

Intraperitoneal meshes in the repair of abdominal wall defects: comparison of polyester with collagen versus polypropylene with polyglycolic acid

Reparo intraperitoneal de defeitos da parede ventral do abdome com telas de poliéster com colágeno e polipropileno com ácido poliglicólico

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A B S T R A C T

Objective: To compare the clinical and histological outcomes of the repair of induced abdominal wall defects with Parietex® and Optilene Mesh Elastic® + Safil® in direct contact with abdominal viscera (intraperitoneal position, IPOM). **Methods:** Sixteen rabbits were allocated into two groups with 8 animals each, corresponding to evaluation on the 30th and 60th postoperative days. All animals were submitted to two standardized symmetric abdominal wall defects, comprising all muscular layers and the peritoneum, followed by repair through the intraperitoneal placement of two different meshes. The experimental design allowed each animal to be its own control. Macroscopic aspects evaluated were: surgical site infection, mesh erosion, suture insufficiency, fistulae, intra-abdominal infection and adhesion formation. Microscopic parameters analyzed consisted of collagen deposition and the immunohistochemical healing process. **Results:** The formation of intraperitoneal adhesions and the other macroscopic outcome measures evaluated did not present significant statistical differences between the two meshes, neither did type I and III collagen deposition and MMP-1 and MMP-8 antibody expression. MMP-13 antibody exhibited significantly higher expression on the 30th postoperative day with Optilene+Safil and on the 60th day with Parietex. **Conclusion:** Due to the similar results obtained, both macroscopically and microscopically, the meshes can be considered equivalent with respect to the healing of surgical wounds in abdominal wall defects in rabbits.

Key words: Surgical Mesh. Adhesion. Collagen. Wound healing. Immunohistochemistry.

INTRODUCTION

After the revolution in the surgical treatment of inguinal hernias through anatomic repair, initiated by Edoardo Bassini (1844-1924), the surgical treatment of abdominal wall hernias went through a second revolution with the advent of synthetic meshes for reconstruction reinforcement. The principle was to elicit the reinforcement of the region through the production of fibrosis, avoiding the excessive use of tissue tension, which had been considered up to that time to be the correct treatment for the repair of hernial defects. René Stoppa (1921-2006), one of the pioneers in that revolution, went so far as to state, in 1989, that the definitive surgical cure for any type of hernia was secure. Thereafter, prostheses began to be employed with the objective of reinforcing the abdominal wall, and the use of meshes disseminated rapidly¹. The following years did not

bring confirmation to that prediction, so attention was redirected to the influence of systemic risk factors and of the types of meshes employed. At present, the chapter on abdominal wall repair through synthetic meshes is open once again².

The advent of prosthetic materials, meshes of the most diverse compositions, was key in improving the technical outcomes of the surgical repair of congenital or acquired abdominal wall defects. Its utilization, compared with the simple raphy of the aponeurotic defect, reduced the recurrence rates of hernias considerably²⁻⁸. The polypropylene mesh is the most commonly used material^{2-4,6,9-12}.

The intra-abdominal use of meshes, however, has restricted indications, since their intraperitoneal placement brings forth complications as it may be associated with the formation of adhesions, enterocutaneous fistulae^{6,7,13-17} and

Experimental study conducted at the Instituto de Pesquisas Médicas – IPEM – of the Hospital Universitário Evangélico de Curitiba/Faculdade Evangélica do Paraná, Curitiba, PR, Brazil.

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intestinal occlusion^{6,7,13,16}, which is the most serious complication of adhesion formation^{18,19}. Consequently, there is a ceaseless search nowadays for a mesh composition that offers the existing advantages in terms of maintaining tissue resistance and tensile strength, yet without giving rise to its various complications²⁰.

The recent use of composite meshes with so-called antiadhesive barriers is a step towards a solution to those complications, as the aim is to provide tissues with adequate tensile strength without inducing the formation of adhesions and their deleterious intra-abdominal effects.

Clinical experience has shown that all meshes available for intraperitoneal use cause a certain extent of intraperitoneal adhesions. Controlled trials are needed in order to enhance the knowledge on the new concepts of prostheses with respect to their intraperitoneal placement.

The objective of this experimental study was to conduct a comparative investigation of wound healing in polyester meshes coated with an absorbable collagen film on one side (control group) and in polypropylene meshes coated with polyglycolic acid mesh (self-manufacturing, experimental group) in the repair of ventral wall defects in rabbits.

