Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2023.188883.2743 Volume 29, Issue 4, Jully 2023
Manuscript ID ZUMJ-2302-2743 (R1)
DOI 10.21608/zumj.2023.188883.2743

ORIGINAL ARTICLE.

Management of Vancouver C Periprosthetic Femoral Fracture after Hip Arthroplasty

Ehab Mohamed Shehata, Elsayed El-Etewy Soudy, Mohamed Abdelfatah Sebaei, Mohamed Ahmed Doma*
Orthopedic Surgery Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

Corresponding author:
Mohamed Ahmed Doma
Orthopedic Surgery Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt

E-mail address:
mohameddoma295@gmail.com

ABSTRACT

Background: Treatment of periprosthetic femoral fractures (PPFF) is difficult. Careful pre-operative planning and meticulous intra-operative technique during hip arthroplasty is the most important aspect in the preventio n of periprosthetic fractures.

Objective: The aim of the present study was to evaluate the results of surgical treatment of Vancouver C periprosthetic femoral fractures.

Methods: The study included 18 patients presented to orthopedic department at Zagazig University Hospitals. ORIF with plate osteosynthesis was used in patients with type C PPF fractures. Time of follow up from six months to one year.

Results: Seven patients responded good satisfaction (38.9%), five responded fair satisfaction (27.8%), three patients had excellent feedback (16.7%), and three patients had poor experience (16.7%). The final results were affected by the time lapse before the occurrence of fracture and the time lapse before union and wasn't affected by the age, sex or the timing of occurrence of the fracture. Functional outcome after healing of the fracture was less than the pre-injury stage.

Conclusion: ORIF with plate osteosynthesis was satisfactory methods for treatment of Vancouver C Periprosthetic Femoral Fractures.

Keywords: Periprosthetic Femoral Fracture; Hip Arthroplasty; Outcomes.

INTRODUCTION

The frequency of periprosthetic femoral fracture is rising correspondingly to the rise in individuals undergoing primary and revision total hip arthroplasty (THA). In roughly 1% of cemented primary hip procedures and 3% to 18% of uncemented primary hip operations, intraoperative fractures are primarily the result of technical errors. After primary arthroplasty, the estimated incidence of postoperative periprosthetic fractures ranges from 1% to 4% [1]. Periprosthetic femoral fractures classification is necessary to facilitate communication between researchers and physicians, guide therapy, and provide insight into results. Vancouver classification is becoming the standard system in periprosthetic femoral fractures. It is based on fracture configuration, quality of bone, quality of fixation of stem and site of the fracture either trochanteric, around stem, at tip of stem or below stem tip [2].

These fractures might be difficult to treat. A revision procedure comprising the insertion of a longer stem to provide intramedullary stabilization, with or without extramedullary allograft strut supplementation, is advised if the femoral component becomes loose [3].

There are several different treatment methods available if the stem is firmly attached. Closed treatment, such as traction or the use of a Spica cast or cast brace, is frequently accompanied by side effects include prosthetic loosening, mal union, nonunion, skin ulceration, loss of knee motion, and health issues from prolonged immobilization. Only un-displaced trochanteric fractures or situations when the patient's health prevents surgery are appropriate for it. The preferred course of treatment in all other circumstances is open

reduction and internal fixation. Cerclage wires, dynamic compression plates, Mennen plates, Ogden plates, Partridge nylon plates and straps, and the Dall-Miles cable and plate system are only a few examples of the extramedullary fixation techniques that have been reported for periprosthetic fractures [4].

There are many ways to prevent and avoid periprosthetic fracture by preoperative good assessment of the patient at risk, careful intra-operative technique with early interfering with any intra-operative problem and strict [5].

Therefore, this study aimed to evaluate the result of surgical treatment of Vancouver C periprosthetic femoral fractures after total hip arthroplasty by ORIF.

