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Original Article

Medial hip arthroscopy portals and their relation to the extra-articular structures: A cadaveric study

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ABSTRACT

Introduction: The present study was to study the relationship of medial hip portals with important neurovascular structures present in this region and to investigate safety zone for medial compartment.
Materials and methods: Thirty specimens from 15 adult cadavers were suitably positioned and anteromedial (AMP), posteromedial portal (PMP) and distal posteromedial (DMP) portals were marked and inserted along the anterior and posterior borders of adductor longus and then dissections were done. The distances were measured from point of entry of portal to femoral bundle, obturator nerve, saphenofemoral junction and profunda femoris artery. The depths of the above given structures were noted from the level of the respective portals. The transverse and sagittal angles of portal insertions were measured.
Results: In our study AMP and DMP were in greater proximity to the profunda femoris artery (2.5 cm and 2.8 cm, respectively), whereas obturator nerve was the closest structure in PMP (2.6 cm). Depth wise the nearest structure in all the portals was obturator nerve (1.1–1.3 cm). The mean values of transverse angle for AMP, PMP and DMP were17°, 18° and 15°, respectively, whereas the sagittal angle were 16°, 18° and 15°, respectively. Profunda femoris artery and obturator nerve were present on an average distance of 2.5 cm from the portal entry point, and depth wise these structures lie about 1 cm from the portal level.
Discussion: These structures are at the risk of getting damaged with misdirected portal. Thus the knowledge of angles of portal insertion is critical for avoiding iatrogenic damage.

1. Introduction

Hip arthroscopy is a procedure to diagnose and treat the pathologies concerned with the hip joint. It is a minimum invasive surgical procedure for examination and treatment of damage within the joint. Arthroscopy is indicated not only for femoroacetabular impingement, but also in synovial disease and acute septic arthritis. Anterior, anterolateral and posterolateral portals are the three standard arthroscopic portals used commonly. Improved techniques give us the better correlation of the arthroscopic findings with the clinical presentation, which could enable us to understand the indications of hip arthroscopy. Many researchers have studied the anatomical relations of portals using cadavers, and they targeted on anterior, anterolateral, posterolateral, peritrochanteric and pericentral portals.[1–5] But to the best of our knowledge, only few authors[6–9] have commented on portals of the medial compartment of hip joint as medial lesions of hip are completely approached via medial portals.

The present study was conducted on medial portals, which are important for congenital hip dislocation in children, femoral head necrosis, joint stiffness and lavage for septic arthritis.[3,7,8] This approach is also important in developmental hip dysplasia, whereas in this condition, it is dangerous to perform closed reduction technique.[10] Inferomedial portal is used for the extraction of firearm projectile.[11] Medial approach to the hip joint is difficult due to likely hood of injury to vital structures such as obturator nerve, profunda femoris artery, saphenous vein and femoral bundle. Our main purpose was to study the relationship of portals with important neurovascular structures present in this region and to investigate safety zone in relation to the medial portals through an anatomical method.

2. Methods

The present study was conducted on fresh cadavers in the Department of Anatomy, PGIMER, Chandigarh. Thirty specimens

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(15 right sided, 15 left sided, age range 50–80 years, males = 8 and females = 7) were carefully dissected. Specimens with pathological abnormalities of the hip joint that include hip deformities, congenital malformations, dislocations, osteoarthritis, trauma, fracture, etc. were excluded from the study.

The cadavers were placed in supine position and their lower limbs were flexed, abducted (70°) and externally rotated. Then three landmarks were considered for marking of portals; those are pubic symphysis, adductor longus and anterior superior iliac spine. These landmarks and portals (AMP, PMP, DMP) were marked before dissection (Fig. 1). The anteromedial portal (AMP) was marked on the anterior edge of adductor longus muscle 10 mm distal from origin of adductor longus. The posteromedial portal (PMP) was marked on the posterior edge of adductor longus muscle 10 mm distal from origin of adductor longus. The distal posteromedial portal (DMP) was marked at the posterior border of adductor longus 5 cm distal to origin of adductor longus muscle. The portals (AMP, PMP, DMP) were marked and inserted according to the study done by Polesello et al.[11]

The lower limbs were dissected on both sides (right, left) to locate the following structures; saphenofemoral junction, obturator nerve, femoral bundle and profunda femoris artery. After identifying these structures, three Steinmann pins (4 mm × 200 mm) were inserted towards the head and neck junction of femur. The AMP penetrated the pectineus muscle and then joint capsule. The PMP passed behind the adductor longus and reached the joint capsule. The DMP penetrated medial posterior border of adductor longus and then reached the joint capsule (Fig. 2). All three portals were anchored, and the distances and depths were measured by digital Vernier Caliper. Angles were measured in transverse and sagittal plane from skin surface using pair of divider and measured on protractor.

