



The Dual Innervation of the Gluteus Maximus Associated with Other Anatomical Variations of the Gluteal Region

Gluteal Bölgenin Diğer Anatomik Varyasyonları ile İlişkili Gluteus Maksimumun İkili İnnervasyonu

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ABSTRACT

The gluteus maximus (GM) is a big quadrilateral musculature that lines the rear portion of the pelvis. It is innervated by the inferior gluteal nerve. The sciatic nerve, inferior gluteal nerve, and posterior cutaneous nerve of the thigh are branches of the sacral plexus. The superior and inferior gluteal arteries are the chief arterial supply to the gluteal region. In the present case, there was a dual innervation of the GM. The superior gluteal artery and the superior gluteal nerve was piercing the piriformis and the inferior gluteal artery was running between the posterior cutaneous nerve of the thigh and the inferior gluteal nerve. According to our literature review, anatomical studies in which this cadaveric procedure has been performed have not been previously reported. The anatomical variations of the gluteal region are important to surgeons, physicians, anatomists, and nurses.

Keywords: Gluteus maximus, sciatic nerve, cadaver, dual innervation, piriformis

ÖZ

Gluteus maksimum (GM) pelvisin arka kısmını kaplayan büyük dörtgen kas sistemidir. İnnervasyonu inferior gluteal sinir tarafından yapılır. Siyatik sinir, inferior gluteal sinir ve uyluğun posterior kutanöz siniri sakral pleksusun dallarıdır. Süperior ve inferior gluteal arterler gluteal bölgenin başlıca arteriyel beslenmesidir. Mevcut olguda, GM ve superior gluteal arterin ikili bir innervasyonu vardı. Superior gluteal sinir piriformisi delmekte ve inferior gluteal arter uyluğun posterior kutanöz siniri ile inferior gluteal sinir arasında seyretmekteydi. Literatür taramamıza göre, bu kadavra prosedürünün uygulandığı anatomik çalışmalar daha önce bildirilmemiştir. Gluteal bölgenin anatomik varyasyonları cerrahlar, hekimler, anatomistler ve hemşireler için önemlidir.

Anahtar kelimeler: Gluteus maksimum, siyatik sinir, kadavra, çift innervasyon, piriformis

INTRODUCTION

The gluteus maximus (GM) is a big quadrilateral musculature that lines the rear portion of the pelvis. It originates from the iliac crest, posterior part of the gluteal surface of the ilium, dorsal part of the sacrum, side of the coccyx, and sacrotuberous ligament. Three-quarters of it is placed into the iliotibial tract, while the other quarter is introduced into the gluteal tuberosity. It is supplied by the inferior gluteal nerve (IGN). GM is a chief extensor of the hip joint and acts as an anti-gravity muscle¹.

The sacral plexus (SP) branch known as the IGN has root values of L5, S1, and S2. The sciatic nerve (SN) is the thickest in the body and is a branch of the SP with

root values L4-S3. Another branch of SP with root values of S1-S3 is the posterior cutaneous nerve of the thigh (PCNT). The inferior gluteal artery (IGA) supplies blood to the GM after entering the gluteal region through the greater sciatic foramen. It is a branch from the internal iliac artery's anterior segment. The superior gluteal artery (SGA) is a branch of the posterior segment of the internal iliac artery that reaches the gluteal region via the greater sciatic foramen and passes above the piriformis, accompanied by the superior gluteal nerve¹.

In this case report, we present a unique rare case of dual innervation of the GM and IGA compression. SGA and SGN were piercing the piriformis. Variations in the innervation of GM are exceedingly rare. According to

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Received: 09 January 2024

Accepted: 28 April 2024

Online First: 29 May 2024

Cite as: Raviteja P, Chandrupatla M, Bhingardeo AV, Susai S. The Dual Innervation of the Gluteus Maximus Associated with Other Anatomical Variations of the Gluteal Region. Medeni Med J 2024;39:136-139



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our literature review, anatomical studies in which this cadaveric procedure has been performed have not been previously reported.

CASE REPORT

During the usual dissection of a 61-year-old female corpse, which had been embalmed in formalin during hands-on training for undergraduate and postgraduate medical students at the department of anatomy, a discrepancy was observed in regular cadaveric dissection; therefore, it was exempted from review by the ethics board. As it was a cadaver, the body would come under a body donation program, the consent was given by the next kin of the deceased.