METHODS

The study included 18 patients presented to orthopedic department at Zagazig University Hospitals between September 2021 and Mars 2022. All patients were subjected to complete clinical and radiological examination pre-operatively and at the end of follow up. All patients had a PPFF VANCOUVR C after THA. Time of follow up from six months to one year.

Eighteen cases were included in this study. The age ranged from 27 to 70 years old with a mean age 48.9 and standard deviation ±12.26. Out of the total population, 10 were females (55.6%) and 8 were males (44.4%). Half of patients were manual workers (50%) and other half were not workers (50%). Ten patients (55.6%) were due to simple fall and eight patients (44.4%) were sustained during road traffic accident. Ten patients had cementless THA (55.6%) and eight patients had cemented THA (44.4%). Ten patients had normal bone stock and stability (55.6%), while eight patients had osteoporotic bone stock (44.4%) (Table 1).

The ethical committee at Zagazig University approved the study. All of the subjects' written informed permission was acquired. The Declaration of Helsinki, the World Medical Association's code of ethics for studies involving humans, guided the conduct of this work.

Surgical Approach:

Direct incision on the scar of the previous wound with extension on the lateral aspect of the thigh to allow reduction and fixation of the fracture in all cases. We used different types of plates; ORIF with cable plate in 9 cases, ORIF with LCP in 4 cases, ORIF with DCP in 2 cases, MIBO technique in 2cases and Retrograde femoral Nail in one case.

X-rays were assessed as regards healing of the fracture, alignment of the bone, and stability of the prosthesis. The results were assessed at the end of the follow-up (The period of follow up ranged from six to one year with an average of 1.5 years) according to Modified Merle d'Aubigné scoring system [6].

Statistical Analysis

Using Microsoft Excel, data are evaluated. The Statistical Package for the Social Sciences (SPSS) version 20.0 software was then used to import the data for analysis. Quantitative data is grouped and represented by mean SD whereas qualitative data is represented as numbers and percentages. quantitative independent multiple by ANOVA differences. P value was chosen at 0.001 for very significant results and 0.05 for outcomes that were significant.

RESULTS

The present study showed Seven patients (38.9%) had good results, five (27.8%) had fair results, three (16.7%) had poor results and three had excellent results (16.7). The mean score was 13.83± 286. Ten patients (55.6%) had satisfactory results and eight patients (44.4%) had unsatisfactory results (Table 2).

Seven patients experienced slight or intermittent pain (38.9%), five patients had no pain (27.8%), three patients had moderately, severe but patients were able to walk (16.7%), two patients had pain after walking but resolve (11.1%), and one patient had severe pain that prevents walking (5.6%). The mean score was 4.67 ± 1.24 (Table 3).

Six patients had no can but slight limp (33.3%), five patients had long distance with cane or crutches (27.8%), five patients had normal walking grade (27.8%), while two patients had limited walking even with support (11.1%). The mean was 4.78 ± 1.00 (Table 4).

Nine patients had walking distance of less than 500 meters (50%), four patients had about 500 meters (22.2%), three patients had wheelchair (16.7%), and while two patients had more than 500 meters waking distance (11.1%) (Figure 1).

Sixteen patients (88.8%) had union and two patients (11.2%) showed delayed union. Regarding relation between trauma and outcomes, our study found that patients with FD were more satisfied that patients with RTA (P value 0.02) (Table 5).

A case of 60 years old worker male patient presented with periprosthetic fracture femur on right bipolar fixed seven years ago. History of left bipolar

fixed three years ago. Patient had postoperative Vancouver type C periprosthetic femoral fracture and operated by cable plate. The patient had CKD; he was cane dependent. The overall score according to Modified Merle d'Aubigné scoring system before the fracture was 10 points and at the end of follow-up was 13 (Figure 2).

