A Prospective Study of Subvastus Approach vs. Medial Parapatellar Approach for Total Knee Arthroplasty

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ABSTRACT

BACKGROUND

Among the various surgical approaches for total knee arthroplasty, medial parapatellar and subvastus approach are two commonly used surgical approaches in total knee arthroplasty. The aim of this study is to compare the functional outcome between subvastus approach and medial parapatellar approach.

METHODS

This is a prospective study which compared medial parapatellar approach (Group-1, 30 patients) and subvastus approach (Group-2, 30 patients) from November 2017 to March 2019, in Rajarajeswari Medical College and Hospital, Bangalore. Patients were followed up for 16 months. Revision knee arthroplasty cases and total knee arthroplasty cases operated by other surgeons were excluded.

RESULTS

There was no significant difference between subvastus approach and medial parapatellar approach. Except that in subvastus approach, quadriceps tendon was not disrupted. Pain was better controlled in subvastus approach on post-operative day but operative time was more in subvastus group. There were no difference between two groups with regard to duration of stay, blood loss and post-operative complications.

CONCLUSIONS

Subvastus approach provided better pain relief postoperatively, but operative time was more in subvastus group. There was no significant difference between the two groups in duration of stay and post-operative complications. Subvastus can also be considered as an alternative surgical approach along with standard medial parapatellar approach for primary total knee arthroplasty.

KEYWORDS

Medial Parapatellar, Subvastus, Total Knee Arthroplasty, KSS

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DOI: 10.18410/jebmh/2019/664

Financial or Other Competing Interests: None.

How to Cite This Article:
Khalid Fiyaz M, Balasubramanian S, Bhargav G, et al. A prospective study of subvastus approach vs. medial parapatellar approach for total knee arthroplasty. J. Evid. Based Med. Healthc. 2019; 6(51), 3166-3170. DOI: 10.18410/jebmh/2019/664

Submission 22-11-2019,
Peer Review 30-11-2019,
Acceptance 09-12-2019,
Published 20-12-2019.

BACKGROUND

For advanced osteoarthritis of the knee joint, total knee arthroplasty is the effective treatment for pain relief and knee joint function. Various surgical approaches has been described around the knee joint. Among that most commonly used surgical approach for total knee arthroplasty was medial parapatellar approach which is used as a standard approach in majority of knee joint replacement. It was first described by Von Langenbeck[1] in 1879. It has the advantage of good joint exposure but also has drawbacks of impairing the extensor mechanism of knee joint and interfering with the vascular supply of patella. Patellofemoral instability and maltracking can occur after the MP approach. Because of the above disadvantage subvastus approach was introduced by Hoffman in 1991.[2] It is a quadriceps sparing procedure resulting in better postoperative knee range of movements and less impairment of vascular supply to patella[3] by avoiding damage to the articular branch of the descending geniculate artery that lies within the belly of vastus medialis and joins the patellar plexus with the medial superior geniculate artery at the superomedial corner of the patella. And shortens the hospital stay.[4] Disadvantage in this technique was difficulty exposure and eversion of patella. As it requires more technical skills, its popularity over medial parapatellar approach was limited.

METHODS

This study included sixty cases for total knee arthroplasty which were performed at Rajarajeswari medical college and hospital, Bangalore for advanced osteoarthritis of knee from November 2017 to March 2019. There were 30 knees in each group (Group-1 medial parapatellar and Group-2 subvastus approach). Each group was selected randomly either for subvastus or medial parapatellar approach. Patients were admitted to the elective orthopaedic ward after having total knee arthroplasty. Both groups of patients had pre-operative administration of intravenous antibiotic Ceftriaxone 1.5 grams at the time of induction of anaesthesia, followed by three doses post operatively. All cases were operated in Laminar flow theatre. Tourniquet was used for all the patients inflated at time of incision and deflated after the application of compression dressing. Both groups had similar pain management protocol. Mild pain was treated with paracetamol and non-steroidal anti-inflammatory drugs. Three further doses of intravenous antibiotics were given post operatively in both groups. Thromboprophylaxis was carried out for 10 days postoperatively using subcutaneous low molecular weight heparin injections. All the patients received the same post-operative rehabilitation protocol. They were mobilised on post-operative day one with full weight bearing protocol by assistance from the physiotherapist using the walking frame.