METHODS

This study was conducted at the Instituto de Pesquisas Médicas – IPEM (Medical Research Institute) of the Graduate Program in Principles of Surgery at the Hospital Universitário Evangélico de Curitiba/Faculdade Evangélica do Paraná, Curitiba, Brazil, in compliance with the Guidelines for the Care and Use of Laboratory Animals as prescribed by the Colégio Brasileiro de Experimentação Animal – COBEA (Brazilian College of Animal Experimentation) and approved by the Research Ethics Committee of the Sociedade Evangélica Beneficente.

Sixteen adult, male rabbits (*Oryctolagus cuniculus*) weighing between 2.5 and 3 Kg were used. The animals were in good health, housed in standardized cages, and receiving adequate chow and water *ad libitum*. They were kept under controlled temperature, humidity and luminosity conditions. The rabbits were randomly allocated into two groups with 8 animals each: Group 1, comprising the animals scheduled for euthanasia on the 30th postoperative day, and Group 2, on the 60th day.

Two different meshes were placed intraperitoneally in each animal, on either side of the ventral wall. Thus, each animal was its own control, preserving isogeny.

Two meshes with differing compositions were used: a woven polyester mesh coated with a protective collagen film (Parietex®, Covidien, control group) and a bilayer polypropylene mesh coated with polyglycolic acid mesh (self-manufactured from Optilene® Mesh Elastic and Safil®, BBD Aesculap, experimental group). The meshes were trimmed to a 3 x 3 cm square. The Parietex® mesh was only trimmed, whereas the components of the experi-

mental group mesh were trimmed, superimposed and attached to each other with interrupted 4-0 polypropylene sutures. In the present study protocol, the edges of the polypropylene component were not covered by the running horizontal mattress suture of the polyglycolic acid mesh.

The rabbits were anesthetized with intramuscular ketamine hydrochloride (40 mg/Kg) associated with xylazine hydrochloride (7 mg/Kg). The animals were considered to be anesthetized when unconscious and without voluntary movements. Throughout the surgical act, half the starting dose was added whenever necessary, in order for the surgical procedure to be completely painless for the animals.

The choice for antibiotic prophylaxis was intravenous cefazolin at a dose of 0.125 mg/kg, administered through the marginal ear vein upon anesthetic induction.

After hair removal and cutaneous disinfection, an 8-cm median incision was made through the skin and subcutaneous tissue 3 cm below the xifoid process. The ventral muscle tissue was exposed on both sides as far as the lateral border of the abdomen. In order to achieve standardized defects on the ventral wall, a triangular metal template with 2-cm sides was used. The defects were produced bilaterally 2 cm from the linea alba, encompassing all muscle layers and the peritoneum.

The locations for mesh fixation were also standardized, the left side for the Parietex® mesh and the right side for the Optilene® Mesh Elastic/Safil®. Fixation was performed through six interrupted 3-0 polypropylene sutures in such a way that the meshes were fully extended and completely covered the defect on the ventral wall (Figure 1).

Skin closure was performed with running 3-0 mononylon suture. By the end of the procedure, sodium dipyrone was injected intramuscularly at a dose of 0.5 ml/kg.

The postoperative period involved daily monitoring of the animals, as well as supplying water and chow up to the date set for euthanasia. Prior to that procedure, the rabbits underwent anesthesia once again. As soon as anesthesia was confirmed, 10 mL of potassium chloride 19.1% were administered intravenously through the marginal ear vein, leading to death by cardiac arrest.

Following verification of death, the animals were placed on an operating table in the supine position, after

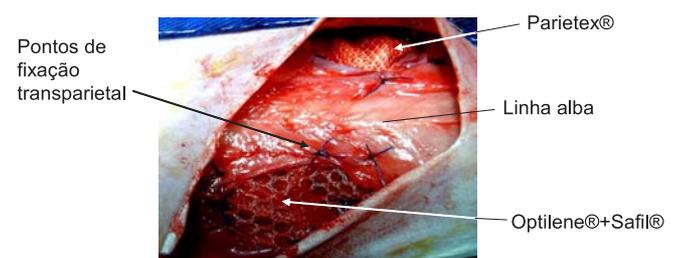


Figure 1 – Intraoperative aspect of the two meshes symmetrically fixed to the ventral abdominal wall.

which a horizontal suprapubic incision was made, extending along both flanks up to the costal arch.

