
بسم الله الرحمن الرحیم

Open abdomen

Reza hajebi MD.

General surgeon

Sina hospital TUMS

definition

- An open abdomen is defined as purposely foregoing fascial closure of the abdomen after the cavity is opened. Management of complex abdominal problems with the open abdomen and temporary abdominal closure techniques has become a common and valuable tool in surgery

- Several challenging clinical situations can necessitate leaving the abdominal cavity open after surgery, resulting in an open abdomen

The indications for open abdomen are as follows:

- Damage control for life-threatening intraabdominal bleeding
- severe acute pancreatitis
- severe abdominal sepsis
- prevention and treatment of the abdominal compartment syndrome

General aspects

- the most challenging of the wounds that a surgeon faces
- metabolic, physiological, and dynamic implications
- management of complex abdominal problems have become common and valuable tools for the surgeon .
- Several challenging clinical situations force the surgeon in leaving the abdominal cavity open after surgery, resulting in an open abdomen or laparostoma

Damage control

Damage control surgery :

- rapid control of bleeding
- reversing physiologic exhaustion
- critically ill or injured patient

preferred method for those general surgical patients whose physiological derangements do not allow the completion of an intended operation

Damage control

- 10–15% of all laparotomies are managed with damage control techniques
- *Persistent hypotension*
- *acidosis* (*pH* < 7.2)
- *hypothermia* (*T* < 34°C)
- *coagulopathy*

Damage control

- *primary goal of the trauma surgeon:*
- *control of active hemorrhage* (vascular shunting or ligation, direct packing, resection, etc.)
- control of contamination
- temporary abdominal closure

In DCS the abdomen should never be closed because of the high risk of intra-abdominal hypertension.

The second stage is stabilization of the physiological parameters in the ICU

final stage usually occurs within 24–48 h of the initial operation (preferably following the reversal of the lethal triad)

- open abdomen complications:
- nutritional problems dealing with fluid and protein loss
- loss of abdominal domain secondary to fascial retraction
- frozen abdomen
- enteroatmospheric fistulas

Severe abdominal sepsis

- *The role of an open abdomen in the management of severe secondary peritonitis has been a controversial*
- severe secondary peritonitis
- severe sepsis and septic shock
- organ dysfunction
- hypotension
- myocardial depression
- coagulopathy

Severe abdominal sepsis

- *the intervention should be cut short* because of the suboptimal local conditions for healing
- *can influence the intra-abdominal pressure*
- bowel distension
- ascites
- parietal muscle contraction

Severe abdominal sepsis

- inability to completely control contamination in a single operation:
- definitive intervention or anastomosis
- risk of developing abdominal compartment syndrome:
- Extensive visceral edema and decreased abdominal wall compliance
- 24–48 h *after the initial surgery, the patient should be taken back to the operating room* for reoperation, lavage, drainage, source control, and if its feasible the closure of the abdominal wall

Severe abdominal sepsis

- patients with abdominal sepsis:
- worse outcomes after an open abdomen
- increased incidence of fistula formation
- intra-abdominal abscesses
- higher-delayed primary closure rate
- no definitive data regarding the use of open abdomen in the face of severe peritonitis

Abdominal compartment syndrome

- Intra-abdominal hypertension:
- sustained pathologic increase in intra-abdominal pressure greater than or equal to 12 mm Hg
- Abdominal compartment syndrome:
- a sustained increase in intra-abdominal tension ≥20 mm Hg that is associated with new organ dysfunction or failure

Abdominal compartment syndrome

Abdominal perfusion pressure(APP)=

mean arterial pressure(MAP)−intra−abdominal pressure(IAP)

Abdominal compartment syndrome

- *Intra-abdominal hypertension can lead to*
- *tissue and abdominal visceral hypoperfusion and organ dysfunction*
- Uncontrolled intra-abdominal hypertension (exceeds 25 mm Hg) can cause abdominal compartment syndrome
- characterized by:
- cardiorespiratory and renal dysfunction, as well as bacterial and toxin intestinal translocation and intracranial hypertension

Abdominal compartment syndrome

- Primary:
- pathophysiologic process within the abdominopelvic cavity
- caused by :
- Bleeding
- acute ascites
- rapidly growing tumor or another type of mass
- retroperitoneal edema
- packing of visceral injuries