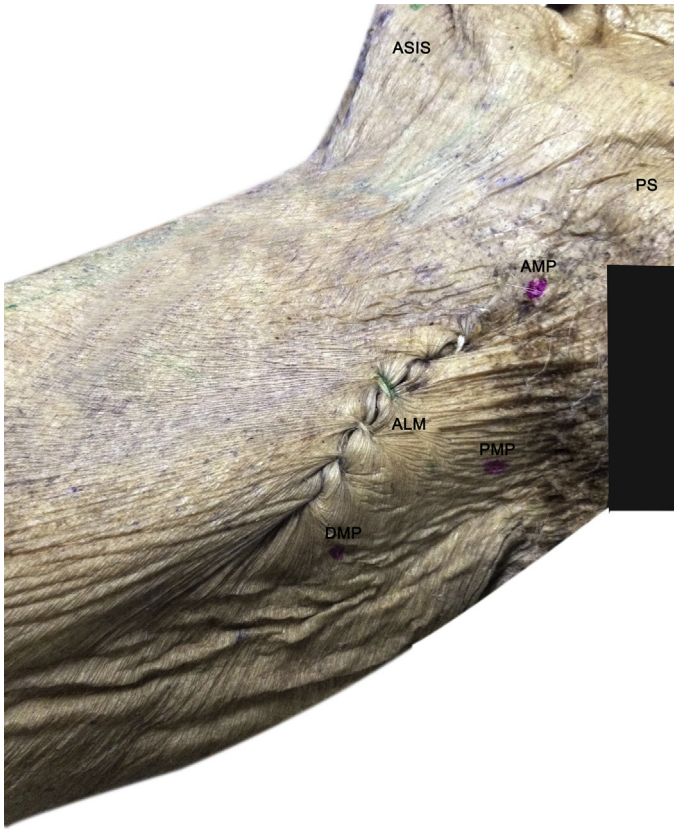

Fig. 1. Right hip positioned in flexion, abduction and external rotation showing various landmarks before dissection. The anteromedial portal (AMP) was marked on the anterior edge of adductor longus muscle 10 mm distal from origin of adductor longus, the posteromedial portal (PMP) was marked on the posterior edge of adductor longus muscle 10 mm distal from origin of adductor longus and the distal posteromedial portal (DMP) was marked at the posterior border of adductor longus 5 cm distal to origin of adductor longus muscle. ASIS, anterior superior iliac spine; PS, pubic symphysis; ALM, adductor longus muscle; AMP, anteromedial portal; PMP, postero medial portal; DMP, distal posteromedial portal.

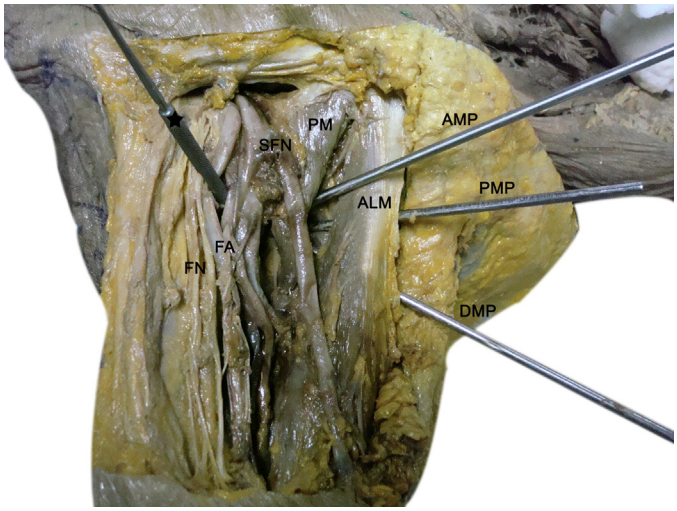

Fig. 2. Right hip showing of entry of portals via the anterior, posterior border of adductor longus muscle (ALM) and their relationship with the anatomical structures. FN, femoral nerve; FA, femoral artery; SFN, saphenofemoral junction. * Indicates the pin which was inserted up to the head and neck junction where all the three portals are anchored.

