

# Efeitos da Analgesia Peridural e do Bloqueio Contínuo do Plexo Lombar sobre a Reabilitação Funcional após Artroplastia Total do Quadril \*

## *Effects of Epidural Analgesia and Continuous Lumbar Plexus Block on Functional Rehabilitation after Total Hip Arthroplasty\**

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### RESUMO

Duarte LTD, Beraldo PSS, Saraiva RA - Efeitos da Analgesia Peridural e do Bloqueio Contínuo do Plexo Lombar sobre a Reabilitação Funcional após Artroplastia Total do Quadril.

**JUSTIFICATIVA E OBJETIVOS:** A dor após artroplastia total do quadril (ATQ) é intensa e agravada pelas mobilizações, o que demanda técnica analgésica eficaz e que permita mobilidade precoce, participação nas atividades de reabilitação e rápida recuperação funcional. O objetivo do estudo foi comparar os efeitos das técnicas de analgesia controlada pelo paciente (ACP) pelas vias peridural e perineural do plexo lombar sobre a reabilitação funcional em pacientes submetidos à ATQ.

**MÉTODO:** Pacientes estado físico ASA I a III foram alocados aleatoriamente nos grupos Peridural e Lombar. Para a ATQ, foi realizada anestesia peridural lombar contínua com ropivacaína a 0,5% (Peridural) ou bloqueio contínuo do plexo lombar com ropivacaína a 0,5% (Lombar). Na sala de recuperação, iniciou-se ACP com infusão de ropivacaína a 0,2% (Lombar) ou ropivacaína a 0,2% + fentanil 3 µg.mL<sup>-1</sup> (Peridural). A eficácia da analgesia nas primeiras 48 horas após a ATQ (escores de dor, consumo de morfina de resgate e de bolos da bomba de ACP) foi comparada entre os grupos. Diferentes parâmetros da reabilitação pós-operatória foram estudados.

**RESULTADOS:** Quarenta e um pacientes foram submetidos à análise estatística. Os escores de dor em repouso foram semelhantes nos dois grupos. Apesar do controle mais efetivo da dor dinâmica no grupo Peridural e o uso de morfina ter sido maior, mais frequente e mais precoce no grupo Lombar, não houve diferença entre os grupos em nenhum dos parâmetros estudados de reabili-

tação. As técnicas de analgesia não influenciaram as falhas no processo de reabilitação.

**CONCLUSÕES:** A maior efetividade da analgesia peridural não se traduziu em melhora no processo de reabilitação, nem reduziu o tempo necessário para alcançar os desfechos estudados.

**Unitermos:** ANALGESIA, Pós-operatória: controlada pelo paciente, peridural, plexo lombossacral; CIRURGIA, Ortopédica: artroplastia quadril; RECUPERAÇÃO PÓS-OPERATÓRIA: reabilitação funcional.

### SUMMARY

Duarte LTD, Beraldo PSS, Saraiva RA – Effects of Epidural Analgesia and Continuous Lumbar Plexus Block on Functional Rehabilitation after Total Hip Arthroplasty.

**BACKGROUND AND OBJECTIVES:** Pain after total hip arthroplasty (THA) is severe and it is aggravated by movements, which requires an effective analgesic technique that allows early mobilization, participation in rehabilitation activities, and fast functional recovery. The objective of this study was to compare the effects of epidural and perineural patient-controlled analgesia (PCA) of the lumbar plexus on functional rehabilitation of patients undergoing THA.

**METHODS:** Patients classified as physical status ASA I to III were randomly divided into two groups: Epidural and Lumbar. For THA, patients underwent continuous epidural lumbar block with 0.5% ropivacaine (Epidural) or continuous lumbar plexus block with 0.5% ropivacaine (Lumbar). In the recovery room, PCA with infusion of 0.2% ropivacaine (Lumbar) or 0.2% ropivacaine + fentanyl 3 µg.mL<sup>-1</sup> (Epidural) was instituted. Analgesic efficacy in the first 48 hours after THA (pain scores, rescue morphine consumption, and bolus of the PCA pump) was compared between both groups. Different postoperative rehabilitation parameters were analyzed.

**RESULTS:** Forty-one patients underwent statistical analysis. Resting pain scores were similar in both groups. Despite more effective control of dynamic pain in the Epidural group and the greater, more frequent, and earlier morphine consumption in the Lumbar group, rehabilitation parameters evaluated did not differ in both groups. Analgesia techniques did not affect rehabilitation failures.

**CONCLUSIONS:** The greater effectivity of epidural analgesia did not translate in improvement of the rehabilitation process nor did it decrease the time necessary to achieve end goals.

**Keywords:** ANALGESIA, Postoperative: patient-controlled, epidural, lumbosacral plexus; POSTOPERATIVE RECOVERY: functional rehabilitation; SURGERY, Orthopedic: hip arthroplasty.

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***Effects of Epidural Analgesia and  
Continuous Lumbar Plexus Block on  
Functional Rehabilitation after Total Hip  
Arthroplasty***

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**INTRODUCTION**

Pain relief and increased hip mobility and the quality of life of patients with chronic degenerative disease of the hip joint

are the objective of total hip arthroplasty (THA). However, in this process postoperative functional rehabilitation determines the success of the treatment.

