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Abstract: ABSTRACT
BACKGROUND:
A contained open abdomen is commonly used during damage control laparotomy and consists in the temporary coverage of the abdomen for protection of the viscera and reduction of intraabdominal pressure. Definitive closure of a contained open abdomen is technically difficult due to the inability to obtain primary fascial suture. The insertion of a prosthetic mesh can be complicated with enterocutaneous fistula and other definitive closure techniques need several surgical procedures.

We describe a low cost technique that allows an early definitive closure of great abdominal wall defects avoiding the risk of intestinal fistula.

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Cover Letter

EARLY CLOSURE OF A CONTAINED OPEN ABDOMEN USING A BI-PEDICLED MIOFASCIAL OBLIQUE RECTAL FLAP TECHNIQUE.

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Key word
Open abdomen; Trauma; Damage control laparotomy
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(1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data. Fabian Gutarra, Javier Rodriguez Asensio, Gustavo Kohan, Carlos Quarin. Laura Petrelli, Bernabé Matias Quesada
(2) drafting the article or revising it critically for important intellectual content, Fabian Gutarra, Javier Rodriguez Asensio, Gustavo Kohan, Carlos Quarin, Laura Petrelli, Bernabé Matias Quesada.
(3) final approval of the version to be submitted. Fabian Gutarra, Javier Rodriguez Asensio, Gustavo Kohan, Carlos Quarin, Laura Petrelli, Bernabé Matias Quesada.

Overall responsibility: Fabian Gutarra

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EARLY CLOSURE OF A CONTAINED OPEN ABDOMEN USING A BI-PEDICLED MIOFASCIAL OBLIQUE RECTAL FLAP TECHNIQUE.

INTRODUCTION

A contained open abdomen is commonly used during damage control laparotomy and consists in the temporary coverage of the abdomen for protection of the viscera and reduction of intraabdominal pressure. The most common procedures include the insertion of a prosthetic mesh or a "Bogotá Bag", the vacuum-assisted closure system (VAC) or strategies using native tissues(1)..

Definitive closure of a contained open abdomen is technically difficult due to the inability to obtain primary fascial suture. Lateral fascial retraction and development of adherences avoid a safe abdominal closure; moreover the insertion of a prosthetic mesh maybe complicated with enterocutaneous fistula. This scenario represents a challenge that has required different strategies (1, 2, 3, 4, 5, 6 7, 8, 9). The aim of this study is to describe a new procedure to achieve a tension free definitive abdominal closure using a bipedicled miofascial oblique rectal flap (BIMORF) technique. To our knowledge this technique has not been previously reported.

METHODS

Patient population

This is a retrospective review of a prospective collection of data of all patients admitted to the Mariano y Luciano de la Vega Hospital who required open abdomen management from January 5th 2005 through January 6th, 2007. This study was carried out in compliance with the regulations for the clinical research of the ethical committee of the Mariano y Luciano de la Vega Hospital.

Open abdomen management

All patients who required open abdomen during the damage control laparotomy were temporarily closed with a vacuum assisted closure (VAC). It has been the preferred technique because it reduces the lateral fascia retraction(10). Dressings were changed every 48 hours and definitive closure was evaluated on

each changing. If the abdominal fascia could be fully approximated without tension, a direct fascial closure was performed. If not, the BIMORF technique was used. Early closure was defined as definitive closure performed during the first 20 days of hospital stay. Any closure after day 20 was considered a late definitive closure.

Surgical technique

Anatomic reference

Above the arcuate line, the anterior rectus sheath is formed by the external oblique aponeurosis and the external lamina of the internal oblique aponeurosis, whereas the posterior rectus sheath is formed by the internal lamina of the internal oblique aponeurosis, the transversus abdominis aponeurosis, and the transversalis fascia. Below the arcuate line, the anterior rectus sheath is formed by the external oblique aponeurosis, the internal oblique aponeurosis, and the transverse abdominis aponeurosis. There is no aponeurotic posterior covering of this lower portion of the rectus muscles, although the transversalis fascia remains a contiguous structure on the posterior aspect of the anterior abdominal wall. (Fig 1C)

