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STAGED VERSUS SIMULTANEOUS APPROACH IN COMPLEX BILATERAL TOTAL KNEE REPLACEMENT: EXPERIENCE FROM TERTIARY INSTITUTION IN NIGERIA

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ABSTRACT

Background: **Bilateral end-stage knee osteoarthritis is a common presentation. The decision facing both patient and surgeon is whether to undertake the replacement of both knees in one sitting i.e. simultaneous bilateral total knee replacement (SMTKR) or to undertake this as a staged bilateral total knee replacement (STTKR). The decision is made harder by the presence of severe coronal and sagittal plane deformities and associated bone loss. We present our results of treating such patients with a focus on a trilogy of cost, complication and functional outcome following SMTKR.**

Methodology: **A retrospective review of 31 patients who presented with bilateral knee arthritis. 19 underwent SMTKR and 12 underwent STTKR. Data on the trilogy of complication, cost and functional outcome were collected and analysed**

Result: **Our cohort of patients was overwhelmingly female in both groups at overall F/M = 30/1. Patients in the SMTKR group were slightly younger at a mean of 65 years compared to 69 years in the STTKR group. Mean Oxford Knee Score (OKS) improved significantly in all groups, mean of 54 in SMTKR and 56 in the STTKR groups. There was one fatality in the STTKR from upper GI bleeding and 1 revision for bone graft failure. The overall cost is less with SMTKR.**

Summary: **SMTKR is a safe and effective undertaking in properly selected patients with bilateral end-stage knee arthritis with severe deformities. Significant experience is however needed to successfully tackle complex deformities and such procedures should be undertaken by experienced arthroplasty surgeons.**

Keywords: Osteoarthritis, Simultaneous, Staged, Arthroplasty, Complex deformities

INTRODUCTION

Total knee replacement results in excellent relief of pain, restoration of function and significant improvement in the quality of life of those with end-stage knee arthritis.[1] Because total knee arthroplasty has only recently become more widely available in Nigeria, many of our patients have had no option but to put up with the disability of end-stage knee arthritis. Patients are now coming forward for total knee replacement, many of who present with bilateral often severe longstanding knee osteoarthritis. The decision facing both patient and surgeon then is either to replace both knees in one sitting under the same anaesthetic (simultaneous bilateral total knee replacement, SMTKR) or replace one knee first followed by replacement of the other knee after an interval of time (staged bilateral total knee replacement, STTKR). Compounding this decision is the additional need to undertake the complex reconstruction of one or both knees for severe coronal plane deformities often with significant bone loss and flexion contractures.

Recent discussions about total knee replacements had focused on the trilogy of cost, complications, and outcome[2] with continuing debate regarding the safety of SMTKR.[3,4,5]

Given the concerns regarding an increased risk of complication with SMTKR, is this approach justified in patients who in addition require complex reconstruction of one or both knees for severe deformity?

The aim is to present our experience with bilateral total knee replacements for complex bilateral knee osteoarthritis, focusing on functional outcome, cost and complication with both SMTKR and STTKR.

METHOD

We undertook a retrospective search of our arthroplasty registry to identify all patients who underwent bilateral total knee replacement between January 2015 and December 2018 either as SMTKR or STTKR. Exclusion criteria were revision surgery and unilateral arthritis.

Thirty one patients presented to us within the review period with bilateral knee problems requiring total knee replacement. Nineteen of these patients had SMTKR while twelve patients had STTKR.

For those who underwent the staged procedure, determinants were patient preference, age above 80 years, significant co-morbidities particularly cardiorespiratory, religious beliefs (Jehovah's witness) and lack of funds for two knees in one sitting.

All patients underwent standard pre-operative assessment in consonance with our hospital care pathway and patients requiring further specialist medical review were referred as appropriate and optimised. All patients were admitted one or two days before surgery. Pre-operative antiseptic wash was undertaken the night before surgery.

The patients had regional anaesthesia- combined spinal and epidural block which was also used for postoperative pain management. Prophylactic antibiotics were given before the incision and when SMTKR was undertaken a second dose of antibiotics was administered after the tourniquet was released on completion of the second knee replacement. Antibiotic prophylaxis is then continued for 24 hours post-operation.

When SMTKR was undertaken, both knees were prepared and draped with repeat skin preparation and draping of the second knee at the commencement of the second knee replacement. Our initial practice was a staggered approach, whereby the more severely damaged joint was started first and once the bone cuts have been completed and trials satisfactory, the other knee was started allowing the use of the single instrument set we had for both knees. We then acquired another knee replacement instrument set and subsequently did both knee simultaneously as we now had 2 instrument sets. We found that there tended to be a crowded operating table during SMTKR leading to reduced efficiency and risk of injury. We have now gone back to the staggered approach but with 2 instrument sets rather than one. We have found this to be the best compromise as there is only about 30 to 45 minutes lead time between the first and second knee replacement. Severe valgus was managed using TC3 (Varus-valgus constrained) prosthesis in four patients (Figure 1), while this was required to manage severe Varus deformity in one patient. (Figure 2). Metaphyseal sleeve was used to address tibia bone defect in three patients (Figure 2).

