THE BLOOD SUPPLY OF THE TENSOR FASCIA LATA MUSCLE AND ITS CLINICAL APPLICATIONS
THESIS

Submitted In Partial Fulfilment Of Requirements
For The Master Degree - General Surgery

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1986

ACKNOWLEDGMENT
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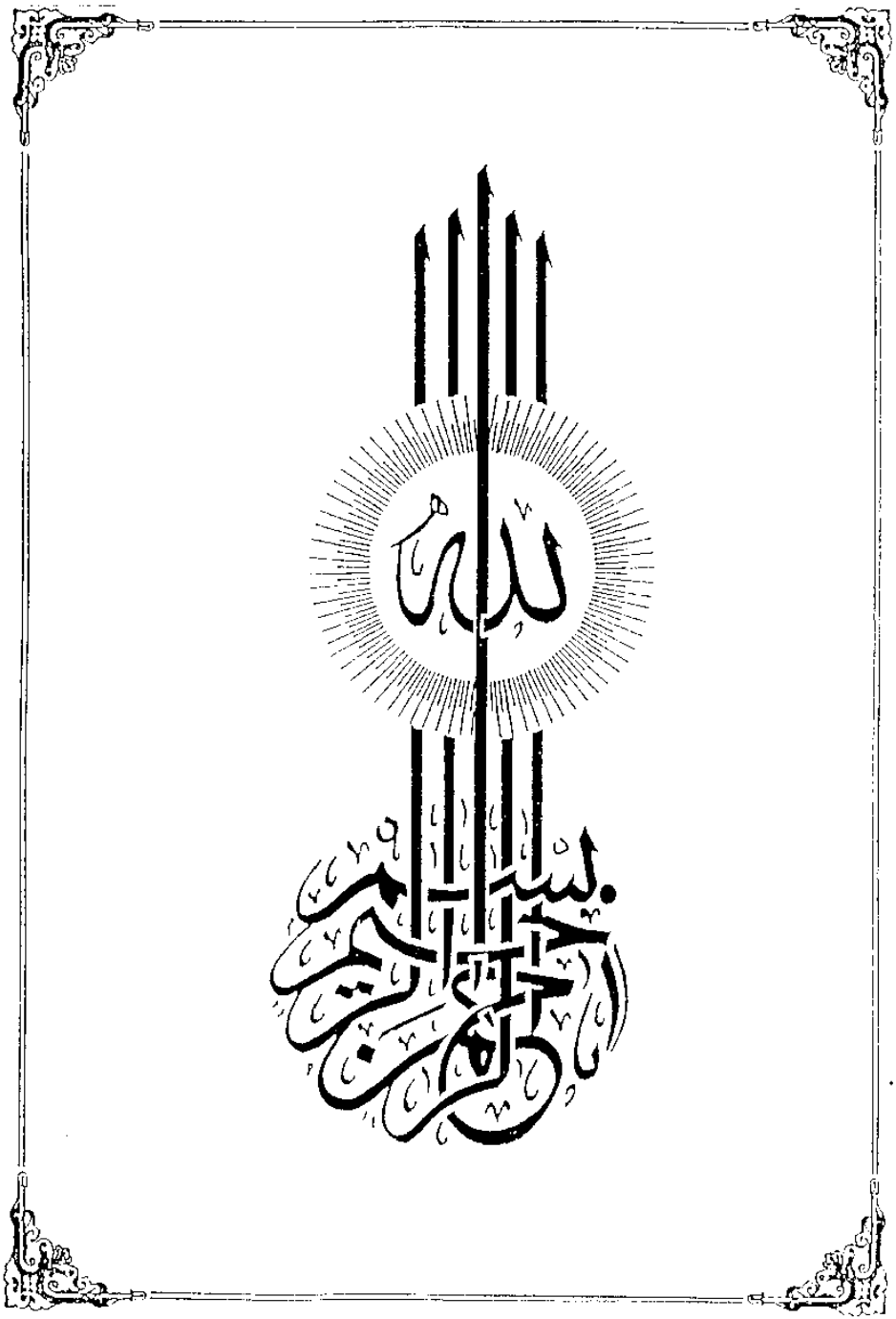
I would like to express my deepest appreciation to Prof . Dr . M.M.Nafeh for his kindness in accepting to pursue this work under his supervision .

I am indebted to Dr . M.Zaki and Dr . S.Hosny for their assistance and guidance .

Lastly , I am very grateful to Prof . Dr . H.A.Badran , Dr . M.Ashraf and Dr . A.Salah for allowing me to include their patients in this work .



