

Early Clinical and Functional Outcome of Primary Total Knee Replacement with Posterior Cruciate Substituting Prosthesis for Primary Knee Osteoarthritis Using 2011 Knee Society Score

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Abstract

Background: Primary knee Osteoarthritis (OA) is the commonest articular disease in middle age and elderly people. Primary total knee replacement (TKR) is a known world-wide standard and definitive treatment of primary knee OA following failed adequate non-operative management. It is of clinical importance to assess the clinical and functional outcome of TKR to prognosticate the severity of primary knee OA. The new (2011) knee society scoring system (nKSS) is both surgeons and patients' assessment tool for the treatment outcome of TKR. **Study Design:** Prospective interventional analytical study. **Aim and Objective:** The aim of the study was to determine early clinical and functional outcome of primary total knee replacement in patients with primary knee osteoarthritis using nKSS. The objectives were: 1) To determine the pre-operative nKSS and post operative nKSS; 2) To determine relationships between pre-operative nKSS and post operative nKSS at 6 weeks, 3, 6, 9 and 12 months; 3) To determine the complication rates in patients undergoing primary TKR in the study centre. **Methods:** A prospective interventional study of 59 patients aged 51 to 70 years who had 67 Total Knee Replacements (TKRs) participated in the study between November 2015 to June 2018 at National Orthopaedics Hospital, Lagos, Nigeria. Patients' socio-demographic data, pre-operative and post-operative nKSS system were recorded at 6 weeks, 3, 6, 9 and 12 months during follow up. The data were

analyzed using Statistical Package for Social Science (SPSS). **Results:** There were 41 females and 18 males (M:F = 1:2.3). There were total of 67 TKRs with 31 right TKRs, 20 left TKRs and 8 staged bilateral TKRs. The participants' age ranged from 51 to 70 years with the mean age of 59.5 (± 8.5) years. Four patients did not complete the study due to various reasons. The remaining 55 participants completed the study period with progressive improvement of their post-operative nKSS at 6 weeks, 3, 6, 9 and 12 months post-operatively when compared with pre-operative nKSS (P value < 0.05). All the patients studied had improved post-operative nKSS with a faster rate of improvement in those with lower pre-operative nKSS. However, One-way Analysis of Variance (ANOVA) showed no statistical significant relationship between the lower pre-operative nKSS and post-operative nKSS on follow up (P value > 0.5). **Conclusion:** This study revealed improved early clinical and functional outcome of primary total knee replacement in primary knee osteoarthritis using nKSS in all the studied patients. There is no significant negative effect of lower pre-operative nKSS (and its components) on the post-operative nKSS outcome.

Keywords

Clinical and Functional Outcome, 2011 Knee Society Score, Primary Total Knee Replacement, Primary Knee Osteoarthritis

1. Introduction

Primary knee Osteoarthritis (OA) is a pandemic disease of global importance which leads to disability and negatively affects the daily activities of patients [1]. It is the commonest articular disease in middle age and elderly people [2] [3]. It is a leading cause of physical and functional disability, cause of socioeconomic burden and expense, including time lost from work, medical care, and disability support not only to the patient but also to the family members and community [1] [4] [5]. These patients may present with gradually developing knee pain that is aggravated or triggered by activity and improve with rest, knee joints instability, angular deformity, recurrent swelling and post-inactivity stiffness [3] [6] [7].

Total knee replacement (TKR) is a major technical Orthopaedic procedure which has become a very successful procedure for treating various forms of arthropathies [8] [9]. TKR is a known world-wide standard and definitive treatment of primary knee OA for deformity that limits functions, causes instability and persistent incapacitating pain from the pathology despite adequate non-operative management [8] [9]. TKR procedure is now gaining more attention in Nigeria and perhaps sub-Saharan Africa due to growing interest among orthopaedic surgeons, increasing technical expertise and facilities as well its increasing awareness among patients and their relatives. The assessment of knee function, pathology and its implication on patient's quality of life is very important to provide an objective evaluation of treatment interventions for

clinical and research contexts. There are numerous assessment tools or scoring systems with varying sensitivity and validity and many have undergone up-grading, reviews and modifications over the years. The new (2011) Knee Society Score (nKSS) has improvement on the old KSS and it has been formally validated in a multi-centred trial study using standard psychometric procedures and considered superior assessment tool pre- and post TKR [10].

The aim of this study was to examine in our practice, early clinical and functional outcome of primary total knee replacement in patients with primary knee osteoarthritis using nKSS while the objectives of this study were: 1) To determine the pre-operative nKSS and post operative nKSS at 6 weeks, 3, 6, 9 and 12 months respectively; 2) To determine relationships between pre-operative nKSS and post operative nKSS at 6 weeks, 3, 6, 9 and 12 months respectively; 3) To determine the complication rates in patients undergoing primary TKR in the study centre.

