Is there a change in ischiofemoral space in lateral position in comparison to supine

H. Abdolmohammadpour Bonab[1], D. Treytak[1], C. Azzopardi[2], Karthikeyan. P. Iyengar[3], Rajesh Botchu[2]

[1] Aston Medical School, Aston, Birmingham, UK

[2] Department of Musculoskeletal Radiology, Royal Orthopedic Hospital, Birmingham, UK

[3] Department of Orthopedics, Southport and Ormskirk Hospital NHS Trust, Southport and Ormskirk Hospitals Mersey and West Lancashire Teaching NHS Trust , Southport, UK

SUMMARY

Ischiofemoral impingement (IFI) is caused due to impingement of soft tissues between the ischium and the lesser trochanter of the femur, resulting in pain and discomfort. IFI can be caused due to anatomical abnormality, previous trauma and surgery. The quadratus femoris muscle is usually affected in these cases, which can become oedematous and show fatty atrophy. Management of IFI include analgesics, physiotherapy, image-guided intervention and surgery. This study aims to provide an overview of IFI, evaluate the ischiofemoral space in a cohort of ten patients, and suggest the safest position for image-guided interventions in patients with IFI.

The ischiofemoral space and distance between the sciatic nerve and the medial part of the femoral neck were measured in supine and lateral positions on 10 consecutive patients by two fellowship-trained musculoskeletal radiologists on Computed Tomography (CT) axial sequence. There were 10 patients in the study (3 female and 7 males), with an average age of 29 years (11-70 years). A statistically significant increase in the ischiofemoral space and the distance between the sciatic nerve and the medial part of the femoral neck was found in the lateral position compared to the supine position. There was good intra- and inter-observer reliability, with a kappa value of 0.8. The increase in the ischiofemoral interval in the lateral position suggests that it is relatively safer to perform image-guided interventions and injections in the ischiofemoral interval in the lateral position with a potential reduction in the risk of incidental sciatic nerve injury.

Key words: Ischiofemoral impingement – Quadratus femoris – Ischiofemoral space – Ischiofemoral interval – Computed Tomography

INTRODUCTION

Ischiofemoral space is the area between the lateral cortex of ischial tuberosity and the medial cortex of the lesser trochanter. IFI is characterised by impingement of soft tissues between the ischium and the lesser trochanter of the femur, resulting in pain and discomfort (Johnson, 1977; Souto et al., 2009; Torriania et al., 2009; Taneja et al., 2013). IFI is an uncommon cause for hip and posterior thigh pain. This was first described by Johnson in 1977. IFI syndrome is associated with pre-existing trauma and hip surgery. IFI is caused by a narrowing of the space located between the

Corresponding author:
Dr Rajesh Botchu. Department of Musculoskeletal Radiology, The Royal Orthopedic Hospital, Bristol Road South, Northfield, Birmingham, UK. Phone: -00441216854000. E-mail: drbrajesh@yahoo.com

Submitted: April 14, 2023. **Accepted:** June 13, 2023

https://doi.org/10.52083/OAQD8529

lateral aspect of the os ischium and the lesser trochanter of the femur that entraps soft-tissue structures (Taneja et al., 2013). The quadratus femoris muscle is primarily affected, becoming irritated and manifesting with muscle-belly oedema or even fatty degeneration in chronic disease (Torriania et al., 2009) (Fig. 1).

A mechanical compression with, and oedema of, the soft tissues causes impingement of the surrounding tissues; the quadratus femoris muscle in particular is affected by this. This pathology is seen in symptomatic patients with IFI. The mean normal safe ischiofemoral distance (IFD) in a healthy female is approximately 18.6 +/- 68 mm, and 23 +/- 67 mm in a healthy male (Hujazi et al., 2016).

The presenting symptoms of IFI are posterior hip pain and may be misinterpreted with other deep gluteal and hamstring syndromes. It has been associated with different conditions such as congenital posteromedial femoral position, coxa valga, large lesser trochanter, osteochondromatosis of the hip and malunited extracapsular fractures of the proximal femur (Torriania et al., 2009; Hujazi et al., 2016).

IFI pain is usually localised to the posterior hip, but may radiate to the posterior thigh and knee due to irritation of the sciatic nerve (Gollwitzer et al., 2017). Clinically, pain can be elicited with passive hip extension, flexion, adduction, external and internal rotation.

