

# Bilateral Absence of Gemelli Muscles. Case Report

Ausencia bilateral de los músculos gemelos. Reporte de caso

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**SUMMARY:** The gemelli are deep muscles, which act together with the obturator internus muscle, stabilizing dynamically the hip joint. In the present article, a case of bilateral absence of both gemelli muscles in the pelvis of a female cadaver is described. A possible embryological explanation of this condition is discussed, besides its clinical and surgical importance.

**KEY WORDS:** Superior gemellus muscle; inferior gemellus muscle; anatomical variations.

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## INTRODUCTION

The gemelli muscles, together with piriformis, obturator internus, obturator externus and quadratus femoris, are deep muscles of the hip joint. These muscles are considered short lateral rotators (Stähelin *et al.*, 2002; Yoo *et al.*, 2015) and together are called "rotator cuff of the hip", they act as dynamic stabilizers (Pine *et al.*, 2011) by the positioning of the femoral head in the acetabulum (Moore *et al.*, 2010).

For Moore *et al.*, gemelli and obturator internus muscles form a triceps muscle, the *triceps coxae*, which occupies the space between the piriformis and quadratus femoris muscles. The names "superior gemellus" and "inferior gemellus" are precisely from its relations with the obturator internus muscle (Llusá *et al.*, 2004). The superior gemellus muscle originates in the external face and in the inferior margin of the ischial spine, while the inferior gemellus muscle originates from the ischial tuberosity (Testut & Latarjet, 1975). Both muscles are inserted next to obturator internus muscle tendon on the medial face of the greater trochanter of the femur (Ito *et al.*, 2012).

The function of these muscles is also common with the obturator internus. They act as lateral hip rotators when the knee is in extension and as hip abductors when knee is in flexion (Moore *et al.*). According to Terry (1942), the combined function of the obturator internus muscle and both gemelli muscles, work as a powerful hip lateral rotator.

There are reports in the literature describing bilateral absence of superior gemellus muscle (Terry; Bajka *et al.*,

2004; Fernandes *et al.*, 2013). According to Bergman *et al.* (1988), in very rare cases, both gemelli muscles may be absent.

A case of bilateral absence of both gemelli muscles in a female pelvis that belongs to morphology laboratory of the Universidad de Talca is presented in this article. The purpose of this report was to describe the possible embryological explanation of this condition and its clinical and surgical importance.

## CASE REPORT

During a dissection routine in the pelvis of a female cadaver belonging to the morphology laboratory of the Universidad de Talca, a bilateral anatomical variation in the deep muscular plane of the gluteal region was observed. On both sides, the superior and inferior gemelli muscles were absent. The tendon of internal obturator muscle joins the tendon of piriformis muscle and together inserts into the greater trochanter of the femur.

## DISCUSSION

Gemelli muscles variations are rare anomalies (Arifoglu *et al.*, 1997). Wood (1867) reported bilateral absence of the superior gemellus muscle in 4.28 % of samples

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(3 of 102 corpses). Only 1 of the 34 female cadavers of this study presented this condition (2.9 %). In this corpse, bilateral absence of superior gemellus muscle coexisted with unilateral absence of inferior gemellus muscle. Terry said in his study that the superior gemellus muscle was absent bilaterally in 6.3 % of the samples (16 of 254 corpses), and its incidence on women was of 3.9 % (3 of 76 women).

Bardeen (1906) proposed that the obturator internus and gemelli muscles derive from a common outline, and then the obturator internus muscle moves toward the intrapelvic space to cover the obturator foramen. Aung *et al.* (2001) indicated that during migration, the muscle bundles that extend medially to the ischiopubic ramus form the obturator internus muscle, and those which remain lateral to the ramus, form the gemelli muscles.

According to Naito *et al.* (2015), the development of the gemelli muscles is parallel to the maturing of obturator internus muscle tendon. In their study on human embryos, they noted that at tenth week of development, the obturator internus muscle tendon was attached to the gemelli muscles, arranged between them. Windisch *et al.* (2007) mentioned that the superior gemellus muscle can merge with the piriformis muscle or gluteus minimus muscle, and the inferior gemellus muscle can fuse with the quadratus femoris muscle. This was confirmed by Naito *et al.*, who noted that at 15 weeks of development, the superior gemellus muscle binds both to piriformis muscle tendon and the belly of the

obturator internus muscle, while the inferior gemellus joins the quadratus femoris muscle. This could explain the absence of both gemelli muscles in this case, assuming that the superior gemellus muscle remained attached to piriformis muscle, and the inferior gemellus muscle to quadratus femoris. If so, the piriformis and quadratus femoris muscles should present a larger size compared to the normal side, which it was not possible to determine due to bilateral absence of both gemelli muscles.

Rouvière & Delmas (2005) indicated that the gemelli muscles are obturator internus muscle extrapelvic fascicles, since both converge in the tendon and share a common insertion. According to Pine *et al.* obturator internus muscle tendon almost immediately forms after leaving the pelvis, joining the superior and inferior gemellus muscles. These three muscles form a joint tendon that is inserted into the medial face of the greater trochanter of femur (Ito *et al.*; Tamaki *et al.*, 2014).

When two or more muscles share the same insertion, could be argued about whether each one is an independent muscle or are heads of the same muscle, considering factors such as the innervation, positional and functional independence, even the historical nomenclature (Shinohara, 1995).

