Int. J. Morphol.,
39(2):359-365, 2021.

Anatomic Landmarks for a Safe Arthroscopic Approach to the Deep Gluteal Space: A Cadaveric Study

Hitos Anatómicos para un Abordaje Artroscópico Seguro del Espacio Glúteo Profundo: Un Estudio Cadavérico

Bruno Capurro[1]; Marc Tey[1]; Joan Carles Monllau[1]; Ana Carrera[2]; Fernando Marques[1] & Francisco Reina[2]

CAPURRO, B.; TEY, M.; MONLLAU, J. C.; CARRERA, A.; MARQUES, F. & REINA, F. Anatomic landmarks for a safe arthroscopic approach to the deep gluteal space: A cadaveric study. *Int. J. Morphol., 39(2)*:359-365, 2021.

SUMMARY: To determine the morphometric landmarks and anatomical variants relevant to the arthroscopic approach to the deep gluteal space. Twenty deep gluteal spaces from cadaveric specimens were dissected. The anatomical variants of the sciatic nerve (SN) were determined according to the Beaton and Anson classification. A morphometric study of the distances in the subgluteal space was carried out to define the anatomical references to achieve a safe arthroscopic approach for piriformis syndrome [GT-SN=Distance from greater trochanter (GT) to SN emergence; GT-IT=Distance from GT to ischial tuberosity (IT); GT-IGA=distance from GT to inferior gluteal artery (IGA) emergence; IT-SN=distance from IT to SN emergence; IT-IGA=distance from IT to IGA]. The SN showed the most frequent anatomical pattern with an undivided nerve coming out of the pelvis below the piriformis muscle (Beaton type A) in 16 specimens (80 %). The common peroneal nerve emergence in the subgluteal space through the piriformis muscle (PM) with the tibial nerve being located at the lower margin of the piriformis muscle (Beaton type B) was observed in 4 specimens (20 %). The morphometric measurements of the surgical area of study were: GT-SN=7.23 cm (±8.3); GT-IT=8.56 cm (±0.1); GT-IGA=8.46 cm (±0.97); IT-SN=5.28 cm (±0.73), IT-IGA=5.47 cm (±0.74). When planning surgery for the deep gluteal syndrome in adult patients, the fact that the emergence of the SN in the subgluteal space is approximately 7 cm from the greater trochanter and 5 cm from the ischial tuberosity must be considered.

KEY WORDS: Surgical anatomy; Deep gluteal space; Sciatic nerve; Hip arthroscopy.

INTRODUCTION

The deep gluteal syndrome (DGS) describes the presence of pain and/or dysesthesias in the buttock area, hip or posterior thigh and/or radicular pain due a non-discogenic and extra pelvic entrapment of the sciatic nerve (SN) (Carro *et al*., 2016). It is a frequent cause of posterior hip pain and almost 6-8 % of sciatica cases (Martin *et al*., 2015; Martin & Gómez-Hoyos, 2019). It is also reported as retro-trochanteric pain (Meknas *et al*., 2009, 2011). Therefore, it has a significant impact on the quality of life of the patients. Its diagnosis and treatment are a challenge for both radiologists and orthopaedic surgeons (Meknas *et al*., 2009, 2011; Martin *et al*., 2014, 2015; Marin-Peña *et al*., 2017).

Decompression of the SN and piriformis muscle (PM) tenotomy have been proposed to treat DGS. They have shown good results at the 2-year follow-up in clinical series (Kay *et al*., 2017). Arthroscopic treatment of DGS has shown similar results to open surgery in clinical series. It also has a lower rate of complications (Hernando *et al*., 2015).

Anatomical variants of the SN are well described in the literature (Beaton & Anson, 1937; Smoll, 2010; Natsis *et al*., 2014). There are also studies that describe the morphometrics of the deep gluteal space (Haadaj *et al*., 2015). However, there are no morphometric studies with reliable reference points to guide arthroscopic surgeons seeking to plan safe surgeries around the SN and its division in the deep gluteal space. Since gluteal space arthroscopic surgery is performed under radioscopic control, morphometric references related to bone landmarks can be a guide in the arthroscopic approach.

