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Перфузия яичек в оценке аутопластики пахового канала перемещенным апоневротическим лоскутом

С. Т. Сапиева✉, М. Т. Алиякпаров, Н. Т. Абатов, Р. М. Бадыров

Медицинский университет Караганды, Караганда, Казахстан

Автор, ответственный за переписку: Сапиева Сауле Тулегеновна, saule.sapieva@mail.ru

АННОТАЦИЯ

Обоснование: Разработанные в мире многочисленные способы устранения дефектов брюшной стенки на сегодня не позволяют говорить о решении проблемы грыж. В частности, до конца не изучены причины хронических послеоперационных болей, связанных с влиянием рубцовых изменений на семенной канатик. Исследования кровотока в яичках после пластики грыж в основном показали разноречивые результаты.

Цель: Сравнительная оценка показателей кровотока в яичковой, капсулярной и паренхиматозной артериях, диаметра яичковой артерии при методе аутопластики перемещенным апоневротическим лоскутом и герниопластике по Лихтенштейну с помощью УЗИ.

Материалы и методы: Были прооперированы 70 пациентов с диагнозом неосложненной паховой грыжи, из них новым методом аутопластики (Группа I) — 35 пациентов; в группе сравнения с герниопластикой по Лихтенштейну с использованием частично рассасывающегося сетчатого имплантата (UltraPro) — 35 пациентов (Группа II). Динамику изменений показателей кровотока в артериях оценивали с помощью цветной доплерографии перед операцией, в ранний и поздний послеоперационные периоды.

Результаты: Парный критерий Вилкоксона показал значительную разницу между дооперационными измерениями и измерениями сразу после операции в обеих группах. Статистически значимые различия между группами были обнаружены в конечно-диастолической скорости и индексе резистентности в яичковой, капсулярной и паренхиматозной артериях через 6 месяцев и 1 год после операции. Также оказалась существенной различие показателей пиковой систолической скорости в яичковой артерии на поздних сроках после герниопластики. Диаметр яичковой артерии в динамике имел тенденцию к увеличению, однако статистически значимого различия между группами выявлено не было.

Выводы: Метод аутопластики пахового канала перемещенным апоневротическим лоскутом не оказывает существенного влияния на перфузию яичка. В Группе II показатели артериального кровотока через 6 месяцев и 1 год после операции оказались ниже базальных значений и имели статистически значимые различия в сравнении с группой I.

Ключевые слова: паховая грыжа; герниопластика; аутопластика; цветная ультразвуковая доплерография

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Testicular Perfusion in the Assessment of the Inguinal Canal Autoplasty by Transferred Aponeurotic Flap

Saule T. Sapiyeva[✉], Makash T. Aliyakparov, Makash T. Abatov, Ruslan M. Badyrov

Medical University Karaganda, Karaganda, Kazakhstan

Corresponding author: Saule T. Sapiyeva, saule.sapieva@mail.ru

ABSTRACT

BACKGROUND: Numerous methods of eliminating abdominal wall defects developed in the world today do not allow us to talk about solving the problem of hernias. In particular, the causes of chronic postoperative pain associated with the effect of scarring on the spermatic cord have not been fully studied. Testicular flow studies after hernia repair mostly showed different outcomes.

AIM: Comparative assessment of blood flow parameters of the testicular, capsular and intratesticular arteries, as well as the diameter of the testicular artery after autoplasty with a displaced aponeurotic flap and Lichtenstein hernioplasty using ultrasound.

MATERIALS AND METHODS: A new method of autoplasty was used in 35 patients (Group I). The comparison group (Group II) amounted to 35 patients with Lichtenstein hernioplasty surgery using partially absorbable mesh endoprosthesis (UltraPro). The dynamics of changes in blood flow in the arteries was assessed using color Doppler before surgery, in the early and late postoperative periods.

