

The Surgical Treatment of Traumatic Injury of the Spleen

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Abstract

The questions connected with the surgical treatment of traumatic injury of the spleen are of great variety. But at the same time according to the data from thematic literature, splenectomy is the best way of treatment, but it does not give satisfactory result. According to the above mentioned information we have come across 2 methods of surgical treatment of the spleen trauma. The first method is transference of the damaged spleen after appropriate cleaning into the extraperitoneal space. (Certificate of authorship 5/ 5/5 2001 year, Tbilisi). This method was used 5(five) times. Another one is the method of spleen tissue transplantation into the "pocket" of the big epiploon and transference of this "pocket" with transplantant extraperitoneally. (Certificate of authorship 5/269, 2001 year, Tbilisi). This method was used 11(eleven) times. It was investigated not only the advantages of above mentioned methods, but also the results of using other organ - saving operations and splenectomy in order to treat the traumatic injury of the spleen.

Keywords: *spleen, trauma, organ-saving operations, auto transplantation, appendectomy*

Introduction

Surgical treatment is the main method to cure traumatic injury of the spleen and splenectomy represents one of the ways, which is used for many years. After plenty of examinations we have found out that splenectomy have both negative and positive sides. (Abasov V.H.1982) After such conclusion it was made some attempts to save spleen tissue.(Pavlorski M.P., Chulkin S.N.1992, Ovokwa R.O., Ugvu B.T. at al 1997) In spite of above mentioned data during the last 30 years the operations for saving organs were seldom. (Shapkin Y. G., Chalik Y.V., Malikov V.V. 2000). At the same time there are some cases where in spite of different attempts it is very difficult to save even a part of a spleen. In this situation, it is worth using

autotransplantation of the spleen tissue. (Epifonov N.S. 1992, Chu K.M. at al 1995). The method of splenautotransplantation is diversified (KaladzeH.Z. 1999, Zoli G., Gozazza G.R. at al 1994) and because of that scientists have different points of view, especially that this method is not complete and need more detailed searching.

It is clear how important are questions connected with surgical treatment of traumatic injury of the spleen and there has not been final conclusion about it yet. Because of it each new research work-would it be theoretical or practical-is actual for medicine.