[1] Department of Orthopaedic Surgery and Traumatology, Hospital del Mar, Universitat Autònoma de Barcelona, Barcelona, Spain.
[2] Medical Sciences Department, Clinical Anatomy, Embriology and Neuroscience Research Group (NEOMA), Faculty of Medicine, Universitat de Girona, Girona, Spain.

The purpose of the present study was to determine morphometric landmarks and anatomical variants relevant to the arthroscopic approach for DGS.

The hypothesis was that the greater trochanter (GT) as well as the ischial tuberosity (IT) are useful constant landmarks relative to the SN that make for a safer approach to the deep gluteal space.

MATERIAL AND METHOD

A descriptive study of surgical anatomy was performed. It included twenty cadaveric specimens. The specimens, which come from the voluntary body donation program of our institution, were consecutively admitted.The program complies with the legal and ethical framework governing body donation programs in our country. The study received the approval of the ethics committee of our institution (MED-UG 25/10/2016). Sixteen gluteal regions were from female cadavers and four were from male cadavers. Ten gluteal regions were dissected in 5 complete pelvises and 10 in isolated hemipelvis among which the contralateral hemipelvis had been rejected due to the exclusion criteria (previous surgery). Twelve specimens were preserved with an intra-arterial injection of 10 % formalin and the remaining eight were fresh-frozen specimens. All of them corresponded to elderly Caucasians ranging from 65 to 85 years old. The cadaveric specimens were evaluated by an orthopaedicsurgeon. If they had any previous surgery in the pelvis or hemipelvis, they were excluded.

The first part of this study consisted in the anatomical dissection of the deep gluteal space following the steps in the Natsis anatomical study (Natsis *et al*.). All dissections and measurements were performed by an orthopaedic surgeon with the assistance of a professor of anatomy. The dissections were performed in the prone position with neutral hip rotation and neutral adduction-abduction. After removal of the broad skin and soft tissue of the posterior aspect, the gluteus maximus and medius were dissected vertically and the muscular flaps were moved laterally. Blunt dissection was carried out to identify the PM and the SN. The anatomy of the SN in relationship to the PM and their emergence in the subgluteal space was determined and classified based on the Beaton and Anson classification (Beaton & Anson). They are type A, an undivided SN below the PM; type B, one division of the SN passing through and the other below the PM; type C, one division above and the other below the PM; type D, an undivided SN passing through the PM; type E, one division of the SN passing through and the other above the PM; type F, an undivided nerve above the PM (Fig. 1). Other possible anatomical variations at this level were also recorded and analyzed. They were then compared to the anatomical variations previously observed in the published literature.

During the second part of the study, measures were taken to localize the SN relative to the bone landmarks. The main references were the center of the SN at its emergence as it passes through the infrapiriformis foramen and the emergence of the inferior gluteal artery (IGA) in the major sciatic foramen. The following distances were measured:

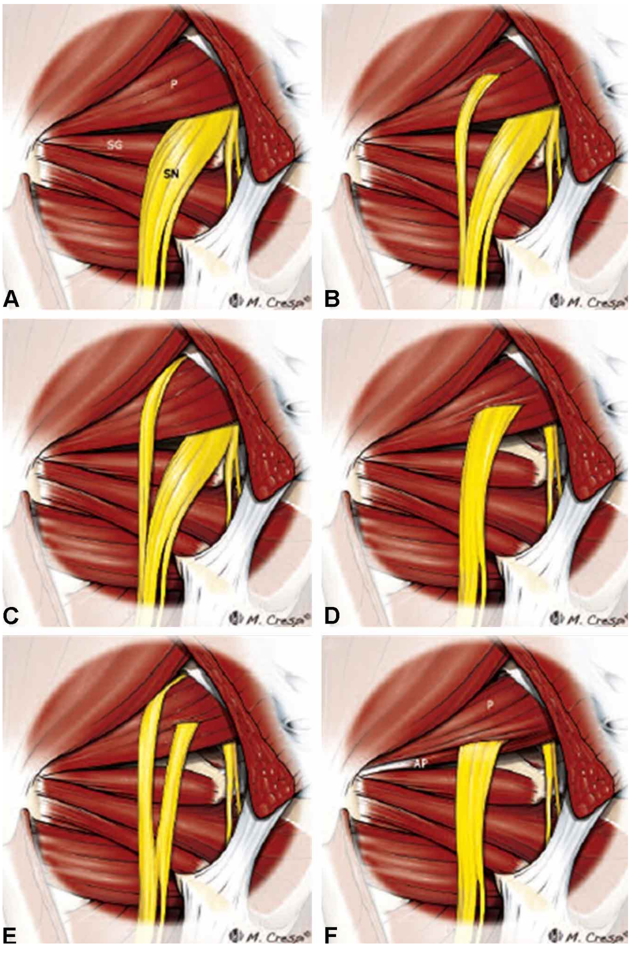

Fig. 1. Anatomic variations of the relationship between the piriformis muscle and sciatic nerve. Left posterior view of the DGS. Diagrams illustrate the six variants, originally described by Beaton and Anson in 1937. (a) An undivided nerve emerges below the piriformis muscle (normal course). (b) A divided sciatic nerve passing through and below the piriformis muscle. (c) A divided nerve passing above and below an undivided muscle. (d) An undivided sciatic nerve passing through the piriformis muscle. (e) A divided nerve passing through and above the muscle heads. (f) Diagram showing an additional unreported B-type variation consisting of a smaller accessory piriformis (AP) with its own separate tendon. SN sciatic nerve, P piriformis muscle, SG superior gemellus muscle (Reprint with permission of Carro *et al*.).

the distance from the tip of the GT, at the postero superior facet, to the SN emergence (GT-SN); the distance from the tip of GT to the centre of IT in the middle of common hamstring tendon origin (GT-IT); the distance from the tip of GT to the IGA (GT-IGA); the distance from the center of IT to the SN emergence (IT-SN); and the distance from the center of IT to the IGA (IT-IGA) (Fig. 2).

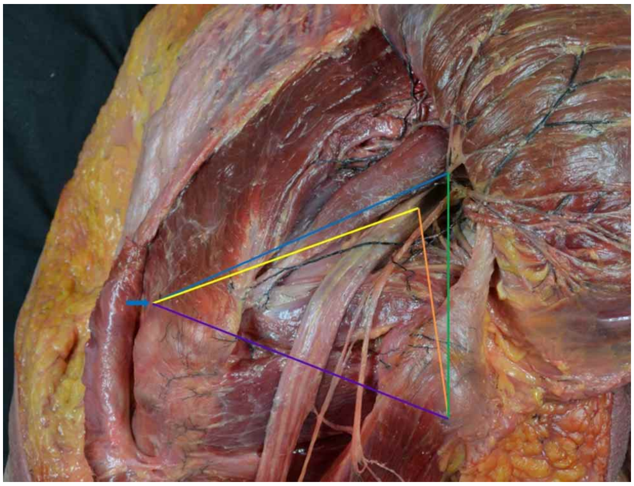

Fig. 2. Measures in type A variant (posterior view). Blue arrow, tip of the greater trochanter. Yellow line, GT-SN=Greater trochanter (GT) to sciatic nerve (SN) emergence; Purple line, GT-IT=GT to ischial tuberosity (IT); Blue line, GT-IGA=GT to inferior gluteal artery emergence (IGA); Orange line, IT-SN=IT to SN emergence; Green line, IT-IGA=IT to IGA.

Upon finding the nerve divided (types B, C and E), the following measurements were made: the distance from the GT to the tibial nerve (TN) emergence (GT-TN); the distance from the GT to the common peroneal nerve (CPN) emergence (GT-CPN); the distance from IT to the TN emergence (IT-TN); the distance from the IT to the CPN emergence (IT-CPN) (Fig. 3). The thickness of the SN was measured at the level of its exit from the infrapiriformis foramen. In the cases in which it was divided at that level, the thickness of the TN as well as that of the CPN was also measured.

Measurements were taken using a digital caliper (Digimatic Caliper, Mitutoyo, Japan) with an accuracy of 0.01 mm. All measurements were obtained by the same observer to avoid interobserver error. All measurements were taken twice to minimize intra observer error and then rounded to the nearest decimal.

Statistical analysis. The continuous variables measured were expressed as mean and standard deviations (SD) and had a 95 % confidence interval. When 2 related items of data were analysed, the Mann-Whitney test was used. In all cases, a p value of <0.05 was considered statistically significant. The statistical analyses were performed using the STATA 15.0 software package (Stata Corp, College Station, Texas, USA). As it was a descriptive study and the specimens were limited in number, no sample size analysis was done.

