FOLIA MEDICA CRACOVIENSIA
Vol. LV, 4, 2015: 91–97
PL ISSN 0015-5616

Certain remarks on blood supply of normal human uterine corpus — corrosion casting and SEM study

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Abstract: Corrosion casting and scanning electron microscopy are currently best available technique which allows observation of microvascular bed of different anatomical structures and obtaining quasi 3-D pictures, necessary for reconstruction of microvessels. Application of synthetic resins, which fill practically the whole vascular bed enables profound analysis of such obtained specimens.

Key words: human uterus, blood supply, corrosion casting, scanning electron microscopy.

Introduction

Blood supply of human uterus raised interest of many scientists for many years. Nowadays the interest is surviving its renaissance because of new methods of uterine fibroid treatment — fibroid embolization — usually using the uterine artery as a main access [1]. The main artery which supplies the viscera of the pelvis — internal iliac artery — typi-

cally divides into two divisions: anterior and posterior. Dominant vessels of the posterior division is the superior gluteal artery The main vessels of the anterior division is the inferior gluteal artery. Other more significant branches are: uterine artery in the females, inferior vesical, middle rectal and the internal pudendal arteries.

Less than 50% of patients in which embolization of the uterine artery was performed, this vessels was first branch of the anterior division [2] which arose more antero-laterally than antero-medially as it is said in anatomical textbooks [3].

There are numerous anatomical variations of origin of the uterine artery, three of them are the most frequent: in about 40% of females internal iliac artery divides into three branches: anterior and posterior divisions and the uterine artery. In 5% uterine artery originates from internal iliac artery above its subdivision into two stems, in 10–15% arises together with the inferior vesical artery.

There is an anatomical anastomosis between the uterine and ovarian arteries but clinically it is not so commonly confirmed and during embolization it was observed in 10–15% only. In about 1% of females subjected to embolization the uterine artery was unilaterally absent. Complete lack of uterine artery was present in 0.3%, while in next 3% of cases one could observe single, minute vessels arising from the main trunk of the internal iliac artery [4].

The course of the uterine artery can be divided into three segments: descending, transverse, and ascending. First fragment runs from the its origin on top of the obturator fascia and reaches the base of the broad ligament. Transverse portion runs medially along the base of the broad ligament, crosses ureter about 2 cm far from the uterine cervix and 1–2 cm lateral to the lateral vaginal fornix. Ureter arches posterior and inferior with respect to the uterine artery. The ascending portion arises along the lateral border of uterus between two layers of broad ligament, its terminal portion ascends till the level of ovarian ligament and divides into branches supplying ovary and the oviduct [5]. Transverse and ascending part gives rise to lateral branches which subsequently divide into anterior and posterior arcuate arteries. They supply the adjacent anterior and posterior uterine walls, or if they do not split, then supply both walls at the same time. Arcuate arteries give rise to radial arteries which run centripetally and peripheral branches which course centrifugally, toward the surface of the uterus. At the border between the myometrium and endometrium radial arteries give rise to straight (basal) and spiral arterioles. Both spiral and straight arteries give rise to vessels which divide into capillaries, which form in the superficial layer of endometrium rich submucous plexus. Peripheral branches supply distal layers of the myometrium and the serosa. There are numerous bilateral anastomoses between right and left branches [6].

Venous drainage begins in venous subendometrial plexus, similarly rich plexus is located in the myometrium. Both plexuses are united by minute veins. Venous flow begins also in the venous dilatations which receive capillaries [7]. Venous lakes are seen mostly in functional layer of endometrium. The venules draining plexuses and venous lakes run

peripherally, forming common junctions. Venules empty into arcuate veins, localized on both sides of the uterus, which drain blood toward uterine veins or non-homogenous uterovaginal venous plexus. This plexus is usually a tributary of the internal iliac vein.

Material and methods

The study was carried out on 67 human uteri of females aged between 36–54 years, which died because of diseases not associated with the internal female genital tracts, obtained during autopsies. The study was approved by local Ethical Committee. The whole material was collected upon 12–22 hrs from the moment of decease. The protocol used was described in details in [8, 9].

