Results of Localization of the lateral cutaneous nerve of the thigh before performing the anterior portal of hip arthroscopy

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Introduction
Palsy of the lateral cutaneous nerve of the thigh is one of the neurological complications recognized to occur after performing the anterior portal of hip arthroscopy which is also associated with the possibility of various complications, being near the neurovascular structures is one of the reasons for some of these complications. The discomfort caused by palsy of the lateral cutaneous nerve of the thigh can cause the patient's dissatisfaction and suffering which in some severe cases can outweigh the benefit from the arthroscopic treatment.
Aim
The primary objective was to assess the effect of ultrasound mapping of the lateral cutaneous nerve of the thigh in reducing the risk of its injury while performing the anterior portal of hip arthroscopy, the secondary objective was to assess the effect of getting the anterior portal medially as safely as possible, so that to be in direct access to the anterior part of the labrum, on traction time and subsequently traction related complications, of which the pudendal nerve injury is the most worrying.
Methods
The study included 39 patients undergoing hip arthroscopy for anterior labral repair and femoral osteoplasty and/or acetabuloplasty between March 2020 and December 2022.
Results
The traction time averaged 57.3 min (range 40–85 min; SD 11.3). Two (5.1%) patients suffered partial lateral cutaneous nerve of the thigh palsy. Postoperatively seven (17.9%) patients had partial pudendal nerve palsy in the form of numbness at the perineum which recovered within 7.6 weeks (range 5–10 weeks; SD 1.7), one (2.6%) patient suffered complete palsy in the form of numbness and temporary impotence which recovered completely after 3 months.
Conclusion
The present research demonstrates the safety and potential advantages of employing ultrasound to locate the lateral cutaneous nerve of the thigh, which could also decrease the time spent on traction and its related complications.

Keywords:
anterior portal of hip arthroscopy, complications of hip arthroscopy, hip arthroscopy, lateral cutaneous nerve of the thigh, palsy of lateral cutaneous nerve of the thigh, ultrasound mapping

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Introduction

Originally utilized for removing loose bodies, draining/debriding septic arthritis, and treating pediatric hip disorders, hip arthroscopy is now employed for a range of hip conditions. The acknowledgment of femoroacetabular impingement (FAI) causing hip pain in young adults has quickly increased the popularity of hip arthroscopy by utilizing the same principles of bone correction previously seen with open surgical dislocation. Hip problems can be categorized as central compartment, peripheral compartment, peritrochanteric space, and subgluteal space disorders [1].

FAI is a clinical entity that causes hip pain in young adults. Hip pain, hip motion limitation, and abnormal hip joint morphology on imaging are characteristic clinical presentations [2]. Although FAI was originally described in 1936 [3], in 2003 Ganz *et al.* proposed a theory in which FAI causes hip pain and dysfunction with the subsequent development of primary osteoarthritis [4]. It is proposed that abnormal bony morphology, such as an enlarged femoral head-neck junction (cam type), a prominent acetabular rim (pincer type), or more commonly mixed deformity, is associated with FAI and ultimately leads to osteoarthritis [5,6].

It was originally addressed with open procedures; the gold standard of care has shifted to hip arthroscopy [7–10]. In the past 20 years, there has been a significant rise in the number of hip arthroscopy procedures carried out, owing to advances in arthroscopic technique and instrumentation [1,9–11]. Previous randomized controlled trials have primarily shown that surgery is more beneficial than physiotherapy in the treatment of FAI [12,13]. A recent study in which all patients received labral repair when deemed necessary compared correction of bony deformity versus lavage showed a significantly lower rate of re-tear and reoperation with osteochondroplasty [14].

The goal of the current arthroscopic procedure, called osteochondroplasty, is to repair any soft tissue lesions, like labral tears, and correct the bony deformities typical of FAI [15,16]. Numerous studies have concluded that osteochondroplasty is a safe and effective procedure with low rates of complications [14,17,18].

Due to the hip's relative stability, considerable force is required during surgery to dislodge the femoral head. To generate the required distraction force, patients are usually placed on a traction table with a perineal post that serves as a fulcrum. The pudendal nerve may be harmed by direct compression against the perineal post as a result of this traction, which could result in complications related to the perineal post. Sexual and sensory disorders have been linked to pudendal nerve injury [19,20]. Studies have shown that using traction tables for various procedures, such as hip arthroscopy, can result in a rate of pudendal neuralgia ranging from 1.8 to 27.6% [21,22].

