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Challenging abdominal incisional hernia repaired with platelet-rich plasma and bone marrow-derived mesenchymal stromal cells. A case report

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ABSTRACT

INTRODUCTION: The necessity to develop new treatment options for challenging procedures in hernia surgery is becoming even more evident and tissue engineering and biological technologies offer even newer strategies to improve fascial healing. The present case reports a patient-tailored surgical technique performed to repair a grade IV abdominal incisional hernia, with a combined use of platelet-rich plasma and bone marrow-derived mesenchymal stromal cells, implanted on a biological mesh.

PRESENTATION OF THE CASE: A 71 year-old female patient complained of an abdominal incisional hernia, complicated by enterocutaneous fistula, four-months following laparostomy. Contrast enhanced computed tomography showed an incisional hernia defect of 15.5 × 20 cm, with a subcutaneous abscess and an intestinal loop adherent to the anterior abdominal wall, with a concomitant enterocutaneous fistula. Surgery involved abdominal wall standardized technique closure, with in addition platelet-rich plasma and bone marrow-derived mesenchymal stromal cells implanted on a biological mesh. Two years follow up showed no recurrences of incisional hernia.

DISCUSSION: Coating surgical meshes with patient's own cells may improve biocompatibility, by reducing inflammation and adhesion formation. Moreover, platelet-rich plasma is a good source of growth factors for wound healing, as well as a good medium for bone marrow multinucleate cells introduction into fascial repair.

CONCLUSION: This approach is likely to improve abdominal wall repair in high grade (IV) incisional hernia, with the real possibility of improving prosthetic compatibility and reducing future recurrences. The authors agree with the necessity of further studies and trials to assure the safety profile and superiority of this procedure.

1. Introduction

What is the best mesh for abdominal incisional hernia (AIH) repair? What is the best surgical technique? For years, answers to these and more questions have been asked, and at the present time, more than 100 surgical meshes are available on the market. However, the ideal mesh does not yet exist, and still needs to be developed [1]. Moreover, there is the necessity to develop new treatment options for challenging procedures in hernia surgery (closure of open abdomen, wound infections, obesity-related issues), and at the same time, tissue engineering and biological technologies offer even newer strategies to improve fascial healing [2]. AIH is one of the most common post-operative complications after abdominal surgery, with a reported incidence around 20% [3], and a 10-year cumulative rate of recurrence between 32% and 63% [4]; in some cases, recurrent AIH can be complicated by enterocutaneous fistula (EF), bowel obstruction, surgical site infection, anatomical loss and lateralization of the abdominal wall muscles[4]. Repairing high grade ventral hernias (more precisely, grade III and IV, according to Ventral Hernia Working Group classification [5]), are challenging for surgeons, and post-operative complications (i.e. adhesions, EF) still occur, despite advances in prosthetic technologies [6,7]. Given this, recent scientific studies have concentrated on improving prosthetic biocompatibility, such as coating mesh with the patient's own cells, thus reducing for-

Abbreviations: AIH, abdominal incisional hernia; EF, enterocutaneous fistula; PRP, platelet-rich plasma; BM-MSCs, bone marrow-derived mesenchymal stromal cells; CECT, contrast enhanced computed tomography; ICU, Intensive Care Unit; VEGF, vascular endothelial growth factor; PDGF, platelet-derived growth factor; TGF, transforming growth factors; FGF, fibroblast growth factors; EGF, epidermal growth factor.

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Fig. 1. Preoperative contrast enhanced CT-scan. Incisional hernia defect of about 15 × 20 cm, with a portion of small bowel inside and an important diastasis of rectus muscles.

eign body induced inflammation, formation of adhesions, together with bowel obstruction and fistula formation [8,9]. Platelet-rich plasma (PRP) and bone marrow-derived mesenchymal stromal cells (BM-MSCs), implanted on a collagen scaffold, are one of the possible tissue engineering techniques used to improve fascial healing, as they seem to optimize the second and the third phase of wound healing process (proliferation and maturation). Besides, they strongly improve tensile strength and total energy absorption after a primary fascial repair [10,11]. The present case describes a patient-tailored surgical technique performed at the public Hospital "Infermi" of Rimini, Italy, in order to repair a grade IV AIH, with a combined use of PRP and BM-MSCs, implanted on a biological mesh (cross-linked acellular porcine dermal collagen). The paper has been reported in line with the SCARE criteria [12].