RESULTS: The Wilcoxon paired test showed a significant difference between preoperative and immediately postoperative measurements in both groups. Statistically significant differences between the groups were found in the end-diastolic velocity and resistance index in the testicular, capsular and intratesticular arteries 6 months and 1 year after surgery. The difference in peak systolic velocity was significant in the testicular artery also in the late stages after hernioplasty. The diameter of the testicular artery tended to increase in dynamics, but there was no any statistically significant difference between the groups.

CONCLUSIONS: The method of autoplasty in the inguinal canal with a displaced aponeurotic flap does not significantly affect testicular perfusion. In Group II, arterial blood flow indicators 6 months and 1 year after surgery were lower than basal values and had statistically significant differences compared to Group I.

Keywords: *inguinal hernia; hernioplasty; autoplasty; color ultrasound doppler*

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Background

Inguinal hernia is the most frequently diagnosed hernia and one third of males during their lifetime are diagnosed with the inguinal hernia [1]. Inguinal hernia repair is the only definitive treatment and is one of the most common surgical procedures performed [2, 3]. However, the mesh implant, being in the tissues, causes a local tissue reaction of chronic inflammation in response to the introduction of a foreign body [4]. Despite the fact that Lichtenstein method is the gold standard for uncomplicated inguinal hernia, the use of a mesh in an emergency context remains controversial. Pure tissue repairs have an essential role in the management of incarcerated or strangulated inguinal hernia. To date, there has been little agreement on what is the best surgical technique suitable for emergency hernia surgery [5]. The data are contradictory with respect to hemodynamics in the testicular parenchyma in patients with inguinal hernias. A decrease in the maximum systolic and diastolic blood flow velocity was registered before surgery, as well as a significant increase in the resistance index, which indicates compression of the elements of the spermatic cord during the formation of a deep inguinal ring [6, 7]. Other authors note the absence of differences in testicular blood flow before and immediately after surgery [8, 9].

It is possible to reduce the number of complications arising from implants using the autoplasmic method of inguinal hernia repair. Our team developed a new method of the inguinal canal plasty with a displaced aponeurotic flap (Badyrov R. M., Abatov N. T. Autoplasty of the posterior wall of the inguinal canal with a displaced aponeurotic flap. Certificate on Intellectual Property No. 298 of 2018, 25 October). Therefore, it became necessary to investigate the effect of various techniques on testicular perfusion.

The **aim** of this study was the comparison of the results of indicators of the blood flow of the testicular, capsular and intratesticular arteries using a new modified autoplasty method and Lichtenstein hernioplasty using an ultrasound.

Materials and Methods

The study included patients with diagnosis of uncomplicated groin hernia, operated on in the Surgery Department of the Clinic of Karaganda Medical University during the time period from 2018 to 2022. The criteria for inclusion were males at the age 18 to 70 years with uncomplicated inguinal hernias, and the absence of gross concomitant pathology. A new method of autoplasty was used in 35 patients. The comparison group amounted to 35 patients with Lichtenstein hernioplasty surgery using partially absorbable mesh endoprosthesis (UltraPro). There were 38 (55%) patients with oblique inguinal hernias and 32 (45%) — with direct inguinal hernias. Inguinal hernias according to the Nyhus classification were 30% of type I, 25% of type II, and 45% of type III. The average age of patients included in group I was 51.5 years, in group II it was 51.8 years. Seventy five percent of patients were discharged from the clinic on the 6th or 7th day, and the average in-hospital stay was 6.4 days in both groups. The study was approved by the Local Committee on Ethics (No. 10-06.2018), all patients signed informed consent for participation in the study. The group average was calculated for all quantitative data arithmetic (X), standard deviation (SD). The reliability of the differences between the studied groups was determined by statistical methods using parametric criteria: the Mann–Whitney criterion for comparison of independent groups ('experience-control'). All values of p less than 0.05 were considered statistically significant.

Patients were examined in a position lying on the back using a 10 MHz ultrasonic linear sensor (Logic P9 from GE, USA). The sensor was neatly placed directly in the groin area, on the skin of the scrotum. The patient was suggested to hold the penis over the pubis. Real-time scanning was obtained in standard longitudinal and transverse sections. The following parameters were estimated in 1 week, 1, 3, 6 months and 1 year after surgery: bloodstock in testicular, capsular and intratesticular arteries peak systolic velocity (PSV), end diastolic velocity (EDV) and resistive index (RI). The resistive

index was calculated using the formula $RI = PSV - EDV/PSV$.