Results and discussion

Corrosion casting technique aided by scanning electron microscopy is currently the best method to study casts of microvessels in quasi 3-dimensional character [10]. Still at the moment of injection of the uterine vascular bed with synthetic resin (Mercox CL-2R) one can see filling of all vessels, even if the procedure was unilateral only [6]. On the transverse sections of the uterine corpus, including its anterior and posterior walls, we could see numerous arcuate arteries (1.4–1.7 mm) (Fig. 1–3).

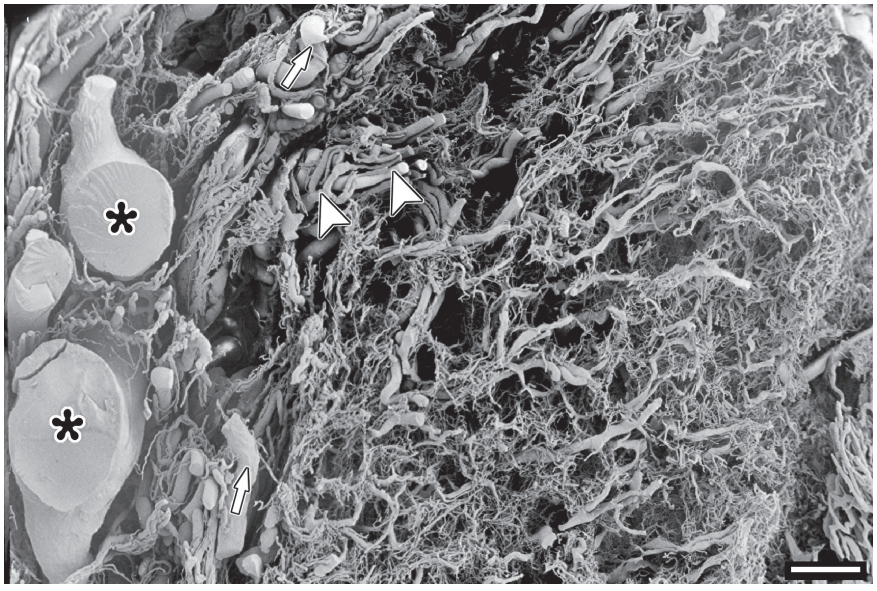

Fig. 1. Corrosion cast. SEM. Uterus of 50-year old female. Coronal section of the corpus. On the left side visible zone of arterial branches of uterine arteries (*), arcuate arteries (↑), and radial arteries (⌂). On the right side visible endometrial vessels. Bar = 1000 μm.

