

The Use of Lasers and Prosthetic Hernioplasty in Patients with Strangulated Ventral Hernias

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ABSTRACT

The issue of using synthetic prosthesis for plasty at strangulated hernia still remains disputable. From 1992 to 2015 we have operated 219 patients with strangulated ventral and inguinal hernias. Patients were randomized in 2 groups. Tensioning means ways of hernioplasty have been performed in 124 patients consisted the 1st group, and the 2nd group consisted of 95 patients have been performed hernioplasty by reticular prosthesis with the use of carbon dioxide laser intraoperatively. Hernias size in the second group was estimated based on Chevrel and Rath (SWR classification) methods. W4 – 6 (12.2%), W3 – 16 (32.6%), W2 – 24(48.9%), W1- 3 (6.1%). Local complications of the postoperative wound in the 1st group have been noted in 15 (13.0%): suppuration – 13, wound hematoma – 1, fecal fistula – 1. Lethality was 4%. In the 2nd group complications of postoperative wound were observed in 33 (35.4%): seroma – 30 and suppuration - 3. Lethality in that group – 3.1%. The analysis of nearest results of postoperative complications showed that suppuration (11.3%) were dominated in the 1st group and in the 2nd one (where used synthetic prosthesis) there was the biggest quantity of seromas 32.6%, and the use of carbon dioxide laser intraoperatively allowed to reduced pyoinflammatory complications in the wound up to 3.3% (3 times less in compared with the 1st group).

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INTRODUCTION

Strangulated hernias take the fourth place subject to the frequency of operative interventions in the urgent surgery. Postoperative lethality varies from 10 to 40% [1] and depends on some objective reasons. It is generally known that strangulated hernia's treatment outcome is directly proportional to the time of incarceration moment up to the hospital admission. Elderly and gerontal ages of patients, presence of concomitant diseases are also important. Incarceration of caval organs (16%-21%) is often complicated by acute bowel obstruction or by necrosis of strangulated loop with peritonitis development [2, 3].

In spite of strangulated exterior abdomen hernia's diagnostics comparative simplicity, patients are admitted 12 hours later from disease starting, at the presence of evident signs of acute bowel obstruction (ABO) and lethality can reach 35% in patients of elderly and gerontal ages [4, 5]. Ultrasound investigation (USD) is one of the objective diagnostic criteria in emergency herniology along with X-ray investigation of abdominal cavity. USD data allow detecting type and nature of incarceration, condition of strangulated organs, to perform differentiated diagnostics in 88% patients [6, 7].

Well-timed and correct diagnostics of strangulated ventral hernia and also concomitant surgical pathology allows choosing adequate surgical tactics. But operative treatment at strangulated hernias is characterized by its own peculiarities and high risk for the patient. At strangulated hernia's operative treatment the key-point issue to be solved is the choice of the type of abdominal wall defect closure which is often performed in infected conditions. Hernia plasty by local tissues still remains traditional type [8]. Unfortunately, it is effective only at small hernias and in patients of the young and middle age. In patients with giant and recurrent hernias which are often complicated by incarceration, relapse reaches 40-60% [9].

Deficiency of own tissues at hernia ring plasty and appearing syndrome of intra-abdominal pressure increasing are very important. Replacement of hernia contents into abdominal cavity leads to respiration limitation, cardiac activity disorder and other complications due to diaphragm high standing and developed deficiency of abdominal cavity. Compressing, tension autoplasty at giant and “non-enclosing” hernias sometimes leads to the development of fatal abdominal compartment-syndrome (ACS) [10]. That is why it is more rational to use hernioplasty “without tension” with the application of up-to-date polymeric materials in these patients.

The issue of the transplants use is challenged by some authors who consider that it increases the risk of wound complications and in some cases can lead to transplant rejection. Surgical treatment of hernias in infection conditions is the most complicated problem of herniology connected with the high risk of wound infection development and hernia’s relapse [11]. This study has been done to investigate nearest results of allohernioplasty and the use of laser techs in patients with strangulated hernias.

