

精索静脉曲张手术治疗中左肾静脉血流情况

BLOOD FLOW CONDITION IN THE LEFT RENAL VEIN IN OPERATIVE TREATMENT OF PATIENTS WITH VARICOCELE

© V.N. Krupin¹, M.N. Uezdnyj¹, S.Yu. Zubova², P.I. Petrova¹

¹ Privolzhskiy Research Medical University, Nizhny Novgorod, Russia;

² Nizhny Novgorod Regional Clinical Hospital named after N.A. Semashko, Nizhny Novgorod, Russia

For citation: Krupin VN, Uezdnyj MN, Zubova SYu, Petrova PI. Blood flow condition in the left renal vein in operative treatment of patients with varicocele. *Urology reports (St. Petersburg)*. 2020;10(1):33-38. <https://doi.org/10.17816/uroved10133-38>

Received: 14.01.2020

Revised: 18.02.2020

Accepted: 19.03.2020

🔍 **研究的目的。** 评估精索静脉曲张患者经精索静脉结扎后左肾静脉血流的特点及急性肾损伤的生物学标志物的动态变化。

材料与方法。 对64名18–23岁的第一种血流动力学型精索静脉曲张患者进行观察。3例患者出现明显的左肾静脉压迫，其余61例患者接受了伊万尼塞维奇手术。术前及术后第2、10、30、90天行左肾静脉彩色多普勒超声检查，测量静脉血流量。在此期间，所有患者都接受实验室检查，包括研究血液和尿液中胱抑素C和白介素-18的含量。

结果。 在结扎内精静脉后的第一天，血液和尿液中急性肾损伤的生物标志物浓度增加。术后所有患者均出现左肾静脉直径增大1.5–2毫米，肾门血流线速度降低5–6厘米/秒。术后第10天，肾门左肾静脉直径增加3–4毫米，线性血流速度减慢2–2.5厘米/秒。术后3个月内左肾静脉血流速度及内径恢复正常，并且，在大多数情况下，它恢复到最初的指标，而22.9%的患者在随访第90天未恢复。

结论。 精索静脉曲张内精静脉结扎时，左肾静脉血流异常，急性肾损伤生物标志物浓度升高，表现为静脉高压和肾缺氧。在大多数患者中，这些指标在术后随访90天恢复正常。

🔍 **关键词：** 精索静脉曲张；静脉高血压；肾缺氧

🔍 **The purpose of the study** was to evaluate the blood flow in the left renal vein after ligation of the internal spermatic vein with varicocele and to study the changing of the level of biological markers of acute kidney damage in these patients.

Materials and methods. Under observation were 64 men in age 18–23 years with the first hemodynamic type of varicocele. In 3 patients clinically significant compression of the left renal vein was revealed and the remaining 61 patients underwent surgery by Ivanissevich approach. Before the operation, on the 2nd, 10th, 30th and 90th days after the operation patients underwent Doppler blood flow rate by ultrasound with color mapping of the left renal vein with measurement of venous blood flow velocity. During these periods all patients underwent laboratory tests, including the study of the content of cystatin C and interleukin 18 in the blood and urine. **Results.** On the first day after ligation of the internal spermatic vein an increase in the concentration of biological markers of acute kidney damage in the blood and urine was noted. After surgery all patients showed an increase in the diameter of the left renal vein by 1.5–2 mm and a decrease in the linear blood flow velocity in the region of the renal vein by 5–6 cm/s. On the 10th day after the operation the diameter of the left renal vein was increased by 3–4 mm more and the linear blood flow velocity slows down by 2–2.5 cm/s. The restoration of blood flow velocity and the diameter of the left renal vein occurred within three months and in most cases returned to baseline and in 22.9% of patients recovery did not occur by the 90th day of observation.

Conclusion. Ligation of the internal spermatic vein with varicocele is accompanied by impaired blood flow in the left renal vein and an increase in the concentration of biological markers of acute kidney damage, which is a manifestation of venous hypertension and renal hypoxia. In most patients these indicators normalize to the 90th day of observation after surgery.

🔍 **Keywords:** varicocele; venous hypertension; renal hypoxia.

