




# Intraoperative Local Analgesic PENG Infiltration in Total Hip Arthroplasty

## *Infiltración Analgésica PENG Intraoperatoria en Artroplastía Total de Cadera*

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### Abstract

**Objective** Describe a novelty intraoperative application of the PENG analgesic infiltration in total hip arthroplasty and describe results in a case series.

**Method** Retrospective case series. Clinical charts were revised from patients who underwent an elective total hip arthroplasty (THA) and an intraoperative PENG analgesic infiltration performed by the surgeon between September and December 2020.

**Results** 74 patients were included in this study, an average of 60.1 years old. 63 were simple primary THA and 11 were complex. Median VAS scale for postoperative pain was 0 in the acute recovery unit, 2 in the first 24 hours, and 1 in the next 24 hours. 95.9% were able to walk in the first 24 hours and 98% were discharged under 48 hours from surgery

**Conclusion** In our case series where the novel way of implementing PENG analgesic infiltration in a THA was applied, we observed a maximum median VAS of 2, the ability to walk in the first 24 hours in 95% of patients and 98% of patients were discharged before 48 hours, with no cases of readmission due to pain.

### Keywords

- ▶ PENG
- ▶ total hip
- ▶ analgesia PENG infiltration

### Resumen

**Objetivo** Describir una novedosa forma de aplicación de la infiltración analgésica PENG en el intraoperatorio de artroplastía total de cadera (ATC) y presentar los resultados obtenidos en una serie de casos.

**Método** Serie de casos retrospectiva. Se revisaron las fichas clínicas de pacientes operados de prótesis de cadera electiva, sometidos a una infiltración analgésica PENG por cirujano entre Septiembre y Diciembre de 2020.

**Resultados** 74 pacientes, edad promedio de 60.1 años. 63 corresponden a prótesis simples y 11 a complejas. La mediana de dolor postoperatorio según EVA fue de 0 en la unidad de recuperación, 2 en las primeras 24 hrs y 1 para las siguientes 24 hrs. El 95,9%

### Palabras Claves

- ▶ PENG
- ▶ total hip
- ▶ analgesia PENG infiltration

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de los pacientes lograron deambular en las primeras 24 horas y el 98,7% logró irse de alta en las primeras 48 hrs.

**Conclusión** En nuestra serie de casos donde se aplicó la novedosa forma de implementación de la infiltración analgésica PENG en una ATC, observamos una mediana de EVA máximo de 2, deambulación en las primeras 24 horas postoperatorias en el 95% de los pacientes y una estadía hospitalaria menor a 48 horas en 98% de los pacientes, sin casos de readmisión por dolor.

## Introduction

The complexity of postoperative analgesic management in total hip arthroplasty (THA) has been widely described in the literature.<sup>1</sup> The ineffective control of pain is one of the main concerns of the health team, since it is associated with a significant increase in immobility, the risk of DVT, myocardial infarctions, pneumonia, sleep disturbances, cognitive alterations and inability to perform adequate immediate postoperative rehabilitation.<sup>1,2</sup> All of the above leads to an increase in hospital days, recovery time and costs for the health system, but more importantly, it leads to a significant deterioration of patient satisfaction.<sup>1</sup>

Since the year 2000, various protocols have been described in the literature, such as ERAS (Enhanced Recovery After Surgery) or "Fast Track" that have sought to improve the postoperative period of patients, allowing optimization of hospital stay, without increasing morbidity or readmissions. The management of postoperative pain is one of the most relevant points to achieve these objectives.<sup>3</sup>

In 2018, a group of regional anesthesiologists from the University of Toronto described a block called PENG (Pericapsular Nerve Group) to provide analgesia in elderly patients with proximal femur fractures.<sup>4</sup> The block showed good analgesic quality without motor block, which would allow early motor rehabilitation.<sup>4</sup> Since then, some literature has been published regarding PENG block, describing good results with the application of this block in THA for fracture and coxarthrosis.<sup>5-7</sup> Currently, there is no gold standard in peripheral analgesic blockade for THA which allows for complete pain relief and, in turn, facilitates early ambulation in the postoperative period. These are the key milestones for a patient to be discharged early.

In our interest in finding a solution to this problem, we realized that through the direct lateral surgical approach, the surgeon is able to directly visualize the area where the local anesthetic is deposited in the PENG block. So we proposed this new way of applying it, where the surgeon performs it during surgery, under a modality of local analgesic infiltration.

The objective of this work is to describe a new form of application of the PENG analgesic infiltration performed by the surgeon in the intraoperative period and to present the results obtained in a series of cases.