(A) **Distance**: The distance was measured from the site of entry of portal to medial border of femoral bundle, medial border of obturator nerve, saphenofemoral junction, and origin of profunda femoris from femoral artery.
(B) **Depth**: The depth of above given structures was taken, as a shortest vertical distance from the level of inserted portal to the structures by digital Caliper.
(C) **Angle**: The horizontal axis of limb was marked and transverse angle was measured between the horizontal axis and site of entry of portal. The sagittal angle was marked from the skin surface to the entry of portal. The above given methodology for measuring distance, depth and angles were performed for all the three portals.

In order to reduce bias from the study site of entry of portals to the target end point i.e. head and neck junction of femur was checked twice, and then measurements were taken. To assess intraobserver variations, each measurement was taken thrice, and all the measurements were statistically assessed by paired t test and no significant difference was found between the measurements. The average of three was used as final reading. All the measurements were statistically analysed. Standard deviation, mean and range were calculated.

3. Results

3.1. Anteromedial portal (AMP)

At the anterior border of adductor longus muscle portal was positioned anteromedial to the head and neck junction of femur after piercing pectineus and the joint capsule from. The mean distance of profunda femoris artery, obturator nerve

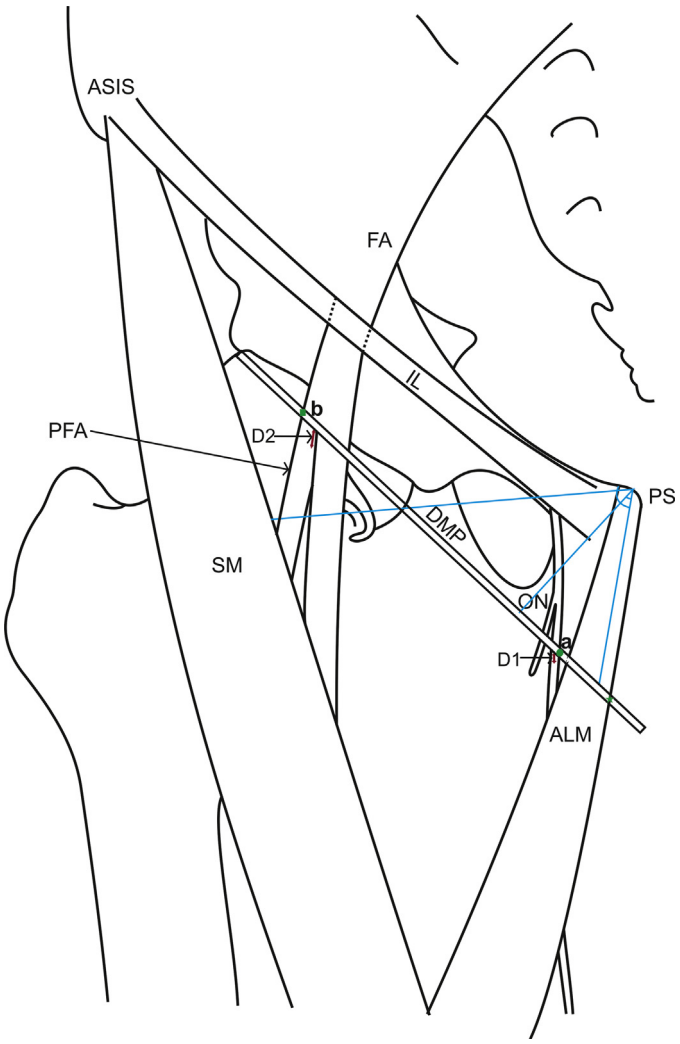

Fig. 3. Right hip showing measurement of distance of obturator nerve (ON) (a) and profunda femoris artery PFA (b) from the anteromedial portal (AMP).

(Fig. 3), saphenofemoral junction and femoral bundle to the portal entry point was 25.16 ± 4.40 mm, 24.36 ± 4.30 mm, 26.46 ± 4.09 mm and 25.65 ± 3.7 mm, respectively, as shown in Table 1. On analysing the above mentioned distances in the two sexes statistically significant differences was observed in profunda femoris artery and obturator nerve to the portal entry point. Mean values were observed more in females as compared to males (Table 4).

