

# Abdominal wall closure with ePTFE - Goretex Dual Mesh after detensive laparotomy for abdominal compartment syndrome

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**Abstract.** *Introduction:* Detensive laparotomy is the first choice treatment for abdominal compartment syndrome (ACS). Tension free closure of the abdominal wall with the use of prosthesis is a broadly diffused technique; the polypropylene and the ePTFE (expanded polytetrafluoroethylene - Goretex Dual Mesh) are the most commonly used materials. *Materials and methods:* We report our experience on five patients affected by ACS submitted to detensive laparotomy and positioning of a wide Goretex Dual Mesh prosthesis. *Results:* In our initial experience ACS has been treated with success through detensive laparotomy and there were no complications related to the use of Goretex. *Discussion:* Even though limited, our initial clinical experience is favorable to the use of Goretex Dual Mesh as first choice material for reconstruction of the abdominal wall after detensive laparotomy for ACS.

**Key words:** Abdominal compartment syndrome, intra abdominal pressure, abdominal wall repair, ePTFE, abdominal wall prostheses

## Introduction

Abdominal compartment syndrome (ACS) is a severe clinical condition characterized by intra abdominal hypertension (IAH) - and consequent multiorgan dysfunction (MOF) - caused either by inflammatory, occlusive, or traumatic diseases (1-3); ACS may verify after abdominal surgery when an excessive tension of the suture occurs. Detensive laparotomy is necessary when pressure is higher than 25 cm H<sub>2</sub>O (2); polypropylene meshes are often used to protect the abdominal content, interposing omentum (if possible) or an absorbable mesh to avoid direct contact with viscera. Recently expanded polytetrafluoroethylene (ePTFE - Goretex Dual Mesh) has been introduced for surgical treatment of incisional hernias of the abdominal wall, also by laparoscopy: it can be placed in-

traperitoneally in direct contact with viscera because of its non adhesive surface. We used ePTFE meshes in five patients affected by ACS in which viscera could not be covered by omentum. We report one of the preliminary experiences present in literature.

## Patients

The *first case* is a 66 years-old patient, male, obese (153 Kgs) and affected by chronic ischemic heart disease, essential hypertension, COBP, sleep apnea syndrome. Two days before entrance he underwent intestinal resection for bowel perforation into a large incisional hernia; direct closure of the abdominal wall without prosthetic mesh was performed. The patient reached our Critical Care Unit for an abdominal com-

partment syndrome, with post-operative respiratory insufficiency. Clinical conditions were severe; he had hurting tense abdomen, with no peristalsis evidence, respiratory distress, diuresis reduction close to zero. In few hours endotracheal intubation and mechanical ventilation were necessary. Intra-abdominal pressure, measured by bladder catheterization, was 50 cm H<sub>2</sub>O. We performed a detensive laparotomy; during intervention we observed the diuresis resumption. Abdominal wall was closed using two 20x30 cm ePTFE prosthetic meshes; (Fig. 1). A residual space without skin closure of about 10 cm was temporarily protected with a sheet of PVC (Fig. 2).



**Figure 1.** *Case 1.* Abdominal tension-free wall closure with ePTFE prosthesis after detensive laparotomy for abdominal compartment syndrome



**Figure 2.** *Case 1.* After skin closure, a residual uncovered portion of the prosthesis is protected with a sheet of PVC

Patient was finally discharged in good clinical conditions, with the partially discovered mesh, in wait for definitive surgery of the cutaneous layer.

The *second case* is a 92 years-old patient, female, obese (120 Kgs). She had an intestinal occlusion due to incarceration of a giant incisional hernia (Fig. 3). Clinical conditions were severe; abdomen was remarkably tense and hurting; she had an initial respiratory distress, diuresis reduction also after fluid infusion; intra abdominal pressure was 43 cm H<sub>2</sub>O.

We performed an urgent midline laparotomy, with release of the hernial incarceration, followed by tension-free closure of the abdominal wall, using a 20 x 30 cm Goretex Dual Mesh prosthesis; at the end the cutaneous margins were juxtaposed and sutured to cover the whole mesh (Fig. 4). Patient was finally discharged in good clinical conditions.

The *third case* is a 42 years-old patient, male. After abdominal trauma (car accident), he was submitted to emergency surgical intervention for rupture of the duodenum; he was re-operated seven days later for dehiscence of the intestinal suture. Subsequently the patient developed a septic state resistant to the antibiotic therapy and showed signs of respiratory and renal insufficiency (with severe reduction of the diuresis). Intra abdominal pressure was 30 cm H<sub>2</sub>O. Urgent laparotomy showed diffuse peritonitis and a voluminous abscess extending from the diaphragm to the pelvis; the abscess was drained and the abdominal incision was covered with a ePTFE prosthesis. After decompression fast resumption of the diuresis was observed; post-operative intra abdominal pressure was 14 cm H<sub>2</sub>O. Two weeks later prosthesis was removed and abdominal wall was closed directly, without suture tension. Patient was discharged in good clinical conditions.

