

Duplicated gluteus maximus muscle: rare variant anatomy: a case report - a case report

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ABSTRACT

The gluteal region is an important anatomical and clinical area that contains muscles and vital neurovascular bundles. The gluteus maximus is the largest and most powerful muscle in the human body. While there can be some anatomical variations in the gluteus maximus, they are generally minor and do not significantly affect its function; however, its proximity to the sciatic nerve necessitates attention. Hence, a thorough understanding of the gluteal region's anatomy is crucial.

In the gluteal region of an adult male cadaver dissection for the postgraduate surgical trainees' regular cadaver dissection course, we discovered a variation of the gluteus maximus muscle that was duplicated with a superficial big portion and a deep small muscle component. The little portion was attached to the hip bone by two tendinous slips connected by a tendinous arch under which the sciatic nerve runs. With this type of anatomical disposition, the sciatic nerve may become entrapped if a small portion of the gluteus muscle hypertrophies, resulting in sciatica.

Since the gluteus maximus can entrap the sciatic nerve, understanding the anatomy of the gluteal region is crucial for both anatomical and clinical reasons. Clinicians should be aware of this anatomy for successful surgeries of the gluteal region, intramuscular injections, and dealing with complaints of sciatica. Additional investigation and dissections of the gluteal region are urged for a better comprehension of human anatomy and its variability.

Keywords: Duplicated Gluteus Maximus, Sciatic Nerve, Anatomical Variation, Clinical Implications, Sciatic Nerve Entrapment

INTRODUCTION

The gluteal region is an important anatomical and clinical area that contains muscles and vital neurovascular bundles. It is a common injection site because the muscles are thick and large, providing a substantial volume for absorption of injected substances by intramuscular veins. The

gluteus maximus is the largest and most superficial muscle of the buttocks [1]. It is a thick and powerful muscle with a triangular shape, a broad origin at the back of the pelvis, and a tapering insertion on the femur. It is composed of several muscle fibers that merge into a thick tendon as they approach the femur. Its size and location make it an essential muscle for activities such as walking, running,

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climbing, and maintaining an upright posture [2].

The gluteus maximus arises from the posterior gluteal line of the ileum, the aponeurosis of the erector spinae, the dorsal surface of the lower part of the sacrum, the side of the coccyx, the sacrotuberous ligament, and from the gluteal aponeurosis [3]. The fibers of the superior and larger part of the gluteus maximus and superficial fibers of its inferior part insert into the iliotibial tract and indirectly, via the lateral intermuscular septum, into the linea aspera of the femur. Some deep fibers of the inferior part of the muscle attach to the gluteal tuberosity of the femur, known also as the third trochanter. In the superior part of its course, the sciatic nerve passes deep to the gluteus maximus. The main actions of the gluteus maximus are extension and abduction of the hip. It also contributes to maintaining stability in the pelvis during weight-bearing activities. The sciatic nerve is the largest in the body and is the continuation of the main part of the sacral plexus. The sciatic nerve does not supply structures in the gluteal region. It supplies the posterior thigh muscles, all leg and foot muscles, and the skin of most of the leg and foot [2]. Anatomic variations of the gluteus maximus muscle are not frequently mentioned in anatomy textbooks. However, these variations may be of clinical importance when surgery in this region is considered [4]. The sciatic nerve runs inferolateral under cover of the gluteus maximus, midway between the greater trochanter and ischial tuberosity. Neuropathies of the lower extremities frequently accompany trauma or surgical interventions to the abdomen, pelvis, and lower limbs [5]. The incidence of sciatic neuropathy ranges from 0.05% to 1.9%. The sciatic nerve can be injured proximally in the pelvis or gluteal region or, less commonly, distally in the thigh. Trauma is the most common cause of proximal injuries, often accompanying fractures of the hip joint. A thorough understanding of the anatomy of the nerves of the lower extremity, their points of vulnerability, and their functional role are valuable in identifying injury [5].

CASE PRESENTATION

On July 11, 2023, we encountered the duplicated left gluteus maximus muscle during the regularly scheduled postgraduate cadaveric dissection session.

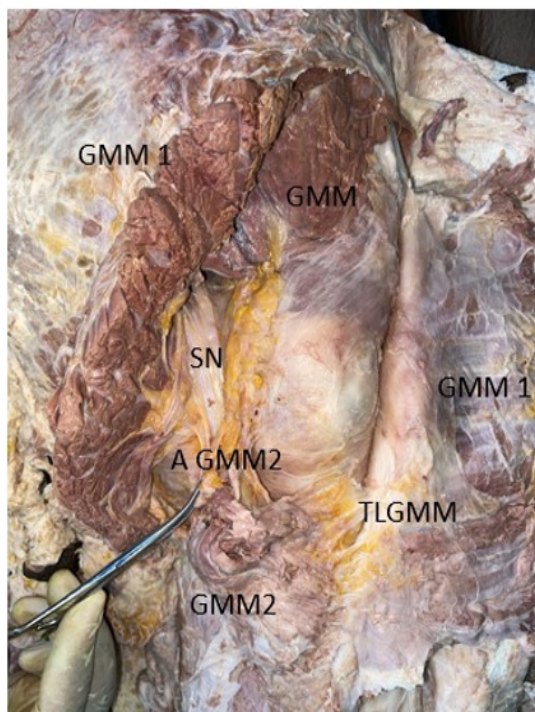


Figure 1: GMM1: Gluteus Maximus Muscle (Sacroileal part), GMM2: Gluteus Maximus muscle (Sacrococcygeal part), GMM: Gluteus Medius Muscle, TLG: Tendinous lamina of the Gluteus Maximus Muscle, SN: Sciatic nerve

