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The Incidence and Further Outcome of Periprosthetic Supracondylar Femoral Fractures Post Total Knee Arthroplasty in India

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Abstract: ***Background: Periprosthetic supracondylar femoral fractures following total knee arthroplasty (TKA) are infrequent, but is a nightmarish complication. The purpose of this study was to evaluate the incidence and outcomes of periprosthetic supracondylar femoral fractures following TKA using nonoperative as well as open reduction and internal fixation (ORIF) techniques. Materials and Methods: Between August 2014 and August 2019, we followed 3920 operated patients of total knee arthroplasty (TKA) conducted at Patan Janta Hospital & Research Foundation and identified a total of 23 patients with periprosthetic supracondylar fractures. A retrospective analysis of the records of these patients was conducted. Details regarding pre fracture status, treatment offered and the present status were recorded and analyzed. Time from index arthroplasty to periprosthetic fracture ranged from five days to six years. There were 17 men and 6 women and the average age was 68.26 years (range 52-83 years). Of the 23 patients, 20 patients were managed with operative methods, whereas only three patients with relatively undisplaced fractures were treated nonoperatively. Results: The total incidence of periprosthetic fractures in operated cases of TKA was 0.58%. Three patients had infection after surgery. As per radiological assessment, two of three conservatively treated cases had malunion, whereas among 20 cases treated operatively, 16 had primary union with one malunion. Two patients had union after bone grafting, whereas two had nonunion. The average reduction in the knee score after fracture was 20.53%. Twenty one patients were able to achieve limited but independent activity. Conclusions: Desirable results for periprosthetic fractures can be obtained if proper and timely intervention is done. However, short duration of followup and small number of patients were the major limiting factors of this study***

Keywords: Distal femoral locking plate, periprosthetic fracture, supracondylar femur fracture, total knee arthroplasty

1. Introduction

Periprosthetic supracondylar femur fractures following total knee arthroplasty (TKA) are infrequent, but have devastating complications. Although the prevalence is low at present, ranging from 0.3 to 2.5%,it is bound to increase as the number of TKAs performed increases.[1,2]

Many of these periprosthetic fractures occur as a result of low-energy trauma. Risk factors associated with the development of periprosthetic fractures include osteopenia, osteoporosis and certain disease processes such as rheumatoid arthritis, seizure disorders and myasthenia gravis.[1,3-7] The use of corticosteroids, old age and female sex have been implicated.[1,7,8] Processes related to the implant and surgical technique such as anterior femoral notching, malalignment, loosening of the implant and osteolysis also play an additional role in the development of periprosthetic fractures.[3,4,7,9] Treatment options range from nonoperative methods including casting, traction and bracing to surgical treatment with open reduction and internal fixation (ORIF), intramedullary fixation and even revision arthroplasty(though rare). Rates of nonunion for supracondylar fractures proximal to total knee prostheses are higher than for supracondylar fractures without the knee implant.[1,3,4,10] Stems, rods, screws and cement may block the medullary canal, preventing intramedullary fixation of fractures.[1,3,4,10] Stems and rods also block screw fixation through the medullary canal to hold plates on the bone. It has been shown that patients sustaining a periprosthetic distal femur fracture have increased morbidity and mortality rates compared to distal femoral fractures without a prosthesis.[1,3,4,10] If all treatment types are pooled together, the rate of nonunion is 9%, loss of fixation 4%, rate of infection is 3% and the rate of revision surgery is 13%.[11] The purpose of this study was to assess the outcome after periprosthetic supracondylar femur fractures following TKA.

2. Materials and Methods

Materials And Methods Between August 2014 and August 2019, we followed 3,920 operated patients of TKA and identified 23 patients operated for TKA with a periprosthetic supracondylar fracture [Table 1]. A retrospective analysis of their records was conducted. Details regarding the prefracture status and treatment offered were obtained from the Medical Record Department of the hospital. All the patients were clinically examined for their present status. Detailed history regarding the fracture was obtained. Pre and post fracture knee score were revised. Predisposing factors such as female gender, osteopenia, inflammatory arthritis, increasing age, use of corticosteroids, presence of notching, manipulation for TKA, major trauma and bone osteolysis were assessed. Prefracture status was difficult to assess exactly as all the patients reported to us post fracture. However, from the history it was clear that they had good range of motion (more than 90°) and had no stiffness. The inclusion criterion was any patient operated for primary TKA surgery having periprosthetic supracondylar femur

fracture and the exclusion criteria were any patients with periprosthetic tibial or patellar fractures, patients with revision TKA and having periprosthetic supracondylar femur fracture. The functional outcome of patients was assessed by using the Knee Society Score(KSS). The time from index arthroplasty ranged from five days to six years. We classified the patients having supracondylar fractures according to the Rorabeck's scheme of classification. Rorabeck et al. divided periprosthetic supracondylar femur fractures into three types. Type I involves a nondisplaced fracture in association with a stable prosthesis, type II is a stable prosthesis with a displaced fracture and type III involves any fracture in the presence of a loose prosthesis.[2,12-14]