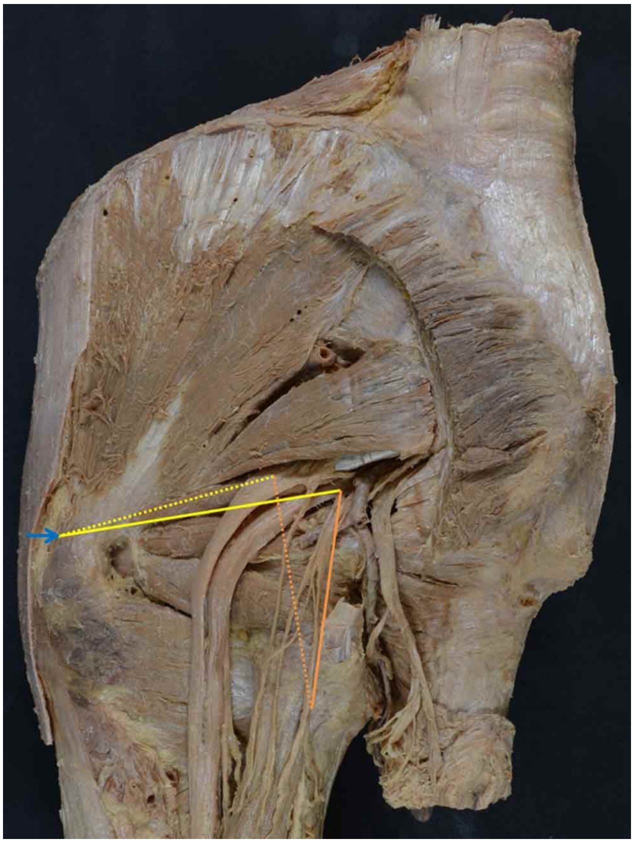

Fig. 3. Measures in type B, C and E variants (posterior view). Blue arrow, tip of the greater trochanter. Yellow line, GT-TN=from the greater trochanter (GT) to the tibial nerve (TN) emergence; Dotted yellow line, GT-CPN=distance from greater trochanter to common peroneal nerve (CPN) emergence; Orange line, IT-TN=distance from ischial tuberosity (IT) to the TN emergence; Dotted orange line, IT-CPN=distance from the ischial tuberosity to the CPN emergence.

RESULTS

The relationship of the SN and the PM in the deep gluteal region followed Beaton type A in 16 specimens (80 %) (Figs. 4.1 and 4.2). In 11 out of 16 specimens (68.75 %), the nerve emerged as a single unified trunk. In 5 out of 16 specimens (31.25 %), the TN and CPN were divided proximally before their exit from the deep gluteal space (Fig. 4.2). In 4 specimens (20 %), Beaton type B was observed. It is a pattern in which the CPN passes through the PM while the TN is located at the inferior edge of the PM (Fig. 5.1 and 5.2). Of the 5 bilateral cadavers studied, only one type B anatomical variant was found, and it was unilateral. No other type of anatomical variant was observed in this study.

The most relevant and consistent measurements of the morphometric study in the type A variants were GT-SN=7.22 cm (±0.83) and IT-SN=5.29 cm (±0.8) (Fig. 6). Other measurements are detailed in Table I. In Table II, measurements corresponding to Type B variants can be seen.

No differences were found in the morphometric study relative to sex (p=0.147), the side (p=1.00) or whether the cadaver was fresh frozen or fixed with formalin (p=0.648).

