

Original Research Article

To study surgical outcome of various surgical procedures of lateral release in valgus knee in total knee arthroplasty

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ABSTRACT

Background: Fixed valgus deformity presents a major challenge in total knee arthroplasty (TKA), especially in moderate or severe cases. In knee arthritis, fixed-varus deformity (50 to 55%) is three times more frequent than fixed-valgus deformity (10 to 15%). Valgus deformity occurs more commonly in rheumatoid arthritis and also in osteoarthritis with hypoplasia of the lateral femoral condyle. Valgus deformity is often associated with flexion or external rotation contracture of the knee. In this study we aim to study the surgical outcome of total knee replacement in valgus deformity via standard medial parapatellar approach using various techniques like Pie –Crusting release of lateral structures or combined technique of pie crusting and standard release of lateral structures. Aim: To evaluate surgical outcome of various surgical techniques via standard medial parapatellar approach in fixed valgus deformity in Total Knee Arthroplasty.

Methods: The present study involved both male and female patients with osteoarthritis of knee with valgus deformity. In present series, 26 consecutive patients of osteoarthritis with valgus deformity operated with total knee replacement were included. Previously operated cases of high tibial osteotomy and patients having contraindication for TKA were excluded from the study.

Results: Valgus angle in this study was between 13 to 27 degree with average 17.84 degree. These results were comparable to many such similar studies. In our study, post operatively, knee society score was average 87.69 and function knee score was 82.5. Mean range of motion was 105 degree. In our study, mean tibiofemoral alignment improved from 17.84 valgus to 4.7 valgus.

Conclusions: Knee society score is excellent with both techniques and there is no difference in both techniques Iliotibial band and posterolateral capsule are most common structures that require release. Initial ligament balancing should be done with pie crusting and then sequential lateral release if require.

Keywords: Total knee arthroplasty, Knee society score, Krakow classification

INTRODUCTION

Fixed valgus deformity presents a major challenge in total knee arthroplasty (TKA), especially in moderate or severe cases. In knee arthritis, fixed-varus deformity (50 to 55%) is three times more frequent than fixed-valgus deformity (10 to 15%). Valgus deformity occurs more commonly in rheumatoid arthritis and also in osteoarthritis with hypoplasia of the lateral femoral

condyle. Valgus deformity is often associated with flexion or external rotation contracture of the knee. The deformity is more prevalent in females than males (9:1).

In valgus deformity there is contracture of lateral structures like lateral collateral ligament, iliotibial band, posterolateral capsule and stretching of medial collateral ligament.

The most commonly used classification is the Krackow classification of valgus deformity for total knee arthroplasty:¹

- *Type I:* valgus deformity, with the medial capsular ligament and soft tissue intact, i.e., without excessive attenuation.
- *Type II:* valgus deformity; more severe and an attenuation of the medial capsular ligamentous sleeve.
- *Type III:* valgus deformity in which significant over correction is present after valgus proximal tibial osteotomy or conceivably a tibial plateau fracture resulting in the same configuration. The deformity is by definition significant, and the soft-tissue structures to both the medial and lateral side are usually intact.

A successful outcome of surgery is predicted on restoration of proper static alignment through the femoral and tibial bone preparation, followed by restoration of stability through ligament balancing.² Ligament balancing and changes in bony anatomy of the valgus knee may be more difficult to correct than with varus deformity. The structures most commonly released in a valgus knee include the osteophytes, iliotibial band, the posterolateral aspect of the capsule, the lateral collateral ligament, the popliteus tendon, and the lateral head of the gastrocnemius muscle. In addition, the medial collateral ligament may need to be shortened or advanced. The correction of deformities and establishing ligament balance are priority mechanical objectives in the implantation of total knee prostheses (TKPs) to ensure a good, durable and functional result.³⁻⁶

In this study we aim to study the surgical outcome of total knee replacement in valgus deformity via standard medial parapatellar approach using various techniques like Pie-Crusting release of lateral structures or combined technique of pie crusting and standard release of lateral structures.

Aim

To evaluate surgical outcome of various surgical techniques via standard medial parapatellar approach in fixed valgus deformity in Total Knee Arthroplasty.

METHODS

The present study "Surgical outcome of various surgical procedure of lateral release in valgus deformity in total knee arthroplasty" was undertaken at the department of Orthopedics, Ruby Hall Clinic, Pune from March 2012 to March 2013 after obtaining ethical clearance. The patients operated after March 2012 were studied and followed prospectively. The study involved both male and female patients with osteoarthritis of knee with valgus deformity. In present series 26 consecutive

patients of osteoarthritis with valgus deformity operated with total knee replacement, were included. Previously operated cases of high tibial osteotomy and patients having contraindication for TKA were excluded from the study.