The repair technique of the inguinal canal posterior wall with displaced aponeurotic flap was performed as follows: the medial sheet of the aponeurosis of the abdomen external oblique muscle was peeled

off to a white line using a «blunt» method. The next step was to cut out a quadrangular aponeurotic flap (4.0 × 7.0 cm in size) of the combined aponeurosis of the internal oblique and transverse abdominal muscles from the anterior wall of the rectus abdominis muscle vagina (Figures 1, 2).

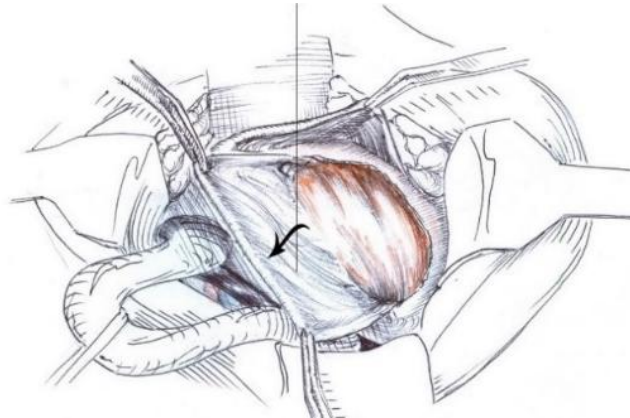


Fig. 1. The flap from the anterior wall of the rectus abdominis muscle vagina is highlighted and moved down for plastic surgery.

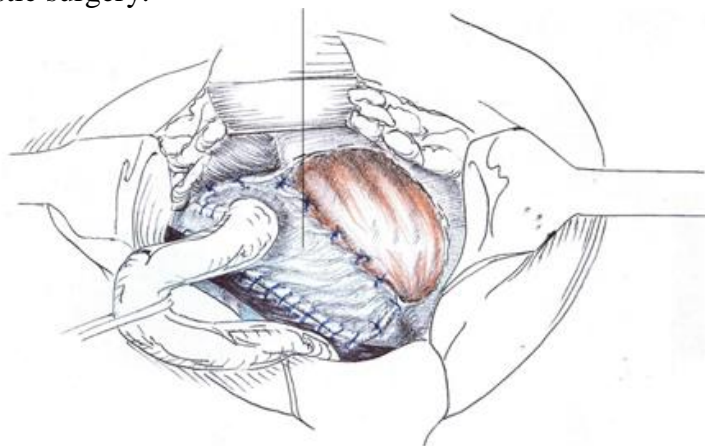


Fig. 2. The inguinal triangle is closed with a displaced aponeurotic flap of the rectus abdominis muscle vagina.

Results

The main criterion for the effectiveness of hernioplasty is a relapse the in both groups consisted 0% for a period of up to 12 months. In the dynamics of both groups, an improvement in the velocity of blood flow was noted before the surgical procedure and immediately after the surgery with a decrease in the vessel resistance index (Figures 3–5).

A statistically significant effect on blood flow was detected in the testicular artery, which leads to a decrease in perfusion below the basal values after surgery for 12

months after surgery ($PSV = 18.9 \pm 1.9$ cm/s, $EDV = 4.0 \pm 0.7$ cm/s, $RI = 0.8 \pm 0.03$). In the group where the inguinal canal autoplasty method was used ($PSV = 22.6 \pm 2.3$ cm/s, $EDV = 7.0 \pm 1.4$ cm/s, $RI = 0.68 \pm 0.07$), these changes were not detected.