- Secondary:
- in the absence of a primary abdominopelvic process

Abdominal compartment syndrome

- The organ dysfunction :
- changes in lung and renal function
- pulmonary dynamics change:
- tidal volumes decrease
- in mechanical ventilation increase in peak pressure
- Renal dysfunction:
- decrease in urine output (renal vein compression)
- Other organs can display changes heart and brain
- also generate changes in other intra-abdominal organs

Abdominal compartment syndrome

- *All patients in the intensive care unit should have measurements of their intra-abdominal pressure*
- *incidence remains sub-diagnosed*

- When abdominal compartment syndrome is suspected, bladder pressures should be measured
- accomplished by instilling a small amount of sterile saline into the bladder and attaching a Foley tube to a pressure transducer

Abdominal compartment syndrome

Final 2013 consensus definitions of the World Society of the Abdominal Compartment Syndrome

Intra-abdominal pressure (IAP)

Normal ≈ 5–7 mm Hg

Intra-abdominal hypertension grade I ≈ 12–15 mm Hg

Intra-abdominal hypertension grade II ≈ 16–20 mm Hg

Intra-abdominal hypertension grade III ≈ 21–25 mm Hg

Intra-abdominal hypertension grade IV ≈ > 25 mm Hg

Abdominal compartment syndrome

- four main principles in the management of intra-abdominal hypertension:
