



Accuracy of Hip Pericapsular Nerve Block (PENG) without Ultrasound Aid in Patients with Hip Pain

Acurácia do bloqueio dos nervos pericapsulares (PENG) do quadril sem auxílio de ultrassonografia em pacientes com dor no quadril

Giancarlo Cavalli Polesello¹ André Sanches Saú² Marco Rudelli³ Walter Ricioli Junior³
Nayra Deise dos Anjos Rabelo⁴

¹ Adjunct Professor Physician, Faculdade de Ciências Médicas da Santa Casa de São Paulo (FCMSCSP), São Paulo, SP, Brazil

² Intern physician, Hip Group, Department of Orthopedics and Traumatology, Irmandade Santa Casa de Misericórdia de São Paulo, SP, São Paulo, Brazil

³ Assistant physician, Núcleo de Apoio à Pesquisa em Análise do Movimento (NAPAM), São Paulo, SP, Brazil

⁴ Physiotherapist, PhD Professor, Núcleo de Apoio à Pesquisa em Análise do Movimento (NAPAM), São Paulo, SP, Brazil

Address for correspondence Giancarlo Cavalli Polesello, M.D, Ph.D., Rua Dr. Cesário Motta Junior, 112, Bairro Vila Buarque, São Paulo, SP, Brasil
(e-mail: giancarlopolesello@hotmail.com; dot.quadril@hotmail.com).

Rev Bras Ortop 2023;58(6):932–938.

Abstract

Objective To describe and evaluate the accuracy of the pericapsular nerve group (PENG) block technique with no ultrasound guidance.

Method Series of 40 infiltrations in patients with hip pain undergoing outpatient follow-up in the hip surgery group or admitted to the emergency room from a hospital in São Paulo, SP, Brazil. The hip PENG technique was guided by palpable anatomical pelvic structures, with no ultrasound orientation for needle positioning, using the equipment only to check the correct location after an unguided puncture.

Results In the 40 hips infiltrated from 35 patients with a mean age of 59.2 years, the success rate was 85%. Among the mispositioned cases, 71.4% occurred in the first 13 applications and 28.6% in the subsequent 27 applications. In all patients, the neurovascular bundle was in the medial third of the pen-made demarcation. Even in cases with a failed needle location, the distance from the neurovascular bundle was safe. A single adverse effect occurred, with spontaneous improvement of the femoral nerve apraxia within two days.

Conclusion Unguided PENG block is a viable technique for a physician knowledgeable about its application in services with no ultrasound availability.

Keywords

- ▶ analgesia
- ▶ anesthesia
- ▶ nerve block
- ▶ hip fractures
- ▶ pain management

Study developed at the Hip Group, Department of Orthopedics and Traumatology, Faculdade de Ciências Médicas Santa Casa de Misericórdia de São Paulo (FCMSCSP), São Paulo, SP, Brazil.

received
September 14, 2022
accepted
January 18, 2023

DOI <https://doi.org/10.1055/s-0043-1776909>
ISSN 0102-3616.

© 2023. Sociedade Brasileira de Ortopedia e Traumatologia. All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

Resumo

Objetivo Descrever e avaliar a acurácia da técnica do bloqueio PENG realizado sem auxílio de ultrassonografia.

Método Série de 40 infiltrações em pacientes com dor no quadril, em acompanhamento ambulatorial no grupo de cirurgia do quadril ou admitidos no pronto atendimento de um hospital na cidade de São Paulo. Utilizada a técnica de bloqueio nervoso pericapsular do quadril (PENG) guiado por estruturas anatômicas palpáveis da pelve e sem auxílio de ultrassonografia no posicionamento da agulha, usando o aparelho apenas para conferência da localização correta após punção não guiada.

Resultados Nos 40 quadris infiltrados em 35 pacientes com idade média de 59,2 anos, obtivemos um índice de acerto de 85%. Dos casos mal posicionados 71,4% ocorreram nas primeiras 13 aplicações e 28,6% nas 27 aplicações subsequentes. Em todos os pacientes o feixe neurovascular estava situado no terço medial da marcação realizada à caneta e mesmo nos casos em que houve falha da localização da agulha havia distância segura ao feixe neurovascular. Obtivemos apenas 1 caso de efeito adverso, onde ocorreu apraxia do nervo femoral com melhora espontânea em 2 dias.