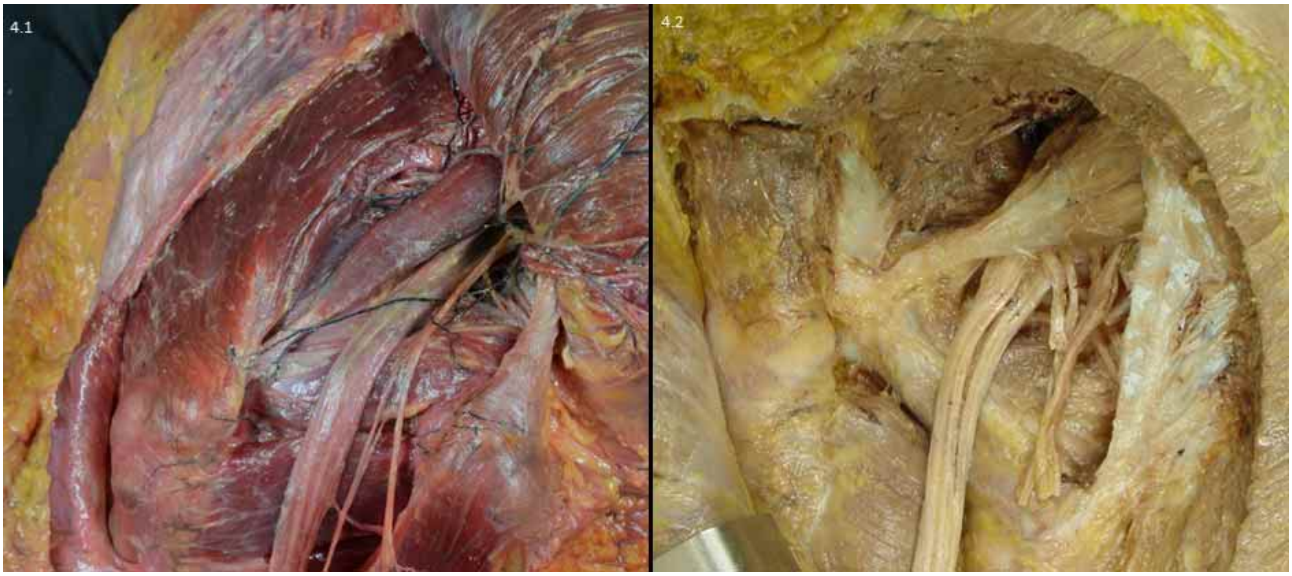

Fig. 4. Examples of Type A anatomical variants. 1. Left deep gluteal space, posterior view, type A variant in a fresh frozen cadaver. 2. Left deep gluteal space, posterior view, type A variant with the sciatic nerve divided into the Tibial Nerve and Common Peroneal Nerve in a cadaver fixed with formalin.

Fig. 5. Type B anatomical variants. 1. Left deep gluteal space, posterior view, type B variant in a cadaver fixed with formalin. 2. Right deep gluteal space, type B variant in a fresh frozen cadaver.

Table I. Morphometry of cases that corresponded to Beaton's type A.

Measurements	Mean (cm)	Standard Deviation	95 % Confidence Interval
GT-SN	7.22	0.83	6.77–7.68
GT-IT	8.49	1.21	7.85-9.13
GT-IGA	8.34	0.97	7.87-8.82
IT-SN	5.29	0.81	4.86-5.72
IT-IGA	5.38	0.78	4.97-5.80
SN thickness	1.54	0.22	1.43-1.66

GT-SN=distance from the greater trochanter to the sciatic nerve emergence; GT-IT=distance from the greater trochanter to the ischial tuberosity; GT-IGA=distance from the greater trochanter to the major sciatic foramen determined by the inferior gluteal artery; IT-SN=distance from the ischial tuberosity to the sciatic nerve emergence; IT-IGA=distance from the ischial tuberosity to the inferior gluteal artery. SN (sciatic nerve).

Table II. Morphometry of cases that corresponded to Beaton'stype B.

Measurements	Mean (cm)	Standard Deviation	95 % Confidence Interval
GT- TN	7.55	0.76	6.32-8.77
GT-CPN	6.82	0.52	5.99-7.65
IT- TN	5.27	0.38	4,67-5.88
IT- CPN	5.73	0.57	4.82-6.64
CPN thickness	0.83	0.31	0.39-1.31
TN thickness	1.37	0.66	0.32-2.23

GT-TN=distance between greater trochanter and the tibial nerve emergence; GT-CPN=distance from the greater trochanter to the common peroneal nerve emergence; IT-TN=distance from the ischial tuberosity to the tibial nerve emergence; IT-CPN=distance from the ischial tuberosity to the common peroneal nerve emergence. CPN (common peroneal nerve); TN (tibial nerve)

