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The Use of a Porcine Collagen Implant in Open Abdomen Closure after Peritonitis Treated with Negative Pressure Wound Therapy - a Case Report

Kashchenko V.A, Toidze, V.V, Vasyukova E.L.*

***Abstract* — Successful treatment of peritonitis with negative pressure wound therapy has been frequently reported. Long term open abdomen treatment in complex cases such as in the treatment of peritonitis, often leads to an extensive abdominal wall defects. It may be challenging to close such a defect. Both primary sutures and synthetic meshes are strongly discouraged in surgical treatments of such cases. We present a clinical case demonstrating successful treatment of a class IV abdominal wall defect using a porcine dermal collagen implant (Permacol, Medtronic) in a patient after peritonitis treated with NPWT.**

***Keywords* — peritonitis, abdominal wall defect, porcine collagen implant**

I. Introduction

ABDOMINAL hypertension based on infection, trauma, vascular complications and retraction of the structures may lead to an open abdomen and often complications. Negative Pressure Wound Therapy (NPWT) has been successfully used in the treatment of peritonitis.[1] A large abdominal wall defect and chronic inflammation may result from long term treatment with NPWT.[2] Dynamic sutures have been used; however in case of abdominal hypertension, infection, extensive defects and tissue damage, this is not a suitable option.[1,2] In cases of large defects, most surgeons agree that the defect should be repaired in a tension free manner, performing plastic surgery of *rectus abdominis* or using a prosthetic mesh material.[2,3] A great variety of mesh materials for abdominal wall reconstruction are available. Different types of mesh have unique sets of characteristics. There are three main types of prosthetic mesh: synthetic (polypropylene, polyester etc.), composite and biological mesh.[4] Synthetic implants are traditionally used and their range is being steadily increased.

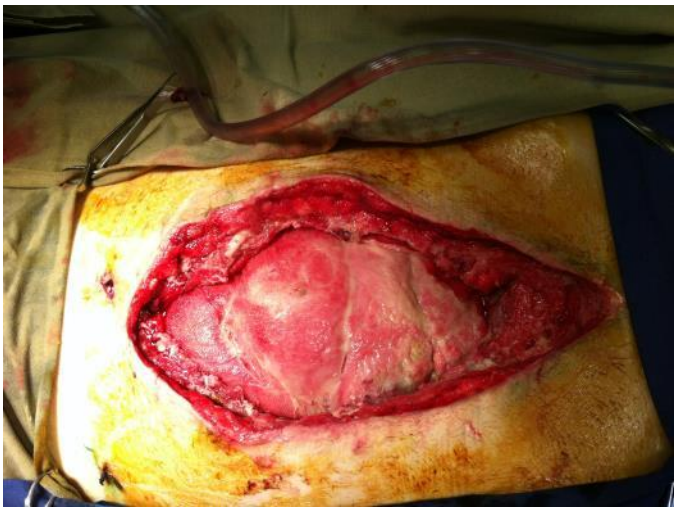

Fig. 1: Wound at one of the vacuum-system treatment stages.

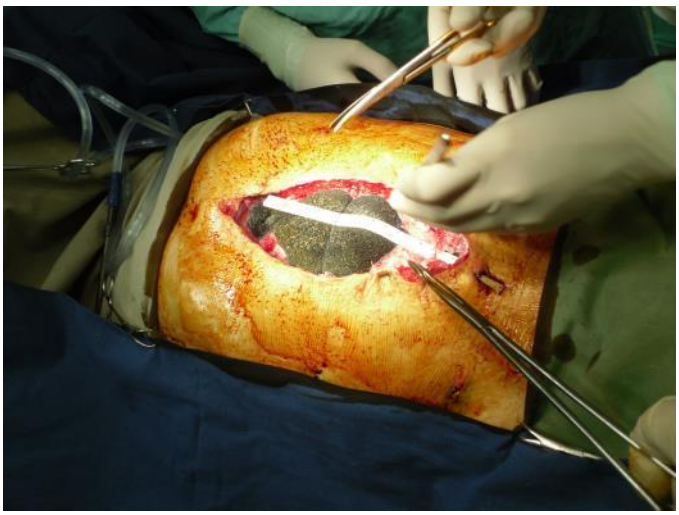

Fig. 2: Stage of setting of CNP-system.

