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ANALYSIS OF DEEP FEMORAL ARTERY ORIGIN VARIANCES ON FETAL MATERIAL

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Summary. *Literature data are pointing out on variability in height of separation of deep femoral artery from femoral artery. The knowledge of variance in height origin of deep femoral artery and its branches distribution is of great significance for preventing flaps necrosis, particularly tensor fasciae latae, when used in plastic and reconstructive surgery. The research was performed on 100 fetuses, from collection of Institute for Anatomy of Medical Faculty in Nis, injected with Micropaque or Latex solution, fixed and preserved in 10% formalin solution. Method used was dissection under magnifying glass and surgical microscope. All characteristic cases were photographed and collected data statistically processed. It was determined that deep femoral artery, in most cases, originates in the first quarter of specific distance (inguinal ligament - top of femoral triangle) in both male and female and right and left side as well. The least represented was separation in the fourth quarter, and this type was found only in female sex. A deviation in height origin of deep femoral artery leads to variance in its lateral branches distribution as well as changes in its calibre.A variance in height origin of deep femoral artery and its branches will cause changing in their calibers, strongly influencing vascularisation quality of belonging flaps.*

Key words: *Fetal material, deep femoral artery, separation height*

Introduction

Deep femoral artery (DFA) (*a. profunda femoris*) is the largest lateral branch of femoral artery (*a. femoralis)* and major thigh artery which vasculises thigh aductors, flexors and extensors (1,2).

Deep femoral artery (DFA) most frequently origins in femoral triangle (*trigonum femorale*) at 2-6 cm below inguinal ligament (*lig. inquinale*) (1,3,4,5,6).

Certain degree of deviation, regarding exact place of DFA origin, has been noticed (7,8,9). According to some authors, DFA origin can be high, immediately beneath inguinal ligament, or low, outside femoral triangle. Upon DFA separation height, in other words deviation from typical, depend distribution and position of where its lateral branches are separating. It is common for two circumflex arteries to origin from DFA (*a. circumflexa femoris lateralis et medialis*) but when separation is low they commonly origin from femoral artery (FA) (7,10, 11,12).

Because of deviation in height of origin as well as manner and place of origin of lateral and medial circumflex arteries, deep femoral artery also demonstrates variability regarding its caliber. If circumflex arteries are separated from DFA, its caliber is similar to that of femoral artery while if these parts are directly from femoral artery, DFA caliber is significantly decreased (8,10,13).

Quain studied the manner of DFA separation on 543 cases and established that in most cases it separates on 25 to 50 mm below inguinal ligament.

Vigueri's results were somewhat different. By separating first eight centimeters of DFA on four parts, quarters, each 2 cm in length, this author determined that DFA most frequently origins in the second and third quarter (7).

From lateral circumflex femoral artery, DFA branch, an ascedent branch is separated, which supplies tensor fasciae latae muscle with blood and this muscle has wide application in plastic surgery as muscle – cutaneous flap (14).

The knowledge of variance in height origin of deep femoral artery and its branches is of great significance for preventing necrosis of tensor fasciae latae flap when used in plastic and reconstructive surgery (13,15,16).

Research goals

The aim of this research was to precisely determine, on fetal material, the place of the height of DFA separation from FA with regards to inguinal ligament - top of

femoral triangle distance and at the same time perception of the problem towards sex and side (left and right).

Material and Methods

The research material were fetuses from a collection of Institute for Anatomy of Medical Faculty in Niš. The analyses were performed on 100 fetuses, both sex, different gestational age, 200 legs in total. Out of a total number of fetuses analysed, 41 were male and 59 female. Fetuses gestational age was in range from III to X lunar months and it was determined on the basis of parietal-coccyx length which was from 17cm to 28cm. Measured parietal-coccyx length was compared with the same tabular values for gestational age quoted perinatology book by Kurjak 1989 (17).

Within the analysis, both right and left sides were observed.

Out of 100 analysed fetuses, in 70 blood vessels were injected with Micropaque or Latex solution and afterwards fixed and preserved in 10% formalin solution and in 30 no solution was injected. A dissection of FA and DFA was performed under magnifying glass and with surgical microscope. Each working phase and characteristic cases were photographed. In order to establish the height of DFA separation, the distance from inguinal ligament to the place where sartorius muscle crosses aductor longus (top of femoral triangle) had to be determined. This distance, for each analysed case, was divided into four equal parts from top to bottom: first, second, third and fourth quarter. The dissection was performed from surface, firstly removing the skin, towards the deepth untill FA and DFA. The determining quarter in which DFA separates regarding quarters was determined as aforementioned.