2. Patients and Methods

Patients aged 51 to 70 years with clinical (symptomatic) primary knee OA who had primary TKR after failed non-operative measures were studied over a periods of 36 months (November 2015 to June 2018). The exclusion criteria includes: patients with previous knee pathology or surgery, congenital or structural limb deformity, extensor mechanism dysfunction, clinical features of neurovascular deficits, active infection in any part of the body, inability to comply with treatment guideline protocols or uncontrolled medical condition(s), peripheral vascular disease and associated hip and/or ankle pathology.

Informed consent was obtained from all recruited patients. The indication for the TKR was failure of non-operative care with persistent incapacitating pain and/or functional knee failure due to severe deformity resulting from primary knee OA. After the careful selection of the patients, each patient was educated about the TKR, physiotherapy and postoperative protocols. Symptomatic primary knee OA was diagnosed using triad of detailed history taking, physical examinations and knee radiographs. Additional investigations were appropriately done based on the patient's pathology rule out differentials and confirmed associated joint pathology.

Personal information and information on symptoms of primary knee OA as well as nKSS were obtained using questionnaires (designed) that was incorporated into nKSS which was tested for ease of understanding and clarity among test sample of population before administered for the studied group. The TKR prosthesis used was cemented posterior cruciate substituting for all the patients. All the patients had subarachnoid block anaesthesia. Tourniquet was used for all the participants on the proximal third of the thigh to reduce blood lose. A mid-line anterior knee surgical approach was used (with medial para-patellar capsulotomy) in all the cases. Standard peri-operative care was observed which include prophylactic antibiotics, deep vein thrombosis (DVT) prophylaxis (physi-

cal and pharmacological), adequate analgesia and all patients commenced ambulation with walking aids (physiotherapy) as tolerated within 24 - 72 hrs post-operatively with or without removal of closed drain from the surgical wound. Patients were discharged home between 6 - 14 days after TKR. Sutures were removed between 14 - 18th day after TKR. Early clinical and functional statuses were assessed at 6 weeks, 3, 6, 9 and 12 months after TKR by using the nKSS system.

The nKSS has been reported to be broadly applicable and to accurately characterize patient outcomes after TKR (10). Statistical analysis showed the internal consistency, construct and convergent validity, and reliability of the separate subscale measures (10). It is a validated instrument Scoring System based on surgeon- and patient-generated data, adapted to the diverse lifestyles and activities of patients with TKR. This tool allows surgeons to appreciate differences in the priorities of individual patients and the interplay among function, expectation, symptoms, and satisfaction after TKR (10). The nKSS consist of 1) Patient Demographics which includes a detailed modification of the Charnley Functional Classification and included at each evaluation period since the functional classification can change with length of follow-up, 2) Objective Knee Score which is completed by the surgeon or researcher, 3) Patient Expectations and Satisfaction which is completed by the patients. They are important in the clinical and functional assessments of patients undergoing TKR and feature prominently in the new KSS, 4) Functional Score for the patient to fill.

The data that was generated from this was subjected to statistical analysis using Statistical Package for Social Science (SPSS) version 24.

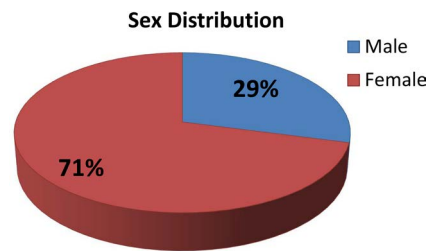
3. Results

Fifty nine patients with primary knee OA who had primary TKR were studied. There were 41 females and 18 males with a total number of 67 knees. There were 31 right TKRs, 20 left TKRs and 8 staged bilateral TKRs. The male to female ratio was 1:2.3. The participants' age ranged from 51 to 70 years with the mean age of 59.5 (± 8.5) years. Four patients with unilateral TKR were excluded from final analysis: 1 (1.7%) died of pulmonary embolism, 1 (1.7%) patient voluntarily declined from the study, 1 (1.7%) patient with superficial surgical site infection who was not interested in the study again, though the infection resolved, and 1 (1.7%) patient with deep surgical site infection who eventually declined further treatment in the study centre despite sections of counselling against that.

A total of 55 (93.2%) participants (39 females and 16 males) who had 63 TKRs completed the study period (21 months), hence were analyzed. Forty one (74.5%) of the participant are married, 11 (20.0%) are widow/widowers and 3 (5.5%) participants are divorcees. The duration of symptoms of the primary knee OA ranged from 2 to 13 years with mean duration of 7.9 years.