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INTRODUCTION

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The field of reconstructive surgery has grown rapidly and steadily . Until recently , that the skin receives a significant amount of its blood supply from the underlying muscles was only of teoretical interest. This was because a widespread misconception existed that numerous specific cutaneous vessels would eventually be identified as the primary sources for the cutaneous blood supply . However , the scarcity of such cutaneous vessels stimulated the research in the role played by the perforating musculocutaneous vessels as a source of blood supply to the skin (McCraw and Dibbell , 1977) .

In areas of the body which do not contain specific cutaneous vessels , it was found that elevation of certain muscles with the overlying attached skin as composite musculocutaneous flaps would conseve the blood supply to the skin via the perforating vessels from the muscle (Bowden and McCraw , 1981).

This is the basic idea of the musculocutaneous flap method .

The development of the musculocutaneous flaps has advanced the field of reconstructive surgery as much as any other single principle . The technique is not difficult to perform and allows one stage repair of a wide variety of defects . An important musculocutaneous flap is the tensor fascia lata flap . It is a reliable versatile flap which has been used to reconstruct soft tissue defects , for microvascular tissue transplantation and together with a block of the iliac crest as an osteomusculocutaneous flap . Being one of the most useful flaps for a variety of difficult reconstructive problems stimulated us to choose the blood supply of the tensor fascia lata muscle and its clinical applications as the subject of this study .

ANATOMICAL CONSIDERATIONS

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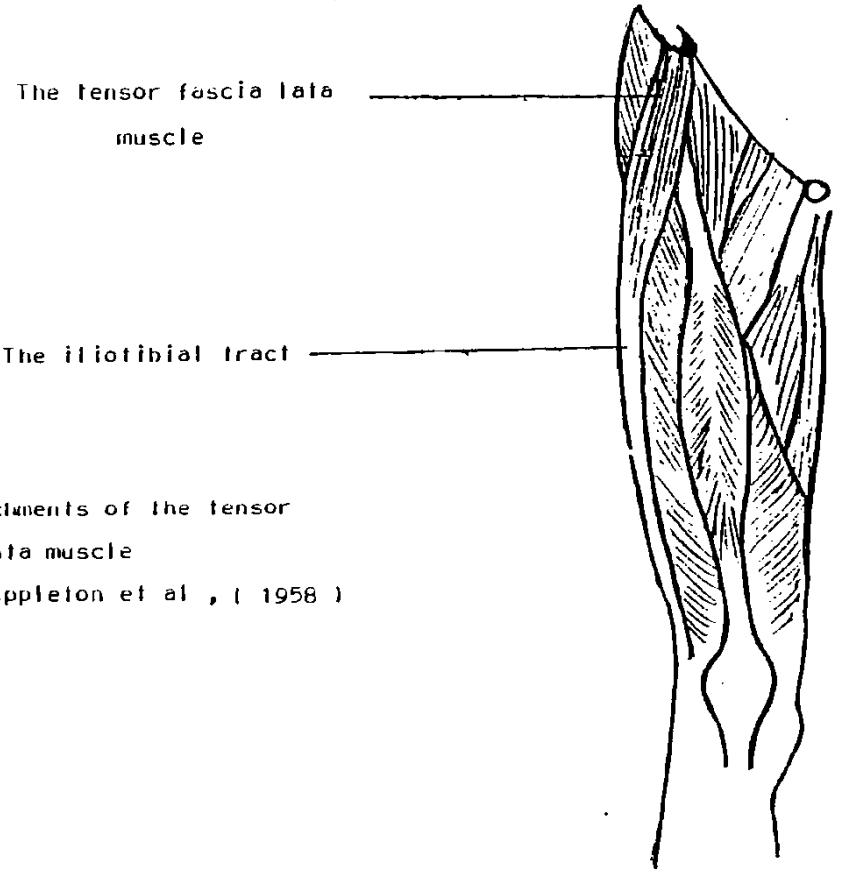
The tensor fascia lata is a short flat muscle located laterally in the upper part of the thigh .

SURFACE ANATOMY :

The tensor fascia lata muscle forms a rounded prominent swelling below and lateral to the anterior superior iliac spine infront of the gluteal depression . Its voluntary action is tested by asking the patient lying on the back to raise the lower limb with the knee extended . An elevation formed by the muscle will be seen diverging from that formed by the sartorius muscle below and lateral to the anterior superior iliac spine (Appleton et al , 1958) .

ATTACHMENTS OF THE TENSOR FASCIA LATA MUSCLE :

(Fig 1)



* Fig . 1 : The attachments of the tensor fascia lata muscle (After Appleton et al , (1958)

ORIGIN :
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The muscle takes origin from :

* The anterior two inches of the outer lip of the iliac crest .

* The lateral surface of the anterior superior iliac spine and part of the border of the notch below it .

* The deep surface of the fascia lata .