We dissected the GM into two halves and reflected it as superomedial and inferolateral. We found an incidental finding in the right gluteal region; the GM was innervated by the two nerves. The superomedial half of the GM was innervated by the branch of the SN that gave twigs. The inferolateral half of GM was supplied by IGN. The PCNT received an extra branch from the IGN. The IGA ran between the PCNT and the IGN, which led to the compression of the artery, as shown in Figures 1 and 2. SGA and SGN were piercing the piriformis, as shown in Figure 3. The left gluteal region was normal.

DISCUSSION

Quiñones-Rodríguez et al.² reported bilateral dual innervation of GM by the SN and IGN branches. Those with an aberrant branch from the SN to the GM may be more vulnerable to iatrogenic nerve injury because of intramuscular gluteal injection or surgical procedures².

Lesser et al.³ described a case in which the components of the SN distal to the piriformis formed a nerve loop. From the nerve loop, some branches innervated the GM, and one branch communicated with the PCNT. These variations increase iatrogenic nerve injuries.

Inflammation of the piriformis muscle is known as piriformis syndrome. Due to inflammation, the SN is compressed, resulting in pain in the inferomedial portion of the gluteal region, sciatica, and dyspareunia in females⁴. Because of the presence of SN innervation to the GM, the pain may radiate to the entire gluteal region in piriformis syndrome cases. In addition, inflammation of the GM strains the aberrant branch of the SN.

Sumalatha et al.⁵ reported a higher division of the SN into the common peroneal and tibial nerves. The common peroneal nerve enters the gluteal region as two trunks, medial and lateral. GM is innervated by the medial

trunk of the common peroneal nerve⁵. Paval and Nayak⁶ noticed that IGN is derived from the two roots. One root pierces the piriformis, and the other root emerges from the lower edge of the piriformis⁶.

Golmohammadi and Delbari⁷ found a higher division of the SN into the tibial and common peroneal nerves. The IGN originated from the common peroneal nerve⁷.

The piriformis receives innervation from the anterior rami of S1 and S2. According to Iwanaga et al.⁸, the innervation of the piriformis was primarily the superior gluteal nerve. In this case, the superior gluteal nerve and SGA were piercing the piriformis.

The PCNT received an extra branch from the IGN. If there is any injury to the IGN, the pain may radiate to the area where the PCNT innervates the region. The most common site for gluteal intramuscular injection was the upper outer quadrant of the GM. In this case, there was dual innervation of the GM by the SN and IGN. The gluteal

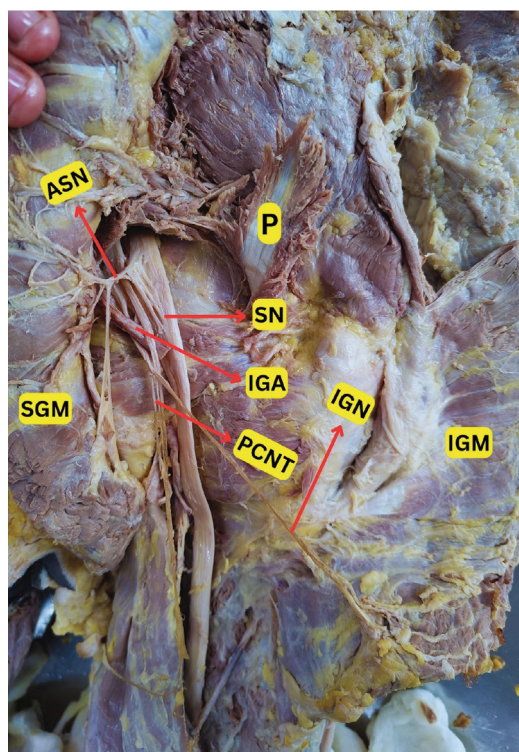


Figure 1. Shows the dual innervation of the gluteus maximus (GM) and the inferior gluteal artery passing between two nerves.

IGM: Inferolateral part of the gluteus maximus, SGM: Superomedial part of the gluteus maximus, IGN: Inferior gluteal nerve, ASN: Abnormal branch of the sciatic nerve, SN: Sciatic nerve, PCNT: The posterior cutaneous nerve of the thigh, IGA: Inferior gluteal artery, P: Piriformis