- first of all:
- serial monitoring of intra-abdominal pressure every 4–6 h
- optimization of systemic perfusion and organ function
- medical procedures to reduce intra-abdominal pressure
- (sedation, analgesia, or neuromuscular blockade, and prompt surgical decompressive laparotomy for refractory intra-abdominal hypertension)

Abdominal compartment syndrome

- Medical interventions:
- sedation to improve abdominal wall compliance,
- placing of a nasogastric tube for gastric drainage,
- removing intraperitoneal fluid collections
- limiting intravenous fluids if possible
- Diuresis
- allowing hypercarbia by reducing tidal volumes

- ***the only solution for ACS is decreasing the pressure by performing a decompressive laparotomy***

Management of the open abdomen

- *temporary abdominal closure can:*
- *Prevent evisceration*
- *facilitate subsequent access to the abdominal cavity*
- *prevents retraction of the skin and fascia*

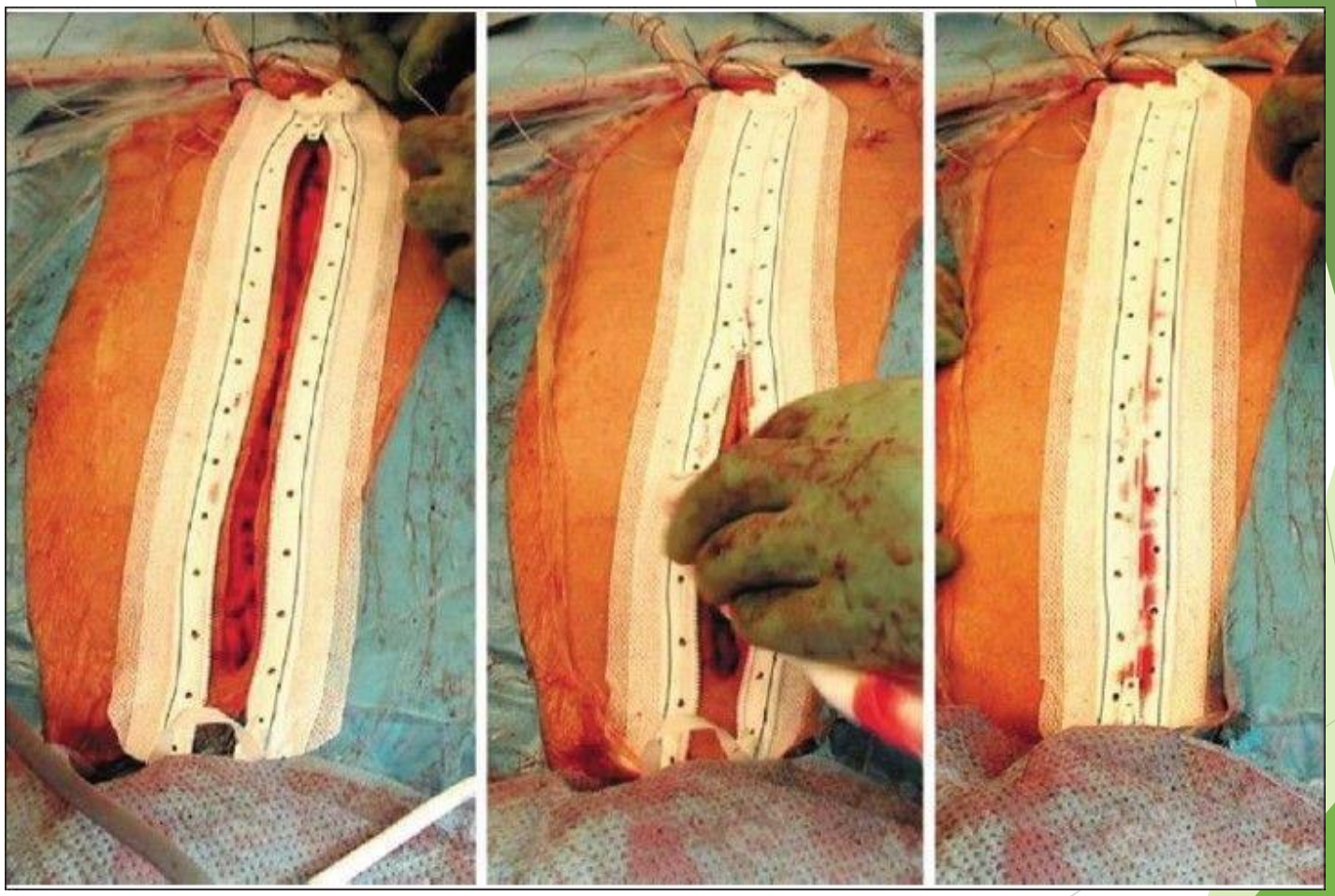
- ideal temporary abdominal closure should be:
- easy to apply and remove
- allow rapid access to a surgical second look
- drain secretions
- ease primary closure
- have acceptable morbidity and mortality
- allow easy nursing, and last but not least
- be readily available and cheap

