Comparative Study on the Efficiency of 2 Different Types of Meshes (Polypropylene and ProGrip™) in the Surgical Treatment of Incisional Hernias

BOGDAN ANDREI SUCIU[1,2], IOANA HALMACIU[1]*, DECEBAL FODOR[1,2], CRISTIAN TRAMBITAS[1], ADRIAN IVANESCU[1], DUMITRU GODJA[2], VLAD VUNVULEA[1], CALIN MOLNAR[2], KLARA BRINZANIUC[1]

[1] University of Medicine and Pharmacy Tirgu Mures, Anatomy Discipline, 38 Gheorghe Marinescu Str., 540142, Tirgu Mures, Romania

[2] Mures County Clinical Emergency Hospital, Surgery Clinic no.1, 50 Gheorghe Marinescu Str., 540136, Tirgu Mures, Romania

Postoperative eventration is a quite common condition in patients with clinical records of abdominal surgery. The purpose of this study was to investigate the efficacy of use of 2 different types of meshes (Polypropylene mesh and ProGrip™ mesh-self-gripping mesh) in the surgical treatment of incisional hernias. In this respect, we conducted a study in which we introduced 128 patients operated for incisional hernias. Patients were divided into 2 lots: group A (102 patients with polypropylene mesh) and group B (26 patients with ProGrip™ mesh). From the analysis of the data studied, we noticed that the average duration of surgery and hospitalization for patients with ProGrip™ mesh is lower compared to patients with polypropylene mesh. Also, the rate of local postoperative complications was lower when using the ProGrip™ mesh (15.38%) than in the case of polypropylene mesh. In conclusion, we can state that the use of the ProGrip™ heterologous mesh is beneficial in the surgical treatment of patients with incisional hernias. The major advantage of using this type of mesh is given by a shorter hospitalization period for these patients, as well as by a lower rate of local postoperative complications in these patients.

Keywords : incisional hernias, reconstruction, mesh

Incisional hernia is a frequent pathology, that occurs in patients with clinical records of abdominal surgical interventions. To this date, it is considered that approximately 10-15% of patients that previously underwent surgical interventions on the abdomen, will develop over time an incisional hernia [1,2]. The main risk factors for occurrence of incisional hernias are : obesity of the patient, infections of the abdominal wall, defects in the surgical technique when closing the abdominal wall in previous interventions [3,4]. Postoperative infections may increase the likelihood of occurrence over time of a incisional hernia up to 80% [5].

Patients with incisional hernias may have multiple complications such as bowel obstruction, strangulation, necrosis of an intestinal loop. Some of these complications may endanger the patient's life, so the surgical indication in these patients is absolute [6,7]. Besides that, the quality of life of these patients is influenced, therefore the surgical indication in these patients will indeed be absolute [8].

Surgical treatment in these patients can be performed with or without heterologous material. In the last period, in the literature the vast majority of authors recommend the use of heterologous materials in abdominal wall reconstruction techniques, considering that the risk of recurrence of the incisional hernia in these cases is lower. [9].

It must also be mentioned that in the cases where heterologous meshes are used in the abdominal wall reconstruction techniques, the postoperative morbidity will be increased in those patients compared to surgical techniques where heterologous materials are not used. The main local postoperative complications that may occur in these cases are: local haematomas, seromas, mesh rejection, abdominal wall suppurations. [10,11] These meshes can be applied by both open, classic, or laparoscopic approaches.

Experimental part

The purpose of this article was to study the efficacy of using two types of heterologous meshes in abdominal wall reconstruction techniques, in the treatment of incisional hernias. In this respect, we performed a retrospective observational study for a period of 15 months, between 1.01.2017-31.03.2018. We introduced 128 patients admitted and operated at the Surgery Clinic No. 1 of the Medical University Hospital Tirgu Mures with the diagnosis of incisional hernia. As criteria for inclusion in this study, we only introduced patients where prosthetic materials were used in abdominal wall reconstruction techniques.