Operative Procedure

Medial Parapatellar Approach- This approach done on the medial border of the quadriceps tendon, cuff of tissue is left on the patella on which to repair the medial joint capsule. A standard longitudinal midline skin incision is done. The parapatellar retinacular incision is extended proximally along the length of the quadriceps tendon, leaving a 3- to 4-mm cuff of tendon on the vastus medialis for later closure. The incision is continued around the medial side of the patella, extending 3-4 cm on to the antero-medial surface of the tibia along the medial border of the patellar tendon. Medial side of the knee is exposed by subperiosteally elevating the anteromedial capsule and deep medial collateral ligament off the tibia to the posteromedial corner of the knee. Extend the knee and evert the patella to allow an optional release of lateral femoral plicae. In obese patients, if eversion of the patella is difficult, develop the lateral subcutaneous flap further so that the patella can be everted underneath this tissue, but this should be done with caution to leave adequate subcutaneous tissue under the skin to avoid the potential complication of flap necrosis. The infrapatellar fat pad is excised or retracted. The patella is dislocated and flipped laterally. It is important at this step to protect the insertion of the patellar tendon on tibia. If there is risk of the avulsion of the patellar tendon, as seen by excessive tension on the tendon, one wire/pin can be inserted at the patellar tendon insertion. If difficulty is encountered while flipping the patella, then incision can be extended between rectus femoris and vastus medialis proximally. The knee is finally flexed to 90 degree to gain exposure to entire knee joint. Advantage of this exposure is that it allows excellent exposures and it is relatively easy to safely execute. Drawbacks of this approach include disruption of the quadriceps mechanism at the junction of vastus medialis and the quadriceps tendon, hence destabilizing the patella.[1] Superior lateral genicular artery is at risk during lateral retinacular release, as may be the last remaining blood supply after medial parapatellar approach and fat pad excision.[5] Infrapatellar branch of saphenous nerves becomes subcutaneous on medial aspect of knee after piercing the fascia between the sartorius and gracilis and provides sensory to the anteromedial aspect of the knee. Injury to this nerve can lead to postoperative neuroma.[5] If inadvertently cut during surgery, resect and bury end to decrease chance of painful neuroma.

Subvastus Approach- This approach uses a straight midline skin incision that is extended above and below the patella. After development of a medial subcutaneous flap, the lower border of the vastus medialis is visualized. Because the vastus medialis inserts into the superior medial corner of the patella, the fascial sheath along the inferior border of the vastus medialis is incised from the patella down to the medial intermuscular septum. It is suggested that two stay sutures be applied at the apex of the patella and the dissection carried out in-between the sutures. These sutures can later be used as landmarks for anatomical restoring of the tissues. It follows a transverse approach at the mid patella level through the medial retinaculum, inferior to the vastus medialis. The medial aspect of the vastus medialis is

bluntly dissected from the medial intermuscular septum approximately 10 cm proximal to the adductor tubercle. This incision separates the vastus medialis from the medial intermuscular septum staying distal to the aperture for femoral vessels. The arthrotomy then continues distally along the medial margin of the patella, with the medial retinaculum incised along the medial border of the patellar tendon and down onto the tibia; the extent of the exposure is dictated by the requirements of the surgery. Care should be taken at this point to avoid injury to the neurovascular contents of Hunter's canal. To gain access to the joint, the capsule of the suprapatellar pouch should be divided to release the patella, which is everted and dislocated laterally as the knee is flexed. The sub vastus approach, which allows direct access to the anterior knee joint, has been heralded as being more anatomic than the medial parapatellar arthrotomy. The sub vastus approach leaves the extensor mechanism and the majority of medial vessels supplying the patella intact and studies suggest it has significant disadvantages over other approaches. Patients exhibit earlier straight leg raise, reduced blood loss, lower opiate consumption, and better knee flexion earlier in the recovery process.[6] When compared with the medial parapatellar approach, patellar tracking was significantly improved in the sub vastus group[6] while hamstring to quadriceps ratio reached normal levels sooner.[7] The disadvantages to this approach are offset by increased difficulty with exposure and greater difficulty everting the patella, which may explain why this is not a popularized technique.[6,8] The sub vastus approach is applicable to most reconstructive procedures of the knee, with the exception of lateral unicompartmental knee replacement arthroplasty.

