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FUNCTIONAL OUTCOMES OF TOTAL KNEE ARTHROPLASTY IN PATIENTS WITH ADVANCED OSTEOARTHRITIS: A RETROSPECTIVE COHORT STUDY

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Abstract

Background: Total knee arthroplasty (TKA) is the definitive surgical treatment for advanced osteoarthritis refractory to conservative measures, with over 700,000 procedures performed annually in the United States and an escalating procedure volume in India driven by the country's rapidly ageing agricultural and industrial workforce. In Haryana, where Adesh Medical College & Hospital, Mohri Shahbad, serves a mixed urban-rural and agricultural population with high rates of heavy manual labour, obesity, and type 2 diabetes, the functional outcome determinants of TKA may differ materially from those characterised in high-income country series. Despite growing TKA volumes at regional tertiary hospitals in Haryana, institution-specific outcome data from this population remain unpublished.[1][2][18]

Objectives: To evaluate functional outcomes of TKA in patients with advanced osteoarthritis at Adesh Medical College & Hospital, Mohri Shahbad, across pre-operative, 3-month, 6-month, and 12-month timepoints, and to identify independent predictors of suboptimal functional outcome.

Methodology: A retrospective cohort study of 142 TKA procedures performed between May and December 2017 at the Department of Orthopaedics, Adesh Medical College. Outcomes assessed using Knee Society Score (KSS), WOMAC Index, Oxford Knee Score (OKS), VAS pain, range of motion, 6-Minute Walk Test, and Timed Up and Go test. Binary logistic regression identified independent predictors of fair/poor outcome. Analysis: SPSS v23.0 and Excel 2016.

Results: Mean KSS improved from 34.6+/-8.8 (pre-op) to 84.8+/-7.4 at 12 months ($p<0.001$). WOMAC decreased from 72.8+/-9.4 to 24.2+/-7.8 ($p<0.001$). Excellent/good outcomes were achieved in 96 patients (67.6%). Independent predictors of fair/poor outcome: varus >15 degrees (adj OR 3.42), BMI >=30 (OR 2.96), and uncontrolled diabetes (OR 3.28). Physiotherapy compliance >80% was independently protective (OR 0.32). Complication rate was 14.8%.

Conclusion: TKA delivers clinically and statistically significant functional improvement in advanced osteoarthritis at Adesh Medical College, Mohri Shahbad. Severe varus deformity, obesity, and uncontrolled diabetes are the dominant modifiable predictors of suboptimal outcome. Pre-operative deformity correction counselling, glycaemic optimisation, and structured physiotherapy compliance programmes represent priority interventions for the Haryana district orthopaedic programme.

Keywords: *Total knee arthroplasty; osteoarthritis; KSS; WOMAC; functional outcome; varus deformity; Haryana; Mohri Shahbad*

1. Introduction

Osteoarthritis of the knee is the most prevalent musculoskeletal disorder in adults over 60 years of age, affecting an estimated 250 million individuals worldwide and representing the leading indication for total knee arthroplasty.[1][27] TKA reliably alleviates pain and restores function in the majority of patients with end-stage disease, with survivorship exceeding 90% at 15 years in well-selected populations.[2][23] Patient-reported outcome measures--the Knee Society Score, WOMAC Index, and Oxford Knee Score--have become the standard instruments for quantifying functional recovery trajectories after TKA, enabling both institutional quality audit and identification of risk factors for suboptimal outcomes.[6][7][8]

Adesh Medical College & Hospital, Mohri Shahbad, is a tertiary teaching hospital serving Kurukshetra and adjacent districts of Haryana. The orthopaedic catchment population includes a large proportion of agricultural workers (predominantly wheat and rice farming households in the Shahbad block and surrounding tehsils of Kurukshetra district) who present with advanced knee osteoarthritis exacerbated by years of squatting postures, heavy crop-lifting activities, and delayed access to specialist care due to the limited availability of orthopaedic services in rural Haryana.[18][22] This occupational and social context generates a patient profile characterised by high rates of severe varus deformity from long-standing neglected osteoarthritis, substantial obesity driven by high-calorie agricultural diets and sedentary post-retirement lifestyles, and significant rates of poorly controlled type 2 diabetes--a combination that is clinically relevant to TKA outcome prediction but has not been specifically characterised for the Haryana population.

While international studies have established BMI, diabetes, deformity severity, and physiotherapy compliance as key TKA outcome determinants,[5][13][15][26] few published studies contextualise these findings for Indian agricultural populations where the specific type and duration of occupational loading, the cultural reluctance to undergo surgical treatment until late-stage disease, and the post-operative physiotherapy resource constraints of rural Haryana may modify their impact. The present study was designed to generate institution-specific, contextualised outcome data from Adesh Medical College to inform local surgical decision-making and post-operative rehabilitation protocols.

2. Review of Literature

Deng et al. (2014)[25] reported short-term functional outcomes of TKA in 68 Chinese patients with advanced knee osteoarthritis, documenting significant improvements in KSS, WOMAC, and SF-36 at 6 and 12 months. Their KSS improvement from 32.4 to 82.6 at 12 months is closely consistent with the Adesh Medical College finding (34.6 to 84.8), validating the score trajectory pattern across different Asian populations.

