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Case Series

Surgical and functional outcomes of vancouver type B2 postoperative periprosthetic femoral fracture treated with revision arthroplasty and coxa femoral bypass

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ABSTRACT

As the number of total hip arthroplasties have steadily increased, one would expect a concomitant increase in catastrophic postoperative events such as periprosthetic fractures. This study evaluates the surgical and functional outcome, along with the associated complication rates in patients undergoing revision arthroplasty following Vancouver type B2 post-operative periprosthetic femoral fracture. We studied 14 Clinically and radiologically diagnosed patients with Vancouver type B2 Post-operative Periprosthetic femoral fracture. The post-operative VAS score has decreased to 2.23±0.92 from a pre-operative score of 8.30±0.9, $p<0.001$. The average Harris Hip Score has improved from 44.05±7.71 pre-operatively to 83.63±7.75 post-operatively at 6 months, $p<0.001$. At 6-month follow-up, we had 57% excellent results, 29% good results, 7% fair results, and 7% poor results based on Harris Hip Score. The revision arthroplasty of Vancouver type B2 post-operative periprosthetic femoral fracture with revision arthroplasty and coxa femoral bypass has excellent-good surgical as well as functional outcomes in terms of regaining abductor function by an increase in range of motion at the affected hip joint, significant pain relief leading to improved quality of life after surgery at short term follow up period.

Keywords: Hemiarthroplasty, Periprosthetic fracture, Revision arthroplasty, Total hip replacement

INTRODUCTION

The profile of the patients having their hips replaced is changing, from older patients with minimal needs to the young adults who wish to have the maximum from their hip. Despite successful outcomes, total hip arthroplasty revision rates have steadily increased in recent years. In an immortal cohort, all hip replacements will eventually fail because of infection, fracture, or a combination of normal tribological and biological processes (aseptic loosening 69%, infection 17%, and recurrent dislocation 12%).[1] The prevalence of postoperative periprosthetic fractures after primary Total Hip Arthroplasty is around 1% after 5 years. The swedish national hip arthroplasty register reported an annual incidence of between 0.045% and 0.13%. Postoperative fractures have been estimated to occur in approximately 4% of revision Total Hip Arthroplasties.[2-5] Risk factors for periprosthetic fracture following Hip Arthroplasty include the use of cementless implants, advanced age, osteoporotic bone, female gender, and index diagnosis at the time of surgery.[6] The Vancouver classification introduced by Duncan and Masri is the most widely used classification system for post-operative periprosthetic femoral fractures. The classification takes into consideration the anatomical location of the fracture, the fixation status of the stem, and the quality of bone stock surrounding the stem. The fractures that are located around the stem with loose stem and good bone quality are classified as Vancouver type B2 (VTB2). According to the Vancouver algorithm, VTB2 fractures, Revision arthroplasty with a long stem that bypasses the fracture

remains the recommended procedure.[7,8] Coxa femoral bypass is a tension band wiring technique used to secure the greater trochanteric fragments in an unstable intertrochanteric fracture.[9] This technique can be utilized in vancouver type B2 fractures for fixation of greater trochanter fragment to facilitate faster and better recovery of abductor mechanism. The purpose of the present study is to evaluate the surgical and functional outcome, along with the associated complication rates in patients undergoing revision arthroplasty with coxa femoral bypass for Vancouver type B2 post-operative periprosthetic femoral fracture.

METHODS

The study was conducted on 14 patients who were clinically and radiologically diagnosed with Vancouver type B2 post-operative periprosthetic femoral fracture. It was conducted Between October 2019 to March 2021. Patients were evaluated at pre-operative period, 6 weeks, 3 month and 6 months post-operative follow-up periods with serial radiography, Visual Analog Score (VAS), Harris Hip Score (HHS) for pain and disability scoring, 6-months post-operative period Visual Analog Score (VAS), Harris Hip Score (HHS) were used to assess the functional outcomes of revision arthroplasty. Grading of harris hip score at 6 month post-operative period is as follows.

Table 1: Grading of harris hip score at 6 month post-operative follow up period.

Harris hip score (HHS)	Grade
90-100	Excellent
80-90	Good
70-80	Fair
<70	Poor

Inclusion criteria

Vancouver type B2 Periprosthetic femoral fracture following total hip arthroplasty and hemiarthroplasty. Age>18 years.