Conclusão O bloqueio PENG não guiado é uma técnica viável e pode ser realizada por um médico que já possui conhecimento na aplicação, em serviços onde não haja disponibilidade do aparelho de ultrassonografia.

Palavras-chave

- ▶ analgesia
- ▶ anestesia
- ▶ bloqueio nervoso
- ▶ fraturas do quadril
- ▶ manejo da dor

Introduction

The description of the hip pericapsular nerve group (PENG) block technique using ultrasound (US) occurred in 2018. PENG block has been widely studied for pain management,¹⁻¹³ mainly in the perioperative period of hip surgeries, with promising results.²⁻¹² This technique can also be used in patients with femoral neck fractures admitted to the emergency care unit who present with significant associated pain^{1,3-8,11-13} or even in subjects with degenerative diseases who cannot undergo an immediate surgical procedure.¹⁴

Jaramillo et al.¹⁴ showed that PENG neuroablation in patients with chronic hip pain can drastically reduce the use of opioid analgesics for a long time and improve their quality of life.

In Brazil, a major challenge for orthopedists using this technique in their clinical practice is the unavailability of essential materials, including ultrasound equipment, especially in regions lacking healthcare resources. Given this difficult access to proper equipment, we developed this study to analyze the accuracy of the PENG block technique with no US guidance, using only anatomical parameters. To date, there is no description or report in the literature of PENG blocks with no US guidance. We believe this initiative is viable and may significantly contribute to hip pain relief in several clinical situations.

Methods

Participants

We collected data from male and female subjects using the Orthopedics and Traumatology service from January to July 2022 with hip pain on an outpatient follow-up visit or a proximal femur fracture and admitted to the institutional

emergency room. We excluded patients with pathological bone fractures, neuropathic pain, previous sensory deficits, and immature skeletons.

The study occurred at the Hip Group from the Department of Orthopedics and Traumatology of a tertiary institution in the state of São Paulo, Brazil. Following resolution 196/96, the study only started after the approval from the institutional Ethics and Research Committee of the same institution (CAAE: 57596421.0.0000.5479).

Procedures

To perform the technique with no US aid, the infiltrations followed palpable anatomical structures, i.e., the only guidance consisted of local anatomical parameters (▶ **Fig. 1**), with no visualization of adjacent structures as in US.

It is worth mentioning that US confirmed needle positioning before medication injection to guarantee the correct injection site and determine whether the technique was correct or incorrect. In cases with poor positioning, we repeated the needle placement in the correct location to ensure proper medication application in all cases.

To prepare the infiltration, we sterilely aspirated 15 mL of 0.25% bupivacaine (Cristália®, Campinas, SP, Brazil) with vasoconstrictor (epinephrine 1:200,000) and one 5-mL ampoule of triamcinolone 20 mg/mL (Apsen Farmacêutica®, Santo Amaro, SP, Brazil).

We placed the patients in the horizontal supine position with no traction. With the hip in a neutral position, we proceeded to the following sequence:

- Palpation and demarcation of the anterior superior iliac spine (ASIS) and the superior branch and body of the ipsilateral pubis (P) with a dermatographic pen (▶ **Fig. 1**).

