Fixation and Implant Retention of Extracapsular Femoral Neck Periprosthetic Fractures Around Hip Resurfacing Arthroplasty – A Case Series

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Learning Point of the Article:
Open reduction internal fixation and implant retention is a reasonable alternative surgical strategy in patients with extracapsular femoral neck periprosthetic fractures around well-fixed and functioning hip resurfacing arthroplasties.

Abstract

Background: Extracapsular femoral neck fractures in the presence of a resurfacing hip arthroplasty (RHA) appear to be independent of suboptimal technique during the initial implantation of the RHA and present with a similar etiology as native hip fractures – that is, a fragility fracture related to pathological or age-related osteoporosis, as a consequence of trauma. In the presence of a well-fixed and previously well-functioning RHA, the options for management include revision arthroplasty or open reduction and internal fixation (ORIF). In the absence of loosening through mechanisms of wear, infection, metallosis, or suboptimal prosthesis positioning, many authors have advocated ORIF with implant retention. However, there is often debate regarding the use of total hip arthroplasty in these cases.

Case Series: The authors conducted a thorough assessment of the literature followed by a retrospective review of outcomes for three patients treated by ORIF with implant retention for extracapsular femoral neck fractures around a RHA, using a standardized technique. All patients were independently mobile and active with well-fixed and well-functioning RHAs before the date of injury. All patients suffered low-energy trauma resulting in the fracture. There were no intraoperative or perioperative complications. All patients achieved full weight-bearing status and independent mobility. Two patients achieved radiographic union and returned to full range of movement and independent mobilization comparable to their preoperative state. One patient was lost to follow-up.

Conclusion: The authors believe that fixation of extracapsular proximal femoral fractures distal to a well-fixed, well-functioning RHA is a good management option in an independent and active patient. A higher level of evidence is needed to investigate the surgical management options of these injuries comparing osteosynthesis with revision arthroplasty.

Keywords: Periprosthetic fracture, hip resurfacing arthroplasty, extracapsular neck of femur fracture, fixation, implant retention.

Introduction

Fractures following a resurfacing hip arthroplasty (RHA) are a well-recognized complication with an incidence between 1% and 2.5% with multifactorial etiology [1, 2, 3, 4, 5, 6]. For intracapsular neck of femur fractures, technical factors are implicated, particularly femoral neck notching and malpositioning of the prosthesis, and this post-operative complication is found to occur in a higher percentage in female patients and patient with a high BMI or osteoporosis [2, 6, 7]. The treatment options for these fractures can range from non-operative management for those patients with undisplaced or incomplete fracture [8, 9] to operative management in the form of fixation or revision arthroplasty [9, 10].

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All patients were independently mobile, active with well-fixed and well-functioning RHAs before the date of injury. All patients suffered low-energy trauma causing the fracture. The three cases that we describe in this paper are homogenous in presentation, treatment and outcome, and therefore presented in the table below (Table 2). Pre-operative (Fig. 1-3) and post-operative (Fig. 4-6) radiographs are also included for each of the cases. 3-D reconstructed images from a computerized tomography (CT) scan for case 3 can be visualized as part of Figure 3.

Case Series

The three cases that we describe in this paper are homogenous in presentation, treatment and outcome, and therefore presented in the table below (Table 2). Pre-operative (Fig. 1-3) and post-operative (Fig. 4-6) radiographs are also included for each of the cases. 3-D reconstructed images from a computerized tomography (CT) scan for case 3 can be visualized as part of Figure 3.

All patients were independently mobile, active with well-fixed and well-functioning RHAs before the date of injury. All patients suffered low-energy trauma causing the fracture. All patients underwent CT scans to further delineate the fracture pattern, to assess for radiographic signs of loosening, and to assess bone stock and suitability for fixation. Intraoperatively, patients were placed on a traction table. Optimal closed reduction of the fracture was achieved using intraoperative image intensifier (II). An extended direct lateral approach to the proximal femur was used. The fascia lata was divided along its fibers and the vastus lateralis split. Fracture reduction was improved, held with 2 mm Kirschner wires placed across the fracture site, and position confirmed with II. An anatomically contoured distal femoral variable angle LCP (VA-LCP) intended for the contralateral distal femur was measured, selected, and positioned in an inverted manner (proximal and distal ends reversed). The position was checked...
using image intensifier. A non-locking fully threaded cortical screw was inserted distal to the fracture site to seat the plate to bone. The senior author believes that it is essential to achieve the best possible screw hold in the neck, and therefore accept to some extent that the plate distally may not sit perfectly centered over the shaft of the femur. Shaft screws can be inserted distally through a minimally invasive plate osteosynthesis technique if desired. All patients were asked to partially bear weight on the operated side for 8 weeks. The time to radiographic union and the time to discharge from physiotherapy with achievement of previous level of function were recorded for two patients. One patient, case 3 (Fig. 3-6), was lost to follow-up as she moved out of the country.

