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Outcomes of Surgical Management of Periprosthetic Fractures Around the Total Hip Replacement

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Vijaya Hosahali Kempana*[1], Syed Kashif Abbas[2], Chekwas Obasi[3], Michael C Moss[4]

[1]Trauma and orthopaedics Southampton General Hospital, England

[2]Associate specialist Southampton General Hospital, England

[3]St. Richard Hospital Chichester, England

[4]Consultant Surgeon St. Richard Hospital Chichester, England

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ABSTRACT

Introduction The incidence of periprosthetic fracture is increasing with higher numbers of arthroplasty being offered to end-stage arthritis. The optimum management of fracture involves complex decision-making based on fracture biology and associated bone loss. We present our experience of periprosthetic fractures management around total hip arthroplasty in a district hospital. **Materials and Methods:** This is a prospectively collected data of patients with PPF (periprosthetic fracture) who were managed with either fixation or revision surgery based on anatomic location of the fracture and associated comminution. Preoperative and postoperative imaging were reviewed along with functional postoperative status to assess the results. **Results:** Thirty-three limbs were operated on in 30 patients with PPF. The mean age of presentation is 81 yrs. The decision for revision hip replacement or fixation was based on preoperative CT scans. Thirteen patients were unable to regain the pre-injury functional status. Three patients had perioperative mortality and five had more than one intervention due to complications. **Conclusion:** PPF around total hip replacement is a challenging procedure and is associated with significant morbidity and mortality.

INTRODUCTION:

Total Hip Arthroplasty (THA) is one of the commonly performed procedures in the UK. National Joint Registry (NJR) showed figures of over 100,000 primary THA with an annual increase of 3.5% (1). The majority of patients are in 60 -70 yrs age groups and thus reflecting the tendency to be more active and thus more prone to develop complications related to higher activity levels. Periprosthetic fracture (PPF) comprises 10.5% of cases that require revision hip surgery. The incidence of these fractures varied between 0.5% and 2% but up to 4% following revision total hip arthroplasty [2,3]. The rate of femoral intra-operative fractures is around 1.7% for primary THA compared to the 20-year postoperative fracture probability of 3.5% (4). Management strategies for periprosthetic fractures vary according to many variables including physiological age, comorbidity, activity levels, location of fractures, etc. Vancouver classification is most commonly used to guide management (5), which categorize fracture according to location and availability of bone stock and stability of components. Sometimes modifications are made according to patient-related factors as mentioned above which can make a decision-making process difficult. There is a high complication rate (26-43%) following the treatment of hip periprosthetic fractures. (6). Moreover, similar problems in the elderly age group are also associated with higher mortality.

We are presenting our subset of a patient who presented to the district hospital intending to focus on our practice and outcomes of managing patients presenting with Type B periprosthetic fractures.

MATERIALS AND METHODS:

This is a case series of prospectively collected data reviewed retrospectively. We included all patients presented with Vancouver Type B fracture treated between 2011 to 2016 at a district hospital, we excluded patients who were treated non surgically, who had intraoperative fractures, and with age less than 65 at the time of presentation. All patients had preoperative CT scans to define the fracture pattern and availability of bone stock.

Previous medical records and images were retrieved to assess indications of primary hip surgery and duration since the index procedure. Any prior comorbidity was recorded and categorized according to ASA grade.

Fractures were classified by the author based on radiological and intraoperative findings according to Vancouver classification into B1 (fracture with stable stem), B2 (fracture with unstable stem), and B3 (fracture communition with unstable stem). The decision of any particular treatment was at the discretion of the operating surgeon and preoperative discussion with the patients.

Patient records were reviewed at regular intervals to update follow-up visits using patient notes, Picture Archiving and Communication System (PACS), and Sema Helix. Patient return to activities of daily living (ADL) was set as the main benchmark for success and was recorded in each follow-up visit in addition to other variables. Additionally, the length of hospital stay, the requirement for blood transfusion, and time to the union were also recorded. Radiological findings were classified using the criteria proposed by Beals and Tower [7]. According to this classification, outcomes were graded as excellent (stable arthroplasty with minimal deformity), good (stable arthroplasty or with minimal subsidence and the fracture healed with moderate deformity) or poor (loosening, nonunion, sepsis, severe deformity, or new fracture). An implant was described as stable if there was an absence of radiolucent lines around the stem or progressive implant migration or subsidence [8].

RESULTS AND DISCUSSION:

RESULTS:

A total of 30 patients were operated on with 33 surgical procedures as three had bilateral fractures. The majority of the patient were female (21 as compared to 9). Mean age 81 yrs (68-94) with median ASA III. Fractures were further classified in B1, B2, and B3 based on findings on plain films and CT scans. Twenty-one patients had B2 fractures as opposed to nine with B1 and three with B3 fractures. Preoperative x rays were analyzed with regards to bone stock and integrity of cement mantle and extension of fractures into the isthmus in addition to the type of implants used for primary surgery. Further information was retrieved from records of previous

surgery, where available. Twenty-one patients had cemented stem and 11 had uncemented with one patient had cemented spacer with subsequent fracture around it. The majority had cemented stem in place. Time from primary surgery to periprosthetic fracture was noted to be 9.8 yrs for cemented and 6.1 yrs for uncemented. The mean waiting time for definitive treatment was 3 days. For treatment, the uncemented revision was the first preference followed by cement in cement replacement and open reduction internal fixation with a plate. One patient had proximal femur replacement due to extent of comminution and poor bone stock. The selection of implants was according to the surgeon's preference. The mean length of hospital stay was 26 days. All patients were followed at regular intervals i.e. six weeks, 3 months, and 12 months, with a mean follow-up of 14 months. Three patients lost to follow in addition to five mortalities, three of which were during the perioperative phase **Table 1**.