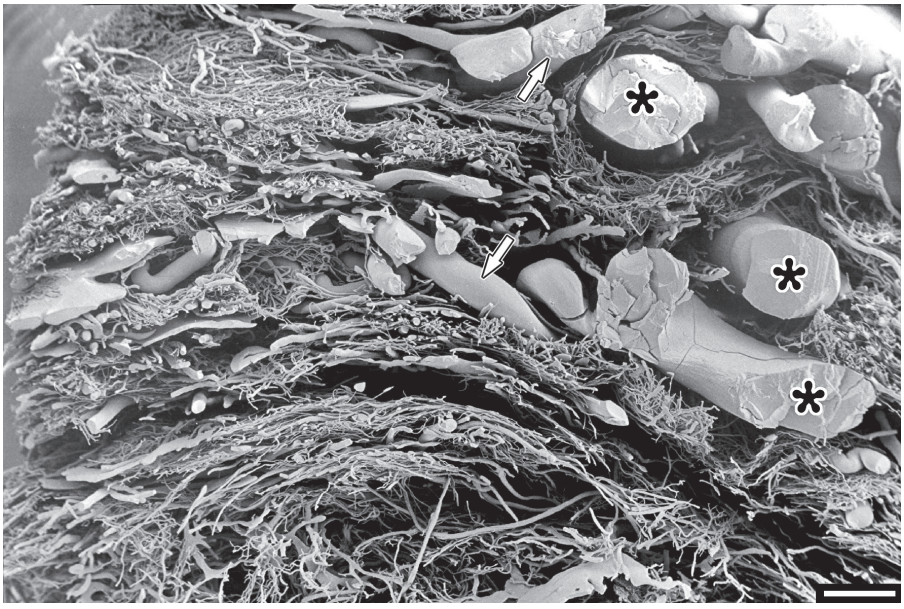

Fig. 2. Corrosion cast. SEM. Uterus of 50 year old female. Sagittal section. External layers — visible arterial branches (1.5–2 mm) (*) with arcuate arteries (↑). Bar = 1000 μm.

Fig. 3. Corrosion cast. SEM. Uterus of 50-year old female. Coronal section of the corpus. On the right side of the microphotograph visible minute arteries and veins in the external coat of uterus (↑). On the left side — capillaries of the endometrium (⌂). Bar = 1000 μm.

Branches of the arcuate arteries — the radial arteries, arose chaotically and penetrated toward endometrium (Fig. 4).

In the entire myometrium one could observe relatively rich capillary plexus. It was present also within the superficial layer of uterine corpus, and specially rich was in the endometrium (Fig. 5).

Vein of the uterine corpus ran in company arteries, although the mostly formed separate arrangements. Endometrium of uteri studied measured 3.6–8 mm. It contained chaotic pattern of blood vessels, mostly capillaries, but also arteries and venules. We have noticed also minute venous dilatations (~150–420 μm), which had a form of finger-like, flattened digitations, which received numerous venules (35–80 μm) and capillaries (~16 μm) (Fig. 6).

Application of autopsy material used for SEM studies is still scarce [11]. What is important this method may be successful only after elimination of about 63% of material only during initial stages of the experiment [12]. Our findings confirm datas observed by other authors with special respect to observation carried out by Schlegel, Farrer-Brown and Holmgren [7, 13–15].

We can conclude that most interesting findings are associated with measurements of the vessels which supply uterus — since their caliber is of main importance during uterine fibroid embolization [16].

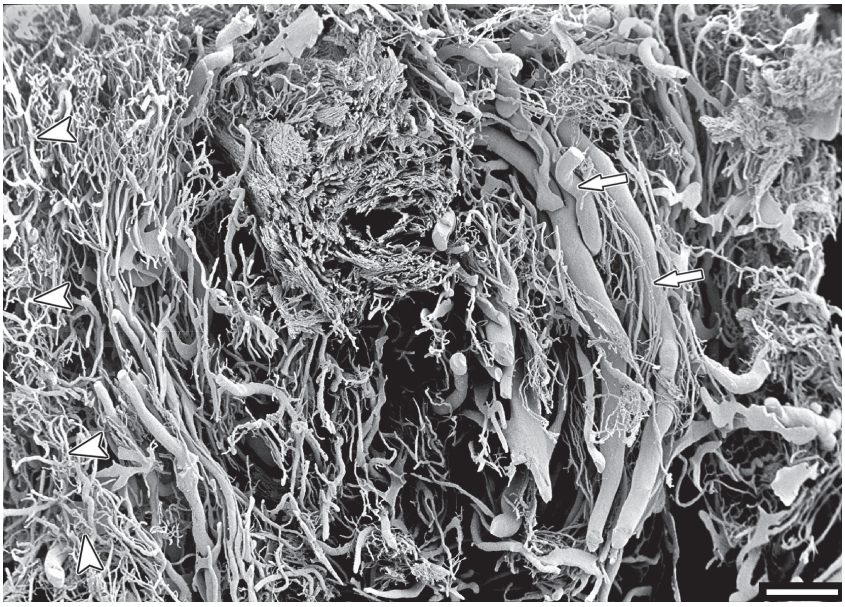

Fig. 4. Corrosion cast. SEM. Uterus of 50-year old female. Coronal section of the corpus. Radial arteries (↑) and capillary plexus. On the left side of microphotograph visible endometrial vessels (⌂). Bar = 1000 μm.