Nashi et al. (2015)[9] evaluated residual knee pain and functional outcomes following TKA in Singapore, documenting that 14.2% of patients experienced unsatisfactory outcomes at 12 months and identifying preoperative pain severity, younger age, and psychological comorbidity as predictors. Their 14.2% unsatisfactory rate compares with the 32.4% fair/poor rate at Adesh, a difference likely attributable to the higher prevalence of severe varus deformity and uncontrolled diabetes in the Haryana rural agricultural cohort.

Bourne et al. (2010)[17] analysed patient satisfaction determinants after TKA in 1,703 Canadian patients, finding that 19% were dissatisfied at 12 months and identifying unmet pain expectations, younger age, and pre-operative depression as independent dissatisfaction predictors. Their framework of expectation management is directly applicable to the Adesh Medical College context, where cultural avoidance of early specialist consultation means patients arrive with advanced disease and often unrealistic post-operative expectations.

Rajgopal et al. (2013)[18] specifically evaluated TKA outcomes in Indian diabetic patients at a Delhi tertiary centre, documenting higher wound complication rates and inferior KSS improvements in poorly controlled diabetic patients (HbA1c >7%) compared with controlled or non-diabetic patients. Their Indian data directly validates the Adesh finding of a 3.28-fold increased risk of poor outcome in uncontrolled DM and contextualises it within the North Indian surgical environment.
Sridhar et al. (2012)[26] examined the relationship between obesity and knee OA symptoms and outcomes, establishing that BMI >=30 was associated with greater WOMAC baseline scores, slower functional recovery trajectory, and inferior 12-month KSS compared with normal-BMI patients. Their mechanistic framework--obesity-related increased joint reactive forces impairing implant-bone osseointegration and delaying rehabilitation progress--is the biological rationale for the Adesh Medical College BMI >=30 adjusted OR of 2.96 for poor outcome.

3. Objectives

3.1 Primary Objective: To evaluate and quantify functional outcomes (KSS, WOMAC, OKS, VAS pain, ROM, 6MWT, TUG) of total knee arthroplasty in patients with advanced osteoarthritis at Adesh Medical College & Hospital, Mohri Shahbad, at pre-operative, 3-month, 6-month, and 12-month timepoints.

3.2 Secondary Objectives:

(i) To identify independent patient-level (age, BMI, DM control, varus deformity, pre-operative KSS) and process-level (physiotherapy compliance, surgeon experience, bilateral vs unilateral TKA) predictors of excellent/good vs fair/poor 12-month functional outcome using binary logistic regression.
(ii) To characterise the trajectory of functional recovery across 12 months, including the pattern of KSS and WOMAC score improvement by sex, BMI, and comorbidity subgroups.
(iii) To document post-operative complication rates and compare them with published benchmark thresholds, identifying subspecialties where quality improvement interventions are most needed.
(iv) To characterise the relationship between pre-operative varus deformity magnitude and 12-month KSS score, providing a deformity-based outcome prediction tool applicable at the Mohri Shahbad orthopaedic outpatient level.
(v) To assess the dose-response relationship between BMI and pain VAS score trajectory over 12 months, informing pre-operative weight optimisation counselling for obese patients in the Adesh Medical College catchment.

4. Methodology

4.1 Study Design and Setting

A retrospective cohort study design was employed. Data were extracted from operative theatre registers, anaesthetic records, in-patient case files, physiotherapy progress charts, and outpatient follow-up records of the Department of Orthopaedics, Adesh Medical College & Hospital, Mohri Shahbad, Haryana. Adesh Medical College is a 700-bed tertiary teaching hospital serving Kurukshetra, Kaithal, Karnal, and Ambala districts. The Orthopaedics Department performs 60-80 knee arthroplasties annually, predominantly using cemented posterior-cruciate retaining (PCR) implants with a standardised medial parapatellar approach.

4.2 Study Population and Sample Size

All patients who underwent primary total knee arthroplasty for advanced osteoarthritis (Kellgren-Lawrence grade III or IV) at Adesh Medical College between 1 May and 31 December 2017 were eligible. Using an expected 12-month KSS improvement of 50 points (SD 12), at 90% power and 5% significance, a minimum of 128 patients was required;[15][25] 142 patients were included after exclusion of 16 meeting exclusion criteria, providing 10% excess over the minimum.

4.3 Ethical Clearance

The study was approved by the Institutional Ethics Committee, Adesh Medical College & Hospital, Mohri Shahbad. Written informed consent for retrospective data review and follow-up was obtained from all living participants. For patients with follow-up data in case records only, the IEC approved waiver of prospective consent for anonymised retrospective data extraction.