Exclusion criteria

Vancouver Type A, B1, B3, C periprosthetic femoral fracture following total hip arthroplasty and hemiarthroplasty. Periprosthetic acetabular fracture. Patients having co-morbidities are categorized as grade 4 or grade 5 patients as per ASA grading. Any primary or secondary malignancy leading to revision surgery.

Surgical technique

General anesthesia: Hypotensive spinal-epidural anesthesia.

Patient positioning: Lateral decubitus position.

Surgical approach: Posterior-lateral approach.

The femoral head was dislocated, and the stem, with all remaining cement, was completely removed. Extended trochanteric osteotomy was performed in cases which had difficulty in extraction of cement and stem. The fracture was exposed, as far as possible anatomically reduced, and fixed using cerclage wires. The femur was then reamed to allow the insertion of a diaphysial fitting, cementless, tapered, fluted long femoral stem, the fracture was bypassed by at least two cortical diameters with a long stem (>4 cm). Fragments of greater trochanter were framed with coxa femoral bypass. It is a tension band wiring of the greater trochanter with stainless steel wire passed around the femoral stem at the level of lesser trochanter connecting the greater trochanter in a figure of 8 patterns (Figure 1 and 3).

Post-operative protocol

Postoperatively our patients were kept partial-weight bearing for 6 weeks. They are then progressed to full weight-bearing by 3 months postoperatively.

RESULTS

We had 14 patients (9 males, 5 females), with a mean age of 66.2±6.61 years at the time of revision surgery with a maximum number of cases 7 (50%) were between 61-70 years. 6 (42%) patients were operated on the right hip whereas 8 (58%) were operated on the left hip. 10 (72.0%) cases were revision Total hip arthroplasty and 4 (28.0%) cases were the conversion of hemiarthroplasty to total hip replacement. 5 (35%) cases had Cemented primary femoral stem and 9 (65%) cases has an uncemented primary femoral stem.The postoperative VAS score has decreased to 2.23±0.92 from a pre-operative score of 8.30±0.9, p<0.001. The average HHS has improved from 44.05±7.71 pre-operatively to 83.63±7.75 post-operatively at 6 months, p<0.001.

Table 2: Functional outcome of revision arthroplasty of vancouver type B2 post-operative periprosthetic femoral fracture.

Variables	Pre-OP scores	Post-OP scores	P value and significance
	Mean±SD	Mean±SD	
VAS	8.30±0.9	2.23±0.92	P=0.001, VHS
HHS	44.05±7.71	83.63±7.75	P=0.001, VHS

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant, VAS=Visual Analog scale, HHS= Harris Hip Score, OHS= Oxford Hip Score.

At 6 months follow-up, we had 57% excellent results and 27% good results, 7% fair results, and 7% poor results based on HHS (Table 1).

Table 3: Classification of assessment of Harris Hip scores at 6 months post-operative period.

Classification based on HHS	Number (%)
Excellent (90-100)	8 (57.0)
Good (80-90)	4 (27.0)
Fair (70-80)	1 (7.0)
Poor (<70)	1 (7.0)
Total	14 (100.0)

Overall, 4 complications were observed in this study, 2 cases had superficial skin Infection, 1 case of intra-operative fracture, and 1 case of deep venous thrombosis.

Figure 1: (A and B) Pre operative radiograph of Vancouver Type B2 postoperative periprosthetic femoral fracture following Total Hip Replacement. (C and D) Post operative radiography following Revision Arthroplasty with diaphysial fitting long stem and coxa femoral bypass.

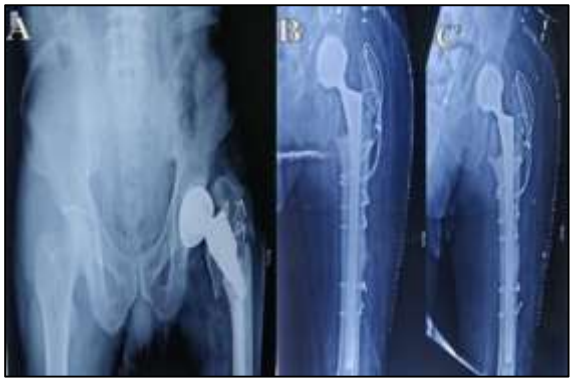

Figure 2: (A) Pre operative radiograph of Vancouver Type B2 postoperative periprosthetic femoral fracture with cantilever breakage of femoral stem. (B and C) Post operative radiography following Revision Arthroplasty with diaphysial fitting long stem and coxa femoral bypass.