The 128 patients were divided into 2 lots: Group A consisting of 102 patients with polypropylene mesh and group B of 26 patients with ProGrip™ (Covidien) mesh, a self-gripping mesh. As a structure, the ProGrip™ mesh is a plastic material made of polyester and polylactic acid. In both groups studied, the mesh was placed over the aponeurosis after closing the abdominal wall (figs.1, 2).

In the two groups of patients analysed, we studied separately the following parameters: the duration of the surgery, the average duration of postoperative hospitalization of these patients, the occurrence of postoperative local complications (hematomas, seromas, abdominal wall suppurations). The statistical analysis of

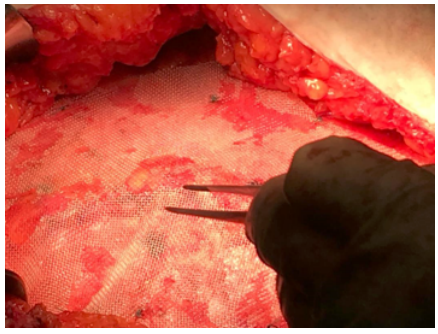

Fig.1. Polypropylene mesh placement over the aponeurosis

* email : anca_halmaciu@yahoo.com; Phone: (+40)740091324

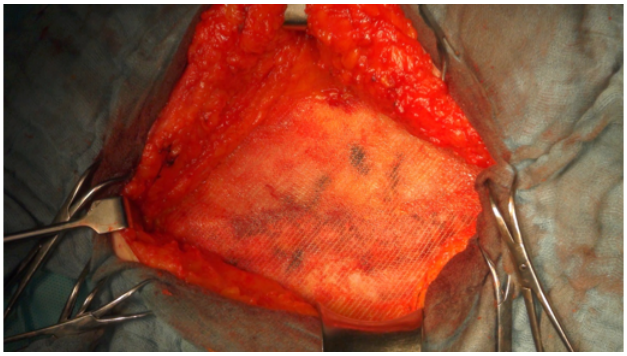

Fig. 2. ProGrip™ mesh, placement over the aponeurosis

the data was done using Microsoft Excel and GraphPad Prism 7® software using the t-student test.

Results and discussions

Regarding the gender distribution in the two groups studied, we obtained the following results: in group A there were 61 women (59.80%%) and 41 men (40.19%), and in group B were 19 women (73.07%) and 26 men (26.92%). (fig. 3)

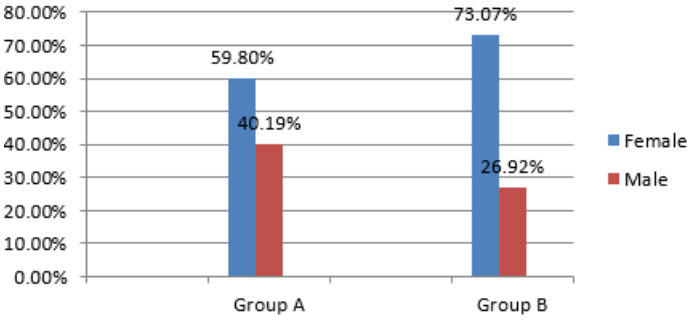

Fig. 3. Gender distribution of the two groups studied

The average age of patients included in group A was 61.27 years (36-85 years), and in group B was 56.19 years (range 34 to 79 years).

From the statistical analysis of the operation time, we noticed that in the case of the group A the mean operation time was 3,049 h, and in the case of the group B, the mean operation time was 2 h. From the statistical analysis, with the t-student test, we noticed that this is statistically significant in terms of surgical intervention time. ($p < 0.05$) (table 1) Our results are not surprising because one of the major advantages of using the self-gripping meshes is that in such cases fewer sutures are required to fix the mesh to the aponeurosis of the abdominal wall. This is due to some extensions, micro-hooks, of the mesh that make it easier to attach to the abdominal aponeurosis. A major advantage of reducing the time of surgery in these cases is the reduction of infectious contamination in such cases.

Regarding the duration of hospitalization in the studied patients, we noticed that the average duration of hospitalization in case of group A was 10,59 days (and the average duration of post-operative hospitalization was 9,875 days), and in case of group B the average duration of hospitalization was 8.07 days (and the average duration of postoperative hospitalization was 7.42 days). The statistical analysis revealed a clear, statistically significant difference. ($P < 0.05$) (table 2).