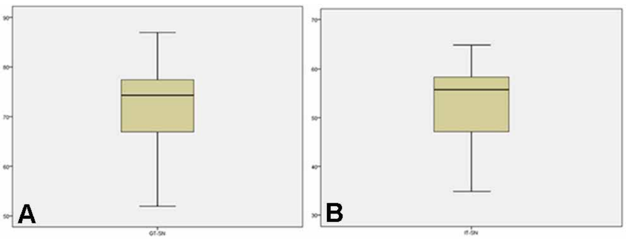

Fig. 6. a. Box plot of GT-SN distance from the greater trochanter to the sciatic nerve emergence (mm). b. Box plot of IT-SN. Distance from the ischial tuberosity to the sciatic nerve emergence (mm).

DISCUSSION

The most relevant finding of the present study is that constant morphometric landmarks have been described to minimize iatrogenic damage to the SN and IGA. A constant distance from the tip of the GT and the center of the IT was identified in the adult Caucasian population [GT-SN distance of 7.22 cm (±0.8). and IT-SN of 5.29 cm (±0.81), GT -IGA 8.34 cm (±0.97) and IT-IGA=5.38 cm (±0.78)].

The tip of the GT and the center of the IT have been taken as points of reference given that they are easily identifiable points during the intraoperative fluoroscopic control in the arthroscopic approach. Unlike the study by Haladaj *et al*., in which the lateral margin of the trochanter was taken as a reference, the tip of the trochanter was used as a reference in our study since this structure is easily located with fluoroscopy in the operating room. Therefore, the margin of error is less than that of the previous study in which it is difficult to interpret the correct site to measure from the lateral margin of the trochanter. In the present study, the IGA distance was considered important because it informs about the distance at which the artery can be found and thus avoid iatrogenic damage. It is also important to understand that the center of the SN was used as a reference point for the measurements in this study with the average thickness of the SN obtained being 1.52 cm (±0.22). This should be taken into consideration by the surgeon who is going to approach the nerve from lateral to medial.

Very few studies take the morphometry of the deep gluteal space into consideration. The first attempt at it was carried out by Güvençer *et al*. (2009). They described the SN in male limbs and the PM relative to selected bony landmarks. The first anthropometric study that came closest to studying the relationship between the SN and the PM was that of Haladaj *et al*. It included 30 specimens. It aimed to study morphometry in terms of sex and anatomical variants. The conclusion was that there is a statistical association between lower limb length and the distance from the SN to the GT in the male specimens. Moreover, a statistically significant correlation was observed between lower limb length and the distance from the SN to the IT in the female specimens.

By means of one hundred CT scans, Currin *et al*. (2015) took measurements of the deep gluteal space. The results obtained in that study were very much like those of the present work [the distance of the SN from the IT was a mean 5.86 cm (±0.8) and 6.26 cm (±1.0) from the GT].

In the present study, only the type B variant was found. It represents 20 % of the sample. The distances obtained in these variants [GT-TN=7.55 cm (±0.76); GT-CPN=6.82 cm (±0.52); IT-TN=5.27 cm (±0.38); IT-

CPN=5.73 cm (±0.57)] is within a range of dispersion similar to that of the normal variant, type A [GT-SN distance of 7.22 cm (±0.83) and IT-SN of 5.29 cm (±0.81)]. These results make it possible to propose the reference landmarks independently of the anatomical variations if we consider the standard deviation to simplify the result.

The hypothesis in which the GT and the IT serve as constant morphometric reference landmarks to perform a safe arthroscopic technique in the subgluteal space can be considered correct for the reasons previously stated. It allows for an estimation of the localization of SN and IGA based on the bony landmarks, which reduces the risk of damaging those structures. We should consider finding the SN at 7 cm ± 1 cm medial to GT and 5 cm (±1) from the IT. This can be very helpful in cases with big scars and fibrous flanges (Smoll; Marin & Gómez-Hoyos, 2019) in the subgluteal space were finding those structures can be very challenging and injury to those structures can lead to irreversible damage with very serious consequences.

