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BLOOD SUPPLY OF HUMAN UTERINE CERVIX — A SEM STUDY

Abstract: Aim: The main goal of this study was assessment of vascular structure of human uterine cervix.
Materials and Methods: The study was carried out on 25 human uteri of females aged 25–45, collected upon autopsy. Vessels were injected with synthetic resin, next corroded and coated with gold, finally observed using scanning electron microscope.
Results: On a sagittal section we have distinguished several zones in the vascular picture of the uterine cervix consisted of differently arranged veins, arteries, arterioles and capillaries. Due to technical reasons we were unable to receive a picture of vascular composition of cervical uterine canal on transverse section.
Conclusions: Scanning elector microscopy is a method which might be applied to study the structure of human uterine cervix.

Key words: human uterine cervix, blood supply, SEM, microcorrosion.

INTRODUCTION

Cancer of the uterine cervix belongs to the leading malignancies in all over the world. Most of anatomical observations on the vasculature of uterine cervix concentrate on surface, subepithelial vessels, for colposcopic reasons [1–3]. Blood supply of human uterus was a subject of several studies [4–7], both normal and under pathological conditions [8–14], although not too much attention was paid to the uterine cervix. Blood supply of surface epithelium of uterine cervix was also the subject of several anatomical studies [15–17]. Deep blood vessels supplying uterine cervix were also a subject of numerous studies, however methods used allowed mostly qualitative assessment. SEM and microcorrosion enable almost 3-D evaluation of vascular network and seems to be best currently available method.

MATERIAL AND METHODS

Twenty five uteri were obtained upon autopsy of women aged 25–45 years, deceased due to causes not related to disorders of the reproductive system. The study was approved by the Ethics Committee of the Jagiellonian University Medical College (KBET/121/8/2007). The material was collected 6–24 h after death. Each uterus together with ovaries and cervical portion of the vagina was removed in such a way that relatively long fragments of uterine and ovarian vessels (arteries and veins) were retained.

Immediately after removal, the uteri were perfused via the afferent arteries with prewarmed (37°C), heparinized saline (12.5 IU/ml heparin; Polfa, Poland, containing 3% dextrane (70kDa) and 0.025% lidocaine (Lignocaine; Polfa, Poland), until the fluid outflowing via the veins was completely transparent (~5 min). Next perfusion was continued using a solution of 0.66% paraformaldehyde/0.08% glutaraldehyde (Sigma, Germany) in 0.1 mol/l cacodylate buffer, pH 7.4 supplemented with 0.2% lidocaine. Finally, the vascular system was injected with 60–80 ml of Mercox CL-2R resin (Vilene Comp. Ltd. Japan) containing 0.0625 mg/ml methyl acrylate polymerization initiator (Vilene Comp. Ltd. Japan) and the uteri were left in a warm water bath (56°C) for several hours to allow polymerization and tempering of the resin.

When the polymerization was completed, the uterine tissues were macerated for 5–6 days by repeated baths in 10% potassium hydroxide at 37°C followed by washing with warm (50–55°C) running tap water. The obtained vascular casts were washed for the next 4–5 days in multiple changes of distilled water under mild vacuum conditions, cleaned in 5% trichloroacetic acid for 1–2 days, washed again in distilled water for 2–3 days and freeze-dried in a lyophilizer (Liovag G2; Aqua Fina, Germany).

The freeze-dried casts were examined macroscopically, gently dissected [18] to expose the vasculature of uterine cervix and stored in an exiccator containing phosphorus pentoxide until the microscopic examination. They were then mounted onto copper plates using colloidal silver and 'conductive bridges' and coated with gold. The casts were examined using a JEOL SEM 35-CF scanning electron microscope at 20–25 kV (Jeol, France).

RESULTS AND DISCUSSION

The study was designed to show the angioarchitecture of 'pericervical' zone of human uterine cervix, with special attention to cervical canal and its nearest regions, using corrosion casting technique and scanning electron microscopy (SEM). Application of SEM and corrosion casting has been many times described by different authors [19] but so far it has not been a subject used to see the cervical vascular structures of human uterus in many cases [20–22].

