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VASCULAR STALK ANALYSIS OF THE TENSOR FASCIAE LATAE FLAP

Aleksandra Vuksanović[1], Sladjana Ugrenović[2], Ivan Jovanović[2]

[1]Medical School, University of Montenegro, Podgorica
[2]Medical School, University of Niš, Serbia
E-mail: alexandrav2006@yahoo.com

Summary. *Flaps represent segments of the skin and subcutaneous tissue, fascia, muscles or bones, with their own vascular net on a particular vascular stalk. For a successful usage of a flap, it is necessary to know its vascular net, as well as the areas supplied by its vascular stalk. The most frequently used flap for covering defects in the groin, lower part of the abdomen, trochanter, gluteal and ischiadicus region is the tensor fasciae latae. The muscle is short and meaty only in its upper third, after which it descends as a broad tough strip entering the iliotibial tract of the iliotibial fascia latae Maissiat tract. The muscle is vascularized by the lateral circumflex femoral artery, that is, by its ascending branch which, as a single dominant branch, enters the muscle through its medial side. The lateral circumflex femoral artery is the lateral branch of the deep femoral artery which is the largest lateral branch of the femoral artery. The dominant vascular stalk enters deep structures 8-10 cm beneath the anterior superior iliac spine. The knowledge of the vascular net and vascular stalk characteristics of the tensor fasciae latae has an exceptional significance in plastic and reconstructive surgery as it can help prevent flap necrosis during its usage for defect reconstruction and covering. Therefore, the knowledge of the lateral circumflex femoral artery origin and its branches is of a great importance in successful planning and clinical application of this flap.*

Key words: *Flap, tensor fasciae latae, vascularization*

Introduction

Flaps are segments of the skin and subcutaneous tissue, fascia, muscles or bones which have their own vascular network on a particular vascular stalk. They are used for reconstruction of simple or complex defects of different form and size and in different locations (1).

The tensor fasciae latae is the flap that is most commonly used in covering defects in the groin, in the lower part of the abdomen, trochanter, gluteal or ischiadic region. The tensor fasciae latae belongs to the group of femoral muscles. This long muscle extends from the pelvic bone to the tibia. It is meaty only in its upper third, after which it descends as a broad tough strip entering the iliotibial fasciae latae Maissiat tract. Motor innervation comes from the lateral branch of the superior gluteal nerve, while sensitive innervations are enabled by the lateral femoral cutaneous nerve (2,3,4).

The structure of the tensor fasciae latae flap can be muscle-cutaneous, muscle-facial, muscle, and bone-muscle-cutaneous.

For a flap to "survive" it is necessary to know its vascular network, as well as the surface that is supplied by the vascular stalk.

The vascular stalk appears on the deep medial side of the muscle, 8-10 cm under the anterior superior iliac spine when the rectal femoral muscle is pulled. The lateral circumflex femoral artery is the lateral branch of the deep femoral artery that represents the largest deep lateral branch of the femoral artery. Arising from the deep femoral artery at its origin parts, from where it continues outwards, it passes between the rectal femoral muscle and the lower part of the iliopsoas muscle and soon divides giving its own lateral branches: the ascending, descending and transverse branches (1,2,3,4,5).

The ascending branch of the lateral circumflex femoral artery represents a dominant branch in vascularization of the tensor fasciae latae flap (1). This muscle's flap has a developed practice in plastic and reconstructive surgery. It is, therefore, most important to know its vascular stalk characteristics before its use in the reconstruction of defects (6,7,8,9).

Patients and Methods

Dissection is chosen as the method that is most frequently used in the study of anatomy systems and structures, because it allows direct exposure and visual monitoring of anatomical-topographic relations, the course of the blood vessels trunk, as well as the lateral and terminal branches.

The study was performed on autopsy material using the method of micro-dissection of the lower limbs of 10 fetuses to whose blood vessels Micropaque solution was injected (showing white in the photos). Being part of the collection of the Institute for Anatomy, Faculty of

Medicine, University of Niš, the fetuses had already been fixed in a 10% formalin solution.