## Materials and Methods

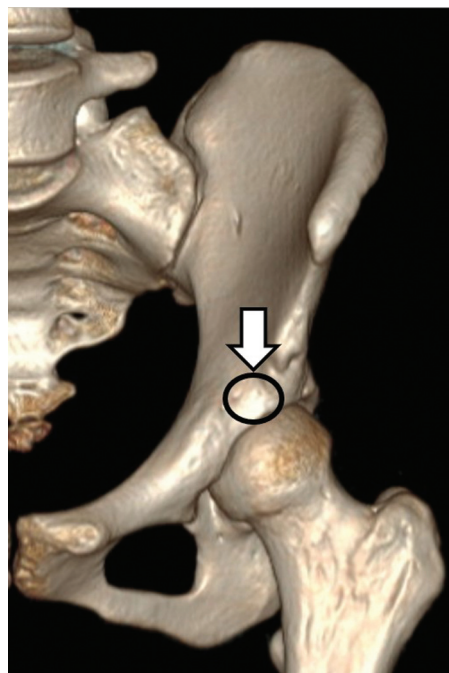
Retrospective study, case series. Approved by the ethics committee of our institution.

The inclusion criteria were patients operated on for THA due to primary coxarthrosis at the Hospital del Trabajador, who have received PENG analgesic infiltration by a surgeon between September and December 2020, ASA I or II patients,<sup>8</sup> undergoing spinal anesthesia and who do not require postoperative stay in an intermediate unit at the hospital.

Patients operated using an approach other than the direct lateral one, subjected to general anesthesia, those in which the performance of PENG analgesic infiltration was not recorded in the operating protocol, and cases of bilateral THA during hospitalization were excluded.

The original technique of the PENG block, described by Girón-Arango et al, consists of depositing 20 ml of local anesthetic under ultrasound vision in a space limited by the psoas muscle on the anterior side, the pubic ramus on the posterior side, the iliopectineal eminence on the medial side, and the anterior inferior iliac spine (AIIS) from the side<sup>4</sup> with the patient positioned supine, as schematized in ►Figure 1.

The surgical technique used in this study is performed through a direct lateral approach to the hip,<sup>9</sup> with the patient

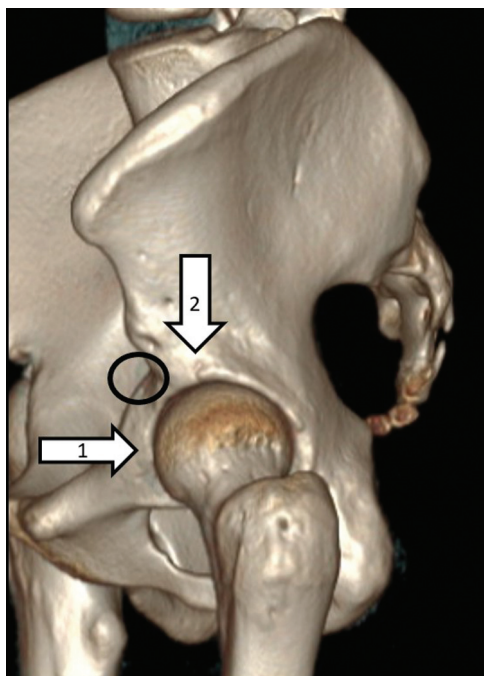


**Fig. 1** Three-dimensional reconstruction of the left hemipelvis of a patient in the supine position. The circle represents the place where, using ultrasound support, an anesthetist places the local anesthetic in the PENG block.

in lateral decubitus, 3 retractors are positioned to allow visualization of the acetabulum; the first of them on or slightly distal to the iliopectineal eminence, the second lateral to the AIIS, and the third on the posterior wall nailed to the ischium. Therefore, between retractors 1 and 2, the area where the local anesthetic is deposited in the PENG block is directly visualized (–Figure 2). In this place, midpoint between the iliopectineal eminence and AIIS, using a No. 21G needle to perforate 1.5cm of the joint capsule attached to the anterior wall, we infiltrate 20 ml of 0.375% bupivacaine. Then a block is performed for anatomical repairs of the lateral femoral nerve placing 10 ml of 0.25% Bupivacaine 1 cm medial and 1 cm distal to the AIIS.<sup>10</sup>

From the clinical records of the patients, we obtained demographic data, commonly used medications, duration of surgery, complexity of surgery (simple primary THA, complex primary THA, revision THA), intraoperative complications, maximum VAS in the Anesthetic Recovery Unit (ARU), rescue with morphine administered in ARU, motor block with Bromage scale<sup>11</sup> at discharge from ARU. We also obtained maximum VAS during the first 24 hours, maximum VAS in the following 24 hours, analgesic rescues administered, time of first analgesic rescue, motor block at the time of performing kinesiology, ability to ambulate during kinesiology within the first 24 hours and hours of hospitalization. In the outpatient follow-up, the presence of early postoperative complications and the need for hospital readmission due to pain were recorded.