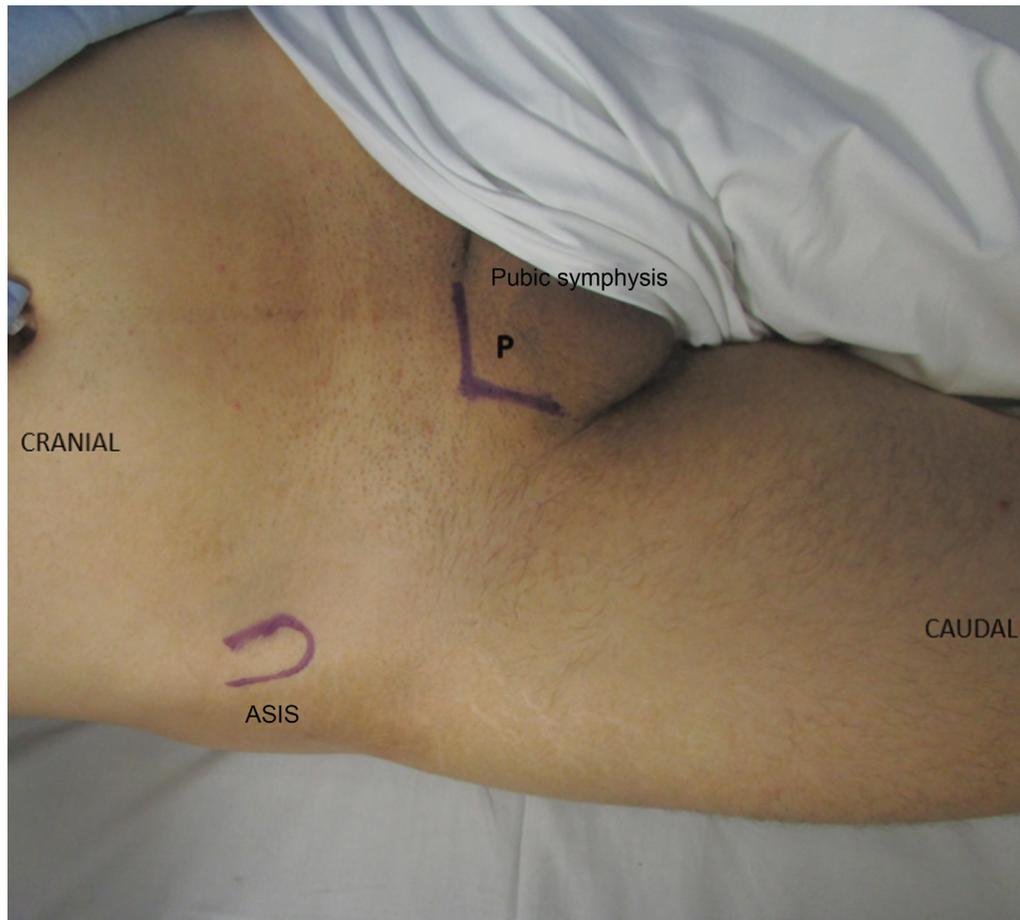


Fig. 1 Beginning of the skin demarcation. Drawing the anterior superior iliac spine (ASIS) contour and longitudinal and transverse palpation of the iliopubic branch.

- Demarcation of a line connecting the two points (i.e., ASIS and P) towards the path of the inguinal ligament (► **Fig. 2**). Next, we divided this line into three-thirds (► **Fig. 3**).
- Positioning the injection needle in the middle of the lateral third of the demarcated line, at a 70° inclination to the patient's skin, towards point P (► **Figs. 4 and 5**).
- Needle introduction until it touched the bone, followed by its retraction for approximately 1 mm.
- Positioning a convex 3.5-MHz US probe medially to the needle following the demarcated line to verify the needle's unguided placement (► **Fig. 6**). The goal was to reach a point between the anterior inferior iliac spine (ASIS) and the iliopsoas muscle tendon, visible on US (► **Fig. 7A**).
- In cases of poor positioning (► **Fig. 7B**), we readjusted the needle for the correct solution injection.
- After assuring the correct needle position, we slowly and continuously infiltrated 20 mL of the solution.

The risks involved were inherent to this procedure, including infection, abscess, hematoma, local pain, bleeding, and artery or vessel perforation. However, these risks were minimized as much as possible by the institutional protocol procedures. The same orthopedist, who had prior training

and familiarity with the pericapsular block, performed all infiltrations.

Statistical Analysis

We tested the normality of demographic data and expressed them as mean and standard deviation (SD) values. Moreover, we performed a qualitative analysis of the technique's binary error and accuracy data and expressed them as absolute and relative measurements.

Results

Thirty-nine patients were eligible for the study. The study included 35 subjects (40 hips) and excluded four patients (four hips), two for having a pathological bone fracture, one for refusing their study participation, and one for presenting a diagnosis of complex regional pain.

Of those included in the research, 11 subjects were male (27.5%), and 29 were female (72.5%), with an average age range of 59.2 ± 18.9 years. All complained of hip pain. The average weight and height were 66.5 ± 12.8 kg and 160.8 ± 9.0 cm, respectively, with an average body mass index (BMI) of 25.9 kg/m².

