

Impact of operations upon systematic microcirculation in case of pyeloureteral junction obstructions

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The article analyses the influence of open and laparoscopic pyeloplasty and endopyelotomy, balloon dilation and laser resection pyeloureteral segment hydronephrosis on the systemic microcirculation. It was determined that the 52.2-82% of patients mostly after open pyeloplasty was observed circulatory disorders in the vessels of the conjunctiva, dilation of arterioles, dilatation and plethora venules, violation of the normal ratio of caliber of arterioles and venules. Violation of blood flow in small vessels concerned intermittent blood flow, antegrade blood flow or stasis, and speed violations and the nature of the flow to characterize the phenomenon of fragmentation and perivascular edema.

Key words: stricture pyeloureteral segment, plastic pyeloureteral segment, bulbar microscopy, conjunctiva index.

Laparoscopic and open pyeloplasty are pathogenically substantiated methods of the treatment of pyeloureteral junction obstruction, which guarantee radical ablation of displasive tissues [1]. However, endourological palliative methods, in the basis of which the cutting of a narrowed segment lies, allow to decrease traumatization of tissues, a negative influence of the volume of this traumatization during concomitant heart-vascular diseases of the patient, and sometimes to shorten the time of surgical intervention [3, 4]. There are some publications, the authors of which compare the effectiveness, the amount of blood loss, the duration of operation, the quality of the life of patients, operated by these methods. Any surgical intervention on the organ influences upon its local microcirculation, but considerable deteriorations of surface tissues during surgical intervention may influence upon system microcirculation. Having deeply analyzed literature data, we drew a conclusion that biomicro-

scopic research is a rather effective diagnostics method of microcirculation condition [5, 6]. Bulbar conjunctiva is the most perspective for the research in clinic practice among the objects of biomicroscopic studies.

Impact of open and laparoscopic pyeloplasty, as well as endopyelotomy dilatations and laser resection of hyeloureteral junction during hydronephrosis upon systematic microcirculation has been analyzed.

MATERIAL AND METHODS

Conjunctival bulbar biomicroscopy was carried on with the help of the device with the video camera UB-SL-85 for slot lamps for the estimation of the condition of microcirculation, proposed by Ye.E. Konstantinova and N.L. Tsapayeva in 2002 [2]. Conjunctival bulbar biomicroscopy was carried on under the conditions, which exclude previous physical loadings and psychotraumatic factors of the patients in a sitting position. In order to have the possibility to do objective conclusions during the investigation of conjunctival vessels it is necessary to stick to the following conditions: patients who have no local inflammation processes, tissue affection (e.g. pterihion), cornea or lashes diseases, patients who suffered a acute respiratory virus infection not less than a month before examination take part in the research; investigations were carried on under the room temperature during 30–40 sec. While estimating vascular component one must differentiate: arterioles and venules, which are usually situated side by side, arterioles pass by a straight column and are less contrast, venules are more wavy, with a bigger diameter; precapillary arterioles and capillaries, which link arterioles and venules, differ by a caliber (8-18 mm) and the position. A size of capillaries is determined by the width of the axis layer of erythrocytes; in case of a change of the diameter of larger vessels about 4–6 mm are

Table 1

Indices of Conjunctival Index (CI) in the patients who were subject to laparoscopic pyeloplasty in comparison with the indexes of the patients who were subject to open pyeloplasty, (n₁=38, n₂=46)

CI	Extravascular CI ₁	Intravascular CI ₂	Vascular CI ₃	General CI _{gen}
Average Value, \bar{X}	6,342	12,842	20,157	
Standard Deviation, S	0	0,878	1,405	2,047
Standard Deviation of the Mean, $S\bar{\chi}$	0	0,142	0,227	0,332
Variance	0	0,771	1,974	4,190
F-criterion	0	0,481	0,326	0,345
F-test (Sig.)	N/A	0,024	0,0007	0,001
Diff. Average Values, $X_2 - X_1$	-0,195	-0,331	-2,375	-2,929
T-test (Sig.)	0,001	0,161	<0,0001	<0,0001
T-value	3,308	1,412	5,548	4,790

Indices of conjunctival index (CI) in the patients who were subject to endourological methods for PJO correction in comparison with the indexes of the patients who were subject to open pyeloplasty (n₁=46, n₂=46)

CI	Extravascular CI ₁	Intravascular CI ₂	Vascular CI ₃	General CI _{gen}
Average Value, \bar{X}	0,847	5,826	10,652	17,195
Standard Deviation, S	0,363	0,949	2,182	3,030
Standard Deviation of the Mean, $S\bar{X}$	0,053	0,140	0,321	0,446
Variance	0,131	0,902	4,765	9,183
F-criterion	0,819	0,563	0,788	0,757
F-test (Sig.)	0,507	0,057	0,429	0,354
Diff. Average Values, $\bar{X}_2 - \bar{X}_1$	-0,347	-0,847	-4,565	-5,891
T-test (Sig.)	<0,0001	0,0004	<0,0001	<0,0001
T-value	4,360	3,633	9,419	8,655

added to the value of the axis layer of erythrocytes with the help of the object – micrometer (as a wall layer of plasma, the width of which is 2–3 mm, is practically not differentiated in arterioles and venules).