They can only be used extraperitoneally in an uncomplicated clean wound. This type of implant is characterized by high tensile strength; however it is inappropriate for intra-abdominal use due to direct contact with the bowel.[5] Composite implants were offered to solve these problems. They allow for avoiding

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Sokolov Hospital №122 of the Federal Medical and Biological Agency St-Petersburg State University.
*Correspondence to evgenija.piter@mail.ru

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adhesion formation and can be implanted

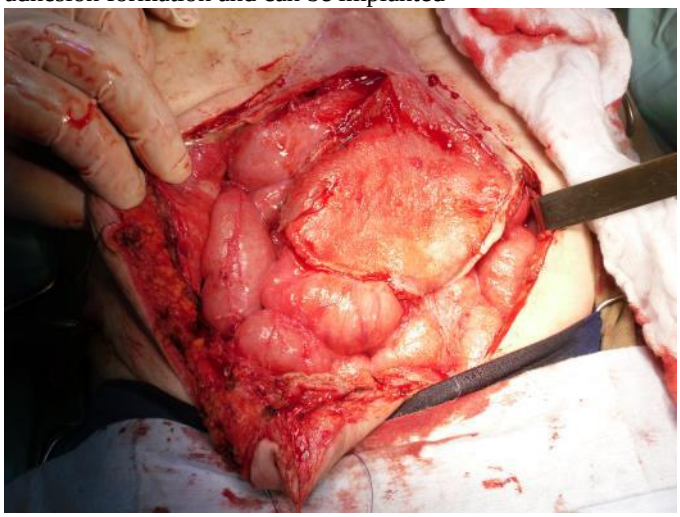

Fig. 3: The large abdominal wall defect after peritonitis treatment.

intraperitoneally. However the use of traditional synthetic and composite implants can be associated with complications, including wound infection and mesh explantation in cases of large abdominal wall defects and in infected operative fields. Biologic meshes were offered in the past two decades to improve outcomes in infected field surgical procedures.

II. Case Report

We present a clinical case of abdominal wall reconstruction in a patient with large abdominal defect as a result of peritonitis treatment using NPWT.

The 46-year-old man underwent distal gastrectomy because of complicated 2 postbulbar ulcers penetrating into the pancreas and into the hepatic pedicle associated with stenosis. Early postoperative period comlicated by acute pancreatitis with biliary peritonitis. The patient underwent relaparotomy with lavage and drainage of the abdominal cavity followed by cholecystostomy. The disease progressed and infectious pancreatic complications such as infected pancreatic necrosis, peripancreatic, retroperitoneal space and right colon necrosis with peritonitis followed. The next reoperation was performed in 5 weeks after gastrectomy and consisted of the right hemicolectomy, debridement of the necrotic tissue, choledochostomy and drainage of the abdominal cavity.

NPWT (Suprasorb CNP, Lohmann & Rauscher) was used for peritonitis treatment after the last laparotomy (Fig. 1,2).

A 18 x15 cm post laparotomy wound was left open and treated with NPWT for 15 days. After the infection had been resolved an autoderm plastic was performed to attempt wound closure, however this was not successful. In our case the large abdominal wall defect was not appropriate for primary closure. We therefore used a porcine collagen implant (Permacol, Medtronic) to attempt closure of the large abdominal wall defect (Fig. 3).

The implant was cut to shape of the abdominal wall defect (Fig. 4) and was fixed with separate vicryl sutures (Fig. 5, 6).