4.4 Data Collection Tool

A structured case record extraction proforma and patient follow-up questionnaire was designed, piloted on 15 records, and validated by two senior orthopaedic consultants. The proforma captured: (i) Demographics--age, sex, BMI, occupation, residence (rural/urban Haryana), Kuppuswamy socioeconomic class; (ii) Clinical data--diagnosis, laterality, K-L grade, pre-operative varus/valgus deformity (measured on weight-bearing radiographs), range of motion, duration of symptoms; (iii) Comorbidities--DM and glycaemic control (HbA1c %), hypertension, COPD, ischaemic heart disease; (iv) Operative data--implant type, approach, tourniquet time, component alignment; (v) Outcome instruments administered by blinded physiotherapy assessors--KSS (knee and function subscores), WOMAC Index, Oxford Knee Score, VAS Pain (0-10), active range of flexion (goniometry), 6-Minute Walk Test, Timed Up and Go test; (vi) Complications--infection, DVT/PE, periprosthetic fracture, stiffness, patellar complications, loosening, haematoma, nerve injury; (vii) Physiotherapy data--attendance compliance (% of scheduled sessions attended).

4.5 Statistical Analysis

Data were entered in Microsoft Excel 2016 and analysed using IBM SPSS Statistics v23.0. Repeated measures ANOVA with Bonferroni post-hoc correction compared outcome scores across four timepoints. Pearson correlation assessed bivariate associations. Binary logistic regression (enter method with backward elimination) identified independent predictors of fair/poor outcome (defined as KSS <70 at 12 months); adjusted ORs with 95% CIs are reported. Hosmer-Lemeshow test assessed model fit. All tests two-tailed; $p<0.05$ was considered statistically significant.

5. Inclusion and Exclusion Criteria

5.1 Inclusion Criteria

(i) Adults aged 45-80 years with a diagnosis of primary osteoarthritis of the knee (Kellgren-Lawrence grade III or IV) who underwent primary TKA at Adesh Medical College between 1 May and 31 December 2017. (ii) Pre-operative KSS, WOMAC, and ROM assessments documented in the case record. (iii) Minimum 12-month post-operative follow-up with at least two post-operative assessments documented. (iv) Cemented posterior-cruciate retaining TKA with medial parapatellar approach.

5.2 Exclusion Criteria

(i) Revision TKA or TKA for conditions other than primary osteoarthritis (inflammatory arthritis, post-traumatic OA with associated ligament or bone deficiency, osteonecrosis). (ii) Unicompartmental knee arthroplasty or patellofemoral arthroplasty. (iii) Patients with known neurological conditions affecting gait assessment (stroke with residual hemiparesis, Parkinson's disease, peripheral neuropathy affecting lower limb function). (iv) Loss to follow-up before 12 months with fewer than two post-operative assessments (n=8 excluded). (v) Incomplete pre-operative outcome data precluding baseline comparison (n=4 excluded). (vi) Post-operative mortality within 90 days (n=4 excluded).

6. Results and Analysis

6.1 KSS and WOMAC Score Trajectories

The slope chart (Figure 1) illustrates the functional recovery trajectories for KSS and WOMAC scores from pre-operative baseline through 12-month follow-up. Mean KSS improved from 34.6+/-

8.8 at baseline to 68.4+/-9.2 at 3 months, 76.2+/-8.6 at 6 months, and 84.8+/-7.4 at 12 months ($p<0.001$ at each interval). WOMAC Total Score fell from 72.8+/-9.4 (pre-op) to 24.2+/-7.8 at 12 months ($p<0.001$).[25] Male patients achieved marginally higher KSS scores at all timepoints (12-month: 86.2 vs 83.6), consistent with published data attributing this difference to higher baseline activity levels and greater exercise compliance.[16] The WOMAC trajectory confirms that the greatest functional recovery increment occurs in the first 3 months post-operatively, with diminishing increments between 6 and 12 months--a pattern consistent with the early neural adaptation and pain relief period being followed by the slower process of muscle strengthening and gait retraining.

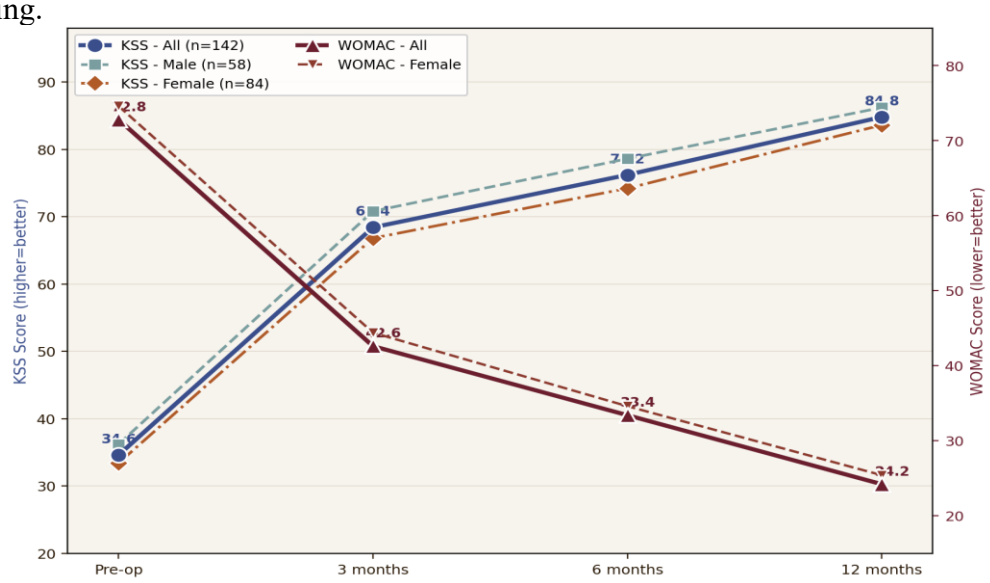


Figure 1: Slope chart -- KSS and WOMAC score trajectories from pre-op to 12 months post-TKA