Figure 1, Figure 2, charts and tables show the distributions of TKR between the sex and limbs, and the nKSS, its components and changes with the scores after TKR at pre-operative, 3, 6 and 12 months post operative periods.

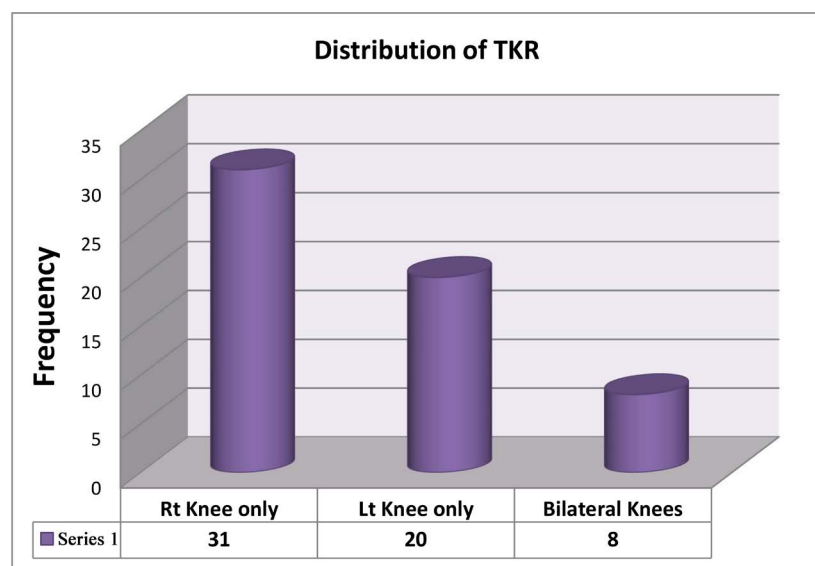
The distribution of the TKR between the sexes



Note: Majority of the participants were females (M:F = 1:2.4).

Figure 1. Sex Distribution.

The distribution of the TKR between the limbs (right, left or both)



Key: Rt-Right; Lt-Left. **Comments:** Majority (52.5%) of the TKRs were done on the right knees; Eight patients (13.6%) had staged bilateral TKRs (16 knees).

Figure 2. Laterality of the knees involved among those who completed the study.

4. Discussion

This study involved 59 patients (41 females and 18 males) with primary knee OA who had 67 TKR (31 right TKRs, 20 left TKRs and 8 staged bilateral TKRs) and followed up till 12 months after surgery. The participants had male to female ratio of 1:2.5, age ranged from 51 to 68 years (59.5 ± 8.5). This ratio is similar to reports from many hospital-based studies in Nigeria, that is with higher incidence in females than males [11]. Similar incidence was reported in a previous pilot study at the study centre [12]. Among the study population, 8 (14%) patients had staged bilateral TKRs. This bilaterality is in keeping with the report that 10% - 20% of the patients with primary knee OA may need bilateral TKR in less than a year intervals [12]. The pattern in this study is also similar with the findings in literature that primary knee OA is commoner among middle age and elderly. Also *Anyaehe et al.* in study of 45 knees with TKR from 38 patients

showed similarity of gender, limbs involved, duration of symptoms before TKR and age distribution among the patients [13]. In another centre in Eastern part of Nigeria, *Katchy et al.* studied 52 (20 males and 32 females) patients which revealed a similar distribution of gender, laterality, age distribution and symptoms duration before TKR among the patients like what was noted in this study [14]. *Katchy et al.* also reported 18 (26.47%) valgus knees deformity (mean $22.07^\circ \pm 5.73^\circ$), 12 (17.65%) varus deformity (mean $14.69^\circ \pm 2.84^\circ$), 8 (11.77%) knees with flexion deformity ($10.2^\circ \pm 1.32^\circ$), and 30 (44.11%) knees without any angular deformity [14].

The long duration of symptoms (mean of 7.9years) and natural history of the pathology which is progressive and showed that our patients in this part of the world usually present for TKR at advanced stage of knee OA, after failed conservative form of care from different modalities. The marital status of the participants (74.5% married, 20.0% widow/widowers and 5.5% divorcees) reflected the age at presentation (middle age and elderly) and the socio-cultural nature in the studied population.