The evaluation of the macroscopic findings comprised the following variables: a) surgical wound infection – when purulent discharge or any fetid discharge could be detected between the skin and the muscle tissue of the ventral wall; b) mesh-induced cutaneous ulceration – when it was possible to identify the mesh on the wall with the naked eye; c) incisional hernia formation – when bowel loops and/or omentum were interposed between the mesh and the ventral wall; d) formation of fistulae with the mesh – when there was close mesh adhesion to the intestine, to the extent that the mesh was in contact with the organ mucosa; e) intraperitoneal infection – when there was free purulent or fetid intracavitary fluid or localized intracavitary abscess; f) adhesion formation – if present, adhesions were classified according to Nair *et al.*²¹ in grade 0 (complete absence of adhesions), grade I (single adhesion between two organs or between an organ and the abdominal wall), grade II (two adhesions between organs or between organs and the abdominal wall), grade III (more than two adhesions between organs or between organs and the abdominal wall) or a generalized mass of intestinal adhesions without attachment to the abdominal wall), grade IV (generalized adhesions between organs and the abdominal wall).

For microscopic evaluation, an en bloc fragment comprising all ventral wall layers was taken at the insertion of the mesh, along with the viscera attached to it, if present. The specimen was stretched out and attached to a rigid surface to prevent warping, and only then was it soaked in 10% formalin. After 24 hours fixation, it was cut into three specimens for subsequent collagen study and immunohistochemistry. The material was submitted to routine histological processing for the preparation of paraffin blocks and yielded five 2- μ m sections for immunohistochemical study by the usual techniques of the method, and two 5- μ m sections for collagen analysis through

picrosirius red staining. The primary antibodies used for immunostaining were MMP-1 at a 1:250 dilution, MMP-8 at a 1:1000 dilution, ready-to-use MMP-13, IgG at a 1:500 dilution, and the secondary antibodies Donkey Anti-Mouse at a 1:100 dilution and IgG – HRP.

For the quantitative assessment of immunohistochemical staining, the ImagePro-Plus 5.1 software was used (Media Cybernetics, Silver Spring, Maryland USA). Measurements were performed from photomicrographs digitized and analyzed through a macro specifically written for this reading (Figure 2).

In the statistical analysis, the non-parametric Mann-Whitney test and Fisher's exact test were used in comparing the mesh groups. For the intragroup comparison of meshes, the non-parametric Wilcoxon test and the binomial test were used. Values of $p < 0.05$ indicated statistical significance.

RESULTS

No animal mortality occurred either during anesthetic induction or in the perioperative or postoperative period.

Macroscopic evaluation

a) surgical wound infection: not found in any animal of either group, irrespective of the mesh employed.

b) ulceration of the skin overlying the mesh: erosion occurred in four animals in the Parietex® group and one in the Optilene®+Safil® group with euthanasia on the 30th postoperative day. As for the animals with euthanasia on the 60th day, there occurred no erosion of the mesh into the skin in any of the animals, regardless of the mesh; no statistical difference was found between meshes or between groups ($p = 0.375$).

c) repair dehiscence: observed in one animal of the Parietex® group with euthanasia on the 60th