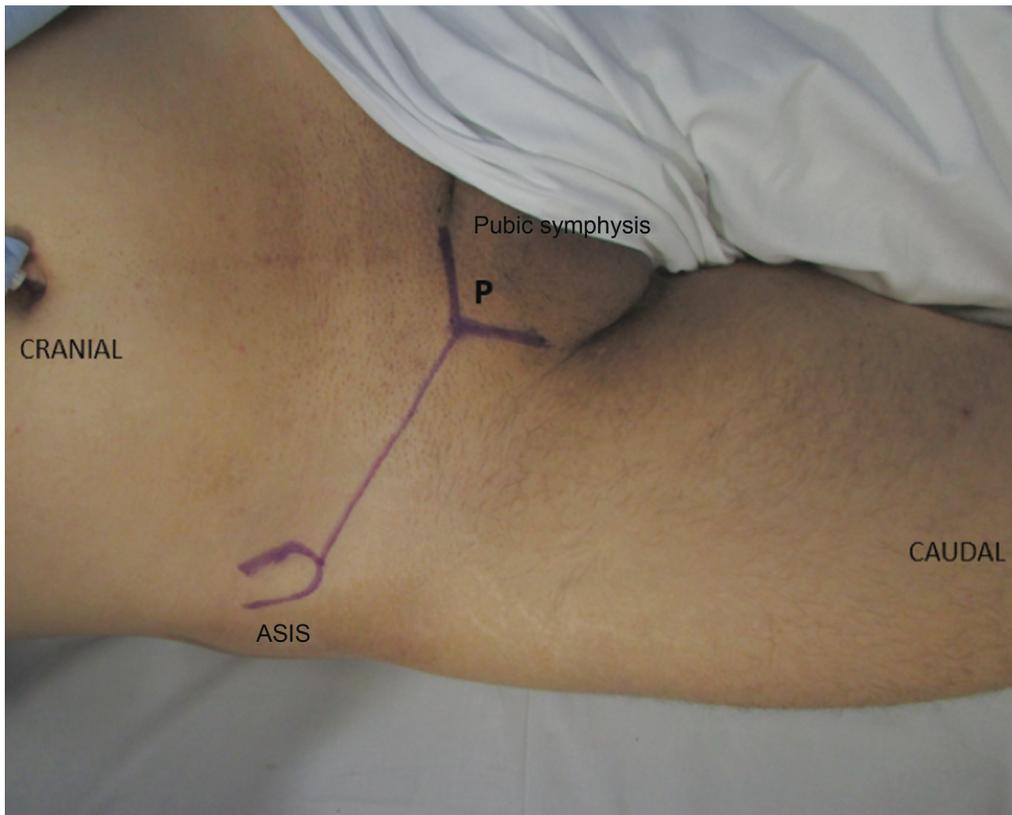


Fig. 2 Union of half of the anterior superior iliac spine (ASIS) and the apex of the pubic (P) demarcation.