We have noticed a decline in the overall walking ability of our patients with this injury. Thirteen (33%) patients had not regained their pre-fracture walking status until their last follow-up. There is a worsening in functional status in all ambulatory groups as summarized in **Table 2**.

Complications were divided into major and minor according to the need for intervention. Five patients (16%) required more than one intervention. The main indication for revision surgery was dislocation followed by infection. Other complications included loosening, heterotopic ossification, significant leg length discrepancy, and delayed union.

Mortality was categorized as perioperative i.e. within 30 days of surgery and delayed. Three (10%) patients had perioperative mortality. Hospital-acquired pneumonia is found to be the most common associated pathology leading to higher mortality after surgery. The remaining two had mortality at 4 months and 2 yrs from medical conditions.

The mean time to radiological union was 7 months (4-15 months). One patient had delayed union for which bone grafting was performed and subsequently united 8 months following the second surgery.

DISCUSSION:

Management of periprosthetic fracture is very challenging and is further complicated by the presence of associated medical conditions. Like all revision surgery, associated morbidity and

mortality risks are higher than expected with primary surgery. Patient postoperative rehabilitation is also quite important as many of them face challenges in regards to regaining preoperative functional status. Since it's difficult for patients to be on protective weight bearing due to age and compliance, we try and start most of our patients with full weight-bearing with increased emphasis on using some support with frame or stick for balancing and prevent further fall. In our series one patient had a fall that resulted in hip dislocation which was reduced in theatre and found to be stable in manipulation under anesthesia.

The selection of a patient for any particular type is surgery is dependent on patient-related factors and expectations for which a thorough process of informed consent exists. All of our patients who had Vancouver B1 fractures were advised fixation over revision after careful assessment of the existing cement mantle, further assessments were made at the time of surgery if the stem is grossly stable. In cases of the highly polished stem, we expect to see some movement especially if there is no cement mantle at the collar which is attributed to the biomechanical design of the implants. Furthermore, we have done plate fixation for two patients with B2 fractures as the fracture was undisplaced and the general health of the patient was a limiting factor for any revision surgery. We chose to do a locking plate with a combination of uni cortical screws in cement and Cables proximal and good bicortical fixation distal to fracture to provide biomechanically rigid construct. We had three wound-related complications with superficial surgical site infection in one patient who was managed only with antibiotics without the need of was out. The other two patients had the deep infection for which DAIR (Debridement Antibiotics and Implant Retention) including change of modular component without any need of further washout. The second patient with a deep infection had two-stage revisions.

Revision surgeries were mostly advised to the patient with a relatively better physiological state. Patients were further categorized based on bone stock and the presence of comminution. If the fracture pattern was stable with some preservation of cement mantle then a better option is to do cement revision after absolute reduction of the fracture and provisional fixation with two or three Dall Miles tension cables to prevent any leakage of cement through the fracture site which could further hinder healing. If there is any evidence of comminution then the next decisive factor is to look for bone stock proximally and if there is any involvement of isthmus as the selection of implant would depend on these factors. With comminution and no involvement of the isthmus

the choice is to retrieve the implant and clear out all cement from the canal and do cementless modular stem bypassing the fracture site at least two shaft diameters. If the isthmus is also involved then the better option is to do a long interlocking stem. In cases of severe loss of bone stock that is not reconstructable then proximal femoral replacement is the last resort which is a usual case in B3 complex fractures.

Revision surgery was performed in five patients with recurrent dislocation as the main indication. Two patients had a revision of acetabular component and augmentation with screws and constrained liner because of poor soft tissue. One patient had revision to a dual mobility cup to make it more stable to the arc of motion. No further episode of dislocation was noticed in these patients. The other two revisions were done for deep infection.

In follow-up radiograph two patients had evidence of heterotopic ossification which was asymptomatic thus managed conservatively, two patients also showed evidence of loosening of the femoral component with lucencies around the stem but as their mobility was already minimal because of general health, no further interventions were carried out.

CONCLUSION:

PPF is associated with significant morbidity and mortality even in experienced hands. These injuries should be treated by an experienced surgeon and well-equipped centers to minimize the complication rates. Patients should be well informed about the possibility of high complications which are associated with these injuries.

Table No. 1: Patient demographics

Age	
65-75	05(17%)
75-85	22(73%)
>85	03(10%)
Gender	
Male	09(30%)
Female	21(70%)
Type of fracture	
B1	09(27%)
B2	21(64%)
B3	03(09%)
ASA	
II	14(47%)
III	13(43%)
IV	03(10%)
Type of primary Stems	
Cemented	21(70%)
Uncemented	11(37%)
Cemented spacer	01(03%)
Revision implants	
Zimmer ZMR	09(28%)
Stryker restoration stem	02(7%)
Long stem Furlong	01(3%)
JRI Securus	03(10%)
CPT (Cement in cement)	02(6%)
Exeter V40 (cement in cement)	02(6%)
KAR stem	01(3%)
Proximal femoral replacement	01(3%)
NCB (fixation)	12(36%)
Complications	
Major	09 (27%)
Minor	05 (15%)

Table 2: Pre and Post Fracture Ambulatory Status

	Prefracture ambulatory status	Postfracture ambulatory status
Able to walk unaided	18 (54%)	10 (30%)
Walking stick	08 (24%)	10 (30%)
Two sticks / frame	04 (12%)	06 (18%)
Unable to walk	03 (10%)	04 (12%)

Figure No. 1: B1 fracture treated with Proximal femur locking plate with evidence of healing 12 months postoperative x rays and no subsidence of femoral component.

Figure No. 2: B1 fracture pre and post-operative x rays with evidence of healing.

B2 fracture treated with a Locking plate.

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