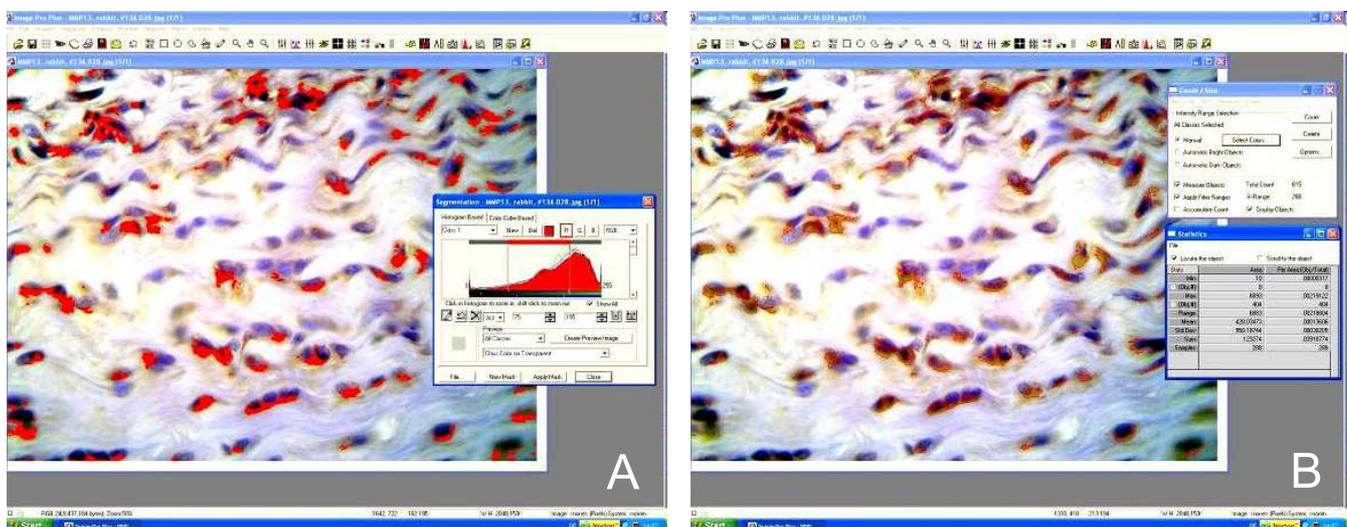


Figure 2 – Quantitative immunohistochemical staining analysis performed by the Image-Pro Plus software: A – color segmentation (red) of the areas corresponding to brown for visual assessment of program settings; B – numerical results.

postoperative day; no statistical difference was found between meshes or between groups

d) formation of fistulae with the mesh: no fistulae were formed between the mesh and the intra-abdominal organs in any of the study animals, irrespective of the type of mesh material or postoperative time course.

e) occurrence of intraperitoneal infection: in one animal of the Parietex® mesh group, an intra-abdominal septal abscess was observed in the group scheduled for euthanasia on the 30th postoperative day; no statistical difference was found between meshes or between groups.

f) adhesion formation: no statistical difference was found between meshes or between groups of postoperative time course (Table 1) (Figure 3).

Microscopic evaluation

Collagen study

There was no significant difference between mesh types regarding type I collagen, either for the animals evaluated at 30 days or at 60 days (Tables 2 and 3).

There was no significant difference between mesh types with respect to type III collagen either after 30 days or 60 days. Table 3 shows that the median for animals with euthanasia on the 30th day was greater than the median for those with euthanasia on the 60th day for both types of mesh.

Type I/III collagen ratio was also similar between groups, with an upward trend over time (Table 4).

Immunohistochemistry

Regarding antibody MMP-1, there was no significant difference between mesh types either at 30 days or 60 days.

Similarly, there was no significant difference between mesh types either at 30 days or 60 days with respect to antibody MMP-8.

As for antibody MMP-13, a significant difference was found between mesh types both at 30 days ($p=0.0499$) and at 60 days ($p=0.036$). On the 30th postoperative day, the Optilene®+Safil® mesh exhibited significantly greater MMP-13 immunostaining. In contrast, the Parietex® mesh showed significantly greater MMP-13 immunostaining on the 60th day. In comparing the group of animals scheduled for euthanasia on the 30th day with the group with euthanasia on the 60th day, no significant difference was found for the Optilene®+Safil® mesh ($p=0.105$), but there was a significant difference for the Parietex® mesh ($p=0.015$), with greater MMP-13 immunostaining on the 60th day.

DISCUSSION

The animal used in the study was the rabbit, chosen for its docility, small body size, ease of handling and housing. However, the decisive factor was the fact that rabbits contract their ventral musculature – as humans

Table 1 – Comparison of meshes for adhesion formation on the 30th and 60th postoperative days.

Evaluation	Nair's Classification (1974)	Mesh type		p value
		Optilene®+ Safil®	Parietex® vs. Optilene®+Safil®	
Day 30	0 / I	4 (50%)	1 (12,5%)	0,281
	II / III	4 (50%)	7 (87,5%)	
Day 60	0 / I	8 (100%)	4 (50%)	0,076 (*)
	II / III	0 (0%)	4 (50%)	
30x60 intragroup		0,076	0,282	

$p =$ Fisher's exact test (*) considered not quite significant, despite a clear trend, when comparing Parietex® with Optilene®+Safil®.