After THA, pain is severe and it is aggravated by movements, especially in the first 24 hours<sup>1,2</sup>. The choice of anesthetic and postoperative analgesia technique should promote adequate pain relief after arthroplasty with minimal side effects and allow early mobility and active participation in the rehabilitation process, accelerating functional recovery, ambulation, and hospital discharge<sup>3,4</sup>.

Although different postoperative analgesia strategies are available for THA, the best one, based on the efficacy of pain control and effects on postoperative rehabilitation, has not been determined. Epidural analgesia is probably the technique used more often after THA among us. The use of diluted local anesthetic solutions combined with opioids or not promotes analgesia that is superior to intravenous patient-controlled analgesia (PCA) with morphine, and allows adequate pain control during patient mobilization<sup>2,3</sup>. However, this technique is not devoid of risks.

Peripheral nerve blocks promote analgesia of excellent quality with limited motor and sympathetic blockades<sup>5,6</sup>, allow early rehabilitation and ambulation, and avoid the adverse effects of local anesthetics and opioids administered in the neuro axis<sup>7</sup>. Posterior lumbar plexus block is effective in post hip arthroplasty analgesia by reducing pain scores and analgesic consumption<sup>5,6,8</sup>. Some studies have demonstrated that the analgesia provide by continuous lumbar plexus block is equal or superior to that of epidural analgesia or intravenous PCA with morphine, but with a reduced incidence of adverse events and faster recovery<sup>4,8</sup>.

Although there are studies demonstrating the efficacy of continuous epidural block and lumbar plexus block in postoperative analgesia of THA, the effects of both techniques on the functional rehabilitation of those patients are not known. The present clinical assay was designed to compare the effects of lumbar plexus epidural and perineural PCA on the functional rehabilitation of patients undergoing THA.

## METHODS

The study was approved by the Ethics and Research Committee of the Rede SARAH de Hospitais de Reabilitação. After obtaining a signed consent, patients with physical status ASA I to III scheduled for THA between March and September of 2006 at the Hospital SARAH Brasília (a tertiary rehabilitation hospital) were consecutively included in this double-blind, randomized clinical study. Patient who refused to participate; those with peripheral neuropathies, coagulopathies, or hypersensitivity to the drugs used for analgesia; infection at the puncture site; deformities or prior spinal surgeries; dementia or other conditions that affected the understanding on how to use the visual numeric scale (VNS) and the ACP pump; use of preoperative opioids; or those scheduled for hip revision arthroplasties were excluded.

Patients were randomly divided into two groups based on a computer-generated random permutation table and presented on sealed envelopes. Randomization was done in blocks of eight patients and stratified according to the surgical approach (lateral or posterior). In the Epidural group patients received continuous epidural anesthesia during the surgery and postoperative epidural PCA, while in the Lumbar group patients received continuous posterior lumbar plexus block during the surgery and postoperative patient-controlled perineural lumbar plexus analgesia. The anesthesiologist responsible for the case was informed in which group the patient was allocated only at the time of the surgery and, afterwards, he was no longer part of the study. Arthroplasties were performed by one of three surgeons that perform this surgery at the Hospital SARAH Brasília.

Patients received 5 mg of oral diazepam as pre-anesthetic medication on the night before and on the morning of the surgery. All anesthetic blocks were performed by the same anesthesiologist with the patients in lateral decubitus, maintaining the limb to be operated on a non-dependent position. In the Epidural group, a 18G Touhy needle (Perifix®, BBraun, Melsungen, Germany) was used for the paramedian puncture in the L<sub>3</sub>-L<sub>4</sub> or L<sub>4</sub>-L<sub>5</sub> space with the loss of resistance technique. After identification of the epidural space, 10 to 15 mL of 0.5% ropivacaine, according to the height of the patient, was administered. Finally, 3 to 5 cm of a 20G multi orifice catheter was inserted into the epidural space in the cephalad direction verifying the presence of blood or CSF during aspiration.

In the Lumbar group, posterior lumbar plexus block was performed with an electrically isolated 10.2 cm long 18G Touhy needle (Contiplex®, BBraun, Melsungen, Germany), according to the technique described by Capdevila<sup>5</sup>. The lumbar plexus was located by identifying the motor response of the femoral quadriceps muscle with a peripheral nerve stimulator (Stimuplex, Dig RC, BBraun, Melsungen, Germany). Stimulation impulses were initially regulated at an intensity of 1.5 mA, duration of 50 µs, and frequency of 2 Hz. After the identification of muscle contractions final needle position was obtained based on the best response between 0.35 and 0.5 mA. At this moment, after negative aspiration of CSF and blood, 0.4 mL.kg<sup>-1</sup> of 0.5% ropivacaine was administered in fractionated doses over one minute. Finally, 3 to 5 cm of a multi orifice 20G catheter was introduced into the psoas compartment in the cephalad direction, and the presence of CSF and blood was verified during aspiration.