In the sagittal sections of the uterine cervical corrosion casts, very close to the outer subserosal layer, immediately beneath the serous membrane, one could observe densely arranged vessels, both arteries and veins (~500 μm). More medially, about 1–2 mm, towards the cervical canal we could observe a zone of the largest vessels. Their caliber reached 0,8–1 mm. These vessels were encircled by avascular regions which were probably the result of corrosion of the perivascular connective tissue. System of cervical vessels consisted of three layers: a zone of the outer vessels, usually large arteries and veins, located very close or inside the outer membrane; zone of muscular layer; which were characterized by more loose and irregular arrangement and finally a zone of vessels located very close to the lumen of the cervical canal, which were more dense (Fig. 1).

Arteries and veins of the zone of large vessels were giving off the branches (~220–260 μm) which penetrated at right angles to the long axis of the cervical canal (Fig. 2). Next these branches were subdivided into small capillaries (~12–18 μm) forming a lauder-like system (Fig. 1), which consisted of vessels running partially parallel to long axis of cervical canal, next at right angles and finally parallel again (Fig. 3).

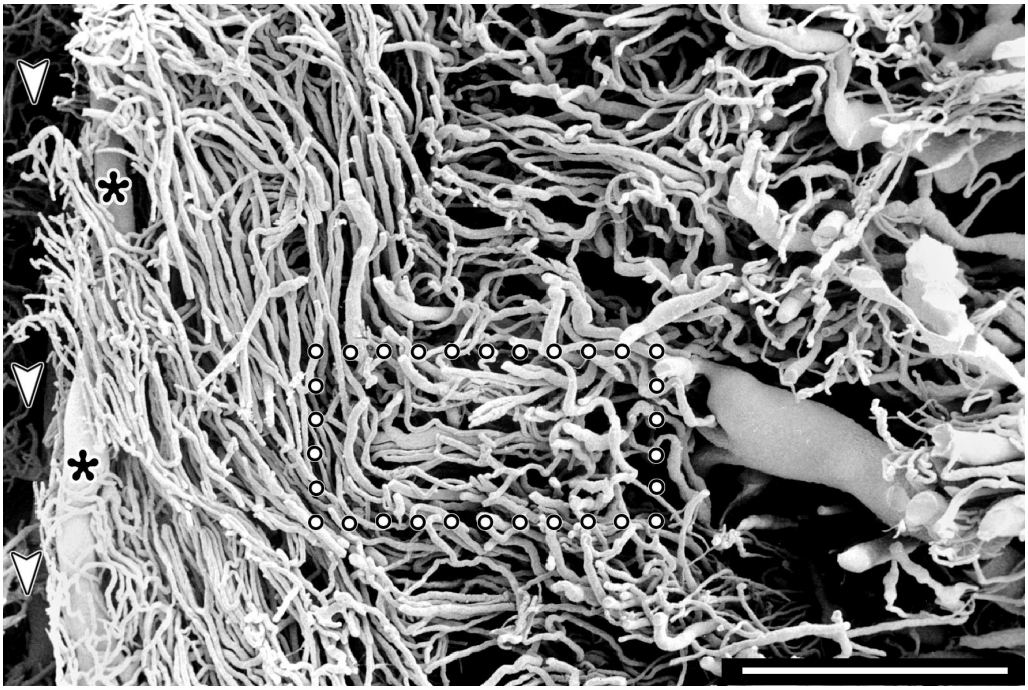

Fig. 1. Corrosion cast. SEM. System of small vessels close to the cervical canal. Lumen of the cervical canal on the left [▽], a vein in its neighborhood [✱], partially covered by loose capillary plexus. Muscular layer vessels on the right. The limited area [○○○], seen next on the Fig. 4. Bar = 1000 μm.