The risk to pudendal nerve neuropraxia is increased with traction time [14]. the traction time can be influenced heavily by portal placement especially the anterior portal with the attendant risk of injuring the lateral cutaneous nerve of the thigh by ambitiously relatively medial placement to facilitate the trajectory of the anterior aspect of the labarum and allow the anchor to be placed safely in the thin anterior highly curved anterior wall of the acetabulum without penetrating the joint space [23,24].

The study aims to assess the extent to which the mapping of the lateral cutaneous nerve of the thigh via ultrasound would decrease the incidence of its palsy without compromising the trajectory of the portal i.e., does not increase traction time and its related complications

Methods

This study was conducted between March 2020 and December 2022. It includes 39 patients undergoing hip arthroscopy for anterior labral repair and femoral osteoplasty and/or acetabuloplasty.

Exclusion criteria included patients with concomitant preoperative meralgia paresthetica, patients who received regional anesthesia, patients with joint space narrowing on plain radiography, patients who underwent labral debridement, patients who had labral repair of superior and posterosuperior labral tears that is the anchor was placed through the anterolateral portal, and patients who failed to complete the follow-up for the first 6 months postoperatively.

All patients agreed to treatment after clarification of all treatment alternatives with their conceivable upsides and downsides comes about.

After anesthetizing the patient, an ultrasound was performed by an anesthetist familiar with ultrasound-guided injections.

The lateral cutaneous nerve was identified as it enters the lower limb passing through or underneath the inguinal ligament about 2–3 cm medial to the anterior iliac spine and followed distally to the level two finger breadths below the tip of the greater trochanter (Fig. 1).

Then sterilisation and draping of the patient was done with exposure of the area 3 inches medial to the line extending vertically downwards from the anterior superior iliac spine.

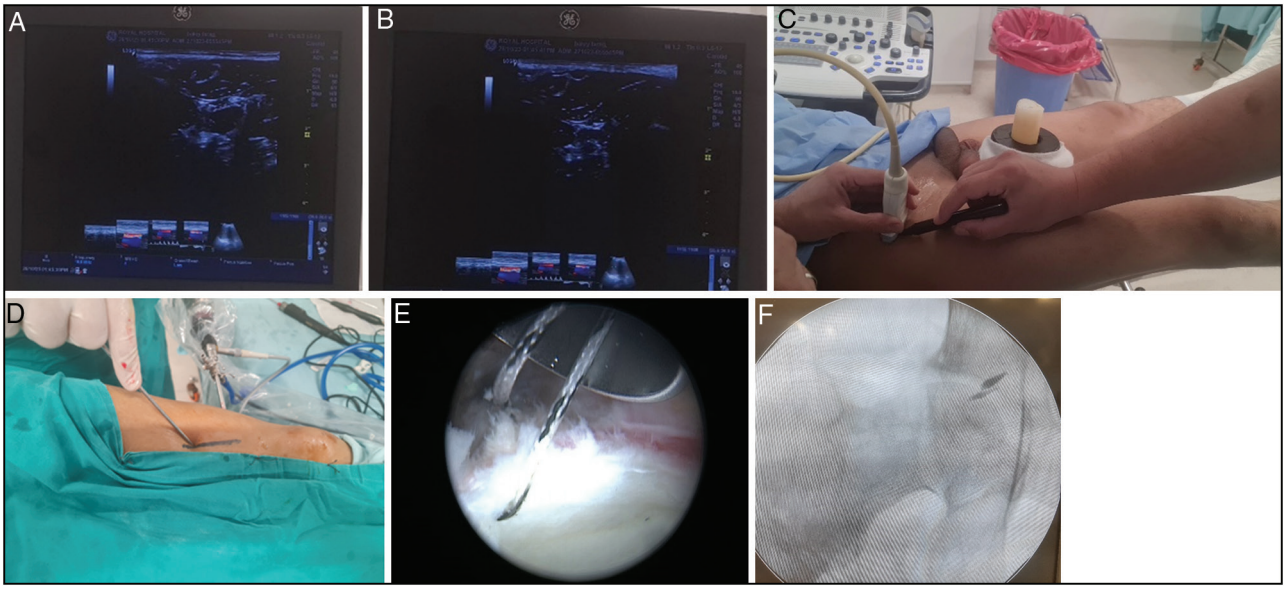
Classic anterolateral portal performed just above the tip of the greater trochanter was accomplished first followed by identification of the safe zone in the capsule to accomplish the anterior portal which was done just lateral to the previously done marking of the lateral cutaneous nerve of the thigh under ultrasound guidance. Thus, getting the portal medially as safe as possible to facilitate repair of the anterior part of the labarum and to shorten the traction time which is directly related to the traction-related complications of which the pudendal nerve injury is the most serious complication.