During the surgery, extra doses or infusion of ropivacaine through the catheter were not allowed. Analgesic drugs or anti-inflammatories were not administered during the surgery. Patient-controlled analgesia was instituted upon arrival to the post-anesthetic care unit (PACU). The infusion rhythm of the PCA pump (Pain Management Provider, Abbott Laboratories, Illinois, USA) was adjusted to a continuous infusion of 0.0625 mL.kg<sup>-1</sup>.h<sup>-1</sup>, patient-applied dose of 0.0625 mL.kg<sup>-1</sup>, and blockade interval of 30 minutes in both groups. In the

Epidural group a solution of 0.2% ropivacaine with fentanyl without preservatives at a concentration of 3 mg.mL<sup>-1</sup> was used. In the Lumbar group 0.2% ropivacaine without preservative was administered.

Continuous infusion was initiated as soon as the patient arrived at the PACU. If at this moment the patient complained of pain with a score equal or greater than 4 cm (according to the VNS where zero represents absence of pain and 10 the worse pain possible) a bolus of the analgesic solution (0.625 mL.kg<sup>-1</sup>) was administered by the anesthesiologist responsible for the PACU, who was unaware of the type of blockade. If 10 minutes after the bolus by the PCA pump the pain score remained unchanged, 50 µg.kg<sup>-1</sup> of intravenous morphine were administered every 10 minutes until relief of the pain.

The postoperative analgesic prescription included intravenous morphine 50 µg.kg<sup>-1</sup> if requested by the patient in case of pain. Other analgesics or anti-inflammatories were not prescribed. The only exception was 750 mg of acetaminophen administered when the temperature was above 38° C.

The quality of postoperative analgesia was evaluated during the next 48 hours by independent observers who were not involved in the study and were not aware of the type of blockade. The moment the patient arrived at the PACU was considered moment zero and additional observations were done after 4, 8, 12, 24, 36, and 48 hours. The rhythm of the continuous infusion and boluses was adjusted according to the pain severity, side effects, or motor blockade in the lower limbs. The objective was to maintain the patient pain free at rest or with mild pain (score < 3) during movements with the administration of the smallest dose possible of the analgesic solution. At the end of 48 hours PCA was discontinued and the catheter removed.

The efficacy of analgesia produced by both techniques was evaluated by resting pain scores and during movements of the operated limb; rescue morphine consumption; the time between the blockade and the first rescue dose of morphine; and the number of boluses administered by the PCA pump. The incidence of adverse effects (nausea, vomiting, pruritus, urinary retention, and motor blockade of the lower limbs) was also analyzed.

After the first 48 postoperative hours, patients started a rehabilitation program in which they were followed and oriented by physical therapists until hospital discharge. In the rehabilitation program, patients were oriented on how to protect the arthroplasty and they fulfilled predetermined stages of hip mobility, load on the joint, walk training, and adaptation to activities of daily living (ADL) as well as exercises to strengthen the periarticular musculature.

Both groups of patients were compared regarding the time necessary to fulfill specific steps of the rehabilitation process during this program. The days after the surgery patients achieved independence to: seat on the side of the bed with the lower limbs dangling; get out of bed for the first time; walk with the walker for the first time; get out of bed and return

to bed without the risk of dislocating the prosthesis; perform ADL; and change the walker for crutches were all recorded. The day patients were discharged from functional therapy and from the hospital was also recorded.

In the present study, it was assumed that postoperative analgesia by the lumbar plexus perineural PCA was equal to the epidural technique in patients undergoing THA. For such, considering a mean dynamic pain score of 3.3 cm, with standard deviation of 2.9 cm, 24 hours after the onset of analgesia with the epidural technique<sup>3</sup>, at least 20 patients in each group would be necessary to obtain an improvement equal or superior than 2.0 cm, with standard deviation of 1.5 cm, in pain scores, assuming alpha of 0.05 and beta of 0.20 (80% potency).

The Student *t* test was used to compare continuous parameters. Non-parametric nominal data was analyzed by the Chi-square and Fisher's Exact tests. The non-parametric Mann-Whitney U test was used to analyze parameters that did not show normal distribution. The Chi-square test was used to analyze the distribution and frequency of individuals without motor blockade. The development of motor blockade was not compared point-to-point.

Data are presented when appropriate as means, medians, or proportions per category. Data were collected on Excel (Microsoft, v. XP, CA, USA), and the SPSS for Windows (Statistical Package for the Social Sciences, v. 13, Chicago, IL) and Stat View (SAS Institute, v. 5.0.1, Cary, NC, USA) softwares were used for statistical analysis. To estimate the risk of a type I error, it was adopted a *p* < 0.05. In the analysis, patients were considered in the groups they were allocated, adopting the intention to treat principle.

## RESULTS

During the study period, 48 patients underwent THA. However, six patients were not included in the study because they were scheduled to undergo revision arthroplasties. All patients who fulfilled the inclusion criteria agreed to participate in the study. One patient initially included in the Lumbar group was excluded due to a change in conduct during the surgery. Thus, 20 patients were included in the Epidural group and 21 in the Lumbar group (Figure 1).

Both groups were similar regarding gender, age, weight, height, and physical status (Table I). Commonly, patients had associated morbidities especially hypertension, but with equal contribution in both groups. Arthritis of the hip was the most common preoperative diagnosis leading to the surgery (63%). Although it did not configure a difference, all four patients with rheumatoid arthritis included in the study were in the Lumbar group. Similar number of patients in both groups had pain and functional limitation in the contralateral side to the surgery. The surgical technique (lateral or posterior approach) and the surgeon showed similar distribution in both groups. However, surgeries in the Epidural group were more frequently on the right side (*p* = 0.03).

