Injury, Int. J. Care Injured 46S (2015) S3–S11

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Common complications in hip fracture surgery: Tips/tricks and solutions to avoid them

Theodoros H. Tosounidis [a,b], Raul Castillo [a], Nikolaos K. Kanakaris [a], Peter V. Giannoudis [a,b,*]

[a] Academic Department of Trauma & Orthopaedic Surgery, University of Leeds, Clarendon Wing, Floor A, Great George Street, Leeds General Infirmary, LS1 3EX Leeds, UK
[b] NIHR Leeds Biomedical Research Unit, Chapel Allerton Hospital, Leeds, West Yorkshire, Leeds LS7 4SA, UK

ARTICLE INFO

Keywords:
Hip fractures
Elderly
Surgical fixation
Complications

ABSTRACT

Surgical management of hip fractures in elderly people is challenging and complications relating to surgery could be devastating. They often lead to reoperation and revision surgery and can be associated with significantly increased morbidity and mortality. The most common surgical complications after internal fixation of hip fractures include cut-out, nonunion, Z-effect/medial migration, periimplant failure and avascular necrosis. High quality surgical fixation is of outmost importance to avoid surgical complications. This article presents the aetiology, risk factors and incidence of perioperative and post-fracture fixation complications. Technical tips and tricks for a successful fixation as well as the contemporary evidence surrounding the augmentation of osteoporotic bone fixation in internal fixation of hip fractures are discussed.

Introduction

Hip fractures are increasing in numbers and most commonly occur in elderly women [1,2]. The mean age of a patient who suffers a proximal femur fracture has been estimated to be above 80 years. The co-existence of significant comorbidities, dementia and difficulties in pain management constitute the medical management of these patients challenging [3–5]. Despite recent advances in surgical and medical management of elderly patients with hip fractures latest relevant research has shown that the one year post-injury associated mortality is still high ranging from 18.8% to 22.8% and increases with age [6–9].

Surgical management of hip fractures in elderly patients is the mainstay of treatment with non-medical treatment reserved for non-ambulatory patients or patients who cannot tolerate an anaesthetic. Specific parameters that can have an impact on outcome following hip fracture surgery include the inherent poor bone quality, the specifics of reduction – implant selection – fixation, the need of fixation augmentation, and the challenges in rehabilitation and pain management [10]. Along with medical complications, fracture fixation failure has detrimental effects on the overall health of the patient [11]. The aim of this study is to describe the most common surgical complications after hip fracture fixation surgery in the elderly and to provide useful tips and tricks in order to avoid them.

Common surgical complications

The actual incidence of complications after fracture fixation surgery is difficult to be accurately estimated due to inadequate follow up and limited inclusion of cognitively impaired or demented patients in hip fracture trials [12,13]. Taking into consideration the fact that this population constitutes more than one fifth of the patients suffering hip fractures [14], it becomes evident that no safe and reliable estimations can be done in relation to the actual burden of the failed fractured fixation in hip surgery. Nevertheless the incidence of collective surgical complications requiring re-intervention in proximal femoral fractures has been estimated in the region of 6.9%, with mechanical failure and infection being the most common ones [11].

Proximal femoral fractures can broadly classified as those involving either the trochanteric or the neck area i.e. AO/OTA 31.A and AO/OTA 31.B respectively [15]. In subtrochanteric fractures the fracture line traversing the femur is predominantly found within 5 cm of bone distal to the lower margin of the lesser trochanter [16]. Different complication rates after surgical fixation have been described for these fractures due to different biomechanics, fixation techniques and biologic healing potential.

* Corresponding author at: Academic department of Trauma & Orthopaedic Surgery, University of Leeds, Clarendon Wing, Floor A, Great George Street, Leeds General Infirmary, LS1 3EX Leeds, UK. Tel.: +44 113 3922750.
E-mail address: pgiannoudi@aol.com (P.V. Giannoudis).

http://dx.doi.org/10.1016/j.injury.2015.08.006
0020–1383/

The most common causes of failure of fixation that lead to reoperation have been reported to be the following: nonunion, avascular necrosis of the femoral, implant cut-out, "Z-effect", implant breakage, detachment of the implant from the femur, intra-operative and late post-operative peri-implant fracture [17]. In a recent review Broderick et al. [17] reported a high overall failure (41%) and reoperation rate (45.5%) in patients above 60 years of age who were treated with internal fixation for a displaced femoral neck fracture. This was significantly higher compared to the failure and reoperation rates in patients of the same age who underwent fixation for an undisplaced femoral neck fracture; 14.8% and 15.4% respectively. The stability of the fracture pattern appears to be a significant factor determining the results of internal fixation of pertrochanteric fractures as well, rating from 3.8% for stable patterns to 22.9% for unstable patterns.