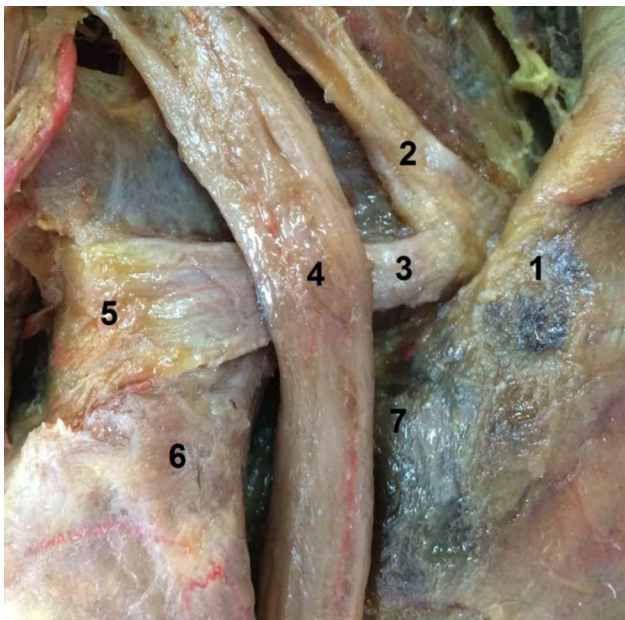


Fig. 1. Posterior view of deep muscles of the right hip joint. 1= greater trochanter; 2= tendon of piriformis muscle; 3= tendon of obturator internus muscle; 4= ischiatic nerve; 5= obturator internus muscle; 6= ischial tuberosity; 7= quadratus femoris muscle.

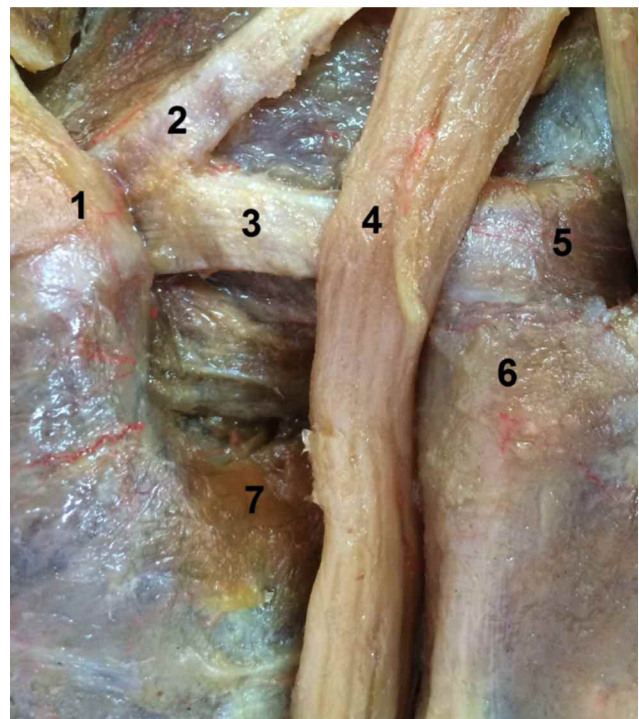


Fig. 2. Posterior view of deep muscles of the left hip joint. 1= greater trochanter; 2= tendon of piriformis muscle; 3= tendon of obturator internus muscle; 4= ischiatic nerve; 5= obturator internus muscle; 6= ischial tuberosity; 7= quadratus femoris muscle.

Muscles classifying depends largely on their innervation. In the study of Shinohara, in most cases, the superior gemellus muscle received a double innervation from quadratus femoris muscle nerve and obturator internus muscle nerve (12 of 14 corpses). Aung *et al.* demonstrated dual innervation from nerves mentioned above, in 60.4 % of the samples for the superior gemellus muscle and 2 % for the inferior gemellus muscle. Moore *et al.*, indicated that despite the inferior gemellus muscle receives separate innervation from the quadratus femoris nerve, is more realistic to consider these three muscles as a single unit, as they are incapable of independent action. The truth is that most current anatomy texts describe these muscles separately (Rouvière & Delmas; Drake, 2005; Schünke *et al.*, 2010; Pró, 2014).

Terry, related the absence of the superior gemellus muscle with a decrease in the size of the ischial spine, which is not possible to verify in this case because the muscle was absent on both sides.

Naito *et al.* speculated that the gemelli muscles could play a role in the orientation of obturator internus muscle tendon through its long downward trajectory. According to these authors, the gemelli muscles appear to provide a tensile

force to the tendon of obturator internus muscle along the longitudinal axis. In this report the tendon of internal obturator muscle joins the tendon of piriformis muscle and together inserts into the greater trochanter of the femur.

To improve clinical and surgical results of interventions that are performed at the level hip joint level, it is necessary to know the detail of the muscles that are around. The posterior approach in total hip arthroplasty is particularly relevant for short lateral rotators of the hip (Yoo *et al.*). Such surgery requires accurate identification, repair and management of short lateral rotators, which ensures the stability of the hip joint after surgery (Pine *et al.*; Tamaki *et al.*).

The bilateral absence of both gemelli muscles could decrease the probability of success in total hip arthroplasty surgery, as there would be fewer muscles involved in maintaining the stability of the joint. Greater understanding of the hip joint short lateral rotators arrangement and its anatomic variations could ensure optimal results when the posterior approach is used during such surgery. The use of a bilateral echography in the area could anticipate the absence of these muscles, which would facilitate taking additional measures pre and post surgery.

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**RESUMEN:** Los gemelos son músculos profundos, que actúan junto al obturador interno estabilizando dinámicamente la articulación de cadera. En el presente artículo se describe un caso de ausencia bilateral de ambos músculos gemelos en la pelvis de un cadáver femenino. Se discute la posible explicación embriológica de esta condición y su importancia clínica y quirúrgica.

**PALABRAS CLAVE:** Músculo gemelo superior; Músculo gemelo inferior; Variaciones anatómicas.

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