绪论

压迫左肾静脉在肠系膜上动脉的区域导致静脉血流的侵犯,增加肾静脉压力,因此,结果导致静脉曲张流入左肾静脉,弥补了左肾静脉压力的增加[1-3]。一个常见的和容易诊断的症状的区域肾静脉高压是精索静脉曲张[4]。精索静脉曲张的发生是继发于左肾静脉血流动力学的破坏[5,6]。既往研究表明,精索静脉曲张手术治疗消除了静脉肾性高血压的代偿机制,可导致血流动力学障碍增加,导致动脉性高血压的发展[7]。

一般认为,左肾静脉血流动力学显著受压的诊断标准是超声在1.5-2.5毫米及以下狭窄区确定肾静脉前后大小,局部血流速率增加大于110厘米/秒[8]。然而,这些数据是为有功能的络脉(内精脉、肾上腺静脉等)的情况提供的。当络脉被消除时,左肾静脉的血流动力学如何改变尚不清楚。术中测压显示,内精静脉结扎前后,若保留腰静脉支,则未发现左肾静脉系统血流动力学紊乱[9,10]。还有另一种观点,认为任何阻断内精静脉的方法都伴随着肾静脉血流动力学的破坏和肾脏反应的改变[11]。

上精静脉的栓塞后,145例患者左肾静脉压升高1毫米Hg为22.7%,升高2毫米Hg为4.8%,升高3毫米Hg为2.0%,升高4毫米Hg为1.4%,即近三分之一的患者在手术中记录到静脉压升高[12]。由于精索静脉曲张患者在结扎内精静脉后的术后期间,左肾静脉系统的静脉血流动力学异常可能增加,这与肾脏缺血增加有关,有可能发展为急性损害其实质。已知肾组织损伤的主要因素是肾脏组织缺氧,见于肾静脉的高血压,可导致部分肾小球纤维变性[13-15]。

通过测定生物标志物的水平,有可能在第二天怀疑发生急性肾损伤的可能性很高(高达73%)[16-18]。肾对急性损伤(包括缺血

性损伤)的早期反应研究突出了诸如血清胱抑素C、KIM1、L-FABP和白细胞介素-18(IL18)等生物标志物[19]。

本研究的目的是评估精索静脉曲张患者经精索静脉结扎后左肾静脉血流的特点及急性肾损伤的生物标志物的动态变化。

材料与研究方法

64名18至23岁的第一例血液动力学型精索静脉曲张患者使用飞利浦Epiq 5设备彩色超声多普勒造影检查。测量肾门左肾静脉直径及肠系膜上动脉与主动脉间区血流线速度。所有患者,除了3人在临床上明显左肾静脉压迫外,都接受了伊万尼塞维奇手术。术后第2、10、30、90天超声多普勒显像监测左肾静脉状态及肾门水平沿左肾静脉血流速率。另外,为了检测精索静脉曲张患者急性肾损伤的发生和动态,所有接受手术男性患者术前及术后第2、10、30、90天检测血清胱抑素C、IL18血尿水平。使用Microsoft Excel 7.0和Statistica软件对结果进行统计处理。平均值差异的可靠性是用相依样本和独立样本的t检验参数标准来评估的。

研究成果

3例患者的左肾静脉被诊断为明显的压迫(4.7%)。在这些病例中,肾门水平的肾静脉直径分别为15、15.5、16毫米,主动脉与肠系膜动脉之间的肾静脉直径分别为2.5、2.7、3.3毫米。同时,左肾静脉主动脉-肠系膜切面血流线速度超过100-125厘米/秒,肾门水平肾静脉血流速度19.5-31厘米/秒。另61例左肾静脉的直径在肾门是在8.8至11.2的范围(9.8 ± 1.2)毫米,主动脉与肠系膜上动脉之间肾静脉直径为3:1,范围2.5-3.9(3.4 ± 0.4)毫米。肾静脉门水平血流线速度为17.8-26(20.3 ± 1.3)厘米/秒,狭窄区为36-63(49.8 ± 1.8)厘米/秒,增加不超过2.5倍。

所有病人,除了3人在临床上明显左肾静脉压迫外,都接受了伊万尼塞维奇手术。61例手

术患者术后第二天均出现左肾静脉直径增大1.5—2毫米,平均增大 11.1 ± 0.1 毫米(图1)。所有病例肾门区血流线速度均下降5—6厘米/秒,为 17.1 ± 0.7 厘米/秒(图2)。术后第10天,肾门区左肾静脉直径增加3—4毫米,线性血流速度减慢2—2.5厘米/秒(图1,2)。

肾门水平左肾静脉血流线速度下降9—11厘米/秒,而狭窄区线速度增加至101—115厘米/秒。在61名患者中,有49人发现了类似的情况。其余12例患者狭窄区血流线速度增加至80—97厘米/秒。