Suction drainage was applied over the mesh and was

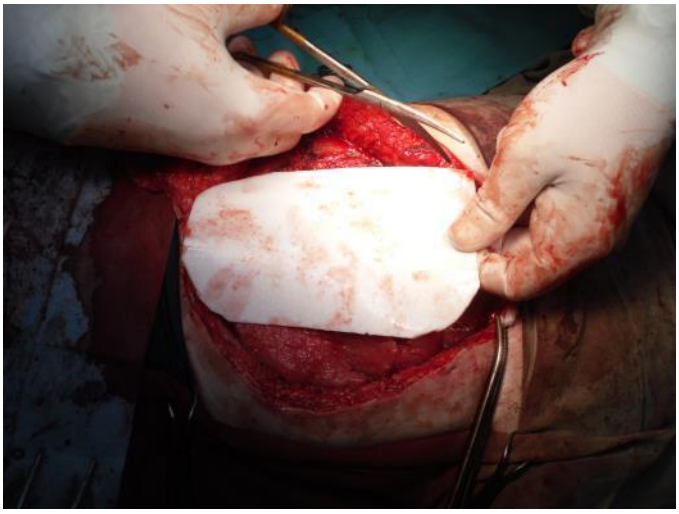

Fig. 4: The abdominal wall defect was reconstructed with 18x15cm Permacol mesh

removed at day 6 post surgery. One minor complication, a 70 ml seroma, occurred at day 12 post surgery, which was resolved after it was punctured. The patient was discharged on day 23 post surgery after successful closure was achieved (Fig. 7).

III. Discussion

Various options are available for open abdominal treatment of peritonitis. In the present clinical case we applied NPWT.[1] However, after resolving the infection the large abdominal wall defects that remain are not appropriate for primary closure.[1] The abdominal compartment-syndrome can develop at primary closure of large defects and special implants may be required for abdominal wall reconstruction.[2,3] Polypropylene has been used for more than 20 years as synthetic materials with proven efficacy.[4] This monofilament material is characterized by durability, inertness and resistance to infection.[4] It is an optimal mesh for extra-peritoneal placement and in cases of a clean wound. However the use of non-absorbable synthetic mesh was not possible for closing of the abdominal wall defect in our case due to its tendency to induce bowel adhesions.[4] Besides, the use of synthetic materials can cause postoperative complications such as wound infections, implant adhesion to a bowel and mesh contamination, frequently requiring a second surgical procedure.[4] There are absorbable synthetic implants for contaminated wounds, which are used in cases when there is no alternative to close the abdominal cavity.[6] However a second operation with non-absorbable materials is necessary for some of these patients, due to the fact that the recurrence rate is 50%.[6] In our case we used a collagen implant for abdominal wall defect reconstruction.[3] Collagen is an acellular biological implant, derived from human or animal dermis, pericardium or intestinal submucosa.[7] The properties of biological implants depend on the materials from which they are derived and the processing methods.[8] Some biological implants are stabilized chemically by crosslinking. Thus implants are subdivided into cross-linked and non-cross-linked biological meshes.[9]

Cross-linked biological prostheses are more durable and

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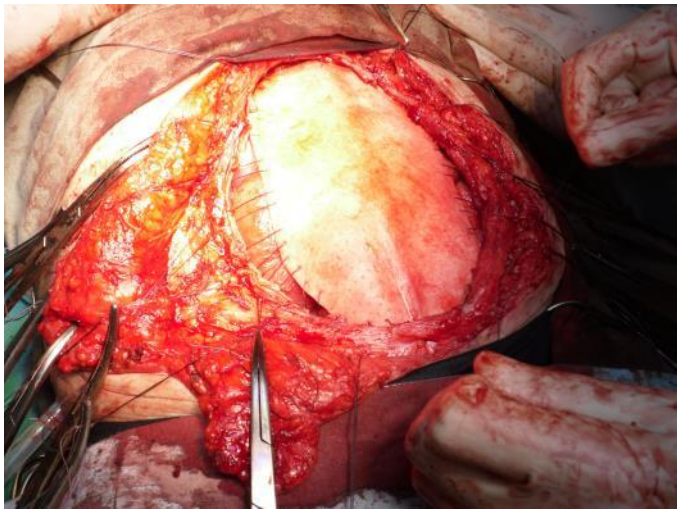

Fig. 5: Permacol covers the abdominal wall defect.