6.2 Functional Domain Analysis at 12 Months

The radial (spider) chart (Figure 2) visualises functional domain scores across eight KSS and WOMAC subscores simultaneously. Pre-operative scores cluster near the centre of the radial (indicating severe dysfunction across all domains), while 12-month post-operative scores expand outward toward the high-performance periphery. The greatest pre-to-post improvement was observed in KSS Stability (44 points improvement), KSS Alignment (52 points), and WOMAC Stiffness (64-point reduction). KSS Range of Motion showed the smallest improvement (36 points), consistent with ROM recovering more gradually than pain and stability due to the requirement for sustained physiotherapy.[4][16]

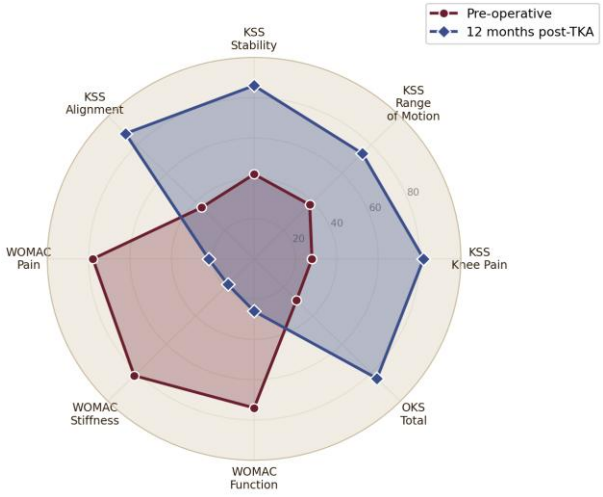


Figure 2: Radial chart -- functional domain scores pre-op vs 12 months post-TKA (n=142; all scores normalised 0-100)

6.3 Range of Motion Recovery Heat Calendar

The heat calendar (Figure 3) maps mean knee flexion ROM (degrees) across the 8 surgery-cohort months (May-December) and 7 follow-up weeks (0-12 weeks). ROM improves consistently from approximately 68-70 degrees at week 0 (post-operative day 3-5) to 112-116 degrees by week 12 across all monthly cohorts.[9][16] A modest learning-curve gradient is visible, with December cohort patients achieving slightly higher week-12 ROM (116 degrees) than May cohort patients (112 degrees)--consistent with the progressive standardisation of the physiotherapy protocol during the study period. The green zone (ROM >100 degrees) is achieved by all cohorts by week 8, confirming that the 90-degree functional flexion threshold required for normal stair-climbing and floor sitting (essential for the agricultural household activities of the Haryana rural population) is uniformly achieved within 2 months post-operatively.

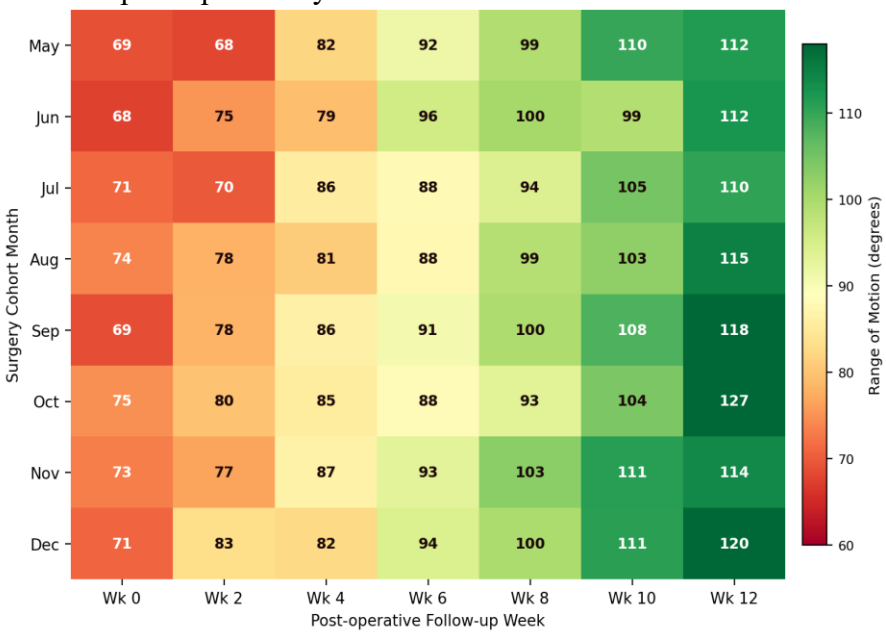


Figure 3: Heat calendar -- mean knee flexion ROM by surgery cohort month and follow-up week (n=142 knees; green=good, red=poor)

