



Review

Avascular necrosis of the femoral head following trochanteric fractures in adults: A systematic review



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ABSTRACT

Introduction: Avascular necrosis of the femoral head (ANFH) following trochanteric fractures (TFx) is infrequent. The causal relationship between ANFH and TFx remains controversial. Although several major risk factors for ANFH have been proposed, most of them remain under discussion. In this study we undertook a systematic review of the literature to investigate the incidence of AVN, risk factors and outcomes following TFx fixation.

Materials and methods: A comprehensive review of the literature was undertaken using the PRISMA guidelines with no language restriction. Case reports of ANFH and series of TFx with or without cases of ANFH published between inception of journals to December 2013 were eligible for inclusion. Relevant information was divided in two sections. Part I: included the analysis of detailed case reports of ANFH, either published isolated or included in series of TFx, with the objective of establishing potential risk factors, clinical and radiological presentation, time to development, treatment and outcome of this complication. Part II: analyzed series of TFx, which included cases of ANFH with or without details of aetiology, treatment modalities and outcomes, with the objective of assessing the incidence of ANFH in TFx.

Results: Overall 80 articles with 192 cases of ANFH after TFx met the inclusion criteria. The most probable developmental pathway appears to be a disruption of the extra osseous arterial blood supply to the femoral head. Suggested risk factors included high-energy trauma with fracture comminution and displacement, and an atypical course of the fracture line, more proximal, at the base of the neck. Most cases were diagnosed within the first two years after fracture. The clinical and radiological features appear to be similar to those of idiopathic avascular necrosis of the femoral head. The incidence of AVFH with a minimum of 1-year follow-up was calculated 0.95%, and with a minimum 2-year follow-up it was 1.37%. Total hip replacement was the mainstay of treatment.

Conclusion: The incidence of AVFH after Tfx fixation is small 1.37% within the first 2 years of injury. Risk factors for the development of this complication are related to the severity of trauma, fragment geometry and fracture displacement. Optimum surgery of these fractures cannot guarantee prevention of ANFH.

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Introduction

Proximal femoral fractures continue to be a subject of great attention to the clinicians as they have been associated with an increased risk of complications and mortality [1–10].

Since the first published case of avascular necrosis of the femoral head (ANFH) in a series of trochanteric fractures (TFx) by Picchio et al. in 1954 [11], few such cases have been reported [12,13]. The causal relationship between ANFH and TFx remains controversial [4] and its pathogenesis continues to be obscure [12–22].

Although several major risk factors for ANFH have been suggested, most of them remain under discussion or are highly questioned. As the incidence of hip fractures is expected to rise dramatically during the next 2 decades, similarly, the incidence of AVFH is envisaged to increase. The purpose of this systematic review of the literature is to investigate the incidence, risk factors, treatment modalities and outcomes of this clinical post fracture fixation complication.

Materials and methods

This review was conducted in accordance to the PRISMA guidelines [23]. Data were documented according to a standardised protocol, where objectives and inclusion criteria were specified in detail.

Searches were conducted using the following databases: Pubmed, Embase, Springer, OvidSP, ScienceDirect, Dialnet, J-Stage, Scielo, and KoreaMed. The following keywords were used: “osteonecrosis”; “avascular necrosis”; “femoral head”, “trochanteric fracture”; “pertrochanteric fracture”; “intertrochanteric fracture”; and “extracapsular femoral fracture”. Three reviewers selected potentially relevant abstracts and obtained full copies of the articles. Additionally all references of the retrieved articles were also reviewed.

Criteria for eligibility

Studies selected were original clinical articles that addressed ANFH following TFx in adult patients 18 year-old and older, with no language restriction. All types of studies – case report, case series, case control, randomised controlled trials were considered eligible. Biomechanical and anatomical/morphological articles were excluded. Date limits were set from inception of journals to December 2013.

Data extraction

Relevant information obtained was divided in two parts. Part I of the study included detailed case reports of ANFH after TFx or cases of ANFH with useful information related to risk factors, clinical and radiological presentation, time to development, treatment modalities and outcomes. Such data were extracted as type of study, age, gender, severity of trauma, type of fracture, fracture displacement, treatment, time to surgery, fracture complications, further surgeries, fracture healing, time to radiological diagnosis of ANFH, complications of ANFH, further treatment, and outcome. Part II of the study included cases of ANFH with or without details of aetiology or treatment outcomes. Such data were extracted as type of study, time-period of study, number of patients, time to follow-up, and number of cases of ANFH, with the objective of assessing the overall incidence of this complication.

Statistical analysis

As the majority of the data collected were from case series and case reports statistical analysis in relation to risk factors and computation of odds ratio for the development of ANFH was not possible. Descriptive statistics were employed where possible.

Results

The literature search identified 2724 possible eligible studies. However, 2643 studies were omitted as they did not fulfil the inclusion criteria or were repeated in the databases search, leaving 81 studies for review. Of these, the 3 cases [13,25,26] reported in one study [24] were questionable and for this reason were excluded. Therefore, the remaining 80 studies were included in the final analysis. All studies were retrospective.

Twenty-three articles were primarily selected for 38 detailed case/s [12,15,19–22,27–43]. However, one case reported by Recht and Bouillet [12] had undergone previous radiotherapy and another case from the same authors had undergone preoperative forage of the femoral head; moreover, one case published by Bejui et al. [15] was an adolescent; therefore, none of the above cases were eligible for inclusion leaving 23 series with 35 detailed cases of ANFH. Thirteen series of fractures of the trochanteric region with 63 cases of ANFH with useful information were also primarily selected [13,14,16–18,44–51]. Although the cases described by

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