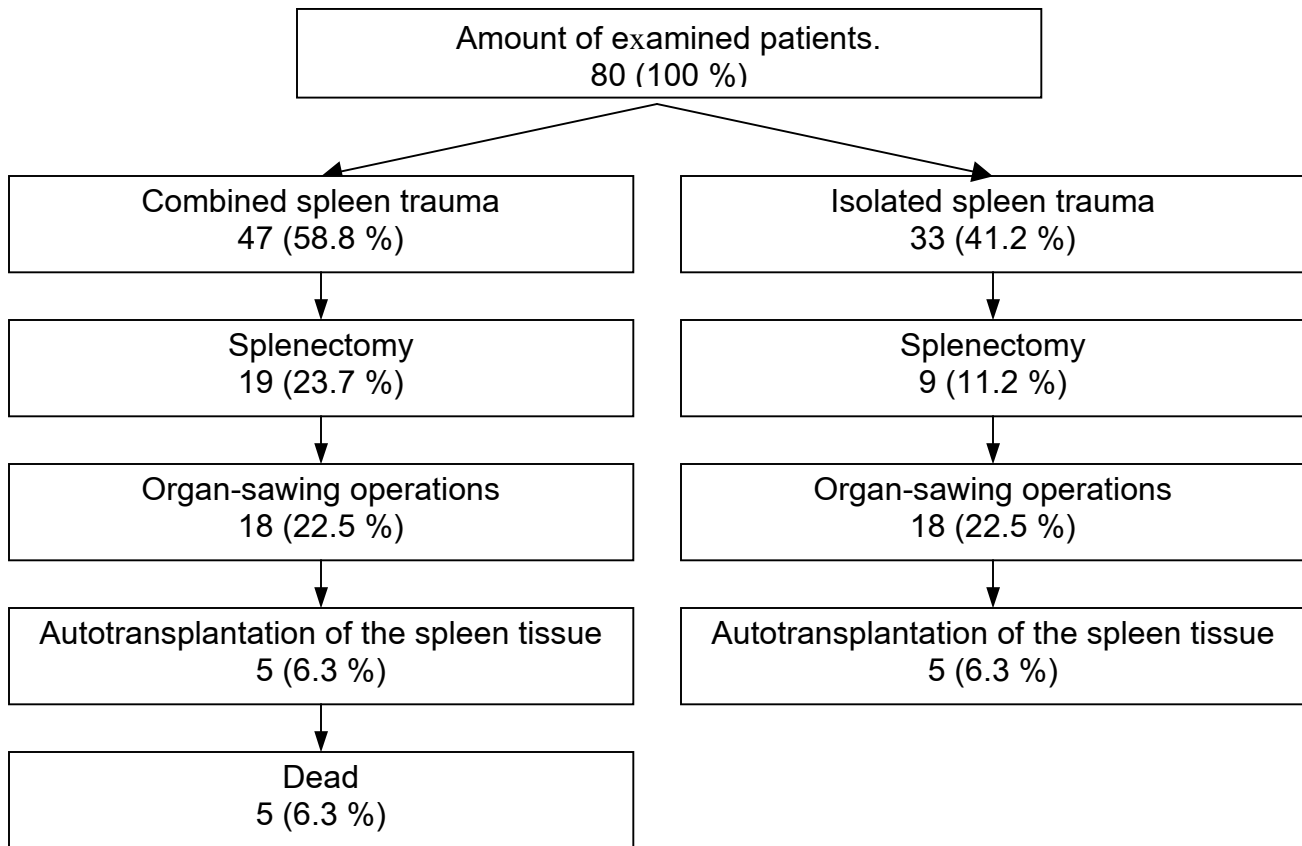


Fig.1 Results of examinations during the trauma and during the period after the early operation.

Patients and Methods

According to the above mentioned information the aim of our research paper is to analyze the consequences of patients cured of spleen trauma by surgical treatment in Ajarian Autonomous Republic for the last 12 years (1990-2001). For this purpose 107 patients' data were analyzed. From this group 15 patients (14%) had undergone splenectomy before (3-12 years) and their data of investigations were used for studying the complex result of immune status after spleen ablation, and 80 patients (77,8%) were examined during the trauma and during the period after the early operation. This division is shown in the Fig. 1.

With the help of splenectomy, organ-saving operations and autotransplantation of the spleen tissue with the purpose of patients comparative immune characterization, 107 sick persons were combined in 4 group consisted of 15 patients (14%). They had different types of rupture. The data of these patients were used as control results.

1.First group consisted of 15 patients(14%).

2.Second (2nd) group consisted of 40 patients (37,4%). These persons had undergone splenectomy. The investigation results of 12 patients were taken after 3-12 years from operation.

3.Third (3 rd) group consisted of 36 patients(37,7%). These patients had undergone different types of organ-saving operations.

4.Fourth (4th) group consisted of 11 patients (10,3%) who had undergone spleen investigation and autotransplantation of its tissue. 5 patients were dead.

During the close trauma of abdominal cavity in order to affirm the diagnosis, laparotomies was used 12 times, laparoscopy - in 58 cases (laparoscope by CARL STORZ firm with becoming instrument set), echography was used in 84 cases (ultrasonograph SCANNER 150), and angiography was used 27 times (with the help of Seldinger's method by PHILIPS SERIOMOBILE 2000 x-

ray control. Also it was used urography (78%) and angiocatheter (size 18G-20 G). For operations we used argon plasmatic scalpel ""Fokel"-9-2 (9 pacel -9-2) and the SUPER -M s becoming electro coagulant. In order to prove the functions of transplanted spleen tissue it was made radioisotope examinations (in 2 cases), with the half of 99 m TC. For Clinic-immunological investigations we use everyday methods, but during the process of investigation, figure are formed according to the variational statistic rules. (Sereiko A.F., Ermakova V.V. and others, 1997), by using Pentium 3 computer.

Results of Investigation

As we have mentioned second group consists of 12 patients data (8male-66,7% and 4 female 33,3%). Which have undergone splenectomy in different periods (3-12 years) since the first investigation. 3 patients had no characteristic pathological clinical features. Underwent trauma and splenectomy did not influence on them.

Some kinds of pathological changes have 9 patients (75%). Since the operation on the spleen at 5 patients 55%-it have been developed some kind of maladies which we can hardly connect with trauma and surgical treatment .

Postsplenectomy syndrome means total weakness, reducing the vital activity, changeable mood, periodical pain of little intensity in the belly area, which can be cured by itself, without any treatment. This syndrome was found at 4 (44,4%) inpatients (3 male and 1 female). All the patients were at the age from 25 to 45 years old.

