

## Original Research Article

# The reduction in the incidence of iatrogenic meralgia paresthetica after hip arthroscopy by preoperative mapping of the nerve

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## ABSTRACT

**Background:** The gold standard for treating femoroacetabular impingement (FAI) is hip arthroscopy. The proximity of neurovascular structures makes them susceptible to injury. Among these, damage to the thigh's lateral cutaneous nerve is frequently sustained during the anterior portal hip arthroscopy procedure. The study's main goal was to determine whether ultrasound mapping of the thigh's lateral cutaneous nerve reduced the risk of injury during anterior portal hip arthroscopy. The secondary goal was to determine how traction time and subsequent traction-related complications-of which pudendal nerve injury is the most concerning-were affected by medially positioning the anterior portal to allow direct access to the anterior part of the labrum.

**Methods:** The study included 51 patients who underwent hip arthroscopy for femoral osteoplasty and/or acetabuloplasty, as well as anterior labral repair, between August 2022 to November 2024.

**Results:** The average traction time was 57.1 minutes, with a range of 40 to 85 minutes and an SD of 10.4 minutes. Three patients (5.9%) experienced partial palsy of the lateral cutaneous nerve of the thigh. Following surgery, one patient (2%) experienced complete pudendal nerve palsy, and 8 patients (15.7%) experienced partial palsy.

**Conclusions:** The present study discusses the safety and potential advantages of mapping the lateral cutaneous nerve of the thigh using ultrasound. It also suggests that this method may help to shorten the duration of traction and minimize complications associated with it.

**Keywords:** Meralgia paresthetica, Hip arthroscopy, Complications of hip arthroscopy, Iatrogenic nerve injury

## INTRODUCTION

Young adults with hip pain may have a clinical condition called FAI. Clinical manifestations include hip pain, hip motion restriction, and abnormal hip joint morphology on imaging.<sup>1</sup> Although FAI was first reported in 1936, Ganz et al put forth a theory that FAI results in hip dysfunction and pain, which is followed by the onset of primary osteoarthritis.<sup>2</sup> Abnormal bony morphology, such as a prominent acetabular rim (pincer type), an enlarged femoral head-neck junction (cam type), or more frequently mixed deformity, is thought to be linked to FAI and ultimately result in osteoarthritis.<sup>3</sup>

Originally treated with open procedures, hip arthroscopy has become the gold standard of care. The number of hip arthroscopy procedures performed has increased significantly over the last 20 years due to advancements in arthroscopic technique and equipment. Prior randomized controlled trials (RCTs) have mainly demonstrated that surgery is more effective than physical therapy in treating FAI.<sup>4,5</sup> A recent study comparing correction of bony deformity versus lavage revealed a significantly lower rate of re-tear and reoperation with osteochondroplasty. In this study, all patients received labral repair when deemed necessary.<sup>6,7</sup>

The current arthroscopic procedure, known as osteochondroplasty, aims to correct the bony deformities characteristic of FAI and repair any soft tissue lesions, such as labral tears.<sup>8</sup> Several investigations have found that osteochondroplasty is a low-complication procedure that is both safe and effective.<sup>9</sup>

Because the hip is relatively stable, it takes a lot of force to dislodge the femoral head during surgery. In order to produce the necessary distraction force, patients are typically positioned on a traction table with a fulcrum acting as the perineal post. Direct compression against the perineal post due to this traction may cause damage to the pudendal nerve, potentially leading to perineal post complications. Damage to the pudendal nerve has been connected to sexual and sensory disorders. Studies have indicated that incidence of pudendal neuralgia resulting from use of traction tables for various procedures, including hip arthroscopy, can range from 1 to 27%.<sup>10</sup>

The longer traction time, the greater the chance of pudendal nerve neuropraxia.<sup>11</sup> In order to facilitate the trajectory of the anterior aspect of the labrum and enable the anchor to be safely placed in the thin anterior highly curved anterior wall of the acetabulum without penetrating into the joint space, the anterior portal in particular and the associated risk of injuring the lateral cutaneous nerve of the thigh can have a significant impact on traction time.<sup>12</sup>

The primary objective of the study was to assess the efficacy of ultrasound mapping of the lateral cutaneous nerve of the thigh in mitigating the risk of injury during anterior portal hip arthroscopy. The secondary objective was to evaluate the impact of medially positioning the anterior portal on traction time and the incidence of traction-related complications, with particular emphasis on the potential for pudendal nerve injury, which is of significant concern.