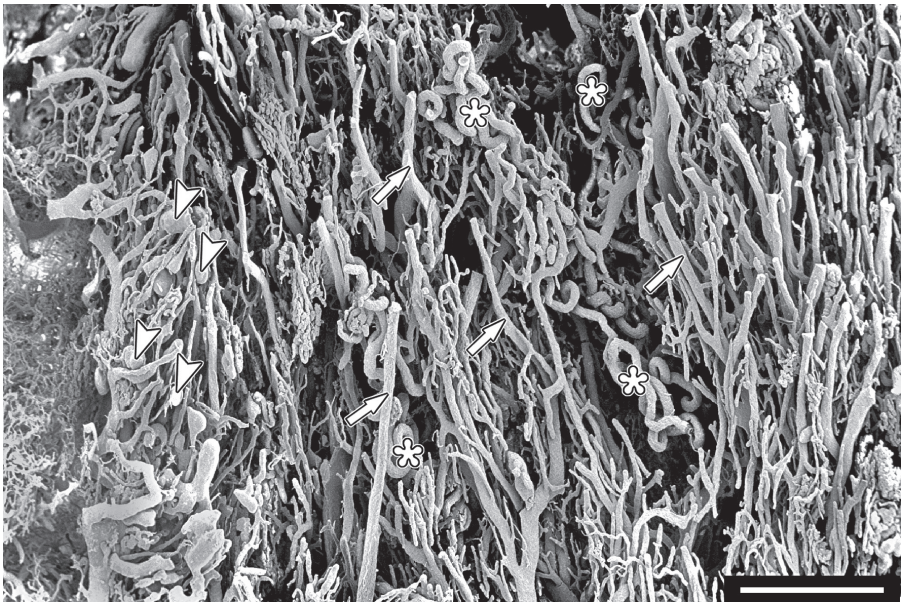

Fig. 5. Corrosion cast. SEM. Uterus of 41-year old female. Sagittal section. Spiral (*) and straight (↑) arterioles ~70 μm. On the left side of microphotograph numerous artifacts (⌂), mostly extravasations. Bar = 1000 μm.

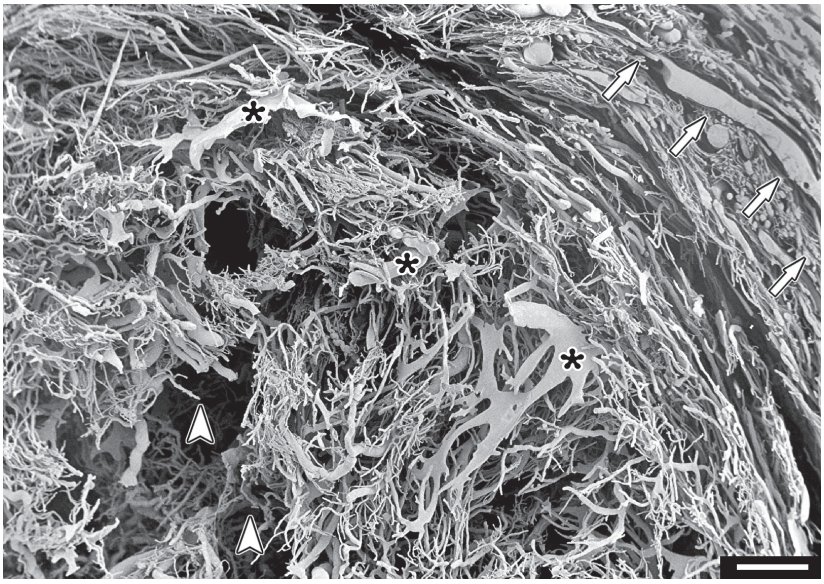

Fig. 6. Corrosion cast. SEM. Uterus of 38-year old female. Venous dilatations within endometrium (*) — on the right visible external vessels (↑). On the left side of microphotograph visible fragment of uterine cavity. Bar = 1000 μm.

Conflict of interests

None declared.

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