ABDOMINAL WALL CATASTROPHE, THERAPEUTIC STRATEGY – A CASE REPORT AND REVIEW OF THE LITERATURE

CATÁSTROFE DA PAREDE ABDOMINAL, ESTRATÉGIA TERAPÊUTICA – RELATO DE UM CASO CLÍNICO E REVISÃO DA LITERATURA

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ABSTRACT

A complete abdominal wall defect (AWD) is life-threatening, has a functional and cosmetic impact on patients' quality of life and represents a significant challenge for surgeons, requiring a multidisciplinary treatment strategy. The goals of the reconstructive surgery in the management of these defects are to provide stable coverage of the abdominal contents, restore function and achieve complete wound closure. We present a case that shows that the use of a biological mesh (porcine dermis), negative wound pressure therapy (NPWT) and split skin grafting is suitable to manage such defects when visceral exposure is present. A biological mesh is a good and less aggressive alternative to the use of free flaps, closing the AWD in a tension-free manner in an infected field or in one that is suspected of being infected and it has been shown to be better tolerated than synthetic meshes in open abdomens, with the ability to provide vascular ingrowth and incorporate itself into the native tissue. On the other hand, NPWT showed to provide a firm bandage for the patient and a closed, moist environment, protected from the invasion of bacteria, while eliminating excessive exudation, stimulating angiogenesis and reducing the wound surface area.

Key Words: *abdominal wall reconstruction, porcine dermis, negative wound pressure therapy, skin grafts*

RESUMO

Um defeito completo da parede abdominal (AWD) ameaça a vida, tem um impacto funcional e cosmético na vida dos doentes e representa um grande desafio para os cirurgiões, exigindo uma estratégia de tratamento multidisciplinar. Os objetivos da cirurgia reconstrutiva no tratamento destes defeitos são fornecer uma cobertura estável do conteúdo abdominal, restaurar a função da parede abdominal e atingir um encerramento completo da ferida. Apresentamos um caso clínico que mostra que o uso de uma prótese biológica (derme suína), terapia de pressão negativa (NPWT) e enxertos cutâneos é adequado para tratar estes defeitos quando o doente tem exposição visceral. O uso de uma prótese biológica é uma alternativa boa e menos agressiva em comparação com o uso de retalhos livres, encerrando o AWD sem tensão num terreno infetado, e mostrou ser melhor tolerado do que o uso de próteses sintéticas num abdómen aberto, com a capacidade de fornecer um meio para crescimento vascular e de se incorporar aos tecidos do doente. Por outro lado, a NPWT mostrou fornecer um ambiente firme, fechado e húmido, protegido da invasão de bactérias, ao mesmo tempo que elimina a exsudação excessiva, estimula a angiogénese e reduz a área de superfície da ferida.

Palavras-chave: *reconstrução da parede abdominal, derme suína, terapia com pressão negativa, enxertos cutâneos*

INTRODUCTION

Abdominal wall defects (AWD) can result from trauma, tumours, necrotizing infections or complications of previous surgeries[1], particularly when patients are managed with open abdomen techniques in a damage control strategy. A complex AWD is defined as any defect presenting with two or more of the following criteria: large or multiple AWD ≥ 10cm in width; wound class III (contaminated) or IV (dirty); parastomal, lumbar or subcostal location; multiple previous repair; loss of domain; presence of fistula; open abdomen and/or primary closure impossible without component separation technique.[2] A complete AWD is life-threatening[3], has a functional and cosmetic impact on patients' quality of life[1] and represents a significant challenge for surgeons. The most severe complication is the development of enteroatmospheric fistula, extremely difficult to manage.