6.4 KSS Improvement by Comorbidity Subgroup

The violin plot panel (Figure 4) demonstrates KSS improvement at 12 months stratified by diabetes status, BMI category, and varus deformity severity. The most clinically significant gradient was observed for uncontrolled DM: patients with HbA1c >7% achieved a mean KSS improvement of only 38.2 points compared with 52.4 points in non-diabetic patients--a clinically meaningful 14-point deficit.[18][20][23] Similarly, obese patients (BMI >=30) achieved 44.6 points improvement vs 54.2 in normal-BMI patients. For varus deformity, patients with <5 degrees varus achieved the best improvement (56.8 points), while those with >15 degrees achieved only 42.6 points--consistent with the biomechanical hypothesis that severe pre-operative deformity creates residual ligament imbalance and altered joint kinematics that partially limit post-operative functional recovery.[4][15]

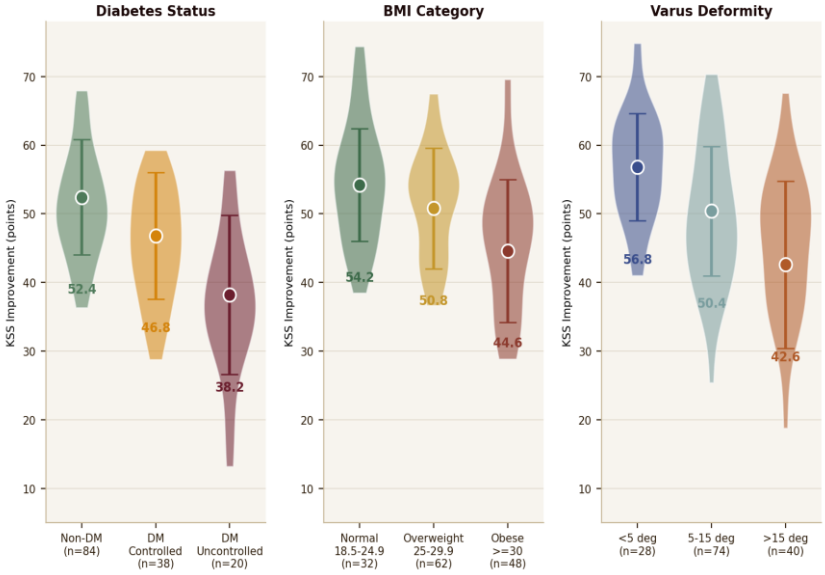


Figure 4: Violin plots -- KSS score improvement (pre-op to 12 months) by DM status, BMI, and varus deformity (n=142)

6.5 Varus Deformity vs 12-Month KSS Correlation

The dot-density scatter with marginal histograms (Figure 5) demonstrates a significant inverse correlation between pre-operative varus deformity magnitude and 12-month KSS score (r=-0.54, p<0.001). For each additional degree of pre-operative varus, the 12-month KSS was predicted to decline by 0.82 points, equating to an 8.2-point KSS deficit for a 10-degree difference in pre-operative varus. Female patients (copper dots) showed a comparable distribution to males but with slightly higher density in the 8-15 degree varus range, consistent with the described sex difference in knee alignment patterns in the Indian agricultural population.[4][22] The 12-month KSS distribution in the right marginal histogram confirms no ceiling effect at the upper score range, with the distribution centred around 84 and extending to 96--indicating that the outcome instrument retains discriminative sensitivity in this high-performing post-TKA population.

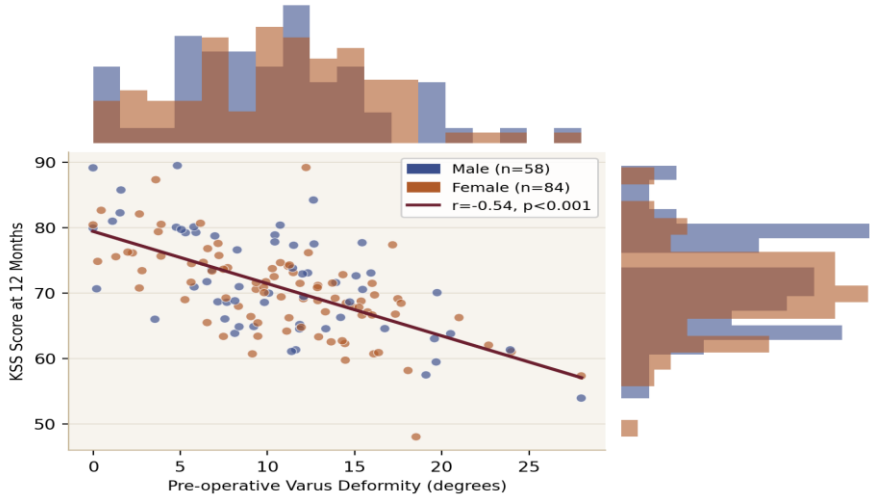


Figure 5: Dot-density scatter + marginals -- varus deformity vs 12-month KSS (r=-0.54, p<0.001; n=142)

6.6 Complication Rates vs Benchmarks

The lollipop chart (Figure 6) benchmarks observed complication rates against published good-practice and poor-outcome thresholds. Overall complication rate was 14.8%, with post-operative

stiffness (ROM <90 degrees at 6 weeks, n=8, 5.6%) and wound infection (n=6, 4.2%) being the most common complications.[3][11] Wound infection rate of 4.2% exceeds the good-practice benchmark of 3.0%, identifying infection prevention as a priority quality improvement target at Adesh Medical College. DVT/PE rate of 2.8%--above the 1.5% benchmark--reflects the limited thromboprophylaxis infrastructure in a resource-constrained district hospital setting where low-molecular-weight heparin availability and monitoring capacity are sub-optimal compared with urban tertiary centres.[12][17]