There are some limitations to the present study. The first is that all the samples were from an adult Caucasian population and predominantly female (16 females vs. 4 males). This predominance is because the specimens were progressively included as they were donated and were not selected based on sex. However, no sex differences were found in our statistical analysis. The second limitation is that no arthrotomy or radiographs were performed to assess the presence of hip deformities. However, the macroscopic appearance did not show deformity in the studied hips. Another limitation is the fact that linear measurements (2 dimensions) were taken in the cadavers and the surface is curvilinear in vivo (3 dimensions). However, the fluoroscopy images used in the operating room to mark the references are in 2 dimensions and the surgeon uses the linear measurement.

Among the strengths of the study are that, it is a cadaveric anatomical study with 20 specimens oriented to the clinical treatment of pathologies of the deep gluteal space, mainly the DGS. Additionally, no significant differences were found between the measurements made in fresh cadavers and those prepared with formaldehyde. The percentage of anatomical variations of the SN in relation to the PM was observed in 20 % of the specimens studied, type B being the most frequent of Beaton's classification. It is like those described in the literature (Smoll). However, these anatomical variants also have the same relationship to the described landmarks by including the standard deviations in the analysis. This affirms that the distance of these structures is constant with respect to the landmarks used in the adult Caucasian population regardless of the anatomical variant found.

Clinical Application. Identifying the SN at its point of emergence in the infrapiriform space represents a challenge for the surgeon. Taking 7 cm from the GT and 5 cm from the IT as anatomical references is valuable information that aids in locating the SN and preventing iatrogenic injury to the IGA. However, arthroscopic surgery in the deep gluteal space should only be performed by very experienced arthroscopic surgeons. Otherwise open surgery is preferred. Additionally, it is important to emphasize that 1in 5 to 6 patients can present an anatomical variant, type B being the most frequent.

CONCLUSION

When planning arthroscopic surgery of the deep gluteal space in adult patients, localization of the SN and IGA relative to the bone landmarks (GT and IT) must be considered to prevent iatrogenic damage, highlighting that the emergence of the SN in the deep gluteal space is approximately 7 cm from the GT and 5 cm from the IT.

ACKNOWLEDGMENTS

The authors sincerely thank those who donated their bodies to science so that clinical anatomical research could be performed. Results from such research can potentially increase our overall knowledge to improve patient care.
To Dr. Luis P. Carro for his advice and authorization to use his explanatory image (Fig. 1).

CAPURRO, B.; TEY, M.; MONLLAU, J. C.; CARRERA, A.; MARQUES, F. & REINA, F. Hitos anatómicos para un abordaje artroscópico seguro del espacio glúteo profundo: Un estudio cadavérico. *Int. J.Morphol., 39(2)*:359-365, 2021.

RESUMEN: El objetivo del estudio fue determinar referentes morfométricos y variantes anatómicas relevantes en el abordaje artroscópico del espació subglúteo. Se disecaron veinte regiones glúteas procedentes de cadáver. Las variaciones anatómicas del nervio ciático (SN) se determinaron de acuerdo con la clasificación de Beaton y Anson. Se llevó a cabo un estudio morfométrico de distancias en el espacio subglúteo, con objeto de determinar referencias que permitan un abordaje artroscópico seguro del sindrome piriforme [GT-SN= distancia trocánter mayor (GT) a la emergencia del nervio ciático (SN); GT-IT= distancia GT a la tuberosidad isquiática (IT); GT-IGA= distancia GT a la emergencia de la arteria glútea inferior (IGA); IT-SN= distancia IT a la emergencia del SN; IT-IGA= distancia IT a la IGA]. El patrón más frecuente del SN fue su emergencia no dividida por el margen inferior del músculo piriforme (tipo A Beaton) en 16 especímenes (80 %). La salida del nervio fibular común a través del músculo piriforme (PM) con el nervio tibial localizado en el margen inferior del PM (tipo B Beaton) se observó en 4 especímenes (20 %). Las medidas en el área quirúrgica de estudio fueron: GT-SN= 7,23 cm ± 8,3; GT-IT= 8,56 cm ± 0,1; GT-IGA= 8,46 cm ± 0,97; IT-SN= 5,28 cm ± 0,73 IT–IGA= 5,47 cm ± 0,74. En la cirugía del síndrome glúteo profundo en adultos, debe considerarse que la salida del SN hacia el espacio subglúteo tiene lugar aproximadamente a 7 cm del GT y a 5 cm de la IT.