The mean values for the depth of various structures from the portal path were found to be 12.68 ± 4.06 mm for the profunda femoris artery, 11.62 ± 2.91 mm for the obturator nerve, while the saphenofemoral junction and femoral bundle were present at the depth of 13.45 ± 2.89 mm and 14.37 ± 3.08 mm, respectively. The maximum and minimum depths between the profunda femoris artery and portal were 23 mm and 6.9 mm, respectively (Fig. 2). The obturator nerve was observed to lie at minimum of 5 mm and maximum of 17.1 mm depth. The saphenous and femoral bundle depths were in the range of 9–21 mm and 8.7–19.6 mm, respectively (Table 2). The mean sagittal angle between the skin surface and the entry of AMP portal was observed to be 15° and the transverse angle between horizontal axis of limb and portal site entry was 16° (Table 3).

3.2. Posteromedial portal (PMP)

At the posterior border of adductor longus muscle PMP was positioned posteromedial to the head and neck junction of femur and then the portal passed between the adductor longus and gracilis muscles superficially and then the joint capsule. The distance of profunda femoris to the portal entry point was 30.73 ± 4.36 mm. Similarly, the obturator nerve was observed at a distance of 26.83 ± 3.78 mm (Fig. 4), the saphenofemoral junction was at a distance of 30.27 ± 4.83 mm, while femoral bundle was seen at a mean distance of 32.19 ± 4.54 mm from the portal entry point (Table 1). On analyzing the above mentioned distances between males and females, no statistically significant difference was observed (Table 4).

The mean values for the depth of various structures from the portal path were found to be 14.38 ± 3.22 mm for the profunda femoris artery, 13.55 ± 3.2 mm for the obturator nerve and the saphenofemoral junction and femoral bundle was present at the depth of 14.23 ± 2.66 mm and 15.87 ± 3.20 mm, respectively (Table 2). The mean sagittal angle between the skin surface and the entry of PMP portal was observed to be 18° and the transverse angle between horizontal axis of limb and portal site entry was 17° (Table 3).

3.3. Distal posteromedial portal (DMP)

At the posterior border of adductor longus muscle portal was positioned 5 cm distal to inguinal crease posteromedial to the head and neck junction of femur, and the portal pierced

Table 1
Distances from portals to various anatomical structures.

Anatomical structures	Distance (mm) Mean ± SD (Range)								
	AMP			PMP			DMP		
	Right	Left	Total	Right	Left	Total	Right	Left	Total
Profunda femoris artery	25.36 ± 3.6 (18–33.5)	24.97 ± 5.20 (17–37.6)	25.16 ± 4.40 (17–37.6)	30.79 ± 4.28 (23–37.6)	30.67 ± 4.58 (24.7–40)	30.73 ± 4.36 (23–40)	31.24 ± 4.68 (24.3–38.4)	26.73 ± 4.39 (18.5–37)	28.99 ± 5.01 (18.5–38.4)
Obturator nerve	24.81 ± 4.75 (17.5–32.6)	23.92 ± 3.91 (17.4–31)	24.36 ± 4.30 (17.4–32.6)	27.55 ± 3.69 (19.8–34.4)	26.12 ± 3.85 (17.3–31.3)	26.83 ± 3.78 (17.3–34.4)	27.99 ± 3.88 (22.60–34.4)	27.27 ± 4.18 (21.60–36.30)	27.63 ± 3.98 (21.6–36.3)
Saphenous nerve	26.69 ± 5.2 (18.4–34)	26.23 ± 2.73 (21–31)	26.46 ± 4.09 (18.4–34)	30.47 ± 5.37 (22–40)	30.07 ± 4.4 (23–40)	30.27 ± 4.83 (22–40)	33.02 ± 4.8 (27–40)	26.81 ± 3.46 (22–32)	29.92 ± 5.21 (22–40)
Femoral bundle	26.07 ± 3.72 (21–35)	25.23 ± 3.75 (19–31)	25.65 ± 3.70 (19–35)	33.45 ± 4.18 (27.5–42.4)	30.93 ± 4.68 (24.8–38)	32.19 ± 4.54 (24.8–42.4)	30.89 ± 4.06 (24–37.6)	30.56 ± 3.81 (26.00–38.40)	30.73 ± 3.86 (24–38.4)

AMP, anteromedial portal; PMP, posteromedial portal; DMP, distal posteromedial portal; SD, standard deviation.

Table 2
Depth from portals to various anatomical structures.