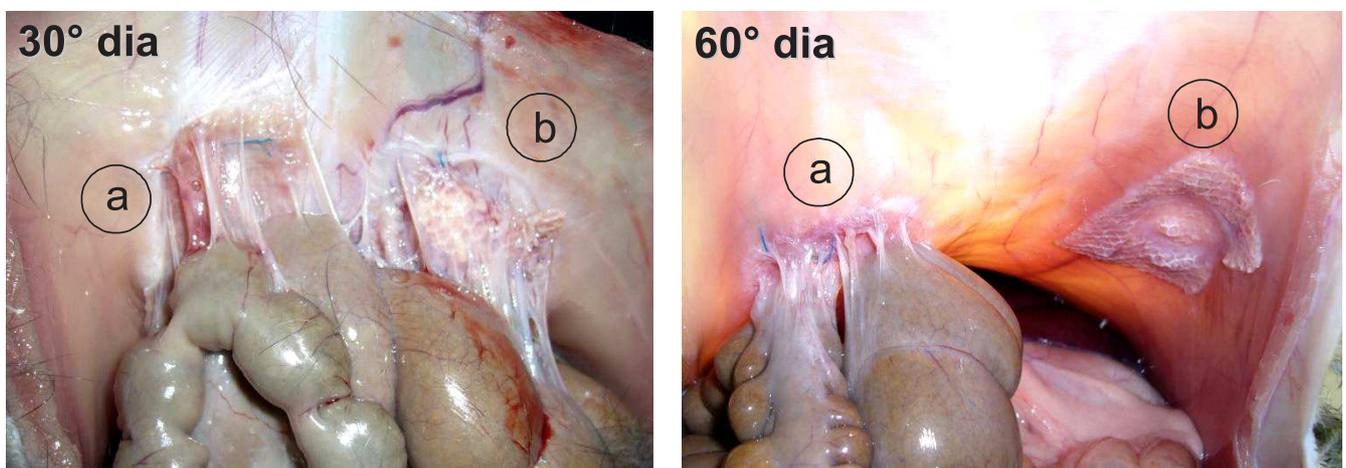


Figure 3 – Aspect of intraperitoneal adhesions on the 30th and 60th postoperative days. a) Optilene®+Safil®; b) Parietex®. The adhesions in both images were classified as Nair grade II (1974).

Table 2 – Comparison of means, medians and statistical analysis of the type I collagen study for Parietex® and Optilene®+Safil® meshes.

Postoperative time course	Mesh type	Mean	Median	Standard deviation	p value Parietex® vs. Optilene®+Safil®
30 days	Parietex®	7107,0	1663,5	11066,4	0,484
	Optilene®+Safil®	5870,0	2081	7157,0	
60 days	Parietex®	59935,5	38714,5	62973,5	0,263
	Optilene®+Safil®	22129,1	19870,5	17482,7	

p = non-parametric Willcoxon test.

Table 3 – Comparison of means, medians and statistical analysis of type III collagen study for Parietex® and Optilene®+Safil® meshes.

Postoperative time course	Mesh type	Mean	Median	Standard deviation	p value Parietex® vs. Optilene®+Safil®
30 days	Parietex®	52247,6	52674,5	33527,8	0,401
	Optilene®+Safil®	39662,1	21891,0	43388,0	
60 days	Parietex®	24777,6	7701,5	43910,4	0,575
	Optilene®+Safil®	12936,6	8435,5	17525,2	

p = non-parametric Willcoxon test.

Table 4 – Type I/III collagen ratio.

Mesh		30th day p.o.	60th day p.o.
Optilene®+Safil®	Type I	5870,0	22129,1
	Type III	39662,1	12936,6
	Ratio I/III	0,14	1,71
Parietex®	Type I	7107,0	59935,5
	Type III	52247,6	24777,6
	Ratio I/III	0,13	2,41

do – and this is very important in the dynamics and physiology of mesh fitting on the abdominal wall, as well as a major factor in incisional hernia formation.

The choice of meshes is easily justified by the current interest in composite meshes, which can prevent the formation of intra-abdominal adhesions when exposed to the inside of the peritoneal cavity and, at the same time, confer adequate tensile strength to the abdominal wall on the side that is apposed to the musculature⁸.

Therefore, in order to establish a comparison, two mesh types were used: a commercially available mesh – made of polyester and coated with polyethylene-glycol-glycerol collagen (Parietex®, Covidien), with good results in various experimental studies^{8,22-24} and another one comprising two superimposed meshes: polypropylene (Optilene® Mesh Elastic, BBD Aesculap) and polyglycolic acid (Safil®, BBD Aesculap).