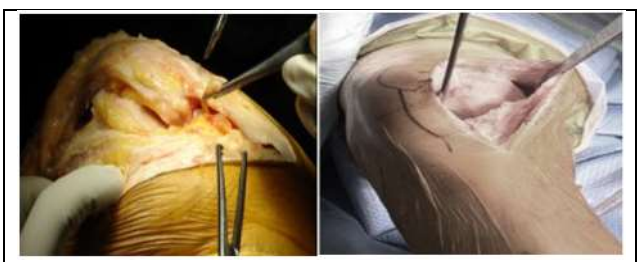

Figure 1 and 2. Medial Parapatellar Approach and Subvastus Approach

Statistical Analysis

Data was entered into Microsoft excel data sheet and was analysed using SPSS Ver. 22. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively.

Graphical Representation of Data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram. P value (probability that the result true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22(IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

RESULTS

Base line demographic data of the patient who has underwent total knee arthroplasty by either medial parapatellar (group-1) or subvastus approach (group-2)

No statically significant between the two groups (p >0.05). Regarding operative time subvastus group had more operative time with mean duration of surgery of 98.56 minutes, range between 60-140 whereas; the mean operative time was 72.60 minutes, range between 45 - 127 in medial parapatellar approach. There was statistically significant difference between two groups in the operative time (p<0.05).

Demographic	Group - 1	Group - 2
Number of Patients	30	30
Age	52 – 78 (64.3)	51 -73 (59.4)
Sex		
Male	10	08
Female	20	22
Side		
Right	15	17
Left	15	13
Diagnosis		
Osteoarthritis	25	22
Rheumatoid arthritis	05	08
Associate Conditions		
HTN	5	6
Obesity and HTN	6	7
HTN and IHD	1	1
OBESITY	3	4
HTN and COPD	2	1
DM	3	4
No associated conditions	10	7

Table 1

No statically significant between the two groups (p>0.05)

Regarding to Blood loss there was no statistical significant difference between the two groups in terms of blood loss and blood transfusions (p>0.05). measurement was taken in gram per decilitre from pre-operative period following 24 hrs after postoperative period.

Pain was less in group-2 (subvastus approach). Post operatively pain was measured on day 1 and day 3 using visual analogue score (VAS). On day 1 in the medial parapatellar group 42.5 percent of patients had score of 0. Whereas in subvastus approach 60.20 percent had score of 0 on day 1 but the mean score was 1.8 and 2.1 respectively. On day 3, Medial parapatellar group had 15.5 percent of patients experienced pain score of 0 and in the subvastus group 36.2 percent of patients experienced pain score of 0. Mean pain score was 2.8 and 3.9 respectively. So on day one there was no significant difference of pain score between the two groups and pain score on day 3 was significantly less in subvastus group when compared to medial parapatellar group (p value <0.01). Regarding to Duration of stay in hospital Subvastus group 7.65 days had shorter duration of stay in the hospital, range between 4- 13 days than medial parapatellar group 9.50 range between 5 to 15 days. There was no statistical significant difference between two groups in terms of duration of stay (p>0.05) and post-operative

complications regarding to Major complications. There was no statistical significant difference in complications between two groups (p>0.05). At the end of 16 months of follow up each group had two revision knee surgery. One patient in medial parapatellar had open reduction and internal fixation for peri prosthetic fracture of the femur. Minor complications (stitch abscess, superficial wound infection), patients were managed as an outpatient without admission into hospital for all the complications were considered as minor complications. There was no statistically significant difference between two groups (p>0.05).

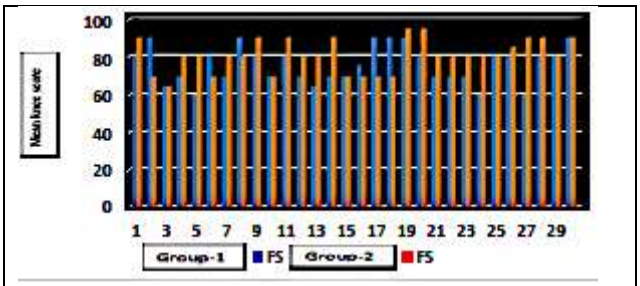

Figure 3. Graphic Representation of Functional Score between the Two Groups

Graphical representation of knee society scores preoperative and postoperative with follow up to 16 months showing no significant difference between two groups.