Anatomical structures	Depth (mm) Mean ± SD (Range)								
	AMP			PMP			DMP		
	Right	Left	Total	Right	Left	Total	Right	Left	Total
Profunda femoris	14.44 ± 4.16 (6.9–17.2)	10.93 ± 3.2 (6.9–23)	12.68 ± 4 (7–23)	14.16 ± 3.68 (7–19.6)	14.59 ± 2.79 (11.5–19.6)	14.38 ± 3.22 (7–19.6)	14.19 ± 2.35 (10.80–19)	13.6 ± 3.76 (7.5–18.7)	13.89 ± 3.09 (7.5–19)
Obturator nerve	11.31 ± 2.91 (5.2–17.1)	11.93 ± 2.98 (5–17)	11.62 ± 2.91 (5–17.1)	12.66 ± 3.10 (5.9–17)	14.43 ± 3.15 (6–19)	13.55 ± 3.2 (5.9–19)	10.15 ± 2.8 (5–14)	14.07 ± 3.50 (9.60–19.50)	12.11 ± 3.7 (5–19.5)
Saphenous nerve	13.87 ± 3.55 (8.7–19.6)	13.03 ± 2.09 (11–18.1)	13.45 ± 2.89 (8.7–19.6)	14.87 ± 2.86 (10–18.6)	13.59 ± 2.36 (10–17)	14.23 ± 2.66 (10–18.6)	13.15 ± 2.23 (8.90–17.5)	13.02 ± 2.13 (8.90–17.0)	13.11 ± 2.14 (8.9–17.5)
Femoral bundle	13.82 ± 2.9 (9–18)	14.93 ± 3.26 (10.2–21)	14.37 ± 3.08 (9–21)	15.43 ± 3.86 (9.8–21.2)	16.31 ± 2.43 (12–19.7)	15.87 ± 3.20 (9.8–21.2)	13.40 ± 3.57 (8.10–20.00)	14.68 ± 2.10 (11.30–18.00)	14.04 ± 2.95 (8.1–20)

AMP, anteromedial portal; PMP, posteromedial portal; DMP, distal posteromedial portal; SD, standard deviation.

Table 3
Measurements of insertion angles for the portal.

Portals	Transverse angle (°) Mean ± SD (Range)			Sagittal angle (°) Mean ± SD (Range)		
	Right	Left	Total	Right	Left	Total
AMP	16.67 ± 3.24 (10–21)	16.80 ± 3.17 (12–23)	16.73 ± 3.15 (10–23)	14.80 ± 2.46 (11–20)	17.07 ± 3.28 (13–24)	15.93 ± 3.07 (11–24)
PMP	16.87 ± 4.61 (11–24)	17.6 ± 3.04 (12–22)	17.23 ± 3.86 (11–24)	17.20 ± 3.38 (13–24)	18.80 ± 13.26 (14–26)	18 ± 3.36 (13–26)
DMP	13.53 ± 2.47 (9–17)	15.33 ± 3.89 (10–21)	14.43 ± 3.33 (9–21)	15.87 ± 2.61 (10–19)	14.80 ± 2.27 (12–19)	15.33 ± 2.47 (10–19)

AMP, anteromedial portal; PMP, posteromedial portal; DMP, distal posteromedial portal; SD, standard deviation.

Table 4
Comparison of distance and depth between male and female.