PALABRAS CLAVE: Anatomía quirúrgica; Espacio glúteo profundo; Nervio ciático; Artroscopia de cadera; Nivel de evidencia: IV (estudio descriptivo anatómico)

REFERENCES

Beaton, L. E. & Anson, B. J. The relation of the sciatic nerve and of its subdivisions to the piriformis muscle. *Anat. Rec., 70(1)*:1-5, 1937.

Carro, L. P.; Hernando, M. F.; Cerezal, L.; Navarro, I. S.; Fernandez, A. A. & Castillo, A. O. Deep gluteal space problems: piriformis syndrome, ischiofemoral impingement and sciatic nerve release. *Muscles Ligaments Tendons J., 6(3)*:384-96, 2016.

Currin, S. S.; Mirjalili, S. A.; Meikle, G. & Stringer, M. D. Revisiting the surface anatomy of the sciatic nerve in the gluteal region. *Clin. Anat., 28(1)*:144-9, 2015.

Güvençer, M.; Iyem, C.; Akyer, P.; Tetik, S. & Naderi, S. Variations in the high division of the sciatic nerve and relationship between the sciatic nerve and the piriformis. *Turk. Neurosurg., 19(2)*:139-44, 2009.

Ha?adaj, R.; Pingot, M.; Polguj, M.; Wysiadecki, G. & Topol, M. Anthropometric study of the piriformis muscle and sciatic nerve: a morphological analysis in a Polish population. *Med. Sci. Monit., 21*:3760-8, 2015.

Hernando, M. F.; Cerezal, L.; Pérez-Carro, L.; Abascal, F. & Canga, A. Deep gluteal syndrome: anatomy, imaging, and management of sciatic nerve entrapments in the subgluteal space. *Skeletal Radiol., 44(7)*:919-34, 2015.

Kay, J.; de Sa, D.; Morrison, L.; Fejtek, E.; Simunovic, N.; Martin, H. D. & Ayeni, O. R. Surgical management of deep gluteal syndrome causing sciatic nerve entrapment: a systematic review. *Arthroscopy, 33(12)*:2263-78.e1, 2017.

Marin-Peña, O.; Tey-Pons, M.; Perez-Carro, L.; Said, H. G.; Sierra, P.; Dantas, P. & Villar, R. N. The current situation in hip arthroscopy. *EFORT Open Rev., 2(3)*:58-65, 2017.

Martin, H. D. & Gómez-Hoyos, J. *Posterior Hip Disorders*. Dallas, Springer, 2019.

Martin, H. D.; Kivlan, B. R.; Palmer, I. J. & Martin, R. R. L. Diagnostic accuracy of clinical tests for sciatic nerve entrapment in the gluteal region. *Knee Surg Sports Traumatol. Arthrosc., 22(4)*:882-8, 2014.

Martin, H. D.; Reddy, M. & Gómez-Hoyos, J. Deep gluteal syndrome. *J. Hip Preserv. Surg., 2(2)*:99-107, 2015.

Meknas, K.; Johansen, O. & Kartus, J. Retro-trochanteric sciatica-like pain: current concept. *Knee Surg. Sports Traumatol. Arthrosc., 19(11)*:1971-85, 2011.

Meknas, K.; Kartus, J.; Letto, J. I.; Flaten, M. & Johansen, O. A 5-year prospective study of non-surgical treatment of retro-trochanteric pain. *Knee Surg. Sports Traumatol. Arthrosc., 17(8)*:996-1002, 2009.

Natsis, K.; Totlis, T.; Konstantinidis, G. A.; Paraskevas, G.; Piagkou, M. & Koebke, J. Anatomical variations between the sciatic nerve and the piriformis muscle: a contribution to surgical anatomy in piriformis syndrome. *Surg. Radiol. Anat., 36(3)*:273-80, 2014.

Smoll, N. R. Variations of the piriformis and sciatic nerve with clinical consequence: a review. *Clin. Anat., 23(1)*:8-17, 2010.

Corresponding author:
Dr. Francisco Reina
77 Emili Grahit St
Medical Sciences Department
Faculty of Medicine
University of Girona
17003 Girona
SPAIN

Email: francisco.reina@udg.edu

ORCID ID: 0000-0002-2664-2277

Received: 19-10-2020
Accepted: 01-12-2020