The narrowing of the IFD, during repeated hip movements, may be the cause of the changes in the quadratus femoris muscle (Torriania et al., 2009). Concomitant pathologies such as post-surgical pathologies of gluteal tendons and hamstring, as well as coxa valga, are initially addressed when treating IFI. Management options of IFI includes rest, physiotherapy, anti-inflammatory medication, CT-guided injections with local anaesthetic, and steroid and rarely surgical intervention is necessary if conservative care is unsuccessful. Surgical management options for ischiofemoral impingement include lesser trochanteric osteotomy and release of the quadratus femoris tendon.

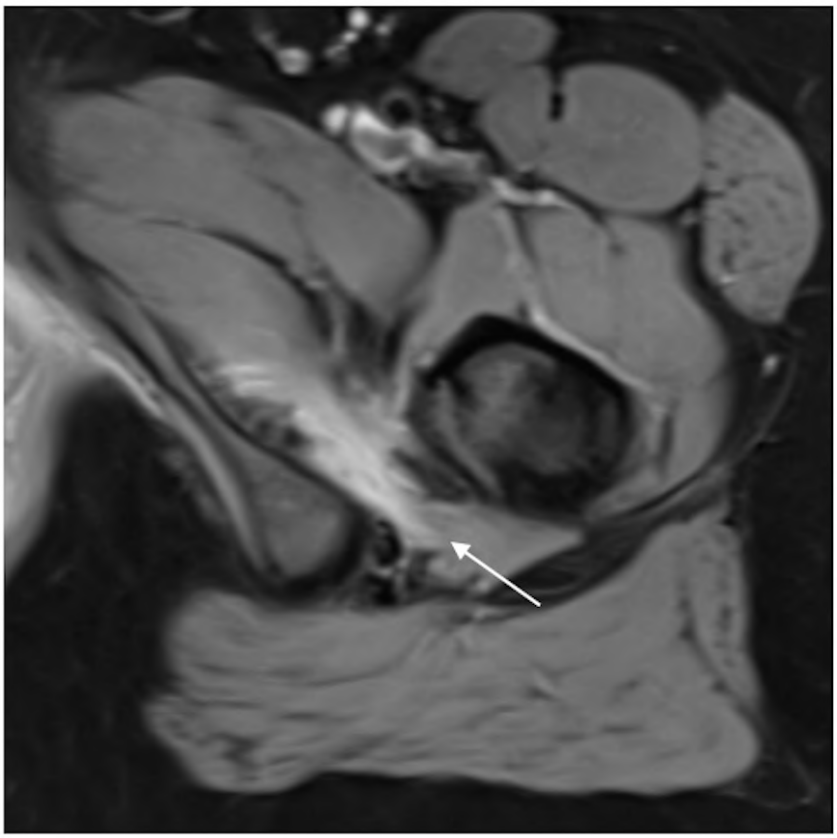

Fig. 1.- Axial PDFS (proton density fat suppressed) image of left hip showing moderate narrowing of ischiofemoral interval with marked oedema of quadratus femoris (arrow).

Image-guided interventions for IFI can be performed in prone or lateral position. We hypothesise that it is relatively safer to perform image-guided intervention in lateral position in comparison to prone position, and this pilot study explores the concept.

MATERIAL AND METHODS

Patients

A pilot study of 10 consecutive patients who had CT scans of the pelvis in supine and lateral position over a 2-year period were included in the study. Patients had imaging (supine and lateral) as part of the investigation for either hip pain or suspected malignancy at our centre. Supine imaging was performed for diagnostic purposes and CT in lateral was obtained as a part of planning for biopsy or CT-guided injection. All images were performed on Siemens Somatom AS (Erlangen, Germany).

Image analysis

The IFD (distance between the ischium and medial part of the femoral neck) and distance between the sciatic nerve and medial part of the femoral neck were measured in supine and lateral images (Figs. 2, 3). This was evaluated by a fellowship-trained musculoskeletal radiologist with over 10 years' experience and another fellowship-trained radiologist with over 5 years' experience. One reader repeated measurement after an interval of 4 weeks. The data that were collected included, age, sex, IFD and distance between the sciatic nerve and the medial part of the femoral neck.