As a whole 130 patients with hydronephrosis of the II-nd degree have been examined. The patients with the pyeloureteral junction obstruction were divided depending on the fulfilled kind of treatment: 46 patients were subject to open pyeloplasty according to Anderson-Hynes, 38 patients – to laparoscopic pyeloplasty: the results of the examination and treatment of 16 patients after endopyelotomy, 17 – after balloon dilatation and 13 – after laser resection were joined into one group of endourological methods during the statistical analysis.

RESULTS AND THEIR DISCUSSION

Comparing the data of conjunctival bulbar microscopy of the patients who had been subject to laparoscopic pyeloplasty, with the data of the patients who had been undergone open pyeloplasty (table 1), actually smaller average values CI₁, CI₃, CI_{gen} after laparoscopic pyeloplasty than after open pyeloplasty, – the difference of average values of extravascular conjunctival index -0,195 (p=0,001), vascular conjunctival index - 2,375 (p<0,001), general conjunctival index -2,929 (p<0,0001) can be observed. It has been proved that laparoscopic surgical intervention in case of pyeloureteral junction obstruction has smaller negative influence upon systemic microcirculation than open pyeloplasty.

Comparing the influence of endourological methods of pyeloureteral junction obstruction with the influence of open operation of haemorrhage in tiny vessels with the help of determination of KI, it has been revealed that laser resection, endopyelotomy or balloon dilatation have actually a smaller impact upon the deteriorations of microcirculation (table 2). The difference of the average values in this case was: of extravascular index - 0,347, intravascular conjunctival index -0,847, vascular conjunctival index - 4,565, general conjunctival index -5,891 (p<0,001).

Microcirculatory channel of conjunctiva is presented by a wide anastomosis network of microvessels which includes all the regions: arterioles, precapillaries, capillaries, postcapillaries, venules and arterioles – venular anastomoses. Precapillaries, capillary arcades and postcapillaries prevail mostly in the surface layer. Arterioles and venules with the ratio of their calibers in the norm of 1:2 prevail in the average and deep layers. Vascular deteriorations of arteriolar region of microcirculatory channel were actually revealed by the spasm of arterioles in 43,1% (56/130) patients, and only in 26,3% (5/19) under the control. Multiple microaneurisms of arterioles and capillaries have been observed more often in

17/46–37% patients after open pyeloplasty. The widening of a vascular retina in the limb and surface layers on the periphery of cornea has been observed during a biomicroscopic research. Diameter of the vessels was different – ampule-like widenings, which outwardly resembled «muffs» or knots, sometimes occurred. Similar changes are predominately typical for the persons who have undergone open pyeloplasty. Actual change of venular regions of microcirculatory channel of bulbar conjunctiva as a dilatation of venules was revealed in 87/130 – 37% patients who had undergone a surgical intervention. Ateriolo – venular ratio changed in 67,6% patients, as 1:4 or 1:5 against 1:2 in practically healthy persons under the control, due to the result of spastic-atic condition of the microvessels. Meandrous waviness of microvessels (p<0.05) was observed in 65,7%, patients after open pyeloplasty to the contrast of 54,2% patients after laparoscopic pyeloplasty and 47,1% after endourological methods. Deteriorations of microcirculation in the vessels of bulbar conjunctiva in 82% (38/46) after pyeloplasty to the contrast of 71% (27/38) after laparoscopic pyeloplasty and in 52,2% (24/46) after endourological methods were typical after open pyeloplasty. Changes have mainly occurred by the spasm of arterioles in 73,9% (34/46) after open pyeloplasty to the contrast of 55,3% (21/38) after laparoscopic pyeloplasty and in 37% (17/46; c²=8,36; p=0,004) after endourological methods and dilatation of venules in 69,7% (32/46) after open pyeloplasty to the contrast of 50,0% (19/38) after laparoscopic pyeloplasty and 41,3% (19/46; c²=6,34; p=0,01) after endourological methods. Spastic – atonic condition of the vessels influences upon the arterial-venous ratio in (69,7% (32/46) after open pyeloplasty to the contrast of 55,3% (21/38) after laparoscopic pyeloplasty and in 32,6% (15/46; c²=11,14; p=0,00085) after endourological methods.