## METHODS

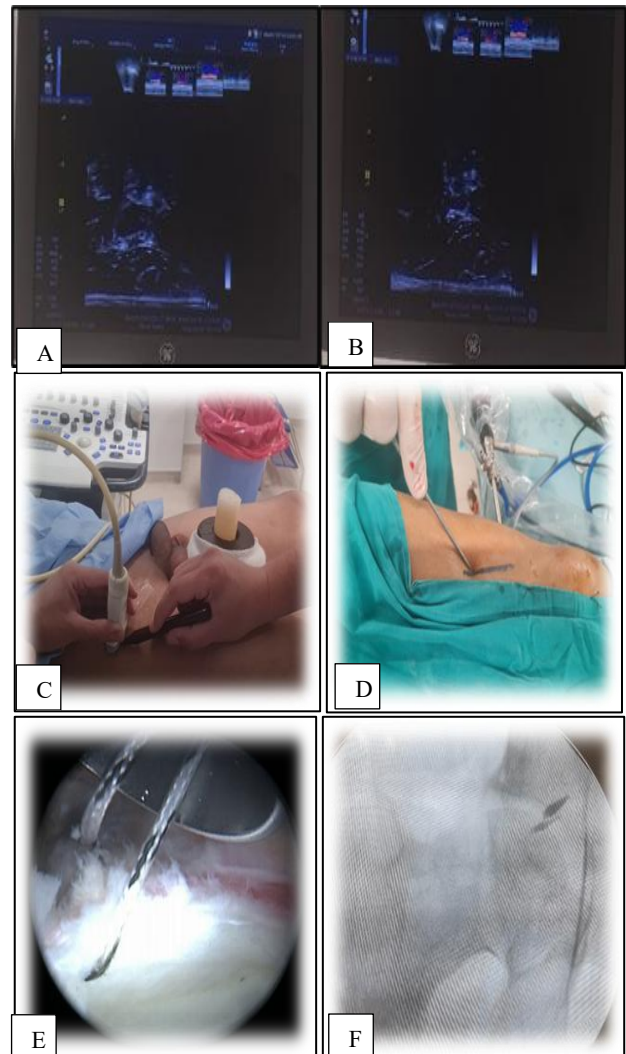
This research was carried out from August 2022 to November 2024 in El-Hadra university hospital, Alexandria, Egypt. Prospectively recruitment was done during this period for patients who were operated for femoral osteoplasty, acetabuloplasty, and anterior labral repair arthroscopically.

Patients who received regional anesthesia, had joint space narrowing on plain x-rays, had both superior and posterosuperior labral tears repaired, had undergone labral debridement/had concurrent preoperative meralgia paresthetica were excluded. The anterolateral portal was used to place the anchor, and patients who did not finish follow-up within 1<sup>st</sup> 6 months after surgery were excluded.

Following an explanation of all available treatment options and their potential benefits and drawbacks, all patients consented to treatment.

After administering anesthesia, a physician skilled in ultrasound-guided injections and pain management conducted an ultrasound on the patient.

About 2-3 cm medial to the anterior iliac spine, the lateral cutaneous nerve enters the lower limb through or beneath the inguinal ligament. It is then followed distally to the level two finger breadths below the tip of the greater trochanter (Figure 1).



**Figure 1 (A-F): A and B ultrasound tracking of the lateral cutaneous nerve of the thigh from proximal to distal, C-marking of the nerve on the skin guided by the ultrasound, D-anterior portal performed just lateral to the marked nerve after doing the classic anterolateral portal, E-intraoperative photo during insertion of the first anchor, F-repair of the labrum with 2 anchors.**

Sterilization and drapery were then performed on the patient, exposing the region 3 inches medial to the line that extends vertically downward from the anterior superior iliac spine. Once the safe zone in the capsule was identified, the anterior portal was completed just lateral to the previously completed marking of the lateral cutaneous

nerve of the thigh under ultrasound guidance. The classic anterolateral portal was completed just above the tip of the greater trochanter. Therefore, securing the portal medially as safely as possible will help repair the anterior portion of the labrum and reduce the traction time, both of which are directly linked to traction-related complications, the most serious of which is pudendal nerve injury.

