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Update Article

# Subtrochanteric fractures of the femur: update

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ABSTRACT

Because of the anatomical peculiarities of the subtrochanteric region, treatment of fractures in this region remains challenging. The undeniable evolution of implants has not been accompanied by the expected decrease in the complication rate.

The aim of this study was to discuss critical points in detail, such as preoperative planning, reduction tactics and the current scientific evidence concerning treatment of subtrochanteric fractures of the femur.



## Fraturas subtrocantéricas do fêmur: atualização

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RESUMO

Devido às particularidades anatômicas da região subtrocantérica, o tratamento das fraturas nessa região permanece desafiador. A incontestável evolução dos implantes não foi acompanhada pela esperada diminuição no índice de complicações.

O objetivo do presente estudo é discutir, minuciosamente, pontos críticos como planejamento pré-operatório, táticas de redução e evidências científicas atuais no tratamento das fraturas subtrocantéricas do fêmur.



## Introduction

Subtrochanteric fractures take place in the proximal region of the femur, whose anatomical definition is difficult and controversial. Fielding[1] proposed a definition that is still frequently used: the subtrochanteric region corresponds to the interval between the lesser trochanter and around 5–7.5 cm below it, toward the femoral isthmus. The fractures can extend

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to the proximal region (trochanteric or femoral neck) or distal region (diaphyseal).[1,2]

They account for 25% of the proximal fractures of the femur and their distribution is bimodal. Young male adults involved in high-energy traumas present complex fracture patterns; whereas old patients, predominantly females, generally present spiral fractures.[1]

Due to the anatomical peculiarity and, especially, due to the difficulty in reduction, the treatment of subtrochanteric fractures is still a great challenge to the traumatologist, not only because of the osteosynthesis difficulties, but also for the still frequent complications. The next section addresses important aspects that will help to explain the peculiarities of the treatment of the subtrochanteric fractures.

## Why are their anatomical and biomechanic characteristics unique?

The subtrochanteric region of the femur is an area of great stress concentration and, due to its muscular insertions, is subjected to several deforming forces. The classic deformities are flexion (provoked by the iliopsoas), abduction (by the gluteus medius), and external rotation (by the external rotators) of the proximal fragment of the femur. The adductors, inserted in the distal region of the femur, are responsible for the varus deformity.[2,3]

Due to the predominance of cortical bone, the subtrochanteric region presents a more precarious vascularization than the transtrochanteric region, which makes the consolidation of the fractures difficult. Complex fractures with medial support failure present elevated rates of fixation failure and reoperation.[2]

## Is there an ideal classification system for subtrochanteric fractures?

There are over 15 described classifications for subtrochanteric fractures.[1,3–5] The Fielding[1] classification subdivides the fractures according to their anatomical location: type 1 fractures are those at the lesser trochanter level; type 2 fractures are those located between 2.5 and 5 cm below the lesser trochanter; and type 3 fractures are those located between 5 and 7.5 cm below the lesser trochanter. Its value is only historical, due to its low reproducibility on account of ethnic variations.

The classification by Russell-Taylor takes into account the entirety of the piriformis fossa (more appropriately termed trochanteric fossa).[1] Type I fractures do not extend into the trochanteric fossa (IA: without extension to the lesser trochanter; IB: with extension to the lesser trochanter). Type II fractures extend into the trochanteric fossa (IIA: without comminution of the lesser trochanter; IIB: serious comminution of the lesser trochanter). When the classification was created, the authors searched for a guideline for the method of fracture fixation with the implants available at the time. Type I fractures, without involvement of the trochanteric fossa, could be treated with first-generation intramedullar implants using the trochanteric fossa as an entry point. Type II fractures, with involvement of the trochanteric fossa, should be treated with extramedullary implants. With the development and enhancement of intramedullary devices – second- and third-generation intramedullary (IM) nails – this classification lost its prognostic and therapeutic guidance value, since the involvement of the trochanteric fossa was no longer a counterindication for intramedullar fixation.

The classification by Seinsheimer is perhaps the most used and practical for subtrochanteric fractures of the femur, since it is characterized by the number of fractured fragments and emphasizes not only the involvement of the medial cortex, but also of the lateral cortex.[2]

Loizou et al.[4] also described a classification system based on the degree of comminution of the subtrochanteric fracture. However, this classification did not gain popularity in the field.

The AO classification takes into account the bone (femur = 3), the location (diaphysis = 2), the energy of the trauma (A, B, or C), and the mechanism (1, 2, or 3). Per convention, the subtrochanteric fracture is characterized as "1".

Although it is widely used and recommended by the OTA, the AO classification has the disadvantage of including the subtrochanteric fracture in a group of fractures with different mechanical and biological behavior: the diaphyseal fractures.[2]

Recently, Guyver et al.[5] proposed a classification called MCG. This system is subdivided into three types: type I: lesser and greater trochanter are preserved; type II: the greater trochanter is involved, but the lesser trochanter is intact; type III: the lesser trochanter is involved (most unstable).

In their original work, these authors also assessed the intra- and inter-observer reproducibility of the MCG, Russell-Taylor, AO, and Seinsheimer classifications. Despite the poor intra- and inter-observer reproducibility of all the classifications (Kappa 0.35), the MCG system presented the highest agreement, followed by the Russell-Taylor, AO, and Seinsheimer classifications.[5]

The authors believe that there is not yet an ideal classification system for the subtrochanteric fractures of the femur that is able to guide treatment and establish prognosis with satisfactory inter-observer reproducibility. In their practice, the authors have adopted the AO classification for ease of communication and because it is the reference in current publications.

## Surgical *vs.* non-surgical treatment

The non-surgical treatment of subtrochanteric fractures leads to deformities caused by shortening and rotational deviation, hindering the return to the functional activities prior to the injury. However, the critical point of non-surgical treatment is related to the morbimortality increase caused by extended periods of immobilization and decubitus. Atelectasis, pneumonia, thromboembolic events, and bedsores are complications frequently associated with extended periods of decubitus.

Currently, the non-surgical treatment of subtrochanteric fractures of the femur is an exception, and must be performed only in patients with extremely serious clinical comorbidities that counterindicate anesthetic and/or surgical procedures.[6]