We also considered the rate of local postoperative complications in these patients (hematomas, seromas, wound infections). For group A, 25 patients (24.50% of patients) experienced local complications. We observed that 5 patients had local hematomas (4.90% of the cases), 8 patients had postoperative seromas (7.84% of the cases) and 12 patients had postoperative wound infection (11.76%). In group B, 4 patients experienced local postoperative complications (15.38% of cases). Thus, we recorded 2 cases of postoperative hematomas (7.69% of cases), 1 case of postoperative seroma (3.84% of cases) and 1 case of wound infection (3.84% of cases) (fig. 4).

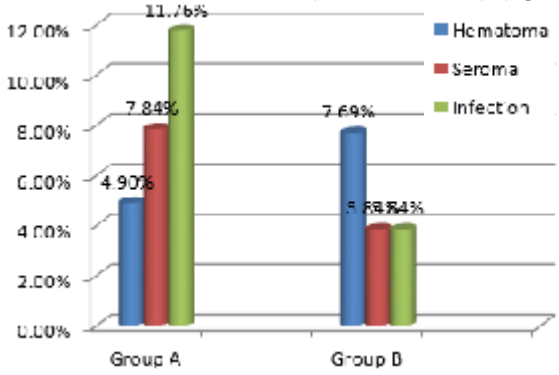

Fig. 4. The incidence of local postoperative complications in the two studied groups

Table Analyzed	Unpaired t test data	Number of values	102	26
Column B	ProGrip	Minimum	2	2
vs.	vs.	25% Percentile	2	2
Column A	Polypropylene	Median	3	2
		75% Percentile	4	2
Unpaired t test with Welch's correction		Maximum	6	2
P value	<0.0001			
P value summary	****	Mean	3.049	2
Significantly different (P < 0.05)?	Yes	Std. Deviation	0.9479	0
One- or two-tailed P value?	Two-tailed	Std. Error of Mean	0.09386	0
Welch-corrected t, df	t=11.18 df=101			
		Lower 95% CI of mean	2.863	2
How big is the difference?		Upper 95% CI of mean	3.235	2
Mean ± SEM of column A	3.049 ± 0.09386, n=102			
Mean ± SEM of column B	2 ± 0, n=26	Sum	311	52
Difference between means	-1.049 ± 0.09386			
95% confidence interval	-1.235 to -0.8628			
R squared (eta squared)	0.5529			

Table 1
STATISTICAL ANALYSIS OF THE DIFFERENCE BETWEEN THE DURATION OF SURGERY BETWEEN THE TWO GROUPS STUDIED

Table Analyzed	Unpaired t test data	Number of values	102	26
Column B	ProGrip	Minimum	3	3
vs.	vs.	25% Percentile	8	7
Column A	Polypropylene	Median	10	8
		75% Percentile	13	10
Unpaired t test		Maximum	25	11
P value	0.0046			
P value summary	**	Mean	10.59	8.077
Significantly different (P < 0.05)?	Yes	Std. Deviation	4.311	2.038
One- or two-tailed P value?	Two-tailed	Std. Error of Mean	0.4268	0.3997
t, df	t=2.883 df=126			
		Lower 95% CI of mean	9.742	7.254
How big is the difference?		Upper 95% CI of mean	11.43	8.9
Mean ± SEM of column A	10.59 ± 0.4268, n=102			
Mean ± SEM of column B	8.077 ± 0.3997, n=26	Sum	1080	210
Difference between means	-2.511 ± 0.871			
95% confidence interval	-4.235 to -0.7876			
R squared (eta squared)	0.06189			

Table 2
STATISTICAL ANALYSIS OF THE DIFFERENCE BETWEEN THE DURATION OF HOSPITALIZATION BETWEEN THE TWO STUDIED GROUPS

These results are explained by the fact that a lower operation time reduces the risk of intraoperative contamination of the patient, and the self-gripping mesh is more easily integrated into the tissues. Data analysis reveals a much lower incidence of wound infection in the batch where self-gripping mesh was used compared to the polypropylene mesh.