All these 9 patients had different types of infection: 5 patients had respiratory virus infection and angina; after

splenectomy was found out chronic bronchitis, in 2 patients, one had relapsing furunculous and another had pylonephritis.

These data become the basis for immunologic investigation of inpatients. The analyses have shown the feat that even after 3-12 year investigation there have been found some deflections in comparison with control date. For example, A-class immunoglobulin concentration, B-lymphocyte absolute and relative quantity, T-suppressor relative quantity are higher than data of the control group, patients I suppressor relative number after splenectomy are higher than data of the control group, but in this case statistic data appeared unbelievable. At the same time M- and G-class data of immunoglobulin concentration, summary activity of the complement, relative quantity of T-helper, number of phagocytes, polymorphous leucocytes and phagocyte of monocytes, and phagocyte index number, polymorph nuclei leucocytes and spontaneous and induced HCT-test data of monocytes are lower than analogical results of the control group.

The results of the 2nd group investigations show that if we compare 2 periods 1)from 6 months till 1 year after splenectomy and 2)3-12 years after the same one, analyses show the same changes in immune status. It means that after an operation on the spleen the movements in immune system are stabilized and further they are not changeable. The investigations which have been made during the period after splenectomy show that the level of immune status have positive changes, but at the same time they have negative ones and are lower in comparison with the norm. Such changes show immunodeficiency, which form the reason of complication.

3rd group consisted of 36 inpatients (25 males, 11 females - *Tab.1*)

Types of operations	Number of patients
Anatomical resection	5 (13, 9 %)
Atypical resection	6 (16, 7 %)
Sewing up of spleen tissue (splenoraphy)	17 (47, 2 %)
Coagulation by argon laser	3 (8, 3 %)
Transplantation of damaged spleen extraperitoneally	5 (13, 9 %)
Total	36 (100 %)

Tab.1 *Organ - saving operation on the spleen.*

Types of trauma	Number of patients
I. close trauma	27 (75 %)
a) spleen haematoma	8 (22, 2 %)
b) tearing a way of spleen lover pole	6 (16, 7 %)
c) damage of the spleen parenchyma	9 (25 %)
d) Simultaneous damage of the spleen capsule	4 (11, 1 %)
II. Open trauma	
entrance wound in abdominal cavity by damaging of isolated spleen	9 (25 %)
Total	36 (100 %)

Tab.2 *Types of trauma on which bases organ - saving operations on the spleen have made.*

We grouped 2 anatomical variants of the damage spleen.

1) Damage location in pole environment;

2) Localization of the damage of artery at the irrigational zone of the first row branch, or in any area of anatomical lobe.

In our opinion, this classification helps surgeons to investigate tissue in short time and shows right surgical treatment. But there is one moment when spleen tissue is damaged at the entrance area or spleen nourishing neuro-vascular bundle is injured. In these cases operation is impossible.

The term "Anatomical resection" is identical to the ablation of that part of spleen that is nourished by blood of A. Lienalis first group branch. In this case ablated spleen tissue surpasses the damaged one. Anatomical resection was used 5 times.

We have sewed up spleen tissue in 17 (47,2%) cases, when the type of trauma does not give a chance for coagulation and at the same time choosing of anatomical or atypical resection is not possible. It was damaged a little part on the surface of the spleen diaphragm or on the fore-part. Atypical resection of the spleen was made mainly during the hard injury and at the form of wedge - shaped resection (6 operations - 16.7%). Treatment of the damage spleen by argon laser was made mainly in that case, when there was only injury of the spleen capsule or injury of the capsule and

important injury of parenchyma without hard haemorrhage (3 operations-8,3%). In this case there is a threat of relapsing haemorrhage development.

In recent years in the case of spleen little damage we began organ extra peritoneal transplantation. This method of operation (certificate of authorship №5/315) is based on the principle of spleen self-tamponage in case of the haemorrhage. Technically, the operation is conducted in such way: abdominal cavity is opened by upper middle laparotomy after the investigation of the haemorrhage reason and revision. Then a traumatic tight is touched on neuro-vascular bundle. After that haemorrhage from the spleen decreases or ceases. We get the spleen through the wound, examine its surface, and if we see damaged blood-vessels, we sew up together by a traumatic needle and suture. Then we delete the tight from blood-vessels and this gives an opportunity to examine the effectiveness of actions and in negative case we can notice bleeding area. We stop haemorrhage by nodulose stitch or by electro coagulator. Then we transplant the processing spleen into retroperitoneal space. For this action, it is cutted from the left lateral trough pariental peritoneum, delete if from frontal lateral and back side of muscles and we form a pocket according to the muscled size and there we transplant the spleen. Cutted peritoneum sheet is sewed up at the front spleen, avoid blood - vessels compressions, so the spleen is in close area and this helps to avoid haemorrhage relapse. After leaving of control drain pipe in the abdominal cavity, its full restoration happens by nodulose stitches. This method was used 5 times (13,9%) and there were no complications.