The obtained data before the surgery showed a significant reliable reduction in all the indicators of blood flow rate in both groups of patients (Wilcoxon test, $p < 0.05$), and the intergroup differences were absent (the Mann–Whitney test, $p > 0.05$). The above-mentioned highlights the effect of inguinal

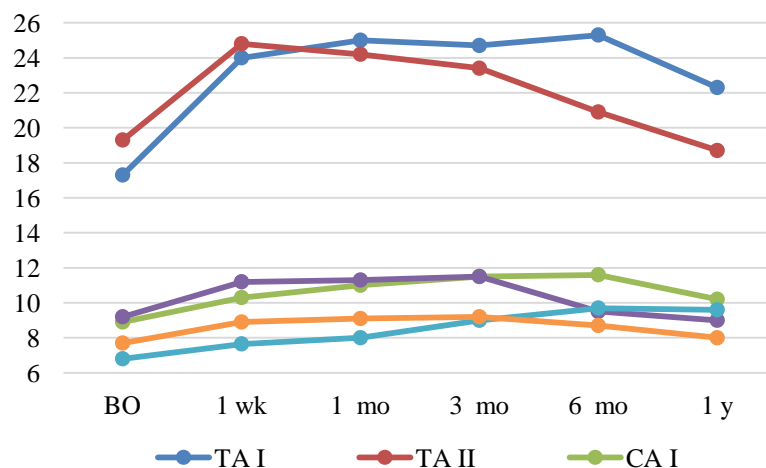


Fig. 3. Analysis for peak-systolic velocity (PSV) of testicular, capsular and intratesticular artery measured before operation (BO), 1 week (1 wk), 1, 3 and 6 months (1, 3, 6 mo), 1 years (1y) later; Group I: new autoplasty method, Group II: hernia repair (Lichtenstein). TA I (testicular artery Group I), CA I (capsular artery Group I), ITA I (intratesticular artery Group I), TA II (testicular artery Group II), CA II (capsular artery Group II), ITA II (intratesticular artery Group II); TA I (testicular artery Group I), CA I (capsular artery Group I), ITA I (intratesticular artery Group I), TA II (testicular artery Group II), CA II (capsular artery Group II), ITA II (intratesticular artery Group II).

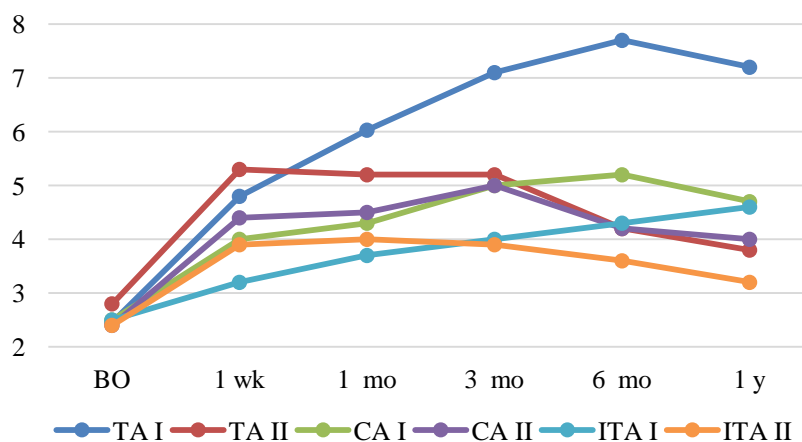


Fig. 4. Analysis for the end-diastolic velocity of testicular, capsular and intratesticular artery measured before operation (BO), 1 week (1 wk), 1, 3 and 6 month (1, 3, 6 mo), 1 years (1y) later.

hernia on testicular perfusion. It should be noted that RI before the operation was high and reliably decreased after the surgery in all studied arteries (Figure 5).

The further study of perfusion indicators in patients of both groups in the postoperative period revealed a gradual increase in the PSV parameter in further observation periods. However, it is worth noting that in the Group II, even a year after the operation PSV of the testicular and capsular artery, it was not re-

turned to basal values (Wilcoxon test, $p < 0.05$) (Figure 1). Statistically significant differences between the study groups were discovered concerning EDV and RI in the testicular, capsular and intratesticular arteries after 6 months and 1 year after surgery. The difference in the peak systolic velocity indicators was essential in the testicular artery from the point of view of the parameters of Doppler mapping as follows after 3 and 6 months after the operation (Mann–Whitney test, $p < 0.05$).

