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A Prospective Study of Functional Outcomes of Posterior Stabilised Total Knee Arthroplasty

[1]K. Lingaraju, [2]Ejazul Haq Chand, [3]K. Dhanush, [4]Arjun Rao Pawar, [5]N. Praveen Kumar and [6]Shashikiran M. Pyati

[1-6]Department of Orthopaedics, Mysore Medical College, Mysuru, Karnataka, India

Abstract

Osteoarthritis is thought to be the most prevalent chronic joint disease. Osteoarthritis is a term used to describe both a degenerative disease of synovial joints with its accompanying radiographic signs and a clinical syndrome of pain, stiffness and restricted movement of the joints. Over the past 6 decades there have been tremendous advances in the surgical techniques and implant designs, making Total Knee Replacement (TKR) one of the most commonly performed and successful surgeries in terms of clinical and functional outcome. Women, on average, have a higher prevalence of OA than men. In this study we determine the effectiveness of posterior stabilised total knee arthroplasty in patients of severe osteoarthritis and rheumatoid arthritis functionally. We also determine the post operative complications in patients who underwent posterior stabilised total knee arthroplasty. The aim of this study is to evaluate the functional results of a total knee replacement with posterior stabilisation using WOMAC index. To determine how well WOMAC index is used for the following functional outcome assessments. Patients of both sex belonging to the age group of 30-70 years with severe osteoarthritis and rheumatoid arthritis presenting to the orthopaedic department of our institution. Our prospective observational study is a series of 14 cases of osteoarthritis and rheumatoid arthritis treated by Posterior stabilised Total Knee Arthroplasty. This study was conducted over a period of 2 years i.e., 2022 to 2024. Patients were followed at an interval of 1 month, 3 months, 6 months and 12 months. Outcome was assessed using WOMAC index. Out of the total 14 patients who were treated with posterior stabilized total knee arthroplasty, 5 patients were male and 9 patients were female. Among both male and female patients, based on the WOMAC index, all(100%) had excellent prognosis. Mean WOMAC index before the procedure was 54.00±7.67. The Mean WOMAC score after the procedure was 89.65±0.95 at 6 weeks, 91.56±1.03 at 3 months, 94.36±1.03 at 6 months and 95.70±0.95. The increase in mean WOMAC index were statistically significant compared to pretreatment levels. According to the WOMAC index, total knee replacement surgery significantly improves functional outcome and activities of daily life. This indicates that the patients' quality of life can be greatly enhanced by this treatment. Thus, we may say that for people with knee discomfort or disability, total knee replacement surgery is a worthwhile option.

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Key Words

Osteoarthritis, total knee arthroplasty (TKA), WOMAC index

Corresponding Author

Arjun Rao Pawar,
Department of Orthopaedics, Mysore Medical College, Mysuru, Karnataka, India

Author Designation

[1]Associate Professor
[2]Assistant Professor
[3]Senior Resident
[4,5,6]Postgraduate Resident

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INTRODUCTION

Osteoarthritis is considered to be the most prevalent chronic joint disease. The incidence of osteoarthritis is rising because of the aging population and the epidemic of obesity. Pain and loss of function are the main clinical features that lead to treatment, including non-pharmacological (include exercise, weight loss, physiotherapy), pharmacological (analgesics, anti-inflammatory drugs, intra-articular steroids and hyaluronic acids) and surgical approaches[3].

The main indications for performing Total Knee Replacement are joint pain and functional limitation and Current research with total knee replacement is directed at refining the design to improve patient quality of life. The desire to achieve greater knee motion and strength motivates researchers to further enhance knee replacements so as to be equal to normal knee. With availability of various prosthesis, it became necessary to conduct studies for assessing the outcome of different prosthesis and hence there are different scoring systems were formulated for assessing the outcome of total knee replacement.

Age Group: The study is conducted among the patients aged between 30-70 years of age.

Pathology: Osteoarthritis is classified into 2 groups primary and secondary. In that primary is chronic degenerative disease and associated with age. As the age increases water content of the cartilage decreases thus making them more susceptible to degradation. This disease is associated with modifiable and non-modifiable risk factors such as lack of exercise, genetic factors, occupational injury, trauma, diabetes, frequent kneeling or squatting for a long time and gender. Prevalence of osteoarthritis in India is 22% to 39%. It is more common in women as compared to male[4].