因此,在结扎睾丸上静脉后第10天,左肾静脉整体直径增加4.5—6毫米(15.3 ± 0.3 毫米),术后持续一个月。术后30天,左睾丸静脉直径平均为 14.9 ± 1.4 毫米。第10天至30天线性血流率较低,分别为 16.3 ± 1.6 厘米/秒和 16.2 ± 1.2 厘米/秒。

在18例患者中,手术后3周在尿液中检测到新鲜红细胞(视野内高达10个)和蛋白尿。术后3个月,47例手术患者门静脉区左肾静脉直径下降,几乎恢复到原来大小(10.1 ± 1.1 毫米)。左肾静脉变窄区(主动脉与肠系膜上动脉之间的通道区)血流线速度初值为 19.9 ± 1.9 厘米/秒。虽然有14例(22.9%)患者改变了上述参数,但未恢复到初始值:肾门水平静脉直径 12.3 ± 0.3 毫米,线速度 17.4 ± 0.4 厘米/秒。

对血液和尿液中急性肾损伤的生物标记物的研究显示术后即刻和术后90天内其浓度的变化。

血液和尿液中生物标记物的初始指标与正常情况下的指标略有不同(胱抑素C:血液为 871.7 ± 89.1 ng/毫升,尿液为 1058.7 ± 83.5 ng/毫升;IL18:血液为 32.7 ± 2.6 PG/毫升,尿液为 18.8 ± 2.1 PG/毫升)[19],尽管差别不大。因此,血胱抑素C初始水平为 986.9 ± 96.4 ng/毫升,术

后1天为 1295 ± 113.2 ng/毫升,术后3天为 1187 ± 121.3 ng/毫升。精索静脉曲张患者尿中胱抑素C的初始水平为 1112 ± 101.2 ng/毫升,术后1天为 2301.3 ± 173.2 ng/毫升,术后3天为 2106 ± 213.4 ng/毫升。术后第10、30、90天只观察尿液中胱抑素C的含量。血液和尿液中IL18水平的动态变化也是术后即刻发生急性肾损害的特征(见表)。

讨论

因此,所获得的数据表明左肾静脉系统的静脉血流量发生异常,且持续90天。第一个血流动力学型精索静脉曲张患者在结扎睾丸上静脉时,许多患者伴有静脉肾高压(血尿、蛋白尿)的临床征象形成。精索静脉曲张结扎术后,门区和主动脉与肠系膜区的左肾静脉直径的比率发生变化,以及术后这些区域的血流率比率,这表明静脉肾高血压的发展。尽管在大多数患者中,伊万尼塞维奇手术后左肾静脉血流

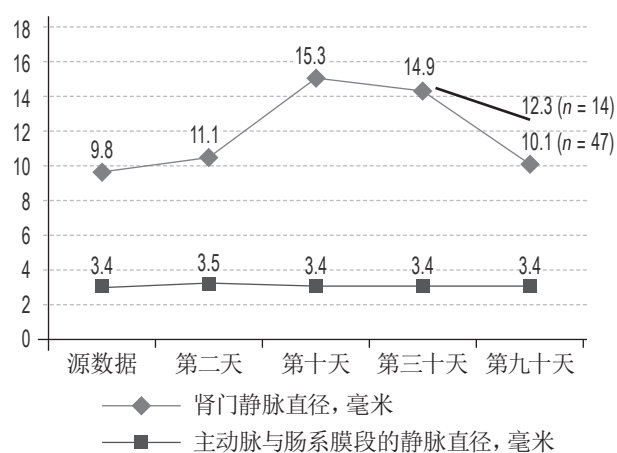


图1. 精索静脉曲张术后左肾静脉直径(伊万尼塞维奇手术)(n=61)
Fig. 1. Diameter of the left renal vein after varicocele surgery (Ivanissevich operation), mm (n = 61)

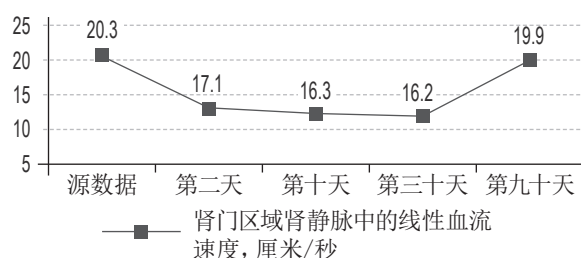


图2. 精索静脉曲张术后左肾静脉的静脉血流动力学(伊万尼塞维奇手术)(n=61)
Fig. 2. Venous hemodynamics in the left renal vein after varicocele surgery (Ivanissevich operation), cm/s (n = 61)