The treatment of AWD is complex, requires a multidisciplinary strategy, is resource and time-demanding and often hazardous. The surgical therapy of an AWD can require several techniques, often in combination, such as: advancement flaps, biological meshes and/or skin grafts. Negative wound pressure therapy (NPWT) can be used to prepare the wound for definitive repair.[4] It can provide temporary coverage of the abdominal defect, allowing clinical stabilization of the patient and resolution of intra-abdominal disease, mimetizing a normal closed peritoneal environment. It also provides a closed moist environment with removal of excess fluid of the parietal wound, promoting granulation tissue formation even on bradytrophic surfaces like prosthetic implants, where spontaneous overgranulation is slow and difficult.[1]

Prosthetic material can provide strength and functionality to the abdominal wall although its use brings along the susceptibility to bacterial colonization and biofilm formation. Biological meshes have a lower risk for graft rejection, complications and infection, compared to nonabsorbable ones.[1] They constitute a surgical strategy for abdominal repair in cases of total loss of the aponeurotic muscle plane, since they allow contact with the intestinal loops and develop neovascularization that allows for skin graft coverage.[5]

We report a rare case of a patient with a large abdominal wall defect with visceral exposure, who was treated with a biological mesh, NPWT and with subsequent skin grafting.

CASE PRESENTATION

A 70-year-old man was transferred to our surgical intermediate care unit (SICU) with the diagnosis of abdominal wall necrosis after being submitted to an open cholecystectomy (Kocher incision) for an acute cholecystitis at a regional hospital. The patient had a past medical history of a colon resection (vertical midline incision) for acute diverticulitis, appendectomy (Rockey-Davis incision), right inguinal hernia repair (inguinal incision), myocardial infarction, chronic obstructive pulmonary disease, arterial hypertension, dyslipidemia, hyperuricemia and peptic ulcer disease.

On postoperative day 3 of the cholecystectomy, the patient developed a complicated surgical site infection, with necrotizing fasciitis of the right-upper quadrant abdominal wall. The patient underwent initial emergency and then repeated surgical debridements of the abdominal wall, as well as nine sessions of hyperbaric oxygen therapy at another hospital. As a consequence, a large full thickness abdominal wall defect developed in the right-upper quadrant, with visceral exposure (figure 1). Considering size (approximately 20x15cm) and location, a primary closure was not possible.

At this moment, the patient was transferred to our unit, aiming at a multidisciplinary intervention by general and plastic surgeons. NPWT was used with a plastic draping over the abdominal content, as a temporary laparostomy. The plastic draping was used with multiple perforations,

Figure 1 – **Destruction of the abdominal wall, mostly in the upper right quadrant, with visceral exposure.**

Figure 2 – **Three days after placement of an absorbable mesh, just before the placement of the biological mesh.**

covering the viscera to the peritoneal recesses, and a polypropylene prosthesis was sutured to the aponeurotic edges, over which the negative pressure system was applied, allowing to get the abdominal walls retracted, handling swollen soft tissue and edematous inner organs. Rasilainen *et al* showed that the use of vacuum and mesh-mediated fascial traction as a temporary abdominal closure resulted in a higher fascial closure rate than methods that don't provide facial traction.[6]

Hospital stay was complicated by several episodes of myocardial ischemia and respiratory failure, which conveyed a significant challenge to hemodynamic stabilization of the patient. In addition, he presented several episodes of upper gastrointestinal bleeding due to his peptic ulcer disease, requiring blood transfusions and endoscopic therapy. On day 18 after arriving to our SICU, a Vicryl® mesh was placed in order to support the defect. Three days later, on day 21 (figure 2), with a stabilized wound with fresh granulation tissue and without any signs of infection, a biological mesh was applied – Fortiva® Tissue Matrix (1.5 mm, 20 x 25 cm) – a non-crosslinked acellular porcine dermal matrix. This porcine dermis acts like a scaffold allowing for neovascularization, which ultimately results in replacement of the implant with the patient's tissue.[7] Once again, NPWT was used, now without any interface. Values ranged from –50 mmHg, in the beginning, and –125 mmHg, in progressive increase and in continuous mode. On day 28, seven days after placement of the biological mesh, no signs of infection were present (figure 3).

