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RESEARCH ARTICLE

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Continuos Lumbar Postoperative Analgesia in Hip and Femur Elderly Patients. Comparison between Posterior and Anterior Access. Retrospective Study

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ABSTRACT

Background and Objectives: The aim of this retrospective study was to compare the effectiveness of lumbar plexus block via the posterior approach (psoas compartment) with the anterior approach (perivascular inguinal), accessed using a neurostimulator, in the quality of analgesia in major orthopedic surgical procedures of the hip and femur undergoing standardized spinal anesthesia.

Methods: All patients received standardized anesthesia. No pre-anesthetic medication was administered in the room, and fasting was shortened with 200 to 400 ml of oral maltodextrin 2 to 4 hours before being taken to the operating room (OR). At the end of the surgical intervention, the patients were separated according to their position during surgery into two groups. Group 1 patients operated on in lateral decubitus with the operated limb upwards underwent a psoas compartment block and Group 2 patients operated on in horizontal dorsal decubitus underwent an inguinal perivascular block. Access to both plexuses was achieved using a neurostimulator, followed by catheter insertion after injection of 20 ml of levobupivacaine. Postoperative analgesia was performed with the same drug at 0.1% S75:R25 at a rate of 10 ml/h, with assessments 4, 8, 12, 16, 20, 24, and 30 hours after the end of the surgical procedure. Pain severity was also evaluated during the same period. The amount of opioids administered in the postoperative period was recorded.

Results: There was no difference between the two groups. Lumbar plexus block reduced the need for opioids, and 52% of the patients who underwent psoas compartment block and 36% of the patients who underwent inguinal paravascular block did not need additional analgesics in the postoperative period. Analgesia lasted for approximately 22 hours in the psoas compartment block and 17 hours in the inguinal paravascular block. No complications occurred during the puncture in either of the two access points, nor were there any complications, especially in the posterior access point.

Conclusions: Psoas compartment block and inguinal paravascular block are excellent techniques for postoperative analgesia in orthopedic surgeries, decreasing the need for opioids. This study showed that the injection in the psoas compartment was easier and more effective for the control of postoperative pain in elderly patients with femur and hip fractures. The use of a 0.1% S75:R25 solution and an elastomeric pump provides high-quality postoperative analgesia.

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Introduction

The goals of perioperative pain management are to alleviate suffering, achieve early mobilization after surgery, reduce hospital stay, and achieve patient satisfaction. Pain control regimens should consider medical, psychological, and physical conditions, the level of fear or anxiety about the surgical procedure, the professional's preference and ability, and the patient's response to administered agents.

Accessing the World Federation of Societies of Anesthesiology (WFSA) website to check if it was possible to find out the number of continuous blocks using ultrasound (US) and/or neurostimulator (NS), the response showed that there is currently no database

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that reports the absolute number of continuous regional blocks in the different National Societies of Anesthesiology. The World Federation of Societies of Anesthesiologists publishes educational recommendations, courses and tutorials on regional anesthesia and ultrasound, but does not maintain a worldwide epidemiological registry of this type of procedure. What exists are surveys carried out in different regions of the world, which show a preference for nerve localization techniques [1-3].

The WFSA does not have a worldwide registry that counts: the number of continuous blocks performed; the percentage guided by ultrasound; the percentage guided by neurostimulator; or a comparison between national societies of different countries. The comparison between US and NS for lower limb peripheral blocks: current scientific evidence favors US over NS for most techniques; however, NS still has utility in specific situations, such as a complement to US, difficult anatomy, or when ultrasound visualization is inadequate.

A systematic review and meta-analysis conducted in 2009 with 13 studies showed that US improves the efficacy of peripheral nerve blocks compared with techniques that utilize NS for nerve localization. However, extensive studies are needed to determine whether the use of US can decrease the number of complications such as nerve injury or systemic local anesthetic toxicity when compared to NS [4].

A study comparing lumbar nerve block with a neurostimulator, posterior (psoas compartment) and anterior (perivascular inguinal), with a single dose of 40 ml of 0.25% bupivacaine, showed it to be an excellent technique for postoperative analgesia in orthopedic surgical interventions, reducing the need for opioids. This study showed that the injection in the psoas compartment was easier and more effective in blocking the five nerves of the lumbar plexus [5].