Statistical analysis

Microsoft Excel data sheet was used for data collection. SPSS 24.0 software (SPSS Inc., Chicago, Illinois, USA) was used for statistical analysis. Descriptive statistics analysis was undertaken. Mean and standard deviation or median (range) were used to summarise the data for continuous variables and frequency/percentage for categorical variables. Comparison of frequencies of paired data was performed using the chi-square test, while means were compared using the Student's t-test. A p-value of <0.05 was considered significant. Kappa Test was used to evaluate for intra and inter observer reliability.

RESULTS

There were 10 patients in the study (3 female and 7 males) with an average age of 29 years (11-70 years). The average safe ischiofemoral distance (IFD) significantly increased in the lateral position compared to the supine position (3.8 cm vs 2.9 cm, *p-value* of 0.01). In addition, the distance between the sciatic nerve and femoral neck

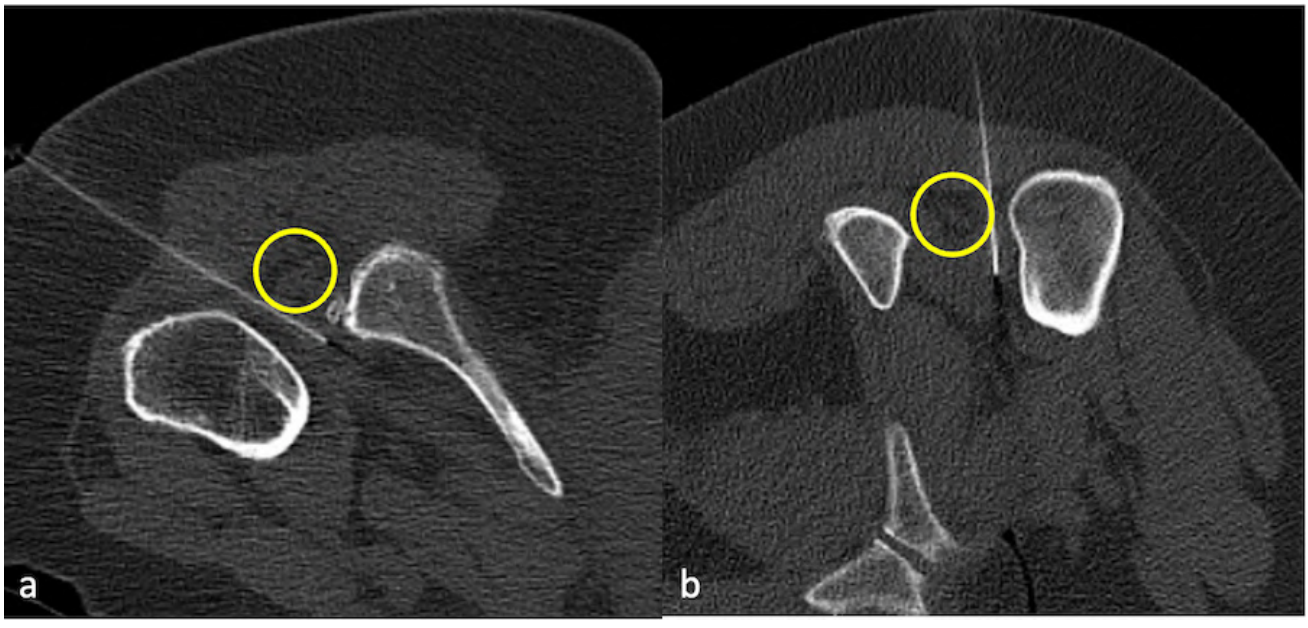

Fig. 2.- Axial CT showing needle in the ischiofemoral interval in prone (**a**) and lateral (**b**) position. Yellow circle shows the sciatic nerve.