MATERIAL AND METHODS

219 patients with strangulated ventral and inguinal hernias were operated in the department of laser surgery at RSCS named after acad. V.Vakhidov from 1992 to 2015. Patients were divided into two groups. To the period from 1992-2004 when tension types of hernioplasty were performed 124 patients have been included who made up the 1st group and since 2005-2015 - the 2nd group in which 95 patients have been performed prosthetic hernioplasty.

Patients age in the 1st group varied from 13 to 85 years, mean age made up 55.1±1.3 years. Anamnesis of hernia carriage was from 1 month to 35 years, mean anamnesis made up 7.6±0.76 years. Mean time from incarceration moment till hospital admission made up 26.3±2.7 hours. In this group, patients with strangulated inguinal hernias dominated – 47 ones, umbilical hernias – 46 ones, ventral hernias – 27 cases, and white line – 6 people. From 124 patients the relapse hernias had in 24% cases, the quantity of relapses varied from 1 to 6. Mean area of herniation consisted of 147.6 ± 17.6 cm². All patients were informed about conducted study. All data was provided with their permission.

In the 2nd patients group with the use of prosthetic hernioplasty mean age was 57.1±1.2 years, minimal - 20 years, maximal - 82 years. Patients suffered from hernia carriage 9.0±1.0 years at average and it from 1 moth to 40 years. The area of herniation made up – 218.8±27.0 cm². The time from incarceration moment to hospital admission was 32±3.3 hours at the average. Subject to the hernia type in the 2nd group patients have been randomized as follows: ventral – 49, umbilical – 31, inguinal – 14, abdomen white line hernia -1. Relapse hernias made up 36.8 % of them and their quantity was from 1 to 6.

At admission patients were performed standard investigation (clinical-biochemical analysis, functional and X-ray investigations) and also ultrasound investigation (USI) of hernia sac contents aponeurosis defect sizes. All patients had clinics of bowel obstruction which has been confirmed by X-ray investigation of abdominal cavity organs. In the 1st patients group X-ray pattern of bowel obstruction (as ileal arch or Kloiber’s cups) has been formed in 20% and in the 2nd group in 35 % cases.

Table 1. Randomizing of patients by age

Items	<19	19-44	45-59	60-74	>75
The 1 st group	2	26	39	51	6
The 2 nd group	-	9	44	37	5

*p>0.05

Table 2. Time of patients address to hospital from incarceration clinics start

Items	< 12 hours	12-24 hours	>24 hours
The 1 st group	61	26	37
The 2 nd group	33	28	34

*p>0.05

Ethical approval

The review board and ethics committee of RSCS named after acad. V.Vakhidov approved the study protocol and informed consents were taken from all the participants.

RESULTS AND DISCUSSION

Patients have been operated in the regime of high keeping all antiseptic roles. After elimination and opening of hernia sac in 50% there was noted hernia waters supply. In the 1st group 3 patients had hernia sac phlegmon. In all cases there was an inflammation in the hernia sac characterized by edema and infiltration of sac walls. The condition of hernia sac and hernia ring has been visually estimated. Hernia sizes in the 2nd group were estimated by J.P. Chevrel and A.M. Rath classification (SWR classification) – 1999 [12]. There were 6 patients (12.2%) with W4, W3 - 16 (32.6%), W2 - 24(48.9%), W1 -3 (6.1%) cases. As it is seen from the table 3 there are no significant differences by the nature of strangulated organ and the quantity of their resections. In both groups after bowels resection with anastomosis has been put in “side to side”.