№	PARAMETERS	2nd DAY AFTER OPERATION	15 th DAY AFTER OPERATION	CONTROL
1	A – class immunoglobulin g/l	5.51±0.08	3.62±0.07	3.59±0.09
2	M – class immunoglobulin g/l	0.27±0.05	0.24±0.5	2.21±0.06
3	G – class immunoglobulin g/l	16.43±0.21	16.35±0.22	16.63±0.23
4	Summary activity of complement (conventional unit)	28.90±0.4	30.38±0.36	30.4±0.44
5	The titre of immune complex, situated in circulation. (conventional unit)	0.66±0.002	0.68±0.002	0.68±0.002
6	T – lymphocyte relative index %	57.5±0.262	60.57±0.21	60.5±0.46
7	B – lymphocyte relative index %	28.5±0.22	28.7±0.3	27.35±0.63
8	T – lymphocyte absolute index (10x10)	1.9±0.01	1.48±0.02	1.49±0.3
9	B – lymphocyte absolute index (10x10)	0.4±0.03	0.49±0.02	0.43±0.09
10	T- chelper index of relative quantity (%)	21.7±0.04	26.89±0.05	27.031±0.53
11	T – supersort relative index %	27.26±0.5	28.90±0.5	29.25±0.74
12	Polymorphonuclei leucocyte index of phagocyte %	39.2±0.6	41.15±0.4	40.6±0.66
13	The showing of polymorphonuclei leukocyte number of monocytes of phagocytes	38.8±0.6	38.78±0.6	30.7±0.45

Tab.3 *The results of patients' immunological investigations after organ - saving operations.*

Tab.3. shows the results after organ-saving operations and in all situations after organ-saving operations and they, in all situations show the same outcome as in scheduled figures or close to them. These date explains declinations in immune status, which happened on the 2 nd day after operation. These facts can be explained by surgical 'aggression'.

4th group consisted of 11 patients. Ablation of a spleen and transplantation of its tissue took place after traumatic damage of the organism. Isolated trauma of abdominal cavity happened 6 times, and in 2 cases was found out the wound in abdominal cavity, made by incomer knife, and in a cases-close trauma. Combined trauma took place in 5 cases, in which simultaneous traumas of chest and abdominal cavity was found out in 4 cases and was noticed in 1 case.

Types of trauma	Number of patients
I. Isolated trauma of abdominal cavity.	6 (54.5 %)
a) close trauma	4 (36.2 %)
b) incoming wound	2 (18.1 %)
II. Combined trauma	5 (45.5 %)
a) abdomen + chest	3 (27.3 %)
b) abdomen + incoming wound of the chest	1 (9.1 %)
c) abdomen + chest cortex trauma	1 (9.1 %)
Total	11 (100 %)

Tab.4 *The division of the 4 th group patients according to the traumas.*

Types of trauma	Number of patients
1. Multiple damage of the spleen tissue	5 (45.5 %)
2. spleen fragmentation	3 (27.2 %)
3. spleen trauma in the area of organ membrane by the damaging of nervo –vascular membrane.	2 (18.2 %)
4. Decapsulation of the spleen from the pulp by diffuse haemorrhage	1 (9.1 %)
Total	11 (100 %)

Tab.5 *Types of spleen trauma found by the revision of abdominal cavity. (4th group).*

10 patients from the above mentioned table were operated after 3-6 hours from the moment of their admission, and only one had double rupture of the spleen and was operated on the 3rd day after trauma.

We found out such damages of the spleen which precludes organ-saving operations. Types of damaged spleen is shown in the *Tab.5*.

All operations are made under a general anesthesia. We use our method (certificate of authorship № 5/269 16.07.2001) which means transplantation of the spleen tissue from the 'pocket' of a big epiploon extraperitoneally. The basic method of operation: umbilicus laparotomy from left side, revision of abdominal cavity, splenectomy by usual method.

