

Original article

Detailed Morphological Study of Tensor Fascia Lata (TFL) and its Clinical Significance

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Abstract:

Background: Tensor fascia latae (TFL) is a hip muscle that is well known to rehabilitation therapists and allied health practitioners. TFL is a muscle that has a complex anatomical arrangement with the iliotibial tract, and it performs various functional roles. TFL is a muscle that may play a role in pain and dysfunction in the lower limb, pelvis and spine. It is however poorly understood, as the research studies that exist on this muscle are few and far between, hence this work was undertaken.

Methods: Forty lower limbs (20 right & 20 Left) for this study were obtained from the department of anatomy. The dissection was carried out bilaterally. Superficial layer of ITT covering TFL has been split vertically to expose the muscle and to observe the lower tendinous part of TFL.

Results: Average length and width of TFL is 17.6cm and 3.7cm respectively. Its lower fibers which are tendinous join the anterior margin of ITT. Insertion of TFL is below the greater trochanter in all the cases. **Conclusion:** The findings of the present work, besides, enhancing anatomical knowledge of the region may be of help to orthopedicians and physiotherapists in the diagnosis and management of pain in the lower limb.

Key words: Tensor Fascia latae, Iliotibial Tract, TFL, Fascia lata, ITT

INTRODUCTION:

TENSOR FASCIA LATAE (TFL) is a hip muscle that is well known to rehabilitation therapists and allied health practitioners. TFL is a muscle that has a complex anatomical arrangement with the ITB, and it performs various functional roles – not only in producing hip movement, but also imparting fascial tension through the fascia latae of the thigh and the specialised ITB. Therefore TFL also plays a key role in not only postural support during one legged stance, but also in limiting the tensile stress on the femur caused by the combination of bodyweight, ground reaction force and how these create unique bending forces on the femur.¹

TFL arises from outer lip of the iliac crest extending from the anterior superior iliac spine to the tubercle of iliac crest. The muscle passes downward and slightly backward and inserted into the iliotibial tract 3-5 cm below the level of greater trochanter.² The nerve supply is from the superior gluteal nerve, which also supplies the gluteus medius and minimus muscles. The function of the muscle depends on the position of the hip. The anterior fibers flex the hip and the posterior fibers abduct and internally rotate the hip.³

The iliotibial tract (ITT) is a combination of the fascia lata, tensor fascia femoris muscle (tensor fasciae latae), and gluteus maximus muscle.³

The ITT continues down the outer third of the thigh, at the femur bone, passing over a protuberance called the greater trochanter. At the level of the greater trochanter, fibers from the gluteus maximus (G.Max) and Tensor fascia lata (TFL) merge with the ITT posteriorly and anteriorly, respectively.⁴

ITT is present only in human beings. Although in lower animals TFL and G.Max get attached to fascia lata but there is no ITT. It is quite disputed whether it should be considered as a distal tendon of these two muscle (TFL & G.Max) or it is a separate functional entity, so that no forces of contraction of these muscles crosses the knee joint. Proximally, the fascia lata envelopes the TFL muscle and cover the G.Max muscle. The fasciae of these two muscles join the iliotibial band just distal to the greater trochanter forming a triangular ‘‘pelvic deltoid.’’³ TFL is a muscle that may play a role in pain and dysfunction in the lower limb, pelvis and spine. It is however poorly understood, as the research studies that exist on this muscle are few and far between. The aim of the present study is to describe the detailed morphology of TFL in adult cadavers as no data is available on the morphology of TFL in the Indian population hence this study was undertaken.

MATERIAL AND METHODS:

The lower limbs for this study were obtained from the department of Anatomy, SAIMS Medical College, Indore. The study was carried out on 20 embalmed cadavers (age 60- 65 years) with no apparent pathology. The dissection was carried out bilaterally on the adult cadavers. The skin and subcutaneous tissue were removed. Fascia lata (FL) was cleaned and ITT was identified on anterolateral aspect of thigh. It was traced proximally to iliac crest. Superficial layer of ITT covering TFL has been split vertically to expose the muscle and to observe the lower tendinous part of TFL.

Following observations were made with the help of measuring tape and photographed.

- Length and maximum width of TFL
- Level of Insertion of TFL in relation to greater trochanter.

The study was undertaken only after the approval was obtained from the Ethical Committee of the institution.