A thorough neurological examination was performed during first two weeks following surgery, and the results were documented. All patients who showed symptoms of either pudendal nerve injury or lateral cutaneous nerve injury were monitored until the injury was resolved.

Using averages, deviations, and spans, descriptive analysis was performed on numerical data. Tests on the data were conducted to see if the outcomes were within the expected range. The Shapiro-Wilk test was utilized to ascertain whether the distribution was normal. Results that fit into a normal distribution would have been compared using the independent means t test. Using the Mann-Whitney U test as a two-way analysis of variance, independent factors were examined for data that were not normally distributed. The p value was used to assess a significance level of less than 0.05. IBM SPSS Statistics 26, based in Chicago, Illinois, was used as the analysis's software.

### Ethical approval

Appropriate ethical approval was obtained from the ethical committee of medical ethics of the faculty of medicine-Alexandria university (IBR number: 00012095, FWA number:00018699).

## RESULTS

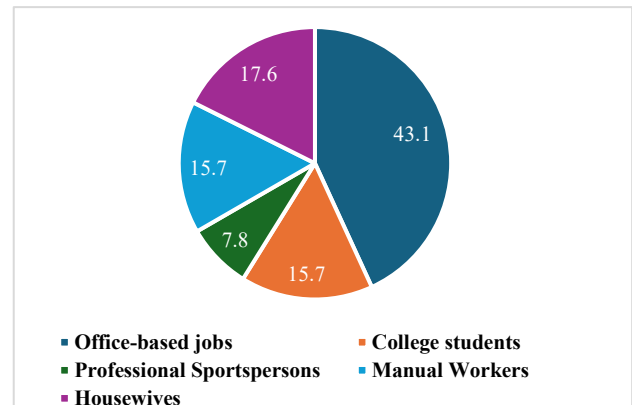
The mean age for the patients was 29.3 years old (range 18 to 52 years old; SD=8.1. There were 27 male patients (52.9%), and 24 female patients (47.1%) in the study population. The mean body mass index (BMI) was 25.9 (range 19 to 39; SD=4.6) (Table 1).

**Table 1: Summary of numeric data.**

| Variables                                                     | Mean | Standard deviation |
|---------------------------------------------------------------|------|--------------------|
| Age (in years)                                                | 29.3 | 8.1                |
| BMI (kg/m <sup>2</sup> )                                      | 25.9 | 4.6                |
| Duration of symptoms (in months)                              | 8.5  | 4.5                |
| Traction time (in minutes)                                    | 57.1 | 10.4               |
| Time till recovery of partial LCNT palsy (in weeks)           | 7.3  | 3.1                |
| Time till recovery of partial pudendal nerve palsy (in weeks) | 7.5  | 1.6                |

There were 22 patients (43.1%) working office-based jobs, 8 patients (15.7%) were college students, 4 patients (7.8%)

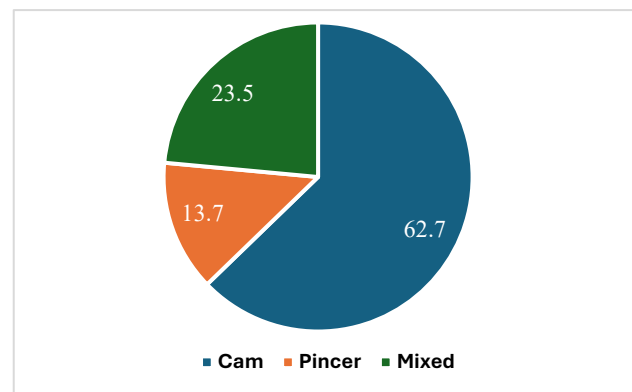
were professional sports players, 8 patients (15.7%) were manual workers and 9 (17.6%) were housewives (Figure 2).



**Figure 2: Distribution of the occupational activity of the study participants.**

Other than the four professional sportsperson patients (7.8%) who participated in competitive sports, 20 patients (39.2%) participated in recreational sports, and 27 patients (52.9%) didn't participate in sports.

The type of bony deformity in 32 patients (62.7%) was cam morphology, in 7 patients (13.7%) was pincer morphology, and in 12 patients (23.5%) was mixed cam and pincer morphology (Figure 3).