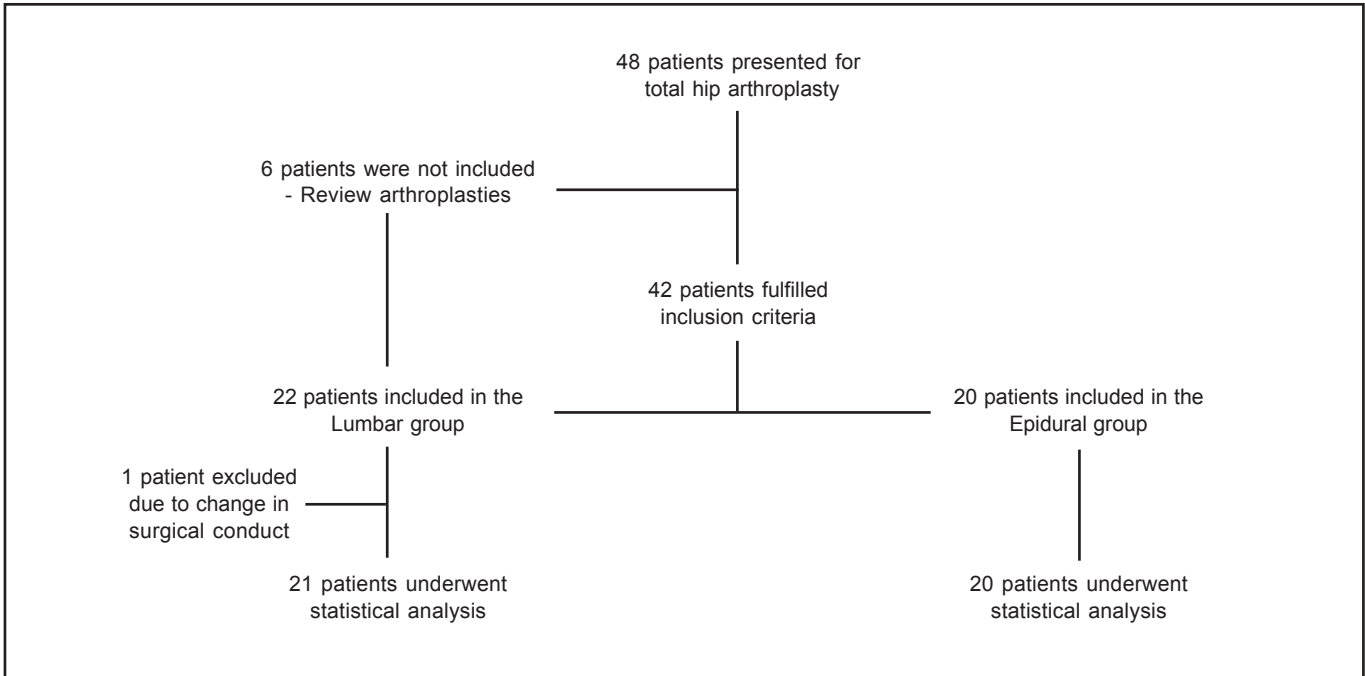


Figure 1. Tree Diagram of Patients Included in the Study.

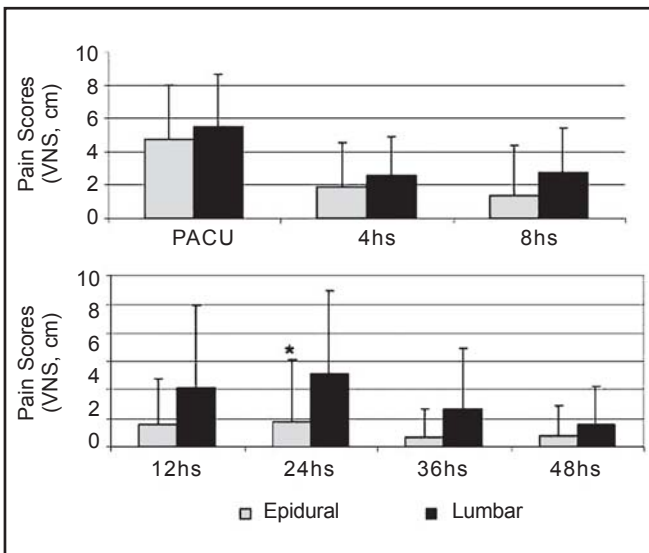


Figure 2. Mean Postoperative Pain Scores at rest in the post-anesthetic care unit (PACU), and 4 to 48 hours after surgery.  $p < 0.05$ .

