Arteriovenous Anastomoses of Major Crural Vessels in Humans

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Arteriovenous anastomoses of the major crural vessels were studied postmortem. The revealed anastomoses were examined by histological technique.

Key Words: *arteriovenous anastomoses; major crural vessels*

The term "arteriovenous anastomosis" (AVA) is widely used by not only angiologists and vascular surgeons, but also other professionals dealing with the treatment of vascular diseases of the lower extremities.

Traditionally, this term is used for description of microcirculation vascular network and denotes circulation bypass excluding exchange capillaries. However, recent studies prompt to use this term for macrocirculation as well [1,4-6,8]. The majority of authors related their findings to varicose disease of the lower extremities and considered them as pathologic structures [5,7,8]. Our pathoanatomic studies revealed AVA in major vessels of the lower extremities virtually in all died individuals irrespective of the cause of their death [2].

Few papers are available, which examine vascular bypass at the level of the major vessels. The pathophysiological role and anatomical structures of gross bypass also received little attention [3].

Our aim was to study the typical AVA of major crural vessels by anatomic and histological techniques.

MATERIALS AND METHODS

The arterial vascular bed in the lower extremities was examined postmortem in humans. The search for AVA was performed in the anterior and posterior tibial and peroneal arteries. The histological examination was performed on typical AVA found in the upper third of the crus. The specimens were fixed in 2.5% glutaraldehyde on phosphate buffer (pH 7.2, 4-5°C) for 12-24 h, washed in 5% glucose on the same buffer (pH 7.2), and postfixed in 1% osmium acid (pH 7.2) for 2 h. Dehydration was performed in ascending alcohols. The specimens were treated with propylene oxide and embedded in Epon and Araldite. Semithin sections (3 μ) were prepared on an LKB-III microtome, contrasted with methylene blue, and examined under a Karl Zeiss JENAVAL microscope.

RESULTS

The lower extremities of cadavers (n=58) were examined irrespective of etiology of the diseases. AVA were predominantly found in the crural region. Typi-

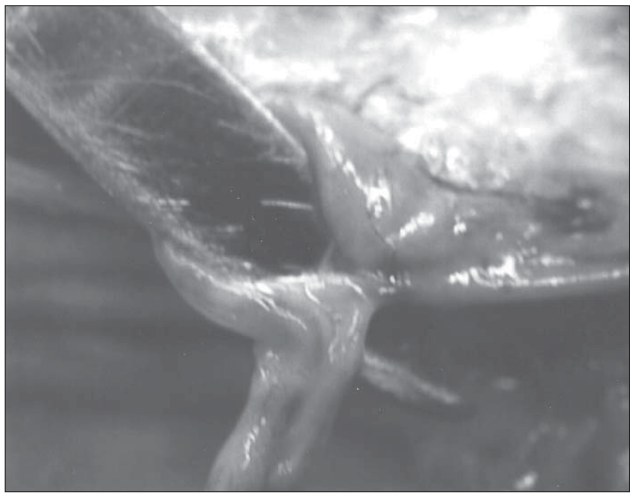

Fig. 1. Anatomic preparation of arteriovenous anastomosis in the upper third of human crus, ×1.75.

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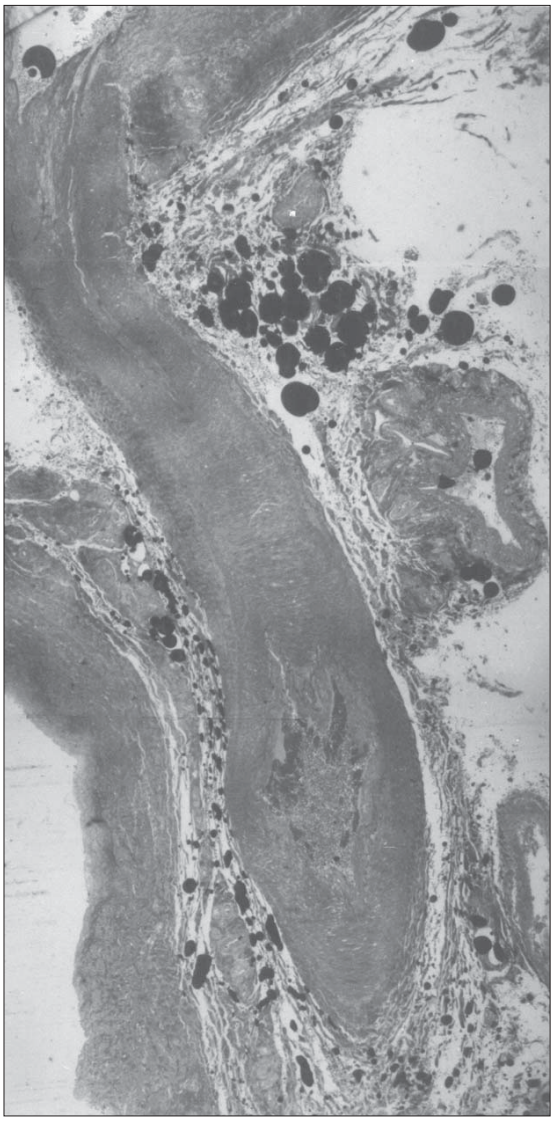