**Figure 3: The distribution of the bony deformity between study participants.**

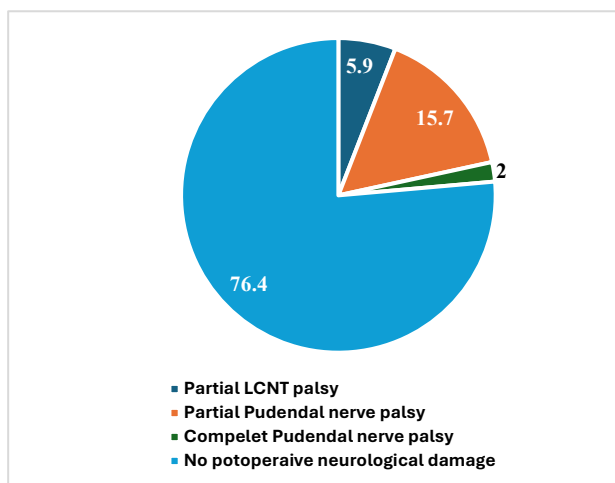
The duration between the onset of symptoms and arthroscopy averaged 8.5 months (range 2 to 22 months; SD=4.5).

During arthroscopy, the traction time (the time between starting traction, developing portals, resecting the pincer lesion in patients with a pincer or mixed deformities, repairing the labrum, till releasing traction to start cam femoral osteoplasty) averaged 57.1 minutes (range 40 to 85 minutes; SD 10.4). Using one-sample Kolmogorov-Smirnov Normal test there was a statistically significant correlation between the type of FAI bony deformity and

the duration of traction ( $p=0.001$ ) with the mixed type taking the longest duration.

After arthroscopy, 3 patients (5.9%) suffered partial lateral cutaneous nerve of the thigh palsy in the form of a localized area of numbness at the proximal one-fourth of the thigh, recovered within average of 7.3 weeks (range from 4 to 10 weeks;  $SD=3.1$ ), and no patients suffered complete lateral cutaneous nerve of the thigh palsy.

Postoperatively 8 patients (15.7%) had partial pudendal nerve palsy in the form of numbness at the perineum which recovered within 7.5 weeks (range 5 to 10 weeks;  $SD=1.6$ ), 1 patient (2%) suffered complete palsy in the form of numbness and temporary impotence which recovered completely after 3 months, and 42 patients (82.4%) didn't have any affection of the pudendal nerve (Figure 4).



**Figure 4: The distribution of the postoperative neurological status of the study participants.**

Age, gender, BMI, occupation, level of sports participation, type of bony deformity, duration of symptoms, and traction time didn't have a statistically significant relationship with the occurrence of the lateral cutaneous nerve of the thigh palsy ( $p=0.5$ ), ( $p=0.6$ ), ( $p=0.4$ ), ( $p=0.7$ ), ( $p=0.5$ ), ( $p=0.2$ ), ( $p=0.2$ ), and ( $p=0.6$ ) respectively using the Pearson Chi-square test.

Age, gender, BMI, occupation, level of sport participation, type of the bony deformity, and duration of symptoms didn't have a statistically significant relationship with the risk of pudendal nerve palsy ( $p=0.4$ ), ( $p=0.5$ ), ( $p=0.4$ ), ( $p=0.3$ ), ( $p=0.3$ ), ( $p=0.4$ ), ( $p=0.07$ ) respectively using the Pearson Chi-square test. Only traction time was statistically significantly correlated with the risk of pudendal nerve palsy ( $p=0.001$ ).

## DISCUSSION

Zhang et al conducted a randomized trial examining the efficacy of ultrasound in safeguarding the lateral cutaneous nerve of the thigh during the anterior approach to total hip

replacement. Their findings indicated that while ultrasound effectively prevented injury to the main trunk of the nerve, it was less successful in protecting the smaller branches.<sup>13</sup> This aligns with the results of the present study, which demonstrated that after performing ultrasound mapping of the lateral cutaneous nerve of the thigh, there were no occurrences of complete nerve palsy; however, three cases (5.9% of the total) exhibited partial damage to the nerve's minor branches.