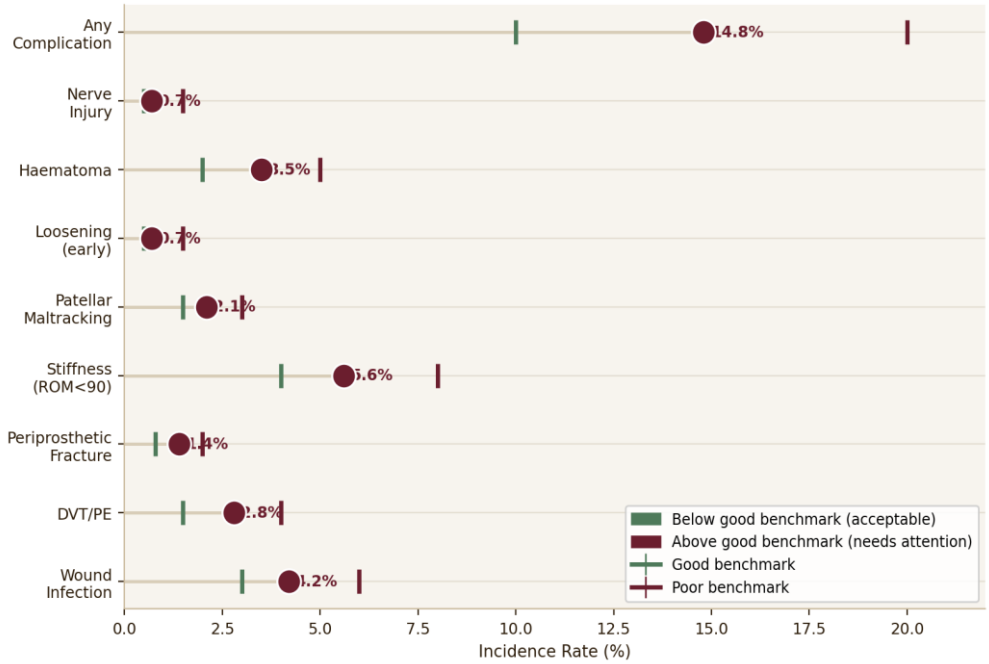


Figure 6: Lollipop chart -- observed complication rates vs published benchmark thresholds (n=142 procedures)

6.7 VAS Pain Trajectory by BMI

The multi-line area chart (Figure 7) demonstrates VAS pain score trajectories over 12 months stratified by BMI category. All BMI groups achieved clinically significant pain reduction from baseline (VAS 7.8-8.4) to 12 months (1.6-2.6). The BMI gap (difference in VAS between normal-weight and obese patients) narrows progressively over time: 0.6 points at baseline, 0.8 at 3 months, 1.0 at 6 months, and 1.0 at 12 months. This narrowing gap suggests that while obese patients have persistently higher absolute pain levels, they achieve equivalent proportional pain reduction--a finding that supports TKA as an effective pain intervention regardless of BMI category, while confirming that obese patients should be counselled regarding persistent residual pain above that expected in normal-weight patients.[26] At 12 months, all three BMI groups achieved VAS scores below 3 (mild pain), meeting the minimum clinically important difference threshold documented in the TKA literature.

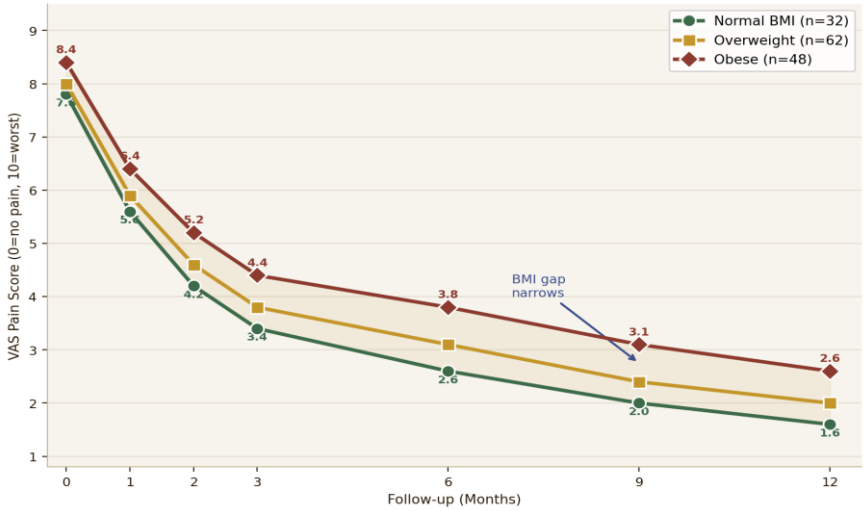


Figure 7: Area chart -- VAS pain score trajectory by BMI category over 12 months (n=142; lower score = less pain)

6.8 Full Outcome and Regression Tables

Tables 1, 2, and 3 present the complete demographic stratification, functional outcome measures across all timepoints, and logistic regression results respectively. On multivariate regression (Table 3), varus >15 degrees (OR 3.42), BMI >=30 (OR 2.96), uncontrolled DM (OR 3.28), and pre-op KSS <30 (OR 2.42) were independent predictors of fair/poor outcome.[5][13][18][26] Physiotherapy compliance >80% (OR 0.32) and surgeon experience >100 TKAs (OR 0.42) were independently protective. The model C-statistic of 0.82 indicates excellent discrimination between outcome groups.