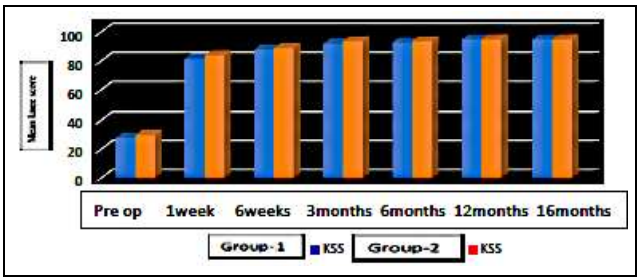

Figure 4. Knee Society Score (KSS) Comparison between the Two Groups

DISCUSSION

This study includes 60 patients. They were divided into two groups, Group-1 medial parapatellar approach and Group-2 subvastus approach. 30 patients in each group. In Group-1 the mean age was 59.2 years and in group-2 the mean age was 61.4 years. There was no significant difference in the age group between two groups. In our study group-1 (10 males, 20 females) and group-2(8 male, 22 females) was taken in our study. Duration of surgery was significantly higher in subvastus group when compared to medial parapatellar approach (p value <0.01). The other studies with similar results were by Lai et al.[9] Bridgman et al,[10] Bourke et al.[11] and Weinhardt et al[12] in their randomised controlled study found no difference between two groups in terms of duration of surgery.

Pain score on day 3 was significantly higher in medial parapatellar group when compared to subvastus group, whereas on day 1 there was no significant difference between two groups. Roysam and Oakley[13] Bridgman, et al.[10] Dutka, et al.[14] and Tomek, et al. found similar results. But, no difference in pain was found between two groups according to Weinhardt, et al.[12] Wouter, et al.[15] and Teng, et al.[16] in their studies. We used visual analogue score for measurement of severity of pain in post-operative period.

Patients who underwent subvastus approach had shorter stay in the hospital for Regarding to Duration of stay in hospital Subvastus group 7.65 days had shorter duration of stay in the hospital, range between 4-13 days than medial parapatellar group 9.50 range between 5 to 15 days. There was no statistical significant difference between two groups in terms of duration of stay (p>0.05). This was similar to results obtained by Bourke, et al[11] and Teng et al.[16] This shorter stay could be due to reduced pain in post-operative period and preservation of quadriceps mechanism in subvastus group and patients could have mobilised earlier in post-operative period.

There was no statistical significant difference in post-operative complications between two groups over 13 months follow up. This was similar to studies done by Dutka, et al.[14] Roysam[13] and Okaley[17] Chen, et al[18] and Weinhardt, et al.[12] But higher rate of complications in medial parapatellar group were found in Matsueda and Gustilo study approach. There were no significant difference between two groups in terms of blood loss and blood transfusions (p>0.05). This was similar to findings of meta-analysis by Pang, et al[19] and in randomized controlled studies by Weinhardt, et al,[12] Bridgman, et al[10] and Bourke, et al[11] Where as Roysam and Okaley[17] and Chen, et al[18] in their study found that there was less blood loss and shorter tourniquet time in the subvastus group. In this study blood loss was measured as difference in preoperative haemoglobin and post-operative haemoglobin.

Regarding to the KSS, there was no significant in the two groups. This study was similar to Van Hemert et al[20] and Bourke et al[11] reported no differences in the early postoperative period. Theoretically, the subvastus approach has advantages over the medial parapatellar approach in morbidity by avoiding potential injuries to the patellar vascularity and extensor mechanism.

CONCLUSIONS

We found no significant difference between the two groups regarding to functional score and knee score. Subvastus approach provided better pain relief postoperatively, but operative time was more in subvastus group. There was no significant difference between the two groups with regard to duration of stay and post-operative complications. Subvastus can also be considered as an alternative surgical approach along with standard medial parapatellar approach for primary total knee arthroplasty without significant differences in the complications of surgery compared to standard approach provided the surgeon has adequate experience.