The collected data were statistically processed and tabulated. The percentage of DFA separation height with regards to sex, left and right side, was determined.

Results and Discussion

The femoral triangle was dissected into 100 fetuses (out of which 41 male and 59 female), its boundaries and content were presented. Due to different gestational age of fetuses, it was not possible to express the distance on fetal material in measurable units and therefore it was divided into four equal parts (from top to bottom: first, second, third and fourth quarter) (Figure 1).

Figure 1 shows the case of distance betwen inguinal ligament and top of femoral triangle, divided into four equal parts from top to bottom. This method was used for each analized case. In this manner the method of determining place of deep femoral artery (DFA) separation was standardized (Figure 2).

Figure 2 shows DFA, which separates in the first quarter of the inguinal ligament – top of femoral triangle distance.

Figure 3. DFA separates in the second quarter of the aforesaid distance on the left leg.

Figure 4. shows the case of DFA separation in the third quarter of the distance on the left leg, which is a rather rare type of separation.

Figure 5. demonstrates the type of separation in the fourth quarter. It is of a weaker calilber, and its common latral branches are distriburted from FA. Along with further dissection it was found that DFA created third and fourth perforant branches continuing on to the back femoral side.

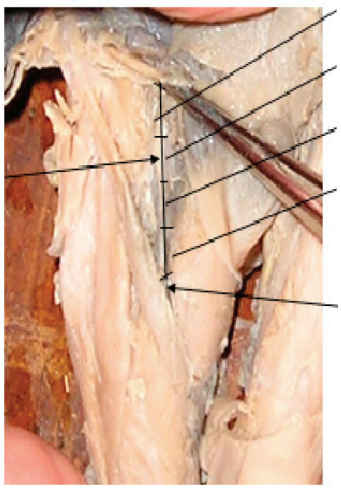

Fig. 1.

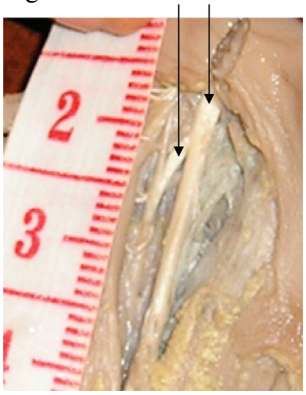

Fig. 2.

Fig. 3.

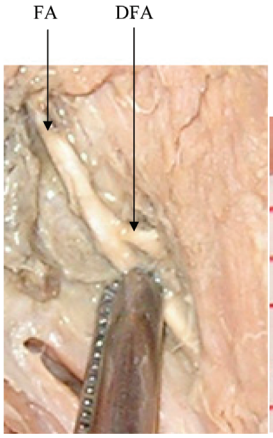

Fig. 4.

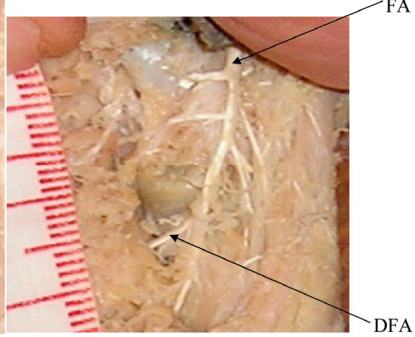

Fig. 5

In most cases, on the examined material, DFA, originated in the first quarter of the given distance, while in the fourth quarter of the given distance, DFA separates in the lowest number of cases. The analysis showed that the DFA caliber decreases along with the separation height, i.e. the lower separation,the smaller the caliber. It can also be noticed, and it is also stressed in literature, that lateral branches, in particularly internal and external circumflex arteries (*a. circuflexa femoris medialis et lateralis*), are separated as the FA branches with the case when the DFA separation is low (in third and fourth quarter).

Table 1 demonstrates the separtion height of DFA in relation to the quarters of inguinal ligament – top of femoral trinangle distance, expressed in percentages, by sex (male and female) and by side (left and right).

Deep femoral artery originates in the first quarter of the distance (top of femoral triangle – inguinal ligament) with male fetuses, out of which 56 % of the cases in the right side, and 63 % of the cases in the left side. With female fetuses, DFA separated in the first quarter in the right side with 52.2% of the cases, and in the left side with 56% of the cases.