The fetuses were of different sex (6 males and 4 females) and of different age (3 to 10 lunar months). The gestation age was determined on the basis of the parietal-coccyx length and by comparing their values with the values in the tables of gestation age, quoted in a perinatology book (Kurjak 1989).

A micro-dissection of the fetuses' lower limbs was performed under a magnifying glass (5 times magnified). Two transversal and one longitudinal cutaneous resection were done. The first transversal resection followed the inguinal fold from the medial to the lateral part up to the anterior superior iliac spine, while the second transversal resection was done above the knee joint. With one longitudinal resection, we bound the middle of the first and the second horizontal resection going lateral and medial from the lateral edge of the rectal femoral muscle (Fig. 1).

Fig. 1. View of the marked anterior femoral region in an 8-lunar month-old fetus

After that, the skin was carefully prepared along with the subcutaneous tissue and lifted to one side. The elements of the Scarps' femoral triangle were identified and the femoral artery was prepared.

In this phase of preparation, the topographic relation of the femoral artery with the femoral nerve and the femoral vein was recorded.

After identifying the place of splitting the deep femoral artery from the femoral artery, the sartorial muscle was removed, cut into the part of the anterior superior iliac spine, lifted from its proximal attach and moved aside.

With the description of the surrounding structures and spatial orientation, the deep femoral artery was prepared, up to the place of splitting the lateral circumflex femoral artery.

In order to clearly see the branches of the lateral circumflex femoral artery and the place of the vascular stalk entering the tensor fasciae latae, one head of the quadriceps femoral muscle was removed.

Aims

In order to assess the possible use of the tensor fasciae latae flap for defect reconstruction, we stated the following study aims:

- The path of origin of the lateral circumflex femoral artery;
- The topographic relation of the mouth and bifurcation of the lateral circumflex femoral artery with the surrounding structures;
- The number of lateral circumflex femoral artery branches; and
- The topographic relation and the number of the lateral and terminal branches of the ascending branch of the lateral circumflex femoral artery.

Results and Discussion

It was established that the lateral circumflex femoral artery originated from the femoral artery in 24% of cases. In 76% of cases, the lateral circumflex femoral artery originated from the deep femoral artery. In two cases, the deep femoral artery and the lateral circumflex femoral artery had a common origin – the femoral artery. During our research, we did not find that the lateral circumflex femoral artery originated from any other blood vessel, which is supported by the reference data (3,4,6,7) (Fig. 2).

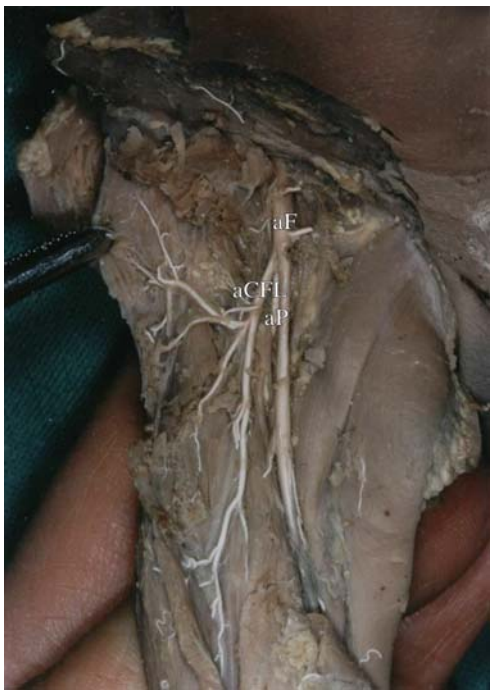

Fig. 2. View of the place of splitting the lateral circumflex femoral artery from the deep femoral artery

In all cases, the topographic relation of the mouth and bifurcation of the lateral circumflex femoral artery with the surrounding structures was the same.

In front of the lateral circumflex femoral artery mouth there was skin with the subcutaneous fatty tissue, fascia lata, and femoral nerve with its branches. Behind the lateral circumflex femoral artery mouth, the iliopsoas muscle was found, the femoral nerve with its branches was found laterally, and the femoral artery was found medially.