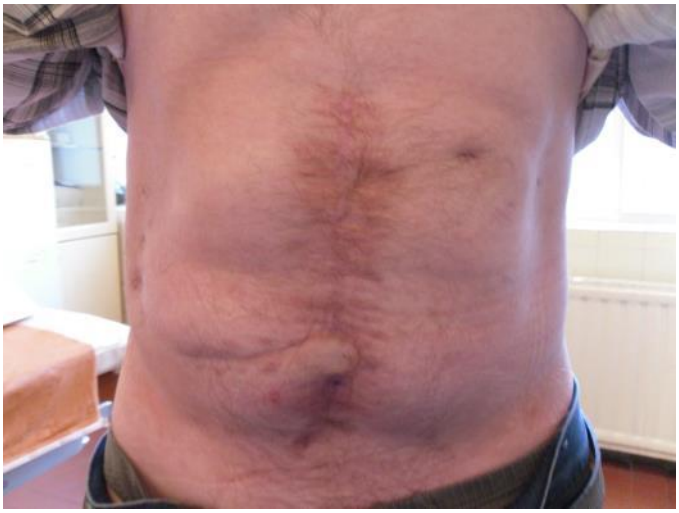

Fig. 7: The patient 9 months after the surgical procedure.

resistant to enzymatic degradation.[10] On the other hand non-cross-linked implants can degrade with time.

We used a porcine dermal collagen implant from which cells and fat deposits are removed.[2,3] The implant consists of a collagen and elastin complex as a result of processing, is cross-linked and is more resistant to tissue and bacterial collagenases.[11] The use of collagen implants is associated with minimal levels of acute inflammation.[2,3] The main benefit of this implant is its possibility of integration in contaminated fields or fields which are at high risk of surgical infection.[12] Infectious complications in hernia repair and in closing of large abdominal wall defects remain a complex issue and often mesh removal is needed. In our case the patient had a contaminated abdominal wall defect. Infectious profile of meshes is different. Cobb reported that infectious complications with use of a composite mesh occur in 10% of cases and over half of these were infected with MRSA.[13]

There are very few studies comparing different types of biological implants.[14] Smart (2012) reported that the best results were achieved with the use of collagen implants in infected fields.[14] However some cases of seroma formation and wound infection were described as a result of collagen implant use.[14] In our case the patient had a seroma, which was punctured successfully. There were no other complications within 9 months of follow-up. Despite the fact that 14 different types of commercially available biological implants are available, there are no large randomized trials comparing clinical efficacy of these implants.[15] What should an ideal surgical implant be like? Certainly it is to provide a long-term structural integrity, optimal tissue integration and resistance to bacterial colonization. It should be noted that the research of some biomechanical and histologic characteristics of cross-linked and non-cross-linked meshes showed that the former had some advantages, though not in all cases.[15] A Multicenter phase III randomized controlled trial has been initiated in 2012 and is ongoing.[16]

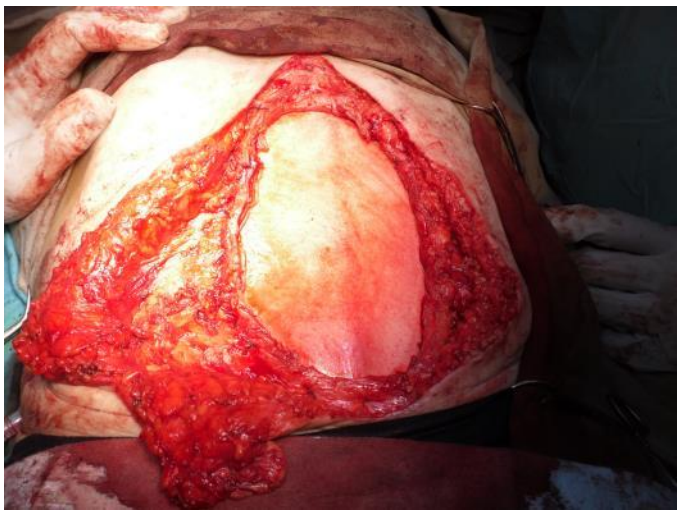

Fig. 6: Wound after mesh fixation.

IV. Conclusions

The use of collagen implants is widely reported. The main properties of the collagen implant we used are the possibility of its use in infected or contaminated fields, biological tolerance of the material and low risk of adhesion. Its disadvantage is the high cost of the material and therefore the use of the implant seems feasible for infected fields or in case of large abdominal wall defects. In our case the implant allowed shorter hospital stay and prevented costs of treating complications. Outcomes of reconstructive surgeries with collagen implants are to be confirmed by large prospective randomized studies.

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