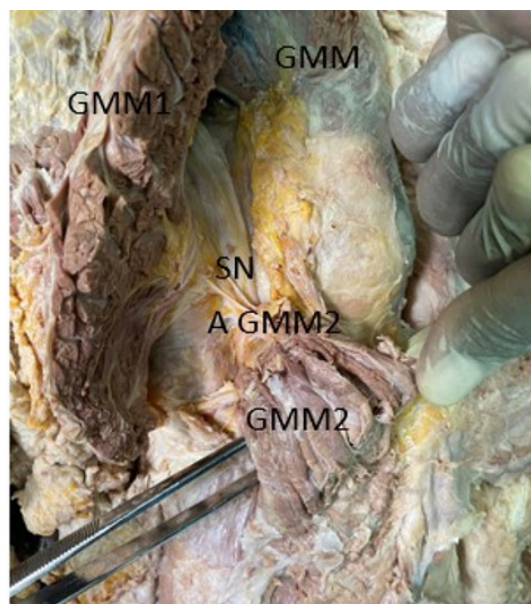


Figure 2: AGMM2: the tendinous arc of the GMM2, GMM1: Gluteus Maximus Muscle (Cut and reflected), GMM2: Gluteus Maximus muscle (Small portion of gluteus maximus muscle), GMM: Gluteus Medius Muscle, SN: Sciatic nerve.

The small portion of the gluteus maximus muscle is attached to the hip bone by two tendinous slips that are linked by a tendinous arc. The sciatic nerve travels beneath that tendinous arch of the small portion of the gluteus maximus muscle. Due to the possibility that the sciatic nerve may become entrapped there when the gluteus muscle is hypertrophied, this particular arching of the muscle has significant clinical significance. The figures below detail our variant gluteus maximus muscle.

DISCUSSION

The human gluteus maximus muscle develops by the fusion of two fetal muscles. The part of the gluteus maximus muscle originating from the coccyx corresponds to a separate fetal muscle that is regularly found in human embryos and fetuses and which has been termed, by its course, the coccygeo-femoralis muscle proper. During the prenatal period, this muscle progressively fuses with the fetal gluteus maximus, which is the proper muscle. Postnatally, the junction of the two fused muscles is masked by the coarse pattern of muscle bundles characteristic of the gluteus maximus muscle [1].

The developmental model outlined for the gluteus maximus shows that adult muscles can be produced by the fusion of numerous fetal muscles and that this union, when incomplete, generates variants in the form of a duplicated divided or bipinnate appearance [4]. Similar to our case, the classic development model would be lacking and would support the existence of gluteus maximus muscle duplication. Seeing the alignment and the size of the gluteus maximus portions in our case would also be explained by the histological concept of the gluteus maximus muscle by Shiraishi et al., where they state that the gluteus maximus develops from two masses, one large and one smaller, both of which are implanted at the gluteal tuberosity of the femur [6].

In embryos and fetuses of up to 40 mm in crown-rump length, the coccygeofemoralis muscle is separated by loose connective tissue from neighboring fetal muscles. Later on, close contact between the coccygeofemoralis and the distal margin of the fetal gluteus maximus muscle develops, and during the prenatal period, both fetal muscles gradually fuse. Postnatally,

the coccygeofemoralis muscle is incorporated into the gluteus maximus muscle, of which the pars sacroiliaca corresponds to the fetal gluteus maximus itself, and the pars coccygeal represents the fetal coccygeofemoralis muscle. Concerning the general process of muscle morphogenesis, the developmental pattern described for the gluteus maximus muscle demonstrates that adult muscles may be formed by a fusion of several fetal muscles [7].

The present case report is of the utmost importance since clinicians should be aware that this muscle is overlying the sciatic nerve and, therefore, could be a potential site of sciatic nerve compression. Surgeons performing procedures in these regions should be aware of this as well for patients' safety, as during the procedures, one could confuse it with normal hip short rotator muscles, hence injuring the sciatic nerve [1]. The sciatic nerve, as a nerve with a long course, is susceptible to compression at various levels. This nerve may be compressed in the gluteal area with a fibrous band, piriformis muscle, gluteal muscles, tumors, and vascular abnormalities [8]. The previous study clearly shows that any increase in pressure in this compartment may result in sciatic nerve compression. Hence, a duplicated gluteus maximus could be among the causes of deep gluteal syndrome. The deep gluteal syndrome is the gluteal area pain due to extra pelvic sciatic nerve compression.

CONCLUSION

Given the anatomical architecture and surgical implications of the gluteal region, understanding its anatomy is essential. Since it can result in sciatic nerve entrapment, surgeons and health professionals should be aware of the possibility of this gluteal variant anatomy while performing different procedures in that region. Knowledge of this gluteus maximus variant anatomy may be important in this situation. More studies and dissections are encouraged to better understand the gluteal region and gluteus maximus muscle in particular and its different variant anatomy for safe procedures.

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