精索静脉曲张患者血液和尿液中急性肾损伤的生物标志物动态 ($n = 61$)Dynamics of biomarkers of acute kidney damage in blood and urine in patients before and after surgery ($n = 61$)

生物标志物	源数据	第二天	第三天	第十天	第三十天	第九十天
血中胱抑素C, ng/毫升	986.9±96.4	1295±113.2	1187±121.3	-	-	-
尿中胱抑素C, ng/毫升	1112±101.2	2301.3±173.2	2106±213.4	1978±121.1	1482±98.8	1267±112.2
血中IL-18, ng/毫升	33.4±3.4	41.5±3.8	67.8±7.8	-	-	-
尿中IL-18, ng/毫升	19.2±1.9	49.3±4.8	30.4±3.0	28.4±2.4	24.2±4.1	20.9±2.1

动力学障碍是可逆的(这可能是由于肾脏的静脉血流出的其他侧支通路取代了结扎的内精静脉),但肾组织长期缺血(长达90天)可能会对其功能能力产生不利影响。此外,14例患者(22.9%)左肾静脉系统血流动力学障碍在第90天未恢复到原来的值。

静脉血流量受损引起的肾组织缺血增加可导致急性肾损伤的发生和发展。在结扎睾丸静脉后的第二天,尿液中IL18的含量已经增加了近一半,表明由于缺血程度的增加,肾小球肾脏系统受到损害。术后所有患者尿液和血液中胱抑素C含量均有升高。急性肾损伤血、尿生物标志物水平的逐渐下降可能是由于肾脏血流动力学系统的代偿机制和其他肾血流络膜的代偿功能的参与。然而,在3个月的时间里,生物标记物相对于初始参数仍然处于升高状态,这使得可以得出结论于肾组织持续缺血的存在。

结论

- 精索静脉曲张患者在结扎精索静脉时,左肾静脉系统的静脉血流量发生异常达3个月之久,22.9%的病例在此期间未恢复。
- 61例患者中有18例在精索静脉结扎后左侧肾静脉血流动力学异常,并伴有微量血尿和蛋白尿,是肾静脉高压的征象。
- 在精索静脉结扎术的第一天,持续3天或3天以上的患者的血液和尿液中存在急性肾损伤的生物标记物浓度增加。

REFERENCES

1. Воронцов Ю.П., Водолазов Ю.А., Русанов И.И. Эндоваскулярное окклюзирование внутренней семенной вены при варикоцеле у детей и подростков // Клиническая хирургия. – 1985. – № 6. – С. 37–38. [Vorontsov UP, Vodolazov YuA, Rusanov II. Endovaskul'arnoe okkl'uzirovanie vnutrenney semennoy veni pri varikotsele u detey i podrostkov. *Klinicheskaiya hirurgiya*. 1985;(6):37-38. (In Russ).]
2. Капто А.А. Артериовенозные конфликты у мужчин с урологической патологией // Урологические ведомости. – 2018. – Т. 8. – № 2. – С. 53–63. [Kapto AA. Arteriovenous conflicts in men with urological pathology. *Urologicheskie ведомosti*. 2018;8(2):53-63. (In Russ.).] <https://doi.org/10.17816/uroved8253-63>.
3. Капто А.А., Смылова З.В. Сосудистые конфликты в андрологии. Часть 1. Артериовенозные конфликты верхнего уровня // Урологические ведомости. – 2019. – Т. 9. – № 2. – С. 29–35. [Kapto AA, Smyslova ZV. Vascular conflicts in andrology. Part 1. Upper level arteriovenous conflicts. *Urologicheskie ведомosti*. 2019;9(2):29-35. (In Russ.).] <https://doi.org/10.17816/uroved9229-35>.
4. Жуков О.Б., Верзин А.В., Пеньков П.Л. Регионарная почечная венная гипертензия и левостороннее варикоцеле // Андрология и генитальная хирургия. – 2013. – Т. 14. – № 3. – С. 29–37. [Zhuikov OB, Verzin AV, Penkov PL. Regional renal venous hypertension and left-sided varicose. *Andrologia i genital'naya hirurgiya*. 2013;14(3):29-37. (In Russ).]
5. Страхов С.Н., Прядко С.И., Бондар З.М., Косырева Н.Б. Варианты архитектоники, гемодинамики левой почечной и яичковой вен и выбор патогенетически обоснованного метода хирургического лечения левостороннего варикоцеле // Анналы хирургии. – 2014. – № 3. – С. 32–40. [Strakhov SN, Pryadko SI, Bondar ZM., Kosyreva N.B. Hemodynamic architectonic variants of left renal and testicular veins and selection of the pathogenetically substantiated method of the surgical treatment of left side varicocele. *Annali hirurgii*. 2014;(3):32-40. (In Russ.).]

