



Mid-Term Follow Up Results of Mini-Subvastus Approach for Total Knee Arthroplasty in Obese Patients

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Abstract

Background: Use of mini-subvastus approach for total knee arthroplasty (TKA) in obese patients is still debated. We had hypothesized in our study published in July 2010, that obesity should not be considered as a problem for patients undergoing a TKA with the mini-subvastus approach as the anatomy of the quadriceps in the obese and the non-obese patient population is the same. We present a mid-term follow-up study of the same set of patients with an average follow up of 96 months.

Materials and Methods: There were 97 obese patients (109 knees), 81 females + 16 males with a mean age of 64 years that underwent TKA by mini-subvastus approach between January 2006 to July 2007. A total of 16 patients (18 knees) were morbidly obese. Out of the total number of patients, 8 were lost in follow up and one died because of unrelated causes. Out of these 9 patients, two were operated for bilateral TKR. Thus, we have a midterm follow up results of 98 knees in 88 patients. Knee society and functional scores were used for patient evaluation and compared to their pre-operative and earlier follow up scores.

Results: At our latest follow-up of 96 months the Knee Society Score and functional scores were 84 (range 64-90) and 58 (range 45-75) respectively. One morbidly obese lady had aseptic loosening of tibial component at 42 months that needed a revision.

Conclusion: Our mid-term results show that the mini-subvastus approach can be considered for TKA in obese

and morbidly obese patient population with outcomes comparable to standard surgical approach.

Background

Obesity is an increasing worldwide problem and the demand for Total knee arthroplasty (TKA) in this patient group is increasing. [1,2] There is a general consensus that excessive weight is a risk factor for TKA as obese patients have a higher incidence of intra-operative and post-operative complications such as wound healing problems, infections, higher incidence of damage to medial collateral or patellar tendon ligament, lower Knee society scores and higher revision rates due to aseptic loosening. [3-5] However, some studies have shown that obesity does not influence the clinical outcome and complication rates at five years following a TKA. [6] Alteration in technique for soft tissue closure and protection of medial collateral ligament can decrease the risk of perioperative complications in obese and morbidly obese patients. [5]

There is no consensus for the ideal surgical approach for TKA. In the subset of obese patients requiring a TKA

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Level of Evidence: AAOS Therapeutic Level II

Educational Value & Significance: JISRF Level B

a standard midline parapatellar approach is generally recommended. Subvastus approach has many advantages as preservation of extensor mechanism integrity, better patellar tracking and early quadriceps recovery thereby facilitating early post operative recovery [7-9] These advantages of the subvastus approach are particularly relevant for the obese with their limited pre-operative mobility. However, obesity is considered a relative contraindication for the subvastus approach in TKA as it is thought to lead to an inadequate exposure, difficulty in eversion of patella and increased risks of patellar tendon avulsion. [10,11] Some authors suggested that increasing obesity can cause greater difficulties in exposure due to higher thigh girths and if the thigh girth measurement is more than 55 cm, the incidence of peri-operative complications with the subvastus approach in TKA is higher. [12]

In our previous study published in July 2010, we had hypothesized that obesity should not be considered a contraindication for this approach for TKA as the anatomy of extensor mechanism does not differ in the obese and non-obese population. Initially we had presented a short term follow up of a group of obese population operated by mini subvastus approach for TKA. Here we present a mid term follow up results of the same group of patient population.

Materials and Methods

All obese (BMI>30) and morbidly obese (BMI>40) patients with a diagnosis of primary OA of knee who underwent a TKA with the mini-subvastus approach between January 2006 to July 2007 at our center were included in this study. Preoperative Anteroposterior (AP) and lateral radiographs (Lat) were taken in all patients (Figure 1) All



Figure 1. Showing Preoperative Anteroposterior and Lateral radiograph.

surgeries were performed by the senior author using Mini-Subvastus approach. [13]

