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A Study of Functional Outcome and Deformity Correction After Total Knee Arthroplasty in Valgus Deformity of Knee: A Cross-Sectional Study.

Dr. Sumit Shivraj Mathapati[1], Dr. Sheth Hardik Grishkumar, Dr. Ravishankar Paswant[3] , Dr. Naresh Kumar Munda[4]

[1]Assistant Professor, Department of Orthopaedic, Faculty of IQ City Medical College Hospital, Durgapur .
[2]Assistant Professor, Department of Orthopaedic, Faculty of IQ City Medical College Hospital, Durgapur
[3]Assistant Professor, Department of General Surgery, Faculty of Kanti Devi Medical College, Hospital & Research Centre, Mathura.
[4]Assistant Professor, Department of Community Medicine, Faculty of Icare Institute of Medical Sciences and Research and Dr. B C Roy Hospital, Haldia, India.

Corresponding Author: Dr. Naresh Kumar Munda

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ABSTRACT

Background: Valgus knee deformity poses a significant surgical challenge during Total Knee Arthroplasty (TKA) owing to lateral soft-tissue contracture, lateral femoral condyle hypoplasia, and complex ligamentous imbalance. Achieving satisfactory deformity correction and functional restoration in such cases demands meticulous pre-operative planning and precise intra-operative technique. **Objectives:** To evaluate post-operative functional outcome and radiological deformity correction following TKA in patients with valgus knee deformity attending a tertiary care centre in West Bengal. **Methods:** A hospital-based cross-sectional study was conducted with a sample size of 54 patients who had undergone TKA for valgus knee deformity. Patients were assessed using the Knee Society Score (KSS), Oxford Knee Score (OKS), and radiological measurement of the mechanical axis. Purposive sampling was employed after applying predetermined inclusion and exclusion criteria. **Results:** The mean age of study participants was 62.4 ± 8.7 years. Females constituted 72.2% of the cohort. The mean pre-operative valgus angle was 18.3° ± 5.6°, which significantly improved post-operatively to 4.2° ± 1.8° ($p < 0.001$). The mean KSS improved from 38.6 to 82.4, and OKS improved from 16.2 to 38.9 at six-month follow-up. Excellent to good outcomes were observed in 83.3% of cases. **Conclusion:** TKA in valgus knee deformity yields satisfactory functional outcomes and reliable

deformity correction when performed at an experienced tertiary centre. Early rehabilitation and adequate soft-tissue balancing are key determinants of success.

Keywords: *Total Knee Arthroplasty, Valgus Deformity, Functional Outcome, Deformity Correction, KSS, OKS, West Bengal*

1. INTRODUCTION

Total Knee Arthroplasty (TKA) is a well-established surgical procedure globally recognised for the management of end-stage knee arthritis. In India, the prevalence of knee osteoarthritis is rising steadily, particularly among the elderly population, with a higher burden noted in states such as West Bengal where sedentary lifestyle, obesity, and nutritional deficiencies converge as risk factors. Amongst the various deformity patterns encountered, valgus knee deformity is relatively less common than varus, yet it presents a significantly more demanding surgical challenge[1].

Valgus deformity of the knee is characterised by lateral deviation of the mechanical axis, with the tibiofemoral angle exceeding 10 degrees laterally. The underlying pathology involves contracture of the lateral soft-tissue structures including the iliotibial band, popliteus tendon, and lateral collateral ligament, along with relative laxity of the medial compartment[2]. The associated bony abnormalities such as hypoplastic lateral femoral condyle, tibial bone loss, and patellofemoral malalignment further complicate the intra-operative balancing[3].

In India, valgus deformity constitutes approximately 10–15% of all TKA cases, and the majority of patients presenting to tertiary centres are females in the sixth to seventh decade of life. Conditions such as rheumatoid arthritis, post-traumatic arthritis, and idiopathic osteoarthritis with valgus alignment are the common aetiologies encountered in Eastern India. Despite the complexity, TKA in valgus deformity has been shown to yield good functional outcomes when appropriate surgical technique and implant selection are employed[4].

The functional assessment of TKA outcomes has evolved considerably over the years. Validated scoring tools such as the Knee Society Score (KSS) and the Oxford Knee Score (OKS) are widely employed in clinical practice to objectively quantify pain relief, mobility, and activities of daily living. Radiological parameters, including the hip-knee-ankle (HKA) mechanical axis and the tibio-femoral angle on weight-bearing radiographs, serve as the primary measures of deformity correction[5].

There is a paucity of published data from West Bengal specifically addressing functional outcomes and radiological correction in valgus TKA. The present study, conducted at a tertiary care centre in

West Bengal, aims to bridge this gap and provide regional data that may guide future clinical decision-making in the management of valgus knee deformity through TKA.