Table (1): Demographic and Clinical data of the studied Patients

Demographic & Clinical data	The studied group	
	No = (18)	%
Age (years) *Mean ± SD* *(Range)*	**48.89±12.266** **(27 – 70)**	
Sex		
Female	**10**	**55.6**
Male	**8**	**44.4**
Total	**18**	**100.0**
Occupation:		
Manual worker	**9**	**50.0**
Not a worker	**9**	**50.0**
Total	**18**	**100.0**
Mode of trauma		
FD	**10**	**55.6**
RTA	**8**	**44.4**
Total	**18**	**100.0**
Type of initial prosthesis		
Cemented THA	**8**	**44.4**
Cementless THA	**10**	**55.6**
Total	**18**	**100.0**
PPFF Vancouver type C after THA		
	18	**100.0**
Bone stock and stability		
Normal	**10**	**55.6**
Osteoporotic	**8**	**44.4**
Total	**18**	**100.0**

Table (2): Distribution of the studied cases according to outcome (n = 18)

			Frequency	%
	Unsatisfactory	Poor	3	16.7
		Fair	5	27.8
	Satisfactory	Good	7	38.9
		Excellent	3	16.7
	Total		18	100.0

Table (3): Pain grade distribution of the studied patients

		Frequency	Percent
	Severe, prevents walking	1	5.6
	Moderately severe but patient is able to walk	3	16.7
	After walking but resolves	2	11.1
	Slight or intermittent	7	38.9
	None	5	27.8
	Total	18	100.0
	Mean ± SD	4.67 ± 1.24	
	Min – Max	2 - 6	
	Median	5	

Table (4): Walking grade distribution of the studied patients

		Frequency	Percent
	Limited even with support	2	11.1
	Long distance with cane or crutches	5	27.8
	No cane but slight limp	6	33.3
	Normal	5	27.8
	Total	18	100.0
	Mean ± SD	4.78 ± 1.00	
	Min – Max	3 – 6	
	Median	5	

Table (5): Relationship between mode of trauma and outcome

			Outcome		Total	
			Unsatisfactory	Satisfactory		
Mode of trauma	**FD**	**Count**	**3**	7	**5.9**	**0.02***
		% within Outcome	**30.0%**	87.5%		
	RTA	**Count**	**7**	1		
		% within Outcome	**70.0%**	12.5%		
Total		**Count**	**10**	8		
		% within Outcome	**100.0%**	100.0%		

*p value less than 0.05 was statistically significant.