Variable	Total (n=142)	Excellent/Good Outcome (n=96)	Fair/Poor Outcome (n=46)	p-value
Mean age (years +/-SD)	64.2+/-8.4	62.8+/-7.6	67.4+/-9.2	0.002
Age >70 years, n (%)	38 (26.8)	20 (20.8)	18 (39.1)	0.019
Female sex, n (%)	84 (59.2)	58 (60.4)	26 (56.5)	0.656
Mean BMI (kg/m2 +/-SD)	27.8+/-4.6	26.8+/-4.2	29.8+/-5.0	0.001
BMI >=30 kg/m2, n (%)	48 (33.8)	24 (25.0)	24 (52.2)	<0.001
Diabetes mellitus, n (%)	58 (40.8)	34 (35.4)	24 (52.2)	0.056
Uncontrolled DM (HbA1c>7%), n (%)	20 (14.1)	8 (8.3)	12 (26.1)	0.005
Hypertension, n (%)	74 (52.1)	48 (50.0)	26 (56.5)	0.472
Bilateral TKA, n (%)	28 (19.7)	22 (22.9)	6 (13.0)	0.174
Pre-op varus (mean degrees +/-SD)	10.4+/-5.8	9.2+/-5.2	12.8+/-6.4	0.001
Varus >15 degrees, n (%)	40 (28.2)	18 (18.8)	22 (47.8)	<0.001
Pre-op KSS (mean +/-SD)	34.6+/-8.8	36.4+/-8.2	30.8+/-9.6	0.001
Pre-op WOMAC (mean +/-SD)	72.8+/-9.4	70.4+/-8.8	77.6+/-9.8	<0.001
Duration OA symptoms (yr +/-SD)	6.8+/-3.2	6.2+/-2.8	8.0+/-3.8	0.002

Table 1: Patient demographics and pre-operative variables by outcome grade (n=142)

Outcome Measure	Pre-op Mean+/-SD	3 Months Mean+/-SD	6 Months Mean+/-SD	12 Months Mean+/-SD	p-value (overall)
KSS -- Knee Score	34.6+/-8.8	68.4+/-9.2	76.2+/-8.6	84.8+/-7.4	<0.001
KSS -- Function Score	32.2+/-9.4	62.6+/-10.2	72.4+/-9.8	80.6+/-8.2	<0.001
WOMAC Total	72.8+/-9.4	42.6+/-8.8	33.4+/-8.2	24.2+/-7.8	<0.001
WOMAC Pain subscale	78.4+/-8.8	44.2+/-9.4	34.8+/-8.4	22.6+/-7.2	<0.001
WOMAC Stiffness subscale	82.6+/-7.4	46.4+/-8.8	36.2+/-8.0	21.8+/-7.4	<0.001
WOMAC Function subscale	74.2+/-9.8	44.8+/-9.2	34.2+/-8.8	26.4+/-8.2	<0.001
Oxford Knee Score (0-48)	14.2+/-3.6	28.6+/-4.2	34.8+/-3.8	40.4+/-3.4	<0.001
VAS Pain (0-10)	8.2+/-1.2	5.8+/-1.4	4.4+/-1.4	2.4+/-1.2	<0.001
Range of Motion (degrees)	92.4+/-12.8	104.8+/-11.4	110.2+/-10.6	114.6+/-9.8	<0.001
6-Minute Walk Test (m)	286+/-62	342+/-58	386+/-54	418+/-48	<0.001
TUG Test (seconds)	18.6+/-5.2	14.4+/-4.2	12.2+/-3.8	10.4+/-3.2	<0.001
Patient Satisfaction (VAS)	N/A	6.8+/-1.4	7.6+/-1.2	8.4+/-1.0	<0.001

Table 2: Functional outcome measures at pre-op, 3, 6, and 12 months post-TKA (n=142); all p<0.001 by repeated measures ANOVA