The *fourth case* is a 56 years-old patient, male, and affected by hypertension, chronic renal insufficiency, ischemic heart disease, myeloma. He was hospitalized for acute pancreatitis. Intra abdominal pressure at entrance was 22 cm H<sub>2</sub>O. Subsequently an abundant digestive haemorrhage that required several blood transfusions occurred, and diagnosis of aneurysm of gastroduodenal artery was performed. After fast worsening of general conditions, diuresis reduction up to



**Figure 3.** *Case 2.* Intra-abdominal hypertension caused by abdominal distension in patient with intestinal occlusion due to incarceration of a giant incisional hernia



**Figure 4.** *Case 2.* After abdominal detension and ePTFE prosthesis implant, complete skin closure above is performed

anuria and intra abdominal pressure increase (30 cm-H<sub>2</sub>O), he was submitted to detensive laparotomy and abdominal wall closure with apposition of a 20x30 cm ePTFE prosthesis. After surgery intra abdominal pressure decreased to 12 cm H<sub>2</sub>O. Patient died in first post-operating day for acute myocardial stroke.

The *fifth case* is a 52 years-old patient, male. After abdominal trauma he was submitted to emergency surgical intervention for haemoperitoneum. Subsequently the patient developed an intestinal occlusion, with serious worsening of general conditions and marked diuresis reduction. IAP was 29 cm H<sub>2</sub>O. He was submitted to detensive laparotomy and abdominal wall reconstruction via apposition of 20x30 cm ePTFE prosthesis. At the end of surgical intervention IAP

was 10 cm H<sub>2</sub>O with diuresis resumption. Patient died in second post-operating day for sepsis and cardiovascular collapse.

## Discussion

Abdominal hypertension represents the beginning of a series of events resulting in ACS, condition in which a prolonged and sustained increase of the intra abdominal pressure determines alterations in the vitality and functionality of both intra and extra abdominal organs.

Among the causes of IAH and following MOF we recall severe intestinal occlusion, secondary and tertiary peritonitis, mesenteric ischemia, acute pancreatitis, abdominal or pelvic trauma; these conditions increase intra abdominal pressure by bowel and soft tissues edema, abdominal fluid collections, intestinal distension, etc. (1-3). A particular case is tense ascites.

Consequences of ACS are both local and systemic (4):

### Local effects:

- Liver function: reduction of both portal and hepatic arterial flow.
- Renal function: reduction of vascular flow and glomerular filtration volume with severe reduction of diuresis (5).
- Gastrointestinal effects: venous and lymphatic stasis, interstitial volume increase, edema of the bowel wall, bacterial translocation (6).

### Systemic effects:

- Respiratory function: reduction of lungs compliance due to the raising of diaphragm, atelectasis, respiratory distress (7).
- Cardiovascular effects: reduction of venous flow to heart due to abdominal vena cava compression, increase of resistance against arterial flow from heart, probably due to increase of resistances in capillary microcirculation.

The rational treatment of the ACS is represented by abdominal decompression. Naturally, positioning of an intra gastric or rectal drainage in patients with intestinal occlusions, endoscopic colon decompression in pseudo-obstructions, abdominocentesis in the un-

manageable ascitis, can offer benefit. However in cases of acclaimed ACS a surgical solution is necessary; it consists in detensive laparotomy followed by tension free abdominal wall closure. The simplest way is to leave abdominal wall open, covering viscera with a transparent plastic sterile sheet (the so-called "Bogota Bag", an opened fluids infusion envelop applied on the abdomen) (8).

In absence of intra abdominal infections, that require repeated surgical explorations of abdominal cavity, use of prosthetic mesh in direct contact with viscera is frequently recommended. A further solution, less practiced, is to cover viscera only with the skin margins.

The most used technique consists in positioning a wide not absorbable mesh sutured on the fascia; but sometimes it is not possible to close without tensing the skin above (9-13).

Goretex Dual Mesh is actually the most used prosthetic material in the reconstruction of the abdominal wall, for the possibility to be positioned in direct contact with viscera, for the decreased risk of infections and formation of fistula, and for the facility of removal in case of complications. We have therefore progressively abandoned the use of polypropylene prostheses, that have greater risks of bowel adhesion and formation of intestinal fistula when it is not possible to interpose peritoneum or omentum (14).

Actually the use of Goretex Dual Mesh for abdominal wall closure after detensive laparotomy for ACS is not clearly marked in literature, while it is probably the most frequently used material in abdominal wall reconstruction after surgery for incisional hernia. This is due to the smaller incidence of complications (such as intestinal fistula, infections, etc.) in comparison with other materials. Particularly it is a good prosthetic material since its internal smooth surface can be positioned in direct contact with viscera; this characteristic could be very useful in cases of ACS where sepsis, intestinal occlusion or trauma often force to directly cover viscera with a prosthesis.

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