Techniques for temporary abdominal wall closure

1. Skin approximation with towel clips or running suture
2. Bogota bag
3. Synthetic meshes
4. Velcro or zipper-type synthetic materials (Wittmann patch, Starsurgical)
5. Negative-pressure dressing
a. Vacuum pack (Barker technique)
b. Vacuum-assisted closure (VAC Therapy, KCI)
c. Abthera™ system (KCI)

Management of the open abdomen

- Since the late 1970s and during the 1980s, abdominal dressings for an open abdomen were quite simple
- centered only on the protection and control of the bowel that can be found outside the abdomen
- nonabsorbable meshes were used:
- a high rate of intestinal fistulation
- In the mid-1980s, a zipper was added to the mesh in order to make the process of re-exploration easier



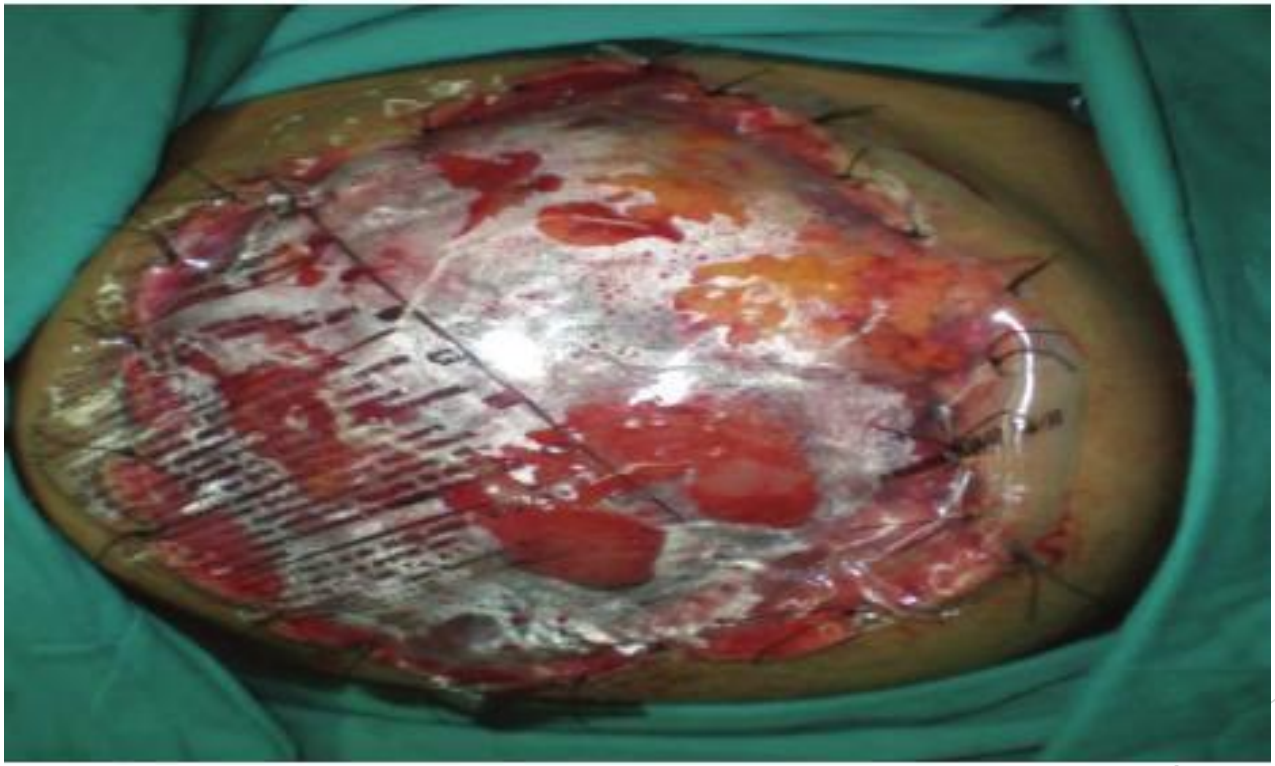
Management of the open abdomen

- Throughout the years, the surgeons moved on from protection of the ileus to the preservation of the peritoneal space and the prevention of lateral retraction of the fascia, which are the most critical obstacles when dealing with the reconstruction of the abdominal wall at the end of the treatment

Management of the open abdomen

- quick abdominal closure in damage control procedures:
- skin approximation with towel clips or running suture has been suggested in patients in extremis

- Another easy method: plastic silo, also known as the Bogotá bag:
- a nonadherent plastic sheet, usually from a sterile 3 liter urology irrigation bag, sutured to the edges of the skin