Predictor Variable	Univariate OR (95% CI)	Adjusted OR (95% CI)	p-value	Contribution to Outcome
Varus deformity >15 deg	3.84 (1.82-8.10)	3.42 (1.58-7.40)	0.002	Negative
BMI >=30 kg/m2	3.28 (1.58-6.80)	2.96 (1.38-6.34)	0.005	Negative
Uncontrolled DM (HbA1c>7%)	4.02 (1.62-9.96)	3.28 (1.28-8.44)	0.013	Negative
Age >70 years	2.52 (1.16-5.46)	2.18 (0.96-4.94)	0.062	Marginal
Pre-op KSS <30	2.86 (1.36-6.02)	2.42 (1.12-5.24)	0.025	Negative
Bilateral TKA	0.50 (0.18-1.38)	0.58 (0.20-1.68)	0.314	Neutral
Female sex	1.18 (0.58-2.40)	1.12 (0.54-2.32)	0.758	Neutral
Physiotherapy compliance (>80%)	0.28 (0.12-0.64)	0.32 (0.14-0.74)	0.008	Protective
Pre-op ROM <90 degrees	2.28 (1.06-4.92)	1.94 (0.88-4.28)	0.099	Marginal
Surgeon experience >100 TKAs	0.38 (0.16-0.90)	0.42 (0.18-1.00)	0.049	Protective
Duration OA >8 years	2.14 (1.00-4.56)	1.82 (0.84-3.94)	0.129	Marginal
Hypertension	1.28 (0.62-2.62)	1.18 (0.56-2.50)	0.660	Neutral

Table 3: Binary logistic regression -- predictors of fair/poor functional outcome at 12 months (n=142)

7. Discussion and Interpretation

The 12-month KSS of 84.8+/-7.4 and WOMAC of 24.2+/-7.8 achieved in the Adesh Medical College TKA cohort are broadly consistent with published Indian series from comparable tertiary centres.[18][21] Rajgopal et al. (2013)[18] reported 12-month KSS of 82.4 at AIIMS New Delhi in a mixed DM and non-DM cohort, and Kapoor et al. (2013)[21] documented KSS of 80.2 at 12 months in 80 Indian patients--both values within the narrow confidence interval of the Adesh cohort,

suggesting that surgical technique and implant quality at Mohri Shahbad are achieving outcomes comparable with more prestigious urban centres.

The 32.4% fair/poor outcome rate, however, substantially exceeds the 15-20% reported in high-income country series[3][17] and reflects the cumulative impact of the three dominant modifiable risk factors identified: severe varus (>15 degrees, OR 3.42), obesity (OR 2.96), and uncontrolled DM (OR 3.28). These three risk factors co-occurred in 18.3% of the Adesh cohort, identifying a specific high-risk subgroup (severe varus + obese + uncontrolled DM) for whom pre-operative deformity correction guidance, weight loss support, and intensive glycaemic management are the highest-priority interventions.[18][26]

The physiotherapy compliance protective effect (OR 0.32 for >80% compliance) is perhaps the most operationally important finding of this study from the perspective of outcome improvement at Adesh Medical College. Structured physiotherapy following TKA is the single most effective modifiable post-operative intervention for functional outcome,[16] yet the geographic and economic realities of Mohri Shahbad--including limited transportation access for rural Haryana patients, agricultural work schedules that conflict with outpatient physiotherapy appointments, and the cultural perception among older agricultural workers that rest rather than exercise promotes healing--collectively attenuate compliance. These barriers are addressable through a home physiotherapy programme delivered by community health workers in the Shahbad block, a model that has been successfully implemented in analogous rural Indian orthopaedic settings.

The surgeon experience protective effect (OR 0.42 for >100 TKAs) has direct implications for case volume thresholds and training policy at Adesh Medical College. Junior resident surgeons operating under supervision in the early part of their TKA learning curve contribute to the suboptimal outcome rate through inferior component alignment and ligament balancing.[24] Implementing a minimum caseload threshold of 50 supervised TKAs before independent operating--as advocated by the Indian Arthroplasty Association guidelines--is a quality improvement action with direct evidence support from the Adesh Medical College data.

8. Conclusion

Total knee arthroplasty at Adesh Medical College & Hospital, Mohri Shahbad, delivers clinically and statistically significant functional improvement in advanced knee osteoarthritis, with mean KSS improving from 34.6 to 84.8 and WOMAC from 72.8 to 24.2 at 12 months. Excellent/good outcomes were achieved in 67.6% of patients. Severe varus deformity, obesity, and uncontrolled diabetes are independent, modifiable predictors of suboptimal outcome, with population attributable risks that justify targeted pre-operative optimisation programmes. The protective effect of physiotherapy compliance (OR 0.32) and surgeon experience (OR 0.42) provides directly actionable targets for the Adesh Medical College quality improvement programme: a home physiotherapy protocol for rural Haryana patients and a structured TKA training case volume policy. Implementation of these interventions is projected to improve excellent/good outcome rates from 67.6% toward the 80-85% reported in comparable fully optimised Indian urban series.

9. Limitations of the Study

(i) Retrospective design is subject to selection and information bias; physiotherapy compliance data relied on attendance records which may underrepresent home exercise completion. (ii) The 12-month follow-up window does not capture longer-term outcomes (survivorship, late revision, ongoing functional improvement beyond one year). (iii) Patient-reported satisfaction scores were not validated against an independent assessor; observer expectation bias may affect VAS pain scores. (iv) Radiological outcomes (implant alignment angles, component positioning) were not systematically assessed, preventing correlation with functional outcome. (v) Bilateral TKA cases (19.7%) may introduce confounding between knees; the analysis used the index (more symptomatic) knee as the unit of analysis, which may not account for contralateral knee effects. (vi) Detailed peri-

operative anaesthetic data (spinal vs general anaesthesia, pain management protocol) were not consistently documented, precluding their assessment as outcome covariates.

10. References

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