Careful neurological examination was done within the first two postoperative weeks and its findings were recorded. Those who demonstrated the signs of the lateral cutaneous nerve of the thigh or the pudendal nerve injury were followed-up till the resolution of the injury which happened eventually in all patients.

Statistical analysis

On numerical data, descriptive analysis was done using averages, deviations, and spans. To determine whether

Figure 1



a, 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 labarum with two anchors.

the results fell within the anticipated range, testing was done on the data. To determine whether the distribution was normal, the Shapiro–Wilk test was applied. For results that fell into a normal distribution, the *t* test for independent means would have been used to compare them. For data that were not normally distributed, independent factors were investigated using the Mann–Whitney *U* test as a two-way analysis of variance. A significance level of less than 0.05 was determined based on the *P* value. For the analysis, IBM SPSS Statistics 26, located in Chicago, Illinois, was utilized as the software.

Results

The mean age for the patients was 28.3 years old (range 18–42 years old; SD 6.8. There were 20 (51.3%) male patients, and 19 (48.7%) female patients in the study population. The mean BMI was 23.9 (range 19–29; SD 2.4).

There were 18 (46.2%) patients working office-based jobs, five (12.8%) patients were college students, three (7.7%) patients were professional sports players, six (15.4%) patients were manual workers, and seven (17.9%) patients were housewives.

Other than the three (7.7%) professional sportsperson patients who participated in competitive sports, 16 (41%) patients participated in recreational sports, and 20 (51.6%) patients did not participate in sports.

The type of bony deformity in 23 (59%) patients was cam morphology, in five (12.8%) patients was pincer morphology, and in 11 (28.2%) patients was mixed cam and pincer morphology.

The duration between the onset of symptoms and arthroscopy averaged 8.2 months (range 2–22 months; SD 4.7). Numerical variables are summarized in Table 1.

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 57.3 min (range 40–85 min; SD 11.3). 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).

After arthroscopy, two (5.1%) patients 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 with 8 and weeks, respectively, and no patients suffered complete lateral cutaneous nerve of the thigh palsy.

Postoperatively seven (17.9%) patients had partial pudendal nerve palsy in the form of numbness at the perineum which recovered within 7.6 weeks (range 5–10 weeks; SD 1.7), one (2.6%) patient suffered complete palsy in the form of numbness and temporary impotence which recovered completely after 3 months,

Table 1 Summary of numerical variables in the study group.

Variable	Mean	Minimum	Maximum	Standard deviation
Age (years)	28.3	18	42	6.8
Duration of symptoms (months)	8.2	2	22	4.7
Traction time (min)	57.3	40	85	11.3

and 31 (79.5%) patients did not have any affection of the pudendal nerve.

Age, sex, BMI, occupation, level of sports participation, type of bony deformity, duration of symptoms, and traction time did not 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 χ^2 test.

Age, sex, BMI, occupation, level of sport participation, type of the bony deformity, and duration of symptoms did not 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 χ^2 test. Only traction time was statistically significantly correlated with the risk of pudendal nerve palsy (P=0.001).

Discussion

Zhang *et al.*, studied the use of ultrasound to protect against the lateral cutaneous nerve of the thigh injury during the anterior approach to total hip replacement in a randomized trial and reported that ultrasound was effective in preventing the main trunk injury but not the small branches [25]. This coincides with the results of the current study, as there were no cases of a complete lateral cutaneous nerve of the thigh palsy after mapping its course with ultrasound, however, there were 2 (5.1%) cases of partial injury to the minute branches of the nerve.