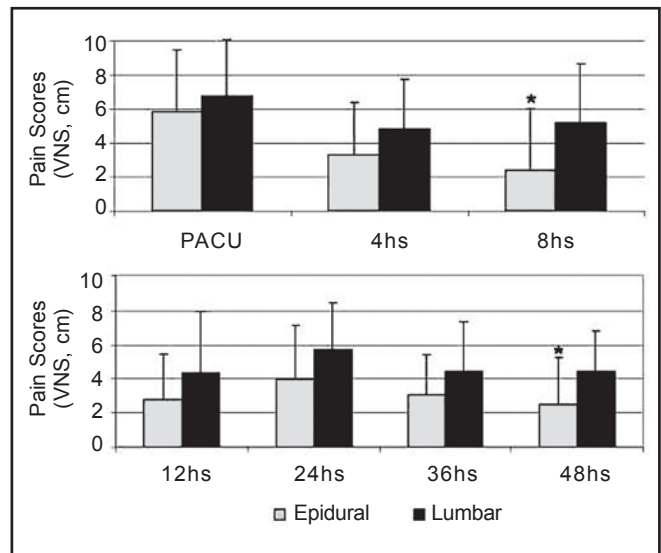


Figure 3. Mean Scores of Postoperative Dynamic Pain in the post-anesthetic unit care (PACU), and 4 to 48 hours after the surgery.  $*p < 0.05$ .

The quality of postoperative analgesia did not differ between both groups.

Upon arrival of the patient to the PACU, dynamic and resting pain scores did not differ between both groups. Only 24 hours after the blockade resting pain scores were lower in the Epidural group ( $0.9 \pm 2.2$  cm vs.  $2.6 \pm 2.9$ ,  $p < 0.05$ ). In general, mean resting pain scores remained below 3.0 cm and did not differ between groups during the observation

period (Figure 2). During movements of the operated limb, pain control was less effective than at rest. Although dynamic pain scores were statistically lower in the Epidural group, only 8 hours ( $2.4 \pm 3.6$  cm vs.  $5.2 \pm 3.4$ ,  $p < 0.05$ ) and 48 hours ( $2.5 \pm 2.8$  cm vs.  $4.4 \pm 2.4$ ,  $p < 0.05$ ) after the blockade, those scores reached the level of moderate pain (between 4.0 and 6.0 cm) in several moments in the Lumbar group (Figure 3).

EFFECTS OF EPIDURAL ANALGESIA AND CONTINUOUS LUMBAR PLEXUS BLOCK  
ON FUNCTIONAL REHABILITATION AFTER TOTAL HIP ARTHROPLASTY

Table I – Demographic Characteristics and Functional Aspects of Patients Included in the Study and Description of the Surgeries.

	Groups	
	Epidural (n = 20)	Lumbar (n = 21)
Gender		
Female	11	11
Male	9	10
Age (years) *	61.0 (14.8)	57.5 (16.3)
Weight (kg) *	69.8 (12.0)	74.0 (13.2)
Height (cm) *	162.2 (10.3)	162.4 (8.8)
BMI (kg.m <sup>-2</sup> ) *	26.5 (3.7)	28.1 (4.9)
Physical Status		
ASA I	3	3
ASA II	17	17
ASA III	0	1
Comorbidities		
Hypertension	11	12
Diabetes Mellitus	1	2
Cardiopathy	3	3
Renal Failure	1	2
Liver Failure	0	0
> 2 Comorbidities	4	4
Preoperative Diagnosis		
Arthritis	16	10
Rheumatoid Arthritis	0	4
Ankylosing Spondylitis	0	1
Avascular Necrosis	4	6
Pain/Limitation of Contralateral Hip		
Yes	12	13
No	8	8
Surgical Technique		
Lateral	12	13
Posterior	8	8
Length of Surgery (min) *	129.8 (30.1)	127.1 (27.6)
Surgeries		
1	7	11
2	8	8
3	5	2
Side of the Surgery		
Right	16	10
Left +	4	11

\*Results expressed a Means (SD)  
+ p = 0.03, operated side x groups

Table II – Postoperative Functional Outcomes. Moments (days) patients achieved independence in each outcome evaluated. Differences were not observed between both groups.

	Epidural (n = 20)	Lumbar (n = 21)
Sitting	1.4 (0.8)	1.3 (0.6)
Getting out of bed	3.3 (0.8)	3.3 (1.1)
First Walk	3.3 (0.8)	3.4 (1.0)
Independence		
ADL	7.8 (2.7)	8.1 (2.2)
Transferences	7.2 (2.5)	7.6 (2.5)
Weaning off Walker	8.0 (3.1)	8.0 (2.6)
Discharge		
Functional Therapy	10.8 (1.4)	10.5 (1.3)
Hospital	12.1 (0.5)	12.3 (1.3)

\*Results expressed as Means (SD)  
ADL – activity of daily living

Lower number of patients in the Epidural group required rescue doses of morphine after the surgery ( $p < 0.01$ ). While 40% of the patients in the Epidural group did not request any rescue dose of morphine, only one patient in the Lumbar group did not require rescue doses of morphine. The accumulated consumption of morphine in 48 hours was approximately double in the Lumbar group ( $11.7 \pm 9.1$  mg vs.  $5.6 \pm 7.5$ ,  $p < 0.05$ ). The first rescue dose of morphine was administered later when the patient received epidural analgesia ( $27.5 \pm 22.8$  hours vs.  $9.2 \pm 10.3$  hours,  $p < 0.01$ ).

