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POSTOPERATIVE PAIN CONTROL WITH GENICULAR BLOCK IN TOTAL KNEE ARTHROPLASTY: FUNCTIONAL IMPACT AND OPIOID CONSUMPTION

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Abstract: Aim: to evaluate the pain control and functional performance effects of genicular nerve blocks performed intraoperatively during primary total knee arthroplasty procedures in patients with advanced gonarthrosis. Methods: 34 patients took part, allocated to group C (control), which received infiltration with saline solution, and group I, which received an infusion of Novabupi for the block. The regional anesthetic procedure was carried out by the surgeon himself during the operation, before the sutures were made, identifying the infusion site by direct visualization of the vasculonervous bundles. The outcomes assessed were the visual analog scale of pain before and after the surgical procedure, joint effusion, muscle strength, ability to stand and walk, as well as opioid consumption in the first 5 postoperative days. Results: greater reduction in pain and muscle strength in the group that received the genicular block. There were no differences when assessing joint effusion, ambulation, pain pattern after discharge or Tramadol consumption. Conclusion: The genicular nerve block was more effective in controlling pain in the immediate postoperative period of primary total knee arthroplasties, sparing patients' motor function. There was no significant difference in opioid consumption.
Keywords: Knee Arthroplasty, Gonarthrosis, Local Anesthesia, Nerve Block.

INTRODUCTION

Total knee arthroplasty (TKA) is the surgical treatment indicated for a number of knee pathologies, most commonly in cases of advanced Kellgren-Lawrence grade 4 gonarthrosis,(1) refractory to conservative treatment. It is considered an effective surgical procedure for managing chronic pain and restoring the anatomical axis of the lower limbs,[2,3] with more than 13,000 procedures performed by the Brazilian public health system, the Sistema Único de Saúde (SUS), in 2019 alone.[4]

Post-operative pain in TKA is one of the factors associated with increased hospital stay and difficulty in the functional rehabilitation process, generating increased costs for the health system.[3] Better local and regional anaesthetic techniques can facilitate immediate mobilization of the joint in the post-operative period, reducing pain and resulting in early discharge and rehabilitation.

Of the various regional anesthesia techniques, femoral nerve block (FNB), adductor canal block (ACB) and sciatic nerve block (SNB) are the most widespread in clinical practice. However, some disadvantages, such as the motor block in FNB or the lack of analgesia in the posterior region of the knee in ACB, lead us to look for alternative techniques.[4,5]

Anatomical studies show that the innervation of the knee comes mainly from the genicular nerves, branches of the femoral, saphenous and common peroneal nerves, forming a network with the tibial and obturator nerves in the posterior compartment.[5] In observational studies, the infiltration of local anesthetic applied to block the anterior genicular nerves led to a reduction in opioid consumption after TKA.[6,7] There are few reports of the effects of the block on functional recovery or its efficacy compared to control groups that do not receive some form of regional block.[8]

The aim of this clinical study was to evaluate the functional impacts in terms of muscle strength and early walking ability, as well as pain control after performing a genicular nerve block intraoperatively for Total Knee Arthroplasty compared to a placebo control group.

MATERIALS AND METHODS

The approval of the research ethics committee was obtained prior to the execution of this study. This was a double-blind randomized clinical trial carried out from September 2022 to March 2023, in accordance with the Consolidated Standards of Reporting Trials

(CONSORT) guidelines.[9]34 patients of both sexes were included, with ages ranging from 59 and 84 years old, with severe Kellgren--Lawrence grade 4 primary gonarthrosis[1]undergoing surgical planning for TKA. Patients with a history of allergy to the substances used, active local or systemic infection, neurological deficit or dementia, secondary gonarthrosis, large angular deformities (greater than 20 degrees), need for revision components and other conditions that would compromise data collection were not included.

Participation in the study was requested after referral for TKA and confirmed only after signing the informed consent form. Continuity of treatment was guaranteed for patients who were not included in the study, regardless of the reason.

Initially, clinical and anthropometric characteristics such as weight, height, BMI, age, affected side, as well as current and past pathological history were documented preoperatively through interview data. The patients selected for the study were randomized into two groups after the data had been entered into a database and randomized using the Research Randomizer application.[12]

The Group C (control) received infiltration with 0.9% saline solution and Group I (intervention) received a genicular nerve block using levobupivacaine.

SURGICAL TECHNIQUE

At the end of the surgical procedure and before the sutures were made, the main surgeon infiltrated 09 ml of Novabupi ® (levobupivacaine hydrochloride) without vasoconstrictor 0.5% divided equally between each nerve in group I and, likewise, 09 ml of saline 0.9% in group C. The surgeon received the material prepared by another member of the team who knew which group the patient in question belonged to.

The sites for the infiltrations were determined clinically using known anatomical structures as parameters: (1) the medial superior genicular nerve was infiltrated slightly above the adductor tubercle and the posterior cortex of the femur; (2) the lateral superior genicular nerve was infiltrated anterior to the meeting point of the posterior cortex of the femur with the lateral condyle and (3) the medial inferior genicular nerve was infiltrated in the region of transition from the diaphysis to the medial condyle of the tibia.[13,) (14)

The entire procedure was carried out while the patient was still in the operating room, under sedation and spinal anesthesia.