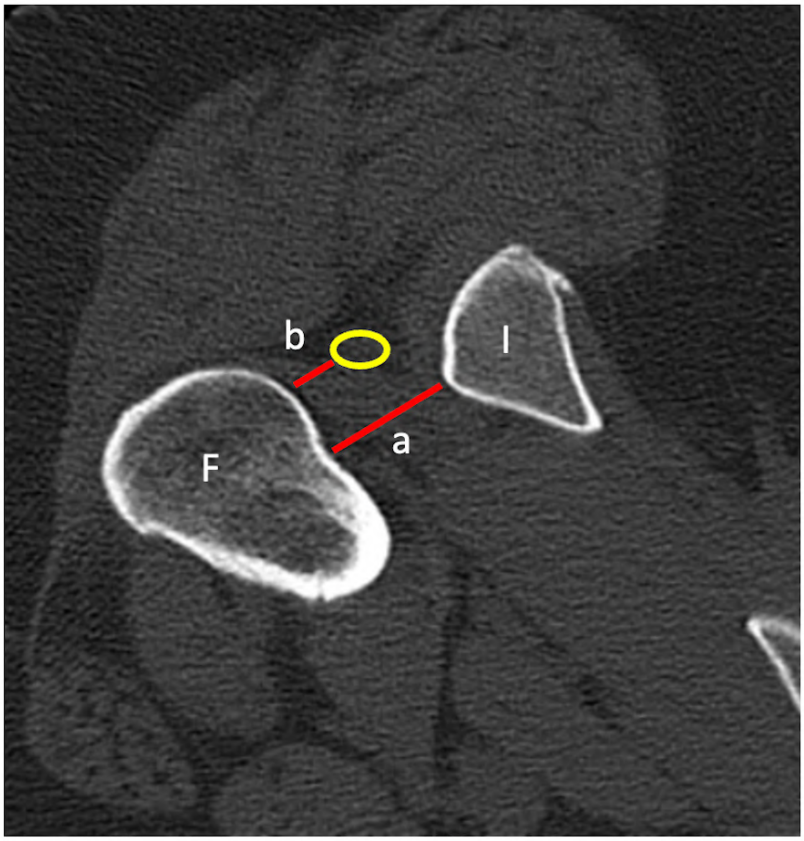

Fig. 3.- Axial CT showing ischiofemoral distance (a) between the medial part of the femoral neck (F) and ischium (I) and distance between the sciatic nerve (yellow ring) and medial part of the femoral neck (distance b).

increased in the lateral position (2.58 cm) compared to the supine position (1.96 cm, *p-value* of 0.03), indicating that it may be safer to perform an injection of the ischiofemoral interval in the lateral position, potentially reducing the incidence of sciatic nerve injury.

The study also revealed a 30-32% increase in the ischiofemoral interval in the lateral position. (Table 1: Summary of Results). A good intra and inter observer reliability was found with a kappa value of 0.8.

Table 1. IFD (ischiofemoral distance) and distance between the sciatic nerve and femoral neck in supine and lateral position. CI-confidence interval.

	IFD supine (cm)	IFD lateral (cm)	Sciatic nerve to femoral neck in supine (cm)	Sciatic nerve to femoral neck in lateral (cm)
Mean	2.920	3.8770	1.960	2.580
SD (Standard deviation)	0.888	0.6081	0.532	0.670
SEM (Standard error mean)	0.281	0.1923	0.168	0.212
90% CI	2.405 to 3.435	3.5245 to 4.2295	1.652 to 2.268	2.192 to 2.968
95% CI	2.285 to 3.555	3.4420 to 4.3120	1.580 to 2.340	2.101 to 3.059
99% CI	2.007 to 3.833	3.2521 to 4.5019	1.414 to 2.506	1.892 to 3.268
Minimum	0.9	3	0.8	1.3
Median	2.95	3.885	2	2.6
Maximum	4.2	4.7	2.9	3.3

DISCUSSION

Ischiofemoral impingement (IFI) is an increasingly recognised condition characterised by vague deep buttock pain with overlapping features of other common conditions in this region, such as hamstring pathologies, piriformis syndrome or spinal radiculopathy, and thus provide diagnostic challenges Jeyaraman et al., 2023).

CT-guided interventions such as steroid injections can be used to deliver medical therapy locally, and have been used to alleviate pain, discomfort and help with symptom management. CT-guided injections can be performed in prone or lateral position (Singer et al., 2015). The optimal position for administering these injections, however, has been a matter of debate. One of the risks of image-guided interventions is inadvertent nerve injury. The sciatic nerve is at particular risk in CT-guided interventions for IFI.

On a PubMed search there were no studies identified which compared the prone and lateral approaches. One study preferred prone position and had stated that going through hamstring tendons is easier and safer, since placing the needle in this direction reduces the risk of damage to the sciatic nerve, which is adjacent to quadratus femoris (Volokhina and Dand, 2013). A lateral approach has been suggested with the needle inserted lateral and deep to the sciatic nerve (Wilson and Keene, 2016). However, there were no studies conducted to compare both of the approaches and suggest the safest route.