Primary OA: It occurs more frequently than secondary OA. Its nature is idiopathic. In older people without a history of disease, it is typical. The main cause is alterations in weight-bearing joints brought on by aging-related wear and tear.

Secondary OA: Owing to risk factors including obesity, infection like TB, suppurative, osteonecrosis, osteochondritis dissecans, gout and rheumatoid arthritis, as well as trauma such as fractures, dislocations or subluxations of the patella, ligamentous injuries and torn meniscus, including surgical trauma-meniscectomy.

Total Knee Replacement Components: There are 3 separate components of TKR:

- Femoral component
- Polyethylene insert
- Tibial component

While many changes have been made to the design and technique of knee arthroplasty, there has been relatively little improvement of patient reported outcomes seen in the literature[5-16].

There have also been reports of early femoral component loosening, tibial post fracture and tibial component loosening with the posterior-stabilized version of this prosthesis designed for higher degrees of flexion.

WOMAC Index: The clinical and functional outcomes were evaluated by WOMAC INDEX. The examination of hip and knee osteoarthritis uses the Western Ontario and McMaster Universities Arthritis Index (WOMAC). The 24 items on the self-administered questionnaire are broken down into 3 subscales. The WOMAC evaluates three distinct factors: function (17 questions), stiffness (2 questions), and pain (5 questions), each of which is measured with questions. Visual Analog Scales and Likert-Boxes are the two formats in which the original WOMAC is offered. For each dimension, a summative score was determined. The total scores were converted into a scale from 0 to 100 similar to the Swedish WOMAC index. Similar to other outcome measures in orthopedics, 100 was regarded as the ideal result. 0 denotes severe symptoms and functional incapacity, while 100 indicates neither symptoms nor impairment.
A summary score was calculated for each dimension, as for the original version of WOMAC, with maximum scores of 20, 8 and 68 for the Likert version. However, to enable comparison across subscales and to other outcome instruments, the summed scores were transformed into a 0-100 scale.

In 1982, Western Ontario and McMaster Universities created the WOMAC Index. WOMAC has been linguistically certified and is available in over 65 languages. The WOMAC can be taken on paper, over the phone, or online and takes about 12 minutes to complete. There are no discernible differences between the computerized and mobile versions of the test and the paper form[17].

MATERIALS AND METHODS

The study will be conducted on a series of 14 cases of patients with severe osteoarthritis, rheumatoid arthritis who underwent cemented posterior stabilised total knee replacement.

This study is conducted over a period of 2 years. Clinical and functional outcome evaluated using WOMAC index at 6weeks, 12 weeks, 6 months and 12 months.

Radiological outcome is evaluated using postoperative x-rays AP view in standing position at 6 weeks, 3 months, 6 months and 12 months.

Source of Data: Patients of both sex belonging to the age group of 30-70 years with severe osteoarthritis and rheumatoid arthritis presenting to the orthopedic department of K.R. Hospital attached to Mysore Medical College, Mysore.

Method of Collection of Data (Sampling Procedures if Any)

Study Design: Prospective observational study conducted at K.R. Hospital, Mysore.

Sampling: Purposive.

Duration of Study: From September 2022-September 2024.

Statistical Methods: Sample size was calculated using formula.

$N= z^2pq/D^2$

Where,

Z = Two tailed probability with 95% C.I.

P = Proportion of prevalence = .01.

Q = 1-p = .99.

D = Margin of error

N = 14

The sample size came around 14. Calculation is based on the estimated no. Of severe osteoarthritis and rheumatoid arthritis cases as per hospital records.

Methodology: All cases who have been diagnosed with severe osteoarthritis and rheumatoid arthritis and satisfy the inclusion criteria and are admitted in the K.R. Hospital, will be considered for the study.

Pre operative Evaluation: After taking consent, physical examination will be done for the assessment of both the motor and sensory component of all lower extremity peripheral nerves and ROM at the knee joint.

Operating Setup: Patient placed in a supine position. Under SAB or GA, total knee replacement is done with a median parapatellar approach. Posterior cruciate ligament is sacrificed and replaced with a femoral cam and tibial post component in cemented posterior stabilised cemented total knee replacement surgery.

Post Operative Rehabilitation: Passive-assisted range of motion started from the post operative day 1 as per pain tolerance.