117 patients in the 1st group were performed muscular-aponeurotic plasty, 7 patients were not underwent plasty due to hernia sac phlegmon 3 patients, hepatocirrhosis, ascites 1 patients and peritonitis 3 patients. In the 2nd group patients before implanting of mesh, aponeurosis and mobilized subcutaneous fat were irradiated by carbon dioxide laser in defocused regime with “Scalpel-1” apparatus, capacity-25 watt and exposure time 1 sec to 1cm². Detected ligature granulomas were worked up by carbon dioxide laser up to carbonization and evaporation. Hernioplasty with implantation of mesh has been performed in different positions: in onlay (71), sublay (5), intra-abdominal (1) and correction of anterior abdominal wall with prosthetic plasty (6). In 12 cases subject to inguinal hernia Liechtenstein’s operation has been performed. Surgery was ended by drain of paraprosthetic area by Redon. Drainages were removed after 4-5 days.

In the 2nd group USI of postoperative wound has been carried out in the postoperative period. In 33 cases echonegative liquid-containing foci was detected. Local complications of the postoperative wound in the 1st group were noted in 15 (13.0%) Lethality made up 4%. In the 2nd group postoperative wound complications were observed in 33 (35.8%) patients. Lethality in this group – 3.1 %.

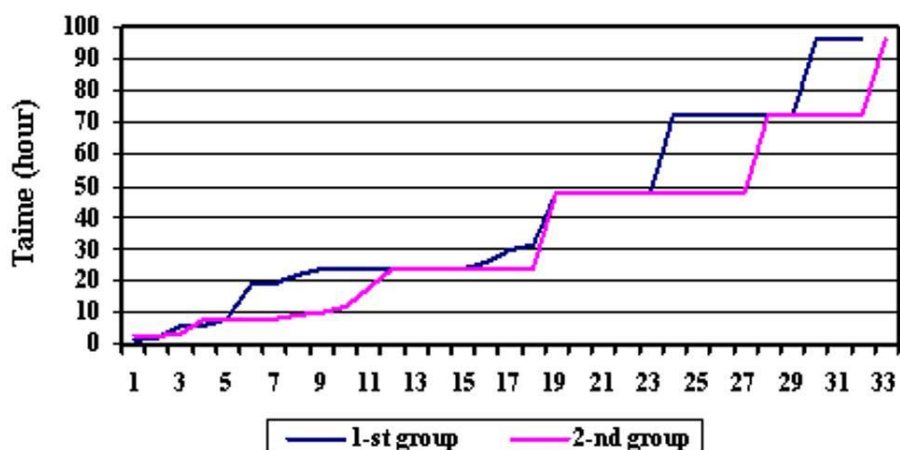
Table 3. Organ incarceration and quantity of their resections

	Bowels		Omentum		Urinary bladder
		Resection		Resection	
1 st group	66	12 (18%)	56	20 (35%)	2
2 nd group	65	10 (15%)	30	22 (73%)	0

Table 4. Postoperative wound complications

Wound complications	1 st group (n=115)	2 nd group (n=92)
Suppuration*	13	3
Hematoma	1	-
Fecal fistula	1	-
Seromas	-	30

*p<0.05 (Chi-square (df=1) - p=0.31; Fisher exact p, p=0.036)



Graph 1. Dependence of strangulated organ necrosis from the time of incarceration clinics start

Both groups were comparable by age and persons elder than 60 years made up 44-45%. One of the main factor influencing on intra-operative picture and postoperative period course is incarceration time. In the 1st group 30% patients addressed 24 hours later and in the 2nd one - 35% patients. As the diagram shows, necrosis of strangulated organ (bowels, omentum) and its resection are directly proportional to the time of incarceration start.

More than 85% patients with bowels or omentum necrosis who were underwent resection, admitted to hospital 24 hours later. The decision about operative treatment of strangulated hernia is taken on the base of subjective (pain in the hernia area, palpatory tenderness of the hernia sac) or objective signs (clinics of acute bowel obstruction). But definition of presence or absence of intestine or omentum incarceration in patients of old and gerontal age with associated pathology is not always possible. Due to incarceration manifestation peculiarities, the quantity of diagnostic mistakes remains rather significant [13]. Occurrence of bowel obstruction, compression and necrosis of strangulated organs are the reasons of hernial sac and its contents infection and as a consequence – appearance of wound infection in patients with strangulated hernias [14].