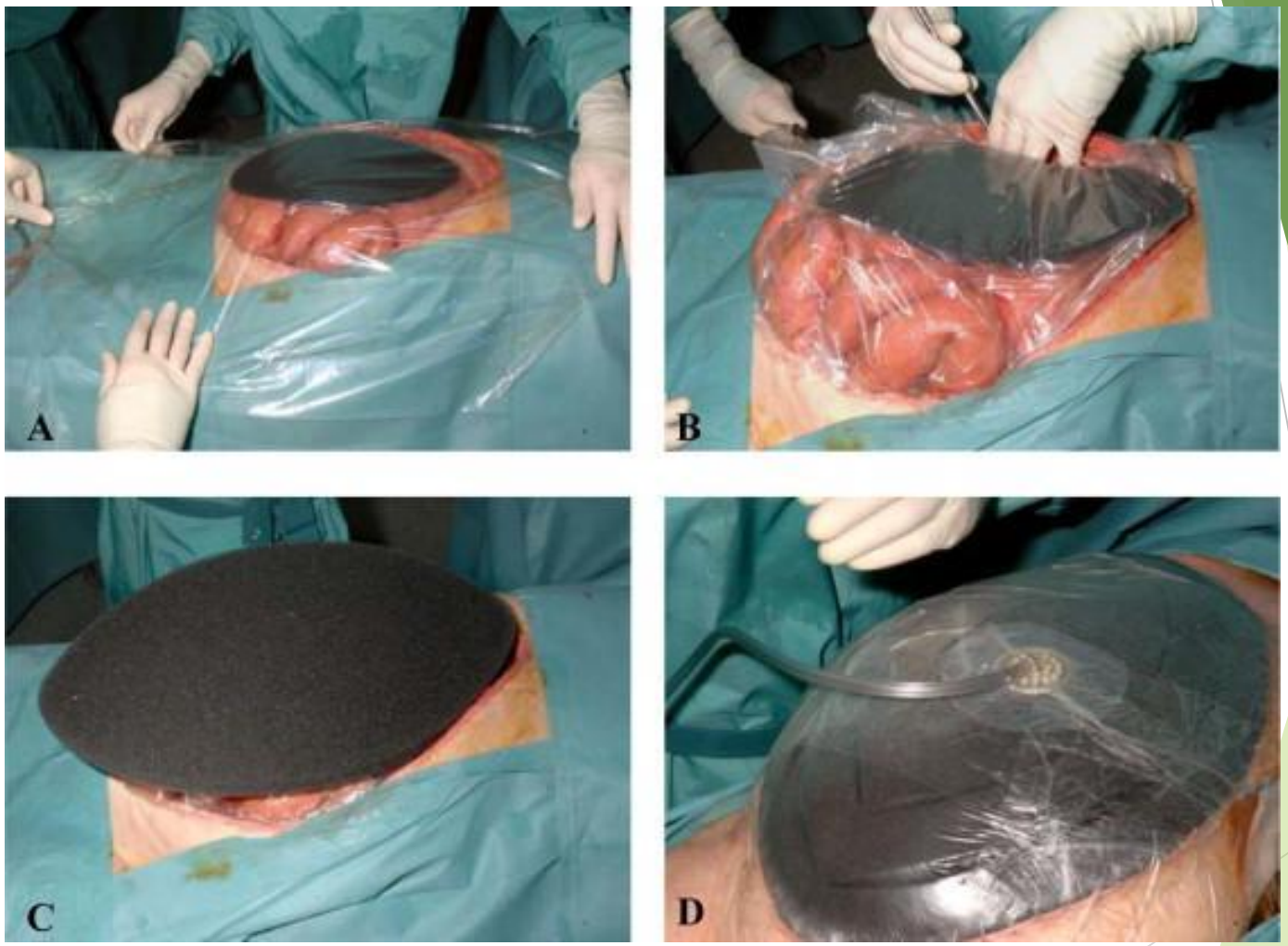
Management of the open abdomen

- In 1995 the vacuum pack technique was described, where a perforated plastic sheet is used to cover the viscera and then sterile surgical towels are placed on the wound; a surgical drain is then connected to a continuous negative pressure that is placed on the towels, and everything is covered by an airtight seal

- the dressing should be changed every 2–3 days in the operative room but could also be changed in the ICU

Management of the open abdomen

- The vacuum pack:
- using a negative-pressure dressing
- (polyurethane foam covered with a protective fenestrated nonadherent layer tubing, a canister, and a computerized pump)
- few advantages:
- reduced need for frequent dressing changes
- increased vascularity of the wound
- decreased bacterial counts
- extended opportunity for definitive fascial closure


A
B
C
D

Management of the open abdomen

- use of negative-pressure wound therapy in the temporary abdominal closure technique used to care for an open abdomen:

- better outcome than no negative-pressure wound therapy

- a new strategy:
- negative-pressure wound therapy with a mesh-mediated fascial traction tension
- a systematic review with 4358 patients, Atema et al:
- most frequently described temporary abdominal closure technique:

negative-pressure wound therapy

The highest weighted fascial closure rate was in negative-pressure wound therapy with continuous mesh or suture-mediated fascial traction and dynamic retention sutures

- negative-pressure wound therapy without fascial traction:

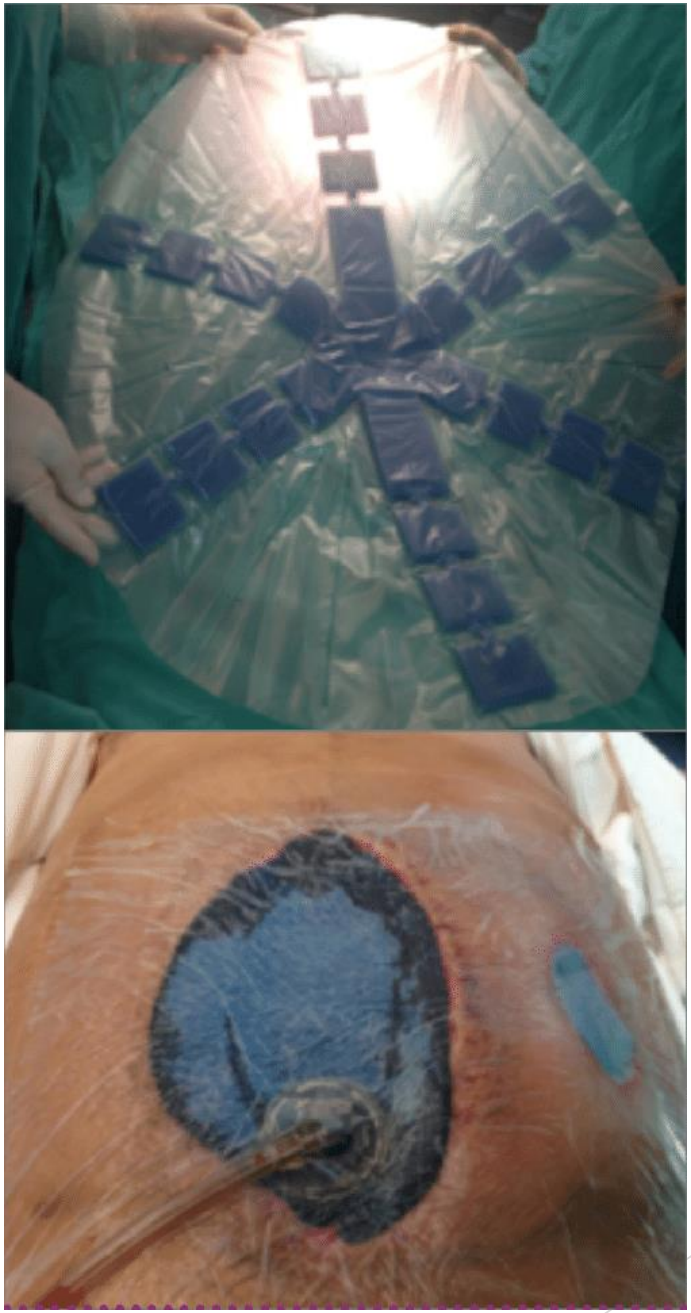
fistula rate of 14.6%,

negative-pressure wound therapy combined with continuous suture or mesh-mediated fascial traction:

the fistula risk dropped to 5.7%

Management of the open abdomen

- Another implementation of the system was introduced by the Abthera™:
- fenestrated plastic sheet with foam sponges that extend in a circular pattern which is then placed over the viscera encompassing the paracolic gutters and the pelvis, foam sponges are placed on top of the protective layer
- an adhesive drape covers the wound and extends over the skin
- Suction tubing is attached to a portable suction device to create negative pressure



Management of the open abdomen

- The three main negative-pressure therapy modalities (Barker, VAC abdominal dressing system, Abthera™)
- The most important difference between all of these modalities is the distribution pattern of the preset negative pressure
- Sammons
- applied a negative pressure of 125 mmHg to these three systems and measured the pressures in different areas of the dressing, concluding that
- pressure distribution of Abthera™ therapy was significantly superior to that of the Barker vacuum packing in all three measure zones and in medial and distal zones when comparing with the VAC system

Management of the open abdomen

- World Journal of Emergency Surgery Guidelines (2018):
- negative-pressure wound therapy along with continuous fascial traction is the preferred method for temporary abdominal closure (Grade 1B)

- Temporary abdominal closure without negative-pressure wound therapy (e.g., mesh alone, Bogota bag) should NOT be used for the purpose of temporary abdominal closure, because of the low-delayed fascial closure rate and the significant intestinal fistula rate that often accompanies the method (Grade 1B)

