OPTIONS IN THE MANAGEMENT OF THE OPEN ABDOMEN

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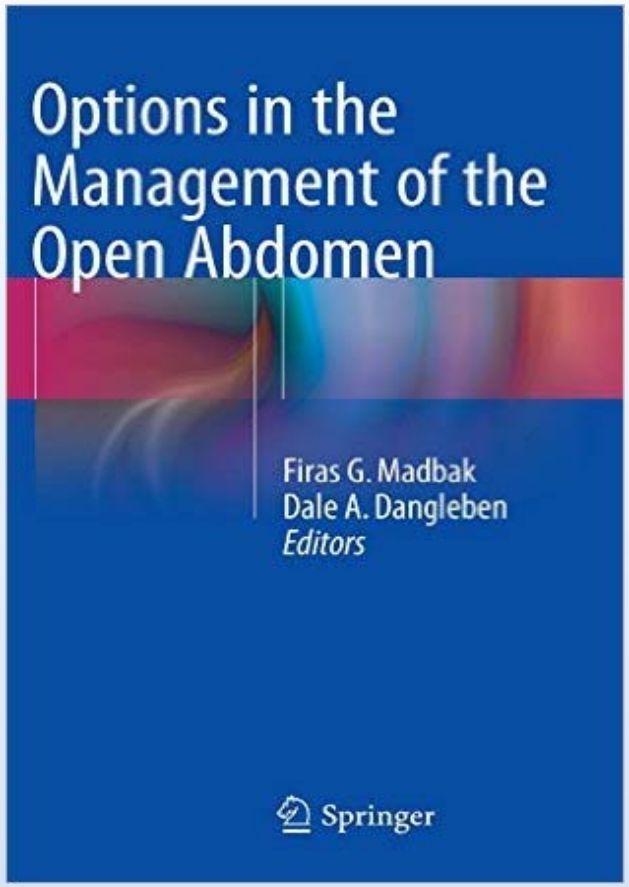
DISCLOSURE

Springer Publishing



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LEARNING OBJECTIVES

- Review the reasons to leave the abdomen open
- Define damage control
- Go over Abdominal Compartment Syndrome (ACS)
- Classify the types of temporary closure
- Review a few techniques in abdominal wall reconstruction
- Discuss use of biological grafts

OVERVIEW

- Reasons to leave the abdomen open
- Damage control
- Abdominal compartment syndrome (ACS)
- Types of temporary closure
- Intermediate closure devices
- Abdominal wall reconstruction
- Biological grafts
- Complications

He that fights and runs away, May turn and fight another day; But he that is in battle slain, Will never rise to fight again.

Tacitus

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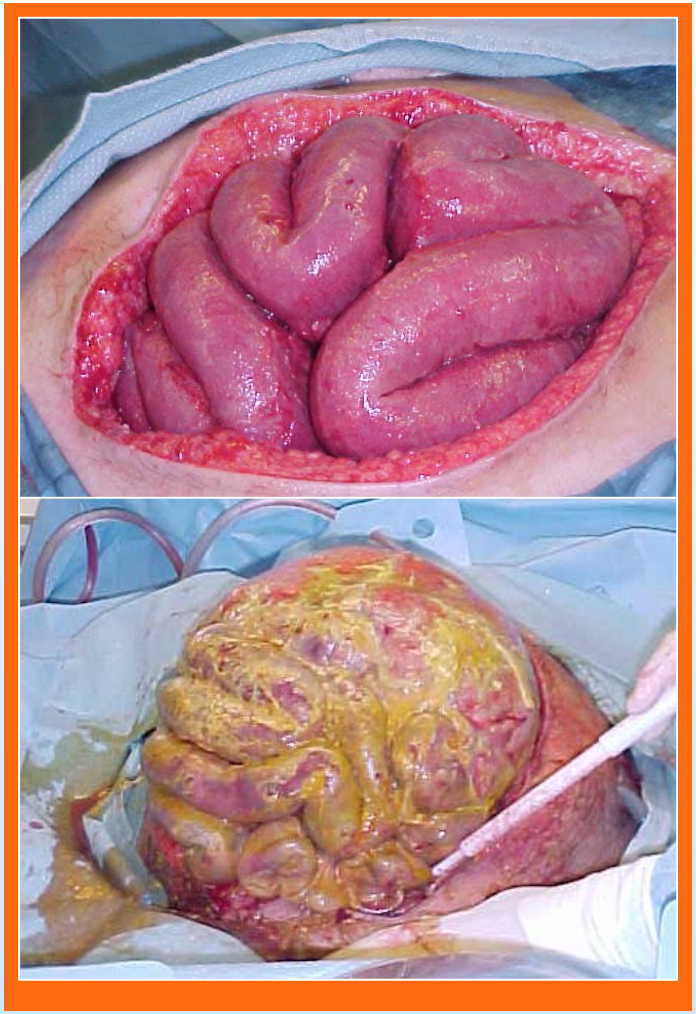
REASONS TO LEAVE THE ABDOMEN OPEN

- Fascial Dehiscence
- Necrotizing Fasciitis
- Marked Visceral Edema
- Damage Control Surgery
  - Trauma
  - General Surgery
- Abdominal Compartment Syndrome



