

# THE VASCULARISATION DEVELOPMENT AND SOURCES OF VASCULARISATION FOR THE ANTEROLATERAL ABDOMINAL MUSCLES

L. L. ONISĂI<sup>1</sup> M. GREAVU<sup>2</sup>

**Abstract:** *The present paper aims to do an objective research over the ontogenesis process of the vascularisation of the anterolateral abdominal wall and, using the results obtained, to verify the validity of the theories formulated until now; it also aims to elaborate a theory regarding the process, if the analysis elements allow it. To fulfill the objectives of this study, we have used dissections, video images through transillumination, photographic pictures and histological studies. We have carried out a microscopic study that aims to minutely observe the processes that happen in dynamic time from early ages on. We have also run a macroscopic study through the inspection of the vessels at the level of the anterolateral abdominal wall.*

**Key words:** *somitic, mesenchyme, vascularization.*

## 1. Introduction

Because of a great number of theories concerning the genesis of the vascularisation of the trunk, the present work aims to verify which theory is valid and possibly, by using the results, to develop a theory concerning the development of the vascularization of the abdominal muscle.

## 2. Materials and Method

This study was carried out on a number of 15 subjects: 9 adult embryos and fetus and 6 human adult corpses. The macroscopic study involved the inspection of the anterolateral abdominal wall,

supplemented by the dissection, the parietal and umbilical morphometry and the study by transillumination. The microscopic study consisted of the prelevation of parts of the embryos, fetus and adults studied macroscopically. The research team carried out Hemalum Eosin Sofran colouring, the Van Gussone method and silver impregnation. We also used the method using the lemon juice and gold chloride according to Roschin. Moreover, for the observation of the vessels of the right abdominal muscle, we used for the compounds, the method of China ink injection, clarification, followed by transillumination and photography.

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<sup>1</sup> Department of Anatomy, Faculty of Medicine, *Transilvania* University in Braşov.

<sup>2</sup> Ph. D. student at *Transilvania* University in Braşov.

### 3. Results

At the same time with the swing of the cephalic and caudal folds, followed by the closure of the embryonic body, the parietal vascular and nervous elements in the ventral wall are differentiated. They are well individualized starting with the seventh week, so that by the occurrence of the fascicular structures of the right abdominal muscle, the vessels and the nerves appear in the conjunctive intrafascicular tissue [14].

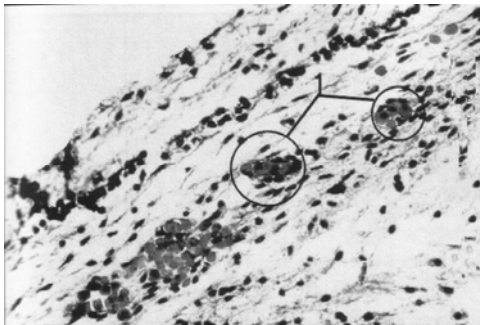


Fig. 1. *Blood vessels in formation 18 mm embryo (week 7), case 11, objective 40x, VG colouring; in parasagittal superumbilical section.*

We can see the subcutaneous zone of the anterolateral abdominal wall where, in parallel with muscular differentiation, in a major area as compared to the fascie exoabdominale, blood vessels appear, the lumen of which contains red blood corpuscles [6], [8-9].

The differentiation of the vessels of the right abdominal muscle is done in parallel with the transformation of the myoblasts into plasmodiums in the weeks 8-14.

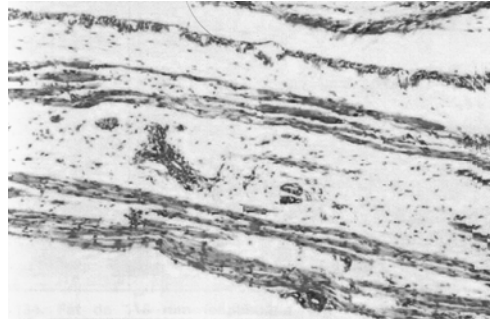


Fig. 2. *87 mm fetus (week 12), case 38, in sagittal superumbilical section (all along the muscle), HE colouring, objective 10x.*

There are vessels and nerves which belong to the muscle, in conjunctive tissue between the fascicles of the right abdominal muscle [1].

By the dissection of the thoracic-abdominal wall at the fetus of 30-34 weeks, the presence of the intern thoracic arteries is highlighted; these arteries are trifurcated at the end, each one in a medial branch, a median branch and a lateral one.