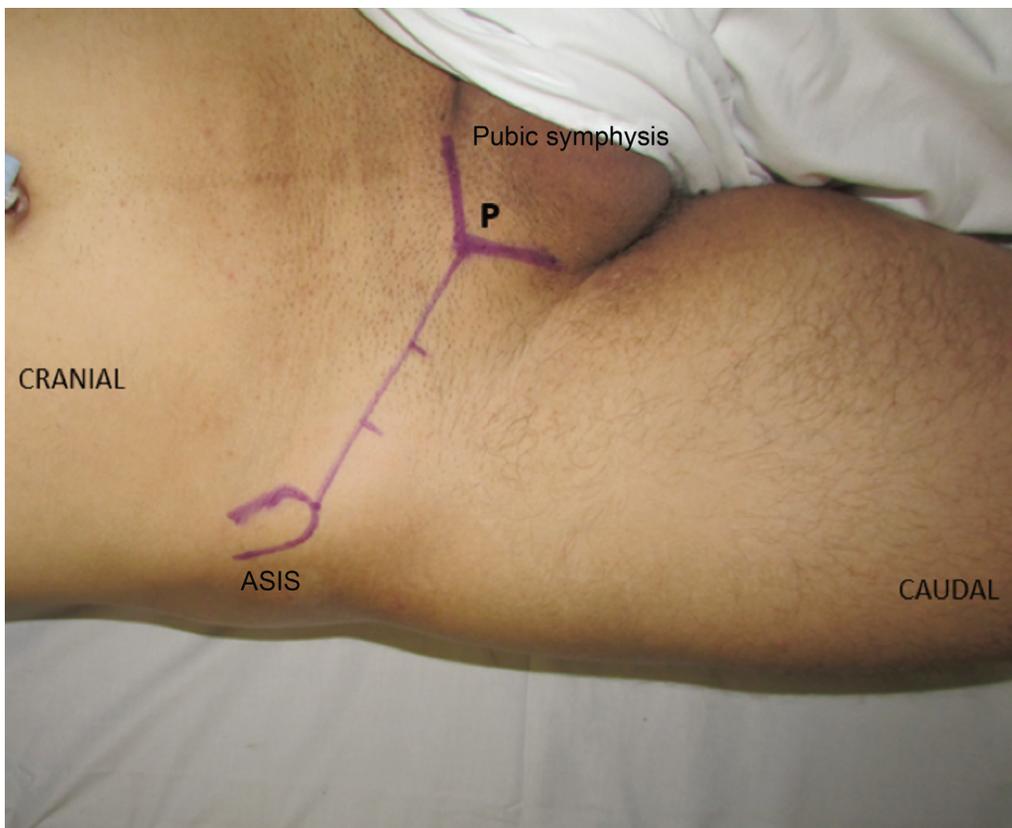


Fig. 3 Division of the demarcation in three parts.

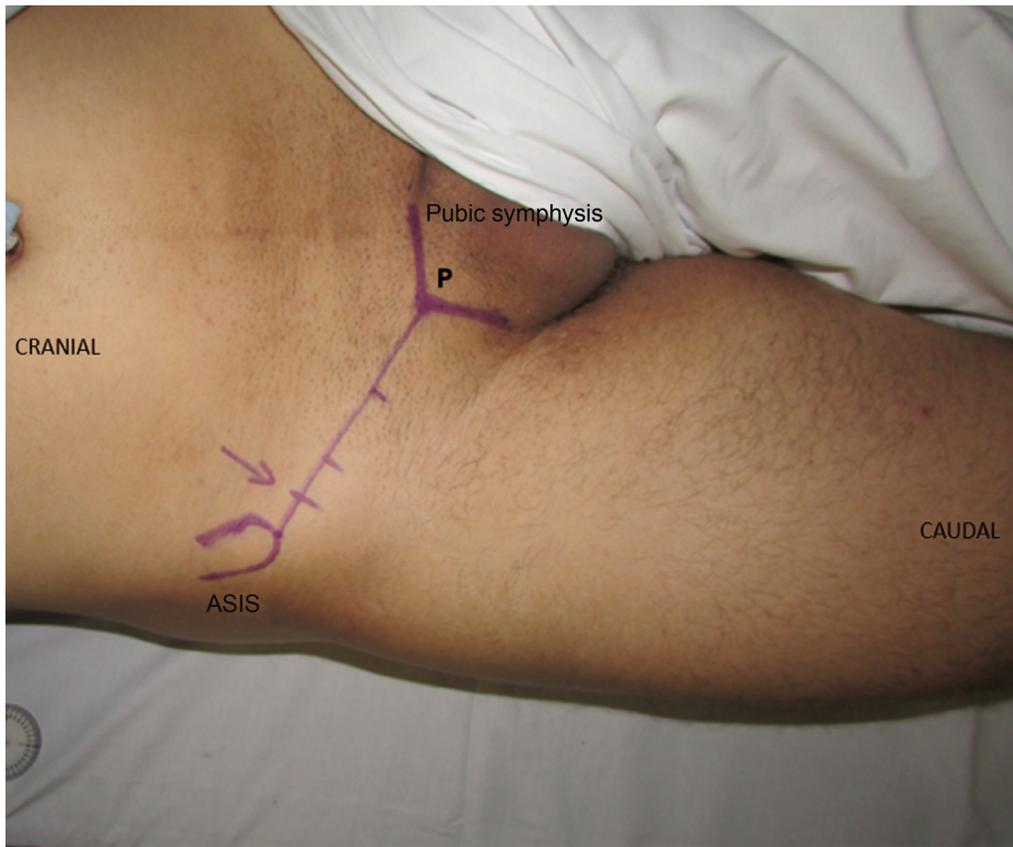


Fig. 4 Demarcation of half of the first third part.