CLINICAL FOLLOW-UP

Before the surgical procedure, the patient underwent a medical interview to confirm the data collected in the outpatient consultation, quantify the pain according to the Visual Analog Scale (VAS), assess muscle strength according to the Medical Research Council scale, quantify joint effusion by grading from 1 to 4 [15]and assess the ability to maintain orthostasis and walk 20 meters on the ground with 50% unloading of the body using a pair of crutches. The assessment of ambulation and orthostasis was measured from 1 to 4, with 1 being the patient who could not tolerate orthostasis, 2 being the patient who could maintain orthostasis with or without support but could not walk, 3 being the patient who could walk with or without support for less than 20 meters and 4 being the patient who could walk with or without support for 20 meters.

After the surgery, the patient was assessed on the first post-operative day by another member of the team, who was unaware of which group he belonged to, applying the VAS, again assessing muscle strength, joint effusion and the ability to maintain orthostasis and ambulate.

After the first 24 hours, the patients filled in a questionnaire created by the authors every day for 5 days, reporting their pain pattern and recording the highest and lowest pain experienced that day according to the VAS. The consumption of tramadol tablets was also recorded. All patients were discharged on the second postoperative day.

At the time of discharge, all patients were prescribed dipyrone 1g orally (VO) every 06/06 hours and ketoprofen 100mg VO every 12/12 hours, with tramadol 50mg VO for up to 06/06 hours in case of persistent pain that did not improve with other medications.

The researchers were given telephone numbers to answer any questions or report any complications.

STATISTICAL ANALYSIS

The information obtained through the forms that are part of the patient interview was analyzed using Microsoft Office / Excel 2011 software (Redmond, Washington, USA).

The results were expressed as the mean ± standard deviation (SD) or, in the case of pain, muscle strength, joint effusion and ambulation, the difference between the means before and after surgery.

The SPSS Statistics 28.0.1 software (Armonk, New York) was used to statistically analyze the data.

The Wilcoxon-Mann-Whitney test and the t-test were used to compare the groups. The significance level set for the tests was 5% (p-value < 0.05).

In the first stage, comparisons were made of the variables recorded pre and post-operatively (VAS, Muscle Strength, Joint Stroke and Ambulation/Orthostasis). The comparison tests were carried out using the difference between the pre and post values of the respective variable for each patient in the two groups. In addition, the variables Age and BMI were tested in order to check whether the groups were homogeneous according to these two characteristics.

We then compared the records of the greatest and least pain and the number of tramadol tablets consumed over the first five days after the surgical procedure. The comparisons were made within the same day in order to check whether the groups had different daily characteristics in the variables of interest. The range of pain was also recorded, based on the difference between the highest and lowest pain recorded on the same day.

RESULTS

The study included 34 patients recruited between September 2022 and March 2023. The patients were randomized and divided into two groups: control - infiltration with SF 0.9% (n = 17) and intervention - infiltration with levobupivacaine (n = 17).

All patients were followed up post-operatively. Three patients from each group were excluded from the statistical analysis due to flaws in filling in the questionnaires. (Image 1)

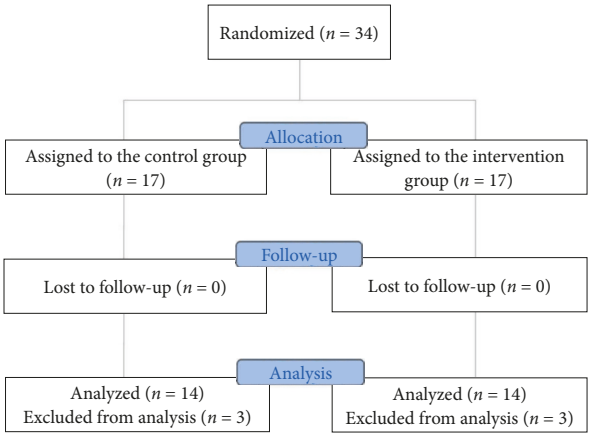

Image 1 Flowchart of the distribution of study participants

Table 1 shows that the mean values for the age and BMI variables are close, indicating that there is no evidence that the groups studied have different profiles for these variables.