In one patient, undergoing SMTKR, the procedure had to be abandoned after completion of the first knee replacement as the patient became haemodynamically unstable.

Post operatively the patients were routinely admitted to the high dependency unit (HDU) and DVT prophylaxis with low molecular weight heparin was commenced 8 hours after surgery and administered daily for 4 weeks post operation. The patients were mobilized out of bed on Zimmer's frame 48hours after surgery. There was a mortality due to upper gastrointestinal bleed 3rd day after surgery in the STTKR group.

Data obtained included demographic data, perioperative and post-operative complications, length of stay, cost of treatment while on admission and functional outcome data as assessed using the Oxford Knee Scores (OKS).

RESULT

Thirty-one patients presented to us within the review period with bilateral knee problems requiring TKR. Nineteen of these patients had SMTKR while twelve patients had STTKR.

Patient demographic data is presented in Table 1. Male to Female ratio was 1:18 for SMTKR and 0:12 for STTKR. The mean age was 65.84years range (52-75 years) for SMTKR and 60.00years range (62-76 years) for STTKR. Mean duration of symptoms before presentation was 10 years range (2-15 years). The pre-operative Oxford knee score and post-operative Oxford knee score of patients who had SMTKR was 26.67 and 53.55 respectively, while the pre-operative Oxford knee score and post-operative Oxford knee score of patients who had STTKR was 28.90 and 56.45 respectively. There were 12 bilateral valgus, 13

Table 1: Demographic data between groups

Characteristics	Bilateral simultaneous (SMTKR)	Bilateral Staged (STTKR)
Mean Age (years)	65.8 (±5.75)	69 (±5.00)
Sex: M/F	1/18	0/12
Bil. Varus deformity	7	6
Bil. Valgus deformity	8	4
Windswept deformity	4	2

Table 2: Comparison of co-morbidities between groups

Co-morbidities/ Deterrents	Frequency (STTKR=19)	Frequency (SMTKR=12)
No comorbidity	13	5
DM/HTN	1	0
HTN	4	1
Parkinson's dx	1	0
Athletes foot	0	1
HF/AF/Pacemaker	0	2
Age over 80yrs.	0	1
Jehovah's witness	0	2
Lack of funds	4 (no comorbidity)	0
Total comorbidities	6/19	7/12

bilateral Varus and 6 windswept deformities. Most of the patients presented with severe deformity in at least one knee. In 22 of 31 patients, at least one knee had severe deformity of 20 degrees or more, 13 of these patients having valgus of 25 degrees or more and 9 patients had deformity of 30 degrees or more.

Pre-operative morbidity data is presented in Table 2. The commonest co-morbidity was systemic hypertension which was well controlled, and they had SMTKR. Two patients who previously had treatment for heart failure and cardiac pacemaker inserted had STTKR. One patient with athlete foot in one leg underwent STTKR with the second knee replacement only undertaken 3 months later, after eradication of the fungal infection. Three patients were Jehovah's witnesses, two of who were also obese and hypertensive. All 3 patients had STTKR and one had a revision of failed tibia graft of the second knee of a SMTKR replacement. One patient with moderately severe Parkinson's disease underwent SMTKR after pre-operative optimization of her Parkinson's disease by a consultant neurologist specializing in the management of Parkinson's disease.

Mean duration of hospital stay for the SMTKR was 14 days while the cumulative duration of hospital stay for the STTKR was 20 days.

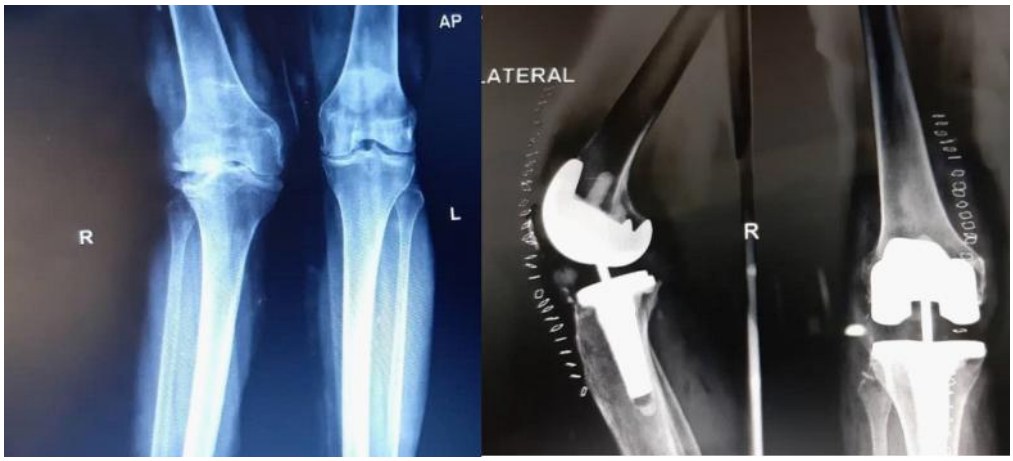

Figure 1: Correction of severe valgus osteoarthritis with TC3 knee replacement

Table 3: Cost and functional outcomes

Operation	No	Mean Pre-op OKS (SD)	Mean Post-op OKS (SD)	Mean Length of stay (days)	Overall Cost Naira (dollars)
SMTKR	19	16.69 (±3.25)	53.55 (±5.25)	7	2.9 million ($6400)
STTKR	12	18.90 (±2.50)	56.45 (±5.00)	10	3.2 million ($7100)