Patients were followed up, till 12 months and followup were evaluated using WOMAC index

Inclusion Criteria: Patients were selected upon following criteria

- Patients aged 30-70 years.
- Patients with severe Osteoarthritis (according to Kellgren-Lawrence scale).
- Patients with severe Rheumatoid arthritis.

Exclusion Criteria

- Trauma to the knee
- Severe soft tissue compromise
- Active infection at the knee joint (septic arthritis)
- Bedridden patients
- Patients with BMI >35

Follow Up Protocol: At 6weeks, 12 weeks, 6months and 12 months.

Outcome Measures: Clinical and functional outcome measured using WOMAC index.

Informed Consent: After explaining the disease condition and treatment with Posterior Stabilised Total Knee Arthroplasty in their native language, informed consent was acquired from all the patients. All the patients agreed for the procedure and to participate in the study. The consent form was signed by all the patients and their nearest relatives.

Clinical Assessment:

- Detailed history of all patients was taken.
- All patients were assessed clinically and functionally using the WOMAC index.
- The preoperative medical evaluations of all patients were done to prevent potential complications that can be life threatening or limb threatening.
- Any limb length discrepancies were noted. Presence of any hip and foot deformities were assessed.
- The extensor mechanism was assessed for any quadriceps contractures.
- The knee deformities were examined for any fixed varus or valgus deformities or presence of any fixed flexion contractures.

Operative Procedure: All patients after thorough pre-op evaluation were taken up for surgery by the same surgical team under general or regional Anaesthesia with the patient in supine position and

knee flexed to 90 degrees. Tourniquet was applied at the thigh region and sterile preparation done from thighs to toes and draped.

Skin Incision: A mid-line skin incision will be made four inches above the superior border of the patella, starting over the medial section of the quadriceps tendon. Following the patella and patellar tendon's medial boundary, the incision will continue in a gradual curve. After that, it will pass across the tibia's proximal end and terminate inferior to the tubercle. The knee joint will subsequently be exposed, either by a medial parapatellar arthrotomy or another method.

Medial parapatellar incision done and patella retracted laterally. Distal femoral cuts taken according to the template made pre-operatively. Proximal tibial cuts taken after templating and extramedullary tibial alignment. Anterior and posterior chamfers cut and prosthesis sizing done. Extension gap checked and trial

Fig 1:Distal femoral cut taken

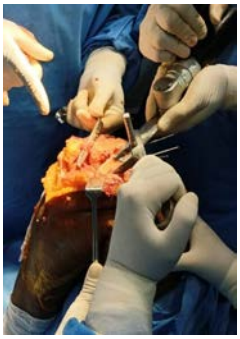

Fig 2: Proximal tibial cut taken

Fig 3: Prosthesis incorporated

Fig 4:Pre operative AP x-ray in standing

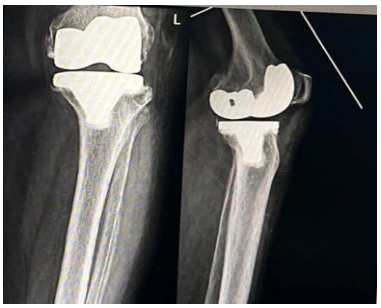

Fig 5: Post operative x-ray at 1 year followup

Fig 6:Active knee flexion at 1 year follow-up

Fig 7:Active knee extension at 1 year follow-up

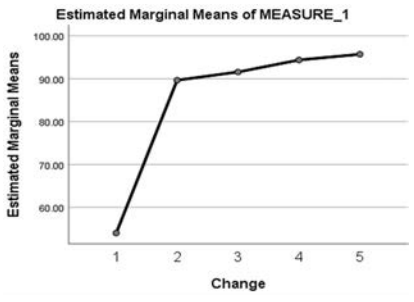

Fig. 8: Change

Table 1: T-Test

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Age	Male	5	62.4000	5.85662	2.61916
	Female	9	59.1111	9.00617	3.00206

Table 2: T-Test

Independent Samples Test

	t-test for Equality of Means			
	t	df	Sig. (2-tailed)	Mean Difference
Age	.729	12	.480	3.28889

Table 3: T-Test

		Side	
		Frequency	Percent
Valid	Right	7	50.0
	Left	7	50.0
	Total	14	100.0

Table 4: T-Test

Indication

		Frequency	Percent
Valid	Osteoarthritis	12	85.7
	Rheumatoid arthritis	2	14.3
	Total	14	100.0

