ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 10 | October - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ISOLATED RIGHT PSOAS MINOR MUSCLE: A CASE STUDY AND LITERATURE REVIEW.

Anatomy

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ABSTRACT

This case report describes a unilateral right psoas minor muscle found during dissection. The muscle was absent on the left side. This finding adds to our understanding of the psoas minor's variable presence. The psoas minor is a vestigial muscle with potential clinical significance. Its anatomical variations can be misinterpreted as pathology and may be relevant during surgery in the retroperitoneal space. The function of the psoas minor is unclear, but it may assist the psoas major in flexion, stability, and tensioning fascia. The presence of a unilateral psoas minor raises questions about its functional significance. This report and literature review highlights the importance of understanding psoas minor variations.

KEYWORDS

Psoas Major, Psoas Minor, Anatomic Variation, Skeletal Muscle.

INTRODUCTION:

The psoas minor muscle, a relatively rare anatomical variant, has gained attention in the medical literature due to its distinctive characteristics and occasional clinical significance. Anatomically, the psoas minor muscle is described as a small muscle located in the lumbar region, originating from the sides of the bodies of the last thoracic and first lumbar vertebrae and the intervening intervertebral disc between them [1]. Although not universally present, studies have reported its occurrence in a minority of individuals, with variations in attachment sites and morphology [2].

Records indicate that the psoas minor muscle is typically lacking in trisomy 18 patients since these individuals typically exhibit delayed muscle development during embryogenesis. [3]. It is located anteromedial to the main psoas. It can be bilateral or unilateral. This type of muscle agenesis is extremely common. [4]. Plantaris, Psoas minor, Pyramidalis, Peroneus tertius, and Palmaris longus are the five muscles that most frequently experience agenesis. The best illustration of a vestigial muscle is the psoas minor. [5]. According to reports, the psoas minor has the highest chance of being congenitally absent (56%) [6].

Clinical cases involving the psoas minor muscle, including instances of unilateral absence or presence, have been documented. Pathological conditions involving the psoas minor muscle, such as metastasis in renal cell carcinoma [7] and involvement in recurrent lymphoma [8], have also been reported. Additionally, the muscle has been implicated in cases of abscess formation due to the spread of infection [9].

This variant muscle has potential as a prognostic biomarker in conditions such as myosteatosis [10]. Furthermore, investigations into muscle fibre type distribution in related muscles have provided insights into functional roles and variations in different populations [11].

Given the extensive research on the psoas minor muscle, this study aimed to present a case report of an isolated right psoas minor muscle, contributing to the literature on this anatomical variant. By reviewing the relevant literature and clinical cases, this report sought to enhance our understanding of the anatomical variations, clinical implications, and functional significance of the psoas minor muscle.

CASE REPORT:

During a practical session for undergraduate medical students at AIIMS, Bibinagar, India, a unilateral right-sided psoas minor muscle was observed on the posterior abdominal wall of a donated elderly female cadaver. The psoas minor was absent on the left side.

The right-sided psoas minor was located superficially and laterally to the major psoas muscle. Following the removal of all abdominal organs, a detailed dissection of the posterior abdominal wall muscles was performed. This revealed the presence of a psoas minor tendon onto the anterior surface of the right psoas major muscle (Fig. 1). The measurement of this variant muscle was done using the measuring tape. The complete length of the muscle was found to be 22.5 cm. The maximum width of the muscle belly towards the origin was 2.3 cm. The variant muscle was photographed using high-resolution camera.

The origin of the psoas minor was traced to the T12 and L1 vertebral bodies. The muscle fibres coursed downwards and anteriorly, its' tendon reaching the pelvic brim, which later merges with the fascia covering the psoas major muscle before inserting into the ilio-pubic eminence (Fig. 2).