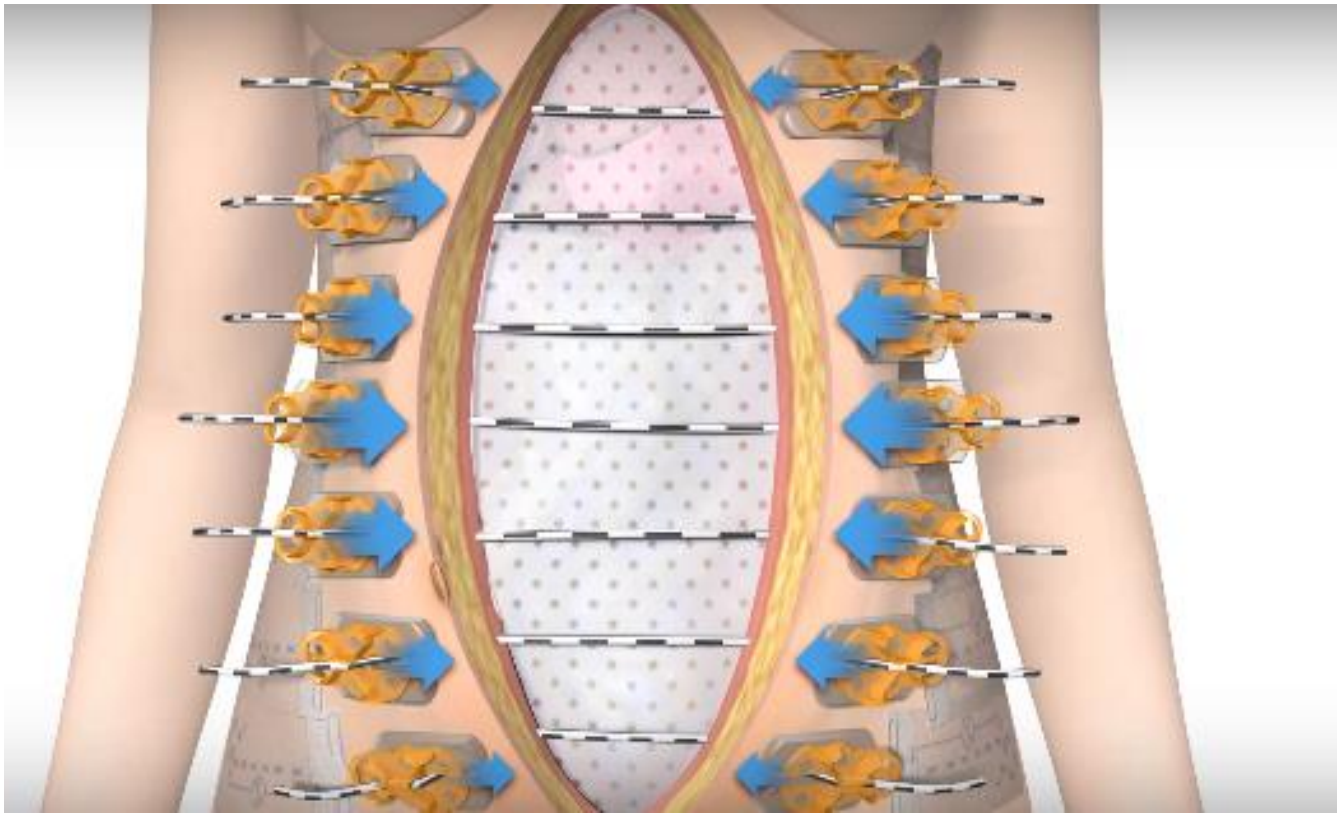
Management of the open abdomen

- The best and the right way to manage a patient with an open abdomen is still unclear: the technique is relatively new, and in the literature, the data and the casuistic reported are too varied and too heterogeneous to assess properly
- Early fascial and/or abdominal definitive closure should be the strategy for managing an open abdomen once any requirements for ongoing resuscitation have ceased, the source control has been definitively reached, there are no concerns regarding intestinal viability, no further surgical re-exploration is needed, and there are no concerns for abdominal compartment syndrome

Management of the open abdomen

- In many patients, early definitive fascial closure may not be possible because of the persistent bowel edema or intra-abdominal sepsis

- In these cases, progressive closure should be attempted when there is a return to the operating room for a washout or dressing change, by placing a few interrupted sutures at the top and bottom of the fascia defect with each new procedure



یک روش جدید

Management of the open abdomen

- *Definitive closure of the abdominal wall has to be achieved as soon as possible*
- *Different techniques in different settings*:
- direct closure with dynamic traction techniques in early closure with little fascial gap
- component separation
- rotational flaps
- prosthetic or biologic mesh, etc

- a planned ventral hernia :
- if severe and persistent contamination of the peritoneal cavity is present

Complications

- *wound infection*
- *fluid and protein loss*
- *catabolic state*
- *loss of abdominal wall domain*
- *development of enteroatmospheric fistula*

- Enteric fistula management is composed of three phases: recognition and stabilization of the patient, anatomical definition and decision-making, and definitive operation

- Enteroatmospheric fistula is a life-threatening condition requiring longitudinal care for many months. A spectrum of vexing clinical problems ranging from hypovolemic shock to malnutrition to complex abdominal wall reconstruction challenges the skill of even highly experienced surgeons. *High-output fistulas and EAFs are best managed in centers providing comprehensive care of intestinal failure*

از توجه شما سپاسگزارم