	Group C (n = 14)	Group I (n = 14)	*Value - p*
Age	69,6 ± 6,85	68,1 ± 6,66	0,549
Weight	76,93 ± 12,73	79,07 ± 11,02	
Height	1,65 ± 0,08	1,65 ± 0,10	
BMI	28,2 ± 3,56	29,2 ± 3,73	0,865

Table 1: Comparison of control variables

	Group C (n = 14)	Group I (n = 14)	*Value - p* Tente t
EVA	-1,57 ± 1,60	-3,29 ± 2,49	0,039
Muscular Strength	-0,79 ± 1,19	-1,43 ± 0,51	0,016
Joint effusion	0,86 ± 0,95	0,57 ± 0,51	0,56
Walking/Standing	-0,50 ± 1,22	-0,57 ± 0,65	0,902

Table 2 Comparison of pre- and post-operative variables between the groups

Day	Less pain			Greater pain			Amplitude		
	Group C (n = 14)	Group I (n = 14)	*Value - p*	Group C (n = 14)	Group I (n = 14)	*Value - p*	Group C (n = 14)	Group I (n = 14)	*Value - p*
1	3,9 ± 2,77	5,3 ± 2,25	0,197	6,6 ± 2,30	7,0 ± 2,98	0,587	2,6 ± 1,75	1,8 ± 1,75	0,332
2	3,6 ± 2,73	3,9 ± 2,59	0,708	6,6 ± 2,25	5,4 ± 3,46	0,382	3,0 ± 2,32	1,5 ± 1,93	0,176
3	4,0 ± 2,28	3,6 ± 1,92	0,707	6,7 ± 2,28	5,3 ± 3,06	0,311	2,7 ± 1,79	1,6 ± 1,85	0,202
4	3,5 ± 1,86	3,8 ± 2,60	0,737	7,1 ± 2,59	5,6 ± 3,78	0,498	3,6 ± 1,97	1,9 ± 1,96	0,095
5	3,0 ± 2,32	3,5 ± 2,45	0,617	6,0 ± 2,10	4,9 ± 3,09	0,701	3,0 ± 2,68	1,4 ± 1,60	0,15

Table 3 Pain pattern reported in the first 5 days after the surgical procedure.

Day	Group C (n = 14)	Group I (n = 14)	*Value - p*
1	1,9 ± 1,51	1,4 ± 0,92	0,466
2	2,0 ± 1,48	1,1 ± 1,13	0,185
3	2,1 ± 1,45	1,1 ± 1,25	0,148
4	2,1 ± 2,09	1,4 ± 1,06	0,218
5	1,6 ± 1,29	1,3 ± 1,16	0,581

Table 4 Consumption of tramadol tablets in the first 5 days after surgical procedure.

When comparing the variables VAS, Muscle Strength, Joint Stroke and Ambulation/Orthostasis, considering the preoperative assessment and the 1st postoperative day, Table 2 shows that both parameters VAS and Muscle Strength showed statistically significant variations.

Table 3 shows that the groups appear to have some difference when comparing records of greater and lesser pain, however all the tests show that there is no evidence of any statistically significant difference (p-values > 0.05).

The range of pain on a single day and overall is, on average, lower in the intervention group over the five days considered in the analysis, but these differences between the means were not statistically significant.

With regard to the number of tramadol tablets consumed during the day (Table 4), group I had lower average values over the five days, but the comparison tests indicate that there is no statistical evidence that the groups have different tablet consumption profiles over the five days (p-values > 0.05).

During the follow-up period, none of the patients had any complications related to the surgical procedure.

DISCUSSION

The main result of the study was that the group that received the genicular block did not show any significant change in the pain pattern measured by VAS, demonstrating the ineffectiveness of the technique in isolation. This finding is not in line with other publications demonstrating the effectiveness of genicular blockade in the immediate postoperative period.[10,11]

A relevant factor for choosing this type of blockade is its ability to spare the motor function of the joint. We didn't observe greater ease of walking in the blocked patients, as reported by Akesen et al.[10], but we also didn't observe a worsening when comparing the groups, even with a reduction in muscle strength in the patients who received the intervention. The reduction in strength was not enough to generate a difference in the ability to maintain orthostatism and early ambulation.

As for the pain parameter, which was reported daily by the patients, considering its highest and lowest value within the same day, there was no statistical difference between the results between the groups. However, it is worth noting an apparently smaller range in the variation of pain sustained over all the days of the study, demonstrating that although there was no noticeable absolute reduction in pain scores, the condition was maintained with smaller variations in the patients who received the blockade.

Regarding the use of opioids, there was a reduction in the average consumption of tramadol tablets sustained even 5 days after the procedure in the intervention group, corroborating the findings of other studies that also show a reduction in the use of opioids in the first 48 hours after the procedure,[11]although we did not find statistical relevance.

When we analyze the trends observed in terms of pain patterns and tramadol consumption, we see that the patients who received the blockade had similar levels of pain, with a smaller range between the worst and least pain reported, even though tramadol consumption appears to be lower. We can infer from this a possible benefit, as less medication is needed to maintain the pain profile observed.

This study has some limitations. Firstly, the sample size - small groups may limit confirmation of the trends observed. Secondly, the analysis time was restricted to the first 5 postoperative days, limiting our analysis to short-term events.

CONCLUSION

The data presented in this study show that the genicular nerve block performed intraoperatively in total knee arthroplasty surgeries, in isolation, was not effective in reducing pain on the first postoperative day and did not benefit early return to walking, nor was there a significant reduction in opioid consumption in the patients who received the intervention.

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