The muscle fibres run downwards and slightly backwards . They usually end about the junction of the middle and the upper third of the thigh . The muscle is enclosed within a sheath formed by the splitting of the upper limit of the iliotibial tract . The superficial layer ascends lateral to the muscle to reach the iliac crest while the deep layer blends with the capsule of the hip joint (Warwick and Williams , 1973) .

INSERTION :
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The muscle is inserted into the iliotibial tract . The latter commences about the level of the greater trochanter where it receives the insertion of the tensor fascia lata muscle anteriorly and the major part of the gluteus maximus muscle posteriorly . The iliotibial tract descends down the postero-lateral aspect of the thigh to be inserted into a smooth circular facet on the anterior surface of the lateral condyle of the tibia (Last , 1981) .

VASCULAR ANATOMY :
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The blood supply of the tensor fascia lata muscle was considered to come from the superior gluteal artery that courses over the gluteus minimus , beneath the gluteus medius to reach the tensor fascia lata muscle from behind (Wangensteen , 1934 and Woodburne , 1965) .

Hill et al (1978) demonstrated the vascular anatomy of the tensor fascia lata muscle . They found that the muscle has a single vascular pedicle consisting of an artery which is a terminal branch of the lateral circumflex femoral artery and two venae comitantes .

The lateral circumflex femoral artery arises from the profunda femoris artery or sometimes from the common femoral artery . It passes laterally between the branches of the femoral nerve deep to the rectus femoris muscle where it breaks into three branches :

* An ascending branch , which runs on the vastus lateralis towards the anterior superior iliac spine .
* A transverse branch , which passes laterally between the rectus femoris and the vastus lateralis muscle .
* A descending branch , which passes down with the nerve to the vastus lateralis muscle (Last , 1981) .

Morrison and O'Brien (1980) described that the vessel which supplies the tensor fascia lata muscle is the ascending branch of the lateral circumflex femoral artery while Hill et al (1978) and Mathes and Nahai (1982) considered it to be the transverse branch of the same artery .

The branch of the lateral circumflex femoral artery which supplies the tensor fascia lata muscle emerges between the vastus lateralis and the rectus femoris muscle . It enters the deep surface of the tensor fascia lata muscle approximately 8 to 10 cm below the anterior superior iliac spine . It divides into 3 branches usually before it enters the muscle . These branches are :

* The upper branch , which supplies the upper part of the muscle and through its origin gives perforators to the iliac crest .
* The middle and the lower branches , which supply the muscle and through musculocutaneous perforators supply the overlying skin down the anterolateral aspect of the thigh to within 5 cm from the knee (Nahai , 1980) .

The artery supplying the muscle ranges from 2 to 3 mm in diameter . The diameters of each of the associated venae comitantes varies from 1.8 to 2.5 mm (Nahai et al , 1978) .

By division of the branch to the gluteus minimus , a vascular pedicle of 4 to 5 cm lengh is obtained . Division of the descending branch of the lateral circumflex femoral artery increases the length of the pedicle to 10 cm (Nahai, et al , 1979) .

A recent study for the blood supply of the thigh skin was carried out by Cormack and Lamberty (1985) . They described that the skin of the anterolateral aspect of the thigh is supplied by the anterior branches of the perforators that pass along the lateral intermuscular septum . These are connected by longitudinally arranged anastomosing vessels forming a plexus in the subcutaneous tissue . Based on these findings , they concluded that the long cutaneous extension of the tensor fascia lata flap is due to communication between the perforators through the tensor fascia lata and the anastomosing vessels allowing longitudinal flow in the subcutaneous plexus to take place .

* NEURAL ANATOMY :
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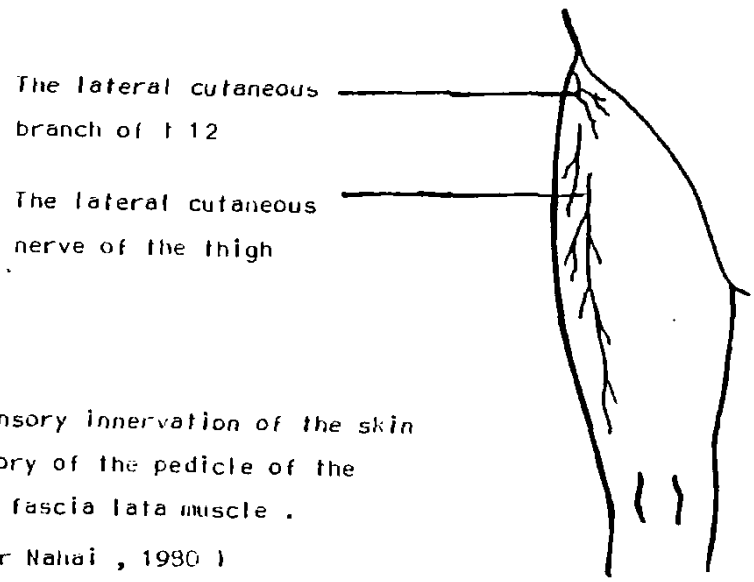
(Fig . 2)