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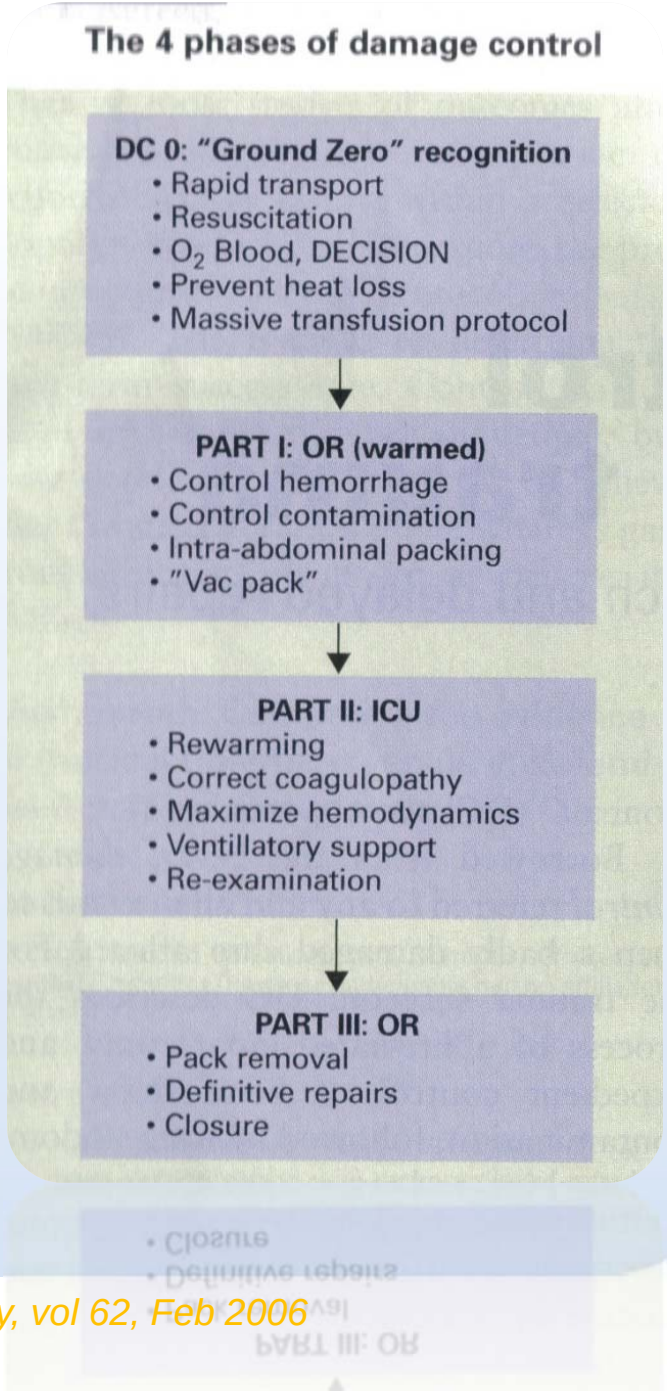
RE-EXPLORATION

- Decision for re-exploration is made at time of surgery (e.g damage control) .
- Timing of re-exploration depends on hemodynamic status of the patient.
- Most re-exploration takes place within 24 to 48 hrs.

DAMAGE CONTROL

- Rotondo and Schwab applied the term “Damage control” in 1993, detailed a 3-phase approach which increased survival rate
- Currently , a 4th step has been added



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Benjamin Braslow, MD, Contemporary Surgery, vol 62, Feb 2006

Indications for the damage control approach

- Inability to achieve hemostasis due to coagulopathy
- Inaccessible major venous injury
- Time-consuming procedure in patient with suboptimal response to resuscitation
- Management of extra-abdominal life-threatening injury
- Reassessment of intra-abdominal contents
- Inability to reapproximate abdominal fascia due to visceral edema

Source: Moore EE, Burch JM, Franciose RJ, et al. Staged physiologic restoration and damage control surgery. World J Surg. 1998;22:1184-1191.

ABDOMINAL COMPARTMENT SYNDROME (ACS)

Early diagnosis

- Early decompression improves outcome

- Routine monitoring of bladder pressures recommended in patients with:

  - 10 liter crystalloid resuscitation
  -10 unit PRBC resuscitation

•*Maxwell RJ et al., J Trauma 1999; 47: 995*

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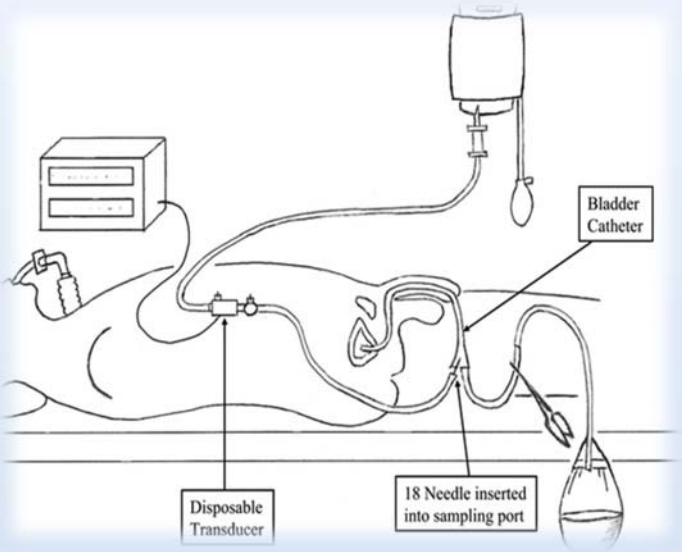
ABDOMINAL COMPARTMENT SYNDROME (ACS)

Bladder Pressure

- The needle is inserted into the urine sampling port of the Foley catheter.
- The transducer is then connected to a monitor and zeroed.
- The drain tubing is then clamped, and the bladder is infused with saline.
- The pressure within the system must be allowed to equilibrate before the mean bladder pressure on the monitor is recorded.



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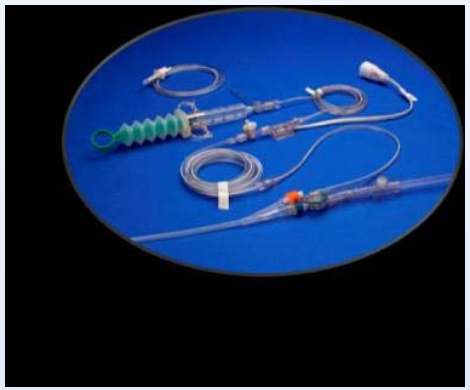
Commercially Available Intra-abdominal Pressure Monitorin Devices

AbViser



The UnoMeter Abdo-Pressure kit

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SURVIVAL FROM ACS

- Mean time to development of ACS 11 ± 2 hrs
- Average resuscitation
-
  17 ± 3 liters crystalloid

  13 ± 3 units PRBCs

- Decompressive laparotomy improved

  -Systolic BP
  -Peak airway pressures
  -Urine output
  -Mortality

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•Biffl WL et al., Am J Surg 2001; 182: 645

INCIDENCE OF ACS AFTER DAMAGE CONTROL LAPAROTOMY

Closure method and ACS

- Fascial closure
  - -80% ACS
  - -MSOF 90%
- Skin closure
  - -24% ACS
  - -MSOF 36%
- Bogotá bag closure
  - -18% ACS
  - -MSOF 47%

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•Offner PJ et al., Arch Surg 2001; 136: 676

ACS ASSOCIATED WITH VARIOUS OTHER DISEASES.