Regarding the Parietex® mesh, its macroporous composition of nonabsorbable material presents the same advantages and disadvantages of the polypropylene mesh, in that it stays in contact with the abdominal wall to induce the influx of inflammatory tissue and, consequently, fibrosis

and tissue resistance. On the other hand, the coating on the polyethylene-glycol-glycerol side, which faces the peritoneal cavity, is intended to produce the exact opposite effect, i.e., to create a thin layer to keep the mesh from adhering to intra-abdominal organs. This membrane covering the polyester on its peritoneal surface includes an oxidized solution of bovine type I collagen in its composition, in addition to polyethylene-glycol and glycerol. It features the qualities of being hydrophilic and completely absorbable in approximately three weeks²⁴. Following resorption, a new layer of peritoneum forms over the mesh, maintaining its isolation from the intra-abdominal organs²⁴.

The other mesh type was engineered with the superposition of two meshes: the polypropylene and the polyglycolic acid mesh. The choice for polypropylene is justified by the fact that it is at present the most commonly used material worldwide, in addition to providing good tissue resistance. Polyglycolic acid, on the other hand, was chosen for being a material which undergoes hydrolysis and is totally resorbed in approximately 60 to 90 days. Therefore, it functions as a barrier that is potentially capable of preventing adhesion formation²⁵.

Macroscopic evaluation

There was no wound infection at the site of the surgical incision in any animal of either group, irrespectively of the mesh employed. Only one animal exhibited septal intra-abdominal infection, with no clinical relevance. These data are in agreement with the reviewed literature^{15,26,27}, since none of the references consulted cited high surgical wound infection rates, regardless of the objective of the study, methodology or prosthetic material used. The reason for this could be the correct and effective use of antibiotic

prophylaxis, as well as the aseptic and antiseptic techniques both pre- and intraoperatively. Such procedures are key to prevent the surgical act from being characterized as contaminated.

Regarding mesh erosion into the ventral wall skin, that is, the formation of a skin ulcer, it occurred in four animals of the Parietex® group, the likely etiology being the absence of adipose tissue between the muscle plane and the hypodermis. This phenomenon is also observed in elderly patients and those with scarce subcutaneous adipose tissue. As for suture insufficiency, it occurred in only one animal. The meshes were equal with regard to the effectiveness in maintaining the tensile strength and integrity of the ventral wall. Authors have demonstrated that the polyester mesh equals the polypropylene mesh in maintaining tensile strength^{8,20}, where porosity is an important factor in tissue ingrowth. Macroporous meshes (polypropylene and polyester) must be in contact with the muscle tissue in order to act to retain the tensile strength of the ventral wall. This is so because cell colonization and inflammatory reaction are directly related to the porosity of the material. Another factor that must be taken into account to prevent hernia recurrence is the need to avoid using resorbable material exclusively^{9,11}, as it will eventually reduce tensile strength on the ventral wall, which may lead to hernia recurrence.

There was no case of fistula formation, irrespective of mesh type or length of postoperative follow-up. This finding confirms the efficacy of both meshes in preventing the formation of tenacious adhesions to the intra-abdominal organs, which would eventually cause the erosion of the mesh into the organ mucosa and the formation of fistulae. Such findings are in line with most of the literature reviewed²⁸, probably because most experimental studies also had relatively short postoperative follow-up. In retrospective clinical studies, with much longer follow-up, authors disagree on these data. Nagy *et al.*²⁹ found that polypropylene meshes led to fistula rates around 75%. However, the mesh they used did not have any sort of antiadhesive barrier, which might account for such a high percentage of complications. The authors themselves concluded that a mesh for intraperitoneal use should not be erosive to avert the formation of fistulae. Furthermore, in a retrospective clinical study by Greene *et al.*³⁰, 13% of fistula formation was found with the use of polyglycolic acid mesh. These data also diverge from the present study, especially in the case of a fully resorbable mesh. In this case, a possible correlation between fistula formation and longer follow-up becomes more evident.