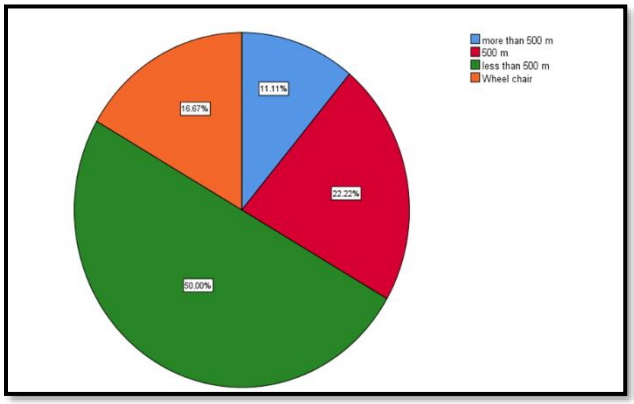

Figure (1): Walking distance distribution among studied patients

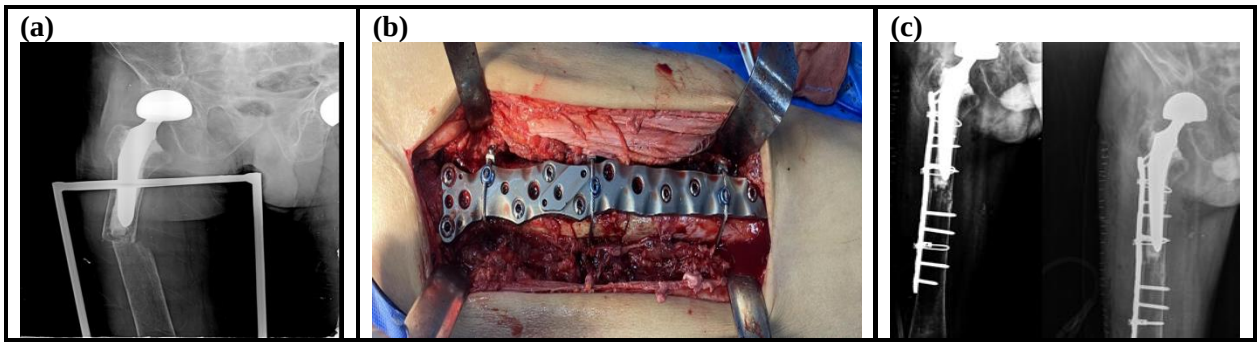

Figure (2): A case of 60 years old worker male patient presented with periprosthetic fracture femur on right bipolar fixed seven years ago showing **(a)** pre-operative x-ray**; (b)** intra-operative picture of cable plate**;** and **(c)** post-operative x-ray.

DISCUSSION

Adult femoral shaft fractures are typically treated surgically with intramedullary fixation, which has recently suppressed plating. Haidar et al [7] found extra medullary fixation is useful in two circumstances for periprosthetic fractures. First off, a revision into a lengthier stem implant is not necessary when the prosthesis is stable. Second, when a lengthy revision procedure is not advised (too elderly, infirm, or low mobility patients).

Pike et al [8] checked intraoperatively if the stem's stability is in doubt. This can be done either by creating a shear stress along the stem's longitudinal axis if the distal end is accessible, or by employing a posterolateral technique to generate an arthrotomy and posterior dislocation of the stem. Arthrotomy, dislocation of the THR, and testing of stem stability do not appear needed, nevertheless, given there was only 1 instance of radiographic misunderstanding of stem stability in our study. In this study, there was no hardware failure at the end of follow up.

Lee [9] reported of 37 patients found that of 13 patients treated by plate fixation, 3 resulted in refractures. One happened through the screw hole left behind after the plate was removed, one happened close to the blade plate that was used to treat the distal fracture, and the other happened through an empty screw hole near the distal stem tip.

In this study a significant difference between the use of pre-injury walking aids and that at the end of follow up where seven patients (58.3%) did not use any aid before the injury while two patients (16.6%) did not use aids at the end of follow up, One patient (8.3%) was cane dependent before the injury while eight patients (68.6%) were cane dependent at the end of follow up.

William et al [10] revealed fifty patients with periprosthetic femoral shaft fractures treated with a large fragment dynamic compression plate, at their last follow-up visit, eleven patients (22%) had

either a decline in their ambulatory status or the requirement for further assistive equipment, compared to thirty patients (60%) who had restored to their baseline ambulatory status. At the time of the follow-up, five patients who had been able to stroll around the neighborhood at baseline could only do so within their homes. Two patients who could have walked around the home at baseline were unable to do so any longer. At their most recent follow-up appointment, four patients who hadn't needed a cane at baseline needed one. Five patients who initially used a walker eventually needed a wheelchair, either frequently (three patients) or intermittently (two).

Such a decline in the functional outcome is probably because of variable degrees of pain and weakness of the thigh muscle due to repeated incisions of the muscle. In this study, the mean time before the occurrence of the fracture was 4.26±2.075 years there was statistically significant relation between the time before the occurrence of fracture and the final score. The shorter the time, the better was the result. Sanjeev et al [11] in their series found the time between the hip replacement and the fracture was quite a distance. In the series, there was no clear-cut "high-risk period" following hip arthroplasty.

In this study, the rate of reoperation due to deep infection was 0 of 18 at the end of follow up only one case had superficial infection and the infection subsided after 3 weeks from the operation under antibiotic coverage. In other studies, Lindahl et al [12] and Mukundan et al [13] found infection rates in type C fractures have varied from 2 of 94 and 1 of 12, respectively.

An irregular blood supply brought on by past surgery, tissue injury, and a lengthy skin incision may have contributed to the comparatively high percentage of reoperations needed to treat deep infections.