After three dressing changes, sufficient granulation tissue was built up, without any signs of infection. Split thickness skin grafts to cover the

Figure 3 – **Seven days after placement of the biological mesh.**

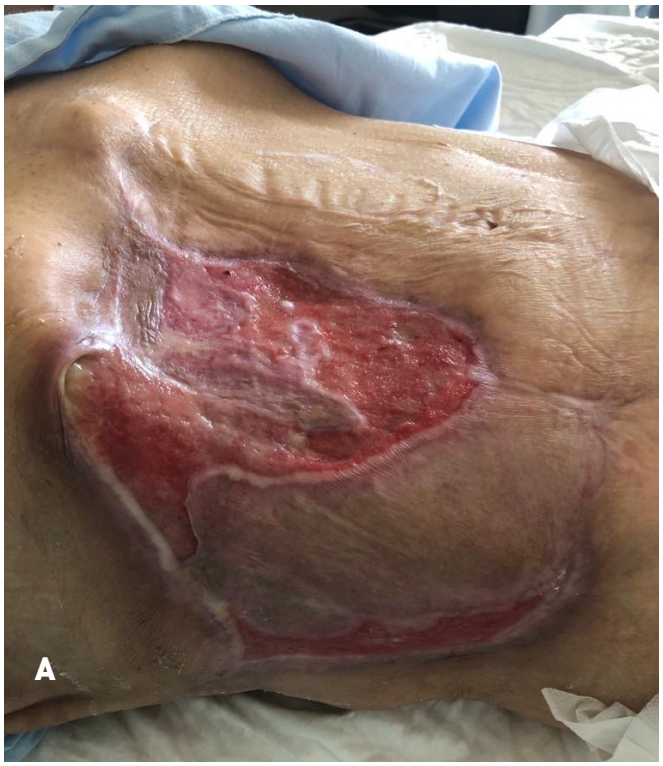

Figure 4 – **A: 1 month after discharge, about fourty-two days after the second application of split skin grafting. B: 2 months after discharge.**

granulated wound were carried on day 49 and day 82 (donor area: right thigh).

NPWT over the grafts was used in order to try to increase graft take rate. The complete replacement of the NPWT dressing was scheduled according to the amount and macroscopic feature of the collected fluid, and in order to avoid damaging the mesh or increase the risk of infection. Despite this and the clinical signs of a clean infection free wound, there was incomplete take of the grafts on both sessions, and the wound presented with abundant exudate, although no microorganism were identified on swab cultures. Considering these conditions, a decision was made towards ambulatory regular wound care with appropriate dressings (Aquacel® Ag) to manage the exudate and promote secondary healing. Discharge from the hospital occurred on day 98.

Before discharge, a physiatrist instituted a rehabilitation program based on kinesitherapy, bronchial hygiene techniques, reconditioning to orthostatism and gait training. One month (about fourty-two days after the second application of split skin grafting) and two months after discharge, the wound was as we see on figure 4A and 4B, respectively.

DISCUSSION

A complete AWD is a life-threatening condition. If the patient survives the initial insult, he will most probably be faced with a mutilating functional and cosmetic result [3] with a significant impact on his quality of life and daily basic activities.

The reconstruction of large AWD is highly challenging and costly,[3] mainly if we are dealing with an open abdomen. Its management requires not only excellent surgical technique tailored to the local conditions, but also attention to the patient's overall situation, medical and nutritional status. The goals of the reconstructive surgery in the management of these defects are to provide stable coverage of the abdominal contents, restore function and achieve complete wound closure.[3,4]

Most AW reconstructions are performed with either musculocutaneous flaps or meshes. Mesh placement is a simpler procedure and avoids potential morbidity related to the donor area.[5]