The bi-pedicled miofascial oblique rectal flap (BI-MORF) technique

The BIMORF technique is a parietal reconstruction technique that evolved from the original technique developed by Albanese (11) for the treatment of supraumbilical eventration and may be used for severe abdominal wall defects indicated in patients with open abdomen or with the abdominal wound granulated (Fig 1A).This technique has several steps. The first is to separate the skin flaps from the underlying abdominal muscles. These flaps are dissected from the fascia bilaterally to almost the midaxillary line to allow identification of the fleshy and the aponeurotic part of the external oblique muscle. Then, the external oblique aponeurosis is incised in a longitudinal way, next to the limit with the fleshy part of the muscle, to expose the internal oblique aponeurosis. (Fig1C – 1D). This incision extends upwards to the thoracic portion and downwards to the groin portion of the muscle. At these points, the incision reaches the middle line passing through the rectus anterior sheath. Fig 1B.

The next step is to dissect the space between the external oblique and the internal oblique aponeurosis until the latter unfolds in two leaves (external and internal lamina of the internal oblique aponeurosis). (2A – 2B) One centimeter inside the internal oblique aponeurosis division, the external lamina of the internal oblique aponeurosis (which is part of the rectus anterior sheath) is incised longitudinally exposing the rectus muscle. (2C- 2D) This allows full exposure of the external edge of the rectus (we start the second incision below the umbilicus). Below the level of the arcuate line, the deep inferior epigastric vessels are dissected and preserved. Toward the cephalic region, the superior epigastric vessels are identified and preserved too.

The rectus posterior surface is dissected and the pubic and costal rectus insertions are transected allowing the elevation of a large fasciomuscular flap. This flap includes the external oblique aponeurosis, the rectus anterior sheath and the rectus muscle, preserving the superior and inferior epigastric vessels. Fig 3A. The next step is to reverse the flaps and suture them in the midline with a polypropylene running suture. Fig 3B – 3C – 4 A.

Ending the procedure, a polypropylene mesh is sewn to the fascial edges of the external oblique covering both fasciomuscular flaps completely (Fig 4b). Two drainages are placed in the inferior part of the wound and one drainage across the wall if needed. Skin is closed with interrupted steaches. (Fig 4C).

In certain cases the defect can be repaired dissecting only one side. Fig 5.

RESULTS

During the 2 year period, 24 patients required contained-open abdomen management at our hospital due to blunt or penetrating trauma (n=18,[75%]), generalized peritonitis (n=2, [8 %]), ruptured abdominal aortic aneurysm (n=3, [13]%]) and intestinal obstruction (n=1, [4 %]). All of the patients received vertical midline incisions from xiphoid to pubis and developed a severe abdominal wall defect. Six patients died from multiple organ failure before a definitive abdominal closure was performed. Of the remaining 18 patients, nine were treated with the bipedicled miofascial oblique rectal flap (BIMORF) and the remaining 9 patients were amenable for a direct fascial closure.

Patients with the BIMORF technique had a mean age of 39.5 years (range 16-75) and were all males. Out of the 9 patients, 6 had early fascial closure and 3 delayed fascial closure. Mean time for surgery was 22 days (range 5 - 210 days). Mean operative time was 140 minutes (range 120-170); mean ICU stay was 40.1 days and mean total hospital stay was 60 days. Two patients died during hospitalization, one of myocardial infarction and the other of pulmonary thromboembolism. One patient developed wound infection and was successfully treated with intravenous antibiotics. Mean follow up was 10 months (range 2-17 months) and no postoperative eventrations developed during the follow-up period.

DISCUSSION

Temporary closure systems like insertion of a prosthetic mesh or Bogota Bag produce a severe lateral retraction of muscles and fasciae and visceral edema, preventing direct fascial closure. The lack of sufficient tissue requires the transposition of autologous muscular flaps or the insertion of a prosthetic material to cover the fascial gap. In our study, the BIMORF technique was a safe and successful method for early or delayed definitive closure of the abdominal wall in patients with contained-open abdomen. In the BIMORF technique transection of the muscle thoracic and pubic insertions allows an extensive mobilization achieving the repair of defects measuring more than 25 centimeters. Another advantage of this procedure is that avoids the risk of bowel fistula for two reasons. First, no dissection is needed to liberate underlying viscera adhesions because the technique only dissects the wall components, not opening the peritoneum. Second, the prosthetic nonabsorbable mesh is inserted above the muscular flap with no contact with the bowel. The insertion of the prosthetic mesh eliminates the weak points vulnerable to intraabominal pressure which may result in late recurrence. But the main advantage of this method is that it allows an early definitive closure, not requiring subsequent readmissions to the hospital and new surgeries. Also is useful in delayed closures.