REFERENCES

[1] Von Langenbeck B. Über die Schussverietzungen des Hüftgelenks. Arch Klin Chir 1874;16:263.

[2] Hofmann AA, Plaster RL, Murdock LE. Subvastus (Southern) approach for primary total knee arthroplasty. Clin Orthop Relat Res 1991;269:70-77.

[3] Matsueda M, Gustilo RB. Subvastus and medial parapatellar approaches in total knee arthroplasty. Clin Orthop 2000;371:161-168.

[4] Kayler DE, Lyttle D. Surgical interruption of patellar blood supply by total knee arthroplasty. Clin Orthop Relat Res 1988; (229): 221-7.

[5] Stern SH, Moeckel BH, Insall JN. Total knee arthroplasty in valgus knees. Clin Orthop Relat Res 1991;273:5-8.

[6] Roysam GS, Oakley MJ. Subvastus approach for total knee arthroplasty: a prospective, randomized, and observer blinded trial. J Arthroplast 2001;16(4):454-457.

[7] Chang CH, Chen KH, Yang RS, et al. Muscle torques in total knee arthroplasty with subvastus and parapatellar approaches. Clin Orthop Relat Res 2002;398:189-195.

[8] Matsueda M, Gustilo RB. Subvastus and medial parapatellar approaches in total knee arthroplasty. Clin Orthop Relat Res 2000;371:161-168.

[9] Lai Z, Shi S, Fei J, et al. Total knee arthroplasty performed with either a mini-subvastus or a standard approach: a prospective randomized controlled study with a minimum follow-up of 2 years. Archives of Orthopaedic and Trauma Surgery 2014;134(8):1155-1162.

[10] Bridgman AS, Walley G, MacKenzie G, et al. Sub-vastus approach is more effective than a medial parapatellar approach in primary total knee arthroplasty: a randomized controlled trial. Knee 2008;16(3):216-222.

[11] Bourke MG, Jull GA, Buttrum PJ, et al. Comparing outcomes of medial parapatellar and subvastus approaches in total knee arthroplasty: a randomized controlled trial. J Arthroplasty 2012;27(3):347-353.

[12] Weinhardt C, Barisic M, Bergmann EG, et al. Early results of subvastus versus medial parapatellar approach in primary total knee arthroplasty. Archives of Orthopaedics Trauma and Surgery 2004;124(6):401-403.

[13] Roysam GS, Oakley MJ. Subvastus approach for total knee arthroplasty: a prospective, randomized, and observer blinded trial. J Arthroplasty 2001;16(4):454-457.

[14] Dutka J, Skowronek M, Sosin P, et al. Subvastus and medial parapatellar approaches in TKA: comparison of functional results. Orthopedics 2011;34(6):148.

[15] van Hemert WLW, Senden R, Grimm B, et al. Early functional outcome after subvastus or parapatellar approach in knee arthroplasty is comparable: a performance-based trial with anatomical findings. Knee Surg Sports Traumatol Arthrosc 2012;20(9):1885-1886.

[16] Teng Y, Du W, Jiang J, et al. Subvastus versus medial parapatellar approach in total knee arthroplasty: meta-analysis. Orthopedics 2012;35(12):e1722-e1731.

[17] Roysam GS, Oakley MJ. Subvastus approach for total knee arthroplasty: a prospective, randomized, and observer-blinded trial. J Arthroplasty 2001;16(4):454-457.

[18] Chen AF, Alan RK, Redziniak DE, et al. Quadriceps sparing total knee replacement. The initial experience with results at two to four years. J Bone Joint Surg Br 2006;88(11):1448-1453.

[19] Pang J, Shen S, Pan WR, et al. The arterial supply of the patellar tendon: anatomical study with clinical implications for knee surgery. Clinical Anatomy 2009;22(3):371-376.

[20] van Hemert WL, Senden R, Grimm B, et al. Early functional outcome after subvastus or parapatellar approach in knee arthroplasty is comparable. Knee Surg Sports Traumatol Arthrosc 2011;19(6):943-951.