Elastomeric Infusion Pumps (EMPs) are designed to safely and accurately deliver continuous infusions and have been successfully used to deliver infusions of analgesics for postoperative analgesia, chemotherapy and cardiology treatments. Patients on continuous pump analgesia prefer elastomeric devices over electronic pumps due to their low weight and size, ease of use, and less interference with sleep. In a patient undergoing bilateral hip arthroplasty, continuous analgesia was performed with EMP via lumbar plexus block at the NS and contiplex A150 set and continuous infusion of 7 ml/h to each side, receiving no bolus for 50 hours [6-8].

The aim of this retrospective study was to compare the effectiveness of continuous lumbar plexus block via the posterior approach (psoas compartment) with the anterior approach (perivascular inguinal), accessed using a neurostimulator and EMP with 0.1% S75:R25, in the quality of analgesia in major orthopedic surgical procedures of the hip and femur undergoing standardized spinal anesthesia.

Methods

According to CNS Resolution 196/96, the Research Ethics Committee approved the project postoperative acceleration in fracture of femur surgeries, number 76/11 and CAAE 0075.0.351.000-11. Because this is a retrospective study, the informed consent form was not kept. All patients aged over 60 years of both sexes, with ASA I-III physical status and femur fracture to be operated on under spinal anesthesia, with analgesia using local anesthetic in the lumbar plexus (anterior or posterior) in a hospital covered by the Unified Health System (SUS) were recorded in an Excel spreadsheet (Figure 1) to be studied in relation to quality and satisfaction with continuous analgesia with an elastomeric pump implanted in the lumbar plexus for postoperative treatment. During the pre-anesthetic visit the project was detailed, explained to the patient and family, and they gave permission for publication in medical journals soon.

The exclusion criteria were hypovolemia, coagulation disorders, severe cardiorespiratory problems, infection, bedridden patient at home, hospitalized in an Intensive Care Unit (ICU), using an indwelling urinary catheter, and refusal of the proposed met.

All patients received standardized anesthesia. No pre-anesthetic medication was administered in the room, and fasting was shortened with 200 to 400 ml of oral maltodextrin 2 to 4 hours before being taken to the operating room (OR). After intravenous access with a 20G or 18G catheter, an infusion of Ringer's lactate solution, supplemented with antibiotic, dexamethasone, and ondansetron, was started. Monitoring was performed using continuous ECG in the CM5 position, non-invasive blood pressure measurement, capnography for sedation, and pulse oximetry. To perform the subarachnoid puncture, 0.5 mg of midazolam and 0.15 mg/kg of dextrocetamine were administered, and spinal anesthesia was performed in the left lateral decubitus position with 3 mL of 0.5% isobaric levobupivacaine in 50% enantiomeric excess (S75:R25), via the paramedian approach, in the L2-L3 or L3-L4 space, using a 27G Quincke-type needle. Sedation during the operation was performed with fractionated doses of midazolam. Dipyrone 30 mg/kg were added to the last crystalloid solution administered before the end of the procedure [9].

At the end of the surgical intervention, the patients were separated according to their position during surgery into two groups. Group 1 patients operated on in lateral decubitus with the operated limb upwards underwent a psoas compartment block (posterior approach) and Group 2 patients operated on in horizontal dorsal decubitus underwent an inguinal perivascular block (anterior approach).

In Group 1 the access to the posterior lumbar plexus was achieved using a stimulator (HNS12 B. Braun, Melsungen) connected to a 100-mm 18G Tuohy type needle. The needle was advanced and the quadriceps was stimulated with a 0.5 mA current until a response was observed. After negative aspiration of blood, 20 mL of 0.2% levobupivacaine were injected through the extension connector of the needle. Maintaining the needle in the same position, a 20G catheter was introduced 4-7 cm in the psoas compartment, being fixed in place with adhesive material and an occlusive dressing. In Group 2, with patients in the supine position, access to the anterior perivascular inguinal lumbar plexus was achieved using a stimulator (HNS12 B. Braun, Melsungen) connected to a 50-mm 22G Tuohy type needle. The needle was advanced and the quadriceps was stimulated with a 0.5 mA current until a response was observed. After negative aspiration of blood, 20 mL of 0.2% levobupivacaine (S75:R25) were injected through the extension connector of the needle. Maintaining the needle in the same position, a 20G catheter was introduced 4-7 cm in the psoas compartment, being fixed in place with adhesive material and an occlusive dressing.