Direct insertion of a prosthetic mesh over the bowel increases the risk of intestinal fistula. In current literature, fistula rates of 12-50% have been reported when nonabsorbable prosthetic mesh was used (2-3). The use of absorbable mesh or a titanium covered mesh reduces but no excludes the risk of bowel

fistula and carries an elevate cost. When abdominal wall is entirely reconstructed with a prosthetic mesh, the prosthetic infection may require the mesh extraction and the abdominal wall defect will persist (7). Moreover, recurrent hernia rates of 15-50% have been reported with the use of polypropylene mesh for definitive closures of large abdominal wall defects (5- 6).

Many techniques have been described for definitive closure of the abdomen using abdominal wall components. The component separation technique described by Ramirez (9) separates the external oblique fascia with an incision lateral to the linea semilunaris and separates the rectus muscles from their posterior fascia. This allows the mobilization of the rectus abdominis to cover the abdominal wall defect but is insufficient for most giant ventral hernias. Jernigan (2) modified this technique including a more extensive mobilization of the fasciae. No prosthetic materials were used in this technique that was successful for the treatment of hernias with a width greater than 25cm. The main disadvantage of this technique is that it requires a three stage management and the last step is performed 6 to 12 months later after the initial step. Recently, Kushimoto (12) described a bilateral anterior rectus abdominis sheath turnover flap method. Although it can be used during the acute-phase management, it is only applicable for defects smaller than 15 centimeters. Sullivan (4) proposed a technique using a bilateral anterior bipedicled flap with permanent prosthesis allowing the closure of giant wall defects (greater than 30cm). As other techniques previously described, this one has two disadvantages. First, it requires an extensive dissection of the adhesions of the bowel to the abdominal wall with the possibility of accidental intestinal perforation and subsequent fistula; secondly, it requires at least three surgical procedures. In addition this procedure was tested only after 12 months of the initial surgery.

In summary, disadvantages of the procedures previously described include a late repair of the wall defect, a great dissection with the risk of intestinal fistula and the requirement of more than one surgical intervention. We describe a low cost technique that allows an early definitive closure of great abdominal wall defects avoiding the risk of intestinal fistula.

ACKNOWLEDGEMENT

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Figure(s)