Portal	Anatomic structure	Mean ± SD (range (mm))			*t* test for comparison
			Male	Female	
AMP	Profunda femoris	Depth	13.08 ± 4.04 (7–23)	12.24 ± 4.18 (6.9–19.6)	0.58
		Distance	23.38 ± 3.43 (17–23.6)	27.21 ± 4.6 (22–37.6)	0.02*
	Obturator nerve	Depth	11.08 ± 3.10 (5–17)	25.86 ± 4.5 (17.5–32.6)	0.28
		Distance	12.24 ± 2.65 (7.9–17.1)	22.66 ± 3.45 (17.4–29.8)	0.04*
	Saphenous nerve	Depth	13.71 ± 3.27 (9–19.1)	12.43 ± 33 (6.9–19.6)	0.29
		Distance	25.57 ± 3.45 (18.4–30.7	8.44 ± 5.23 (21–37.6)	0.10
	Femoral bundle	Depth	14.24 ± 3.07 (9–21)	14.52 ± 3.21 (10.2–20.7)	0.81
		Distance	26.38 ± 3.63 (22–35)	24.81 ± 3.72 (19–31)	0.25
PMP	Profunda femoris	Depth	13.95 ± 3.36 (7–19.6)	14.81 ± 3.04 (11.5–19.6)	0.47
		Distance	29.99 ± 4.22 (23–35)	32.29 ± 4.12 (24.9–40)	0.14
	Obturator nerve	Depth	13.69 ± 3.77 (5.9–19)	13.39 ± 2.54 (7.9–17)	0.80
		Distance	27.55 ± 2.19 (24–31.3)	25.71 ± 4.55 (17.3–31.4)	0.19
	Saphenous nerve	Depth	13.78 ± 2.71 (10–18.6)	14.77 ± 2.62 (10.5–18)	0.32
		Distance	28.71 ± 3.48 (23–34)	31.76 ± 5.93 (22–40)	0.11
	Femoral bundle	Depth	16.93 ± 3.07 (10.5–21.2)	14.66 ± 3.01 (9.8–19)	0.05
		Distance	31.79 ± 4.47 (24.8–42.4)	32.65 ± 4.74 (24.8–38.5)	0.62
DMP	Profunda femoris	Depth	13.75 ± 3.05 (7.5–18.7)	14.06 ± 3.25 (10–19)	0.79
		Distance	27.02 ± 4.26 (18.5–36.8)	31.24 ± 5.00 (24–38.4)	0.02*
	Obturator nerve	Depth	12.64 ± 4.49 (5–19.5)	11.51 ± 2.5 (7.8–16)	0.40
		Distance	27.59 ± 4 (22.6–36.3)	27.66 ± 4.10 (21.6–34.7)	0.96
	Saphenous nerve	Depth	12.71 ± 2.9 (8.9–17)	13.57 ± 1.96 (11.6–17.5)	0.28
		Distance	29.18 ± 4.92 (22–37.4)	30.76 ± 6.39 (21.2–40)	0.46
	Femoral bundle	Depth	14.33 ± 2.15 (9.8–17.2)	13.93 ± 3.77 (8.1–20)	0.73
		Distance	30.94 ± 4.01 (24–38.4)	30.96 ± 3.63 (24.9–37.6)	0.99

AMP, anteromedial portal; PMP, posteromedial portal; DMP, distal posteromedial portal; SD, standard deviation.
* Significant difference observed.

the medial posterior portion of adductor longus and then the joint capsule. The distances of profunda femoris artery, obturator nerve (Fig. 5), saphenofemoral junction and the femoral bundle were 28.99 ± 5.01 mm, 27.63 ± 3.98 mm, 29.92 ± 5.21 mm and 30.73 ± 3.86 mm, respectively (Table 1). On analysing the above mentioned distances between males and females, statistically significant difference was observed in profunda femoris artery to the portal entry point. Mean value of distance was seen more in females (31.24 ± 5 mm) as compared to males (14.06 ± 3.25 mm) as shown in Table 4.

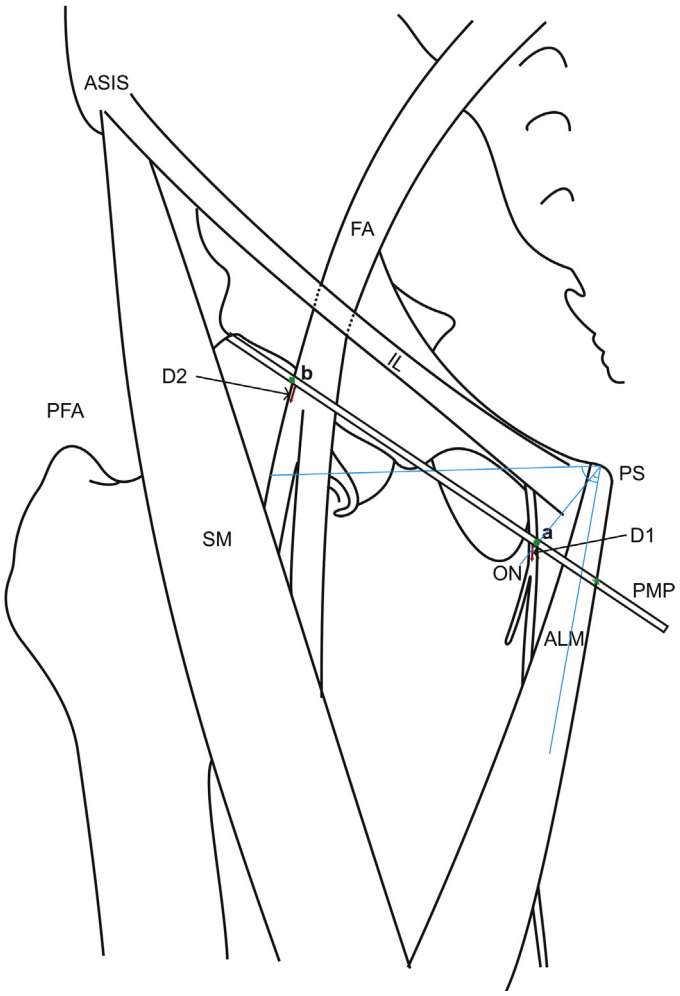

Fig. 4. Right hip showing measurement of distance of obturator nerve (ON) (a) and profunda femoris artery PFA (b) from the posteromedial portal (PMP).