Table 5: T-Test

Superficial-Infections

		Frequency	Percent
Valid	Yes	1	7.1
	No	13	92.9
	Total	14	100.0

Table 6: T-Test

Descriptive Statistics

	Mean	Std. Deviation	N
pre-operative	54.0000	7.67000	14
at-6-weeks	89.6500	.95253	14
at-3-months	91.5643	1.03894	14
at-6-months	94.3643	1.03968	14
at-12-months	95.7000	.95676	14

Table 7: T-Test

Tests of Within-Subjects Effects

Measure: MEASURE-1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Change	17190.273	4	4297.568	381.038	.000
Error(Change)	586.487	52	11.279		

prosthesis put and checked for varus and valgus instability. Cement applied and prosthesis put after pulse lavage. Polyethylene spacer put and checked for varus/valgus instability. Wound wash done and incision sutured in layers after putting drain of 14F. Staples applied and wound dressing done

Post-Op Protocol: The patient's knee was immobilized in a Jones compression bandage and a knee immobilizer immediately postoperatively. The patients were started on IV antibiotics and DVT prophylaxis in the form of subcutaneous low molecular weight heparin.

- 1st post op day, the patient was taught static quadriceps exercises.
- 2nd post op day, the dressing was debulked and wound inspected. Patient was made to walk full weight bearing within the limits of pain with the knee immobiliser and advised to continue static quadriceps exercises.
- 4th post op day, knee flexion was started and the patient was taught dynamic quadriceps exercises.
- IV antibiotics were given for the first 5 days post op and then switched over to oral antibiotics for the next five days. DVT prophylaxis was given for the first 3 days post operatively.
- 12th post op day, staples were removed and the patient was advised to continue regular physiotherapy.

RESULTS AND DISCUSSIONS

In our prospective study conducted over 14 patients, all were subjected to posterior stabilized total knee arthroplasty. Patients were analysed for clinical

and functional improvement using the WOMAC index.

In the group, 5 were male patients and 9 were female patients. Among both male and female patients, all had excellent prognosis. There was equal distribution of side dominance (right-7 and left-7).The main indication for surgery was primary knee osteoarthritis in 12 patients (85.7%), Followed by osteoarthritis due to rheumatoid arthritis in 2 patients (14.3%).

For the total score and each of the parameters, higher score implies lesser disability. The mean total preoperative score was (54.00). The maximum score being, 63.5 and the minimum, being 42.7. Post operatively at 1 year follow up, the total mean score was 95.7, with 93.7 being the minimum and 96.8 being the maximum. There was a statistically significant improvement ($p<0.001$) in the post-operative score when compared to preoperative score.

The score is reported as 80-100 for excellent results, 70-79 being good, 60-69 fair, 40-59 poor and below 40 for a very poor result. Pre operatively 1[7%] patient had a very poor score and [71%]10 patients had poor scores. Post operatively 14[100%] patients had excellent results and no patient had a poor outcome.

Complications were seen in 1 patient (7%), the most common complication seen was Superficial infection, Dislocations, Nerve injury, polyethylene wear and Loosening were not seen in any patients included in the study during the study period. 13 patients (93%) did not have any complications.

CONCLUSION

As a result of its strong construct and validity, the WOMAC INDEX can be utilized as the scoring system to evaluate the functional outcome of total knee replacement surgery. Additionally, it has a positive correlation with a better functional outcome following total knee replacement surgery and hence can be easily correlated.

The posterior stabilized design was proven to be more efficient with easier handling than other designs out of the multitude of implant types available for total knee replacement[18].

Following total knee replacement, our patients were substantially better able to reproduce joint position and increase mobility with increased activity levels and reduced discomfort. According to C. Buz Swanik. Retained capsulo-ligamentous structures and decreased discomfort and inflammation may be the causes of these outcomes[19].

According to the WOMAC Index, this study demonstrates that total knee replacement surgery significantly improves functional outcome and activities of daily life. This indicates that the patients' quality of life can be greatly enhanced by this treatment. Thus, we may say that for people with knee discomfort or disability, total knee replacement surgery is a worthwhile option.

The major limitation of our study was a small sample size and short duration of study which led to some parameters not showing statistically significant difference but could have yielded different results had the sample size been larger and the late outcomes and complications could have been studied better in long duration of study.

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