Surgical Technique

A skin incision was made slightly medial to the midline of the knee, extending from the superior pole of the patella to the tibial tubercle, with the knee in 90° of flexion. Dissection was carried out until the extensor apparatus was exposed. A medial flap was raised to identify the inferior margin of the vastus medialis. The vastus medialis was bluntly dissected off the intermuscular septum. An 'L' shaped capsulotomy was made with the horizontal limb of the L along the inferior margin of the vastus medialis up to the superior pole of the patella. The vertical limb of the L extended from here up to the tibial tubercle. At this stage it was possible to displace the patella laterally to expose the suprapatellar synovium, which was then divided medially keeping the suprapatellar pouch intact. This method allows patella to be subluxed in the lateral gutter further. If there were prominent osteophytes in the trochlear region, these were removed with the knee in extension. A Hohmann retractor was placed, retracting the subluxated patella. A preliminary soft tissue release was carried out from the medial tibia until the mid-coronal plane in the varus knees. The knee was then flexed, with the Hohmann retractor retracting the patella in the lateral gutter. This flexion of the knee with the patella retracted laterally could be easily achieved when the knee had a good range of movement. When the knee was stiff this manoeuvre could be difficult. In these cases, (stiff knees) quadriceps muscle needed to be dissected off the medial intermuscular septum more proximally. Also all hypertrophic osteophytes from the trochlear region and from the patella required meticulous removal so that the patella could be displaced laterally. Once the patella was displaced laterally satisfactorily the knee was gently flexed with a Hohmann retractor placed laterally to keep the patella laterally subluxed. Now another retractor was placed medially around the medial femoral condyle to expose the knee. The cruciate ligaments were excised and this allowed the knee to be flexed a little more. Care was taken to ensure that the patellar tendon insertion remained intact.

Overhanging osteophytes were removed from the femur and the tibia. The distal femoral cut was made first using a downsized intramedullary jig. Remnants of the cruciate ligaments were further excised. (Only Posterior stabilized implants were utilized) The knee was then extended. The lateral tibial plateau was exposed in extension by sharp dissection, taking care to avoid injury to the patellar liga-

ment. The fat pad was not excised. A retractor was placed around the lateral tibial metaphysis and another was placed around the medial tibial metaphysis. The knee was flexed again and the third Hohmann retractor was used posteriorly to sublaxate the tibia forward. An extramedullary jig was utilized to cut the proximal tibia at an adequate depth and angle. In some cases, the cut tibial bone was removed in piecemeal. The knee was now extended and the menisci were excised in extension. Care was taken whilst removing the medial meniscus, not to damage the medial collateral ligament. Overhanging osteophytes were removed from the posteromedial tibia if present. A spacer block was utilized to check the extension space. If necessary, further medial or lateral release was done to establish a proper extension space and to check the alignment. Thereafter, the femur was sized and the appropriate AP cutting jig was placed on the femur such that the flexion space equaled the extension space. Due care was taken to avoid notching of the anterior cortex of the femur by the anterior cut. Champher and the notch cuts were made next. In case of the high-flex (n=90) variety of knee prosthesis, the posterior femur was recut appropriately. The highflex implant was used whenever the knee which was operated had an excellent pre-operative ROM i.e. > 120 degrees). The patella was everted only after the femoral and tibial cuts had been made. Hypertrophic suprapatellar synovium and overhanging osteophytes from the patella were easily removed after everting the patella. The jig was utilized to size and resect the patella if patellar resurfacing was to be carried out (n=3). The patellar resurfacing was carried out when there were prominent arthritic trochlear and patellar lesions. Trial components were inserted and a careful check was made regarding the range of movement, stability, and patellar tracking. If posterior femoral osteophytes were present, they were removed using a curved osteotome. If required, posterior capsular release was carried out. The bony surfaces were washed with pulsatile lavage, dried, and the appropriate components were cemented and the trial insert was placed into the tray. The knee was brought to full extension to pressurize the bone-cement interface during polymerization. After the cement had cured, the trial insert was removed and the entire periphery of both the femoral and tibial implants was checked for any extruded cement, which was removed if present. The definitive tibial insert was placed after adequately cleaning and drying the tibial implant. Thorough lavage was given.

An apical stitch at the angle of the 'L' was first taken to ensure that the capsule was neither advanced nor recessed. The rest of the closure was routine. The knee was infiltrated with 20 ml of mixture containing 0.25% bupivacaine, cefuroxime, and normal saline. A bulky dressing was ap-

plied for the first 24 hours. A femoral nerve catheter was inserted with the help of a nerve stimulator (Stimuplex, Braun) and 10 ml of a mixture containing 2% lignocaine and 0.25% bupivacaine was injected at 4-hourly intervals for 1 day. For 24-48 hours postoperatively a cryocuff was utilized on the operated knee.

The knee implants utilized included Zimmer NexGen Legacy PS in 18 knees, Zimmer NexGen Highflex in 39 knees, Zimmer NexGen Gender solution in 51 knees and PFC Sigma (Cruciate substituting) in 1 knee to give a total of 109 knees.

There were total 97 patients comprising of 81 females and 16 males with a mean age of 64 years (Range 49-80 years), with none of them having history of previous knee surgery. Out of the total, 12 were operated for staged bilateral knee arthroplasty, within the above study period. The patient demographics were as shown in Table 1. The knees were evaluated pre- and postoperatively by the American Knee Society (KSS) clinical and functional score. [14] Standard anteroposterior and lateral view radiographs were obtained post-operatively (Figure 2 & Figure 3). At 6 weeks post-operatively, an additional merchant view (sky-line view) radiograph was taken. The postoperative follow-up was at 6 weeks, 3 months, 6 months, and yearly thereafter. At each yearly follow up radiographs were taken to identify linear radiolucent lines around implants and where compared with previous radiographs to determine whether they were progressive or non-progressive. (Figure 4) The final evaluation has been done at a minimum of 90 months with an average follow up of 96 months (Range 90 to 108 months).