The inclusion criteria are patients having fixed valgus deformity of knee, patient's age >55 years.

The exclusion criteria are previously operated cases of high tibial osteotomy, patients having contraindications of TKA.

Preoperative planning

As a part of pre-operative investigations, x-rays of the knee – AP and Lateral with Single joint weight bearing view, Scanogram of both lower limbs including hip to ankle and routine laboratory investigations, 2D- Echo, PFT were performed. After all routine investigation and medical fitness patient admitted one day prior to surgery.

Surgical technique

Spinal and epidural anesthesia were used for all patients. Painting and draping was done under aseptic condition. Medial parapatellar arthrotomy approach was taken for all patients. The extramedullary tibial guide was placed on the leg using surface landmarks. The distal end of the guide was attached above the ankle, while the proximal end was pinned to the center of the proximal tibia, generally at the medial one third of the tibial tubercle. The anteroposterior distal guide adjustment controlled the posterior slope of the proximal tibial cut. We favored an essentially perpendicular cut relative to the tibial shaft. Intramedullary femoral alignment was used to determine the angle of the distal femoral cut.

Evaluation of the extension gap

Attention was directed to the extension gap. With an appropriately sized spacer block in place, the mediolateral stability of the knee was evaluated in full extension by applying both a varus and a valgus stress. The application of stress should demonstrate lateral side soft-tissue tightness in an unbalanced valgus knee. Next, a lamina spreader was placed centrally in the gap. If the knee was unbalanced, this manifested as a trapezoidal gap. The goal was to achieve a rectangular extension gap. When the gap was trapezoidal, soft-tissue balancing with use of the "inside-out" pie crusting technique was necessary to fractionally lengthen the lateral side.

Closure of soft tissue

Quadriceps tendon closure was done in two layers with absorbable suture material. Patellar tendon sutured with absorbable suture. After subcutaneous closer, staples

were used for skin. Dressing was done with water proof dressing material

Postoperative management

The patient was evaluated closely for any signs of peroneal nerve compromise. Radial pulse and blood pressure were monitored. If any sign of nerve compromise developed, the knee was placed in flexion. Physical therapy and continuous passive motion were initiated as soon as patient was comfortable. Patients were progressed to weight-bearing as tolerated, on next day of surgery. Drain and epidural catheter were removed after 48 hours of surgery. Active knee flexion was allowed as much as possible on second post-operative day. Intravenous antibiotic was stopped after 5 day and patients were discharged with oral medications on day 5.

Staples were removed on day 14. Patients were followed up on 6 week, 3 months and 6 months post-operative period. And after 1 year post operatively, patients were evaluated with knee society score.

RESULTS

Patients age range from 58 to 77 years with average age 67.92 years.

4 patients were in 50-60 age group, 13 patients in 61-70 age group and 9 patients in 71-80 age group. Most common age group was 61-70 tears.

Table 1: Age group.

Age group	Number of patients	Percentage (%)
≤ 60	4	15.4
61 - 70	13	50.0
71 - 80	9	34.6
Total	26	100.0

Table 2: Gender distribution.

Gender	Number of patients	Percentage (%)
Male	12	46.2
Female	14	53.8
Total	26	100.0

In our study, 14 patients were female while 12 patients were male. Female preponderance was observed in our study.

Table 3: Procedure done.

Procedure	Number of patients	%
Pie crusting	14	53.8
Pie crusting and lat. Release	12	46.2
Total	26	100.0

Distribution of patients in respect of procedure

In our study, out of 26 patients 14 (53.8%) patients required only pie crusting for ligament balancing and 12 (46.2%) patients required pie crusting and lateral release for ligament balancing.

Distribution of patients in respect of structure released for ligament balancing

In our study, posterolateral ligament and iliotibial band release was done in all 26 patients (100%) for balancing of extension gap.

For balancing of flexion gap lateral collateral ligament release was done in 11 patients (42.30%).

Table 4: Structures released.

Structures released	No. of patients	%
Posterolateral capsule	26	100
Iliotibial band	26	100
Lateral collateral ligament	11	42.30
Poplitius ligament	3	11.50

Knee society score

Comparison of mean pain score with respect to procedure

Mean pain score in pie crusting group was 47.14 with standard deviation 3.78.

Mean pain score in pie crusting and lateral release combine technique group was 47.08 with standard deviation 3.96. p value = 0.969 (P>0.05).

Difference in Pain score between both techniques was insignificant.

Table 5: Knee society score.