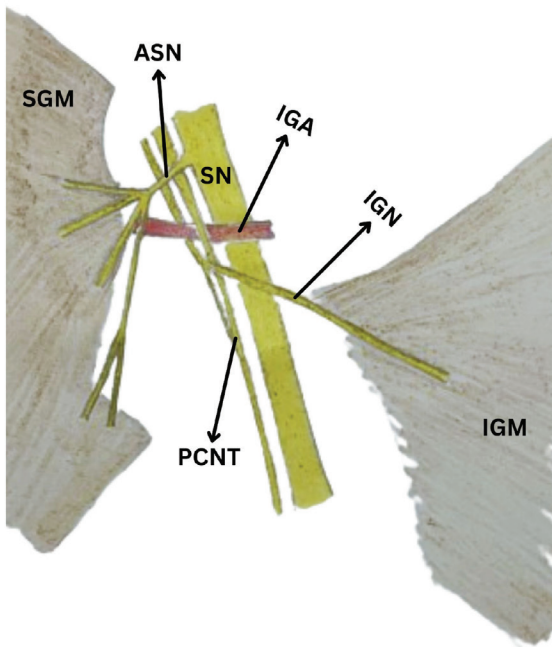


Figure 2. Shows the schematic diagram of the dual innervation of the gluteus maximus (GM).

IGM: Inferolateral part of the gluteus maximus, SGM: Superomedial part of the gluteus maximus, IGN: Inferior gluteal nerve, ASN: Abnormal branch of the sciatic nerve, SN: Sciatic nerve, PCNT: The posterior cutaneous nerve of the thigh, IGA: Inferior gluteal artery

injections may lead to injury of the SN, and the pain may radiate to the area where it innervates the region.

Tillmann and Verlaufsvarianten des⁹ explained how the IGN departs the pelvis by piercing the piriformis. Normally, it exits the pelvis distal to the piriformis.

During in utero development, GM originates as two separate parts, the pars-sacroiliaca and pars-coccygea. These two muscle belly fuse in the tenth week of intrauterine life. Usually, these muscles are innervated by one nerve. If the two muscles are innervated by two different nerves, this leads to dual innervation of the GM¹⁰.

According to our literature review, anatomical studies in which this cadaveric procedure has been performed have not been previously reported. The most common site for intramuscular injection is the upper outer region of the gluteal region. These variations increase the risk of iatrogenic nerve injuries. Surgeons, physicians, anatomists, and nurses need to understand the distinctions in the gluteal territory.

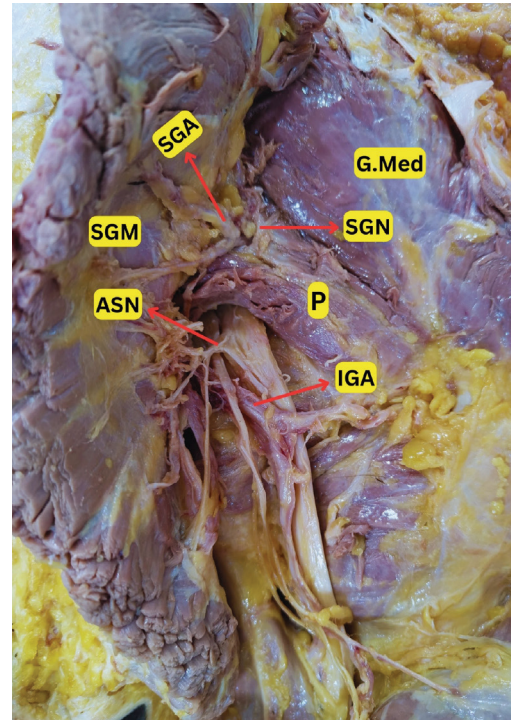


Figure 3. Shows the superior gluteal artery (SGA) and the superior gluteal nerve (SGN) piercing the piriformis.

P: Piriformis, SGM: Superomedial part of the gluteus maximus, G.Med: Gluteus medius, SGA: Superior gluteal artery, SGN: Superior gluteal nerve, IGA: Inferior gluteal artery, ASN: Abnormal branch of the sciatic nerve

Acknowledgments: We would like to thank the cadaver's relatives for giving their relative's corpse for teaching and research. We would also like to recognize the efforts of anatomy laboratory attendees in maintaining the cadavers and the laboratory regularly.

Ethics

Informed Consent: As it was a cadaver, the body would come under a body donation program, the consent was given by the next kin of the deceased.

Author Contributions

Surgical and Medical Practices: P.R., M.C., A.V.B., S.S., Concept: P.R., M.C., A.V.B., S.S., Design: P.R., M.C., A.V.B., S.S., Data Collection and/or Processing: P.R., M.C., A.V.B., S.S., Analysis and/or Interpretation: P.R., M.C., A.V.B., S.S., Literature Search: P.R., M.C., A.V.B., S.S., Writing: P.R., M.C., A.V.B., S.S.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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