The use of a free flap was considered in this patient but it would require an extensive operative intervention and, giving its comorbidities and clinical status, a decision was made towards a quick, less aggressive but still effective procedure. Meshes can be either synthetic (permanent or absorbable) or biological. The use of a biological mesh (porcine dermis) seemed like a good alternative, as shown in this and previous cases.[4,8] It is usually used in an attempt to close the AWD in a tension-free manner in an infected field or in one that is suspected of being infected,[8] and it has been shown to be better tolerated than synthetic meshes in open abdomens, complex parietal defects or contaminated surgical fields, producing less inflammatory reaction and adhesions even when in contact with viscera.[5] This type of mesh, even when exposed (like in the case of our patient), has the ability to provide vascular ingrowth and incorporate itself into the native tissue.[5] In fact, the use of permanent synthetic meshes is historically contraindicated in these cases, given the risk of postoperative infective complications and direct viscera contact, although, according to a review by Köckerling F *et al*, the available evidence is limited in quantity and quality, but it does not support the superiority of biologic over synthetic non-absorbable meshes in contaminated fields.[8,9]

With this case, we also demonstrated that absorbable meshes have a place in temporary abdominal wall support in contaminated conditions, enhancing the likelihood of a subsequent successful placement of a permanent mesh.[1] Furthermore, NPWT showed to provide a firm bandage for the patient, supporting the abdomen.[3] It was a very good system of wound coverage every step of the way, providing a closed, moist environment, protected from the invasion of bacteria, while eliminating excessive exudation and stimulating angiogenesis.[1,3,4,10] It also reduced the wound surface area and enabled better healing performance of the biological mesh.[4] Though other papers and our own personal experience have proved its utility in improving the rate of skin graft take, this was not the case in this patient.

This case report also shows the feasibility, safety and efficacy of this combination of techniques for AWD reconstruction, as previously presented in, at least, 12 cases.[10] The disadvantage of this method is the need for a long hospitalization and outpatient treatment, leading to a high cost. The risk of developing complications is also high, although not present in the case of our patient. Reported complications include evisceration, enterocutaneous fistulas, abundant loss of fluids, seromas and local infections that can appear up to 1 year after mesh placement.[10]

The eventration recurrence rate with a crosslinked acellular porcine dermis mesh is the same between various studies, whatever the methodology, the patient's profile and, above all, the wound contamination, varying from 0% to 15%. This type of mesh has the lowest failure rate of all biological meshes and the longest time until failure occurs.[11] Human cadaveric and other non-crosslinked grafts may have initial success but eventually result in loss of tensile strength, increased tissue laxity and high recurrence rates.[12] In this case, a non-crosslinked acellular porcine dermis mesh was used and we managed to successfully use it for open abdomen bridging in the reconstruction process. Regarding other biological meshes, a recent study aimed to compare the results of the use of fetal bovine with porcine acellular dermal matrix for ventral hernia repair or for open abdomen bridging. The authors concluded that both meshes perform well, with satisfactory recurrence rates, only slightly higher compared to traditional synthetic mesh repairs.[13] Also, poly-4-hydroxybutyrate biosynthetic meshes seem like a reliable alternative across a range of defect characteristics, although further research is needed.[14]

Systemic therapy, organ and nutritional support were also an essential part of the treatment of our patient, as well as psychosocial support. It took us some time to apply the biological prosthesis because,

in the beginning, our priority was to stabilize the patient from a clinical point of view. As explained previously, it was difficult to stabilize him since he had multiple episodes of transient myocardial ischemia and acute upper gastrointestinal bleeding due to peptic/stress ulcers, requiring several blood transfusions and endoscopic treatments. Furthermore, biological meshes of such large dimensions are not routinely used at our hospital. Because of its high cost, a special authorization of acquisition was needed and it took some time to arrive after the order was placed. All of this contributed to a prolonged hospital stay.

CONCLUSION

Large abdominal wall defects represent a big challenge to surgeons, especially when complicated by patient's comorbidities. This case shows that the use of a biological mesh (porcine dermis), NPWT and split skin grafting is suitable to manage such defects when visceral exposure is present.

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