DISCUSSION

Around 4% of all patients who undergo primary Total Hip Arthroplasty will encounter a post-operative periprosthetic fracture at least once in their life.[10,11] According to the Swedish national hip arthroplasty registry (1979–2000), Vancouver type B fractures account for 86% of all post-operative periprosthetic femur fractures. A majority (70%) of type B fractures occur around a loose stem (type B2) following primary total hip arthroplasty.[12] Periprosthetic femoral-shaft fractures are associated with a higher mortality rate, similar to patients with hip fractures. Good functional outcomes can be obtained with early mobilization and stability of the construct.[13]

The Swedish National Hip Registry in 2005 has one of the largest series of periprosthetic femoral fractures, reported on 555 Vancouver type B2 fractures, of which 91% were treated with revision arthroplasty with or without additional fixation. 16.8% of patients with a revised prosthesis required further surgical intervention, 38.5% (20 of 52) of the patients treated with open reduction and internal fixation alone required further surgery.[14] Similar to hip fractures, the 1-year mortality following periprosthetic fracture may be substantially higher when treated with osteosynthesis compared with revision arthroplasty (30-32% vs 10–12%).[15-19] Immediate full weight-bearing and improved mobilization of patients undergoing revision arthroplasty may be the reason for reduced 1-year mortality in patients undergoing revision arthroplasty. In the present study, all the patients were treated with diaphysial fitting, cementless, tapered, fluted long femoral stem, and coxa femoral bypass to secure the greater trochanter fragment irrespective of the primary femoral stem. Only in 1 patient coxa femoral bypass was not done because the greater trochanteric fragment was stable with no displacement.

Comparison of Vancouver type B2 fractures with ORIF and stem revision has been analyzed statistically by multiple studies. Solomon et al. found no statistically significant differences in either the Harris Hip Score (HHS) or mobility.[20] Joestl et al reported no significant but favorable differences concerning ORIF regarding the number of patients who returned to their previous mobility levels.[21] Gitajn et al concluded in favor of revision due to early weight-bearing authorization in this group.[22] This study demonstrates statistically and clinically significant improvement in Visual Analog Score (VAS) and excellent-good function outcome based on Harris Hip Score at 6 months postoperative follow-up. We would like to attribute this improved function outcome to early mobilization with diaphysial fitting stem and better restoration of abductor function with coxa femoral bypass. Ours is the only study in the literature that has combined coxa femoral bypass with revision arthroplasty for Vancouver type B2 postoperative periprosthetic femoral fracture. Most patients of revision arthroplasty are older with multiple comorbidities in addition to poor bone quality.[23] Considering above mentioned factors, most studies report high rates of medical and surgery-related complications, reoperation, and mortality in the first year. Joestl et al found that in a study of 36 patients with Vancouver type B2 fractures, of which 8 were treated by

ORIF and the rest by revision, 14% had complications of dislocation and infection, all of whom were in the revision group.[21] Füchtmeier et al published a study of 121 postoperative periprosthetic femoral fractures, treated according to the most widely accepted Vancouver algorithm, reporting a reintervention rate of 17.3% and a mortality rate of 13.2% in the first year.[24] In the present study, we encountered 4 complications. 1 patient has intra-operative femoral fracture after stem fixation, the fracture attributed to the excess anterior bowing of the femur. The fracture was completely exposed and plating was done to stabilize the fracture. The patient was kept non-weight-bearing for 6 weeks and gradually mobilized after 6 weeks. 2 patients had superficial skin infection which was managed with antibiotics based on culture and sensitivity. 1 patient had deep venous thrombosis which was managed medically. No post-operative dislocations or reinterventions were needed in the post-operative period.

The major limitations of this study were the lack of a comparison group and a small sample size. Without a control group, it is difficult to make valid inferences about the association of high outcomes scores and the current method of management. This study demonstrates the use of long-stem revision arthroplasty and coxa femoral bypass in treating Vancouver B2 fractures. To conclude that this management solution is the optimal method for the management of such fractures, a prospective, randomized controlled trial involving multiple medical centers could be beneficial.

CONCLUSION

The revision arthroplasty of Vancouver type B2 post-operative periprosthetic femoral fracture with revision arthroplasty and coxa femoral bypass has excellent-good surgical as well as functional outcomes in terms of regaining abductor function by an increase in range of motion at the affected hip joint, significant pain relief leading to improved quality of life after surgery at short term follow up period.

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