2. OBJECTIVES

Primary Objective: To assess the functional outcome following Total Knee Arthroplasty in patients with valgus knee deformity using the Knee Society Score (KSS) and Oxford Knee Score (OKS) at six months post-operatively.

Secondary Objectives:

(i) To evaluate the degree of radiological deformity correction as measured by the post-operative tibiofemoral angle and mechanical axis alignment.

(ii) To study the sociodemographic profile of patients undergoing TKA for valgus knee deformity at a tertiary care centre in West Bengal.

(iii) To identify factors influencing functional outcomes following TKA in valgus deformity.

3. METHODOLOGY

3.1 Study Design and Setting

A hospital-based cross-sectional study was conducted in the Department of Orthopaedics and General Surgery at a tertiary care centre in West Bengal over a period of 18 months. Patients who had undergone TKA for valgus knee deformity were enrolled following informed consent. Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement of the study.

3.2 Sample Size Calculation

The sample size was calculated using the following formula for estimating a population proportion:

$$n = Z^2 \times p \times q / d^2$$

Where:

n = Required sample size

Z = 1.96 (standard normal deviate at 95% confidence level)

p = Expected proportion of good-to-excellent outcomes in valgus TKA = 0.80 (based on prior literature reporting 80% satisfactory outcomes)

q = 1 − p = 0.20

d = Allowable error = 0.10 (10%)

$$n = (1.96)^2 \times 0.80 \times 0.20 / (0.10)^2 = 3.8416 \times 0.16 / 0.01 = 61.5 \approx 62$$

Accounting for a 15% non-response and dropout rate, the final adjusted sample size was calculated as approximately 72. However, after applying stringent inclusion and exclusion criteria, 54 patients were found eligible and were enrolled in the present study. This sample size was deemed adequate for a cross-sectional descriptive study with the power to detect clinically meaningful differences.

3.3 Method of Sampling

Purposive (judgement) sampling was employed in the present study. All patients attending the orthopaedic outpatient department or admitted for TKA during the study period who met the eligibility criteria were systematically screened. This non-probability sampling method was chosen given the specific clinical nature of the study population and the need for a homogeneous cohort with confirmed valgus knee deformity.

3.4 Inclusion and Exclusion Criteria

Inclusion Criteria: Patients aged 40 years and above with end-stage knee arthritis and radiologically confirmed valgus deformity (tibiofemoral angle ≥10° lateral), who underwent primary TKA and provided written informed consent, were included.

Exclusion Criteria: Patients with prior knee surgery, neurological disorders affecting lower limb function, active infection, severe osteoporosis, bilateral simultaneous TKA, or incomplete records were excluded from the study.

3.5 Data Collection and Outcome Measures

Data were collected using a pre-tested structured proforma. Functional assessment was performed pre-operatively and at six months post-operatively using the Knee Society Score (KSS) and Oxford Knee Score (OKS). Radiological deformity correction was evaluated using standard weight-bearing anteroposterior radiographs of the knee, with measurement of the tibiofemoral angle and mechanical axis alignment. Statistical analysis was performed using SPSS version 23.0. Paired t-test was used to compare pre- and post-operative scores, and p-value < 0.05 was considered statistically significant.

4. RESULTS

A total of 54 patients who underwent TKA for valgus knee deformity were enrolled in the present cross-sectional study. The data are presented under the following sub-headings:

4.1 Sociodemographic Profile

The sociodemographic characteristics of the 54 study participants are summarised in Table 1 below.

Table 1: Sociodemographic Profile of Study Participants (n = 54)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (Years)	40–60	18	33.3
	>60	36	66.7
Mean Age	62.4 ± 8.7 years	—	—
Gender	Female	39	72.2
	Male	15	27.8
Educational Status	Illiterate	14	25.9
	Primary/Secondary	28	51.9
	Higher Secondary & Above	12	22.2
Residence	Urban	20	37.0
	Semi-Urban	16	29.6
	Rural	18	33.4
Aetiology	Osteoarthritis	31	57.4
	Rheumatoid Arthritis	16	29.6
	Post-Traumatic	7	13.0
BMI (kg/m²)	25–29.9 (Overweight)	24	44.4
	≥30 (Obese)	30	55.6

4.2 Pre-operative and Post-operative Functional Scores

The mean pre-operative Knee Society Score (KSS) was 38.6 ± 7.4, which improved markedly to 82.4 ± 9.2 at six months post-operatively. This improvement was statistically significant ($p < 0.001$). Similarly, the Oxford Knee Score (OKS) improved from a mean of 16.2 ± 4.1 pre-operatively to 38.9 ± 5.3 post-operatively ($p < 0.001$). An excellent-to-good functional outcome was documented in 45 out of 54 patients (83.3%). Fair outcomes were noted in 7 patients (13.0%), and poor outcomes in only 2 patients (3.7%), both of whom had significant pre-operative bone loss and required constrained implants.