OKS- Oxford Knee Score

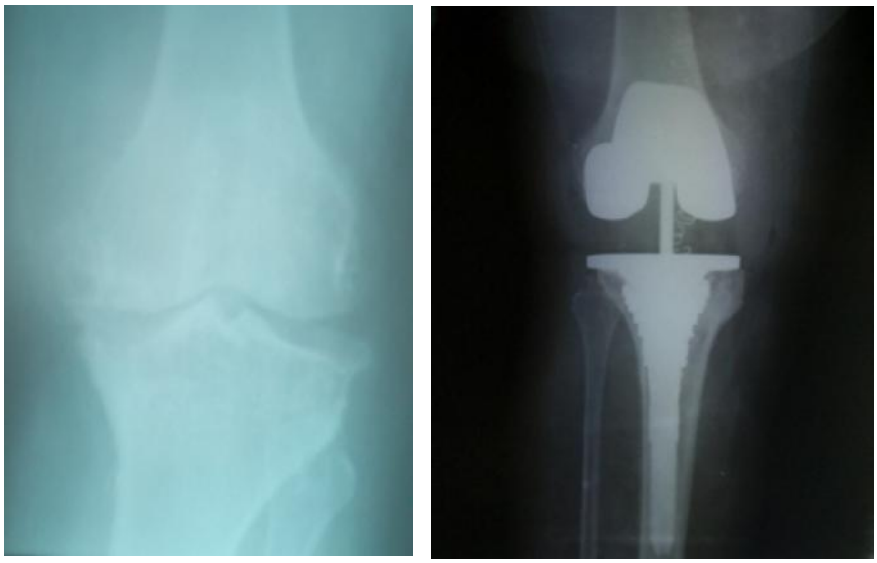

Figure 2: Correction of severe Varus osteoarthritis and medial bone loss in obese patient with TC3 and tibia metaphyseal sleeve

Four of our patients could not afford SMTKR because of the cost of procuring two sets of implants at the same time and elected to undertake a STTKR.

There has been no complication in the bilateral simultaneous group who tended to be slightly younger and healthier (tables 1&2). In the STTKR group, a patient developed instability from failure of incorporation of graft used to treat uncontained tibia defect and has undergone successful revision with metaphyseal sleeve and TC3. He was also in the STTKR group.

The mean Oxford Knee Score (OKS) at a mean 2-year (range 6 months -3 years) follow-up is 53.55 for SMTKR and 56.45 for STTKR with excellent outcome and no complications at latest follow-up. Length of hospital stay, overall cost and functional outcome are presented in Table 3.

DISCUSSION

Our decision on whether to undertake SMTKR or STTKR was guided by the extensive literate on the subject and the complex presentations we were faced with.[2-11] We were careful with elderly patients aged 80 years and above and would undertake a staged approach if there is any concern with frailty or any other significant medical problem. Patients with significant co-morbidities particularly cardiorespiratory conditions were staged. An economic issue that determined the approach was whether patients could pay for both knee replacements in one visit and 4 of our patients deferred the second operation due to lack of funds. SMTKR resulted in reduction in cost that accrued from shorter hospital stay, a single set of laboratory tests and medical consultations, single cost of operating room, anaesthesia and surgical fees, cost of antibiotics, and single physiotherapy rehabilitation for both knees. Also, prudence dictated that we undertook a staged approach with patients of the Jehovah's Witness faith who presented to us with bilateral knee arthritis. We used erythropoietin each time to improve their blood levels before each surgery.

Most of our cases were complex bilateral primary replacement and 22 of 31 patients presented with at least one joint with coronal plane deformity more than 20 degrees. Many patients presented with bilateral valgus osteoarthritis which may reflect prior inflammatory arthritis. Many also presented with bone defects which were treated by autograft of contained defects, screw augmentation, metaphyseal sleeves and augments. Ligament laxities were addressed by balancing the gaps and the use of TC3 prosthesis.

Despite the difficulties faced with what turned out to be complex bilateral primary replacements, our overall result was very satisfactory with significantly improved Oxford knee scores and patients who reported good satisfaction with their joint replacements. There was a few other complications and one fatality of an 82 year old patient who died 3 days post-operation from bleeding from previously undiagnosed varices.

In summary undertaking SMTKR did not increase the risk of complication in patients with severe coronal plane deformities and is a recommended approach in properly selected patients if there are no other contraindications. Significant experience is however needed to successfully tackle the complex deformities

and such procedures should be undertaken by experienced arthroplasty surgeons.

Limitations

1. Selection bias by the surgical team though based on known risk factors for simultaneous TKR as well as affordability
2. Short term follow up, though this patients are still being followed up as per our routine practice.
3. The small sample size, probably a larger number of patients may have been more informative.

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