The study showed a progressive improvement of post-operative scores nKSS at 6 weeks, 3, 6.9 and 12 months when compare with pre-operative nKSS. This post-operative nKSS improvement includes all the components of nKSS (Objective Knee Scores, Patient Satisfaction, Patient's expectation and Functional Activities) as shown in **Table 1**. The post-operative scores nKSS was not significantly affected by the level of pre-operative scores nKSS. The rate of clinical improvement was faster and statistically significant especially in the first 6 months post operative ($p < 0.05$) as shown in **Table 2** above, while thereafter the recovery of nKSS almost plateaux with ($p > 0.05$). This showed that patients were unlikely to gain more KSS after these periods. This is similar to previous report of TKR by *Ugbeye et al.* on their preliminary results of TKRs at NOHI, Lagos in 2009 [9]. The improvement may be as a result of the replacement of the diseased joint with conforming artificial joint prostheses. *Kuroda et al.* [15] also reported

Table 1. Mean score comparative of different components of KSS.

nKSS	Pre-Op	6 Wk Post Op	12 W Post Op	6 Mnth Post Op	9 Mnth Post Op	12 Mnth Post Op	Max Score Possible
OKS	33.70	75.83	81.46	84.56	86.67	87.10	102
PS	10.59	20.52	27.54	32.19	33.80	34.60	40
PE	8.50	10.41	11.81	12.55	13.41	13.60	15
FA	27.07	50.57	73.67	82.93	87.01	88.20	100
tKSS	79.86	157.33	194.48	212.23	220.89	223.50	257

Key: nKSS: New Knee Society Score; OKS: Objective Knee Scores; PS: Patient Satisfaction; PE: Patient's Expectation; FA: Functional Activities; tKSS: Total Knee Society Score; Pre-Op: Pre-Operation; Wk: week; Mnth: Month; Max SP: Maximum Score Possible. **Comments:** There was progressive improvement of KSS at post operative periods; The significant improvement was noted up to 6 months post-operative period; None of the patients attained maximum possible score for the length of follow up; The pre-operative nKSS did not determine the post operative nKSS as in indicated above.

Table 2. Relationships between Pre-OpKSS and Post-OpKSS using one-way ANOVA.

nKSS	Pre-Op	6 Wk Post Op	12 Wk Post Op	6 Mnth Post Op	9 Mnth Post Op	12 Mnth Post Op
Mean	79.86	157.33	194.48	212.23	220.9	223.5

Key: ANOVA: Analysis of Variance; nKSS: New Knee Society Score; Post-Op: Post-Operation; Pre-Op: Pre-Operation; Wk: week; Mnth: Month. **Comments:** There is progressive increment in the mean of total KSS from pre-operative values to the respective post-operative values. Using one-way Analysis of Variance (ANOVA), there is statistical significant relationship (improvement) between the pre-operative KSS and KSS on follow up with p value < 0.05. (0.01, 0.03, 0.04 at 6 weeks, 12 weeks and 6months respectively) while the respective improvements after 6months were not statistically significant (p > 0.05).

similar pre- and post TKR KSS in the study of 49 patient with 79 TKRs where preoperative KSSs were positively correlated with the postoperative symptoms, objective Knee scores, patient satisfaction, patients' expectation and functional activities components of the 2011 KSS score correlated with others postoperatively. The similarity of the post-operative KSS in this study with *Kuroda's* [15] report may be due to the similar follow up periods in both studies. *Girish* in India, reported in one-year follow up for clinical and function outcome of 60 TKRs using Posterior cruciate substituting prosthesis the improvement of pre-operative clinical score and functional KSS score of 24.7 and 41.2 to post-operative score of 89.9 and 87.8 respectively with significant association of improvement of knee clinical score (KCS) and knee functional score (KFS) post-operatively [16].

Relationships between mean of Pre-Operative nKSS and Post-Operative KSS mean using one-way Analysis of Variance (ANOVA) in **Table 2** revealed progressive increment in the mean of total KSS from pre-operative and post-operative respectively with a statistically significant relationship (improvement) p value < 0.05. This is similar to some previous studies [13] [15].

5. Conclusion

The early outcome of this study (up to 12-month follow up) showed a progressive clinical improvement and increases in KSS especially in the first 6 months after TKR with p value < 0.05 (0.01, 0.03, 0.04 at 6 weeks, 12 weeks and 6 months). The pre-operative new Knee society Score did not determine the post operative new Knee society Score.

Recommendations

- 1) Every patient going for TKR should have pre-operative new KSS documented to compare with the early outcome.
- 2) Pre-operative counseling and the informed consent mainly on pre-operative nKSS should not be overemphasized as the later may not predict the outcome of TKR.

Future Research Questions

- 1) The effects of radiologic grading severity on TKR procedure complexity like bone lose, soft tissue balancing and duration of the surgery.

- 2) Effect of Body Mass Index on radiologic severity and KSS.
- 3) Effect of radiologic grading severity and pre-operative KSS on the post operative hospital stay.

The Researchers' Level of the Participation

All authors fully and actively participated in the stages of the study and manuscript writing.

Limitations of the Study

- 1) A multi-centered study with higher sample size will be more statistically significant.
- 2) A longer follow-up period may yield long term outcome details.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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