4.3 Radiological Deformity Correction

The mean pre-operative tibiofemoral valgus angle was 18.3° ± 5.6°. Post-operatively, this was corrected to a mean of 4.2° ± 1.8°, demonstrating highly significant radiological improvement ($p <$

0.001). Restoration of mechanical axis to within ±3° of neutral was achieved in 48 patients (88.9%). Six patients (11.1%) demonstrated residual valgus of 4–6°, yet all reported satisfactory functional outcomes. No case of overcorrection into varus was encountered.

5. DISCUSSION

The present study evaluated functional outcomes and deformity correction following TKA in 54 patients with valgus knee deformity at a tertiary care centre in West Bengal. The findings corroborate evidence from existing national and international literature and provide valuable insights specific to the Eastern Indian patient population[6].

The demographic profile of the study cohort is consistent with established patterns in the published literature. The predominance of female patients (72.2%) and a mean age of 62.4 years align with the natural history of knee osteoarthritis and the higher prevalence of inflammatory arthropathies such as rheumatoid arthritis amongst women in India. Valgus deformity in the Indian subcontinent has a well-documented association with rheumatoid arthritis, which constituted 29.6% of our cohort, in keeping with observations reported by Mullaji and Shetty (2009) from a Mumbai-based series[7]. The high proportion of obese patients (BMI ≥30 kg/m²) in our study at 55.6% underscores the compounding role of obesity in joint degeneration and post-operative rehabilitation.

The statistically significant improvement in the KSS (38.6 to 82.4; $p < 0.001$) and OKS (16.2 to 38.9; $p < 0.001$) at six months is consistent with previously published outcomes. Ranawat et al. (1993) and Keblish (1991) demonstrated that meticulous lateral soft-tissue release and appropriate implant selection were pivotal determinants of outcome in valgus TKA. In our series, the inside-out lateral release technique was predominantly employed, which minimised the risk of popliteal neurovascular injury whilst achieving satisfactory ligamentous balance[8].

The radiological correction achieved in this study was commendable, with 88.9% of patients achieving a post-operative mechanical axis within the acceptable range of ±3° of neutral. This is comparable to the 85–92% accuracy reported in contemporary literature employing conventional instrumentation. The use of posterior-stabilised implants in 75.9% of the patients — owing to the need for posterior cruciate ligament sacrifice in cases with significant lateral contracture — facilitated better coronal balance and patellar tracking[9].

It is noteworthy that in 6 patients (11.1%) with residual mild valgus (4–6°), satisfactory functional scores were still achieved. This finding supports the view articulated by Insall et al. (1985) that a minor

degree of residual valgus, particularly in the context of longstanding deformity, may be physiologically better tolerated than forceful neutral correction, which risks lateral soft-tissue disruption and instability. In our experience, attempting aggressive neutral alignment in cases with severe pre-operative valgus (≥20°) risked peroneal nerve stretch injury, and therefore a deliberate residual valgus of 4–5° was accepted in selected cases.

The poor outcomes observed in 2 patients (3.7%) were attributable to significant pre-operative lateral tibial bone loss necessitating augmentation and use of constrained implants, which are known predictors of inferior outcomes. These cases highlight the importance of pre-operative templating and anticipation of intra-operative complexity in advanced valgus deformity[10].

A limitation of the present study is the relatively short follow-up period of six months. Long-term survivorship data and outcomes beyond one year would provide a more comprehensive understanding of implant durability and functional maintenance. Additionally, the cross-sectional design precludes causal inference, and a prospective cohort study with matched controls would yield higher-quality evidence. Nevertheless, the study fills an important gap in the regional literature from West Bengal.

6. CONCLUSION

Total Knee Arthroplasty is an effective and reliable surgical intervention for the management of valgus knee deformity, yielding significant improvements in functional outcome scores and satisfactory radiological deformity correction. The present hospital-based study conducted at a tertiary care centre in West Bengal demonstrated that 83.3% of patients achieved excellent-to-good functional outcomes at six months, with successful mechanical axis restoration in 88.9% of cases. Adequate pre-operative planning, appropriate implant selection, careful lateral soft-tissue balancing, and structured post-operative rehabilitation are the cornerstones of a favourable outcome. Future multi-centre prospective studies with longer follow-up are warranted to consolidate these findings in the Eastern Indian context.

7.DECLARATION

Conflict of Interest: The authors declare no conflict of interest.

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