The use of synthetic transplants at hernioplasty “without tension” allows to avoid of abdominal cavity deficit formation and to prevent cardiopulmonary disorders in postoperative period without special adaptation of patients, especially in old and gerontal aged patients with many concomitant diseases. Analysis of local postoperative complications results showed that in the 1st group suppurations dominated (11.3%), in the 2nd group with the use of synthetic prosthesis the was the biggest quantity of seromas (32.6%), and applying of carbon dioxide laser intra-operatively allowed to reduce pyoinflammatory complications in wound up to 3.3%, three times less in compare with the 1st group. In both groups in patients with occurred wound complications there were loops of small intestine in hernia sac contests.

For microbial contamination prevention different methods were offered among which antibiotic therapy is a traditional one. Schemes of antibiotics applying before surgery with their going on in the postoperative period have been worked out [15]. But wide mobilization of subcutaneous fat leads to blood circulation and lymphokinesia, micro-circulation disorder due to which it is complicated to achieve proper concentration of antibiotics in the zone of implantation. Kuznetsov [16] determined that the use of reticular prosthesis in the surgical treatment of strangulated hernias is one of determinant factor of increasing the frequency of purulent wound complications and standard schemes of antibiotic prophylaxis and antibiotic therapy do not allow eliminating it. Why authors conclude that traditional scheme of antibiotic prophylaxis used in surgical treatment at strangulated hernias is not effective and does not meet modern requirements of hernioplasty. Its reconsideration and adoption of new schemes may to lead to the reducing of pyoinflammatory wound complications frequency in such type of patients.

The use of high-energy carbon dioxide laser (CO₂) intra-operatively allows to achieve bactericidal effect in wound and its work in one mode regime (Gauss’ mode) stimulates regeneration processes and leads to accelerated integration of mesh in surrounding tissues.

In patients with strangulated ventral hernias the use of carbon dioxide laser allows to perform prosthesis implantation. Inflammatory changes developed on the background of acute bowel obstruction or due to necrosis of hernia sac contents (except phlegmon) are not contraindication to allohernioplasty and prosthesis implantation made of polypropylene.

CONCLUSION

1. At strangulated extensive, giant, relapsed ventral hernias the surgery of choice is prosthetic hernioplasty.
2. Indication to the use of reticular prosthesis is hernia’s relapse, impossibility of defect elimination without tension.
3. Necrotic changes of strangulated organ and its resection are not contraindication to prosthetic plasty.
4. Over-aponeurotic (onlay) prosthesis placing at plasty of strangulated hernias is the most reliable from the practical point of view as required less time consumption.
5. The use of high-energy lasers in patients with applying allohernioplasty in the conditions of infection reduces the quantity of wound complications.

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Authors’ Contributions

All authors contributed equally to this work.

Competing interests

The authors declare that they have no competing interests.

