SCANNING ELECTRON MICROSCOPY OF THE URETERS IN CHILDREN WITH OBSTRUCTIVE URETEROHYDRONEPHROSIS

With the aim of scanning electron microscopy different parts of ureter in reflux and obstructive ureterohydronephrosis in the children has been studied. The differentials consisting in preserve of architectonics of distal parts of ureters in reflux ureterohydronephrosis were revealed. It was shown that a common structure of the ureter remained in this pathology. The differences in structures of distal and proximal parts of ureter expressed in the changes of inflammatory character and violation of safety epithelial layer, edema, inflammatory infiltration of lower layers, especially tunica muscularis. In the proximal part of ureter the wall became thin, because all layers became more thin, especially tunica mucosa and tunica muscularis.

Keywords: Scanning electron microscopy, ureter, ureterohydronephrosis, morphological changes

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Background

Obstructive ureterohydronephrosis is one of the most important problems of the pediatric urology. This is related to wide prevalence of disease, outstanding questions of the surgical treatment and high number of postoperative complications.

The congenital pathologies of the ureters occur in 2-3% of the autopsy samples. Among them there are found double ureters, obstruction of the ureteropelvic junction, noted more often in boys. Bilateral lesions took place in 20% of cases (Kvyatkovskaya, 2009; Leonova, 2009; Cotran, Kumar and Collins, 2004; Rosai, 2003).

Among the various types of the congenital anomalies of the urinary system in children the special place is given to the obstructive uropathy. Their prevalence accounts for from 1% to 5.4% of all children’s population (Kviatkovskaia, 2009; Leonova, 2009; Cotran et al, 2004; Rosai, 2003).

One of the leading conditions of choice of the operative intervention is morphological state of the organ fragments which are subjects to surgical correction or removal. In this connection the evaluation of the structure system of the pathologically changed organ is of great importance for choice of the surgical technique.

Now scanning electron microscopy is effectively used for investigation of the inner structures and vasculature of the urinary tract, including the ureter in experiment and in the clinical practice (Kvyatkovskaya, 1988; Douglas and Hossler, 1995; Dushi, Lutz, Hohlfeld, and Frey, 2002). However, the reports devoted to the morphological investigation of the ureters in ureterohydronephrosis are scant (Khem and Kormak, 1983; Ross, Romrell and Kaye, 2003).

The comparative investigations of the structure of different parts of the ureters with use of scanning electronic microscopy in children were not carries out in the obstructive ureterohydronephrosis. Causes that determine a dilated ureter compared to the rest of the urinary tract are still partly unknown. If concerning the exploration and the clinical diagnosis of these anomalies the important progresses have been made. The morphological research is still able to bring forth data that may help to reveal the pathology and may ease the planning tests for early diagnosis and further surgical interventions.
The above-mentioned seems to be good reasons for performance of comparative investigations of various parts of ureters in the patients with obstructive ureterohydronephrosis with use of scanning electronic microscopy.

**Material and methods**

The samples for scanning electronic microscopy were taken from tissue of the proximal and distal parts of ureters in obstructive ureterohydronephrosis (totally 11 samples) during operative intervention, fixed in the 2.5% solution of glutaric aldehyde on the phosphate and cacodylate buffer, finished fixing with 1% solution of the osmium tetraoxide after dehydration in the alcohol-acetone, then dried with method of critical point in the apparatus HCP-2 and were pulverized with the gold in the apparatus IB-2. The samples were studied in the electronic microscope Hitachi S405A. The written informed consents were obtained from the parents of all children prior to sample collection. Photographing from the monitor display was performed with use of digital photo camera Canon. The microphotographs were under computed processing on the computer Pentium IV Windows 2008.

**Results**

Scanning electronic microscopy (SEM) is the most objective method of evaluation of the three-dimensional structure of the biological objects.

We were performed comparative investigations with use of SEM on the walls of the ureters at the different levels in the obstructive form of ureterohydronephrosis. In the obstructive ureterohydronephrosis SEM investigations in the area of obstruction revealed the connective tissue vegetations, presented mainly, by fiber component (Figure 1).

In big magnifications the cellular elements of the connective tissue are visible well located between chaotic plexiform fibers and single muscular bundles (Figure 2). Proximal ureter parts have rather thin walls with good differentiated membranes of mucosa, muscular and two layers - internal longitudinal, external circular and adventitial tissues (Figure 3).

![Figure 1. Connective tissue growing in the area of obstruction in the obstructive ureterohydronephrosis. SEM x 100.](image1)

![Figure 2. Connective tissue fibers in the area of obstruction in the obstructive ureterohydronephrosis. SEM x 2000.](image2)

The internal surface of the mucosa membrane is lined with closely adhesive to each other monomorphic cells of the urotelium (Figure 4). In big magnifications on their lumen surface the short microvilli and folds of the plasmatic membrane are differed well.
The external surface of the adventitial membrane is lined by the layer of mesothelial cells with multiple folds and microvilli. These cells create uninterrupted layer with characteristic protrusion at the area of nucleus localization (Figure 5).

**Figure 3. The wall of the proximal part of the ureter in obstructive ureterohydronephrosis.**
SEM x 100

**Figure 4. The surface of the mucosa membrane of the proximal part of ureter in obstructive ureterohydronephrosis.**
SEM x 1000

**Figure 5. The external surface of the adventitious membrane of the proximal ureter in obstructive ureterohydronephrosis.**
SEM x 1000

**Discussion**

The morphological investigations of the distal and proximal parts of the ureters in the obstructive ureterohydronephrosis performed with use of scanning electronic microscopy allowed identification of the significant differences in the ultrastructure status of the appropriate part of the ureter and in these pathologies.

The cause of obstruction in the obstructive ureterohydronephrosis is the growing of the connective tissue components of the wall with loss of differentiation between mucosal and muscular membrane and only adventitious membrane identifies structurally.

In the loose connective tissue of the zone of obstruction as well as in the refluxing ureterohydronephrosis the walls of the proximal parts of ureters are thinned. The adventitious membrane undergoes the least changes in all studied parts.

The scanning electron microscopy has acquired significance and popularity among the medical specialists in the study of the microstructures of the body over the last time. In the medical literature there are found reports of a number of authors about their studies.
of the morphological structure and of the urinary tract and particularly the changes in ureteral walls (Douglas and Hossler, 1995; Dushi, Lutz, Hohlfeld, and Frey, 2002; Romih, Korosec, de Mello, and Jezernik, 2005; Grigorenko and Sapin, 2011; Kang, Lee, Jin, Jeong, and Han, 2009; Yurtcu, Gurbuzer, Findik, Avunduk, and Gunel, 2009). Studying morphological structure of the ureter in such congenital anomaly as obstructive ureterohydronephrosis we tried to increase our understanding about pathophysiological changes occurred in the ureter of children.

It would be justified to continue studying morphological peculiarities of the urinary tract in children on a large scale, because we could perform our investigation only on small quantity of samples collected. It is interesting to compare these results with data obtained by other methods of investigation. It will be easy to use these results in the clinical practice.

**Conclusion**

The changes revealed should be taken into consideration in choice of the method of operative treatment of the patients with ureterohydronephrosis.

Because of its limited blood supply the ureter may be very susceptible to injury during surgical intervention, so the anatomical and morphological description increases our knowledge about structure of the ureter. The results offer the plausible explanation for the importance of the use of scanning electron microscopy for determination of the more exact level of the obstruction in the ureter and its state at the morphological level that would be very useful for choice of the operative intervention.

**References**

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