Regarding the macroscopic evaluation of adhesion formation, there was no statistical difference between meshes, which shows that they are equal in preventing adhesions. By the classification of Nair *et al.*²¹, the great majority of adhesions were classified as grades I and II, an indication that they were few. Therefore, both mesh compositions that were apposed to bowel loops were effective in impeding a tenacious adhesion of the meshes to intra-abdominal organs, including the polyglycolic acid mesh, which is totally resorbable between 60 and 90 days.

These findings related to the Parietex® mesh could be explained by the fact that the side facing the peritoneal cavity was composed of microporous material. These data are in accord with those of other authors^{6,17,20,31,32}. Similarly, in line with the good results of the present study in the prevention of adhesion formation, a great number of comparative studies of meshes with and without so-called antiadhesive barriers showed significantly less adhesion formation in the former case^{6,7,8,33}.

On the other hand, the second mesh in the study, which had polyglycolic acid facing the peritoneal cavity, showed the same capability in averting adhesion formation as the Parietex® mesh, even though this likeness was statistically borderline. A decline in adhesion formation was to be expected with the Parietex® mesh in the periods evaluated; however, this could only be verified with a larger number of animals. These results diverge from the findings of studies by Baykal *et al.*³⁴, who found significantly more severe and intense adhesion formation with the polyglycolic acid mesh when compared with the polypropylene mesh. The factor that could account for these findings was the greater inflammatory reaction during the resorption of the polyglycolic acid mesh. A likely explanation for those results lies in the fact that the polyglycolic acid mesh used in the studies by Baykal *et al.*³⁴ was single, and there were other purposes besides preventing adhesion formation, such as the preservation of the integrity of the abdominal wall in order to avert hernia recurrence. Consequently, the mesh was probably coarser and thicker than the one used in the present study, made up of only a thin membrane, precisely to avoid the contact of bowel loops with the polypropylene mesh superimposed to it. Thus, it is likely that the polyglycolic acid mesh in the present study incited less inflammatory and foreign body reaction during its hydrolysis and, consequently, induced less adhesion formation than it would if it were of the same material, only thicker. It is important to stress that a decrease in the number and intensity of adhesions was observed between the 30th and the 60th postoperative days with both meshes. It is to be expected that after the complete absorption of the polyglycolic acid mesh (after around six months) the intensity of adhesions should be even less. It is worth noting that, in the present study, the polyglycolic acid mesh did not receive running horizontal mattress suture to cover the edges of the polypropylene mesh. This detail is to be reevaluated in a future experiment. Not less importantly, it should be stressed that the intraoperative manufacturing of the composite mesh (Optilene®+Safil®) represents a significant reduction in material costs, which may eventually be an argument in favor of the intraperitoneal use of this mesh.

Microscopic evaluation

Junqueira *et al.*³⁵ were the first to describe the picosirius red staining method. It is strong anionic histopathological staining, in which a reaction takes place between the sulfonic acid groups of the dye and the basic groups in the collagen molecules, thus producing the staining. The elongated molecules of picosirius red bind to

the collagen fibers parallel to their long axis in such a way that this interaction between the molecules results in greatly increased birefringence. The quantitative assessment of collagen on the mesh surface facing the peritoneal cavity, by this method, provides important information on collagen fibers, such as the density of its structure and the specific type of fibers formed in the scar tissue. By this staining method, the thicker or more mature collagen fibers appear strongly birefringent under the microscope and are colored red-orange (type I collagen), whereas the thinner and more disperse or immature fibers are weakly birefringent and are greenish (type III collagen).

By and large, the results found in the collagen study are comparable to those of other authors^{7,12}, who noted that meshes with antiadhesive barriers provide for less collagen deposition. They justified this by the fact that micropores elicit an inadequate inflammatory reaction, with reduced influx of fibrocollagenous tissue, scant fibroblasts and the prevalence of giant cells^{11,33}.

In the analysis of the immunohistochemical findings, the results of the statistical tests indicated that there was no significant difference between the types of mesh with respect to antibodies MMP-1 and MMP-8. However, the evaluation of antibody MMP-13 demonstrated that the Optilene®+Safil® mesh exhibited significantly greater immunostaining than the Parietex® mesh, both for the group of animals with euthanasia on the 30th day and the group with euthanasia on the 60th day.

In the present study, immunohistochemistry was intended to assess the extent of degradation of the various collagen types. There are some 20 types of MMP (Matrix Metalloproteinases), but only numbers 1, 8 and 13 are associated with collagen catabolism³⁶. Metalloproteinases, along with macrophages and fibroblasts, are the enzymes responsible for the degradation of extracellular collagen³⁷.