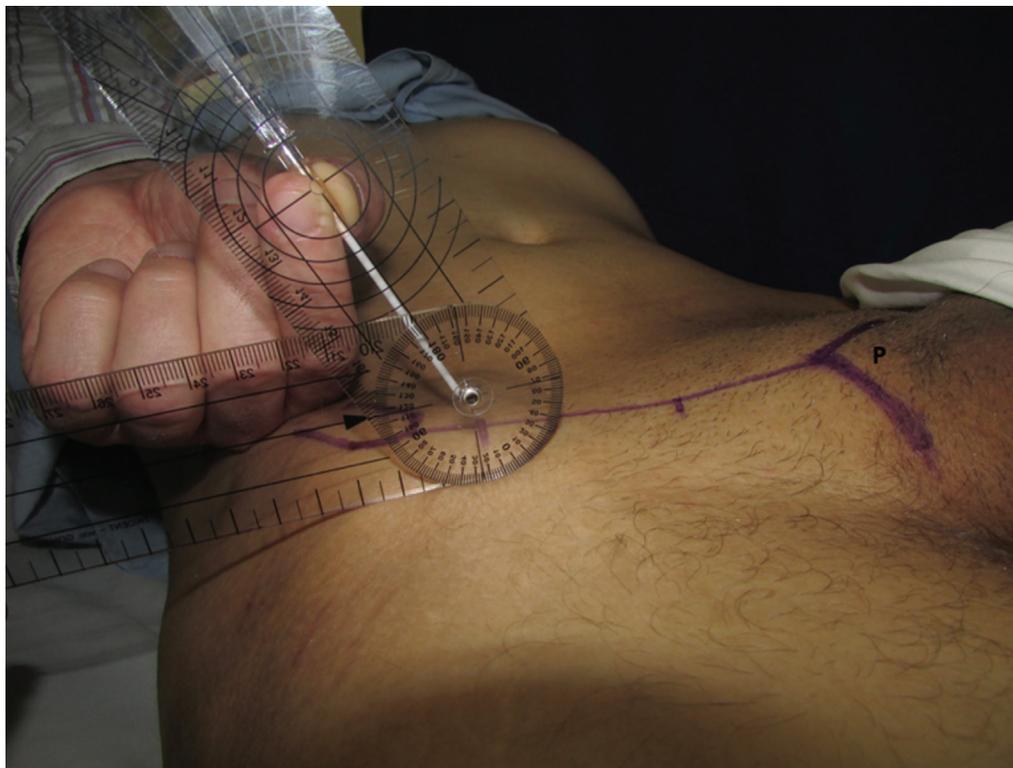


Fig. 5 Aspect of the needle angulation at 70° in the described demarcation.

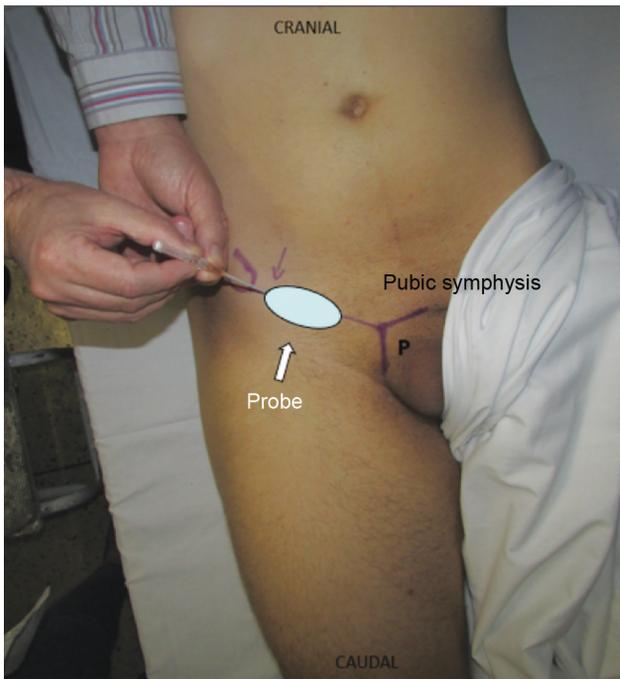


Fig. 6 Aspect of the needle towards the apex of the demarcated iliopubic branch and positioning of the ultrasound probe.

The most frequent diagnoses were primary and secondary arthrosis, with ten (25%) and nine (22.5%) cases, respectively, followed by eight femoral neck fractures (20%), seven trans-trochanteric fractures (17.5%), three femoroacetabular impacts (7.5%), and three other cases (7.5%).

Nineteen applications occurred on the right hip, whereas 21 were on the left hip. US confirmation after puncture determined an 85% success rate (33 applications). When temporally grouping the 40 applications into three-thirds, five (71.4%) of the seven cases with positioning errors occurred in the first application period, one (14.2%) in the second period, and one (14.2%) in the third period.