2. Presentation of case

2.1. Patient information

A 71 year-old Caucasian female arrived at the Department of General and Emergency Surgery in the Rimini public Hospital, referred by her family physician. She complained of an AIH complicated by EF (grade IV [5]). Four months earlier, she had laparoscopic surgery for gastroesophageal reflux disease, which was complicated by an intraoperative splenic bleeding with consequent splenectomy, postoperative pancreatic fistula, and pulmonary embolism. Since the patient needed a redo operation, a laparostomy with vacuum negative pressure therapy was performed. The abdomen was closed 7 days later and the patient was finally discharged. Clinical Finding. At admission, the patient was in a weakened state, with a body mass index of 18 kg/cm2, and a large AIH, with the stomach and a small bowel loop under the subcutaneous layer, and an EF. Diagnostic Assessment. The contrast enhanced computed tomography (CECT) showed an (incisional hernia defects of 15.5 × 20 cm) with a subcutaneous collection in epigastric/umbilical regions, and an intestinal loop adherent to the anterior abdominal wall, with a concomitant EF (Fig. 1). Therapeutic Intervention. A multidisciplinary group (surgeon, nutritionist, lung specialist, radiologist, intensivist and interventional radiologist) was set up to discuss the therapeutic strategy and to enhance patient's preoperative optimisation. For 3 weeks, high calorie intravenous nutrition and respiratory physiotherapy was performed, until patient's performance status was good enough for facing an elective surgical procedure. An epidural catheter for postoperative

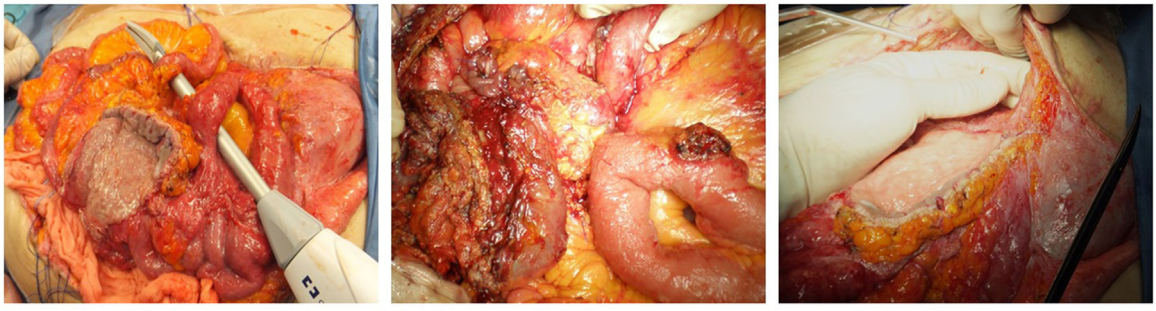

Fig. 2. a-b-c Abdominal intraoperative situation. Macroscopic evidence of an enterocutaneous fistula, with important adhesion between small bowel loops. Fig. 2c also represents the skin patch of 8 × 7 cm, with cutaneous fistulas ostia.

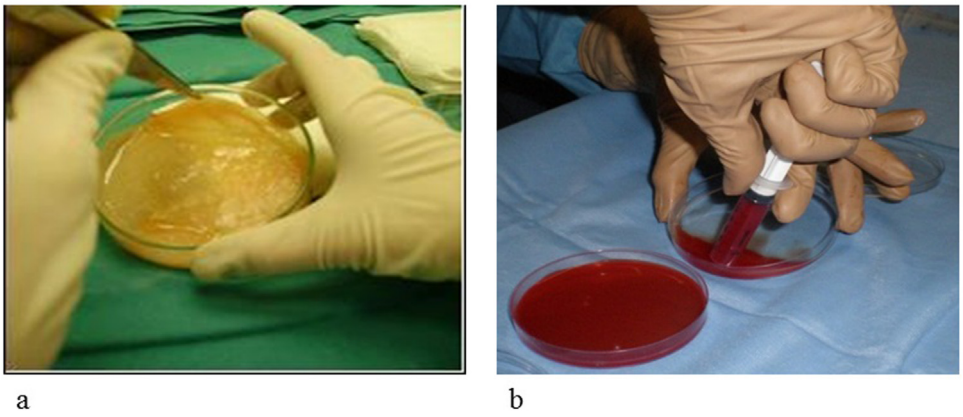

Fig. 3. a-b Making of PRP and BM-MSCs. a: Platelet gel. b: bone marrow stem cells.