Fig. 2. Entry of arteriovenous anastomosis into the vein, ×7.6.

cal AVA is a short vessel with pronounced smooth muscle wall, which goes perpendicularly from the major artery to the corresponding vein (Fig. 1).

Histological study showed that AVA is an intermediate type vessel with well-developed media and primarily circular arrangement of most smooth muscle elements in the media. The wall of AVA has three well-defined layers (Figs. 2 and 3). The internal elastic membrane separates tunica intima from the tunica media, whose thickness surpasses that of other layers and

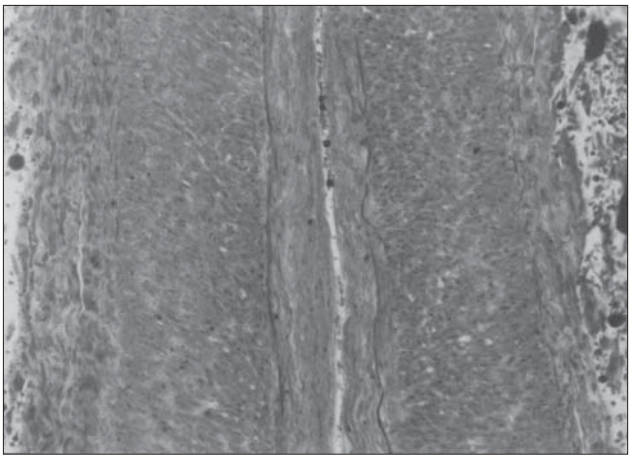

Fig. 3. The wall of arteriovenous anastomosis, ×30.

little varies along the vessel. It should be noted that this thickness corresponds to that of smooth muscle wall in the major vessels. Adventitia of AVA consists of connective tissue elements. The blood vessels of different diameters were seen in the loose connective tissue accompanying the adventitia.

Thus, AVA are the structures connecting the major vessels, which can be found in normal organism. In the lower extremities of humans, they are most frequently located below the popliteal fossa. AVA are intermediate type vessel with well-developed smooth muscle media.

The structure of AVA ensures adequate regulation of the macrohemodynamics in the lower extremities and can provide the basis for many pathophysiological processes during the diseases of the major vessels in the lower extremities.

REFERENCES

1. I. G. Dutkevich, *Vestn. Khir.*, No. 8, 40-45 (1961).
2. V. M. Koshkin and V. R. Zimin, *Angiol. Sosud. Khir.*, **7**, No. 3, 92-97 (2001).
3. L. N. Sidorenko and Yu. I. Kazakov, *Klin. Khir.*, No. 7, 20-23 (1981).
4. D. Bergqvist and S. Bornmyr, *Vasa*, No. 15, 241-244 (1986).
5. K. H. M. Haeger and L. Bergman, *Angiology*, No. 14, 473-479 (1963).
6. H. Haimovici, C. Steinman, and L. H. Caplan, *Ann. Surg.*, No. 164, 990-1002 (1966).
7. A. Kanter, M. Gardner, and M. Isaacs, *Dermatol. Surg.*, No. 21, 885-889 (1995).
8. L. Schalin, *Acta Chir. Scand.*, No. 147, 409-420 (1981).