Sanjeev et al [11] studied 16 patients with periprosthetic femoral shaft fractures found that there were four patients (25%) having major complications. One patient's fracture had healed, but they still experienced hip pain, and the hip prosthesis was eventually removed (Girdlestone procedure). A separate abdominal emergency claimed the life of another patient who had a lingering post-operative infection. A severe infection that necessitated debridement and the removal of all metalwork, including the hip prosthesis and a portion of the infected bone, was the third consequence. A cortical window produced during an attempt to revise a hydroxyapatite-coated femoral stem for discomfort in one patient resulted in a fracture [14].

In this study, at the end of the follow up period there was only two cases (11%) that delayed union. The difference in the rate of complications in this study and other studies may be due to different number of cases, short follow up period and different the methods of treatment. Sanjeev et al [11] found despite good fracture healing, the Harris hip score significantly decreased after the fracture stabilization. The level of mobility was the main factor that varied between most individuals.

Union is considered complete when the patient can bear weight at the fracture site without experiencing any pain, and there is a callus that spans at least one fracture cortical on the lateral and anterior radiographs [15]. Lee [9] found that, the average time of union was 3.1 months (range, 2–6.2 months).

In this study, sixteen patients (88.8%) had union and two patients (11, 2%) showed delayed union. Mabrey [16] reported that the main risk factors for both intra-operative and post-operative fractures were osteoporosis or osteopenia, cortical defects, revision arthroplasty, aseptic loosening, osteolysis, mismatched components and unusual anatomy.

Bethea [17] noted that 75% of patients with post-operative periprosthetic fractures, the implants were already loose. Beal's and Towers [18] used traction in 21 of 29 patients resulted in all fractures mending, however 6 patients had substantial malunion that necessitated surgery to address.

There are various methodological advantages to the current investigation. First, only Vancouver C fractures treated with locking-plate osteosynthesis and occurred during low-energy falls were considered. Second, the Vancouver classification scheme we employed is valid, repeatable, and dependable [19]. Thirdly, as advised, patients were operated on by trauma-focused surgeons [12,20]. The median age at PFF surgery was 78 years, which is consistent to the age reported in other studies on PFF in primary and revision THR. The male to female ratio was 1:3, and there were 1:3. Therefore, we have no grounds to suspect that there was age or sex discrimination [21,22]. Lastly, Lindahl et al [12] described both cement- and cementless-fixed stems were used because PFF results showed no difference between them.

In this study the goal was the initial evaluation within a period of six months so that we

have an early expectation of the final evaluation and also the patients in the study are still within follow up.

CONCLUSION

ORIF with plate osteosynthesis was satisfactory methods for treatment of Vancouver C Periprosthetic Femoral Fractures. Functional outcome after healing of the fracture is less than the pre-injury stage. Healing of the periprosthetic fracture occurred in most of the cases.

REFERENCES

1 **Miyamoto S, Iida S, Suzuki C, Kawarai Y, Nakamura J, Orita S.** The influence of calcar collar and surface finish in the cemented femoral component on the incidence of postoperative periprosthetic femoral fracture at a minimum of five years after primary total hip arthroplasty. Injury, 2022; 53(6), 2247-2258.

2 **Brady OH, Garbuz DS, Masri BA, Duncan CP.** The reliability and validity of the Vancouver classification of femoral fractures after hip replacement. J Arthroplasty. 2000;15(1):59-62.

3 **Masri BA, Meek RM, Duncan CP.** Periprosthetic fractures evaluation and treatment. Clin Orthop Relat Res. 2004; (420):80-95.

4 **Pleva L, Sir M, Madeja R.** Our experiences with the treatment of periprosthetic fractures of femur. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2004;148 (1):75-79.

5 **White LM, Kim JK, Mehta M, Merchant N, Schweitzer ME, Morrison WB, et al.** Complications of total hip arthroplasty: MR imaging-initial experience. Radiology. 2000 Apr;215(1):254-62.