In all hips, the neurovascular bundle was in the medial third of the pen-made demarcation. Even when the application failed, the distance between the needle and the neurovascular bundle was safe. The seven cases with poor needle

positioning occurred in females. In four of them, the needle was in ASIS. Two patients had excessive pelvic anteversion, with poor needle positioning anterior to the hip. In the last case, the patient was obese, and the needle did not reach the bone, requiring its replacement with a larger one.

A single block-related complication occurred in 40 applications (2.5%), with the patient presenting femoral nerve apraxia and quadriceps muscle contraction deficit. This complication resolved within 2 days post-application. This subject had arthrosis secondary to right hip osteonecrosis, and the needle was in the correct position, lateral to the psoas muscle tendon, according to the US.

Discussion

Despite the increasing US popularization, its availability remains scarce in some places, which also suffer from inadequate resources. As a result, the performance of the original PENG block technique is unfeasible. We are aware that US is critical for correct infiltration, as it brings comfort and facilitates bedside care for patients with hip pain waiting for the definitive procedure in hospitals with no US. Therefore, we aimed to analyze the accuracy of performing this technique unguided.

The unguided PENG technique had promising results, with a high success rate (85%). Moreover, it was a safe technique, potentially benefitting patients in services with no US equipment.

Since its original publication in 2018¹, PENG block provided good benefits in controlling pain in patients with acute conditions.^{1,11-13} However, its use and effectiveness in chronic hip conditions remain little explored in the literature.¹⁴ This is another scenario for a potential unguided block test.

The 15% failure rate mostly occurred during the first third of the study, potentially suggesting the need for a learning curve for the procedure. The suggestion is to initially use the US until the professional feels comfortable enough to perform the technique without its guidance. Considering the last two-thirds of our sample alone, we can observe a 92.5% assertiveness with no higher risks to the neurovascular bundle.

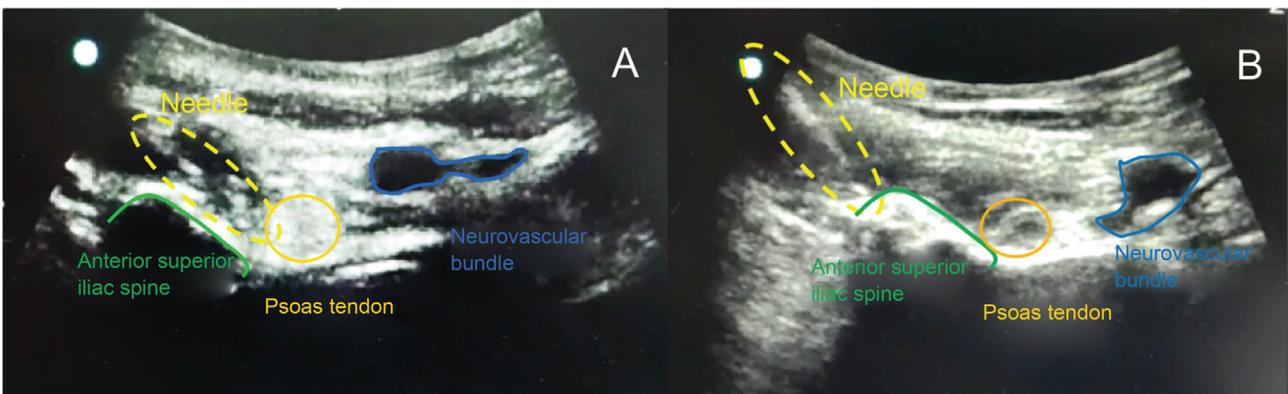


Fig. 7 Ultrasonographic appearance of the structures with good positioning (A). Ultrasound appearance of the poorly positioned structures (B).

As for the cases of poor positioning highlighted in this study, we recommend caution with the unguided technique in obese subjects (maybe performing the puncture with a larger needle) and cases of significant pelvic anteversion.

The femoral nerve apraxia occurred in a 45-year-old female patient with coxarthrosis. We believe this complication is not frequent, as PENG is common in patients with fractures,^{1,11–13} under bed rest. However, other authors reported this complication.¹⁵ We suggest rest and observation for at least one hour for patients with fractures before their release on an outpatient basis after testing the quadriceps muscle function. In rare cases of femoral nerve apraxia, rest for 2 to 3 days is advisable until the weakness of the anterior thigh muscles improves.