In front of the lateral circumflex femoral artery bifurcation, there was skin with the subcutaneous fatty tissue, femoral nerve and sartorius muscle. Behind it, the lateral circumflex femoral vain and iliopsoas muscle were found, and laterally – the ascending branch of the lateral circumflex femoral artery.

Some authors describe three branches of the lateral circumflex femoral artery: the ascending branch, the transverse branch and the descending branch (3,4).

Another group of authors provides evidence that the lateral circumflex femoral artery ends in two terminal branches: the ascending branch and the descending branch (7,10).

The results of our research match with the results of the second group of authors, and indicate that there are two terminal branches of the lateral circumflex femoral artery: the ascending branch and the descending branch. During our research, we also recorded the transverse branch, but only as the largest lateral branch of the ascending branch (Fig. 3).

Fig. 3. View of the lateral circumflex femoral branches: the ascending branch and the descending branch, and the transverse branch as the lateral branch of the ascending branch.

The prevailing part in vascularization of the tensor fasciae latae muscle flap belongs to the terminal branch of the lateral circumflex femoral artery – the ascending branch which enters the deep side of the muscle at the level of trochanter major (Fig. 4).

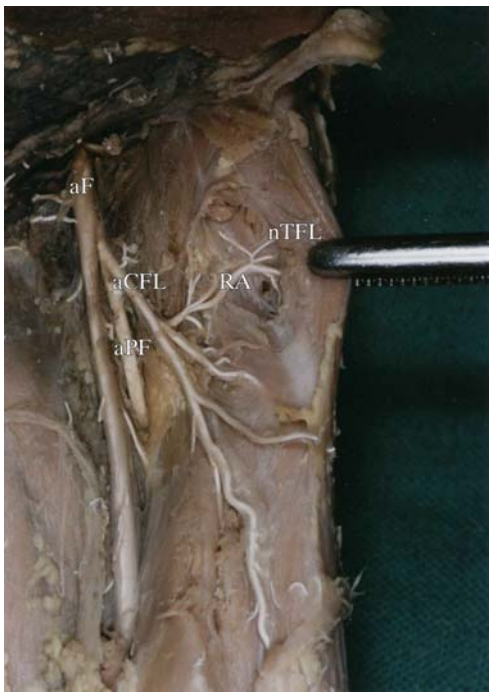

Fig. 4. View of the place of entry of the vascular stalk in the tensor fasciae latae muscle in a fetus, 9 lunar months of age.

The position of the femoral nerve with its branches – the sartorius muscle, the rectus femoris muscle and the tensor fascia lata muscle – in relation to the ascending branch of the lateral circumflex femoral artery was at the front. Behind the ascending branch of the lateral circumflex femoral artery, the following was recorded: the iliopsoas muscle, the vastus intermedius muscle (intermediate great muscle), the vastus lateralis muscle and the ascending branch of the lateral circumflex femoral vein. Laterally, the tensor fascia lata muscle was found, and medially the bifurcation of the lateral circumflex femoral artery.

Due to its high importance as a dominant branch in vascularization of the tensor fascia lata muscle flap, we paid a particular attention to the lateral and terminal branches of the ascending branch of the lateral circumflex femoral artery. The ascending branch of the lateral circumflex femoral artery gave the average X = 3 lateral branches with SD = 1.61 and CV = 0.86% (the variation interval was between max = 6 to min = 0). In all examined cases, among the lateral branches of the ascending branch, the lateral branch of the largest caliber was the transverse branch.

Terminal branches of the ascending branch were very difficult to identify and count, because they are blood vessels of a very low caliber. At only six pre-

pares, it was possible to identify the number of terminal branches of the ascending branch with an average of X = 2 (the variation interval was between max = 3 to min = 1) ±SD = 1.00, CV = 50%. Thus, a small sample could not provide valid data about the exact number of terminal branches of the lateral circumflex femoral artery ascending branch.