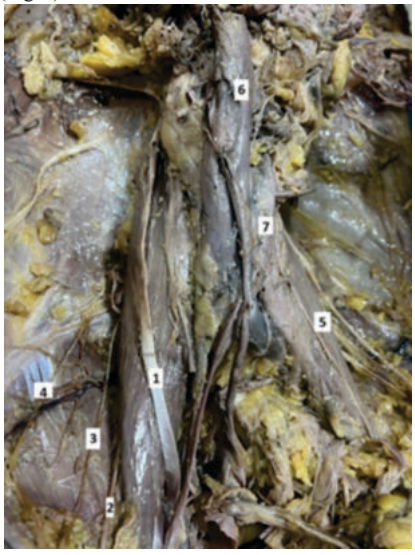

Fig. 1: Photograph showing the unilateral right sided Psoas Minor Muscle. [1: Psoas Minor, 2: Femoral nerve, 3: Lateral femoral cutaneous nerve, 4: Ilioinguinal nerve, 5: Left Psoas Major, 6: Inferior vena cava, 7: Aorta]

Fig. 2: Photograph showing the attachments of Right Psoas Minor. [1: Origin from the T12 and L1 vertebral bodies, 2: Tendon directed downwards to get inserted into the ilio-pubic eminence].

REVIEW OF LITERATURE:

To gain a comprehensive understanding of isolated right psoas minor muscle presentations, we conducted a meticulous search within the PubMed database. We employed a MeSH keyword strategy, specifically focusing on "psoas minor muscle" or "psoas minor clinical importance." This search yielded a total of 105 articles.

For optimal efficiency, we further refined the results by prioritizing articles with freely available full texts (37 articles) and those published within the last decade (31 articles). However, upon closer examination, 24 articles from the most recent timeframe were excluded because they did not directly pertain to the specific focus of our case report.

Following this rigorous selection process, we identified and thoroughly reviewed 7 pertinent articles that provided valuable insights into isolated psoas minor muscle presentations and their clinical implications. These articles formed the foundation for our literature review and informed the context of our case report.

Table showing the articles reviewed:

SL.NO.	AUTHOR	YEAR	FINDING	CONCLUSION
1.	Apurba Patra et al.[12]	2024	Psoas minor was found in 12 cases, 10 bilateral and 2 unilateral out of 30 cadavers studied.	The muscle provides mechanical stability of the underlying iliopsoas. This function may be clinically related to inflammation and pathology of the iliopsoas tendon.
2.	Pamela Dragieva et al.[1]	2018	Psoas minor was present in 6 out of 10 cadavers (60%), the muscle was 3 bilateral and 3 unilateral.	The frequency of psoas minor is higher in Bulgarian population (60%) compared to its presence in the Indian population (36.67%). Shorter psoas minor in the Bulgarian population.
3.	Blake H. Hodgens et al.[13]	2020	The PM was present bilaterally in 39% of cases.	The development of vestigial muscles is seen to occur independently and does not correlate with sex or race.
4.	Donald a. Neumann et al.[14]	2014	16 cadavers were studied. Psoas minor was present bilaterally in 10 cadavers and unilaterally in one male cadaver.	The attachment of psoas minor into the iliac fascia may cause mechanical stability of the underlying iliopsoas muscle. This function can be clinically related to inflammation and pathology involving the iliopsoas tendon and adjacent tissues in the anterior region of the hip.
5.	Matthew Protas et al.[4]	2017	a rare two headed psoas minor muscle was reported.	the effects of psoas minor variants on clinical function and pathologies need further studies.
6.	T. L. Wong et al.[15]	2019	Left Psoas quadratus muscle was noticed that divides the femoral nerve into multiple parts. The muscle originated from the anteromedial surface of the quadratus lumborum and fused with the tendon of the psoas major at the level of the inguinal ligament.	The rare muscle explores to understand the Femoral nerve compression symptoms better.
7.	Shehzad Khalid et al.[16]	2017	psoas tertius muscle was observed arising from the inner half of the 12th rib and from the tips of the transverse processes of the first four lumbar vertebrae which later pierced the femoral nerve and fused with ilio-psoas tendon.	Identification of anatomical variants on imaging can lead to earlier physiologic testing and better treatment outcomes.