Procedure	Number of patients	Pain		P-value
		Mean	SD	
Pie-crusting	14	47.14	3.78	0.969
Pie-crusting and lateral release	12	47.08	3.96	

Comparison of mean range of motion with respect to procedure

Mean range of motion in pie crusting group was 20.29 (101.45 degree) with standard deviation of 2.09. Mean range of motion in pie crusting and lateral release combine technique was 21.50 (107.5 degree). P-value for both group is 0.068 (p >0.005). Difference in range of motion was insignificant between both techniques.

Table 6: Range of motion.

Procedure	Number of patients	ROM		P-value
		Mean	SD	
Pie-crusting	14	20.29	2.09	0.068
Pie-crusting and lateral release	12	21.50	1.00	

Comparison of mean antero-posterior stability respect to procedure

Mean Antero-posterior stability in pie crusting group was 9.64 (<5 mm) with standard deviation 1.34. Mean antero-posterior stability in pie crusting and lateral release combine group was 9.17 (<5 mm) with standard deviation 1.95.

P-value was 0.483 (p >0.05). Difference between both techniques was insignificant.

Table 7: Anterionterior stability.

Procedure	Number of patients	Anterionterior or stability		P-value
		Mean	SD	
Pie-crusting	14	9.64	1.34	0.483
Pie-crusting and lateral release	12	9.17	1.95	

Comparison of mean mediolateral stability with respect to procedure

Mean medio-lateral stability in pie crusting group was 14.19 (<5 mm) with standard deviation 1.82. Mean medio-lateral stability in pie crusting and lateral release combine group was 12.92 (<5 mm) with standard deviation 2.57.

P-value was 0.139 (p >0.05). Difference between both techniques was insignificant.

Table 8: Anterionmedial stability.

Procedure	Number of patients	Mediolateral stability		P-value
		Mean	SD	
Pie-crusting	14	14.29	1.82	0.139
Pie-crusting and lateral release	12	12.92	2.57	

Comparison of mean total knee score with respect to procedure

Mean total knee score in pie crusting group was 88.79 with standard deviation 7.41. Mean total knee score in pie

crusting and lateral release combine group was 86.42 with standard deviation 8.75.

P-value was 0.469 (p >0.05). Difference between both techniques was insignificant.

Table 9: Total knee score.

Procedure	Number of patients	Total knee score		P-value
		Mean	SD	
Pie-crusting	14	88.79	7.41	0.469
Pie-crusting and lateral release	12	86.42	8.75	

Comparison of mean walking score with respect to procedure

Mean walking score in pie crusting group was 45.00 (unlimited distance) with standard deviation 7.60. Mean walking score in pie crusting and lateral release combine group was 45.83 with standard deviation 6.69.

P-value was 0.769 (p >0.05). Difference between both techniques was insignificant.

Table 10: Mean walking score.

Procedure	Number of patients	Mean Walking score		P-value
		Mean	SD	
Pie-crusting	14	45.00	7.60	0.769
Pie-crusting and lateral release	12	45.83	6.69	

Comparison of mean stairs with respect to procedure

Mean stairs score in pie crusting group was 41.43 with standard deviation 7.70. Mean total knee score in pie crusting and lateral release combine group was 40.00 with standard deviation 6.03.

P-value was 0.601 (p >0.05). Difference between both techniques was insignificant.

Table 11: Stair score.

Procedure	Number of patients	Stair score		P-value
		Mean	SD	
Pie-crusting	14	41.43	7.70	0.601
Pie-crusting and lateral release	12	40.00	6.03	

Complications

In our study of 26 patients, post-operative flexion contracture was present in 5 (19%) patients, Patellar

maltracking was present in 5 (19%) patients, extension lag in 1 (3.84%) patient, and no patient developed peroneal nerve palsy.

Table 12: Complications.

Complications	No. of patients	%
Flexion contracture	5	19%
Extension lag	1	3.84%
Peroneal nerve palsy	0	0
Patellar maltracking	5	19%

DISCUSSION

Osteoarthritis with valgus knee is very difficult to correct. Lateral soft tissue release is very important for alignment of knee. However, with the use of advanced new techniques and newer implants design, this scenario has changed.

Incidence with age and sex

Age distribution in this study was between 58 years to 77 years with mean age being 67.92 years. And in this study, more number of females were present 14 (53.84%) compared to males 12 (46.15%).

Elkus et al stated in their study of 35 patients with valgus knee mean age of patient is 67 years out of which 27 were women and 8 were men.⁷

In the study of Lu et al, out of 74 patients 63 were women and 11 were men with mean age of 62.93 years.⁸

Both observations in our study, mean age and female preponderance, were found to be consistent with Elkus et al study and Lu study.

