KnE Materials Science

SMBIM Conference Proceedings
Shape Memory Biomaterials and Implants in Medicine (2017), Volume 2017

Knowledge E
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Conference paper

Laparascopic Hernia Repair with the Use of TiNi-based alloy

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Received: 23 March 2017
Accepted: 9 April 2017
Published: 16 July 2017

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the SMBIM Conference Committee.

OPEN ACCESS

Abstract

The reduction of the endoscopic methods of the inguinal hernia surgical treatment to the everyday practice of the surgery departments led to the better results of treatment. However, the recurrence rate remain sat the level of 2.2-4.4%, and the rate of the intraoperative and postoperative complications is 8%. The paper describes treating 78 patients (59 pations underwent the reduction of the endoscopic methods of the inguinal hernia surgical treatment to the everyday practice of the surgery departments led to the better results of treatment and 19 patients underwent the laparoscopic transabdominal hernia repair with the usage of porous nickelid-titanium. in the period from 2000 to 2016). It shows a procedure of installing porous nickelid-titanium, gives the obtained results of the procedure and analizes the experience of world literature. The procedure of the laparoscopic hernia repair allows to lessen the injury rate of the surgery, to lessen the possibility of the postoperative complications and to simplify the medical staff work.

1 Introduction

During the long history of the herniology that lasts more than a century over 300 methods of plasty of inguinal canal walls were worked out. However, the

How to cite this article: G.Ts. Dambaev et al. (2017), "Laparascopic Hernia Repair with the Use of TiNi-based alloy," in *Shape Memory Biomaterials and Implants in Medicine,* KnE Materials Science, page 193–199. DOI 10.18502/kms.v2i1.796

recurrences that can be seen among 10% of the patients operated for the common inguinal hernias and among 20-30% of the patients operated for the recurrent hernias speak for the absence of the "universal" or "ideal" method [5, 6, 7, 9].

The reduction of the endoscopic methods of the inguinal hernia surgical treatment to the everyday practice of the surgery departments led to the better results of treatment. However, the recurrence rate remain sat the level of 2.2-4.4%, and the rate of the intraoperative and postoperative complications is 8% [3].

Complications and recurrences during the laparoscopic hernia repair are mainly caused by mistakes made during the definite stages of operation and the absence of the ideal material covering the hernial prolapsed. They also include inadequately meticulous hemostasis, incorrect implant sizes, incorrect fixation points, unreliable implant fixation that is caused by the structural imperfection of hernia surgery staplers, because while fixing the implant with the staple it is necessary to put the applied part of the tool exactly perpendicular to the under running surface, however, it is not always possible (especially if the reusable hernia staplers are used).

To eliminate the factors of the first group only the improving of the surgeon's manual skills is necessary, while to eliminate the factors of the second group it is urgent to create brand new implant materials and the methods of their fixation.

Even the most common polypropylene and polytetrafluoroethylene implants that are chemically inert and used all over the world inevitably cause more or less evident inflammation reaction of the surrounding tissues with the formation of seromas of various sizes. Subsequently the contamination of these fluids inevitably leads to the maturation and rejection of the implant. The formation of the "prosthetic aponeurosis" has the same nature as the capsulation. Almost all the materials that are used nowadays for implantation are chemically inert. However, the physicomechanical characteristics of these materials differ greatly from the ones of the real tissues that leads to the constant traumatizing of the surrounding tissues (the abdominal wall makes up to 70000 oscillative motions per day [4] and consequently backs up the inflammation process [1, 2]).

Taking into consideration the above-mentioned information, we made an attempt to improve the results of the surgical treatment of the inguinal hernia with the help of using the porous nickelid titanium plates performing the laparoscopic hernia repair.

2 Experimental

78 patients with inguinal hernias were treated during the period of 2000 through 2016. We did not intentionally select the patients to perform the laparoscopic hernia repair. Only one patient with the cardiovascular decompensation was rejected to perform this type of surgery, as it was extremely dangerous to apply the pneumoperitoneum.