After that, the number of the lateral branches of each terminal branch of the ascending branch was identified on the same sample.

It was established that the first terminal branch gave the average X = 3 (±SD = 1.45, CV = 43.28%), the second terminal branch X = 4 (±SD = 1.26, CV = 35.49%), the third terminal branch X = 3 (±SD = 1.31, CV = 43.66%), the fourth terminal branch gave X = 1 (±SD = 1.04, CV = 32.80%) and the fifth terminal branch gave X = 1 lateral branches (±SD = 1.00, CV = 33.33%) (Table 1).

Table 1. A tabular review of the lateral and terminal branches of the lateral circumflex femoral artery ascending branch.

Ramus ascendens a.CFL	Number of analyzed samples	Average number
Lateral branches	20	3
Terminal branches	6	2

The knowledge of variation regarding the process of creation of the lateral circumflex femoral artery and its branches, as well as the topographic relation with the surrounding structures is crucially important for planning the flap (8,11,12,13,14).

In order to prevent necrosis of the tensor fascia lata flap while using it for reconstruction and recovering defects in plastic and reconstructive surgery, the knowledge of variation in creation of the lateral circumflex femoral artery and its branches is highly important (1,2,5,13).

Conclusion

- In 24% of cases the lateral circumflex femoral artery derives from the femoral artery, while in 76% cases the lateral circumflex femoral artery derives from the deep femoral artery.
- The topographic relation of origin and bifurcation of the lateral circumflex femoral artery with the surrounding structures was the same in all 10 analyzed fetuses.
- The lateral circumflex femoral artery gives two terminal branches: the ascending branch and the descending branch.
- The transverse branch is the largest lateral branch of the recorded three branches of the ascending branch.

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ANALIZA VASKULARNE PETELJKE REŽNJA M. TENSOR FASCIAE LATAE

Aleksandra Vuksanović[1], Sladjana Ugrenović[2], Ivan Jovanović[2]

[1]Medicinski fakultet, Univerzitet Crne Gore, Podgorica
[2]Medicinski fakultet, Univerzitet u Nišu

Kratak sadržaj: *Režnjevi predstavljaju segmente kože i potkožnog tkiva, fascije, mišića ili kosti, koji imaju svoju vaskularnu mrežu na određenoj vaskularnoj peteljci. Da bi se režanj uspješno koristio neophodno je poznavanje njegove vaskularne mreže, kao i površine koju vaskularizuje vaskularna peteljka. Režanj koji se najčešće koristi u*

prepokrivanju defekata u preponi, donjoj polovini trbuha, trohanternoj, glutealnoj i ishijadičnoj regiji je mišić zatezač fascije buta (m.tensor fasciae latae). Mišić je kratak i mesnat samo u gornjoj trećini, da bi se dalje nastavio jakom žilastom trakom koja ulazi u sastav bedreno-golenjačnog snopa butne fascije (tractus iliotibialis fasciae latae Maissiati). Vaskularizacija mišića potiče od spoljašnje polukružne butne arterije (a.circumfexa femoris lateralis), odnosno njene ascedentne grane (ramus ascendens), koja kao pojedinačno dominantna grana ulazi kroz medijalnu stranu u mišić. Spoljašnja polukružna butna arterija (a.circumfexa femoris lateralis) je bočna grana duboke butne arterije (a.profunda femoris), koja je najveća bočna grana butne arterije (a.femoralis). Dominantna vaskularna peteljka ulazi u duboke strukture 8-10 cm ispod prednje gornje bedrene bodlje.
Poznavanje vaskularne mreže i karakteristika vaskularne peteljke režnja m.TFL ima izuzetan značaj u plastičnoj i rekonstruktivnoj hirurgiji, a u cilju prevencije nekroze režnja prilikom njegovog korišćenja za rekonstrukcije i prepokrivanje defekata. Stoga je, poznavanje načina nastanka a.CFL i njenih grana, od velikog značaja za uspješno planiranje i kliničku primjenu ovog režnja.

Ključne reči: *Režanj, m. tensor fasciae latae, vaskularizacija*