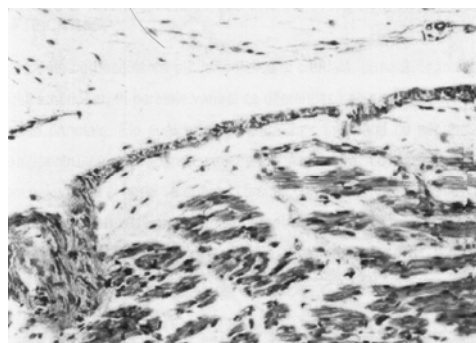


Fig. 3. *87 mm fetus (week 12), case 38, in sagittal section in the superumbilical portion, HE colouring, objective 20x.*

In the mesenchyme found between the muscular fascicles we can see: a ramified vessel flanked by three nervous threads. They belong to the conjunctive interstice of the right abdominal muscle.

The first two final branches of the intern thoracic artery take part in the vascularization of the right abdominal muscle [4], [12]. The higher epigastric artery engages between the right abdominal muscle, located at the anterior side, and the posterior strip of its sheath located at the posterior side, having a path nearly identical to that of the preperitoneal arteries located between the peritoneum and the posterior face of the sheath of the right abdominal muscle. Between the two arteries there are anastomosis which segmentally pass by the posterior strip of the sheath of the right abdominal muscle and in this manner the two arteries (the higher epigastric artery and the preperitoneal one) irrigate the right abdominal muscle too. Crossing the distance from the xiphoid process to the umbilical point, the two arteries finish in the arterial periumbilical anastomotic network. In the three zones of the right abdominal muscle, the arterial device has large polygonal holes formed of the fine vessels of capillary diameter.

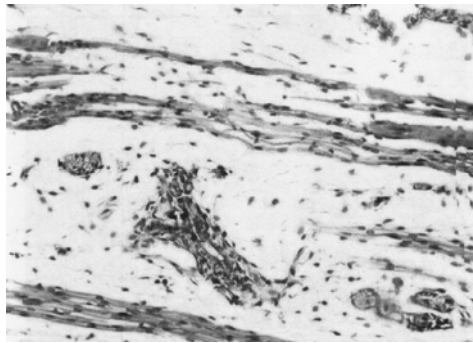


Fig. 4. 115 mm fetus (week 14), case 40, in cross section in the superumbilical portion, HE colouring, objective 20x.

Between the muscular fascicles there is a vessel of large gauge; there are also parietal vessels which are transversely divided and take part in the vascularization of the right abdominal muscle [11].

Each muscular fascicle is surrounded by 8-10 capillary vessels of continuous

type [2]. While aging, the vascular holes which are formed between muscle fibers rarefy. Their diameter increases gradually. The system of the intern thoracic arteries and the lower epigastric arteries represent the main sources which ensure the vascularization of the right abdominal muscle. The superumbilical portion of the right abdominal muscle is more vascularized than the underumbilical portion; this is an area containing a parallel distribution between muscle fibers and the small arteries at the level of this muscle.

#### 4. Conclusions

The anterolateral abdominal wall contains elements coming from the primary mesenchyme, secondary mesenchyme, endoderm, ectoderm [2]. The vessels and the nerves appear the first on this level. The vascularization of the right abdominal muscle is mainly assured by muscular branches of the lower epigastric artery and by branches of the internal thoracic artery. The anatomical structures of innervation and vascularization of the anterolateral wall develop successively [8]. They appear in the interstice between the former and posterior muscular plans corresponding to the development of the former abdominal muscles. In the case of a much reduced number of subjects (2 adult fetus and 2 subjects) we found a variable number of openings in the posterior strip of the sheath of the muscle abdominal right determined by the branches anastomotic between the higher epigastric artery and the preperitoneal arteries [13]. At an obese adult subject, preperitoneal grease penetrates and widens these openings, acting in such a manner that they become real; the grease gets to the space delimited by the posterior strip of the sheath of the right abdominal muscle and the muscular mass on which it creates compression. In the adults preperitoneal grease can transmit

prolongations in the sheath of the right abdominal muscle and towards the thorax. As of the period of foetus, the intern thoracic artery is trifurcated constantly in a medial branch (the preperitoneal artery), a middle branch (the higher epigastric artery) and a lateral branch (the musculophrenic artery). The first two branches take part in the vascularization of the superumbilical portion of the right abdominal muscle. The preperitoneal arteries, not mentioned in the literature of specialty, are branches of the intern thoracic artery around which preperitoneal grease accumulates [3]. The arteries which ensure the vascularization of the anterolateral abdominal wall ramify richly between the fascicles of the right abdominal muscle. Interfascicular anastomosis form intermittent arcades.

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