6. Hargreave TB. Varicocele. In: Hargreave TB (ed). Male Infertility [Internet]. Berlin: Springer-Verlag; 1994. P. 249-267. Available from: <https://doi.org/10.1007/978-1-4471-1029-3>.
7. Крупин В.Н., Уездный М.Н., Петрова П.И. Влияние оперативного лечения варикоцеле на развитие артериальной гипертензии // Урологические ведомости. – 2019. – Т. 9. – № 4. – С. 25–30. [Krupin VN, Uezdnyj MN, Petrova PI. Influence of operative treatment of varicocele on the development of arterial hypertension. *Urologicheskie ведомosti*. 2019;9(4):25-30. (In Russ.)]. <https://doi.org/10.17816/uroved9425-30>
8. Шанина Е.Ю. Дуплексное сканирование с цветным доплеровским картированием в оценке гемодинамической значимости аортомезентериальной компрессии левой почечной вены / Сб. тезисов VII Международной конференции «Современное состояние методов неинвазивной диагностики в медицине. ANGIODOP 2000»; Сочи, 18–21 мая 2000 г. – М.: С-инфо, 2000. [Shanina EYu. Dupleksnoye skanirovanie s tczvetnim dopplerovskim kartirovaniem v otczenke gemodinamicheskoy znachimosti aortomezenterialnoy kompressii levoy pochechnoy veni. In: Proceedings of the VII International conference “Sovremennoe sostoyanie diagnostiki v medicine. ANGIODOP 2000”; Sochi, 18–21 may 2000. – Moscow: C-info; 2000. (In Russ.)]. Доступно по: <https://mks.ru/library/conf/angiiodop/2000/urology/shan2.html>. Ссылка активна на 19.02.2020.
9. Чудновец Л.Г. Оптимизация рентгенохирургического лечения варикоцеле: дисс. ... канд. мед. наук. – М., 2008. [Chudnovets LG. Optimizatsiya rentgenohirurgicheskogo lecheniya varikotsele, [dissertation]. Moscow; 2008. (In Russ.)]. Доступно по ссылке: <http://medical-diss.com/medicina/optimizatsiya-rentgenohirurgicheskogo-lecheniya-varikotsele>. Ссылка активна на 19.02.2019.
10. Сухов М.Н., Гарбузов Р.В., Дроздов А.В. и др. Лечение детей с венозной почечной и внепеченочной портальной гипертензией // Вестник новых медицинских технологий. – 2010. – Т. XVII. – № 3. – С. 135. [Sukhov MN, Garbuzov RV, Drozdov AV, et al. Lechenie detey s venoznoy pochechnoy i vnepechenochnoy portal'noy gypertenziei. *Vestnik novikh medicinskih tekhnologiy*. 2010; XVII(3):135. (In Russ.)]
11. Матар А.А. Изменения гемодинамики левой почечной вены и реакция почек при хирургическом лечении варикоцеле: дисс. ... канд. мед. наук. – Москва, 2002. [Matar AA. Izmeneniya gemodinamiki levoy pochechnoy veni i reaktsiya pochek pri hirurgicheskom lecheni varikotsele. [dissertatoin] Moscow; 2002. (In Russ.)]. Доступно по: <http://medical-diss.com/medicina/izmeneniya-gemodinamiki-levoy-pochechnoy-veny-i-reaktsiya-pochek-pri-hirurgicheskom-lecheni-varikotsele>. Ссылка активна на 19.02.2020.
12. Ишметов В.Ш. Рентгеноэндovasкулярная диагностика и лечение больных с варикоцеле: дисс. ... докт. мед. наук. – Н. Новгород, 2010. [Ishmetov VSh. Rentgenovaskularnaya diagnostika i lechenie bolnyh s varikotsele. [dissertation] N. Novgorod; 2010. (In Russ.)]. Доступно по: <http://medical-diss.com/medicina/rentgenoendovaskulyarnaya-diagnostika-i-lechenie-bolnyh-s-varikotsele>. Ссылка активна на 19.02.2020.
13. Ekim M., Bakkaloglu SA, Tumer N., et al. Orthostatic proteinuria as a result of venous compression (nutcracker phenomenon) – a hypothesis testable with modern imaging techniques. *Nephrology Dialysis Transplantation*. 1999;14(4):826-827. <https://doi.org/10.1093/ndt/14.4.826>.
14. Ферзаули А.Н. Венозная гемодинамика в почке и системе воротной вены при шунтирующих операциях у детей с внепеченочной формой портальной гипертензии: дисс. ... канд. мед. наук. – Москва, 1997. [Ferzauli AN. Venoznaia gemodinamika v pochke i sisteme vorotnoi veni pri shuntiruiucshih operaciyah u detei s vnepechenochnoi formoi portal'noi gipertenzii. [dissertation] Moscow; 1997. (In Russ.)]
15. Страхов С.Н., Бурков А.А., Спиридонов А.А. и др. Нефропатия флелогипертензивного генеза и выбор метода лечения при варикоцеле у детей и подростков // Нефрология и диализ. – 2001. – Т. 3. – № 4. – С. 414–420. [Strahov SN, Burkov AA, Spiridonov AA, et al. Phleborenal hypertension nephropathy and choice of a method of treatment of varikotsele in children and adolescents. *Nephrologia i dializ*. 2001;3(4):414-420. (In Russ.)]
16. Смирнов А.В., Добронравов В.А., Румянцев А.Ш., и др. Национальные рекомендации. Острое повреждение почек: основные принципы диагностики, профилактики и терапии. Часть I // Нефрология. – 2016. – Т. 20. – № 1. – С. 79–104. [Smirnov AV, Dobronravov VA, Rumyantsev ASH et al. National Guidelines Acute kidney injury: basic principles of diagnosis, prevention and therapy. *Nephrology*. 2016;20(1):79-104. (In Russ.)]. <https://doi.org/10.24884/1561-6274-2016-20-1-8-15>.
17. Уразаева Л.И., Максудова А.Н. Биомаркеры раннего повреждения почек: обзор литературы // Практическая медицина. – 2014. – Т. 1. – № 4. – С. 125–130. [Urazayeva LI, Maksudova AN. Biomarkers of ealy renal injury: review of literature. *Practice medicine*. 2014;1(4):125-130. (In Russ.)]
18. Павлов В.Н., Пушкарев А.М., Ракипов И.Г. и др. Биомаркеры повреждения почек при контактной уретеролитотрипсии // Медицинский вестник Башкортостана. – 2015. – Т. 10. – № 3. –