In the second quarter, deep femoral artery with male sex originates in the right side with 36.5% of the cases, while in the left side it originates with 29.5% of the cases. As for the female fetuses, deep femoral artery originates with 25.5% in the second distance quarter in the right side and with 29% of the cases in the left side. It was established that deep femoral artery with male fetuses separated in the third quarter in 7.5% of the cases in both right and left analyzed sides. With the examined female fetuses, deep femoral artery originated in the third distance quarter in the right side with 18.5% and in the left side with 10% of the cases. In 5 % of the female fetuses, deep femoral artetry separates in the fourth quarter in each right and left side. There was no recorded DFA separation with male fetuses in the fourth quarter of the given distance.

Table 2 shows the ratio of the DFA separation by quarters without disagregation of the fetus by its sex and sides. It was found that 59.5% separates from the first quarter, 27.5% from the second , 11% from the third and only 2% from the fourth quarter.

The concept of DFA origin variences is significant, not only for surgery of the front femoral region, but also with interpretation of arteriography of the lower extremity arterial system. The literature also points out that variances in the hight of DFA origin influence the distribution of their lateral branches. If DFA is separated in the third or fourth quarter of its lateral branch, the circumflex arteries are separated as the lateral branch of the FA. It is also found that if DFA separates from third or fourth quarter, its caliber decreases, which will significantly influence the vascularization of the slices they are nourishing. This is important for succesful planning and clinical slice appliance. The caliber and distribution of DFA lateral branches have a significant impact on the quality of vascularization of the muscle-skin slices they are nourishing (18,19,20,21).

Our results, which point out that the largest percentage of DFA separation on the fetal material is in the first quarter, do not comply with literature data on the adults (7). These findings may be explained by the fact that lower extremities during prenatal period of life receive, via fetal blood ciculation, less oxygenated blood and that is why they are weakly developed. Their development and elongation is more intensive in the postnatal life, therefore the FA is elongating and thus the beginning of DFA is declining lower in relation to the inguinal ligament. From the very birth until 12 years of age, the lower extremities grow faster than other parts of the

Table 1. Separation height of the deep femoral artery in relation to given inguinal ligament – top of femoral triangle distance

MALE N = 41							
RIGHT				LEFT			
1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4
56%	36.5%	7.5%	Θ	63%	29.5%	7.5%	Θ
FEMALE N =59							
RIGHT				LEFT			
1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4
52.5%	25.5%	18.5%	3.5%	56%	29%	10%	5%

Table 2. Separation height of deep femoral artery in relation to given distance with all analized cases

↔	**1/4**	**59.5%**
↔	**2/4**	**27.5%**
↔	**3/4**	**11%**
↔	**4/4**	**2%**

body. Only in the 12th year of life the proportion of the parts of body is the same as with the adult person, and it has the patrticular importance for the clinical practice (9).

Conclusion

In our research, DFA separated from FA most frequently in the first quarter of the inguinal ligament – top of femoral traingle distance with both sexes.

The largest percentage of DFA separation is in the first quarter, in both right and left sides.

DFA separation from FA in the second quarter is a half smaller, in the third quarter it is 11% and in the fourth quarter it is only 2 % (with female sex).

The lower was DFA separation in relation to inguinal ligament, the smaller was its caliber and its lateral branches were distributed from the femoral artery.

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ANALIZA VARIJACIJA POČETKA DUBOKE BUTNE ARTERIJE NA FETALNOM MATERIJALU

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Kratak sadržaj: *Literaturni podaci ukazuju na varijabilnost u visini odvajanju duboke butne arterije od butne arterije. U cilju prevencije nekroze režnjeva, a posebno mišića zatezača butne fascije, prilikom korišćenja u plastičnoj i rekonstruktivnoj hirurgiji, poznavanje varijacija u visini nastanka duboke butne arterije i distribucije njenih grana ima veliki značaj. Istraživanja su učinjena na 100 fetusa iz zbirke Instituta za anatomiju Medicinskog fakulteta u Nišu, koji su injicirani Mikropakom ili Lateksom, fiksirani i čuvani u 10% rastvoru formalina. Istraživanja su učinjena metodom disekcije pod lupom i pod operacionim mikroskopom. Svi karakteristični slučajevi su fotografisani, a dobijeni podaci statistički obrađeni.*

Utvrdjeno je da duboka butna arterija u najvećem broju slučajeva nastaje u prvoj četvrtini određene distance (preponska veza-vrh butnog trougla) i kod muškog i kod ženskog pola, kao i kod desne i leve strane. Najmanje je zastupljeno odvajanje od četvrte četvrtine; ovaj tip je utvrđen samo kod ženskog pola. Odstupanja u visini nastanka duboke arterije buta dovode i do varijacija u distribuciji njenih bočnih grana kao i u promjeru njenog kalibra.

Ključne reči: *Fetusni materijal, duboka arterija buta, visina odvajanja*