

Subvastus Versus Medial Parapatellar Approach in Primary Knee Arthroplasty: Postoperative Pain and Early Function

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ABSTRACT

ABSTRACT: Total knee arthroplasty causes significant postoperative pain that has always been negatively associated with recovery, satisfaction, length of hospital stay, and cost. Objective: To perform a comparison of postoperative pain and early function between the subvastus and medial parapatellar approaches used in primary knee arthroplasty. Material and methods: An observational, descriptive, cross-sectional, prospective study was carried out for 6 months; with an evaluation of postoperative pain on the second postoperative day, the third postoperative day, the first and second postoperative week, using the visual analog pain scale. In addition, walking ability with a walker-type support device and quadriceps response were evaluated with the Straight Leg Raise Test as a reference; evaluating the degrees of extension and extensor lag. Results: Significant differences were found between the groups when comparing pain and the SLRT test on the second and third postoperative day, as well as the first and second week after surgery ($p < 0.001$). A significant correlation ($p < 0.001$) was found on the first day evaluated; which predicts the evolution of VAS and SLRT levels until the second postoperative week. Conclusions: The subvastus approach has the advantage of reducing damage to the extensor mechanism and achieving recovery with less pain, better muscle response and a higher degree of satisfaction; more than the traditional medial parapatellar. The immediate postoperative period influences the clinical evolution of the patient in both groups.

KEYWORDS: Subvastus, approach, knee, arthroplasty, pain.

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INTRODUCTION

Arthroplasty is a successful and increasingly common procedure. However, in some cases, patients experience significant postoperative pain, which affects patient satisfaction, increases the length of hospital stay for pain management, and raises costs. This has led to the search for multimodal pain management options in arthroplasty. (1) There are multiple factors that can influence the early postoperative outcome, such as the patient's expectations. (2) The most commonly used approach is the medial parapatellar approach due to its reliability, reproducibility, safety, and ability to be extended if needed. It offers excellent visibility of the joint, allowing for proper measurement, alignment, and ligament balance. Its main drawback is the risk of injury to the extensor mechanism. (3) The subvastus approach respects the extensor mechanism and reduces damage to it. Disadvantages of this approach have

also been reported, such as visualization difficulties, access challenges, a higher level of surgical difficulty, and a longer learning curve; as well as some postoperative complications such as longer tourniquet time, poor implant placement, and early implant failure. (4)

There are conflicting results in the literature reporting better immediate postoperative outcomes. (5) In a case series comparing the subvastus and medial parapatellar approaches in 24 knees, the subvastus approach had better results on the second and fifth postoperative days; however, at six weeks of follow-up, the results were similar for both techniques. (6, 7) In a meta-analysis of 52 articles with 4,533 patients evaluating total knee arthroplasty (TKA) approaches, the subvastus approach yielded better results, with less postoperative pain and better clinical function; however, the parapatellar approach had a shorter surgical time and less blood loss. (8)

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The purpose of this study is to compare the medial parapatellar and subvastus approaches in total knee arthroplasty, their impact on early postoperative pain and muscle response in the first two weeks postoperatively.

Material and methods

A prospective, observational, descriptive, cross-sectional study was conducted with the authorization of the ethics committee of the Red Cross Orthopedic Hospital of Mérida, Yucatán.

Between September 2023 and March 2024, 73 patients who underwent primary total knee arthroplasty with a diagnosis of grade IV gonarthrosis according to the Kellgren and Lawrence classification were divided into two groups of 20 patients each, with similar characteristics. The sample was matched by sex, age, and the side operated on. The age range was from 40 to 85 years. Patients undergoing revision surgery and those without a comparable match to the other approach were excluded. (Figure 1)

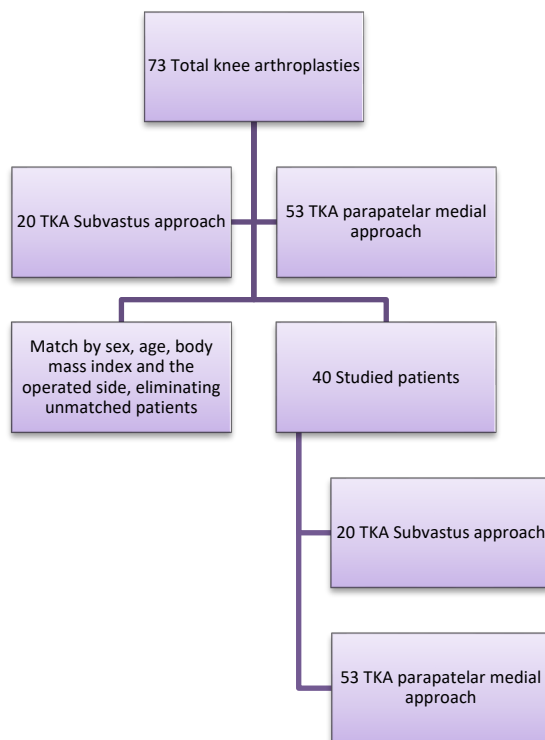


Figure 1: Study distribution: (Group 1: medial parapatellar approach and group 2: subvastus approach).