The formation of the 'pocket' happens at the left brim side of epiploon, in a vascular area by using a traumatic

needle and 8/0, 10/0 thread. The 'pocket' connects only with the upper part of an epiploon and there we can place 30-40 pieces of spleen tissue (size 5-6 mm³). After an operation the pocket is closed.

The next step is making a longitudinal section in the left lateral part, peritoneum is cutted and that part which is close to the wall, deleted from the front lateral wall mussels by hand. These manipulations give an opportunity to place a 'pocket' with transplantant. After this peritoneum cavity is closed. One should exclude the striking of gut loops between the stitches and stopping of blood circulation. Abdominal cavity is closed layerly and according to the indices one can put a drainage-irrigational pipe.

Preparations for spleen fissue transplantation are the next: ablated spleen is bathed in a warm physiological solution, crumpled tissues are deleted, perfusion is

made by cold (4°C) solution through the spleen artery. The solution consists of physiological solution 1 000 millilitre units, heparine 10000 units, penicillin 5 ml canamicin 1.0 g (Mornenko O. N. 1986, Grinev K. M. 1990). Perfusion is made by using 20 gram syring and its full value was examined by color of a perfussate from spleen's vein (color of the spleen was changed from bluish-reddish till whittish-pinkish. The perfussate is colorless). With the help of sharp instrument the spleen is cutled into 5-6 mm³ pieces and they are used as transplantants. Clinic-immunological investigations made after autotransplantation showed such fact. There were important changes in the patients' immune status during the early postoperotonas period. But if on the 7th day these changes are of tendentious character (statistically changes are unbelievable and we can examine them as a surgical aggression), its data is close to statistic. This means that above mentioned changes have specific character. It was found out A - class immunoglobulin concentration, circulating titre of immune complex, absolute and comparative quantity of B-lymphocytes, absolute quantity of lymphocyte and relative quantity of T-suppressors by gradual addition. After 7days from operation there are important reductions of the test, such as M- and G-class immunoglobuline concentration, summary activity of the complement, T-chelper comparative activity, phagocyte quantity of phagocytes, index of phagocytes, spontaneous and reduced test of polymorph nuclei leucocytes and monocytes. Patients' relative number of T-lymphocytes are higher than control figures, but statistical distinction between them is unbelievable. There were carried out 2 types of investigations. The first was the result of the patients after 7 days from operation and the 2nd one was the result of the patients who had undergone splenectomy. These two results coincided. The above mentioned changes reach the culmination on the 15th day, reverse process begins from 30th day or A - class immunoglobulin concentration, circulating titre of immune complex, absolute and comparative quantity of B-lymphocytes, absolute and comparative quantity of T-lymphocytes, gradual fall of T-suppressors' relative quantity and M- and G-class immunogobulin summary activity of complement, relative quantity of T-chelper, gradual addition of polymorphonuclei leucocyte and monocytes' phagocyte and functional activity, The results of investigations during the period of 90 - 180 days are close to the results of control group and differ from the patients' results who have undergone only spleneetomy. During the investigation patients of the 4 th group had not serious declinations in their immune status.

So, during the early post operational period there is a falling in data. Changes to the better side begin from 14 th day to 30th, on the 60th day they reach the normal position, the 180th day is the day of full stabilization.

Investigations of patients' abdominal cavity takes place on the 7th day after operation. These investigations are made by supersound. We inspect patients who have undergone splenectomy and transplantation of the spleen tissue.

Visual observation of the transplanted spleen fissue did not happen for the first control investigation. We found out at 3 patients (27.3%) 3x1. 5x2 mm contour formation (not sharp) ,on the 15 th day. It was placed under the front lateral wall of the abdomen at the area of implantation. The solidity of its tissue was lower that the liver's one. After 30 th day from operation at all the patients (100%) were found solid tissue fixings in the implantation area, at 7 patients (63,6%) were found some distant (from 6 + 0.12) fixings. The distance between them was about 3 mm; the size of the fixings were 12x5 mm. In 5 cases (36,4%) happened visualization of the formed tissue. This visualization was indivisible and identical, solid or oral, size from 34x15 to 60x60 mm. These facts can be explained by the junction of the close located fragments. Further dynamic super sound didn't find out any declinations from the basic product. We didn't find atypical forms of erythrocytes in the smear of the blood of the 11 patients. These patients have undergone splenectomy and autotransplantation of the spleen tissue. But when we look through the 12 patients, who had undergone splenectomy, we found out such erythrocytes (in 8 cases -66.7%).