After catheter fixation in both groups, a disposable elastomeric pump containing 400 mL of 0.1% levobupivacaine 50% enantiomeric excess (S75:R25) was connected to the catheter placed in the posterior and anterior lumbar plexus and transferred to the post-anesthesia care unit (PACU). The pump was programmed for infusion at a rate of 10 ml/h. After the effects of the spinal anesthesia wore off, the patient was transferred to his room.

Pain was assessed using a scale of 0 (no pain), 1 (mild pain), 2 (moderate pain), and 3 (severe pain) by a previously trained nurse

at 4, 8, 12, 16, 20, 24, and 30 hours after the injection of the anesthetic and the start of the elastomeric pump infusion. The patient was transferred to the room and, if they complained of pain, a solution containing 30 mg of ketoprofen 50 mg and 1 g of dipyrone would be administered intravenously. The total doses of the analgesic solution were recorded during the first 30 hours, as well as any cardiocirculatory changes. During the 30 postoperative hours, boluses from the pump were not necessary. Both catheters were removed without intercurrences. After catheter removal, pain was controlled with oral ketoprofen and dipyrone, and released to your residence.

Statistic

Age, weight, height, duration of spinal anesthesia, and analgesic requirements were compared between groups using the Wilcoxon rank-sum test. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, as appropriate. Pain severity, considered an ordinal repeated measure, was analyzed using the nonparametric F1-LD-F1 longitudinal model, with relative treatment effects (RTEs) estimated for each group and assessment time. Post-hoc comparisons were performed using the Wilcoxon rank-sum test with Holm adjustment. The 4-hour assessment was excluded from inferential analysis because it showed no variability. A two-sided $p<0.05p<0.05p<0.05$ was considered statistically significant.

Results

The demographic data for the two patient groups are presented in Table I, and their distribution according to the procedure performed is shown in Table II. There is no significant difference in anthropometric data or type of surgery between the two groups (Table I, Figure 2). Similarly, there was no significant difference in the type of surgery between the two groups (Table II).

Pain assessment on a scale of 0 to 3 during the first 30 hours post-surgery showed that the maximum degree of pain never occurred in either group, with a significant difference (Table III). There was no significant difference in the duration of standardized spinal anesthesia between the two groups (Table III).

In all patients, the first assessment four hours after the block was performed without residual block from the spinal anesthesia. The mean duration of analgesia was 22:22 ± 3:73 hours in Group 1 and 17:44 ± 4:53 hours in Group 2, with a statistically significant difference (Table IV). In 42 patients in Group 1 and 28 patients in Group 2, the use of analgesic doses was not necessary in the first 30 hours, with a significant difference (Table IV). The number of patients in both groups who received one, two, or three doses of supplemental analgesic was with a statistically significant difference between the groups (Table IV). During the infusion of 10 ml per hour of 0.1% levobupivacaine (S75:R25) via catheter and elastomeric pump, no bradycardia or hypotension was reported in the first 30 hours post-operatively.

Table I: Demographics Data for Two Patients Groups

Parameters	Group 1=80	Group 2=77	P-Value
Age (years)	78.74 ± 08.03	73.97 ± 09.35	0.0009206 *
Weight (kg)	66.33 ± 09.64	66.38 ± 12.38	0.8056 *
Height (cm)	160.10 ± 6.60	161.0 ± 8.19	0.5325 *
Gender: M / F	10 / 70	13 / 64	0.5022 **

Values expressed in Mean±SD

* Wilcoxon Rank Test

** Fisher's Exact Test

Table II: Surgeries Performed in Both Groups and Duration of Spinal Anesthesia

Parameters	Group 1=80	Group 2=77	P-Value
Surgery	Group 1=80	Group 2=77	0.2675 *
Total Hip Arthroplasty	19 (24%)	28 (36%)	
Partial Hip Arthroplasty	27 (34%)	26 (34%)	
Femoral Osteosynthesis	28 (35%)	18 (24%)	
Femoral Osteosynthesis + Iliac Graf	6 (7%)	5 (6%)	
Duration of Spinal Anesthesia (h)	2:13 ± 0:32	2:09 ± 0:28	0.5191 **

* Chi-square Test

** Wilcoxon Rank Test

Table III: Pain Scale Assessed at Different Times (F1-LD-F1 Longitudinal Model)