In an earlier study in which the author was involved 15% of the study group developed postoperative complete lateral cutaneous nerve of the thigh palsy [26]. In the current study after using this technique it improved to 5.1% partial lateral cutaneous nerve of the thigh affection.

In a recent literature review by Amadei *et al.*, they reported that the incidence of nerve injuries after hip arthroscopy including pudendal nerve palsy, lateral cutaneous palsy, and sciatic nerve palsy are between 1.4 and 5% [27]. However, in a prospective study by Kern *et al.*, they reported the incidence of nerve injuries after hip arthroscopy to be 13% [28]. In a prospective multicentric Zeman and colleagues reported that 1.3% of their series had perineal hypoesthesia or paraesthesia. They reported both male gender and duration of traction as risk factors for pudendal nerve injury [29]. In the current study partial lateral cutaneous nerve of the thigh palsy occurred in two (5.1%) patients, partial pudendal nerve palsy occurred in seven (17.9%) patients, and complete pudendal nerve palsy occurred in one (2.6%) patient. Gender was not identified in the current study as a risk factor for pudendal nerve injury. Only traction time was identified as a risk factor for pudendal nerve injury. The difference in the results may be due to different sample size.

Femoroacetabular Impingement Randomized Controlled Trial Investigators reported that the traction time averaged 48 min; SD 21.1 min in the osteochondroplasty group which included 79 (73.1%) patients had a labral repair, 20 (18.5%) patients had a labral resection, and nine (8.3%) patients did not have neither repair nor debridement [14]. The traction time in the current study averaged 57.3 min (range 40–85 min; SD 11.3) and all patients included in the study had a labral repair which can explain the difference in the mean traction time.

Femoroacetabular Impingement Randomized Controlled Trial Investigators reported that cam was the most common impingement type in their series (58.4%; 125/214) [14]. In the current study, cam morphology was the most common type of bony deformity (59%) and the difference can be attributed to varying populations at the time of sampling.

The use of ultrasound to help establish portals in hip arthroscopy was described by various authors [30–32]. In their study, Gordey and Wong compared the use of ultrasound versus the c-arm to establish portals, they reported no permanent nerve damage in the ultrasound group [33]. In the current study, the author has no experience in using the ultrasound machine, so that was helped by the anesthesiologists trained in ultrasound mapping of peripheral nerves as a part of their training and for fear of infection that was used and marked before draping and disinfection of the operated field. Also, performing osteoplasty whether for the head-neck junction or the acetabulum is unpredictable without the use of a C-arm.

Bartlett and colleagues in their cadaveric study, found four different types of branching of the lateral cutaneous nerve of

the thigh and that the standard anterior portal will be within 2 mm of the nerve in most cases, so they recommended moving the anterior portal laterally at least 15 mm to minimize the risk of injury of the lateral cutaneous nerve of the thigh [23]. Practically that would make repair of the anterior labarum much more difficult with the attendant risk of increasing traction time which is directly related to more serious injury of the pudendal nerve.

Dippmann *et al.*, reported in a retrospective study of 50 patients reported that portal related injuries affected 16% of the study group [34]. In a study conducted on 1615 patients by Larson *et al.*, found 16.5% incidence of lateral cutaneous nerve of the thigh injury [35]. In the prospective study by Carreira and colleagues that was carried out on 45 patients most of them underwent labral repair, didn't describe any special technique regarding where to place the anterior portal of hip arthroscopy safely, looked specifically for nerve-related injuries following hip arthroscopy, and they reported mean traction time of 110 min, 13.3% incidence of lateral cutaneous nerve of the thigh palsy mostly did not recover, 17.8% incidence of pudendal nerve injury [24]. In the current study, there was only 5.1% incidence of partial palsy of the lateral cutaneous nerve of the thigh which recovered eventually which infers the safety and effectiveness of the technique of mapping the lateral cutaneous nerve of the thigh.

The limitations of the current study are small number of patients, and lack of comparative group.

In this study, the safety and potential benefits of mapping the lateral cutaneous nerve of the thigh using ultrasound are discussed. Firstly, there is a reduced risk to the nerve during the procedure; secondly, a more medially placed portal will help direct access to the anterior labarum, facilitating its repair and reducing the traction time, which is directly related to damage to the pudendal nerve.

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Conflicts of interest
There are no conflicts of interest.

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