The number of doses administered by PCA in 48 hours was greater in the Lumbar group, both in absolute ( $22.6 \pm 12.9$  doses vs.  $9.7 \pm 7.8$  doses,  $p < 0.001$ ) and corrected for the number of hours the perineural or epidural catheter remained in place ( $0.5 \pm 0.2$  doses.h<sup>-1</sup> vs.  $0.3 \pm 0.2$  doses.h<sup>-1</sup>,  $p < 0.001$ ).

Patients in both groups reached the different rehabilitation steps at similar times (Table II). The moments patients walked for the first time, achieved independence for ADL, and changed the walking aid were similar in both groups. The techniques did not differ regarding the time for discharge from functional therapy and hospital.

The co-existence of clinical conditions present before the surgery and inherent to the patient was the main reason why patients were not able to be weaned from the walker and achieve the independence of walking with crutches. The most frequent reasons included lack of attention and cooperation of the patient when performing activities, depression, lumbar pain, and arthritis in the contralateral hip or knee. Surgical factors were determinant in two patients. Postoperative sciatic neuropathic was the reason in one patient in the Epidural group, while a patient in the Lumbar group did not achieve

independence due to a discrepancy in the length of the limbs after the surgery.

## DISCUSSION

Postoperative analgesia using the epidural technique was more effective in patients undergoing THA. While pain scores were similar in both techniques, with a few exceptions the need of bolus doses in PCA was significantly greater, and the consumption of rescue doses of morphine greater, more frequent, and earlier in patients treated with perineural analgesia of the lumbar plexus. Although analgesia of epidural PCA was more effective, it was not associated with better postoperative functional rehabilitation scores.

Total hip arthroplasty is an effective surgical intervention in reducing the pain caused by osteoarthritis. Pain reduction and better functional capacity which eventually will allow patients to achieve an independent life is the main objective of hip arthroplasty. For such, patients are enrolled in a postoperative functional rehabilitation program that should be individualized according to the clinical, psychological, and social conditions of each patient. During functional rehabilitation, the physical therapist contributes to patient recovery trained to execute ADL and become independent, without the risk of dislocating the prosthesis. The family of the patient is involved in all steps of training.

Physical therapy should be instituted early after THA to avoid adhesion, capsular contractures, and muscular atrophy, which can delay functional evolution<sup>9</sup>. Thus, early mobilization of the patient is one of the most important objectives<sup>10</sup>. To make it possible, effective analgesia with minimal side effects is fundamental to allow comfort and agility with faster functional recovery. Postoperative pain limits the ability of the patient for early and active and even passive participation in physical therapy delaying recovery, ambulation, and hospital discharge<sup>11,12</sup>. Besides, inadequate analgesia aggravates endocrine and metabolic responses triggered by the surgical trauma, hinders early mobilization, and facilitates the development of complications secondary to immobility such as deep venous thrombosis, urinary retention, ileus, and respiratory problems<sup>13</sup>. All those factors contribute for a delay in functional recovery, affects negatively the functional outcome of the surgery, and increase in the length of hospitalization and costs.

The present study brings a valuable contribution to the process of choosing an analgesia technique after THA. Despite the known impact that adequate postoperative pain control has on early mobilization and functional rehabilitation after hip arthroplasties, a consensus on the best technique for relief of postoperative pain in those patients does not exist. The choice of analgesic technique by the anesthesiologist is commonly affected by personal experience and ability, without a systematic search for the best result in the control of dynamic pain<sup>14</sup>. The most effective techniques of postoperative

analgesia are those that promote dynamic pain control, allowing patients to move freely. Among those analgesic techniques, epidural analgesia with local anesthetics or in combination with opioids seems to be the most effective on the relief of dynamic pain after major size surgeries<sup>15,16</sup>.

Although adequate postoperative analgesia is seen as a fundamental contributing factor to achieve functional outcomes earlier, differences between both techniques on the time patients achieved the functional criteria analyzed here were not observed. Although epidural analgesia promoted more adequate pain control after THA, the functional results obtained with perineural analgesia of the lumbar plexus were similar. And the length of hospitalization was also similar. Other authors have described similar results<sup>17,18</sup>. Hip mobility and the length of stay in the rehabilitation center were not different when Biboulet et al.<sup>8</sup> compared intravenous PCA with morphine and single-dose femoral nerve and posterior lumbar plexus block after THA. In general, in the population included in the present study, patients sat at the side of the bed on the first postoperative day; stood up and walked on the third day; achieved independence for transferences in bed on the seventh day; were weaned from the walker and achieved independence for ADL on the eighth; and were discharged on the 12<sup>th</sup> postoperative day. Similarly, Singelyn et al.<sup>3</sup> demonstrated similar times for the first walk ( $3.5 \pm 0.7$  days) and length of hospitalization ( $13 \pm 3$  days) with epidural analgesia.

The lack of statistically significant differences in functional evolution between both groups can be explained by the quality of analgesia not being enough to interfere with rehabilitation which is in fact multifactorial and requires multidisciplinary intervention. Alternatively, the investigation was undertaken within a preestablished functional rehabilitation program. Therefore, analgesia techniques did not determine differences in rehabilitation parameters due to this pre-existing routine.