RESULTS:

Table no. 1: Measurement of TFL

Observations	Length of TFL (cm)	Maximum Width of TFL (cm)	Insertion of TFL in relation to greater trochanter (A/T/B)
Maximum	R- 22 L- 22	R- 5 L- 5	B
Minimum	R- 14 L- 13.5	R- 2.8 L- 2	B
Average	R- 17.8 L- 17.4	R- 3.7 L- 3.7	B

TFL- Tensor fascia latae, A-Above, T-At, B-Below, R-Right, L- Left

It was observed that –

1. Maximum length of TFL on right side was 22 cm and minimum was 14 cm (mean- 17.8 cm)
2. Maximum length of TFL on left side was 22 cm and minimum was 13.5 cm (mean- 17.4 cm)
3. Maximum width of TFL on right side was 5 cm and minimum was 2.8 cm (mean- 3.7 cm)
4. Maximum length of TFL on left side was 5 cm and minimum was 2 cm (mean- 3.7 cm)
5. In all the cases on both the side insertion of TFL was below the greater trochanter

We also observed that TFL arises along the iliac crest; fibers of the muscle blend into the fascia lata and deep surface of the ITT and give rise to tendinous fibers that join the iliotibial tract. Splitting of FL forms a distinct sheet for ITT which is easily visualized after incising vertically the fascia covering ITT. Majority of fibers of FL were running at right angle to one another giving typical warp and woof arrangement (Fig. 1). TFL was seen to be enclosed between the two layers of ITT (Fig.2). Average length of TFL is 17.6cm (R – 17.8cm/ L- 17.4cm). Its lower fibers which are tendinous join the anterior margin of ITT (Fig. 3, 4). Insertion of TFL is below the greater trochanter in all the cases. Average width of TFL is 3.7 cm on both the sides.

DISCUSSTION:

The FASCIA LATA is very large, it is connected to: Coccyx, Sacrum, Crest of the ilium, Inguinal ligament, Pubic bone, Ramus and tuberosity of the ischium, Sacrotuberous ligament; passes over the knee and becomes continuous with the fascia of the leg. “The tensor fascia lata, the so-called “**posture muscle,**” aids in this controlling function by drawing the fascia lata tighter upon need, thus pulling the individual muscle groups closer together within their intermuscular septa. This action aids the femur to steer the body-weight back to center from its outward position.⁵

Patrick (2011) described how structures in the body are connected and influence each other, but the fascia lata often gets overlooked in the process. Most people are familiar with the fascia lata from the muscle Tensor Fascia Lata (TFL) – a flexor, internal rotator, and abductor of the hip, which additionally has the role of “tensing” the fascia lata (hence its name). And of course, everyone knows that the TFL connects into the IT-Band along with the G. max which is the more superior thickening of the IT-band. The fascia lata is the sheath of fascia that envelopes our entire thigh and hip region. The muscles which are antagonistic to each other actually share a connection! Extensors are connected to flexors, abductors are connected to adductors, and external rotators are connected to internal rotators. This is a drastically different way of thinking from the way in which most anatomy courses are taught, where muscles have these specific origins and insertions and there is no connection between muscles which are antagonistic to each other save for the fact that contraction of one inhibits the other.⁵

TFL muscle represents a part of the gluteal group. The fibers of the muscle blend into the fascia lata and deep surface of the ITT. Posterior to the main fibers of the tract the ITT is actually stretched behind the muscle between the iliac crest and knee. TFL produced strong retraction of the fascia lata, strong internal rotation of the thigh with flexion of the thigh forward and slightly outward.⁶

TFL, fanning out slightly, about one quarter of the way down the thigh the muscle fibers give rise to tendon fibers that join the iliotibial tract. The TFL is bipartite. The anterior fibers flex the thigh; the posterior fibers medially rotate the thigh. Both parts have abductor force. No one has ever demonstrated convincingly that the muscle is used because of any action it might have across the knee.⁷

From the iliac crest muscular fibres of TFL come down in line with the vertical fibres of the fascia lata and insert on them. One can trace fibrous bundles from its inferior attachment right down to the tibia.⁸

Winslow (1732) said that body of this muscle is placed between two layers of the fascia lata improperly considered an abductor of the thigh, for rotation or rolling of the thigh from in front inwardly.⁶

Albinus (1734) described the muscle as tensor vaginae femoris or muscle of the fascia lata. He explained its function as a real tensor of the fascia lata causing compression of the muscles contained within the fascia, thus providing stability to these and depresses the pelvis both to the side and to the front.⁶

J. Henle in 1871 concluded that TFL does not transmit any action to the knee joint. Sappey in 1888 found no abductor action nor did he find knee action exerted by the TFL. Hamilton and Appleton (1957) stated that TFL plays no direct part in controlling the knee joint movements: it contributes, however, to the stability of the knee joint.⁶

Spasm of the TFL leading to contracture of the IT band is common in patients with residual paralysis after polio.⁹

The TFL and the G. Max represent separated portions of a muscle known as the ilio-tibialis in reptilia (Iguana). The ilio-tibial band represents the original insertion of the muscle and the gluteal part has found a femoral attachment.¹⁰

Last (1954) considered the ITT a thickening of the fascia lata with three-fourths of the G.max and the TFL inserted into it at the level of the greater trochanter. Maintains the knee in the extended position but it is not an extensor of the flexed knee. It may be suspected that the ITT is an independent structure and is not necessarily a part of the TFL muscle.⁶