DISCUSSION:

The present case report describes an isolated right psoas minor muscle identified during routine dissection (Fig. 1 & 2). This finding contributes to the existing knowledge on the variable presence and morphology of the psoas minor muscle. Our findings are consistent with previous reports on the variable presence of the psoas minor. Markov et al. [17] documented a unilateral right psoas minor in a female cadaver, similar to our case. Studies have highlighted its presence in human foetuses [18]. The unilateral and bilateral occurrence of the muscle have been documented in cadaveric studies [19, 20], with some cases reporting variations such as a double-headed psoas minor muscle [4]. Several studies have explored the morphology of the psoas minor in detail, providing valuable data on its size, origin, insertion, and relationship with surrounding structures [1, 21, 22, 12]. Our case contributes to this knowledge base by highlighting the spectrum of minor psoas presentations encountered in anatomical dissections.

The psoas minor muscle, a vestigial muscle, has been a subject of anatomical interest due to its rare occurrence and potential clinical implications. The psoas minor, a slender muscle located posterior to the abdominal cavity, exhibits significant anatomical variations [21, 22]. This variability is attributed to the evolutionary background of the psoas minor. The vestigial muscle diminishes in size and function over time [23, 24]. Embryologically, the psoas minor arises from the intermediate mesoderm, similar to the psoas major and the iliopsoas muscle complex [12, 18]. During human development, the psoas minor may regress, leading to its unilateral presence or complete absence [17, 22].

Psoas minor anatomical variations hold potential clinical significance

for several reasons. Due to its proximity to vital structures, its atypical morphology can be misconstrued as a pathological mass during diagnostic imaging [23, 21]. Anatomical studies have explored the relationship between the psoas minor muscle and adjacent structures, such as the lumbar plexus, femoral nerve, and iliac vein [25].

Understanding the variable anatomy of the psoas minor is crucial for surgeons performing procedures in the retroperitoneal space. Unfamiliarity with its potential presence or unusual course can lead to iatrogenic injuries to adjacent neurovascular structures [21,22]. Additionally, the variable insertion points of the psoas minor can influence the spread of retroperitoneal infections or tumours [6]. Furthermore, muscle presence has been associated with specific conditions, such as its potential influence on postoperative complications in colorectal cancer surgery [26]. Additionally, the impact of muscles on surgical approaches, such as lateral trans-psoas interbody fusion, has been investigated to prevent iatrogenic complications [25, 27]. Conversely, the psoas minor can serve as a surgical landmark during minimally invasive retroperitoneal procedures [12].

The assessment of the psoas muscle, including the psoas minor, has been extended to predicting outcomes in various medical conditions. Studies have linked muscle volume loss to poor prognosis in hepatocellular carcinoma patients [28, 29] and muscle fat infiltration to mortality in cirrhosis patients [30]. Furthermore, muscle status, measured through indices such as the psoas muscle index (PMI), has been associated with disease progression in patients with advanced hepatocellular carcinoma [31].

The function of the psoas minor, likely serving a supplementary role to the psoas major, remains unclear [32,22]. Cadaveric studies have suggested that the psoas minor might contribute to lumbar spine flexion, hip joint stability, and tensioning of the iliac fascia [1,17]. However, its unilateral presence, as observed in our case, raises questions about the functional significance of a single psoas minor muscle. Further research is needed to determine whether a unilateral psoas minor compensates by altering its function or if its presence is merely vestigial.

CONCLUSION:

In conclusion, the literature review and discussion on the psoas minor muscle encompass its anatomical variations, clinical relevance in surgical procedures and postoperative outcomes, and its potential as a prognostic indicator in various medical conditions. Understanding the presence and characteristics of this muscle contributes to broader knowledge in anatomy, surgery, and disease management.

Conflicts Of Interest: None

Financial Support: Nil

Acknowledgements: None

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