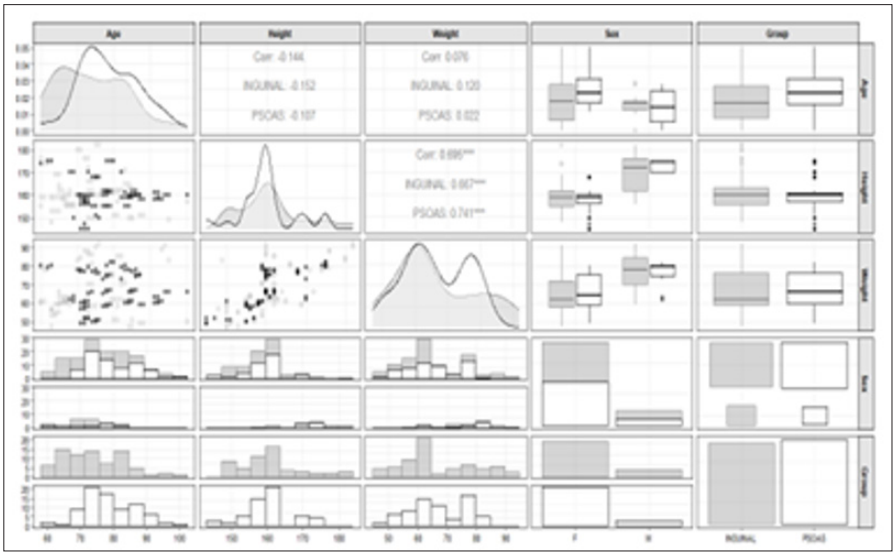
Hours	Group	0	1	2	3	RTE	P-Value
4	1	80	0	0	0	-	
	2	77	0	0	0	-	
8	1	80	0	0	0	0.303	
	2	66	11	0	0	0.362	
12	1	79	1	0	0	0.308	
	2	61	11	5	0	0.402	
16	1	71	8	1	0	0.352	
	2	37	20	20	0	0.571	
20	1	35	31	40	40	0.572	
	2	21	31	25	0	0.671	
24	1	21	40	19	0	0.658	
	2	4	29	44	0	0.812	
30	1	21	40	19	0	-	
	2	4	29	44	0	-	

Table IV: Analgesic Doses in the First 30 Hours

Doses	Group 1=80	Group 2=77	P-Value
No analgesic	42 (52%)	28 (36%)	0.0004135*
One dose	35 (44%)	22 (28%)	
Two doses	2 (2.5%)	20 (26%)	
Three doses	1 (1.5%)	7 (10%)	
Mean duration ± SD (h)	22:22 ± 3:73	17:44 ± 4:53	2.2e-16*

* Wilcoxon Rank Test

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
PSOAS CONTINUOUS S75:R25 0.1% ELASTOMERIC PUMP																
					AL	Duration	4 h	8 h	12 h	16 h	20 h	24 h	30 h	Dura	Num	Surgery
N	Sx	Age	Wei	Hei	SPIN	Surg	Pain	Pain	Pain	Pain	Pain	Pain	Pain	Anal	Dose	
1	F	87	75	160	Bu Is	02:05	0	0	0	1	1	2	2	27	1	PTQ
2	F	86	78	162	Bu Is	02:10	0	0	0	0	0	0	0	36	0	Síntese Fêmur
3	M	69	63	170	Bu Is	02:20	0	0	0	0	0	0	0	32	0	PTQ
4	F	73	52	157	Bu Is	02:00	0	0	0	0	0	0	0	24	0	PTQ
5	F	78	74	160	Bu Is	03:15	0	0	0	0	0	0	0	26	0	PPQ
76	F	94	66	160	Bu Is	02:35	0	0	0	0	2	2	2	21	1	PPQ
77	F	92	61	159	Bu Is	01:55	0	0	0	0	1	1	1	21	1	Síntese Fêmur
78	F	86	75	160	Bu Is	02:05	0	0	0	1	1	2	2	21	1	PTQ
79	F	83	78	161	Bu Is	01:40	0	0	0	0	1	1	1	22	1	Síntese Fêmur
80	M	82	73	170	Ne Is	02:15	0	0	0	0	2	2	2	26	0	Síntese Fêmur
INGUINAL CONTINUOUS S75:R25 0.1% ELASTOMERIC PUMP																
					AL	Duration	4 h	8 h	12 h	16 h	20 h	24 h	30 h	Dura	Num	Surgery
N	Sx	Age	Wei	Hei	SPIN	Surg	Pain	Pain	Pain	Pain	Pain	Pain	Pain	Anal	Dose	
1	F	62	78	174	Ne Is	01:55	0	1	1	2	2	2	2	14	3	PTQ
2	M	71	84	180	Ma Is	02:45	0	0	0	2	1	2	2	12	2	PTQ
3	M	69	64	156	Ne Is	01:35	0	0	0	0	0	1	1	22	1	PTQ
4	M	76	92	182	Bu Is	02:30	0	0	0	2	0	2	2	15	2	PTQ
5	M	73	66	172	Ne Is	02:15	0	0	0	2	1	2	2	19	1	PPQ
73	M	72	88	176	Ne Is	02:55	0	0	0	1	1	2	2	26	0	Síntese Fêmur
74	F	60	61	159	Ne Is	03:30	0	0	0	1	2	2	2	21	0	PPQ
75	F	74	58	150	Ne Is	02:35	0	0	0	1	2	2	2	25	0	PPQ
76	M	82	73	170	Ne Is	02:15	0	0	0	0	2	2	2	26	0	Síntese Fêmur
77	F	84	47	150	Ne Is	01:55	0	0	1	0	2	2	2	18	0	PTQ