In the last decades, the use of heterologous materials has been more common in surgical specialties such as general surgery, thoracic surgery, or orthopaedics [12]. The introduction of meshes in the surgical treatment of incisional hernias has revolutionized the treatment of these patients. Typically, surgical treatment of incisional hernias is performed with or without prosthetic heterologous material. Recent studies have shown that, in the absence of use of prosthetic materials, the risk of recurrence of incisional hernias may even reach 30% [13,14]. In the last decades, more and more types of heterologous materials are used both in abdominal surgery and in thoracic surgery, especially in reconstructive techniques after different types of resections.

Heterologous materials used in the surgical treatment of incisional hernias should have a very good integration capacity. [15-17] After introducing the mesh into the abdominal wall, a local inflammatory reaction occurs, followed by the migration of fibroblasts on the surface of the mesh, followed by the formation of collagen fibers, which allows the mesh to be integrated into the abdominal wall and to increase its resistance at this level [18,19].

When using these meshes in surgical treatment techniques of the abdominal wall, besides the fact that the heterologous material makes up for the wall deficit, it also allows the formation of a high resistance scar [20,21]. Currently, the gold standard technique in the treatment of incisional hernias is the use of heterologous meshes. The mesh can be inserted pro-peritoneal, into the rectus abdominis muscle or supra-aponeurotic. In our study, both groups A and B had the mesh placed supra-aponeurotic, subcutaneously.

One of the main features that heterologous materials used in the abdominal wall reconstruction must meet in patients with incisional hernia is that the increased elasticity. [22] The use of prosthetic materials is the only therapeutic method that can increase the resistance of the abdominal wall. However, the use of these materials is not without risk, often postoperative complications may occur, such as seromas, hematomas, wound infection, mesh rejection. There is also a rather high risk for these patients to experience postoperative adhesions, which may lead to an increase in the morbidity over time. [23]

In addition to the prosthetic materials used in abdominal wall reconstruction, there are local factors that can influence the postoperative results such as: practicing a tidy surgical technique, practicing a well-groomed hemostasis, tissue that are sutured to be well vascularized, as well as the lack of local infection [14,24]. It is therefore particularly important that the abdominal reconstruction be done in the shortest possible time, knowing that the longer the operator's time, the greater the risk of intraoperative contamination .

Over the years, multiple types of heterologous materials have been used in the surgical treatment of incisional hernias, such as polypropylene meshes, PTFE (polytetrafluoroethylene) or Dacron. The main features of the meshes used in surgical techniques are: the size of the pores, the shape and the density of the meshes [20]. Unfortunately, none of these prosthetic materials used in the surgical treatment of incisional hernias has ideal characteristics. Despite this, the most commonly described in literature was the polypropylene mesh [25,26]. The advantage of the polypropylene mesh compared to other types of heterologous materials is that it exhibits very good tissue integration and a relatively low incidence of foreign body inflammatory reactions [27,28]. Particularly good stability of the polypropylene mesh within tissues has also been observed [29].

Recently, the ProGrip™ mesh was introduced into the surgical treatment of incisional hernias. The major advantage of this type of mesh is that it is self-gripping due to polylactic acid micro-hook that grip to the tissues. This allows a lower number of sutures to anchor the mesh to the tissues, thus shortening the duration of the surgery [30,31]. This was also observed in our study.

In addition to the presented advantages, the self-gripping meshes, due to the reduced number of sutures used, also have the advantage of lowering the trauma on tissues compared to classical meshes. This also causes a decrease in the intensity of postoperative pain as well as the need for analgesic medication in the postoperative period [32]. Although these meshes have been used

recently in clinical practice, there are already studies in the literature that have shown that the use of ProGrip™ is beneficial in decreasing the occurrence of postoperative complications in the surgical treatment of incisional hernias, as well as postoperative relapses [33,34].

Conclusions

The use of the ProGrip™ mesh (self-gripping mesh) is beneficial in the surgical treatment of patients with incisional hernias. The major advantage of using this type of mesh is given by a shorter hospitalization period for these patients, as well as by a lower rate of local postoperative complications in these patients.

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