Our results have demonstrated a significant increase in the safe ischiofemoral distance (IFD) and the distance between the sciatic nerve and the femoral neck when patients were in the lateral position as compared to the supine position. The increase in IFD in lateral position can be attributed to internal rotation of the femur. This subsequently increases the distance between the sciatic nerve and the medial part of the femoral neck. Planning the trajectory of the needle along the medial part of the femoral neck during imaging-guided injection ensures that the relative distance between the needle and the sciatic nerve is increased in lateral position. The clinical implication of this finding implies that the lateral position may be relatively safer for administering injections in the ischiofemoral space, thereby reducing the risk of sciatic nerve injury. Moreover, a good intra- and inter-observer reliability with a kappa of 0.8 supports the reproducibility of our measurements.

Limitations of the study

We acknowledge that our study has some limitations. First, the sample size is small, with only 10 patients included in this pilot study. This limits the generalizability of our findings and warrants further research with a larger sample size to confirm the results. However, with a good intra- and inter-observer reliability observed, it strengthens our proposition. Second, our study population included patients who had CT scans of the pelvis for various indications, such as hip pain or suspected malignancy, and hence may introduce potential confounding factors or selection bias. Furthermore, the study only compared supine and lateral positions, assuming that the supine position would be similar to the prone position. Further large prospective studies would help to confirm the results of our pilot study and a more accurate assessment of the safest position for image-guided injections.

CONCLUSION

Our pilot study suggests that the lateral position may be relatively safer than the prone position for administering image-guided injections in patients with ischiofemoral impingement, and provide a potential reduction in the risk of incidental sciatic nerve injury.

REFERENCES

GOLLWITZER H, BANKE IJ, SCHWAUWECKER J, GERDESMEYER L, SUREN C (2017) How to address ischiofemoral impingement? Treatment algorithm and review of the literature. *J Hip Preserv Surg*, 4(4): 289-298.

HUJAZI I, JONES T, JOHAL S, BEARCROFT P, MUNIZ-TERRA G, KHANDUJA V (2016) The normal ischiofemoral distance and its variations. *J Hip Preserv Surg,* 3(3): 197-202.

JEYARAMAN M, IYENGAR KP, BEALE D, BOTCHU R (2023) Ischiofemoral impingement caused by an intrapelvic lipoma of the sciatic nerve-A rare case presentation. *J Orthop Rep,* 2(3): 100165.

JOHNSON KA (1977) Impingement of the lesser trochanter on the ischial ramus after total hip arthroplasty. Report of three cases. *J Bone Joint Surg Am,* 59(2): 268-269.

SINGER AD, SUBHAWONG TK, JOSE J, TRESLEY J, CLIFFORD PD (2015) Ischiofemoral impingement syndrome: a meta-analysis. *Skeletal Radiol.* 44(6): 831-837.

SOUTO SC, THOMAS BJ, OUELLETTE H, BREDELLA MA (2009) Ischiofemoral impingement syndrome: an entity with hip pain and abnormalities of the quadratus femoris muscle. *Am J Roentgenol,* 193(1): 186-190.

TANEJA AK, BREDELLA MA, TORRIANI M (2013) Ischiofemoral impingement. *Magn Reson Imaging Clin N Am,* 21: 65-73.

TORRIANIA M, SOUTO SC, THOMAS BJ, OUELLETTE H, BREDELLA MA (2009) Ischiofemoral impingement syndrome: an entity with hip pain and abnormalities of the quadratus femoris muscle. *Am J Roentgenol,* 193(1):186-190.

VOLOKHINA Y, DAND D (2013) Using proximal hamstring tendons as a landmark for ultrasound- and CT-guided injections of ischiofemoral impingement. *Radiol Case Rep,* 8(1): 789.

WILSON MD, KEENE JS (2016) Treatment of ischiofemoral impingement: Results of diagnostic injections and arthroscopic resection of the lesser trochanter. *J Hip Preserv Surg*, 3(2): 146-153.

YANAGISHITA CM, FALOTICO GG, ROSARIOA DA, PUDINA GG, WEVER AA, TAKATA ET (2012) Ischiofemoral impingement – an etiology of hip pain: Case report. *Revista Brasil Ortopedia (English Edition*), 47(6): 780-783.