The findings concerning MMP-1 and MMP-8 could indicate that the degradation of collagen types III and I, respectively, was similar for both meshes³⁸.

With respect to the findings on MMP-13, they may correspond to a disproportion in the degradation of type II collagen between the two meshes investigated, perhaps influenced by the polyglycolic acid hydrolysis process. MMP-13 acts in the degradation of type II collagen^{38,39}, which is found abundantly in cartilages. Therefore, this type is not so specific for the present study as types I and III collagen, which are found in the dermis and in the reticular connective tissue, respectively³⁶. Other authors argue that the increase in MMP-13 may be related to a delay in the wound healing process^{36,40}. In that case, a likely explanation for the findings of the present study is that the hydrolysis process of the polyglycolic acid mesh was more pronounced in the first 30 postoperative days, and this led to a delay in local wound healing. After that period, wound healing may have been exuberant, which allowed it to be greater than that of the other mesh on the 60th postoperative day.

The fact of the matter is that there is no consistent knowledge on the subject yet, since this is a recent field of studies. Furthermore, it was not possible to compare the data presented herein with the literature, due to the paucity, if not absolute lack, of experimental studies addressing adhesion formation and postoperative wound healing. Future prospects point to the undertaking of new experimental studies using a variety of meshes and evaluations at different stages of the healing process. Thus it will be possible to establish immunohistochemical standards for wound healing.

In conclusion, the comparative study of wound healing in Parietex® and Optilene®+Safil® meshes in the repair of ventral wall defects in rabbits showed similar outcomes, and thus the meshes can be considered equivalent for the parameters analyzed.

R E S U M O

Objetivo: Avaliar a incorporação de telas de poliéster revestido em uma de suas faces por colágeno (Parietex, Covidien) e polipropileno recoberto por ácido poliglicólico (Optilene Mesh Elastic e Safil, BBD Aesculap) no reparo de defeitos da parede ventral de coelhos avaliando a cicatrização no aspecto macroscópico, o depósito de colágeno e a imunomarcagem tecidual pelos anticorpos MMP-1, MMP-8 e MMP-13. **Métodos:** Utilizaram-se 16 coelhos, divididos em dois grupos de 8 animais, avaliados após eutanásia após 30 e 60 dias de pós-operatório. Os animais foram submetidos à realização de dois defeitos simétricos na parede ventral do abdome, à direita e esquerda da linha alba, que compreendendo todos os folhetos musculares e o peritônio. O reparo dos defeitos foi realizado mediante implante intraperitoneal de dois modelos diferentes de telas. Utilizou-se a tela de poliéster revestido com camada protetora de colágeno (grupo controle) e a tela de polipropileno revestido com malha de ácido poliglicólico (manufaturação própria, grupo de experimentação). A avaliação constou de aspectos clínicos, achados macroscópicos, análise dos colágenos tipos I/III e avaliação imunoistoquímica de metaloproteinases. **Resultados:** Os resultados da avaliação clínica e os parâmetros macroscópicos foram semelhantes entre os grupos. 50% dos animais do grupo Parietex tiveram ausência de aderências intraperitoneais a no 30º dia de pós-operatório. Em ambos os grupos observou-se redução das aderências entre o 30º e o 60º dias de pós-operatório, contudo sem diferença estatística. As aderências observadas foram classificadas principalmente de frouxas. Não se observou a ocorrência de complicações envolvendo vísceras intraabdominais. No grupo Parietex houve a ocorrência de formação de ulceração da pele que recobria a tela em 4 animais, em comparação com um no grupo de experimentação. No grupo Parietex foi observada uma insuficiência de reparo após 60 dias. Quanto ao depósito de colágeno tipos I e III, não houve diferença significativa entre os grupos. Os resultados da imunoistoquímica referentes aos anticorpos MMP-1 e MMP-8 também não demonstraram diferença significativa entre as telas. **Conclusão:** As duas telas pesquisadas obtiveram resultados semelhantes tanto nos aspectos macro como nos microscópicos, podendo ser consideradas semelhantes quanto ao reparo de defeitos cirúrgicos da parede ventral do abdome em coelhos.

Descritores: Telas cirúrgicas. Aderências. Colágeno. Cicatrização de feridas. Imunoistoquímica.

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