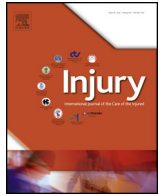




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Review

Femoral neck fractures after removal of hardware in healed trochanteric fractures

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ABSTRACT

Introduction: Hardware removal in healed trochanteric fractures (TF) in the absence of infection or significant mechanical complications is rarely indicated. However, in patients with persistent pain, prominent material and discomfort in the activities of daily living, the implant is eventually removed. Publications of ipsilateral femoral neck fracture after removal of implants from healed trochanteric fractures (FNFARIHTF) just because of pain or discomfort are rare. The purpose of this systematic review of the literature is to report on the eventual risk factors, the mechanisms, the clinical presentation, and frequency, and to pay special emphasis in their prevention.

Materials and methods: A comprehensive review of the literature was undertaken using the PRISMA guidelines with no language restriction. Case reports of FNFARIHTF and series of TF with cases of FNFARIHTF due to pain or discomfort published between inception of journals to December 2016 were eligible for inclusion. Relevant information was divided in two parts. Part I included the analysis of cases of FNFARIHTF, with the objective of establishing the eventual risk factors, mechanisms and pathoanatomy, clinical presentation and diagnosis, treatment and prevention. Part II analyzed series of TF which included cases of FNFARIHTF for assessing the incidence of femoral neck fractures in this condition.

Results: Overall 24 publications with 45 cases of FNFARIHTF met the inclusion criteria. We found that the only prevalent factors for FNFARIHTF were: 1) preexisting systemic osteoporosis, as most patients were older and elder females, with lower bone mineral density and bone mass; 2) local osteoporosis as a result of preloading by the fixation device in the femoral neck, leading to stress protection, reducing the strain at the neck, and increasing bone loss and weakness; and 3) the removal of hardware from the femoral neck, with reduction of the failure strength of the neck. The femoral neck fractures were spontaneous, i.e. not related to trauma or fall, in 87.5% of the cases, mostly subcapital, and with no prevalence between displaced and undisplaced fractures. The clinical presentation was that of a spontaneous fracture, and most of the patients consulted because of hip pain and presented in the emergency room walking by themselves which led to delayed diagnosis in several instances. Radiological diagnosis was mostly with radiographs, though in some cases CT scans or MRI were necessary. The overall median incidence of this complication was 14.5% after hardware removal because of pain or discomfort in healed trochanteric fractures.

Conclusion: The risk factors for FNFARIHTF seem to be preexisting systemic osteoporosis, local osteoporosis as a result of preloading by the fixation device in the femoral neck, and the removal of hardware from the femoral neck, with reduction of the strength of the neck. The clinical presentation may be obscure as most of the patients complain of hip pain of some days or weeks, and arrive in the hospital walking. Therefore, the attending physician should be alert in order to request the appropriate radiological investigation and if this is not clear, CT scan or MRI should be done in order to diagnose promptly these “spontaneous” fractures. Treatment should be replacement surgery in most cases; however, there is some place for internal fixation especially in undisplaced fractures or younger patients.

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The occurrence of the femoral neck fracture after hardware removal may be prevented with reosteosynthesis and the use of bone chips or bone substitutes. Finally, the relatively high incidence of this complication should alert orthopaedic surgeons to reduce the removal of hardware in healed trochanteric fractures to very selected cases.

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Introduction

Trochanteric fractures (TF) are a common cause of morbidity and mortality in the elderly. Internal fixation is the treatment of choice, either by intramedullary or extramedullary devices [1–3].

There are formal indications for implant removal in cases of trochanteric nonunion, infection or significant mechanical complications – cutout, implant breakage, etc. Although there is no consensus whether osteosynthesis should be removed or not from a healed trochanteric fracture in the absence of those complications [4], generally the implant in these cases is not removed [5–8].

However, in symptomatic patients with pain, prominent material, skin irritation, and discomfort in the activities of daily living, hardware is eventually removed [2,6–8], even though it not only entails the risks of surgical intervention, especially in older and elderly patients [1], but also because the improvement of symptoms after hardware removal is unpredictable [4], or moderate at best [5].

Reports of ipsilateral femoral neck fracture after removal of implants from healed trochanteric fractures (FNFARIHTF) just for pain or discomfort are rare [8].

The purpose of this systematic review of the literature is to investigate the eventual risk factors, the mechanism and pathoanatomy of the femoral neck fracture, the diagnostic and therapeutic modalities, the outcomes and recommendations for its prevention, and finally to investigate the frequency of this complication.

Material and methods

This review was conducted in accordance to the PRISMA guidelines [9]. Data were documented according to a standardized protocol, where objectives and inclusion criteria were specified in detail.

Searches were conducted using the following databases: Cochrane Library, Pubmed, Embase, Springer, OvidSP, Science Direct, Dialnet, J-Stage, Scielo, and KoreaMed, and also the Google Scholar searcher. The following keywords were used: “femoral neck fracture”, “trochanteric fracture”, and “hardware removal”. Two 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 FNFARIHTF in adult patients – 18 year-old and older–, with no language restriction. Cases with fractures in pathological bone, trochanteric nonunion, or infectious or significant mechanical complications – i.e. cutout, implant breakage, etc. – were excluded. Date limits were set from inception of journals to December 2016.

Data extraction

Relevant information obtained was divided in two parts. Part I of the study included detailed case reports or cases of FNFARIHTF with useful information, and data were extracted as type of study, age, gender, comorbidities, AO-OTA group of trochanteric fracture [10], fracture reduction, fracture treatment (implant used), position of the implant in the femoral neck and head, post-operative complications, time from internal fixation of trochanteric fracture to implant removal, partial (cervical component) or total hardware removal, time from implant removal to femoral neck fracture, mechanism and severity of injury, site of femoral neck fracture, fracture displacement, symptoms and signs, diagnostic modalities, treatment, and outcome.

Part II of the study included series of healed TF with further removal of hardware which included a case or cases of FNF after removal of hardware, with data extracted as type of study, time period of study, number of patients with healed TF, time to follow-up, and number of cases of FNF, for assessing the incidence of this complication.

Statistical analysis

As the majority of the data collected were from case reports and few case series statistical analysis was not possible. Descriptive statistics were employed where possible.

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