it has been declared that complications in cases which are performed intramedullary nailing are still very common and hemiarthroplasty is still a good alternative method [9] [10].

## 3. Complications

Collapse related to secondary varus and lateral migration of screws have been reported in high incidence. In various studies, cut-out of screws reaches to 10% [11].

Screwing at wrong position or not screwing with appropriate length of pelvic screws or insufficient reduction are held responsible for possible stripping in PFN nails. Screwing 5 - 10 mm till the subchondral bone is recommended by Wang *et al.* [12].

Femoral fracture at distal of PFN is a rarer complication. Commonly it is encountered in use of gamma nail [13]. Banan *et al.* have reported in two of 46 cases and Fogagnolo *et al.* in one of 47 cases development of femoral diaphysial fracture from distal part of nail [14] [15]. Tyllianakis *et al.* has reported implant fracture at the level of distal locking screw in two cases [16]. Rappold *et al.* has determined implant fracture at the level of the hole of neck [17].

In orthopedic traumatic surgery, implant failure is one of the most serious complications. To avoid of these complications, many surgical techniques have been reported [18] [19].

It has been presumed that the incidence of pelvic fractures will increase in the future [20] [21]. Intertrochanteric fractures that are described in pelvic fractures are more commonly seen elderly and are caused by low-power injury mechanisms. Risk factors for intertrochanteric fractures are gender, osteoporosis, history of falling and walking abnormalities [22].

Mortality rate in the first year following pelvic fractures have been reported as to be between 20% and 25%. Markers for mortality in the first year following pelvic fractures are: malnutrition, age of >85, dependency to daily routines, ASA 3 or 4 and development of postoperative complication [2] [3]. Medical complications rates have been reported to be between 10% and 40% in the literature. For decreasing medical complications and high mortality rate, early ambulation is one of the most effective method [23]-[25]. On this direction, these cases

should be operated as soon as possible when optimal conditions are achieved (**Table 1**).

Various implants have been designed in order to be used in surgery of proximal femoral fractures. Cephalomedullary nails which are one of them have been increasingly preferred for treatment of proximal femoral fracture [26]. For fixation of unstable trochanteric fractures, clinical and biomechanical superiority of cephalomedullary nails have been shown [27]-[30]. Cephalomedullary nails have advantages such as application through a small incision, minimal blood loss and short operation time [30]-[33]. In addition to that, malunion and fracture collapse have been observed less commonly in cephalomedullary nails compared to extramedullary systems [34].

Break of gamma nail is an extremely rare complication and is reported to be between 0.2% and 5.7% [35]-[38]. Nonunion is thought to be the primary cause in this complication [38]. Majority of complications which are seen after fixation with gamma nail can be prevented by application of routine rules [39]. Most common site of break in nail is the entrance of the femoral head screw which is the weakest point. Other points are holes of distal locking screws.

Break of intramedullary nails especially in case of a nonunion requires to be extracted, which is very difficult and challenging procedure for the surgeon. Many methods and materials have been described for this procedure. Mandrel devices, percutaneous osteotomes, hook rods, Kuntcher groovers, circlage wire, laparoscopic forceps can be counted as various devices used for this procedure [40]. Riansuwan *et al.* have described an alternative procedure for extraction of broken gamma nail. With this method broken fragment inside the channel was extracted successfully and no complication occurred [19]. Steinberg *et al.* was applied a method by which distal fragment of broken intramedullary nail inside channel can be extracted without requiring an additional approach to bone, without using any special equipment or device and without any damage to channel [40]. Abdelgawad *et al.* has divided the methods that are being used up to today for extraction of broken nails and has described a new method for extraction of nail stuck in the narrow channel in a study published in 2013 [41].

#### 4. Conclusions

All in all, intertrochanteric fractures of femur are commonly seen in people over 65 years old and comprise 8% - 10% of all fractures. In people in this age group, as a result of weakening of function of avoidance behaviour due to decline in physical capacity, accompanying systemic diseases, visual and auditory losses, weakening of reflexes, function of avoidance behavioral against environmental dangers, pelvic fractures occur because of simple traumas due to loss of balance, faltering, slipping and stumbling, fall while standing up from seat, fall while going downstairs. Also, decrease in bony mass elderly leads to segmental unstable intertrochanteric fractures of femur even by simple traumas. These fractures are among important causes that increase mortality and morbidity.

Sufficient reduction and rigid internal fixation are still the best methods for unstable IFF and the most commonly used implants are Gamma nails or proximal femoral nail (PFN). Along with this, because of accompanying of osteoporosis to unstable fracture, difficulties during and after operation and implant failures can be encountered in the use of rigid fixation methods. One of these complications is break of placed PFN or gamma nail.

**Table 1.** Operation methods, advantages and disadvantages and prognosis in intertrochanteric femur fractures.

	Advantages	Disadvantages	Prognosis
Unilateral external fixation	<ul style="list-style-type: none"> <li>operation time is less</li> <li>inexpensive</li> <li>reduced time in the hospital</li> </ul>	<ul style="list-style-type: none"> <li>pin tract infection</li> <li>prolonged union time</li> <li>increased incidence of varus position of the fracture site</li> <li>inferior functional outcome</li> </ul>	<ul style="list-style-type: none"> <li>good in stable fractures</li> <li>poor in unstable fractures</li> </ul>
Dynamic hip screw	<ul style="list-style-type: none"> <li>rigid fixation</li> <li>good compression of the fracture site</li> </ul>	<ul style="list-style-type: none"> <li>the incision length</li> <li>operation time</li> <li>blood loss and drainage</li> </ul>	
Gamma nail	<ul style="list-style-type: none"> <li>earlier rehabilitation</li> <li>the recovery of hip joint function is better</li> <li>the incidence of complications is less less surgical trauma, less screening time</li> <li>less blood loss</li> <li>early weight-bearing</li> </ul>	<ul style="list-style-type: none"> <li>screw cut-out</li> <li>implant failure</li> <li>high cost of implant</li> </ul>	

Most common site of break in nail is the entrance of the neck screw which is the weakest point. Other points are holes of distal locking screws. Break of intramedullary nails especially in case of a nonunion requires to be extracted. Because this procedure is a very difficult and challenging procedure for the surgeon, many studies concerning that has been conducted, and many devices and methods have been tried. Despite this, nowadays, extraction of intramedullary nails through channel is still encountered as a difficult and challenging procedure for surgeons.

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