Among 59 patients (the ratio of men 53 (90%) to women 6 (10%)) under the endotracheal anesthesia The reduction of the endoscopic methods of the inguinal hernia surgical treatment to the everyday practice of the surgery departments led to the better results of treatment. However, the recurrence rate remain sat the level of 2.2-4.4%, and the rate of the intraoperative and postoperative complications is 8%was performed by the common procedure with using the polypropylene mesh implant. After separating the hernia sac and the structures forming the inguinal and crural fossae the hernia formation area was covered with the polypropylene mesh implant. The fixation of the implant was made with the staples of the hernia surgical stapler along the perimeter (excluding the "triangle of pain" and "triangle of doom"). We used the hernia surgical stapler Multifire Endo Universal by Auto Suture and the reusable one-shot stapler by Axioma. The implant was covered with the earlier separated part of the abdominal membrane which was also fixed with the staples.

Among 19 patients (the ratio of men 18 (95%) to women 1 (5%)) the laparoscopic transabdominal hernia repair was performed with the usage of porous nickelid titanium. The age distribution of the patients in the groups is given in the table (1).

Table 1. The Age Distribution of the Patients in the Groups

Age	Patients Groups			
	Hernia repair with polypropylene		Hernia repair with porous nickelid titanium	
	total	%	total	%
From 20 to 40	8	13,6	6	31,6
From 40 to 60	30	50,8	7	36,8
Over 60	21	35,6	6	31,6

The essence of the method developed by us is as follows.

The patient is in Trendelenburg position. Under the endotracheal anesthesia in the upper Kalk's point at the side of the hernia the laparoscope is introduced. The revision of the abdominal cavity organs is performed. Under direct vision the instrument trocars are introduced into the abdominal cavity. The plunger trocar

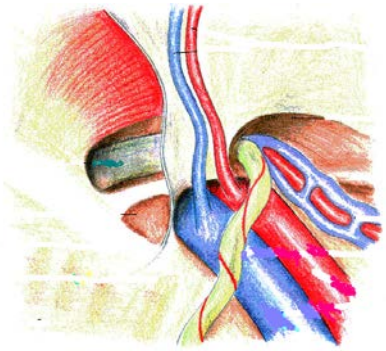

Fig. 1. The iliopectinal tract, Cooper's ligament and the fundus of the transverse muscle of abdomen

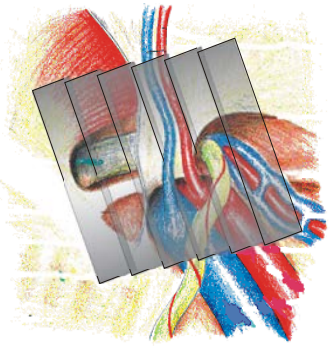

Fig. 2. Put the plates on the lateral and medial inguinal and crural fossae

with the diameter of 10 mm is introduced along the medial border of the abdominal rectus muscle at the other extreme of the hernia 4-5 cm below the omphalus. The trocar with the diameter of 5 mm is introduced along the outside border of the abdominal rectus muscle at the side of the hernia 3-5 cm below the omphalus. The abdominal membrane is cut П-shaped, going round the medial and lateral inguinal fossae and then it is separated with the hernia sac isolation from the anatomic substructures that provides the visualization of the iliopectinal tract, Cooper's ligament and the fundus of the transverse muscle of abdomen (Fig. 1).

If the lipoma of the spermatic cord is diagnosed it is dissected and removed from the abdomen. The meticulous hemostasis is performed. After the visual estimation of the hernial prolapse diameter the rectangular plates are cut from the sterile plates of porous nickelid titanium with the help of the common scissors, the width of the plate is 10 mm (the inner diameter of the trocar) and the length is 15-20 mm more than the height of the inguinal space. The plates held by the cephalic end with the help of any endoclamp are introduced one-by-one into the abdomen through the plunger instrument trocar and immediately put on the lateral and medial inguinal and crural fossae in the direction that is perpendicular to the direction of the iliopectinal tract fiber path overlapping each other along the width for 1-2 mm (fig. 2).