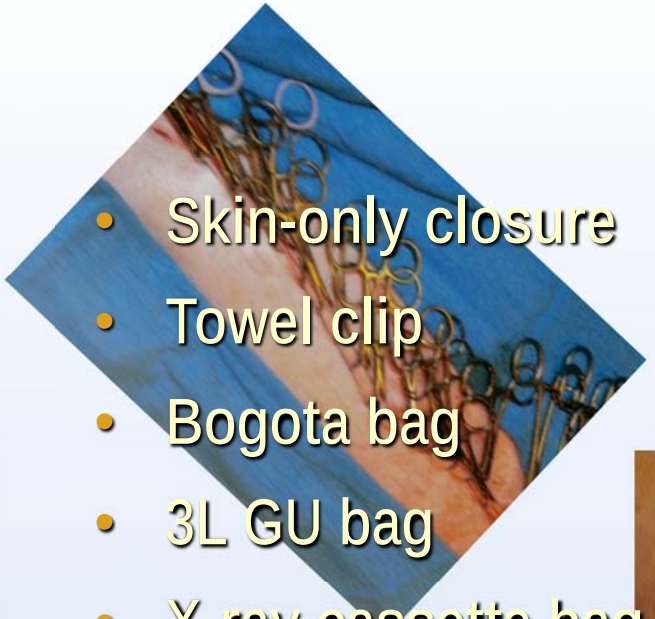
- Ascites
- Ovarian Cancer
- Ruptured AAA
- Perforated Ulcer
- Pancreatitis
- Liver transplant
- Intra-abdominal sepsis
- Trauma

WHAT IS THE IDEAL VISCERAL COVERAGE?

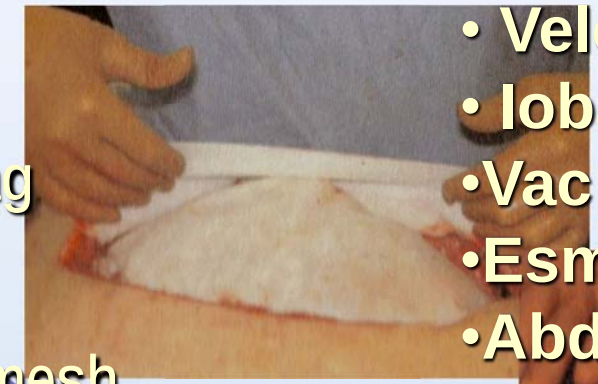
- Readily available
- Repeat access to abdomen
- Rapidly applied
- Prevents loss of domain
- Porous
- Preserves fascia

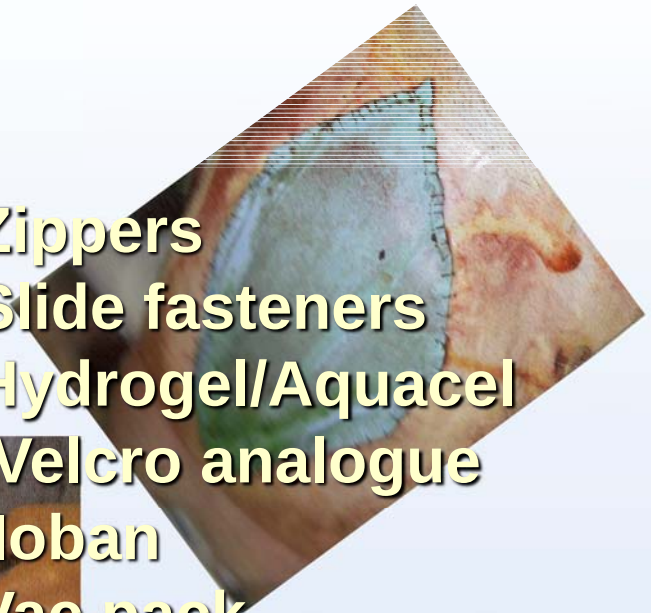
- **Non-reactive to bowel**
- **Quantitates fluid loss**
- **Easily removed**
- **Allows for tamponade**
- **Prevents IAH/ACS**
- **Maintains sterility**
- **Inexpensive**

DESCRIBED TECHNIQUES

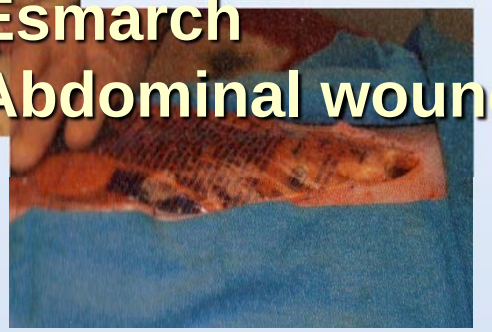


- Skin-only closure
- Towel clip
- Bogota bag
- 3L GU bag
- X-ray cassette bag
- Steri-drape
- Nonabsorbable mesh
- Silastic sheet





- Zippers
- Slide fasteners
- Hydrogel/Aquacel
- Velcro analogue
- Ioban
- Vac pack
- Esmarch
- Abdominal wound VAC



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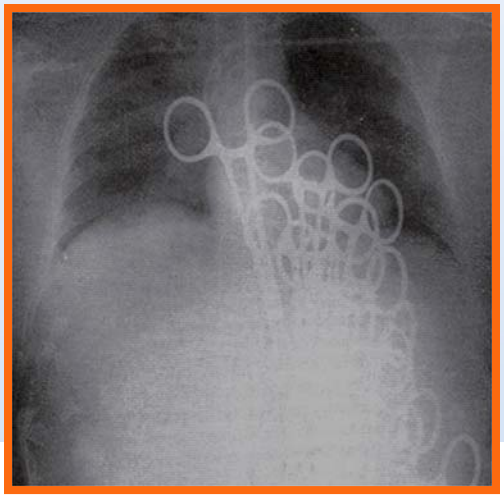
TOWEL CLIPS