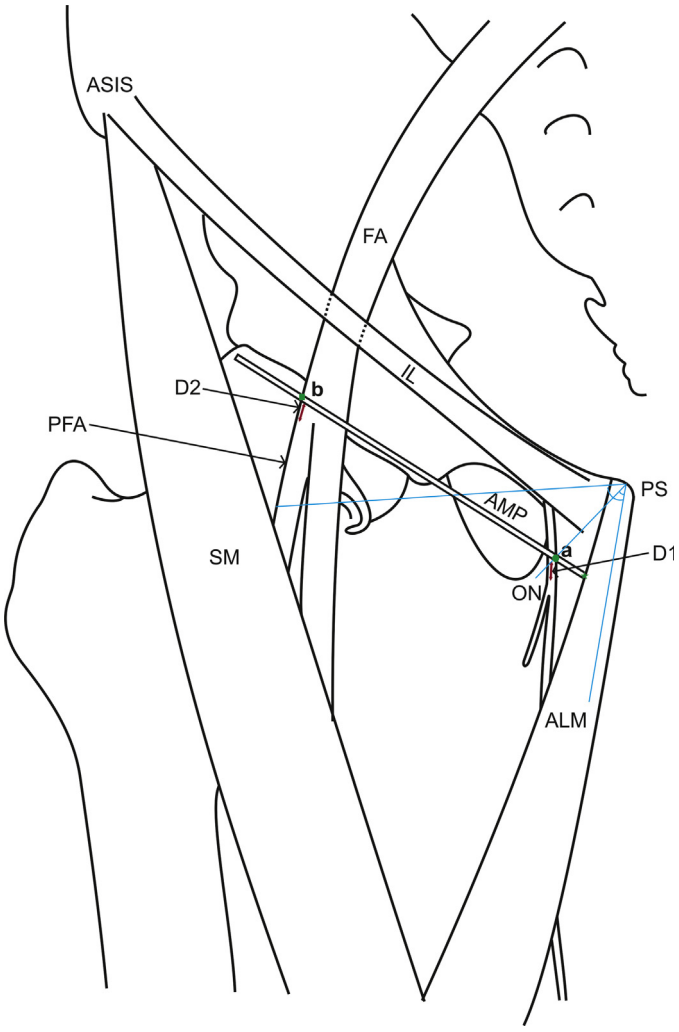

Fig. 5. Right hip showing measurement of distance of obturator nerve ON (a) and profunda femoris artery PFA (b) from the distal posteromedial portal (DMP).

The mean values for the depth of the profunda femoris artery, the obturator nerve, the saphenofemoral junction and the femoral bundle were 13.89 ± 3.09 mm, 12.11 ± 3.7 mm, 13.11 ± 2.14 mm and 14.04 ± 2.95 mm, respectively (Table 2). The mean sagittal angle between the skin surface and the entry of DMP portal was observed to be 15°, and the transverse angle between horizontal axis of limb and portal site entry was 14° (Table 3).

4. Discussion

The applicability of arthroscopic techniques was found in both large and small joints of the body. Both the access and instrumentation within the hip joint are limited because of the constrained ball and socket's bony architecture. Inspite of challenges, arthroscopic surgery of the hip has become an increasingly well-recognised clinical procedure.[1] Arthroscopy minimises soft tissue injury, minimises scar formation as well as reduces blood loss and post-operative pain. Hip arthroscopy is useful for the treatment of torn floating cartilage, torn surface cartilage, ligament reconstruction and trimming of damaged cartilage.[6–8] Many researchers have studied anatomical relationship of hip arthroscopy using cadaveric specimens, and moreover, they have targeted anterior, anterolateral and posterolateral portals.[2,12] The present work was restricted to medial portals, because of less available literature regarding these portals. Lesions in hip, which are situated anteroinferiorly and posteroinferiorly, are difficult to access, but medial lesions of hip are completely approached via medial portal.[9]

Medial hip approach is necessary in clinical conditions such as osteoid osteoma, bone cyst, Brodie's abscess, collagen vascular diseases, post traumatic hip injury and extraction of fire arm projectile.[11,12] Anteromedial approach was used for open reduction, as it was thought to reduce the incidence of avascular necrosis.[8] This approach is also important in the development hip dysplasia, as this approach gave direct access to structures and prevented stricture of caudal capsule and iliopsoas tendon.