No complications at the puncture site were observed during the evaluation period in both cases access is provided to the lumbar plexus. No inadvertent injection or puncture of the subarachnoid space was observed during access to the lumbar plexus in the psoas compartment, nor was unilateral or bilateral epidural block observed. And nor puncture in the kidney or other complications. In the group that accessed the psoas compartment, no patient reported analgesia in the feet, demonstrating that there was no blockage of the sacral plexus. No arterial or venous puncture was observed during catheter insertion in the inguinal perivascular access. The catheter was removed after 30 hours, and the patients were discharged to their homes without any infection or neurological complications.

Discussion

Continuous lumbar plexus block via posterior approach (psoas compartment) or anterior approach (perivascular inguinal) with the aid of a peripheral nerve stimulator and catheter placement is an easy technique to perform with few side effects. The use of elastomeric pumps with a constant flow rate of 10 ml/h allowed for excellent analgesia quality in elderly patients with femur or hip fractures. Analgesia with an elastomeric pump and the use of 0.1% S75:R25 after space expansion with 20 ml of the same solution for catheter placement resulted in 52% of patients not requiring any intravenous analgesic dose in the posterior region, which was higher than the 36% in the anterior region.

If the WFSA brings together 149 societies from 156 countries but does not have a global database that reports how given how many continuous peripheral nerve blocks are performed with the aid of ultrasound, neuromuscular blockade, or loss of resistance, we cannot rule out any form of access to peripheral nerve blocks in the world. Similarly, consulting the Brazilian Unified Health System (SUS) regarding how many hospitals use continuous nerve blocks and with which approach (US or NS), it would not be possible to rule out the use of older forms of access to simple or continuous peripheral nerve blocks. And consulting the Brazilian Society of Anesthesiology, there are no statistics on the use of the various forms of approach to peripheral nerves for analgesia or anesthesia, there are no national statistics. The information contained in this paragraph justifies the performance of continuous lumbar plexus blocks in both approaches (posterior or anterior) with the use of a neurostimulator and elastomeric pump and 0.1% levobupicaine (S75:R25) for postoperative analgesia in elderly patients with femur or hip fracture, in a retrospective study. The average duration of analgesia was significantly longer with posterior access (22 h) compared with anterior access (17 h) [10-12].

In a previous study with a single dose of 40 ml of 0.25% bupivacaine the five nerves of the lumbar plexus, ilioinguinal, genitofemoral, cutaneous lateral femoral, femoral, and obturator nerves were blocked in 92% of patients in the psoas compartment versus 62% in the perivascular inguinal block. In the present study with continuous infusion of 10 ml/h of 0.1% levobupivacaine (S75:R25), the analgesia produced in the five nerves of the lumbar plexus was not evaluated.