Table 1. Patient Demographics

	Obese Group	Morbid Obese Group
Total no. of patients (n=97)	81	16
Total no. Knees (n=109)	91	18
Varus knees		
- Mild Deformity (<150)	79	12
- Severe Deformity (>150)	10	05
Valgus Knee	02	01
Average height (cm)	153.75	149.69
Average Weight (kg)	75.36	97.30
Average BMI (kg/m2)*	33.52	43.29
Average thigh girth (cm)	50.17	61.01
Gender		
- Male	16	0
- Female	65	16

*Thigh girth was measured 15cm proximal to adductor tubercle. [13]



Figure 2. Showing Postoperative day 1 Anteroposterior and Lateral radiograph.

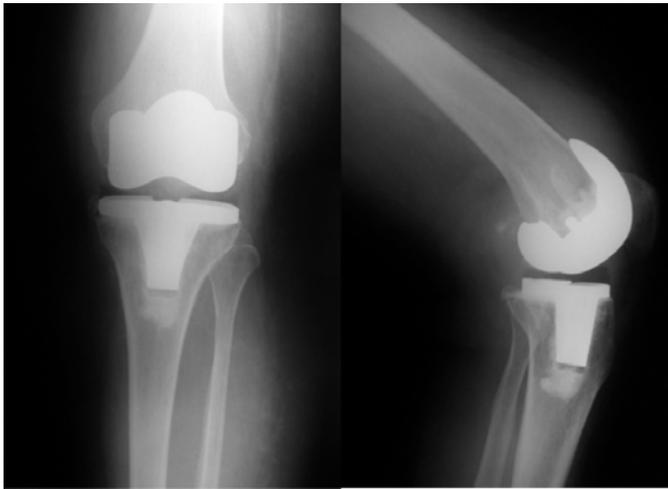


Figure 3. Showing Anteroposterior and Lateral radiograph at 2 months followup.



Figure 4. Showing Anteroposterior and Lateral radiograph at 8 years followup.

Results

The mini-subvastus approach was used in all cases in the study group. Out of the total number of patients, 08 were lost in follow up and 01 died because of unrelated cause. Out of these 09 patients, two were operated for bilateral TKR. Thus, we had midterm follow up results of 98 knees in 88 patients. Mean age of the patients at the last follow-up was 69.5 years.

As in our previous study, the Knee Society score (KSS) had shown improvement from the preoperative average of 42 (range: 17-62) to 89 (range: 72-95) and Knee Society functional score had improved from the preoperative average of 48 (range: 15-60) to 65 (range 50-80) postoperatively. At our latest follow-up of 96 months the Knee Society Score and functional scores were 84(range 64-90) and 58 (range 45-75) respectively. Patellar tracking was excellent in all patients, with none of them requiring lateral release during surgery. Overall the mechanical alignment of the lower limb remained satisfactory with an average valgus angle of 6 degrees (range 30-90).

We had complications in the form of intraoperative Medial collateral ligament (MCL) injury in one case and complete avulsion of patellar tendon in an obese patient with stiff knee. Both were managed surgically. No wound complications and infection were noted in any case.

At the latest follow-up, patient with MCL injury had KSS and functional score of 83 and 70 and the other patient with repaired patellar tendon avulsion had a KSS of 68 and functional score of 55. A young (48yrs) morbidly obese patient had aseptic loosening of the tibial component 42 months post surgery. It was managed with revision arthroplasty again using subvastus approach, with recent follow up KSS and FS of 76 and 65 respectively.

Discussion

The mini-subvastus is a minimally invasive approach for TKA which preserves quadriceps integrity thus allowing a faster and a less painful recovery as compared to medial parapatellar approach. [7,8] Obesity has been considered a relative contraindication for mini-subvastus approach, because of the difficulty in exposure of the knee and eversion of the patella. [11] Our earlier publication with short term follow up showed good functional outcome. In immediate postoperative period, quadriceps recovery in our patients was early and 95% of the patients (103 knees in 87 patients) were able to do an active SLR by day 2 without any lag. The KSS and Knee society functional score had improved from the preoperative average of 42 (Range 17-62)