Cut-out

Cut out of the lag screw or other head-neck-implants is one of the most common complications after fixation of intra- and extra-capsular hip fractures (Fig. 1). This complication is encountered after fixation with either intramedullary [18,19] or extramedullary devices [20]. Cut out has been associated with the Tip Apex Distance (TAD) Index, which represents the sum of distances measured in mm in both anteroposterior and lateral radiographs from the centre of the femoral head to the top of the lag screw [21]. Ideally the TAD should be less than 25 mm since higher values have been correlated to increased risk of cut out and subsequent mortality. Values of TAD greater than 45 mm have been correlated with 60% risk of cut out. In a recent systematic review Rubio-Avila et al. [10] quantified the association between the TAD and the cut out failure in intertrochanteric fractures. The Relative Risk of cut out in patients with TAD $>$ 25 mm was 12.71. The mean difference of TAD in patients who suffered a cut out compared to those who did not was 5.54 mm. Functional outcomes could not be reported in the aforementioned review and the authors suggested that future studies are needed in order formulate recommendations on when a revision surgery is needed when a high TAD is documented postoperatively.

Fig. 1. Anteroposterior hip radiograph showing the cut out of a sliding hip screw.

Central lag screw placement has been questioned with bio-mechanical [22] and clinical studies [23,24] providing evidence for a more inferior screw position. A parameter that has recently been described and potentially predicts the cut out of cepahallomedullary nails is the calcar referenced tip-apex distance (CalTAD) [22]. This screw position has been suggested to offer the higher axial and torsional stiffness. To calculate the CalTAD the same measurements as for the calculation of the TAD are made on the lateral view. On the anteroposterior view the distance from the tip of the lag screw to a point of the femoral had that is bisected by a line parallel to the neck and adjacent to the calcar is measured. Kashigar et al. [20] reported that CalTAD is a reliable predictor of cut out in cephallomedullary nail fixation reporting no cut out in 77 patients when the CalTAD was less than 20.98 mm. The authors suggested the inferior-central placement as optimal lag screw position. The same was concluded in another recent clinical study by De Bruijn et al. [25].

Avascular necrosis

It has been suggested that avascular necrosis of the femoral head due to trauma is a complication most commonly encountered in younger patients with femoral neck fractures [26] but limited high quality evidence is available in relation to its diagnostics and management which are based on the overall broad diagnosis of osteonecrosis [27]. On the other hand, there are studies supporting that the incidence of AVN is higher after internal fixation in elderly [28]. In a recent study Murphy et al. retrospectively reviewed the reoperation rate of internal fixation of femoral neck fractures in patients older than 60 years of age. They documented AVN rates of 2.5% and 5.6% after fixation of undisplaced and displaced fractures respectively. The results of the latter study confirms the observation that initial displacement is a strong predicting factor for development of AVN. Fracture characteristics such as displacement and posterior comminution as well as the quality of the reduction are currently considered predictors of AVN [29].

Recent studies support that the effect of timing of internal fixation is no longer considered a strong factor associated to the development of AVN [30,31]. In the only randomised controlled trial comparing the open reduction and capsulotomy versus closed reduction Upadhyay et al. [32] found no difference in the rates of ANV. Avascular necrosis of the femoral head after pertrochanteric fractures although rare it has been reported to range from 0.3% to 1.16% [33]. Barquet et al. [34] in systematic review of the literature documents an AVN incidence of 1.37% within the first two postoperative years after internal fixation of trochanteric fractures. Again characteristics of the index injury such as displacement and fracture morphology were considered risk factors for AVN. Of note is that fracture reduction quality and optimal fixation was not found to be associated to this complication.

Z-effect and central migration

Z-effect and reverse (or paradoxical) Z-effect is a complication occurring in proximal femoral nails that allow for two proximal interlocking screws to be inserted to the femoral neck/head. Z-effect is a phenomenon that occurs during physiologic loading in which the inferior screw migrates laterally whilst the proximal screw migrates medially. This pattern of failure was originally described by Werner-Tutschku [35]. Although the aetiology of the phenomenon is not fully understood, it has been suggested that the vertical loads head/neck cause varus moment to rotationally/tortionally unstable femoral neck/head segment, are the primary causes [36]. It has also been