* Fig . 2 : The sensory innervation of the skin territory of the pedicle of the tensor fascia lata muscle . (After Nahai , 1980)

MOTOR NERVE SUPPLY :
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The motor nerve supply of the tensor fascia lata muscle is derived from the inferior branch of the superior gluteal nerve (L 4,5 and S 1) (Warwick and Williams , 1973) .

It enters the deep surface of the muscle slightly proximal to the site of entrance of the vascular pedicle (Mathes and Nahai , 1982) .

SENSORY NERVE SUPPLY OF THE SKIN TERRITORY OF THE MUSCLE :
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The superior portion of the cutaneous territory receives its innervation from the lateral cutaneous branch of T 12 which is located in the subcutaneous tissue at the posterosuperior aspect of the tensor fascia lata flap . The middle and inferior portions receive the lateral cutaneous nerve of the thigh which enters the medial edge of the flap within the subcutaneous tissue 8 to 10 cm below the anterior superior iliac spine (Mathes and Nahai , 1982) .

The lateral cutaneous branch of T 12 crosses the iliac crest 5 cm behind the anterior superior iliac spine while the lateral cutaneous nerve of the thigh passes behind or through the inguinal ligament at a variable distance medial to the anterior superior iliac spine .

Both nerves may be included in a sensory tensor fascia lata flap . They can be easily identified . The lateral cutaneous branch of T 12 is smaller , measuring 0,5 to 2 mm in diameter and consists of 2 or 3 fascicles . The lateral cutaneous nerve of the thigh is larger , measuring 2 to 3 mm in diameter and consists of 3 or 4 fascicles (Nahai et al , 1979) .

ACTIONS OF THE TENSOR FASCIA LATA MUSCLE :
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ON THE HIP :
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The tensor fascia lata muscle is a flexor , abductor and medial rotator for

the thigh at the hip .

* Flexion : This action is manifested by the bulge formed by the muscle when the thigh is flexed with the knee extended (Warwick and Williams , 1973) .

* Abduction : There is controversy about this action . Some investigators ignore it completely (Hollinshead , 1958 and Warwick and Williams , 1973) .

* Medial rotation : It is manifested when the hip is flexed . This action helps to overcome the tendency of most flexors of the thigh to rotate the thigh laterally during flexion (Hollinshead , 1958) .

ON THE KNEE :

The action of the tensor fascia lata muscle on the knee depends on the posture . It is not extensor for a flexed knee but when the knee is extended , the iliotibial tract passes in front of the axis of flexion . So , it maintains the extended position (Last , 1981) .

In the erect position , the muscle helps to steady the pelvis on the femur and through the iliotibial tract , it helps to steady the condyles of the femur on the tibia . In this way , the muscle helps to maintain the erect attitude (Warwick and Williams , 1973) .

REVIEW OF THE LITERATURE

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(1) VASCULAR ASPECTS

(A) THE BLOOD SUPPLY OF THE SKIN :

In 1889 , Manchot meticulously investigated the skin circulation by means of dissection . A number of ivestigators later provided excellent reviews on this subject .

McGregor and Jackson (1972) found that a flap with a recognized arteriovenous system running along its axis can be raised with an increased lengh in relation to its width without prior delay . They classified skin flaps according to their vasculature into axial and random pattern flaps .

Smith (1973) confirmed experimentally that axial pattern flaps can safely exceed 1:1 length to width ratio and that it is possible to raise an axial pattern flap of a length exceeding the vascular territory of the involved arteriovenous axis . Their study also confirmed that it is possible to elevate an island of tissue totally dependent on a single arteriovenous axis for its blood supply and survival .

Daniel and Williams (1973) traced the circulation of the skin from the great vessels to the dermal capillaries . They classified the blood vessels into segmental , perforator and cutaneous vessels . Two types of cutaneous vessels supply the skin . These are the musculocutaneous and the direct cutaneous vessels . The main blood supply to the skin is through the musculocutaneous perforators . This supply is supplemented by anatomically variable limited number of direct cutaneous vessels . The musculocutaneous arteries are short perpendicular vessels that supply small areas of the skin while the direct cutaneous arteries are long vessels that course parallel to the surface and potentially supply large areas of the skin . Each musculocutaneous artery is accompanied by one vein while each direct cutaneous artery is accompanied by two venae comitantes and a named vein that courses subdermally .