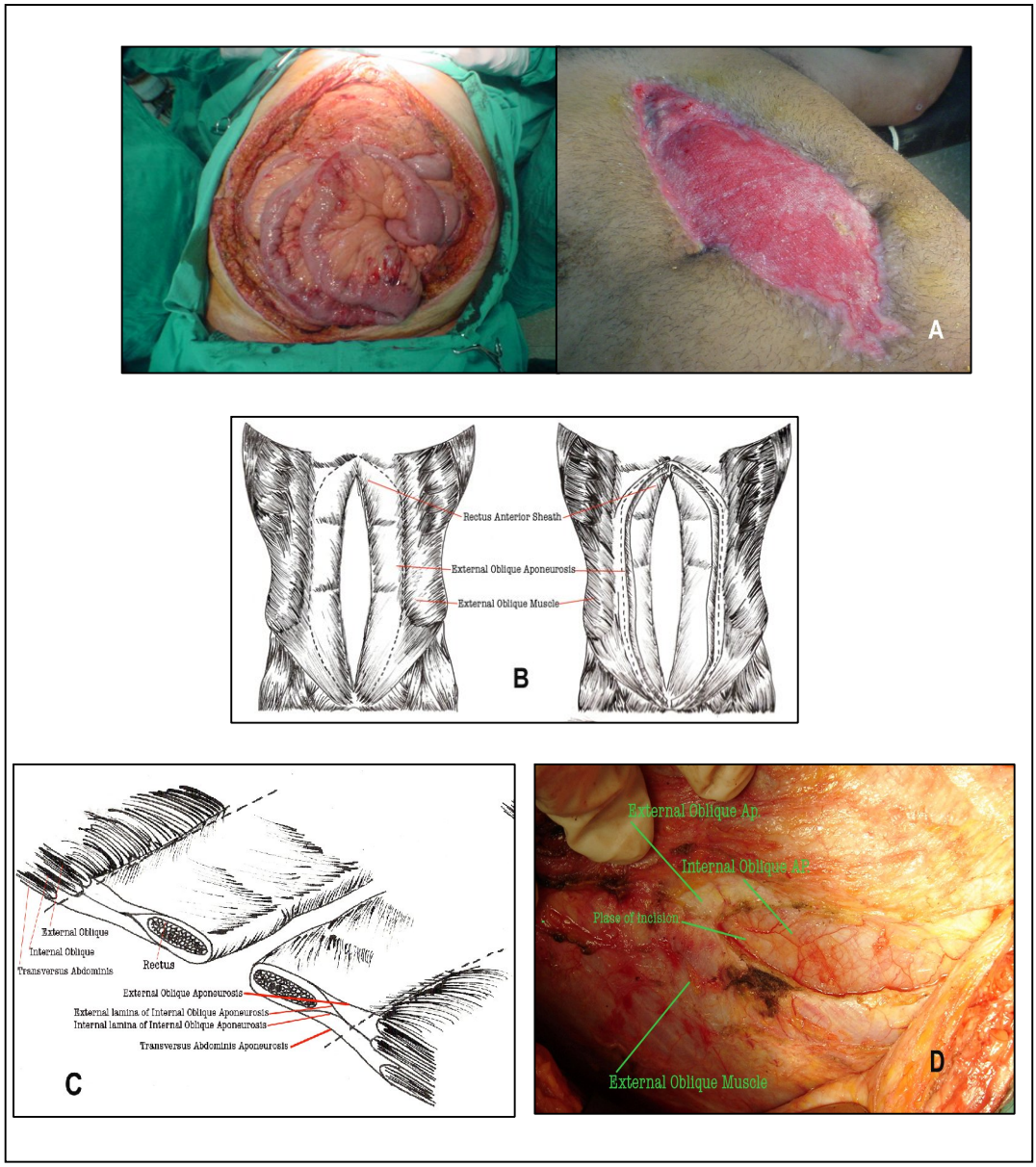

Figure 1. A-Patient with the open abdomen and with the abdominal wound granulated. B-Longitudinal incision on the external oblique aponeurosis. C- Abdominal wall components and placement of incision on the external oblique aponeurosis. D-Placement of incision on the external wall aponeurosis

Figure(s)