Postoperative epidural analgesia facilitates functional rehabilitation after major size orthopedic surgeries<sup>11,12</sup>. However, it seems that the best quality of continuous epidural analgesia does not influence significantly the length of hospitalization<sup>19</sup>. Even when authors demonstrated faster rehabilitation with regional analgesia the length of hospitalization was not reduced<sup>11,12</sup>. It is possible that the absence of an influence on the length of hospitalization could be explained since this parameter depends on several other factors such as the use of surgical drains, catheters, treatment routines, restrictions, etc., that might overcome the positive effects of pain relief. Consequently, in order to demonstrate a reduction in the length of hospitalization by continuous analgesic techniques, the most adequate relief of postoperative pain should be integrated in a multimodal and multidisciplinary rehabilitation program<sup>20</sup>. In fact, Petersen et al.<sup>21</sup> demonstrated that a small reduction in the length of hospitalization of patients undergoing THA when epidural analgesia with local anesthetics and opioids was

inserted in a multimodal context, along with optimization of postoperative mobilization and nutrition. A physical conditioning program is also fundamental and it can promote recovery of mobility and independence after hip arthroplasty. Preparation with preoperative physical conditioning allowed patients undergoing THA to walk considerably longer distances in the postoperative period<sup>22</sup>. Besides, the strength of the upper limbs is necessary after the surgery because at this moment ambulation depends on assisting devices, such as the walker and crutches.

The success of a multimodal rehabilitation program requires organization of perioperative care with collaboration, communication, and understanding among patient, anesthesiologist (and other components of the acute pain department), nursing, surgeon, and physical therapist to optimize the conditions of functional rehabilitation. Educational programs should be instituted and continually updated emphasizing perioperative pathophysiology and review of perioperative care. The experience with this type of multidisciplinary collaboration has been successful in reducing perioperative morbidity<sup>20</sup>.

The presence of comorbidities was the main reason why patients could not walk without a walker. The most frequent conditions included arthritis of the contralateral hip and/or knee, depression, lumbar pain, and lack of attention and cooperation of the patient when performing activities. The involvement of other joints such as in rheumatoid arthritis or of the contralateral hip such as avascular necrosis and osteoarthritis can influence functional recovery of the operated hip since the performance of the patient in rehabilitation program activities can be severely limited. Postoperative complications of the analgesia technique were not the reason of impaired rehabilitation process. The impact of comorbidities on the postoperative evolution of THA was the subject of another study<sup>23</sup>. Patients with a poor functional status before THA did not have a functional outcome as good as those with better preoperative functional status<sup>24,25</sup>. The preoperative status is the only significant predictive factor of functional improvement after arthroplasties in patients with osteoarthritis<sup>26</sup>.

To conclude, epidural PCA with 0.2% ropivacaine and 3 mg.ml<sup>-1</sup> of fentanyl promoted more effective resting pain relief and, especially, during mobilization after THA. However, both techniques investigated here were equivalent on postoperative functional rehabilitation. The greater effectivity of postoperative analgesia promoted by the epidural technique did not translate into optimization of functional rehabilitation after hip arthroplasty.

#### REFERÊNCIAS – REFERENCES

01. Klasen J, Haas M, Graf S et al. - Impact on postoperative pain of long-lasting pre-emptive epidural analgesia before total hip replacement: a prospective, randomised, double-blind study. *Anaesthesia*, 2005;60:118-123.

02. Kampe S, Randebroek G, Kiencke P et al. - Comparison of continuous epidural infusion of ropivacaine and sufentanil with intravenous patient-controlled analgesia after total hip replacement. *Anaesthesia*, 2001;56:1189-1193.

03. Singelyn FJ, Ferrant T, Malisse MF et al. - Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous femoral nerve sheath block on rehabilitation after unilateral total-hip arthroplasty. *Reg Anesth Pain Med*, 2005; 30:452-457.

04. Türker G, Uçkunkaya N, Yavaşoğlu B et al. - Comparison of the catheter-technique psoas compartment block and the epidural block for analgesia in partial hip replacement surgery. *Acta Anaesthesiol Scand*, 2003;47:30-36.

05. Capdevila X, Macaire P, Dadure C et al. - Continuous psoas compartment block for postoperative analgesia after total hip arthroplasty: new landmarks, technical guidelines, and clinical evaluation. *Anesth Analg*, 2002;94:1606-1613.

06. Stevens RD, Van Gessel E, Flory N et al. - Lumbar plexus block reduces pain and blood loss associated with total hip arthroplasty. *Anesthesiology*, 2000;93:115-121.

07. Horlocker TT - Peripheral nerve blocks: regional anesthesia for the new millennium. *Reg Anesth Pain Med*, 1998;23:237-240.

08. Biboulet P, Morau D, Aubas P et al. - Postoperative analgesia after total-hip arthroplasty: comparison of intravenous patient-controlled analgesia with morphine and single injection of femoral nerve or psoas compartment block: a prospective, randomized, double-blind study. *Reg Anesth Pain Med*, 2004;29:102-109.

09. Akeson WH, Amiel D, Abel MF et al. - Effects of immobilization on joints. *Clin Orthop Relat Res* 1987;219:28-37.

10. Gilbey HJ, Ackland TR, Wang AW et al. - Exercise improves early functional recovery after total hip arthroplasty. *Clin Orthop Relat Res*, 2003;408:193-200.