Valgus angle

Valgus angle in this study was between 13 to 27 degree with average 17.84 degree. Elkus et al stated in their study average valgus angle was 15 degree.⁷

In the study of Rajgopal average valgus angle was 20 degree.⁹ In the study of Musil et al average valgus angle was 18 degree.¹⁰ These results were comparable to our present study.

Lateral soft tissue release is very essential for surgical outcome of total knee arthroplasty in valgus knee. At a same time it's very difficult to get anatomical alignment. Use of pie crusting technique is very easy and less time consuming.

We treated our patients as follows:

We studied 26 patients, 12 male and 14 female patients. We used pie crusting technique in 14 patients and

combination of pie crusting and lateral release in 12 patients. Average pre-operative valgus angle was 17.84 degree. Standard midline parapatellar approach used for all 26 patients. In our study posterolateral capsule release done in all 26 patients, and iliotibial band release in all 26 patients for symmetry of extension gap. Lateral collateral ligament release was done in 11 patients, and popliteus tendon release was done in 3 patients. At the end of 1 year average knee score and function score was 87.69 and 82.5 respectively. Post-operative average range of movement was 105 degree. In our study knee society score of pie crusting release and knee society score of patients with both pie crusting and lateral release p value was >0.05 in all criteria of knee society score. Difference between both techniques was insignificant.

Clarke et al, in this study, the clinical outcomes of 24 consecutive knees in 24 patients in whom this method was used in conjunction with a cemented posterior-stabilized prosthesis were evaluated.¹¹ At a mean of 54 months' (range 24-69 months) follow-up, the knees were performing well with a mean Knee Society score of 97 (range 87-100) and mean range of motion of 121° (range 100°-145°). Importantly, there were no clinical failures or cases of postoperative instability and no cases of radiographic loosening or wear. In our study, post operatively, knee society score was average 87.69 and function knee score was 82.5. Mean range of motion 105 degree.

Aglietti et al, in 51 of the 53 knees (96%) they achieved alignment within 5 degrees from neutral.¹² One patient had varus instability in extension. No component was revised. The pie-crusting technique reliably corrects moderate to severe fixed valgus deformities with a low complication rate and reasonable mid-term results. In our study 25 patients (96.15%) had valgus alignment less than 7 degree and 1 patient had valgus alignment of 7 degree.

The study of Rajgopal, patients were followed up for 8 to 14 (mean, 10) years.⁸ All knees had a good patellar position and were clinically stable in both mediolateral and anteroposterior planes. No radiolucency was noted. The mean HSS knee score improved from 48 to 91 (p<0.001). The mean tibiofemoral alignment improved from valgus 20° to 5° (p <0.001). The mean range of motion improved from 65° to 110° (p <0.001). One patient developed a deep infection at year 4, and 2 had periprosthetic fracture. In our study mean tibiofemoral alignment improved from 17.84 valgus to 4.7 valgus. No patient had infection and periprosthetic fracture.

Chechik et al concluded in retrospective study of 42 patients that they used posterolateral capsule release as a sole method of lateral release.¹³ All were successfully balanced. Valgus angle improved 17.5 to 6.3 on average (p <0.0001) and knee score and functional score postoperatively 88.2 and 70 respectively.

Boyer P stated that iliotibial band release is very important for symmetry of extension gap.¹⁴ In 63 patients with valgus knee only 4 were require further release after iliotibial band release for tight extension gap. Post-operative knee score and functional score was 91 and 78.8 respectively. In our study all patient require ITB release for tight extension gap and no further release require after ITB release. Knee society score postoperatively was 87.69 and functional score was 82.5.

Ranawat studied 231 valgus knee patients with valgus deformity ranging from 12 degree- 45 degree.¹⁵ Post-operative valgus alignment was average 5 degree. For the knees that were tight in extension, iliotibial band and posterolateral capsule release were released. For those knees that were tight in flexion, lateral collateral ligament and popliteus tendon were released. Neither ligament advancement procedure on medial side nor valgus or varus stabilized implant was needed. In our study 26 patients with valgus alignment range from 13 degree to 27 degree with average 17.84 degree. Post operatively valgus alignment was 4.7 degree. In our study we released posterolateral capsule and iliotibial band in all 26 patients for tight extension gap. For tight flexion gap we released lateral collateral ligament in 11 patients and popliteus tendon in 3 patients.

CONCLUSION

Lateral release in valgus knee is very essential for ligament balancing and for proper alignment of knee. Both pie crusting and combination of pie crusting and lateral release is equal in outcome in term of knee society score.

From our study we concluded that, Knee society score is excellent with both techniques and there is no difference in both techniques iliotibial band and posterolateral capsule are most common structures that require release. Initial ligament balancing should be done with pie crusting and then sequential lateral release if require.

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