**Discussion**

The literature suggests two distinct fracture modalities emerging in the presence of an RHA: “Atraumatic” and “traumatic.” The predominant mode is an insidious “atraumatic” type of injury that is more often intracapsular and frequently undisplaced or minimally displaced at presentation. According to Carrothers et al., this was the most common cause of revision in a review of 5000 resurfacings [4]. Although there have been reported cases of implant retention in these types of injuries [8, 9], revision arthroplasty is the recommended definitive treatment [2].

The “traumatic” modality occurs in the setting of trauma and therefore does not have a defined timescale or incidence. This subset of fractures is predominantly extracapsular in nature [15, 20], although sub-capital fractures can occur [18]. Favorable results have been reported for extramedullary fixation of intracapsular fractures within this “traumatic” group [34], although once again the recommended course of action is revision arthroplasty.

Complex arthroplasty treatment decisions are best made in conjunction with multidisciplinary team (MDT) discussions, as these cases were [35]. This paper presents 3 cases of fracture around well-fixed and well-functioning hip resurfacing arthroplasties in independent high functioning individuals. To reduce the risks associated with revision arthroplasty and following discussions with the MDT as well as the patients, fixation was the selected treatment in these cases. A distal femoral VA-LCP condylar plate was used as it has more screw options compared to most proximal femoral locking plates. The reversed distal femur plate of the contralateral limb has an anatomic profile that sits well in the proximal femur and allows for increased screw purchase and screw density in the proximal femur around a RHA. It was also decided to avoid using plates with greater trochanteric extensions to reduce the risk of lateral hip pain, iliotibial band irritation, and need for future removal of metalwork.

Patients are suitable for this treatment if they have a well-function and well-fixed prosthesis, if they have good bone stock and are able to fully or partially bear weight without discomfort (in the opinion of the operating surgeon and MDT). An inability to bear weight, in these cases, could be viewed as a surrogate marker of fitness and further guide the decision to fix or revise.

Revision to a total hip replacement remains the treatment of choice for a failed resurfacing, where the mode of failure is loosening, osteonecrosis of the head and collapse, or early fracture due to poor positioning or patient factors. Several studies have shown that the outcome from revision does significantly reduce patient-reported outcome measures (PROMS), when compared to pre-revision or even pre-primary surgery level [29, 36].

Whilst it is recognized that conservative management is an option, particularly in the undisplaced and potentially incomplete fracture, the risks associated with non-operative management of patients with neck of femur fractures are not acceptable to the active and high functioning patient. These
Complications of fixation around the femoral prosthesis of a hip resurfacing arthroplasty include increased risk of deep vein thrombus or pulmonary embolus due to non-weight-bearing status and increased immobility in the rehabilitation period. In addition, trochanteric bursitis and plate irritation may necessitate the removal of the plate. Other complications include periprosthetic fracture distal to the plate fixation, non- and mal-union, and a potentially more complex revision surgery to THA in the future (if required). Avascular necrosis and subsequent collapse if blood supply to the femoral neck is disrupted are a possibility, but this is more likely in the case of an intracapsular fracture, as reported in one case study [18].

In summary, we present our technique that is reproducible and achieves good fixation into the femoral neck. This is yet another tool in the surgeons’ armamentarium of techniques to treat these difficult fractures.

Table 1: Cases of traumatic extracapsular fractures managed with open reduction and internal fixation with a contoured plate, with RHA retention.

| Author                        | No. of cases | Fixation                       | Reported outcome                  |
|-------------------------------|--------------|--------------------------------|-----------------------------------|
| Aning et al., 2005 [15]       | 1            | Intramedullary nail            | Radiographic union                |
| Orpen et al., 2009 [17]       | 2            | NCB locking plate              | Radiographic union in both cases  |
| Whittingham-Jones et al., 2010 [21] | 1          | DCP                            | Radiographic union                |
| Silk et al., 2011 [22]        | 1            | Proximal femoral LCP           | Radiographic union                |
| Weusten et al., 2012 [25]     | 1            | Proximal femoral LCP           | Radiographic union                |
| Carpentier et al., 2012 [23]  | 1            | Distal femoral LCP             | Radiographic union                |
| Macdonald et al., 2014 [26]   | 1            | Proximal femoral LCP           | Radiographic union                |
| Macdonald et al., 2017 [12]   | 2            | Proximal femoral LCP           | Radiographic union                |
| Koulischer et al., 2019 [29]  | 1            | Proximal femoral LCP           | Radiographic union                |

LCP: Locking compression plate, DCP: Dynamic compression, NCB: Non-contact bridging

Clinical Message

Extracapsular femoral neck fractures in the presence of a RHA can be challenging to treat. Fixation with implant retention in the presence of a well-fixed and well-functioning RHA is a suitable alternative management option for independent and active patients.
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