6 **Cameron HU.** Intraoperative hip fractures: ruining your day. J Arthroplasty. 2004;19(4 Suppl 1):99-103.

7 **Haider T, Hanna P, Mohamadi A, Merchan N, McNichol M, Wixted JJ et al.** Revision Arthroplasty Versus Open Reduction and Internal Fixation of Vancouver Type-B2 and B3 Periprosthetic Femoral Fractures. JBJS Rev. 2021; 20;9(8).

8 **Pike J, Davidson D, Garbuz D, Duncan CP, O'Brien PJ, Masri BA.** Principles of treatment for periprosthetic femoral shaft fractures around well-fixed total hip arthroplasty. J Am Acad Orthop Surg. 2009;17(11):677-688.

9 **Lee M.** Periprosthetic femoral fractures after hip arthroplasty. J Korean Hip Society. 2011; 23(3), 174-183.

10 **William J, Maloney R, Smith L.** Periprosthetic Osteolysis in Total Hip Arthroplasty: the Role of Particulate Wear Debris; J Bone Joint Surg [Am.].1995; 77:1448-1461.

11 **Sanjeev P, Bassam A, Clive P.** Periprosthetic fractures of the hip. Curr Orthop.2006; 20, 179-191.

12 **Lindahl H.** Epidemiology of periprosthetic femur fracture around a total hip arthroplasty. Injury. 2007;38(6):651-654.

13 **Mukundan C, Rayan F, Kheir E, Macdonald D.** Management of late periprosthetic femur fractures: a retrospective cohort of 72 patients. Int Orthop. 2010;34(4):485-489.

14 **Whittaker E, McMillan T., Stevenson M.** Management of surgical complications in fracture fixation of the hip. Orthop and Trauma, 2020; 34(2), 73-79.

15 **Hoffmann F, Jones B, Sietsema L, Koenig J, Tornetta P.** Outcome of periprosthetic distal femoral fractures following knee arthroplasty. Injury, 2012; 43(7), 1084-1089.

16 **Mabry TM, Hanssen AD.** The role of stems and augments for bone loss in revision knee arthroplasty. J Arthroplasty. 2007;22(4 Suppl 1):56-60.

17 **Bethea JS 3rd, DeAndrade JR, Fleming LL, Lindenbaum SD, Welch RB.** Proximal femoral fractures following total hip arthroplasty. Clin Orthop Relat Res. 1982;(170):95-106.

18 **Beals RK, Tower SS.** Periprosthetic fractures of the femur. An analysis of 93 fractures. Clin Orthop Relat Res. 1996;(327):238-246.

19 **Froberg L, Troelsen A, Brix M.** Periprosthetic Vancouver type B1 and C fractures treated by locking-plate osteosynthesis: fracture union and reoperations in 60 consecutive fractures. Acta Orthop. 2012;83(6):648-652.

20 **Gausden EB, Tibbo ME, Perry KI, Berry DJ, Yuan BJ, Abdel MP.** Outcomes of Vancouver C Periprosthetic Femur Fractures. J Arthroplasty. 2021;36(10):3601-3607.

21 **Pedersen AB, Mehnert F, Havelin LI, Furnes O, Herberts P, K√§rrholm J, et al.** Association between fixation technique and revision risk in total hip arthroplasty patients younger than 55 years of age. Results from the Nordic Arthroplasty Register Association. Osteoarthritis Cartilage. 2014 May;22(5):659-67.

22 **Pavone V, de Cristo C, Di Stefano A, Costarella L, Testa G, Sessa G.** Periprosthetic femoral fractures after total hip arthroplasty: An algorithm of treatment. Injury. 2019;50 Suppl 2:S45-S51.

To Cite:
Shehata, E., Soudy, E., Sebaei, M., Doma, M. Management of Vancouver C Periprosthetic Femoral Fracture after Hip Arthroplasty. *Zagazig University Medical Journal*, 2023; (1064-1070): -. doi: 10.21608/zumj.2023.188883.2743