One of the major operative difficulties encountered while portal positioning was variation in size of adductor longus muscle, which would lead to small changes in portal positioning.

There are certain possible complications while using medial hip portals like injury to profunda femoris artery, which may result in avascular necrosis, obturator nerve injury may lead to obturator neuropathy and cannulas with sharp edge could injure the neurovascular structures.[14,15] The complication rate from nerve or vessel injury after hip arthroscopy is reported to be 2.2%.[11]

Profunda femoris artery arises from posterolateral aspect of the femoral artery. In our study, anteromedial portal (AMP) and distal posteromedial portal (DMP) were in greater proximity to the profunda femoris artery; 2.5 cm and 2.8 cm distal to portal entry point respectively. Similarly, Polesello et al. reported profunda femoris artery to be closest neurovascular structure to AMP (1.4 cm).

The distance of profunda femoris artery was important, as it could be injured during portal insertion. The iatrogenic injury could be minimized by directing the portal towards femoral head and neck junction and flexing and abducting the hip as far as possible, so that the artery moved more distally minimizing the risk of injury.

The depth of profunda femoris artery in all the portals was maximum 2.3 cm and minimum 0.7 cm. But these are extreme values, which were found in one (2.3%) cadaver each. The depth at which profunda femoris was observed in majority of cases (82%, $n = 25$) was in the range of 1.1–1.8 cm. So, care should be taken while directing the portal towards the joint capsule, as profunda femoris artery was situated only 1–2 cm deep, hence liable to injury with wrong angle of insertion. Injury to profunda femoris artery would result in fistula formation, pseudoaneurysms, thrombosis, bleeding due to puncture and embolism.[15]

In posteromedial portal (PMP), the nearest structure was the obturator nerve at a distance of 2.6 cm. Hence the safety margin is 2.6 cm as after this distance the portal can cause injury leading to obturator neuropathy. Polesello et al. found obturator nerve to be closest structure, at 0.6 cm from the portal entry point. This variation in the distance between the two studies could be because of small sample size of their study. They stated that the portal should be placed at the posterior border of adductor longus to avoid the nerve damage.[11]

Depth wise the closest neurovascular structure in all the portals was obturator nerve (1.1–1.3 cm). Minimum depth of 0.5 cm was observed in two cadavers, rest were in the range of 1.1–1.3 cm. While insertion the portal should not be displaced deeper than 1.1–1.3 cm as the nerve can get injured, so expertise is required while inserting the portal.

In all the portals most safely placed structures were saphenofemoral junction and femoral bundle as they were farthest from portal in both distance and depth.

Statistically significant difference was observed in the distance of profunda femoris in AMP and DMP on comparison of male and female parameters. The distances of profunda femoris and obturator nerve were observed to be more in females 2.7 cm and 2.2 cm, respectively, as compared to males which was 2.3 cm and 1.2 cm, it may be either because of wider pelvis and more neck shaft angle in females or the variation in the origin of the profunda femoris from the femoral artery.

Angle of insertion of portal is important, as this decides the direction of the pin. The mean values of transverse angle for AMP, PMP and DMP were 17°, 18° and 15°, whereas the sagittal angle were 16°, 18° and 15°, respectively. To avoid inadvertent damage to nearby neurovascular structures the direction of pin becomes critical. Although in most of the centres portal insertion is done under fluoroscopic control. There are many peripheral centres without the facility for fluoroscopic guided surgery. Therefore knowledge of safe angle for insertion will be useful for the surgeon. Thus, the profunda femoris artery and obturator nerve were the two major structures, which are at risk of getting damaged on inserting the portal as these were present on an average at a distance of 1 in. from the portal entry point and depth wise these structures lie about 1 cm.

One of the major limitations observed in this study was rigidity and shrinkage in muscle fibres due to formalin fixation and this study can be performed in larger sample size.

5. Conclusion

The purpose of our study was to find out safer angles and distances to approach the hip joint, while inserting the portals medially. The data relating to the distance and depth of neurovascular structure at risk would be immensely helpful to orthopaedic surgeon in planning and execution of surgery.

Conflicts of interest

The authors have none to declare.

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