Intravascular changes have been observed in the majority of patients after open surgical intervention -76,1 percent (35/46) than after laparoscopic pyeloplasty 63,2 percent (24/38) and laser resection, balloon dilatation, endopyelotomy 52,2 percent (24/46; c²=4,73; p=0,03). Changes have been found in coarse-grained, «necklace-like» haemorrhage due to active hyperaggregation or the sludging of erythrocytes in the arterioles of conjunctiva (45,7 percent (21/46) after open pyeloplasty contrary to 36,8 percent (14/38) after laparoscopic pyeloplasty and 26.1 percent (12/46); c²=3,02; p=0,08) after endopyelotomy; in heap-like fragmented haemorrhage on account of sludging in venules 52,2 percent (24/46) after open pyeloplasty as 52,6 percent (20/38) after laparoscopic pyeloplasty and 37 percent (17/46; c²=1,58; p=0,2) after endopyelotomy); partial stasis of blood, the slowing down of haemorrhage (23,9 percent (11/46) after open pyeloplasty as 18,4

percent (7/38) after laparoscopic pyeloplasty and 19,6 percent (9/46; $c^2=0,06$; $p=0,8$) after endopyelotomy); complete stasis because of microthrombosis of venules only in 2,2 percent (1,46) after open pyeloplasty. So, it may be admitted that open surgical interventions indirectly cause worse microcirculation deteriorations than laparoscopic analogous operations. Endourologic endoscopic correction methods of pyeloureteral junction obstruction, – laser resection, balloon dilatation and endopyelotomy probably the least slightly negatively influenced upon the systemic microcirculation.

Вплив операцій при стриктурах пієлоуретерального сегмента на системну мікроциркуляцію
О.В. Шипелик, А.З. Журавчак, Д.З. Воробець

У статті проаналізовано вплив відкритої та лапароскопічної пієлопластики, а також ендопієлотомії, балонної дилатації і лазерної резекції пієлоуретерального сегмента при гідронефрозі на системну мікроциркуляцію. Визначено, що у 52,2–82% пацієнтів переважно після відкритої пієлопластики спостерігаються циркуляторні розлади в судинах кон'юнктиви, – дилатація артеріол, дилатація і повнокров'я венул, порушення нормального співвідношення калібру артеріол і венул. Порушення кровотоку у малих судинах торкались переривистого току крові, антеградного кровотоку або повного стаза, а порушення швидкості і характеру кровотоку характеризувались феноменом фрагментації і периваскулярним набряком.

Ключові слова: стриктура пієлоуретерального сегмента, пластика пієлоуретерального сегмента, бульбарна мікроскопія, кон'юнктивальний індекс.

Conclusion. It has been determined that circulation disorders in conjunctiva vessels, – arterioles dilatation, dilatation and plethora of venules, deterioration of normal ratio of a gauge of arterioles and venules have been observed in 52,2–82 percent of patients, mainly after open pyeloplasty. Deteriorations of hemorrhage in small vessels concerned a broken hemorrhage, antegrade hemorrhage or full stasis, while deteriorations of velocity and a character of hemorrhage were characterized by a phenomenon of fragmentation, sludge and perivascular oedema.

Влияние операций при стриктурах пиелoureterального сегмента на системную микроциркуляцию
О.В. Шипелик, А.З. Журавчак, Д.З. Воробець

В статье проанализировано влияние открытой и лапароскопической пиелопластики, а также эндопиелотомии, баллонной дилатации и лазерной резекции пиелoureterального сегмента при гидронефрозе на системную микроциркуляцию. Определено, что у 52,2–82% пациентов преимущественно после открытой пиелопластики наблюдаются циркуляторные расстройства в сосудах конъюнктивы, – дилатация артериол, дилатация и полнокровие венул, нарушения нормального соотношения калибра артериол и венул. Нарушение кровотока в малых сосудах касались прерывистого тока крови, антеградного кровотока или полного стаза, а нарушения скорости и характера кровотока характеризовались феноменом фрагментации и периваскулярным отеком.

Ключевые слова: стриктура пиелoureterального сегмента, пластика пиелoureterального сегмента, бульбарная микроскопия, конъюнктивальный индекс.

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REFERENCES

1. Адаменко О.Б. Врожденный гидро-нефроз у детей / О.Б. Адаменко // Детская хирургия. – 2002. – № 4. – С. 21–24.
2. Константинова Е.Э. Метод конъюнктивальной биомикроскопии с использованием устройства с видеокамерой УВ-SL-85 для щелевых ламп в оценке состояния микроциркуляции при сердечно-сосудистой патологии / Е.Э. Константинова, Н.Л. Цапаева // Кардиология. – 2002. – 13, 71–78 С.
3. Acher P.L. Ureteroscopic holmium laser endopyelotomy for ureteropelvic junction stenosis after pyeloplasty / P.L. Acher, R. Nair, J.S. Abburaju et al. // J. Endourol. – 2009. – № 6. – P. 899–902.
4. Badawy H. Transperitoneal versus retroperitoneal laparoscopic pyeloplasty in children: Randomized clinical trial / H. Badawy, A. Zoaier, T. Ghoneim et al. // J. Pediatr. Urol. – 2015. Feb 26. pii: S1477-5131(15)00025-X. doi: 10.1016 / .jpurol.2014.11.019.
5. De Nicola R. In vivo confocal microscopy and ocular surface diseases: anatomical-clinical correlation / R. De Nicola, A. Labbe, N. Amar et al. // J. Fr. Ophthalmol. – 2005. – № 7. – P. 691–698.
6. Wei Y.H. In vivo confocal microscopy of bulbar conjunctiva in patients with Graves' ophthalmopathy / Y.H. Wei, W.L. Chen, F.R. Hu et al. // J. Formos. Med. Assoc. – 2013. – № 13. – P. 358–366.

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