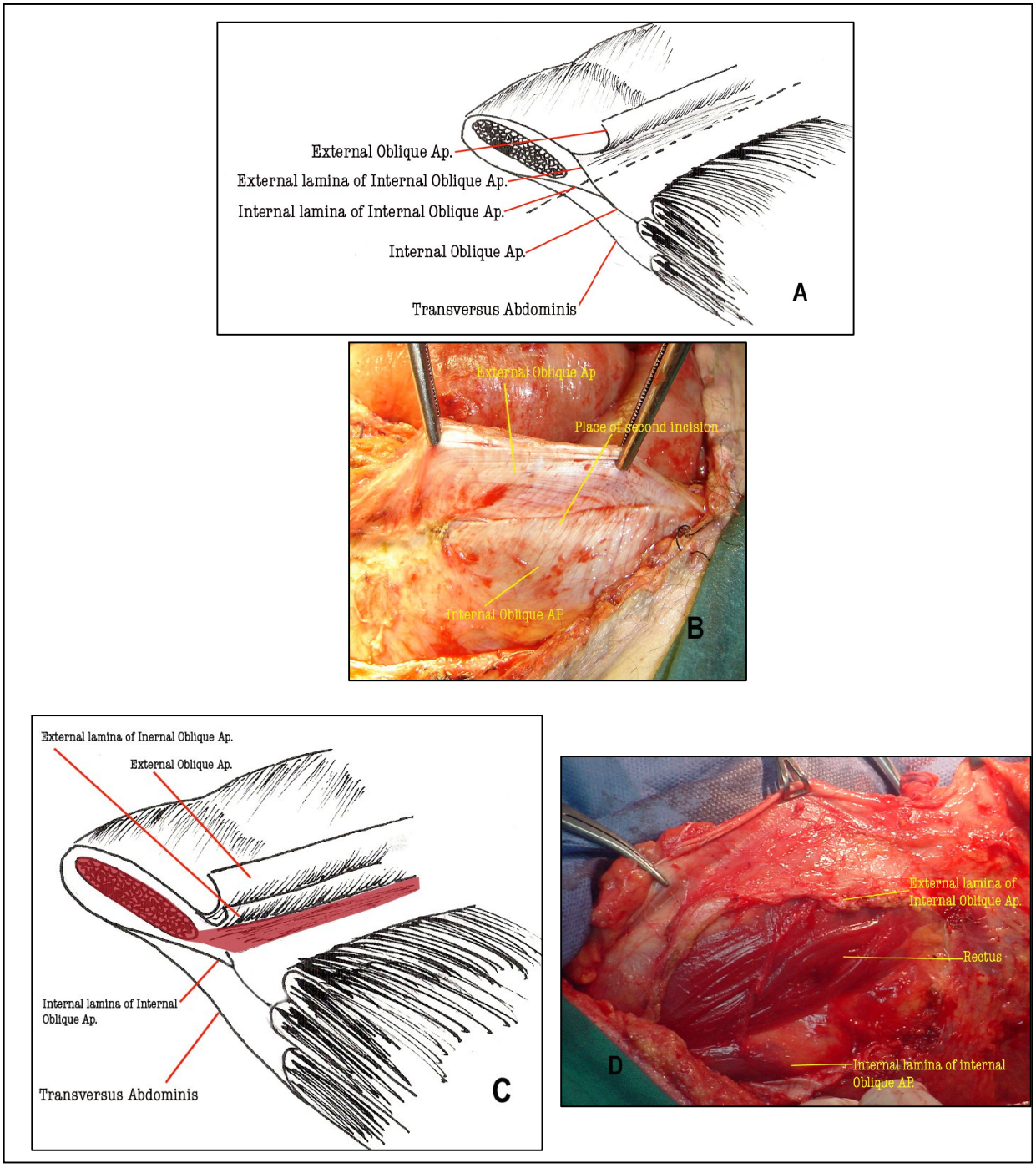

Figure 2. A-B. Placement of second incision on external lamina of internal oblique aponeurosis. C-D.External lamina of internal oblique aponeurosis with exposure of the rectus abdominis.

Figure(s)