- **Pros**
  - **-Quick closure**
  - **-Provides “tamponade”**

- **Cons**
  - **High incidence of ACS**
  - **Up to 24%**



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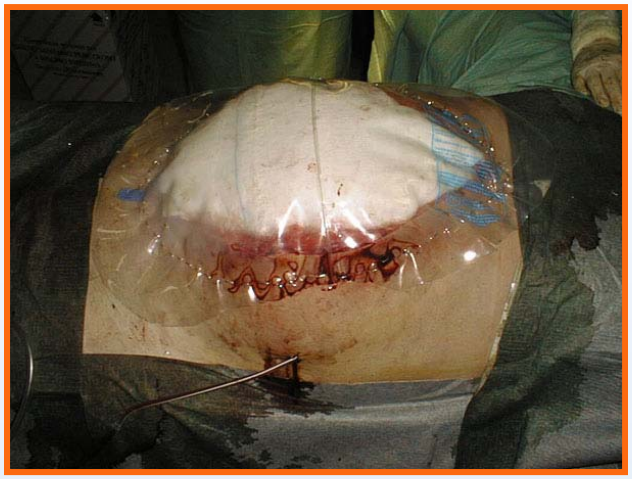
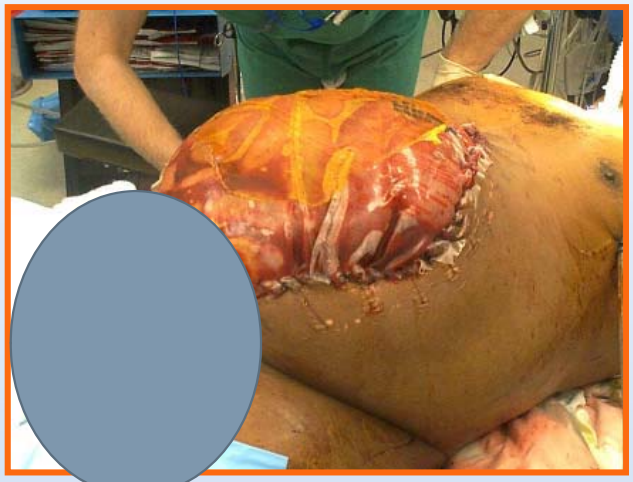
BOGOTA BAG

- named for Columbian surgeons who initially described its use
- sterilized 3-L cystoscopy fluid irrigation bag
- nonadherent, nondistensible inexpensive





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Modified Bogota Bag

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X-RAY CASSETTE BAG

Can also use plastic wound drape or sterile radiograph cassette cover

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BAG CLOSURES

- Pros
  - Quick
  - Allows view of the viscera
- Cons
  - Less tamponade effect
  - 18% recurrent ACS

Abdominal Vac Pack

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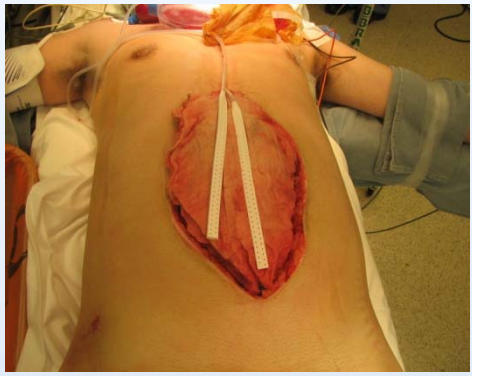
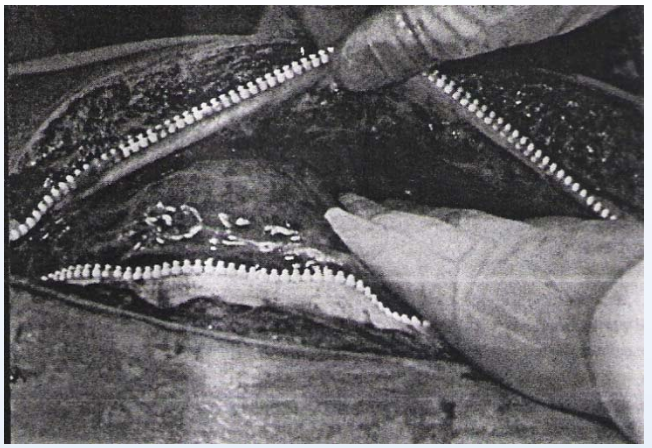
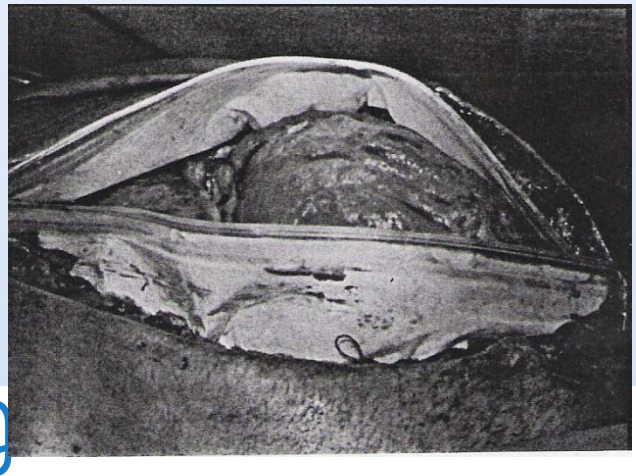
VAC PACK CLOSURE

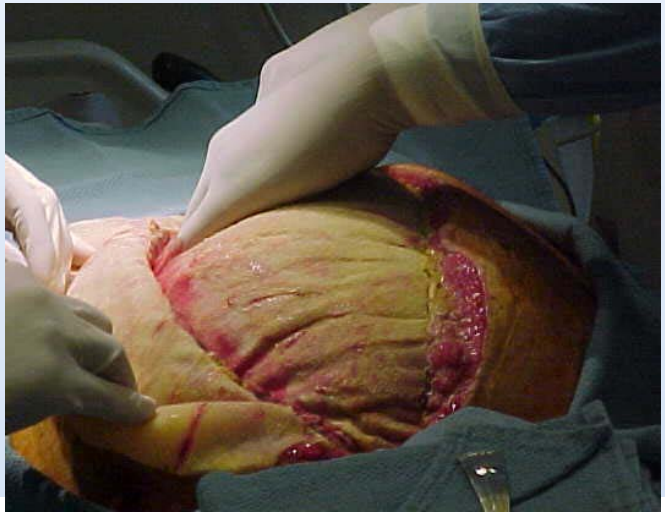


- Pros
  - -Quick
  - -Allows easy re-exploration
  - -Does not violate skin or fascia
  - -Excellent in patients in whom delayed primary closure is anticipated
- Cons
  - - Less tamponade effect

