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Surgical treatment of periprosthetic femoral fractures following hip arthroplasty: Our institutional experience

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ABSTRACT

Purpose: Periprosthetic fractures are one of the most serious complications after hip replacement. The aim of this retrospective study was to evaluate the clinical outcome of surgical treatment of periprosthetic femoral fractures following total hip arthroplasty using treatment algorithm of the Vancouver classification.

Materials and methods: Fifty six periprosthetic femoral fractures operated on during the period December 2004–September 2013 were followed-up retrospectively. There were 40 women and 16 men with mean age at the time of surgery 64.7 years (41–88 years). The mean follow-up for the group was 5 years (range, 1–10 years). Periprosthetic fractures were classified according to the Vancouver classification. The clinical evaluation was performed with the Harris hip score, the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) and Short Form 8 (SF-8). Bone healing, implant survival, pain, function and complications were recorded. Bone healing and implant stability were evaluated clinically and on plain radiographs.

Results: Uneventful bone healing was achieved in 52 cases. In two fractures (one type B1, one type C) nonunion and plate failure occurred. Two cemented stems were revised for aseptic loosening 6.5 and 7 years after fracture fixation. Uncontrollable prosthesis infection and sepsis in a rheumatoid (immunocompromised) patient required disarticulation of the involved extremity.

Discussion and conclusions: Periprosthetic femoral fractures are difficult to treat and require complex treatment approach according to risk assessment, fracture type, implant stability, bone stock and medical status of the patient. Using a treatment protocol of the Vancouver classification we obtained satisfactory outcome.

Introduction

Periprosthetic fractures of the femur following total hip replacement (THR) are one of the most serious complications and represent a difficult treatment challenge. The incidence of these fractures varied between 0.5% and 2% but up to 4% following revision total hip arthroplasty [1,2]. Such fractures may occur intraoperatively or postoperatively. The treatment is based on the site of fracture, implant stability, quality of bone stock and the medical condition of the patient. Conservative treatment has shown poor results and should be reserved for elderly patients with poor medical status but with stable prostheses [3]. Surgical treatment of periprosthetic fractures of the femur following THR has higher morbidity and mortality compared to revision hip arthroplasty for aseptic loosening [4,5]. Difficult surgical treatment, high rate of complications and usually less favourable clinical outcome compared to aseptic revisions necessitate proper evaluation of the periprosthetic fracture, precise planning and implementation of the treatment plan.

Various classifications for periprosthetic femoral fractures around hip arthroplasty have been proposed [6–10]. The Vancouver classification [11] is widely used as it is based on fracture

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location, implant stability and bone quality. Moreover, the classification has been validated and includes treatment algorithm [11,12]. However, decision for the type of internal fixation depends on preoperative plan, intra-operative findings, and possibility to achieve stable fixation and surgeon's preferences as well as logistics. Successful treatment of such periprosthetic femoral fractures varies from nonoperative procedures to extensive revision surgeries [4].

The aim of this retrospective study was to (1) evaluate the clinical outcome; (2) to assess the impact of femoral periprosthetic fracture on patient reported outcome measurements; and (3) to analyse the effect on fracture healing and implant stability of when applying a modified treatment algorithm of the Vancouver classification.

Materials and methods

Fifty six consecutive periprosthetic femoral fractures operated on during the period December 2004–September 2013 were followed-up retrospectively at mean 5 years (range, 1–10 years). During the study period we treated conservatively four other periprosthetic fractures of the greater trochanter that were not included in this study. The cohort included 40 women and 16 men with mean age at the time of surgery 64.7 years (41–88 years). Fifty three of the patients were after primary arthroplasties and three following revision arthroplasties. In one case the prosthesis was bipolar. The primary diagnosis was primary osteoarthritis in 33 hips (58.9%), hip fracture in 14 hips (25%), and in the others – secondary osteoarthritis following Developmental hip dysplasia in 5 (8.9%), osteonecrosis in three (5.4%), and rheumatoid arthritis in one hip (1.8%). In 32 patients the primary THR femoral stem was cemented and in 24 uncemented.