11. Capdevila X, Barthelet Y, Biboulet P et al. - Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. *Anesthesiology*, 1999; 91:8-15.

12. Singelyn FJ, Deyaert M, Joris D et al. - Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous three-in-one block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty. *Anesth Analg*, 1998;87:88-92.

13. Aubrun F - Management of postoperative analgesia in elderly patients. *Reg Anesth Pain Med*, 2005;30:363-379.

14. Fischer HBJ, Simanski CJP - A procedure-specific systematic review and consensus recommendations for analgesia after total hip replacement. *Anaesthesia*, 2005;60:1189-1202.

15. Wheatley RG, Schug SA, Watson D - Safety and efficacy of postoperative epidural analgesia. *Br J Anaesth*, 2001;87:47-61.

16. Wu CL, Cohen SR, Richman JM et al. - Efficacy of postoperative patient-controlled and continuous infusion epidural analgesia versus intravenous patient-controlled analgesia with opioids. A meta-analysis. *Anesthesiology*, 2005;103:1079-1088.

17. Moiniche S, Hjortso NC, Hansen BL et al. - The effect of balanced analgesia on early convalescence after major orthopaedic surgery. *Acta Anaesthesiol Scand*, 1994;38:328-335.

18. Foss NB, Kristensen MT, Kristensen BB et al. - Effect of postoperative epidural analgesia on rehabilitation and pain after hip fracture surgery. *Anesthesiology*, 2005; 102:1197-1204.

19. Kehlet H, Holte K - Effect of postoperative analgesia on surgical outcome. *Br J Anaesth*, 2001;87:62-72.

20. Kehlet H - Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth*, 1997;78:606-617.

21. Petersen MK, Madsen C, Andersen NT et al. - Efficacy of multimodal optimization of mobilization and nutrition in patients undergoing hip replacement: a randomized clinical trial. *Acta Anaesthesiol Scand*, 2006;50:712-717.



22. Whitney JA, Parkman S - Preoperative physical activity, anesthesia, and analgesia: effects on early postoperative walking after total hip replacement. *Appl Nurs Res*, 2002;15:19-27.
23. Imamura K, Black N - Does comorbidity affect the outcome of surgery? Total hip replacement in the UK and Japan. *Int J Qual Health Care*, 1998;10:113-123.
24. Holtzman J, Saleh K, Kane R - Gender differences in functional status and pain in a medicare population undergoing elective total hip arthroplasty. *Med Care*, 2002;40:461-470.
25. Fortin PR, Clarke AE, Joseph L et al. - Outcomes of total hip and knee replacement: preoperative functional status predicts outcomes at six months after surgery. *Arthritis Rheum*, 1999; 42:1722-1728.
26. Caracciolo B, Giaquinto S - Determinants of the subjective functional outcome of total joint arthroplasty. *Arch Gerontol Geriatr*, 2005;41:169-176.

## RESUMEN

Duarte LTD, Beraldo PSS, Saraiva RA - Efectos de la Analgesia Epidural y del Bloqueo Continuo del Plexo Lumbar sobre la Rehabilitación Funcional después de la Artroplastia Total de Cadera.

**JUSTIFICATIVA Y OBJETIVOS:** El dolor después de la artroplastia total de la cadera (ATC) es intenso y se agrava por los movimientos, lo que demanda una técnica analgésica eficaz y que permita la movilidad precoz, la participación en las actividades de rehabilitación, y una rápida recuperación funcional. El objetivo de este estudio, fue comparar los efectos de las técnicas de analgesia

controlada por el paciente (ACP), por las vías epidural y perineural del plexo lumbar sobre la rehabilitación funcional en pacientes sometidos a la ATC.

**MÉTODO:** Pacientes en estado físico ASA I a III, que fueron ubicados aleatoriamente en los grupos Epidural y Lumbar. Para la ATC, se realizó la anestesia epidural lumbar continua con ropivacaína a 0,5% (Epidural) o bloqueo continuo del plexo lumbar con ropivacaína a 0,5% (Lumbar). En la sala de recuperación, se inició ACP con infusión de ropivacaína a 0,2% (Lumbar) o ropivacaína a 0,2% + fentanil  $3 \mu\text{g} \cdot \text{mL}^{-1}$  (Epidural). La eficacia de la analgesia en las primeras 48 horas después de la ATC (niveles de dolor, consumo de morfina de rescate y de bolos de la bomba de ACP), se comparó entre los grupos. Los diferentes parámetros de la rehabilitación postoperatoria también se estudiaron.

**RESULTADOS:** Cuarenta y un pacientes se sometieron al análisis estadístico. Los niveles de dolor en reposo fueron similares en los dos grupos. A pesar de un control más efectivo del dolor dinámico en el grupo Epidural y de un uso más potente de la morfina, que se aplicó más a menudo y precozmente en el grupo Lumbar, no hubo diferencia entre los grupos en ninguno de los parámetros estudiados de rehabilitación. Las técnicas de analgesia no influyeron en las fallas en el proceso de rehabilitación.

**CONCLUSIONES:** El más alto nivel de efectividad de la analgesia epidural, no se tradujo en una mejoría en el proceso de rehabilitación, ni tampoco redujo el tiempo necesario para alcanzar los resultados estudiados.