REPEATED ENTRY







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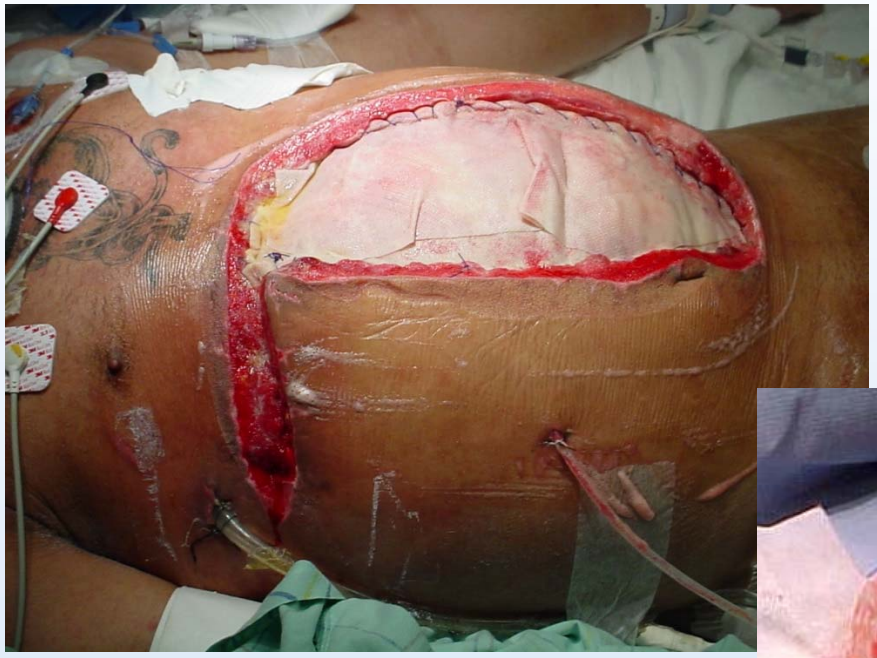
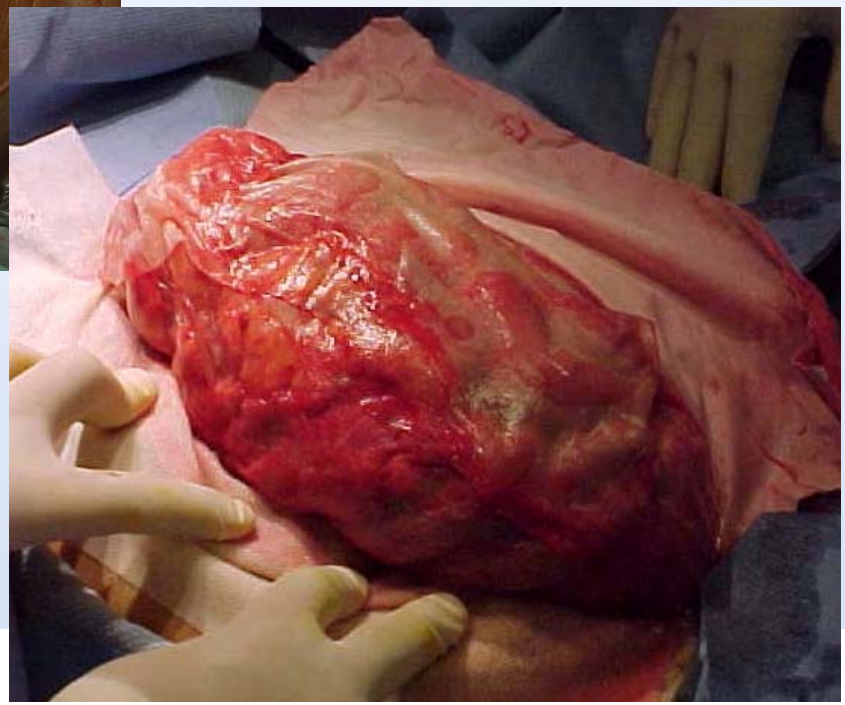
WITTMAN PATCH





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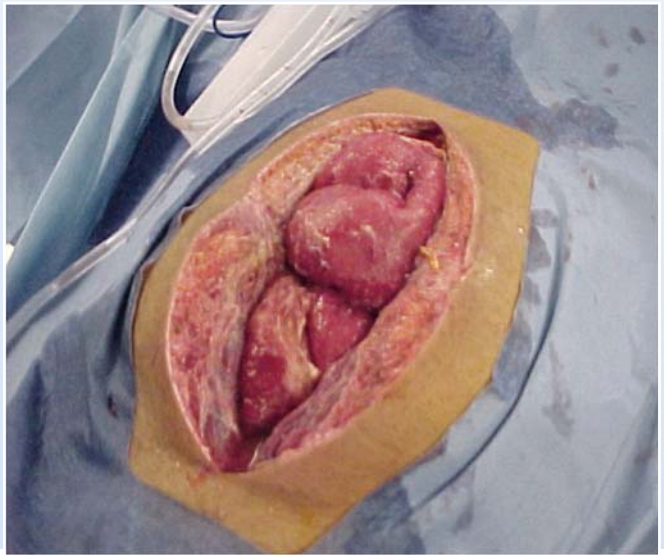
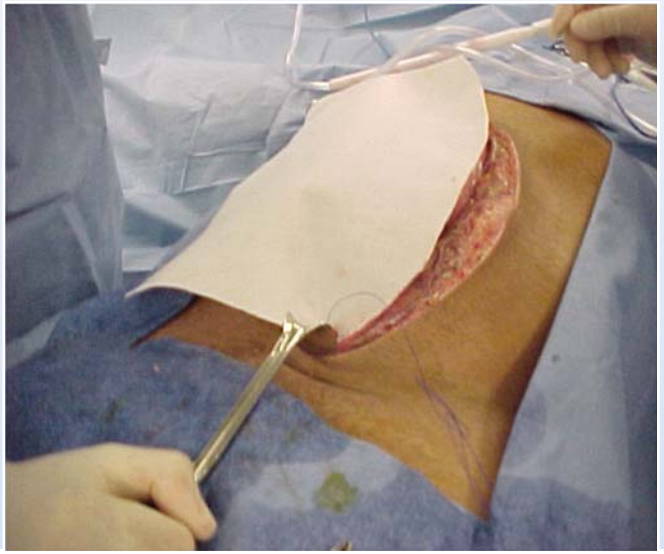
WHAT IS THE WITTMAN PATCH?