& 48 (range:15-60) respectively to 89 (Range 72-95) and 65 (range:50-80) respectively in the post operative period during the initial follow up of 1 year. These scores were comparable to those in studies with non-obese patients and obese patients operated upon with conventional approaches. At midterm average follow up of 96 months the mean Knee Society Score and Functional scores were 84 and 58 respectively. We did a literature study to compare our results with previously published studies. (Table 2) As per a results of Foran et al the implant failure rate, as defined either clinically (Knee Society Score- KSS) or radiographically, is significantly higher in the obese population. [4] Kerkhoffs et al did a meta analysis to study the influence of obesity on the complication rate and outcome of total knee arthroplasty, and found that the overall revision rate is 1.79 times higher in an obese group of patients compared to patients with a normal BMI after five years follow up. [15] In our study, one morbidly obese young patient (age at index operation 48 years) with BMI > 50, had failure due to aseptic loosening of tibial component 42 months post surgery. This was treated with a revision TKA using constrained condylar prosthesis with tibial and femoral rods , again using Subvastus approach. We have been successfully using Subvastus approach for revision TKR as well.

There has been a concern over the issue of component malalignment with minimally invasive TKA especially in obese patients. In our study at latest follow up, all knees had valgus anatomical alignment with average valgus angle maintained at 60 (range 30 – 90), which was measured with standing long leg film as seen in other series. We believe

that component malalignment in Mini-subvastus approach can be avoided by proper use of mobile skin window and careful identification of anatomical. On the knee society roentgenographic evaluation and scoring system, the scores remained less than 10 in all of our patients. As per a recent study by Chalidis BE et al, minimally invasive surgery is a reliable and safe option in obese patients undergoing TKR regardless the level of BMI. [22] It is associated with improved early clinical outcome with optimum radiographic positioning of the implants. An interesting observation in our study was that in comparison to obese patients with age less than 60 years (n=31), obese patients with age more than 60 years (n=52) performed better, with an average KSS of 77 and functional score of 52 in first group as compared to 86 and 63 in the elderly group (p value < 0.05). The explanation for this may be related to lesser physical activity and patient demands in elderly population. Thus it is safe to assume that while elderly obese patients with knee OA are ideal candidates for TKA, caution must be exercised while considering TKA in the young obese especially if morbidly obese BMI >40 or if super obese BMI > 50 and they should be advised to lose weight prior to surgery or be counseled regarding the inferior results before proceeding with surgery. [3]

In the recent years, there has been an increase in the need for TKA performed in younger population for various reasons, obesity being one of them. In a recent study, Kurtz et al. projected that patients younger than 65 years will become the majority treated with TKAs during the next two decades and that up to one million TKAs may be performed for patients younger than 55 years by 2030. [16] Recent studies reporting data from community, academic, and national registries have suggested higher TKA revision rates occur in the younger patient group. [17-19] Out of the young patients in our series, one morbidly obese patient required revision as stated earlier, although the others are being routinely followed to detect early signs of loosening.

Many groups report that post-operative KSS is significantly lower in an obese population, however, the level of improvement is similar to the non-obese group. [5,20,21]

The limitation of this study is that we do not have a control group of non obese patients or those operated by the medial parapatellar. Hence we have compared our results with previously published available literature (Table No. 02). Also we have not separately evaluated the results in Morbidly Obese patients since the number of morbidly obese patients in our study were less. We have

Table 2. Comparison of Reported results of Total Knee Arthroplasty in Obese and Morbidly Obese patients with current Study [23]

Study	Year	Patients (knees)	Mean Age in years	Mean Follow-up in years	Mean Post operative scores at last follow-up	
					KSS	FS
Winiarsky et al [24]	1998	40 (50)	64.6 (45.6-76.5)	4.8 (2-13)	84	53
Spicer et al [25]	2001	285 (326)	66 (35-83)	6.4 (4-12)	77.9	65.8
Foran et al [4]	2004	27 (30)	62 (36-78)	6.7 (5-10.3)	81	NR
Krushell R.J. et al [26]	2007	NR (39)	67.4 (48-81)	7.5 (5-14)	91	44
Dewan et al [27]	2009	102 (135)	64 (NR)	5.4 (2.2-14.6)	88	69
Current study	2015	72(83)	64 (49-80)	8 (7.5-9)	84	58

KSS= Knee Society Score, FS =Functional score

not accounted for associated comorbidities in the obese and morbidly obese group that may have affected the clinical outcome. A separate study involving multiple centres and larger number of patients may be considered to compare outcome of TKA in obese patients operated through mini-subvastus and medial parapatellar approaches.

Conclusion

To conclude, the follow up evaluation results in our patient population operated by subvastus approach have been good till 96 months. This approach offers excellent intra-operative exposure even in obese and morbidly obese patients. It has not resulted in increased complication in our hands and our results have been comparable to TKA with conventional approach. It can be considered for obese and morbidly obese patients undergoing TKA.

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AUTHOR DISCLOSURES

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