Time from insertion of the primary THR prosthesis to periprosthetic fracture was on average 6.2 years (range, 0.5–22.2 years). In 52 cases the periprosthetic fractures were result of a fall, one fracture was sustained in a car accident, one case occurred intraoperatively during reduction of the implant at the end of the operation, and two fractures occurred intraoperatively during revision surgery. The right hip was fractured in 34 patients and the left hip in 22 patients.

The periprosthetic femoral fractures in the series were classified according to the Vancouver classification [11]. Based on this classification, as presented in Table 1, Forty four patients had type B fracture – around or just distal to the stem, of them 16 with type B1 (a fracture of the femur and a stable prosthesis), 14 patients with type B2 (a fracture of the femur with a unstable prosthesis), 14 patients with type B3 (fracture of the femur with an unstable prosthesis and with poor quality of bone). Twelve patients had type C fracture (well below the distal tip of a stable prosthesis). We had four patients with type Ag fracture (greater trochanter) treated conservatively and not included in this series.

Six patients were ASA grade I, 22 patients were ASA grade II, and 28 patients were grade III (Table 2). This reflected the prevalence of ischaemic heart disease (22/56 – 39.3%), diabetes (8/56 – 14.3%) and alcohol abuse (2/56 – 3.6%) in some of the patients.

Table 1
Periprosthetic fractures in the series.

Vancouver type	Number of patients
Ag	4 (treated conservatively)
B1	16
B2	14
B3	14
C	12

Table 2
Distribution of the patients in the series according to ASA (American Society of Anesthesiologists) Physical Status Classification System.

ASA grade	Number of patients
I (a normal healthy patient)	6
II (a patient with mild systemic disease)	22
III (a patient with severe systemic disease)	28

Preoperative ASA health status of the patients did not correlate with the type of fixation or the type of fracture.

Surgical data

Time from admission to surgery was on average 5 days (range, 1–12 days). In all cases lateral decubitus position was used. In two cases extended trochanteric osteotomy was used for implantation of a longer uncemented stem [14]. To a certain extent we deviated from the treatment algorithm of the Vancouver classification as some oblique Vancouver type B and C fractures were treated by plates or by cerclages. Periprosthetic fractures were operated on as follows: in 16 patients with type B1 – 12 were treated by locking plate (Fig. 1), and 4 by cerclage wires. All 14 patients with Type B2 were treated by revision of the stem with a longer revision femoral stem (uncemented in12 and cemented in 2) and 3 by cerclage wires. All 14 patients with Type B3 were treated by a longer revision femoral stem (uncemented in 12 and cemented in 2). In 12 patients with Type C - 9 were treated by locking plates and 3 by cerclage wires. Additional cortical strut grafts were used in two patients (one with Type B1 and one with Type B3) for reconstruction of the proximal femur together with plate reinforcement. In 30 cases wound drainage was used for 24 h. Third generation cephalosporin was used for antibiotic prophylaxis for five days and for thromboembolic prophylaxis we used low molecular weight heparin for 45 days. In the postoperative period partial weight-bearing (tip-toeing) was allowed at discretion of the surgeon and progressive partial weight-bearing was allowed after clinical visit on the second postoperative month provided radiographical signs of callous formation were present. Full weight-bearing was allowed after radiographical signs for fracture healing.

Bone healing, subsidence and implant stability were assessed on plain radiographs. Bone union was diagnosed clinically when patient was able to full weight-bear without pain. The bone implant interface and bone remodeling were assessed by radiographs. Implant survival, pain, function, early and late complications, rehabilitation after discharge, and length of hospital stay were recorded. White blood count, CRP levels and ESR were evaluated in suspicion of infection.

The clinical evaluation was performed using the Harris Hip Score [15]. General and disease-specific health-related quality of life (HRQOL) was measured by the patient using two types of instruments. The disease-specific HRQOL was assessed with the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) [16], a 24-item questionnaire that quantifies hip disease in three domains. The general HRQOL was assessed with the Medical Outcome Study 8-Items Short Form Health Survey (SF-8) [17]. The SF-8 generates two summary measures, a physical component summary (PCS) and a mental component summary (MCS). The health-status questionnaires scores were matched with scores found after primary and revision THR (16). The radiological outcome was graded as excellent, good or poor as previously described [18]. An excellent clinical outcome was registered when