- Two sheets (20 x 40 cm) of Velcro®-like bio-compatible material, which are sutured to the opposing fascia

- The two sheets adhere to each other when compressed together





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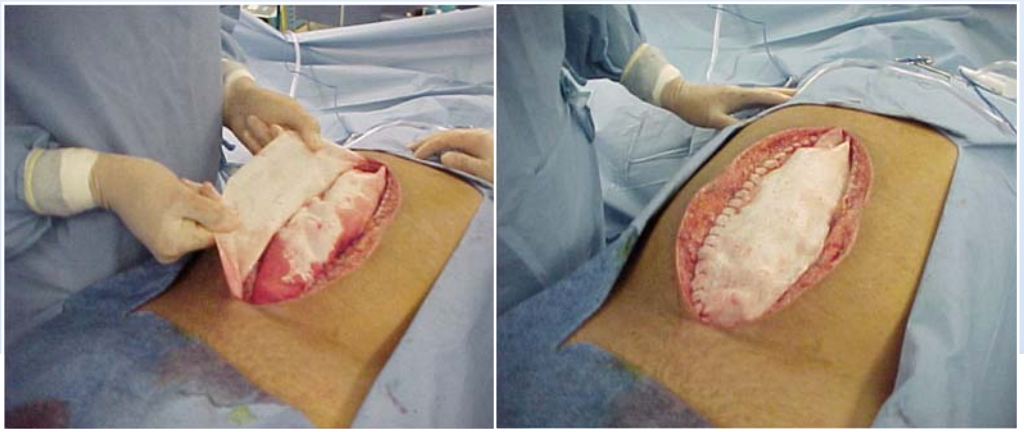
Wittman Patch

- **Access to abdominal cavity is achieved by simply peeling back the two adhering sheets.**
- **Management of the patch requires bedside abdominal wash-outs every 24 - 48 hours, and tightening of the Velcro®-like layers.**
- **It facilitates subsequent packing removal, peritoneal washouts, determination of bowel viability, tissue debridement, and ultimately abdominal closure.**



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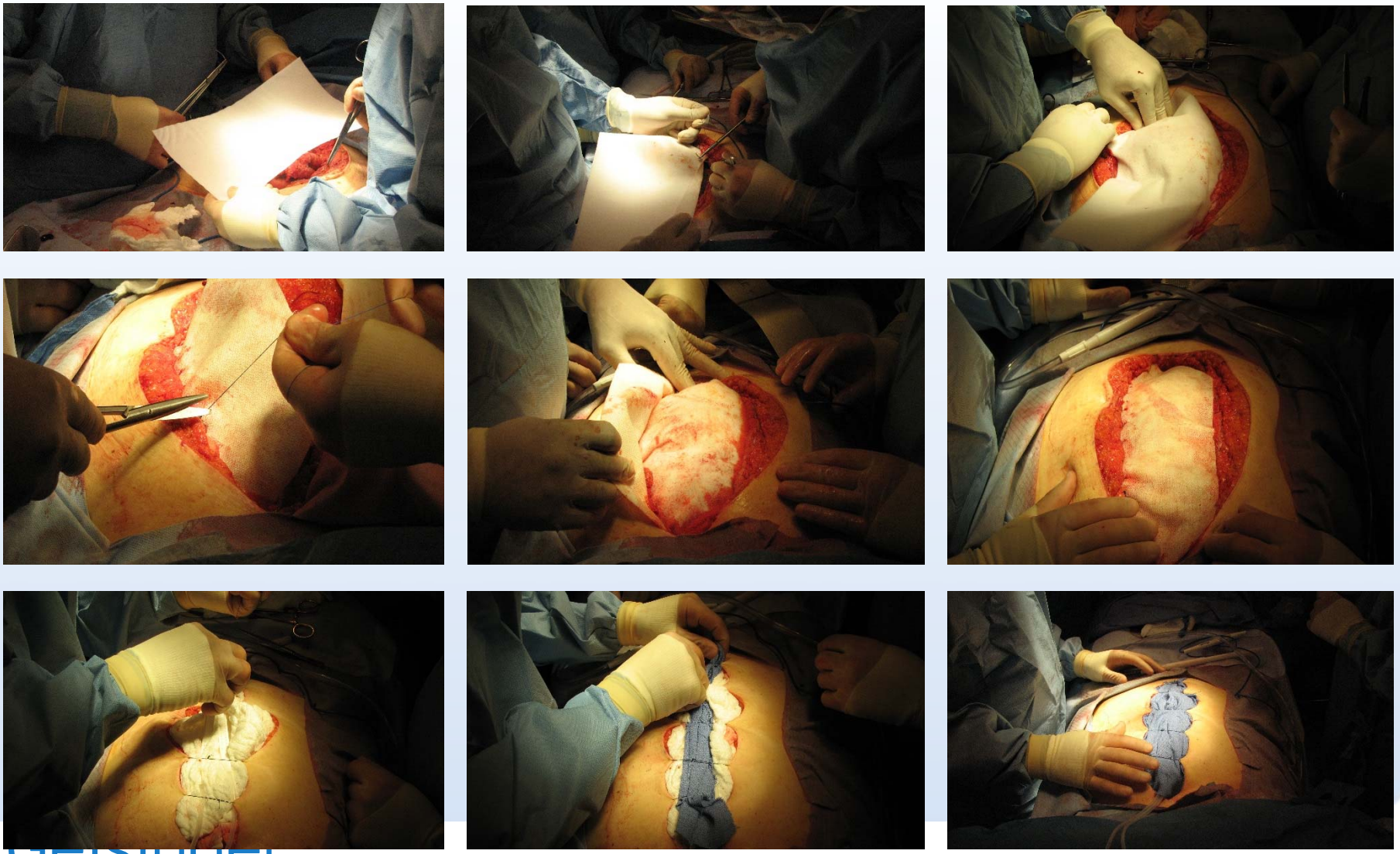
The Wittman Patch



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KCI WOUND VAC

- VAC dressing placed when initial edema resolved
- Non-adherent polyethylene sheet placed over bowel and under fascial edges to prevent adhesions
- Vacuum allows for constant medial traction on fascia, preventing retraction and loss of domain
- Dressing changed every 3 to 5 days in OR or ICU if necessary
- 88% of patients had primary fascial closure at mean time of 9.5 days

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Miller, et al. Wake Forest. Annals of surgery, 5/04

KCl Wound VAC

- Applied after initial damage control procedure or ACS decompression
- Allows delayed primary closure in up to 92% of trauma patients
- No reported incidence of fistula formation
- Mean time to closure 9.9 ± 1.9 days