Continuous peripheral nerve blockade has become a popular method of achieving postoperative analgesia for many surgical procedures. The safety and reliability of infusion pumps are dependent on their flow rate accuracy and consistency. Elastomeric pumps are mechanical devices composed of an elastomeric balloon reservoir into which the drug to be infused is stored, a protective casing, a flow controller and a wound catheter. Elastomeric infusion pumps can deliver infusions over a longer period. Studies have shown good response to analgesia with these pumps for the first 24 hours, but their benefit is not as clear at 48 and 72 hours. There are numerous factors that affect the flow rate of elastomeric pumps. The elastomeric pumps used in this study had a volume of 400 ml, into which 80 ml of 0.5% levobupivacaine in enantiomeric excess of 50% was added, transforming this solution into a 0.1% S75:R25 solution, with a fixed infusion rate of 10 ml/h. If the elastomeric pump is connected to a catheter, the release of the agent may vary, depending on its length. A 30-hour period was determined for preparation for hospital discharge and catheter removal, with the remaining analgesic solution inside the pump. The elastomeric pump has several advantages over the electronic pump, including: portability, ease of use, and a few technical problems such as unwanted alarm triggering.

A recent systematic review and meta-analysis of 206 articles, including 20 randomized controlled trials, demonstrated that continuous lumbar plexus block provided superior pain relief compared to conventional pain management approaches such as general anesthesia. Furthermore, lumbar plexus block reduced overall opioid consumption by patients compared to controls, reduced adverse effects, and improved functional recovery, reinforcing the broader positive impact of meticulous pain management. In our study, the posterior approach proved

to be more effective than the anterior approach in controlling postoperative pain in elderly patients with femur and hip fractures [13].

Orthopedic surgery remains the primary indication for peripheral nerve blocks for both anesthesia and postoperative analgesia, as it is considered one of the most painful surgeries, if not the most painful. Psoas compartment block is a deep regional technique that provides excellent analgesia for hip, proximal femur, and anterior thigh surgeries. When performed with a neurostimulator alone, it has high success rates in experienced hands but is associated with potentially serious complications due to the depth of the puncture and the proximity of neural, vascular, and neuroaxial structures. The main reported complications are: epidural diffusion, subarachnoid puncture, systemic toxicity of the local anesthetic, retroperitoneal hematoma, nerve injury, quadriceps weakness, renal perforation, and infection. The puncture with a neurostimulator did not present any of these complications, nor did the initial injection of 20 ml of 0.2% levobupivacaine (S75:R25), followed by 10 ml/h of 0.1% of the same substance in the 80 patients who underwent analgesia via this route [14,15].

Although generally safe, the use of catheters in peripheral nerves are associated with potential complications. Relatively few complications during insertion have been reported in recent years. Two prospective investigations involving more than 2,100 patients suggest that the incidence of complications related to continuous plexus block is very low and comparable to single injection techniques. The use of US, with or without NS, has led to a marked decrease in complications. Continuous nerve blocks provide a safer alternative to epidural analgesia in patients receiving thromboprophylaxis, especially with low molecular-weight heparin [16-18].

Twenty-eight pediatric ambulatory continuous peripheral nerve block patients for pain management following foot and ankle reconstruction surgery received elastomeric devices during the 12 months of data collection, resulting in a 58% decrease in patient length of stay, without the use of opioids for analgesia, and a decrease in cost and 96.4% patient satisfaction [19].

A retrospective study with 21 patients for ischemic pain due to peripheral obstructive arterial disease, continuous sciatic nerve block with 0.375% ropivacaine provided effective pain control with fewer adverse effects [20].

Various adjuvants have been used to increase the quality and duration of local anesthetics used on peripheral nerves. In a recent editorial, the association of adjuvants with local anesthetics, perineural administration, although effective, is considered off-label and presents concerns about compatibility with local anesthetics due to the potential for crystallization. During peripheral nerve blocks or spinal anesthesia, we never use anything that is off-label [21,22].

Conclusion

Lumbar plexus block, whether approached posteriorly or anteriorly, is a simple, safe, and effective technique for providing perioperative anesthesia and, with the use of a catheter and elastomeric pump, provides excellent postoperative pain control. This study showed that the use of the psoas compartment provided a longer duration of analgesia than the perivascular inguinal approach. The use of a catheter in the lumbar plexus and continuous infusion of 10 ml/h of 0.1% levobupivacaine reduces opioid consumption, decreases opioid-related adverse effects, enhances patient satisfaction, and improves compliance with physiotherapy. The inguinal perivascular approach is an easier approach to perform than psoas compartment block because it is a deep plexus and requires constant training.

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