The total sample (n=40) was determined by a team of expert joint surgeons, and the surgical approach was selected by convenience sampling. Patients were unaware of the technique used in each case, thus constituting a single-blind study.

The following information was recorded for each procedure: surgical approach, surgical time, use of ischemia, duration of ischemia, type of anesthesia, surgeon, prosthesis brand, model, and design, as well as measurements. All patients received either 1 gram of tranexamic acid intravenously or three 650 mg tablets (1950 mg total), depending on drug availability and based on comparative scientific studies with equivalent results. Preoperative analgesia was also administered in all cases with celecoxib 200 mg orally and paracetamol 1 gram intravenously one hour prior to surgery. During the procedure, capsular block was performed using ropivacaine 7.5 mg/ml and adrenaline 1 mg/ml before the end of the surgical procedure. The postoperative protocol consisted of oral celecoxib 200 mg every 12 hours, intravenous paracetamol 1 gram every 8 hours, and intravenous tramadol 50 mg every 12 hours as needed. All requirements for each patient and the surgical approach were recorded.

Postoperative pain assessment was performed on each patient on the second and third postoperative day, at one week and subsequently after 2 weeks of the surgical intervention; the degree of pain was recorded in the morning prior to the physiotherapy sessions; using the visual analog scale of pain (VAS), rating the degree of pain from 0-10. The quadriceps muscle response was assessed using the SLRT test. A positive test result was defined as the ability to raise the leg in extension and maintain it for 20 seconds. Additionally, gait ability with a walking aid was evaluated as either possible or not possible.

RESULTS

General outcomes:

Of the 40 patients studied, each group consisted of 20 patients with a mean age of 70.18 years (range 56-80), 12 left knees and 8 right knees, 10 women and 10 men.

Among the recorded comorbidities were: systemic arterial hypertension (SAH) in 22 patients (55%), type II diabetes mellitus (T2DM) in 8 patients (20%), essential thrombocythemia, and rheumatoid arthritis in one patient.

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Surgery time, ischemia time, and quantification of intraoperative bleeding were reported. (Table 1)

Table 1. Comparative measures of variables, between subvastus and medial parapatellar approaches.

Variable	Subvastus (n=20)			Parapatelar (n=20)			t de Student	p
	Media, SD	Range		Media, SD	Range			
Age	70.65 +/-7.0	56	80	69.70+/-5.8	77	69	0.462	0.323
Ischemia/time	68.25+/-30	20	120	51.75+/-37	120	51	1.519	0.324
Surgery/time	129.90+/-27	90	180	148.00+/-23	200	148	-2.231	0.068
Bleeding	130.00+/-83	50	300	186.50+/-81	300	186	-2.171	0.069
BMI	27.64+/-2.2	23	31	27.91+/-1.7	24	30	-.415	0.68

* <0.05, ** < 0.001

Pain analysis:

VAS scale: A paired Student's t-test was used. Significant differences were found between the groups when comparing pain on the second day, third day, first week, and second week postoperatively. (Table 2)

Table 2. Comparative VAS between subvastus and medial parapatellar approaches.

Variable	Subvastus (n=20)			Parapatelar (n=20)			t de Student	p
	Media, SD	Range		Media, SD	Range			
VAS Day 2	5.35+/-1.0	3	8	7.25+/-0.7	8	7	-6.729	0.016*
VAS Day 3	4.05+/-1.2	2	7	6.10+/-0.8	8	6	-6.112	0.018*
VAS 1 Week	3.85+/-1.0	3	7	6.25+/-0.6	8	6	-8.794	<0.001**
VAS 2 Week	3.15+/-1.1	2	7	5.80+/-1.2	10	5	-6.919	<0.001**

* <0.05, ** < 0.001

Analysis of the need for rescue opioid analgesia.

A report was conducted on the need for in-hospital opioid analgesia on the second and third postoperative days. In the subvastal approach group, 7 patients required rescue opioids

on the second day and 2 patients on the third postoperative day. In the medial parapatellar approach group, 13 patients required rescue opioids on the second day and 7 patients on the third postoperative day. (Figure 2)