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Garner GB et al., Am J Surg 2001; 182: 630

WITTMAN PATCH + WOUND VAC

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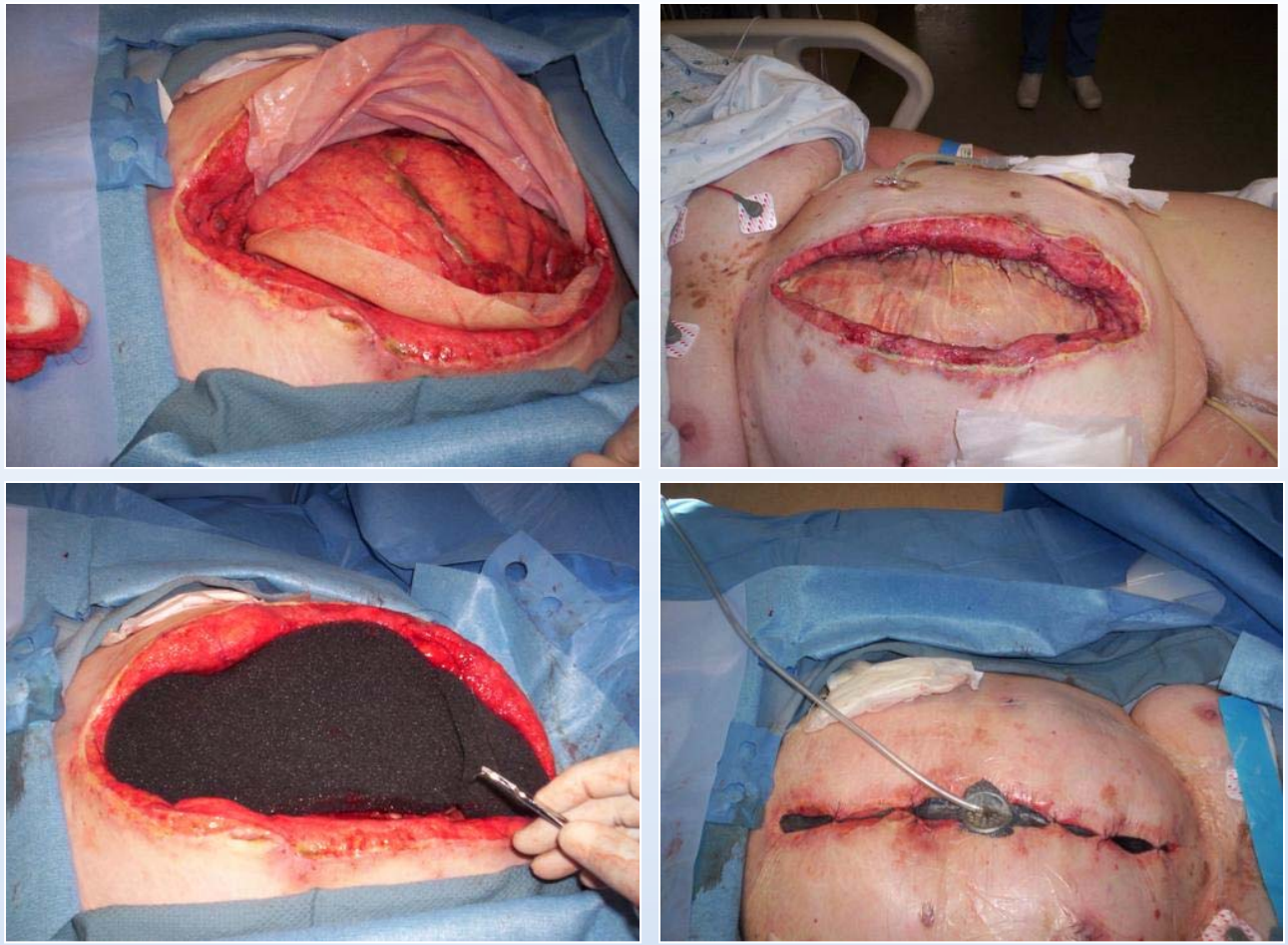
WITTMAN PATCH + VAC +SUTURES



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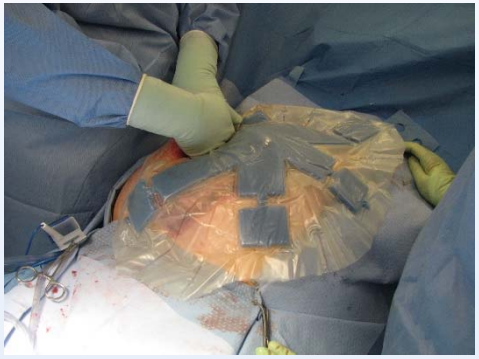
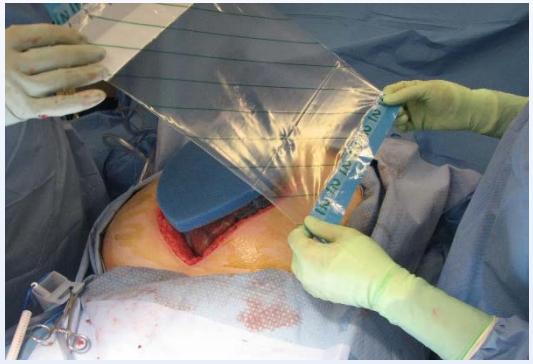
ABTHERA



