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To cite this article: I Kalyakanova et al 2019 J. Phys.: Conf. Ser. 1145 012010

View the article online for updates and enhancements.
Reconstruction of the anterior abdominal wall with postoperative ventral hernias by a modeled implant

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Abstract. The method of "sublay" plastics is the most common in comparison with other types of plastics in postoperative ventral hernias. Unfortunately, the frequency of relapses according to literature data exceeds 10%. Surgeons’ dissatisfaction with the results of operations makes it necessary to look for new ways of operations, types of plastics, implants and possible ways of fixing. The study was conducted on the basis of 85 clinical hospitals (Moscow) and included 66 patients aged from 18 to 83 years. Patients were operated using a self-locking implant Progrip™ with the location of the implant according to the "sublay" method. The material from which the implant is made met all the requirements of an "ideal" implant. However, for a long time, patient monitoring revealed relapses. To reduce the number of relapses, a new modeled Implant Progrip™ was developed and introduced into the clinic.

1. Introduction

Issues related to the formation of hernial defects after surgical interventions on the anterior abdominal wall remain unresolved now. It should be noted that in postoperative ventral hernias, when the hernial defect reaches 20 cm or more - the reconstruction of the anterior abdominal wall is technically complicated. Obviously, to eliminate such large defects in the abdominal wall, it is impossible to do without the use of implants. Also, numerous studies confirm that, with small hernias, the use of an implant is a "gold standard" [1-3].

The factors leading to the formation of postoperative ventral hernias are divided into two groups: correctable and uncorrectable. Correctable (changing) factors include: the weight of the patient (the presence of obesity) and the choice of the technique of surgical intervention [4]. When obesity develops increases intra-abdominal pressure, which leads to the formation of a hernia after the primary operation, as well as an increased risk of recurrence after hernioplasty. Unfortunately, most patients refuse to follow recommendations for weight loss [5].

In an emergency situation, the main access is median laparotomy. In laparotomy, even in the context of a favorable current of the nearest postoperative period, in 19% - 45% of cases it ends up with the formation of a hernial defect. And infection of the laparotomic wound, drainage or tamponade of the abdominal cavity to herniation leads to 63% -80% of cases [6,7].
Uncorrectable risk factors for hernia development include age and chronic comorbidities [4]. Chronic concomitant diseases not only worsen the healing of primary laparotomic wounds, but may be also contribute to the development of increased intra-abdominal pressure [8]. On the factors contributing to herniation, it is difficult to affect even correctable ones. However, it is possible to solve the problem of recurrence of a hernia. Unfortunately, the consensus the method of surgical intervention has not been achieved.

There are three known basic methods of location of the implant with "open" hernioplasty: "onlay", "inlay" and "sublay". According to the authors, with the method of plastics "onlay" and "inlay" often leads the appearance of chronic pain with a sense of "foreign body" [9, 10]. Also, in the above-mentioned methods of plastics, the implant is in contact with the subcutaneous adipose tissue with the development of more frequent purulent inflammatory complications with a high risk of relapse later [11]. Both methods of plastics are not recommended to be performed when plastics can be applied using the "sublay" method [10, 12].

In addition to the "open" hernioplasty method, there is also a hernioplasty with minimally invasive endovideosurgical (laparoscopic) access. The already available adhesive process after previous operations complicates laparoscopic plastics and takes a long time to dissect the adhesions. In this situation, the risk of iatrogenic damage to the intestine or lower epigastric vessels increases with the transition to an "open" operation. Also, contra-indications for performing laparoscopic plastics are the presence of a focus of chronic inflammation, complex multi-chamber hernias and the size of hernial gates more than 10 cm [13-18]. Thus, laparoscopic plastics of the ventral hernia can be performed only in a limited number of patients. The number of relapses after laparoscopic plastics varies from 7% to 18% [19-21].

In connection with this, we chose the most optimal method of fixing the implant according to the "sublay" technique. When choosing an implant, we took into account such a complication as chronic postoperative pain when hernioplasty implant fixed with sutures. So we chose a self-gripping implant Progrip™, which is securely fixed to the tissues with resorbable micro-hooks. And according to a few studies does not cause chronic pain in the postoperative area [22-24].

The aim of the work was to improve the results of treatment of postoperative ventral hernias by modifying the self-gripping implant Progrip™. Compare the results of treatment in patients of working age (up to 60 years) and elderly patients (after 60 years).

2. Materials and methods

During the study period from 2010 to 2016, 66 patients with postoperative ventral hernia were routinely operated. The presence of concomitant diseases in the compensation stage was not a criterion for failure in the operation. All patients received voluntary informed consent for the study. Patients were divided into two groups: the first group included patients older than 60 years, the second group included patients under the age of 60 years. In addition, each group included patients operated on with both a standard self-gripping Progrip™ implant and a modeled self-gripping Progrip™ implant (Table 1).

| Type of implant | Group I | Group II |
|-----------------|---------|----------|
| Modeled         | 17      | 14       |
| Standard        | 17      | 18       |
| Total           | 34      | 32       |

The implant in both groups was placed according to the "sublay" technique with an overlap of the edges of the hernial gates around the perimeter of + 5 cm and to use posterior component separation
technique during major abdominal wall reconstructions. Due to the recurrence of hernia the next 24 months after the operation, Protasov A.V. suggested to change the shape of the implant.