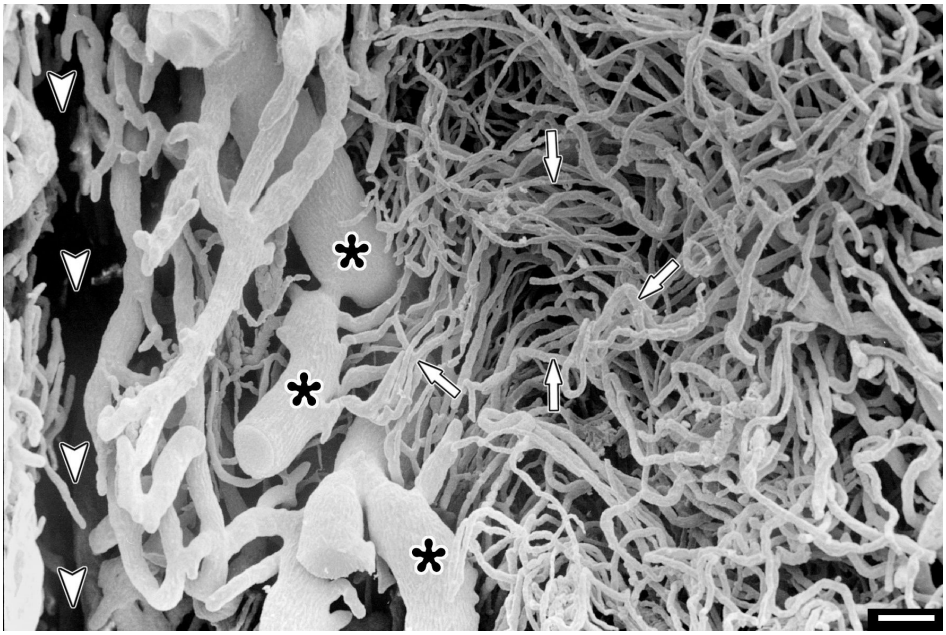

Fig. 2. Corrosion cast. SEM. Large vessels (predominantly veins) [✱] (~120–180 μm), united with the capillary vessels [⇧] (~9–15 μm) close to the lumen of cervical canal [∀]. Bar = 100 μm.

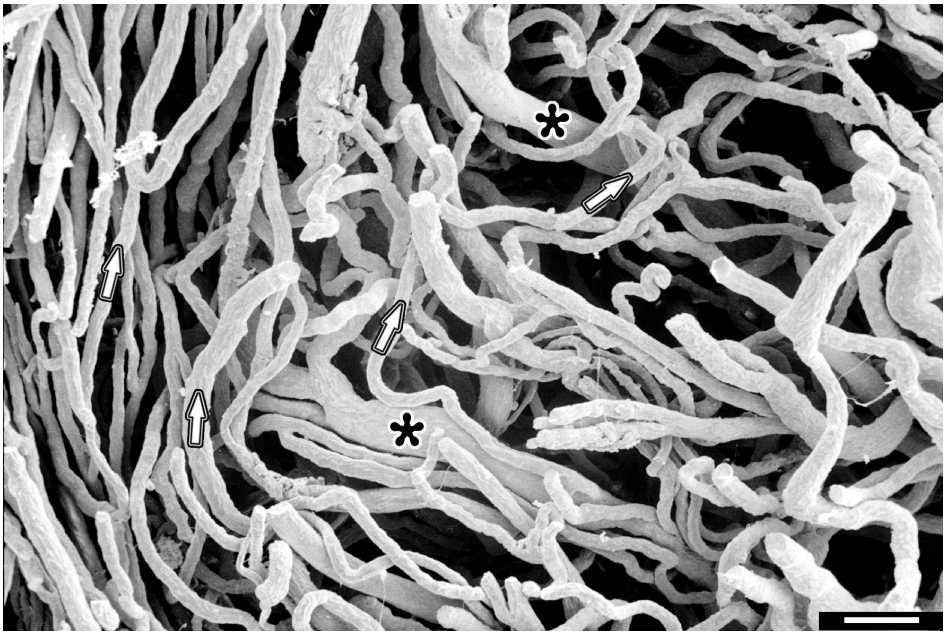

Fig. 3. Corrosion cast. SEM. Capillaries and venules (~18–32 μm). A ladder-like system. Bar = 100 μm.