The diameter of the artery of the spermatic artery before and after the operation was statistically significantly different in both groups, and had a tendency to increase the indicator in the dynamics. This indicator

decreased by 6 months of the postoperative period in the comparison group, however, statistically significant differences were not detected according to the Mann–Whitney criterion (Figure 6).

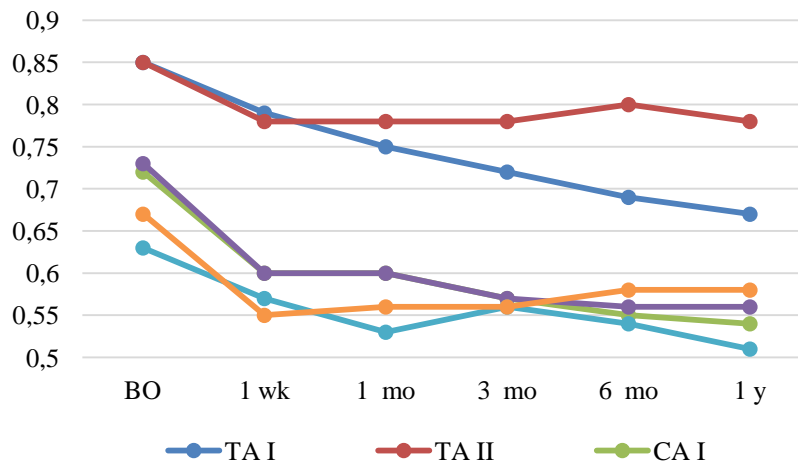


Fig. 5. Analysis for resistive index of testicular, capsular and intratesticular artery.

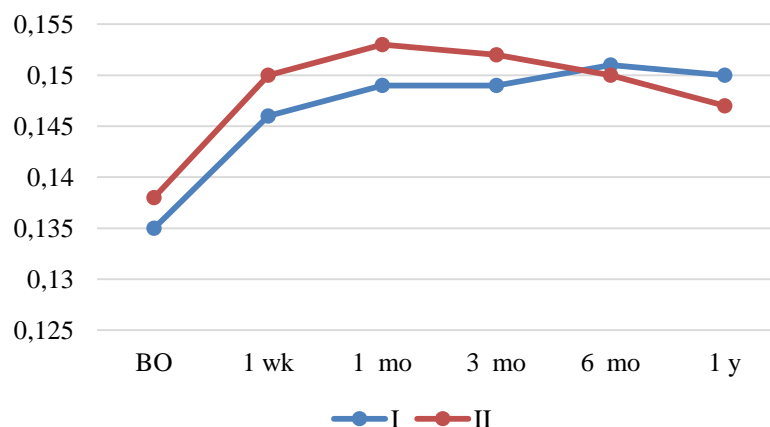


Fig. 6. The diameter of spermatic artery. Group I: new autoplasty method, Group II: hernia repair by Lichtenstein.

Discussion

It has been revealed that patients with the inguinal hernia had hemodynamic disorders in the testicular parenchyma. A decrease in the maximum systolic and diastolic velocity of the blood flow was noted prior to surgery that confirms the known data [7, 10]. An increase of the blood flow rate was observed in patients in both groups during the postoperative period. These indicators were significantly higher in patients of the study group than ones of the comparison group. At

the same time, the resistance index increased significantly in the group where the mesh endoprosthesis was used. This indicates the compression of the elements of the spermatic cord at the level of the deep inguinal ring. The developed modified autoplasty method in the inguinal canal eliminated the existing hemodynamic disorders.

The opinions of the authors about the influence of the plastic of groin hernia on the testicular blood flow were divided. Some believe that the testicular perfusion is suffi-

cient and is provided by many anastomoses that protect it from ischemic damage [11–12]. Others note the effect of implantation of the mesh implant on the volume of testicle and blood flow [13–15].