Age (years)	Sex	Mode of injury	Interval between TKA and periprosthetic fracture (months)	Predisposing factors	Classification (Rorabeck classification)
83	F	Low energy	1	Gr 2 Notching, Pd, Osteoporosis	R2
70	M	High energy (RTA)	71	Gr 1 Notching, Osteoporosis	R2
66	M	High energy (RTA)	22	Gr 2 Notching	R2
74	F	High energy (RTA)	12	Gr 1 Notching	R2
63	M	High energy (RTA)	46		R2
64	M	Low energy	0.5		R2
70	F	High energy (RTA)	12	Gr 1 Notching,	R2
78	M	Low energy	0.1	Gr 1 Notching, Osteoporosis	R2
68	M	High energy (RTA)	24	Pd	R2
83	M	Low energy	0.5	Gr 1 Notching,	R2
				Osteoporosis	
70	M	High energy (RTA)	27	Ra	R2
64	M	Low energy	4	Gr 2 Notching	R2
67	M	High energy (RTA)	20	Gr 1 Notching	R2
69	M	Low energy	4	Cemented Bipolar	R2
65	M	Low energy	9	Gr 1 Notching, Ra	R2
72	F	High energy (RTA)	13	Gr 1 Notching, Pd	R2
52	F	High energy (RTA)	17		R2
80	M	Low energy	6	Osteoporosis, Ra	R2
62	M	High energy (RTA)	5	Gr 1 Notching	R2
64	F	Low energy	0.5	Gr 2 Notching	R2
60	M	Low energy	2	Gr 1 Notching	R1
68	M	Low energy	2	Osteoporosis	R1
68	M	High energy (RTA)	32		R1

RTA=Road traffic accidents, Pd=Parkinson's disease, Ra=Rheumatoid arthritis, Gr = Grade

Twenty of the 23 patients were treated by plating; we used a distal femoral locking plate (DFLP), condylar buttress plate (CBP), or a low contact dynamic compression plate (LCDCP) depending on the fracture. All patients were followed up first at the time of suture removal and then every six weeks for three visits and then six monthly for functional and radiological assessment. Depending upon the postoperative fracture reduction quality and the stability of the fixation, physiotherapy was started in the immediate postoperative period. Initially, guarded knee mobilization (with hinged AK brace) was started and gradually independent knee mobilization was introduced. Subsequently, range of motion and strengthening exercises were introduced and once the signs of clinical and radiological union appeared (decreased pain, increased confidence of the patient, increased range of motion and slow disappearance of the fracture line on X-rays), gradual weight bearing was started. Three of the 23 cases were treated with traction and slab initially, followed by an above-knee cast .One patient was given an immediate cast due to minimal displacement and swelling. All the patients were evaluated at the end of one week for condition of the plaster as well as for radiological alignment. The cast was continued for an average period of 10-12 weeks. Patients were followed up initially at the end of the first week and then every month for condition of the plaster. Clinical and radiological evaluation was done. Once the signs of satisfactory radiological union appeared, the cast was removed and physiotherapy started in form of static quadriceps exercises, stretching exercises, knee mobilization and range of motion exercises. Partial weight bearing was allowed for a period of 4-6 weeks and then full weight bearing was started.

3. Results

The total incidence of the periprosthetic fracture in the operated cases of TKA in our study was 0.58% (23 cases out of 3,920 consecutive primary TKAs). The mean postoperative followup was 26 months(range 5-48 months). There were 6 females and 17 males. The average age in the series was 68.3 years (range 52-83 years). Average age was 68.52 years in males (range 52-83 years) and 67.5 years in females (range 59-78 years). The interval between TKA and periprosthetic fracture averaged 14.38 months (range 0.1-71 months). Of the 23 cases, 11 cases of periprosthetic fractures occurred due to low-velocity trauma; the remaining 12 cases were due to high-velocity motor vehicular accidents (MVAs). Osteoporosis was associated with six cases and these fractures were a consequence of a low-velocity injury. Anterior femoral notching was associated with a total of 14 patients. Ten cases had grade I notching, whereas four cases had grade II notching. One case had an ipsilateral hip implant. Twenty patients had (n = 20) had class II fracture (displaced fracture with intact bone-prosthesis interface); three patients (with low-velocity trauma) had class I fracture (undisplaced fracture). All the 20 cases of displaced fracture were treated operatively with internal fixation. We used

distal femoral locking plate (DFLP) in 16 cases, condylar buttress plate (CBP) in three cases and an low contact dynamic compression plate (LCDCP) in one case. The average duration of hospitalization was 11.08 days; 7.67 days for conservatively managed patients and 11.8 days for operatively managed patients .Three patients had postsurgical infection. No organisms could be isolated from the culture of the discharge. They were treated with surgical debridement and broad-spectrum antibiotics for six weeks. Serial blood counts, erythrocyte sedimentation rate (ESR) and C-reactive protein titers were done and the patients were considered to be free of infection after the titers remained normal for six weeks after stopping the antibiotics. We could achieve union in the form of malunion in one patient, whereas the other two ultimately progressed to radiological nonunion and refused to have any further surgical intervention. The average duration for clinical union as assessed by the ability of the patient to bear full weight without any walking aid was five months, whereas the average duration of radiological union was seven months. Of the three patients who had malunion, two were from the conservatively managed group. The average Knee Society Score on final followup was 80 in the conservatively managed patients and 87.0 in the operated patients. Seventeen of the 23 patients were ambulatory at the latest followup before publication, whereas two were non ambulatory (functional category 4). Thirteen of the 17 patients required assistive devices for ambulation. Most patients were able to achieve limited but independent activity. Residual alignment at last followup for operated cases was 3.77° of valgus and that for conservatively treated cases was 8.67° of valgus .

4. Conclusion

The ultimate goal of management in periprosthetic fractures is to restore anatomical alignment and achieve stable fixation and an as early mobilization as possible. If the prosthesis or implant is loose, or bone quality is poor, then the implant should be revised. If the prosthesis or implant is stable and bone quality is adequate for fixation, then the implant should be retained while the fracture is fixed following standard principles.[15-21]

To conclude, we found that the total incidence of periprosthetic fractures in operated TKA was 0.58% (23 of 3,920); 87% patients (20 of 23) fell in the R2 category of Rorabeck's classification. Desirable results for periprosthetic fracture can be obtained if proper and timely intervention is done, taking into consideration other comorbid conditions.

5. Conflict of Interest

None

6. Funding

None

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