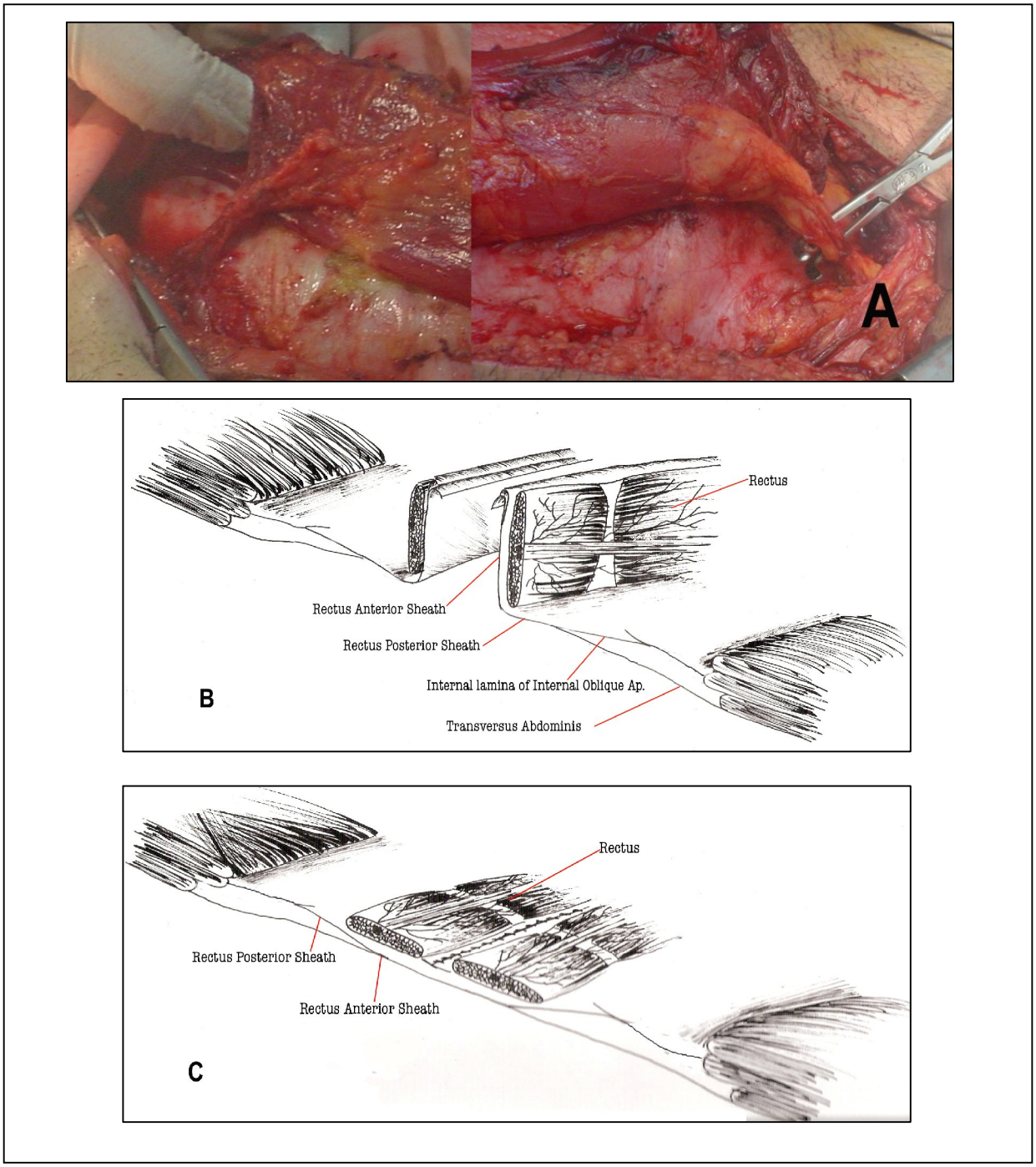

Figure 3. A. Inferior and superior epigastric vessels dissected. B. Turnover of the rectus abdominis muscle and anterior rectus sheath. C. Rectus abdominis flaps reversed and sutured in the midline with polypropylene.

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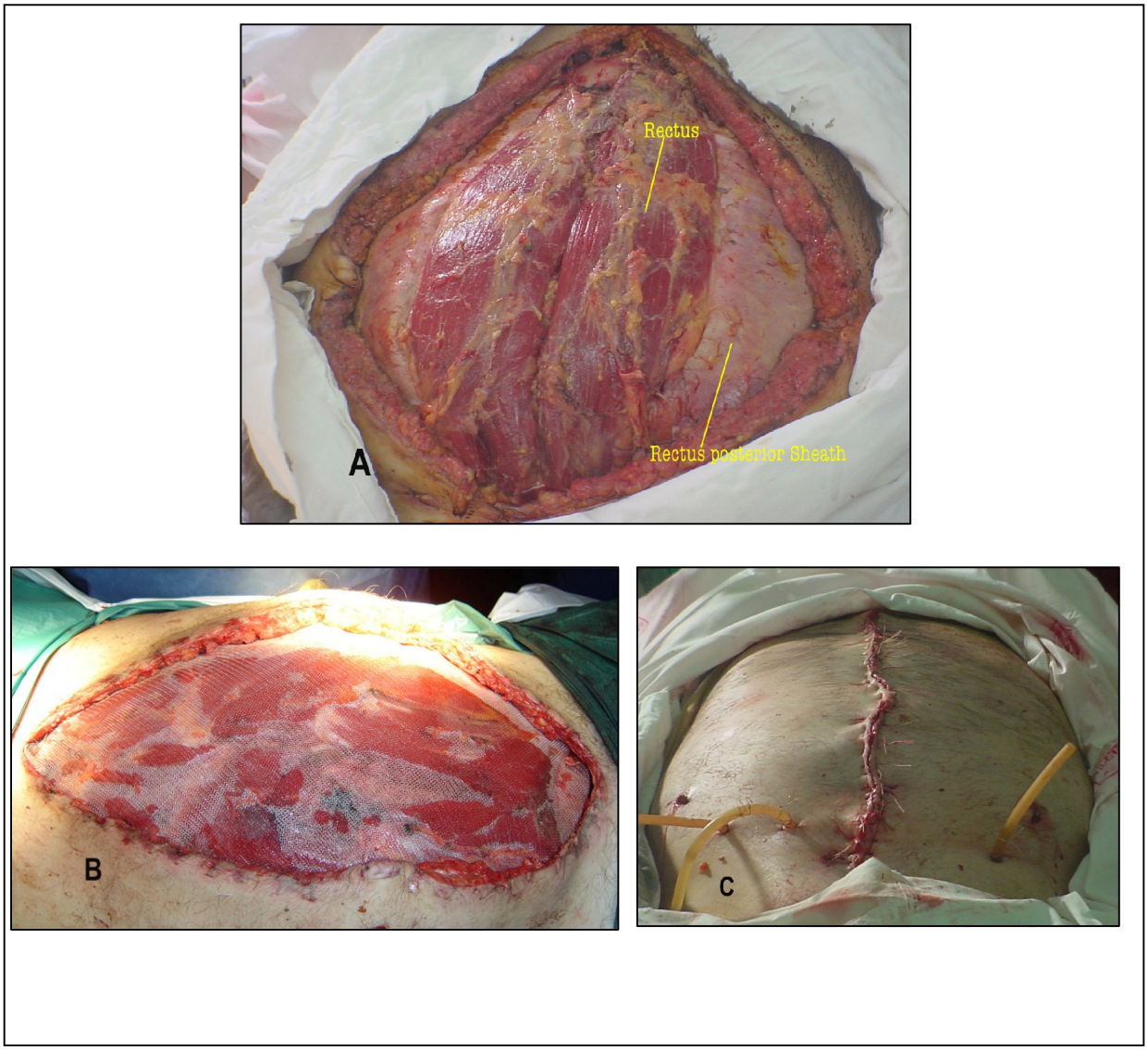