In a recent review of literature by Amadei et al they found that the frequency of nerve damage after hip arthroscopy, such as pudendal nerve palsy, lateral cutaneous nerve palsy, and sciatic nerve palsy, varied from 1.4% to 5%.<sup>14</sup> On the contrary, in a study conducted by Kern et al a higher occurrence of nerve injuries post hip arthroscopy was reported at 13%.<sup>15</sup> Moreover, in a multi-center study by Zeman et al it was discovered that 1.3% of the participants suffered from perineal hypoesthesia or paresthesia, with male sex and duration of traction being linked to pudendal nerve damage.<sup>16</sup> In the current research, three patients (5.9%) had partial lateral cutaneous nerve of the thigh palsy, eight patients (15.7%) had partial pudendal nerve palsy, and one patient (2%) experienced complete pudendal nerve palsy. Interestingly, this study did not identify gender as a risk factor for pudendal nerve injury, highlighting traction time as the main significant risk factor.

In a prior study the author participated in, it was found that 15% of the study participants developed full paralysis of the lateral cutaneous nerve of the thigh after surgery.<sup>17</sup> In the current study, the rate of partial nerve damage decreased to 5.9%, and there were no cases of complete nerve palsy in any patient.

Larson et al it was revealed that 16% of 1615 patients undergoing hip arthroscopy suffered from lateral cutaneous nerve of the thigh injuries.<sup>18</sup> He also reported in another study involving 45 patients focused on labral repair without specifying a particular safe technique for placing the anterior portal during hip arthroscopy. This research aimed to investigate nerve-related injuries post-hip arthroscopy, with an average traction time of 110 minutes. The study reported a 13.3% incidence of lateral cutaneous nerve of the thigh palsy, with most patients experiencing no recovery, and a 17.8% occurrence of pudendal nerve injury.<sup>5</sup> Based on a review of 50 patients, Dippmann et al found that 16% of the participants experienced portal-related injuries.<sup>19</sup> Conversely, the current study documented a lower incidence of partial palsy of the lateral cutaneous nerve of the thigh at 5.9%, with all patients eventually recovering.

The average traction time, as determined by researchers in the FAI RST, was 48 minutes, with a standard deviation of 21 minutes. Nine (8.3%) of the patients in the osteochondroplasty group had neither repair nor debridement, 20 (18.5%) had labral resection, and 79 (73.1%) had labral repair. Additionally, they discovered in



their series that cam impingement was the most common form (58.4%; 125/214).<sup>20</sup> Every patient in the current investigation received labral repairs, and the average traction time was 57.1 minutes (range: 40 to 85 minutes; SD=10.4). Cam morphology accounted for 62.7% of all bone deformities.

Four different branching patterns of the lateral cutaneous nerve of the thigh were found by Bartlett et al in their cadaveric study. Additionally, they discovered that the anterior portal is normally positioned within 2 mm of the nerve. Therefore, they recommended lateralizing the anterior portal by at least 15 mm to lower the chance of harming the lateral cutaneous nerve in the thigh.<sup>10</sup> Such would significantly complicate anterior labrum repair and raise possibility of traction time, which is closely associated with the more serious injury to the pudendal nerve.

Gordey et al examined the C arm and ultrasound methods for creating portals in their study. They discovered that there was no long-term nerve injury in the ultrasonography group.<sup>21</sup> The use of ultrasonography to assist in establishing a portal during hip arthroscopy has been explained by many authors.<sup>22,23</sup> The anaesthesiologists, who were educated in ultrasound mapping of peripheral nerves as part of their training, used and marked the area before draping and cleaning it because the author of the current study was unfamiliar with the ultrasound machine. This was done out of fear for infection. However, doing osteoplasty without a C-arm, whether for the head-neck junction or the acetabulum, is unpredictable.

### Limitations

Among the limitations of the present study are its limited patient population and lack of a comparative group. The safety and possible benefits of mapping the lateral cutaneous nerve of the thigh with ultrasonography are covered in this study. A more medially positioned portal will assist direct access to the anterior labrum, facilitating its repair and minimizing the traction time, which is directly associated to the injury to the pudendal nerve. Firstly, the portal method reduces the danger to the nerve itself.

### CONCLUSION

The present study discusses the safety and potential advantages of using ultrasound to map the lateral cutaneous nerve of the thigh. First, the risk to the nerve itself is reduced during the portal procedure; second, a more medially positioned portal will help direct access to the anterior labrum, facilitating its repair and lowering the traction time, which is directly linked to damage to the pudendal nerve.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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