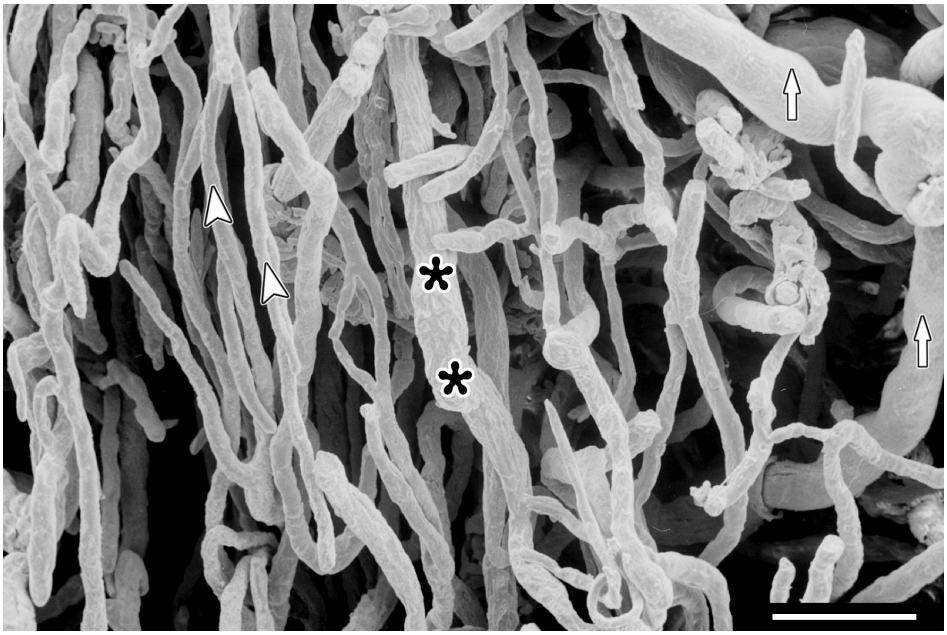

Fig. 4. Corrosion cast. SEM. Capillaries (~12–25 μm) running parallel, to the veins of the lumen of cervical canal, system of arterioles [▽] and venules [✱]. Bar = 100 μm.

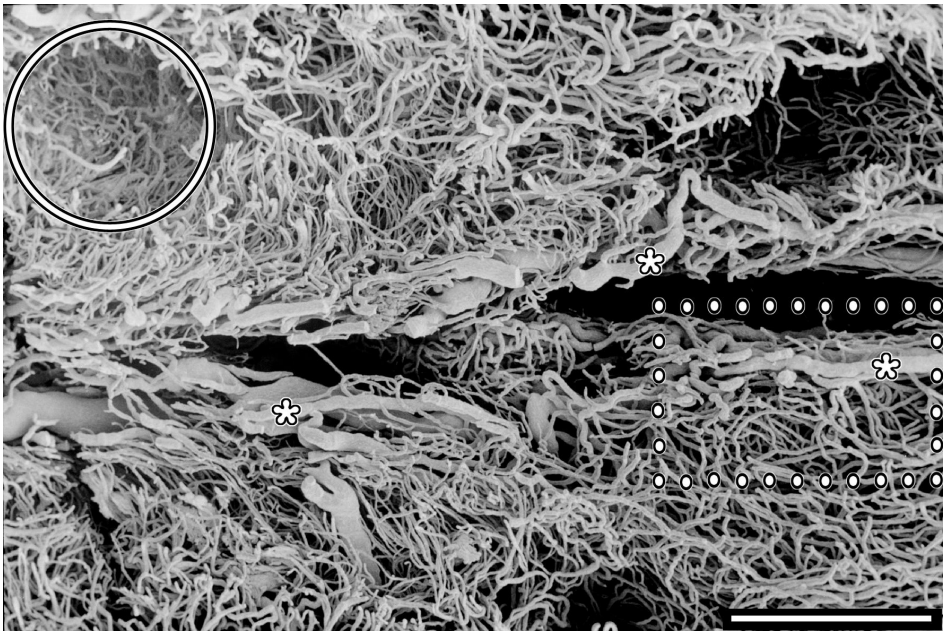

Fig. 5. Corrosion cast. SEM. Cervical canal close to the internal os. Large veins in the lumen of canal [✱]. Bar = 1000 μm.