Figure 4. A. Rectus abdominis flaps reversed and sutured in the midline with polypropylene B. Nonabsorbable prosthetic mesh over the muscular flaps. C. Skin closed with subcutaneous drainages.

Figure(s)

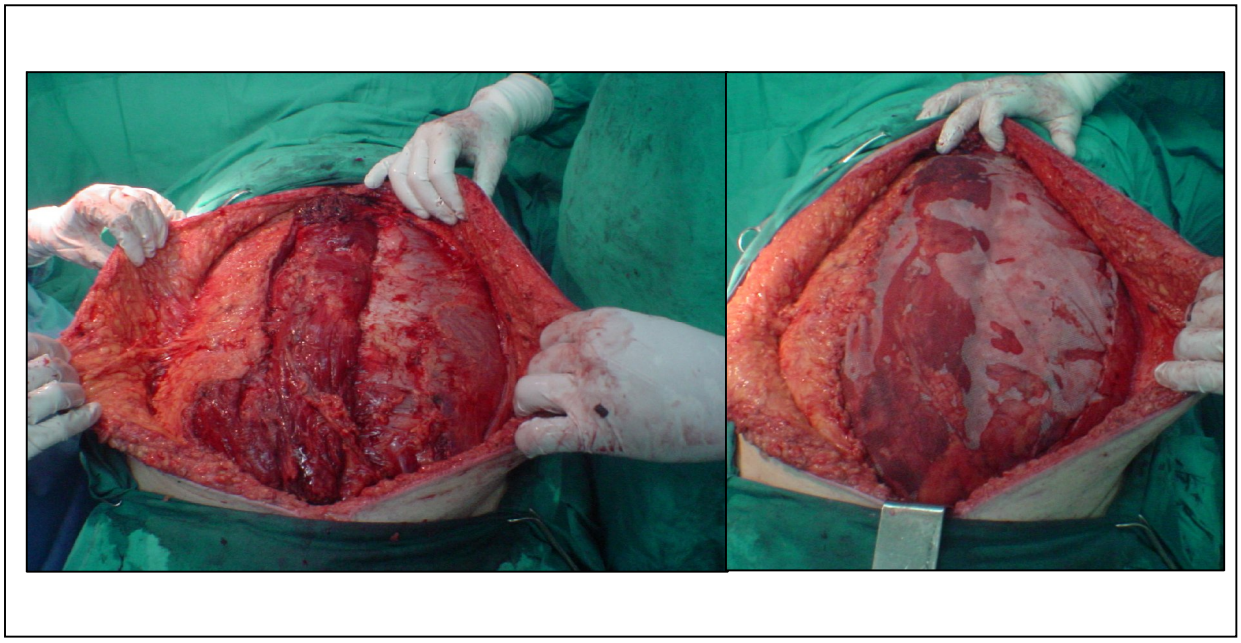

Fig 5. Only side dissection

*** Detailed Response to Reviewers**

According to the recommendation of the EDITOR

We decided:

For a better understanding of the manuscript, the work was based on the BIMORF surgical technique

Best Regards

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