- C. 108–111. [Pavlov VN, Pushkarev AM, Rakipov IG, et al. Kidney injury biomarkers in contact ureterolithotripsy. *Medical Review of Bashkortostan*. 2015;10(3):108-111. (In Russ.)]
19. Кит О.И., Франциянц Е.М., Димитриади С.Н. и др. Роль маркеров острого повреждения почек в выборе тактики хирургического лечения больных раком почки // Онкоурология. – 2015. – Т. 11. – № 3. – С. 34–39. [Kit OI, Frantsiyants EM, Dimitriadi SN, et al. Role of markers for acute kidney injury in surgical management of patients with renal cancer. *Onkourologiya* 2015;11(3):34-39. (In Russ.)]. <https://doi.org/10.17650/1726-9776-2015-11-3-34-39>.

Information about the authors:

Valentin N. Krupin – Doctor of Medical Science, Professor, Head of the Department of Urology named after E.V. Shakhov. Privolzhskiy Research Medical University, Nizhny Novgorod, Russia. E-mail: vn.krupin@mail.ru.

Mihail N. Uezdnyj – Postgraduate Student, Department of Urology named after E.V. Shakhov. Privolzhskiy Research Medical University, Nizhny Novgorod, Russia. E-mail: uezdny_79@mail.ru.

Svetlana Yu. Zubova – Doctor of the Department of Ultrasound Diagnostics, Nizhny Novgorod Regional Clinical Hospital named after N.A. Semashko, Nizhny Novgorod, Russia. E-mail: zubova.svetlana.65@yandex.ru.

Polina I. Petrova – Student. Privolzhskiy Research Medical University, Nizhny Novgorod, Russia. E-mail: voda75@bk.ru.