ITT is composed of dense fibrous connective tissue that appears from the TFL, the gluteal fascia and G. max. ITT is stretched by G. max. and TFL, both inserting on the proximal part of the tract.¹¹

Kaplan (1958) stated that there was no transmission of action of these two muscles to the knee, regardless of the position of the knee or thigh during the stimulation. The fascia and the ITT appeared tensed anteriorly, if the TFL was stimulated, or posteriorly, if the G. Max was stimulated. Contractions of the TFL do not transmit any force below the middle of the thigh except tension of the fascia lata.⁶

Lucas (1992) described that in the swing phase, the proximal IT band and TFL are anterior to the greater trochanter, thereby helping maintain hip flexion.¹

Birnbaum et al. (2004) described that splitting of the IT into a superficial and a deep portion, which covers the tensor fasciae latae. The tensor fasciae latae has an insertion on the IT.¹³

In the present study the average length of TFL was 17.6 cm (R – 17.8 cm / L – 17.4 cm) (Table 1). Beals (2009)¹ has described that the length of TFL as 15 cm long. No other workers have made a mention of the length of TFL. The probable reason for the difference in length can be accounted for the differences in the races and height of two groups studied. The width of TFL at the level of upper border of greater trochanter was 3.7 cm on both the sides (Table 1). Beals (2009)¹ has shown it to be 5 cm wide. The variability in the width can be accounted for the level at which it is measured as inferiorly muscle spreads out slightly. This is also the view described by other workers.⁷

In all the cases studied splitting of fascia to enclosed TFL was observed (Fig.2). TFL is enclosed by splitting of FL (ITT) as has been described by many workers (Winslow 1732)⁶, (Evans 1979)⁸, (Birnbaum et al 2004)¹³.

In the lower part fleshy fibers are replaced by tendinous fibers which join the ITT (Fig.3, 4). Similar feature has been described at anat.stonybrook.edu website. In all the cases examined TFL join the ITT below the level of greater trochanter. This is in agreement with the findings of Kaplan (1958)⁶, Evans (1979)⁸, Joshua Dubin (2006)⁴, Beals (2009)³.

CONCLUSION:

The various parameters that have been studied in the present work in central Indian population have not been carried out in such great details in Indian context. Hence, these values can be utilize for ascertaining the normalcy. The findings of the present work, besides, enhancing anatomical knowledge of the region may be of help to orthopedicians and physiotherapists in the diagnosis and management of pain in the lower limb.



Fig.1 Showing typical warp and woof arrangement of collagen bundles in the FL.

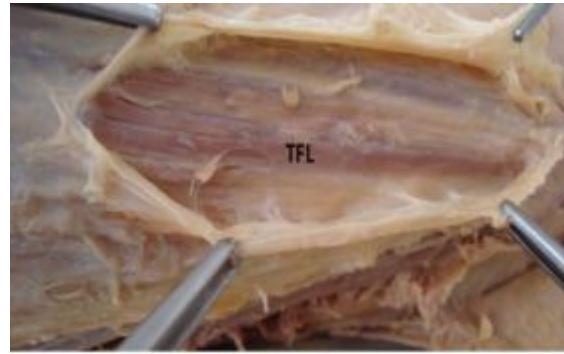


Fig.2 Superficial layer of FL covering TFL has been split to expose the muscle.

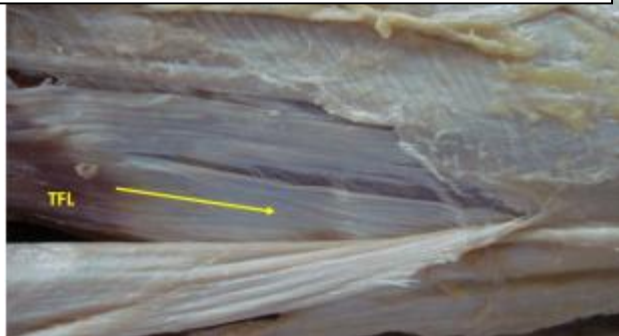


Fig.3 Superficial layer of FL has been split to expose the lower tendinous part of TFL (yellow arrow) which merges with ITT

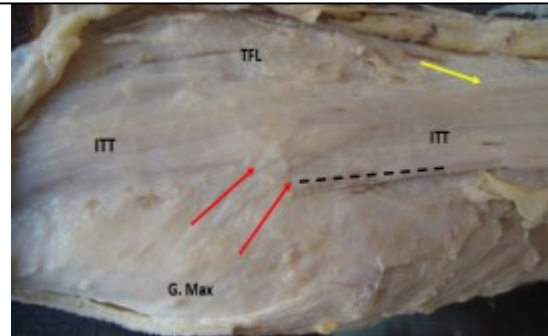


Fig.4 Showing G. Max & fibers of TFL joining ITT (dotted line) ITT

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