Further period of the early operation flew without any complication for patients. We mentioned here the patients after spleneectomy and autotransplantation of the spleen tissue. No letal outcome. Patients spent 12±21 days at the clinic. We observed all the patients during 1 year and didn't find any hint of postsplenectomic syndrome. We made radioisotopic investigations by using 99 mtc in 2 cases in order to prove the functioning of the spleen tissue. Investigations showed that the transplantant was joining actively an isotope and this proved its functioning.

Conclusion

1. Different types of the spleen traumatic damage need detailed and individual investigations.
2. Organ-saving operations are very important. They give an opportunity to save spleen tissue and to exclude postsplenectomy syndrome.
3. During the early post operation period (on the 2nd-5th day) we can find changes in patients' immune status. This can be explained as the result of surgical aggression'. But on the 14th, 15th days these changes return to the control data.

4.Extraperitonic extraction of the spleen is a long - range method and needs further investigation.

5.Transplantation of the epiploon 'pocket' with the extraperiotonically extraction of the spleen gives an opportunity to avoid immune and surgical complications and to create possibilities to examine transplatant.

6.For transplantant inspection we need immune monitoring, purposeful inspection of the atypical forms of the erythrocytes and investigations by super sound. Radio isotopic investigation should be done according to the strict data.

References

1. Kaladze "Autotransplantation of the spleen tissue". Experimental investigations for medical dissertation. Tbilisi. 1999.
2. G. Tsetskhladze, A. Beridze, E. Kashikadze. "Surgical treatment of the spleen injury. Anthology". Batumi State University named by Shota Rustaveli. Anthology of Scientific conference materials. Volume 2. May, 2000.
3. Абасов В. Х., Гаджиев Д. И., Юсубов В. И. - "Органосохраняющие операции при травматических повреждениях селезенки." " Вестник хирургии" ,1982, 6, 84-88.
4. Гринев К. М. - Хирургическая коррекция постспленектомического иммунодефицита Автореферат диссертации на соискание ученой степени кандидата медицинских наук. Ленинград, 1990, 23.
5. Епифанов Н. С. - Лечение повреждений селезенки // Хирургия ,1992, 5-6,85-86.
6. Мироненко О Н - Клинико-экспериментальное обоснование аутотрансплантации ткани селезенки //авт. Дисс., на соиск уч. Степ. Канд. Мед. Наук.. Ворошиловград 1986, 29.
7. Павловский М. П., Чулкин С .Н. - Хирургическая тактика при травме селезенки //Хирургия, 1992, 5-6, 89-93.
8. Серенко А. Ф., Ермаков В.В. и др., - Социальная гигиена и организация здравоохранения // Москва, Медицина, 1997, 672.
9. Шапкин Ю. Г., Чалык Ю. И., Масляков В.В. - Возможности и результаты органосохраняющих операций при травмах селезенки // Вестник хирургии 2000, 159, 6, 41-42.
10. Chu K.M., Lati D.T., Stern H.S., Sheldon D. N. - Fungating carcinoma of the stomach bloc multipliorgan resection and abdominal waereconstruction // Postgraduate medical journal., 1995, 71, 835, 303-305.

Хирургическое лечение травматических повреждений селезенки

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Р Е З Ю М Е

Вопросы, связанные с хирургическим лечением травматических повреждений селезенки весьма разнообразны, согласно данным литературы методом выбора является, спленэктомия, которая однако, не дает удовлетворительных результатов. В статье приводятся данные о применении на практике двух новых методов хирургического лечения травм селезенки: первый - метод перемещения поврежденной селезенки после соответствующей обработки, в экстраперитонеальное двух новых методов хирургического лечения травм селезенки двух новых методов хирургического лечения травм селезенки двух новых методов хирургического лечения травм селезенки двух новых методов хирургического лечения травм селезенки двух новых методов хирургического лечения травм селезенки пространства (авторское свидетельство № 5/515 2001 г. Тбилиси) использован при лечении 5 больных, а второй - метод аутотрансплантации ткани селезенки в "карман" большого сальника и перемещение "кармана" вместе с трансплантатом экстраперитонеально (авторское свидетельство № 5/269 2001 г. б Тбилиси) применен в 11 случаях. Проанализированы результаты использования, как указанных методов, так других органосберегающих операций и спленэктомии. Указанные два метода рекомендуются для применения в широкой клинической практике.

Ключевые слова: *селезенка, травма, органосберегающие операции, аутотрансплантация, аппендэктомия*