The firm fixation between the plates and substructures and between each other is achieved by their adherence caused by the forces of surface tension that appear due to the ultraporous structure, good wetting ability and asperity of porous nickelid titanium as well as the abdominal pressure. Implants are covered with the separated piece of the abdominal membrane. After the desufflation the trocars are removed. The trocar wounds are sewn up with the separate interrupted stitches.

The patients of the both groups were allowed to stand up and walk within 4-5 hours after the surgery end. 2-3 days later after the recovery of the

gastrointestinal tract activity they underwent outpatient care. The great majority of the patients began to work within 7 to 9 days after the surgical treatment. Besides we did not limit the physical exercises and activity.

To evaluate the results of the surgical treatment the patients of the both groups were invited for the examination within 3, 6, 12 months after their discharge from the hospital. The criteria of the treatment success were the patients' evaluation of their state of health, their life quality in the postoperative period and manual examination.

3 Results and discussion

In the immediate postoperative period among the patients who underwent the laparoscopic herniaplasty with the usage of the polypropylene implant complications were noted funiculitis of different severity ranges among 5 patients (8.47%). After the course of salvage treatment that included the usage of antibiotics, physiotherapy, applications the symptoms of funiculitis were neutralized during 3-9 days.

Within the first 3 days after the surgical treatment 3 patients (5.08%) of this group had seromas of different sizes in the projection of the outer inguinal ring and it was confirmed by the ultrasound data. These patients underwent the same salvage therapy together with the single or double paracentesis and evacuation of the serous fluid.

We think that the development of funiculitis symptoms and seroma formations are the results of the surrounding tissues reaction to the foreign material that is chemically inert but less elastic than the surrounding tissues. When the anterior abdominal wall moves the implanted net is transformed lesser that the surrounding tissues, and when the stretching stops it reverts to the original state with the same speed as the speed of stretching, while the surrounding tissues are characterized by the retardation effect. The constant traumatizing of the surrounding tissues with the implant supports the inflammation in the surgery area during the long time up to the moment when the cicatrical capsule is formed. This capsule bridges diversities between the physicomechanical features of the human tissues and polypropylene.

In the postoperative period we observed the treatment results among 51 patients (86.44%) who underwent the laparoscopic hernia repair with the usage of the "traditional" procedure. The observation period was up to 3 years.

During the mandatory attendances all the patients evaluated their state of health as good, they did not notice any bad changes in their life quality as it had been before the surgical treatment. During the manual examination we stated that 50

patients did not have recurrences, infiltrations or any other neoplasms in the inguinal area at the side of the surgical treatment. One patient (1.69% from the total number of the operated people) had the recurrence of the hernia three months later after the surgical treatment. After the repeated laparoscopic herniaplasty it was stated that the reason of this recurrence was the curling of the implant edge. The implant was unfolded and fixed. The postoperative period was standard. During the mandatory attendances (3, 6, 9 months after the repeated plasty) there were not any signs of recurrence.

In the group of patients who underwent the laparoscopic hernia repair with the usage of porous nickelid titanium there were not complications in the postoperative period. We observed the treatment results of 17 patients (89.47%). The observation period was up to 1 year.

The patients did not complain during the mandatory attendances. All the patients evaluated their state of health as good. During the manual examination we did not find any infiltrations, seroma formations in the area of the surgical treatment. One patient suffering from psoriasis had the new psoriatic plaques in the area of the surgical scars. Within the specified time there were not any recurrences after the laparoscopic hernia repair with the usage of porous nickelid titanium.

4 Summary

The procedure of the laparoscopic hernia repair allows to lessen the injury rate of the surgery, to lessen the possibility of the postoperative complications and to simplify the medical staff work.The usage of porous nickelid titanium while performing the laparoscopic hernia repair is caused by its greater physicomechanical compatibility with the human tissues in comparison with polypropylene that is commonly used in such surgical treatments, and it was confirmed by the results of the surgical treatment with the usage of the both procedures. The successful practice of using porous nickelid titanium in the laparoscopic herniaplasty allows to consider the described procedure to be the alternative to the existing ones.

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