It can be assumed that the dense scar changes in the comparison group cause compression of the elements of the spermatic cord at the later dates after the operation and could affect the perfusion of the testicles, where lower blood flow rate indicators and high values of IR compared to the data before surgery (basal values) were revealed. Based on the data obtained, we allocated that hernioplasty by Lichtenstein causes a decrease in blood flow in the arteries of the spermatic cord and the parenchyma of the testicle immediately after the operation, but it remains below the preoperative values in more remote periods.

Conclusion

The results of the analysis allow determining some conclusions of interest to our research. There are statistically significant differences in blood flow indicators between the groups by 12 months after surgery. The mesh hernia repair has a clinically significant effect on the blood flow of the testicular artery, which leads to a decrease in perfusion below basal values after surgery at a later date (PSV = $18,9 \pm 1,9$ cm/c, EDV = $4,0 \pm 0,7$ cm/c, RI = $0,8 \pm 0,03$), which is possible due to the formation of scar changes. These changes were not revealed in group, using the method of autoplasty in the inguinal canal (PSV = $22,6 \pm 2,3$ cm/c, EDV = $7,0 \pm 1,4$ cm/c, RI = $0,68 \pm 0,07$), and it according to our opinion associated with the lack of pressure on the structure of the spermatic cord.

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Дополнительная информация

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Информация об авторах:

☒ Сапиева Сауле Тулегеновна — докторант, врач приемно-диагностического блока клиники медицинского университета, SPIN: 6880-2275, <https://orcid.org/0000-0002-0850-2377>, e-mail: saule.sapieva@mail.ru

Алиякпаров Макаш Тыныштыктаевич — д.м.н., профессор, Академик НАН Республики Казахстан, профессор кафедры онкологии и лучевой диагностики, SPIN: 6849-4536, <https://orcid.org/0000-0002-9276-3966>, e-mail: aliyakparov@kgmu.kz

Абатов Нуркаси Тулепбергенович — к.м.н., профессор, заведующий кафедрой хирургических болезней, SPIN: 7145-5234, <https://orcid.org/0000-0002-4111-6355>, e-mail: abatov_nurkasi@mail.ru

Бадыров Руслан Муратович — доктор PhD, доцент кафедры хирургических болезней, SPIN: 8084-4547, <https://orcid.org/0000-0002-3578-7144>, e-mail: badyrov_ruslan@bk.ru

Вклад авторов:

Сапиева С. Т. — проведение исследования, сбор материала, обработка данных, написание статьи.

Алиякпаров М. Т. — научное руководство, редактирование.

Абатов Н. Т. — научное руководство, концепция.

Бадыров Р. М. — проведение исследования.

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Information about the authors:

☒ Saule T. Sapiyeva — PhD-Student, Ultrasound Doctor of Reception and Diagnostic Unit of the Clinic, SPIN: 6880-2275, <https://orcid.org/0000-0002-0850-2377>, e-mail: saule.sapieva@mail.ru

Makash T. Aliyakparov — MD, Dr. Sci. (Med.), Professor, Academician of the NAS of the RK, Professor of the Department of Oncology and Radiation Diagnostics, SPIN: 6849-4536, <https://orcid.org/0000-0002-9276-3966>, e-mail: aliyakparov@kgmu.kz

Nurkassi T. Abatov — MD, Cand. Sci. (Med.), Professor, Head of the Department of Surgical Diseases, SPIN: 7145-5234, <https://orcid.org/0000-0002-4111-6355>, e-mail: abatov_nurkasi@mail.ru

Ruslan M. Badyrov — MD, PhD, Associate Professor of the Department of Surgical Diseases, SPIN: 8084-4547, <https://orcid.org/0000-0002-3578-7144>, e-mail: badyrov_ruslan@bk.ru

Contribution of the authors:

Sapiyeva S. T. — conducting research, collecting material, processing data, writing an article.

Aliyakparov M. T. — scientific guidance, editing.

Abatov N. T. — scientific guidance, concept.

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