The implant simulation took into account the anatomy of the anterior abdominal wall, as well as the direction of the stretching force of the standard implant, with the installation of which exposed unprotected "weak" points, which promotes the recurrence of a hernia. The meaning of implant modeling is aimed at changing the effect of the tensile force from transverse to longitudinal. Since longitudinal stretching corresponds to the direction of the muscle strength of the anterior abdominal wall, the load decreases, which prevents muscle damage and tearing of the implant. Also, the simulated implant covers the "pathological holes" with the tension of the anterior abdominal wall and neutralizes the load on the developing scar. Thus, the risk of recurrence of a hernia decreases.

3. Results and discussion

The preoperative examination revealed the presence of cardiovascular diseases (including coronary heart disease) in 56 people, respiratory system diseases in 8 people, lower limb varicose in 27 people and oncological diseases in remission in 8 people. Also, 49 people were diagnosed with obesity at different stages in accordance with the WHO classification. These diseases increase the risk of both anesthesia and surgery.

The main criterion for the selection of patients for the study was the presence of a median hernia localization, because it proved impossible to establish a modeled implant with mixed and lateral localization. The size of the hernia defect and the presence of relapses in the anamnesis did not matter.

Table 2 shows the distribution of patients according to the Chevrel J.P classification, taking into account the width of the hernial gates (W) and relapses (R). Recurrent hernias were operated in 21 patients (31.81%), of whom 5 (7.57%) had more than 2 relapses. This category of patients was operated earlier in other clinics. In the majority of patients (56, 05%) there were large (W3) and giant (W4) hernial defects of the anterior abdominal wall, which made it technically more difficult for surgery, especially for elderly patients.

| Relapses | Type of implant | Size of the hernial gates | Total |
|----------|-----------------|---------------------------|-------|
|          |                 | W1  | W2  | W3  | W4  |       |
| R0       | Modeled         | 8   | 4   | 8   | 3   | 23 (34.84%) |
|          | Standard        | 1   | 8   | 6   | 7   | 22 (33.33%) |
| R1       | Modeled         | 2   | 2   | 2   | 1   | 7 (10.60%) |
|          | Standard        | 0   | 3   | 5   | 1   | 9 (13.63%) |
| R2       | Modeled         | 0   | 0   | 1   | 0   | 1 (1.51%) |
|          | Standard        | 1   | 0   | 1   | 2   | 4 (6.06%) |
| Total    | absolute        | 12  | 17  | 23  | 14  | 66 |
|          | relative        | 18.8%| 25.75%| 34.84%| 21.21%| 100% |

Notes: W – width of the hernial gates: W1 – up to 5 cm; W2 – 5-10 cm; W3 – 10-15 cm; W4 – > 15 cm; R – number of relapses: R0 – no relapse, R1 – 1 relapse, R2 – 2 or more relapses; S – localization, in our study all patients were with median (M) localization – SM.

The time of patients' circulation from independent detection of "protrusion" on the anterior abdominal wall prior to contacting the surgeon was 3.5 years on average (3.71 ± 0.52).

The average number of days of hospitalization in Group I (up to 60 years) was 12 ± 5.06 days, in Group II (over 60 years), 13 ± 1.97 days. The large arithmetic deviation in the number of days in Group I
was due to the fact that 4 patients had to perform hernioplasty in several stages because of the presence of ligature fistulas from previous operations.

In processing the data, the mean value of the data (M) and the standard error of the arithmetic mean (±) were calculated. Relative and absolute values were also calculated. To compare the groups, the Student criteria was used. With a significance level of α = 0.05, the differences were not statistically significant.

During the operation, there were no intraoperative complications. However, it was not possible to avoid postoperative complications.

"Local" postoperative complications in Group I of local complications occurred 4.54% of cases (suppurated hematoma - 1, suppuration of the postoperative wound - 1, seroma - 1). In Group II, there were 3.03% cases (suppuration of a postoperative wound - in 1 patient and formation of seromy also in 1 patient). In 3 patients with complications, a two-stage hernioplasty was performed. The first stage was an operation to excise the ligature fistula and a week later the patient had hernioplasty. Therefore, the cause of local postoperative complications was a chronic focus of inflammation in the area of operation.

However, the total postoperative complications in 4.54% of cases occurred only in the elderly (acute cardiac insufficiency - 1, intestinal obstruction - 1, lung collagen – 1). These complications are related to the size of the hernia gates (more than 10 cm), since decrease in the volume of the abdominal cavity after hernioplasty, there is an increase in intra-abdominal pressure with the development of the syndrome of intra-abdominal hypertension. The compensatory possibilities of the organism in elderly patients do not cope. Chronic decompensation develops their concomitant diseases [6, 25]. No lethal cases were recorded.

In a remote period of follow-up, relapses of postoperative ventral hernias were recorded in 9.09% of cases. In this case, a relapse with a modeled self-gripping implant was in 1 case in a patient up to 60 years due to non-compliance with the recommendations. In other cases, relapses were with the use of a standard self-locking implant regardless of the age of the patient. The terms of observation of patients were from 2 to 8 years.

4. Conclusion
Analysis of the results of treatment of postoperative ventral hernia showed the advantage of the modeled Progrip™ implant compared to the standard implant Progrip™ in both age groups and hernia gates of any size. The simulated self-gripping implant eliminated the problem of fixation defects. Therefore the number of hernia recurrences decreased. In addition, to reduce of local postoperative complications in the presence a chronic focus of inflammation in the area of operation should be performed hernioplasty in the long term.

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