All the VAS and Bromage scale records are obtained from the nursing records, while the ability to walk and motor



**Fig. 2** Three-dimensional reconstruction of the left hemipelvis of a patient in lateral decubitus. Arrows represent retractors 1 and 2 used in the direct lateral approach. The circle represents the place where, through direct vision, the surgeon places the analgesic injection at the site of the PENG block.

block is obtained from the physical therapy record of the patient's electronic record.

Statistical analysis was performed using Stata Statistical Software (release 13. College Station, TX: StataCorp LP). Results are presented in medians, means, standard deviation, ranges, and percentages as appropriate.

## Results

In the study period, 74 patients were included. The average age was 60.1 years (range 32-87). In 57 patients they presented comorbidities and in 60 we observed the chronic use of medications for pain.

During the study period, 63 simple THA and 11 complex THA were performed. The average surgical time was 104 minutes (Range 70 - 170 minutes). In 1 patient an intraoperative calcar fracture was observed, which was managed with a wire, not observing other intraoperative complications.

During the stay in the ARU, the median maximum VAS was 0 (SD 0.45). In 4 (5.4%) patients it was necessary to use analgesic rescue with morphine. The median number of motor block with the Bromage scale at discharge from the ARU was 3 (Mean 2.96; SD 0.19; range 2-3).

While on the ward, the median maximum VAS in the first 24 hours was 2 (SD 1.9) and in the following 24 postoperative hours, the 52 patients who remained hospitalized presented a median maximum VAS of 1 (SD 1, 3). In 9 (11.7%) patients it was necessary to use an analgesic rescue, which was administered an average of 12.1 postoperative hours.

Regarding postoperative rehabilitation, 71 (95.9%) patients walked in the first 24 hours and 3 (4.1%) in the following 24 hours. Transient femoral motor block was recorded in 4 (5.4%) patients.

In our series, 22 (29.7%) patients were discharged in the first 24 hours, 51 (68.9%) in the second 24 hours, and only 1 (1.3%) was discharged after 96 hours.

We did not observe cases of immediate early complications or hospital readmissions due to pain.

## Discussion

Proper pain management is an essential point in the postoperative period of THA, since this allows early ambulation and adequate rehabilitation. However, despite multiple efforts, a gold standard has not yet been established to achieve these milestones in a reproducible manner in all patients.

This may be explained by the diversity of surgical techniques and by the complex sensory innervation of the hip. Several regional anesthesia strategies have been proposed, among which the femoral block and the fascia iliaca block stand out;<sup>12</sup> however, the group of authors notes three major problems with these techniques. First of all, both can cause motor block. Secondly, the Obturator Nerve is not blocked as the main target, in the fascia iliaca block this is achieved by using a large volume of local anesthetic. Thirdly, many times the block is not performed with a sterile technique, so it

could conceptually drag skin bacterial flora towards the anesthetic deposit site.

In this sense, the PENG block provides a solution to the first 2 problems previously raised, since it does not cause motor block and the target nerves are the obturator nerve, the accessory obturator and the articular branches of the femoral nerve,<sup>4</sup> all in charge of the innervation of the anterior capsule of the hip joint, which is the most richly innervated area of the joint.<sup>13</sup> With this new technique proposed by our study group, analgesic infiltration is applied directly to the same site as the PENG block during the surgical procedure, solving the third point since everything is done with a sterile technique.

In our study we present 4 cases of femoral motor block recorded by the kinesiologist, who was evaluated by asking the patient to extend the knee in a sitting position on the edge of the bed. We believe that the possible explanations for this are: 1) That the volume administered is excessive for the physical characteristics of the patient and when it diffuses through the tissues, it produces a blockage of the femoral nerve. 2) The existence of anatomical variants of the path of the femoral nerve. 3) Mismanagement by the surgeon. 4) That the patient still has a residual effect of spinal anesthesia at the time of receiving the first kinesiology session.

In addition, we see a fourth important point: time. To the authors' knowledge there are no published studies describing the duration of the execution time of the entire procedure, where an experienced anesthesiologist performs a PENG block. However, in our center, the intraoperative administration of the analgesic infiltration takes less than 120 seconds, which we see as a relevant benefit, since it is clearly less than the time it takes for a conventional anesthetic block.

We are aware that the greatest weakness of the work is that it is a series of retrospective cases, without a control group. However, it corresponds to an initial description of a line of research that will have future prospective studies with a control group.

## Conclusion

In our series of cases where the novel way of implementing PENG analgesic infiltration was applied in a THA, we observed a median maximum VAS of 2, ambulation in the first 24 postoperative hours in 95% of the patients and a hospital stay of less than 48 hours in 98% of the patients, with no cases of readmission due to pain.

### Note

Work carried out in the Hospital del Trabajador, Santiago, Chile.

The group of authors confirms that this work has not been presented or published in any congress or scientific journal.

All authors confirm that they have read and approved the manuscript, taking responsibility for its content.

This study was approved by the ethics committee of the Hospital del Trabajador.

### Declarations of Interest

None.

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