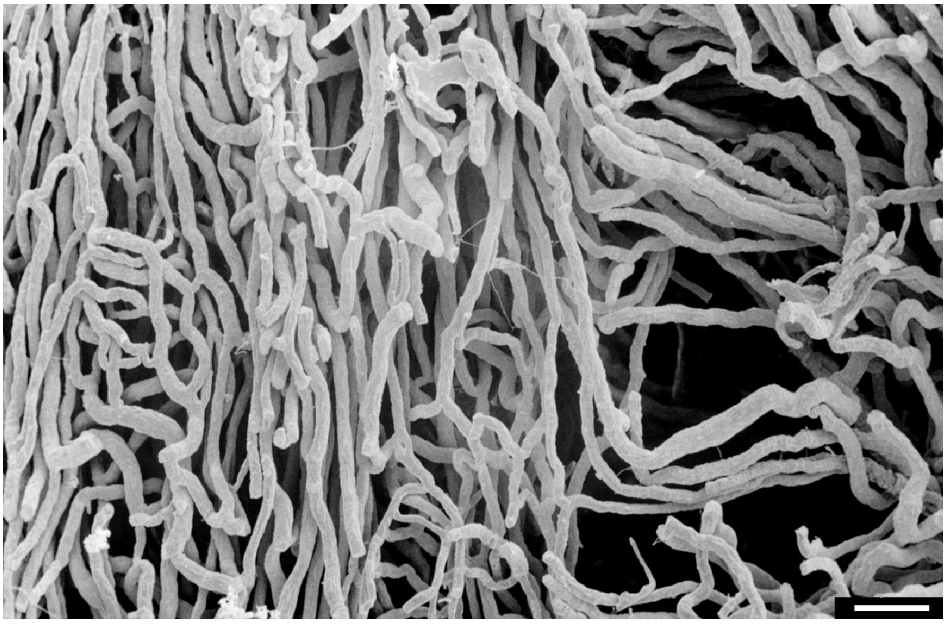

Fig. 6. Corrosion cast. SEM. Vessels of the cervical canal. Bar = 100.

The surface of the cervical canal was encircled by veins (~80–150 μm) which were almost ideally parallel to its long axis. They were neighboring to the ladder-like system, located lateral (Fig. 4). This system was supplied by numerous capillaries (~12–20 μm) (Fig. 5). Large veins located in the canal were covered by rather poor capillary plexus (Fig. 6). These plexuses were united with these veins as well as with more laterally located vessels. We did not observe similar enlargements of cervical veins as were seen in the corpus. We did not find arterio-venous anastomoses, too. In 1999 Cicinelli and Ziegler [23] applied for the first time a term 'portal system', describing a certain system which allows exchange of blood between human uterus and vagina, allowing condensation of different substances administered exogenously. Some of the pictures in our study show regions where small and large vessels (arteries and veins) may adhere — so maybe it is possible that countercurrent transport exists, as suggested by these authors. In 1994 De Souza *et al.* proposed classification of uterine cervical vessels based on magnetic resonance images. His observation was confirmed by our own studies. One of the most interesting observations in our study was the demonstration of pericanalicular system of veins.

Authors have used material obtained from autopsy — the quality was confirmed by our previous study [24]. In the current study we have observed numerous phenomena seen and confirmed by our earlier reports [25–28].

In conclusion: blood vessels of uterine cervix were arranged in the form of three layers: the outer — external layer which contained large vessels, both ar-

teries and veins; the middle layer which had the form of longitudinal systems running parallel to the axis of the cervical canal and the inner layer which consisted mostly of the capillaries. The lumen of the cervical canal was lined with the gentle network of capillaries which encircled large longitudinally running veins which were located very close to the lumen of the canal. The systems of the middle and inner layer were united by the transversely running stems. The corrosion casts of the inner layer contained avascular areas, which were probably caused by the cervical glands which were macerated during preparation of the corrosion specimens.

CONFLICT OF INTERESTS

None declared.

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