This study has some limitations, highlighting the needle adjustment in cases of poor positioning, potentially minimizing infiltration-related complications in adverse locations. Although this method is consistent with the study objective of analyzing the feasibility and accuracy of the unguided technique and preserving patient safety, we believe interpreting the complications observed in this study should be cautious because of their potential underestimation. Further studies analyzing the efficacy and safety of the unguided PENG technique are required.

Conclusion

Unguided PENG block is a viable technique with good accuracy and growing evidence of its potential performance with no US guidance.

Financial Support

This study did not receive any financial support from public, commercial or non-profit sources, commercial or non-profit sources.

Conflict of Interests

The authors declare no conflict of interests regarding this study.

Acknowledgment

We thank Grupo Martins for donating the ultrasound equipment to perform this study.

References

- Girón-Arango L, Peng PWH, Chin KJ, Brull R, Perlas A. Pericapsular Nerve Group (PENG) Block for Hip Fracture. *Reg Anesth Pain Med* 2018;43(08):859–863
- Orozco S, Muñoz D, Jaramillo S, Herrera AM. Pericapsular Nerve Group (PENG) block for perioperative pain control in hip arthroscopy. *J Clin Anesth* 2020;59:3–4
- Acharya U, Lamsal R. Pericapsular nerve group block: an excellent option for analgesia for positional pain in hip fractures. *Case Rep Anesthesiol* 2020;2020:1830136
- Del Buono R, Padua E, Pascarella G, Soare CG, Barbara E. Continuous PENG block for hip fracture: a case series. *Reg Anesth Pain Med* 2020;45(10):835–838
- Morrison C, Brown B, Lin DY, Jaarsma R, Kroon H. Analgesia and anesthesia using the pericapsular nerve group block in hip surgery and hip fracture: a scoping review. [published correction appears in *Reg Anesth Pain Med*. 2022 May;47(5):e1] *Reg Anesth Pain Med* 2021;46(02):169–175
- Sahoo RK, Jadon A, Sharma SK, Peng PW. Peri-capsular nerve group block provides excellent analgesia in hip fractures and positioning for spinal anaesthesia: A prospective cohort study. *Indian J Anaesth* 2020;64(10):898–900
- Luftig J, Dreyfuss A, Mantuani D, Howell K, White A, Nagdev A. A new frontier in pelvic fracture pain control in the ED: Successful use of the pericapsular nerve group (PENG) block. *Am J Emerg Med* 2020;38(12):2761.e5–2761.e9
- Kukreja P, Avila A, Northern T, Dangle J, Kolli S, Kalagara H. A Retrospective Case Series of Pericapsular Nerve Group (PENG) Block for Primary Versus Revision Total Hip Arthroplasty Analgesia. *Cureus* 2020;12(05):e8200
- Pascarella G, Costa F, Del Buono R, et al; collaborators. Impact of the pericapsular nerve group (PENG) block on postoperative analgesia and functional recovery following total hip arthroplasty: a randomised, observer-masked, controlled trial. *Anaesthesia* 2021;76(11):1492–1498
- Del Buono R, Padua E, Pascarella G, et al. Pericapsular nerve group block: an overview. *Minerva Anestesiol* 2021;87(04):458–466
- Allard C, Pardo E, de la Jonquière C, et al. Comparison between femoral block and PENG block in femoral neck fractures: A cohort study. *PLoS One* 2021;16(06):e0252716
- Lin DY, Morrison C, Brown B, et al. Pericapsular nerve group (PENG) block provides improved short-term analgesia compared with the femoral nerve block in hip fracture surgery: a single-center double-blinded randomized comparative trial. *Reg Anesth Pain Med* 2021;46(05):398–403
- Mosaffa F, Taheri M, Manafi Rasi A, Samadpour H, Memary E, Mirkheshti A. Comparison of pericapsular nerve group (PENG) block with fascia iliaca compartment block (FICB) for pain control in hip fractures: A double-blind prospective randomized controlled clinical trial. *Orthop Traumatol Surg Res* 2022;108(01):103135
- Jaramillo S, Muñoz D, Orozco S, Herrera AM. Percutaneous bipolar radiofrequency of the pericapsular nerve group (PENG) for chronic pain relief in hip osteoarthritis. [published online ahead of print, 2020 Apr 27] *J Clin Anesth* 2020;64:109830
- Yu HC, Moser JJ, Chu AY, Montgomery SH, Brown N, Endersby RVW. Inadvertent quadriceps weakness following the pericapsular nerve group (PENG) block. *Reg Anesth Pain Med* 2019;44(05):611–613