REFERENCES

1. Tanaka S, Yamamoto T, Kubota D 2008. Predictive factors for surgical indication in adhesive small bowel obstruction. *Am. J. Surg.* 196(1): 23-27.
2. Ermolov AS, Ilichev AS, Dzeytova RM, Bognitskaya TV. 2009. Prosthetic plasty in patients with strangulated umbilical hernia. The 3rd Congress of Moscow surgeons: Materials of Congress. [Article in Russian: Ермолов А.С., Протезирующая пластика у больных с ущемленной пупочной грыжей. Ермолов А.С., Ильичев В.А., Дзейтова Р.М., Богницкая Т.В. III Конгресс Московских хирургов: Мат. съезда. Москва. 2009. С. 111.]
3. Zafar H, Zaidi M, Qadir I, Memon AA. 2012. Emergency incisional hernia repair: a difficult problem waiting for a solution. *Annals of Surgical Innovation and Research* 6:1
4. Vasiliev MN, Vanyushin PN, Valika EN. 2009. Alloplasty in the cure of strangulated postoperative ventral hernias. Plenum of problem commission "Emergency surgery". [Article in Russian: Васильев М.Н., Аллопластика в лечении ущемленных послеоперационных вентральных грыж. Васильев М.Н., Ванюшин П.Н., Валька Е.Н. Пленум проблемной комиссии «Неотложная хирургия». Н. Новгород 2009; 7-8.]
5. Derici H, Unlap HR, Nazil O. 2008. Prosthetic repair of incarcerated inguinal hernias: is it a reliable method? *Langenbecks Arch Surg.* 56-59.
6. Khaled A, Abd Al-Latief A, Mohamed AA, Taha B. 2013. Clinical outcome of use of mesh in acute hernia. *EJS.* 32 (1): 37-41.
7. Kharitonov SV, Kuznetsov NA, Zinyakova MV. 2005. Ultrasound investigation in optimization of diagnostics of anterior abdominal wall strangulated hernias International surgical congress "New techs in surgery". [Article in Russian: Харитонов С.В., Ультразвуковое исследование в оптимизации диагностики ущемленных грыж передней брюшной стенки Харитонов С.В., Кузнецов Н.А., Зинякова М.В. // международный хирургический конгресс «Новые технологии в хирургии», - 2005, С. 445].
8. Baily J, Schmidbauer S, Hallfeldt K. 2001. The use of an underlay polypropylene mesh in complicated incisional hernias: Successful French Surgical Technique *Minerva Chir.* 56 (1): 111-117.
9. Uzun MA 2008 Traumatic lumbar hernia. *Ulus. Travma. Acil. Cerrahi. Derg.* 14(3): 253-5.
10. Despres JP. 2008. Abdominal obesity and the metabolic syndrome: contribution to global cardi-ometabolic risk. *Arterioscler Thromb Vase Biol.* 28: 1039-1049.
11. Kukosh MV, Vlasov AV, Gomofov GI. 2012. Preventive measure for early post-surgery complications for endoprosthesis of ventral hernia. *Russia. Surg. News,* 5(32). 7 [Кукош М.В., Власов А.В., Гомозов Г.И. Профилактика ранних послеоперационных осложнений при эндопротезировании вентральных грыж. *Новости хирургии* 2012;5:32–7.].
12. Chevrel JP, Rath AM. 2000. Classification of incisional hernias of the abdominal wall *Hernia,* 4: 7–11.
13. Sartelli M, Coccolini F, van Ramshorst GH, Campanelli G, Mandalà V, Ansaloni L. et al. 2013. WSES guidelines for emergency repair of complicated abdominal wall hernias. *World J Emerg Surg* 8:50.
14. Yang L, Wang H, Liang X, Chen T, Chen W, Song Y. et al. 2015. Bacteria in hernia sac: an important risk fact for surgical site infection after incarcerated hernia repair *Hernia.* 19(2): 279-283.
15. Kostyuchenko AL, Belskikh AN, Tulupov AN, 2000. Intensive therapy of postoperative wound infection and sepsis, 448, St-Petersburg: Foliant [Article in Russian: Костюченко А.Л., Интенсивная терапия послеоперационной раневой инфекции и сепсиса. Костюченко А.Л., Бельских А.Н., Тулупов А.Н. Ст-Петербург: Фолиант 2000; 448]
16. Kuznetsov AV, Shestakov VV, Smarj TM. 2014. Results of hernia repair in conditions of infected tissues under various methods of antibiotic prophylaxis, *Russia. Med. Edu. Siberia* 3: 56. [Кузнецов А.В., Шестаков В.В., Смарж Т.М. Результаты грыжесечений в условиях инфицированных тканей при разных способах антибиотикопрофилактики. *Медицина и образование в Сибири* 2014;3:56.]