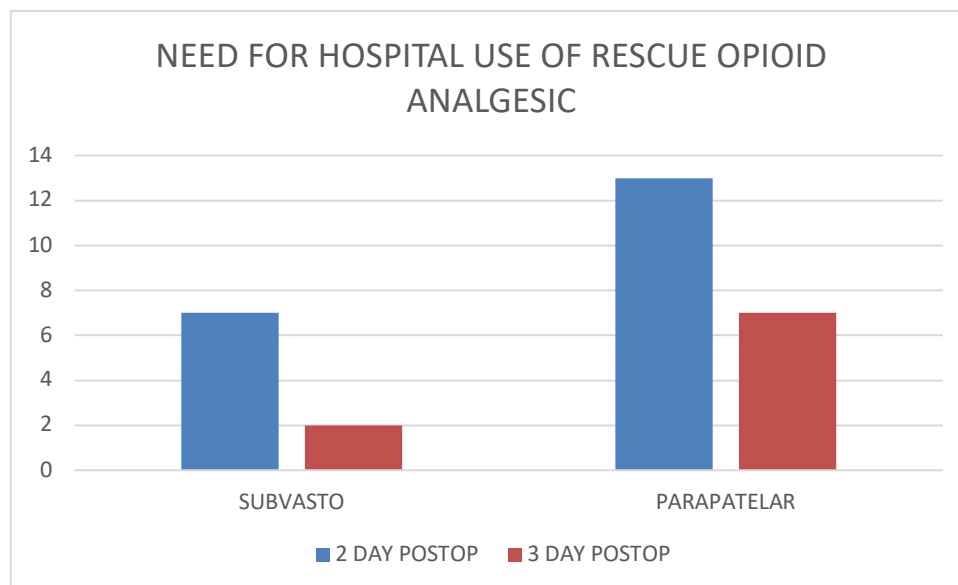


Figure 2: Distribution of need for rescue opioid use during hospital stay.

Muscle response analysis (SLRT test).

When performing the SLRT analysis, patients in the parapatellar approach group had a positive test 1 on the second day, 2 on the third day, 5 in the first week, and 8 in

the second week of the study. In the subvastal group, 4 patients had a positive test on the second day, 10 on the third day, 14 in the first week, and 19 at the end of the second postoperative week ($p < 0.001$). (Figure 3)

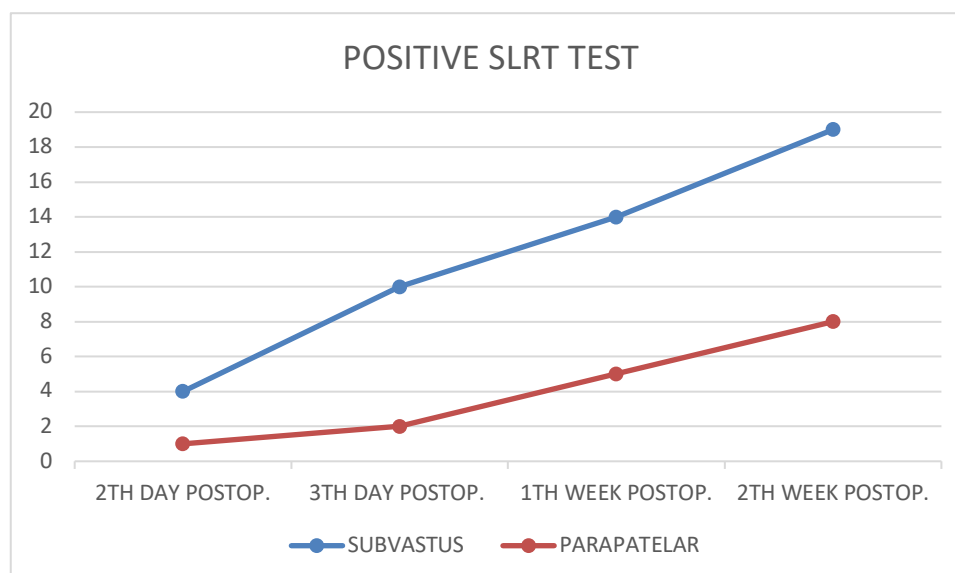


Figure 3: Evolution of positive SLRT test results compared over time in the first two weeks. ($p < 0.001$).

These results support the idea that the subvastus approach results in less pain and better muscle control than the parapatellar approach in the early postoperative stage.

DISCUSSION

The VAS was used to assess early postoperative pain, which is a simple and easy-to-apply test; moreover, it is currently a validated method for clinical evaluation. (9-11)

This study found a significant difference in early postoperative pain and muscle control in favor of the Subvastus approach group; which coincides with the results of Ahmed et al. who reported improvement in functional scales, including pain up to 6 months; but without finding a significant difference at twelve months of postoperative evaluation. (12,13)

Early quadriceps function is assessed, as it is considered closely related to pain in the early postoperative period. Approaches that preserve the extensor mechanism have been shown to provide patients with greater mobility, a more complete recovery, and greater early postoperative satisfaction. In this study, muscle control assessment using SLRT was better in the subvastus group ($p < 0.001$), consistent with the study by Hasan et al., who reported that patients operated on with a subvastus approach achieved SLRT earlier than those operated on with a medial parapatellar approach. (14)

Geng et al. concluded that patients operated on using the subvastus approach had better postoperative mobility, a better SLRT test, and less pain; consequently, they found that these patients had a higher satisfaction rate and a better postoperative recovery. Although the purpose of this study was not to evaluate patient satisfaction, we believe that the subvastus group will have a better satisfaction rate and postoperative experience. (15,16)

The limitations of this study are considered to be the sample size and the short follow-up period; however, the matching of

the characteristics of the patient groups studied makes the study more reliable.

CONCLUSIONS

The subvastus approach results in less early postoperative pain and better muscle control from postoperative day 2 through the first two weeks; this has an impact on the early recovery period; as well as a greater sense of surgical satisfaction for patients undergoing total knee arthroplasty, compared to the medial parapatellar approach.

The subvastus approach is recommended for its advantages when there are indications for primary knee replacement, when the surgeon's experience and training are compatible with the approach, and when the patient's characteristics allow it.

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