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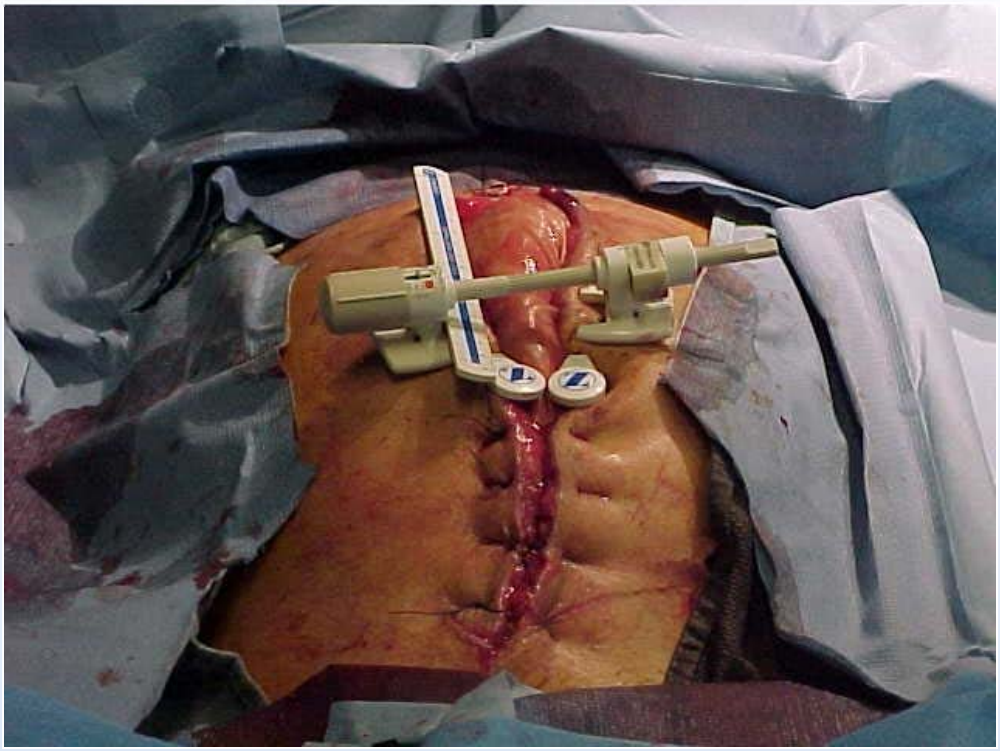
SURECLOSURE DEVICE



Dangleben- Grossman Technique

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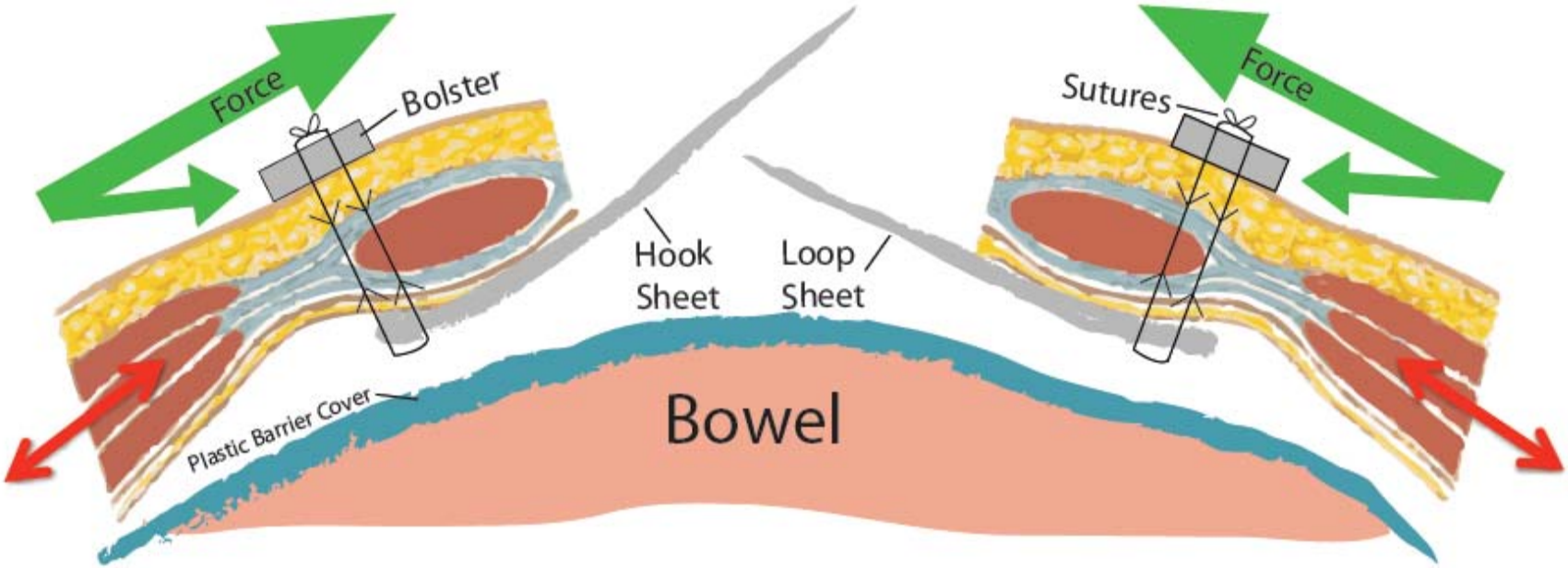
Force
Bolster
Hook Sheet
Loop Sheet
Sutures
Force
Plastic Barrier Cover
Bowel

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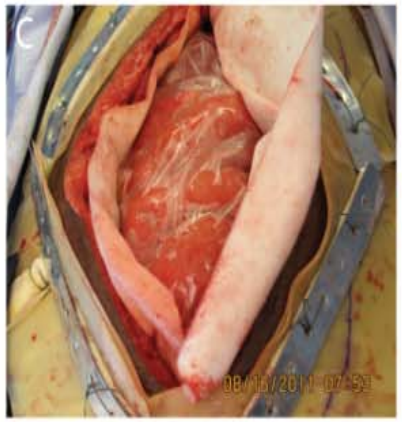
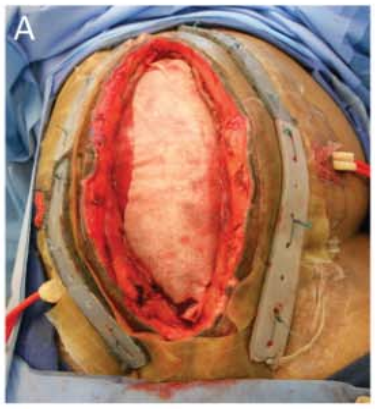
A. Transabdominal Wall Traction (TAWT) System: Skin protective hydrocolloid dressings applied.

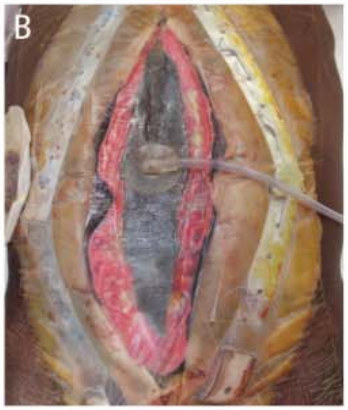
B. TAWT Insertion: Bowel protection barrier and skin protecting bolsters applied.



C & D. TAWT Insertion: Hook and loop sheets placed as underlay.

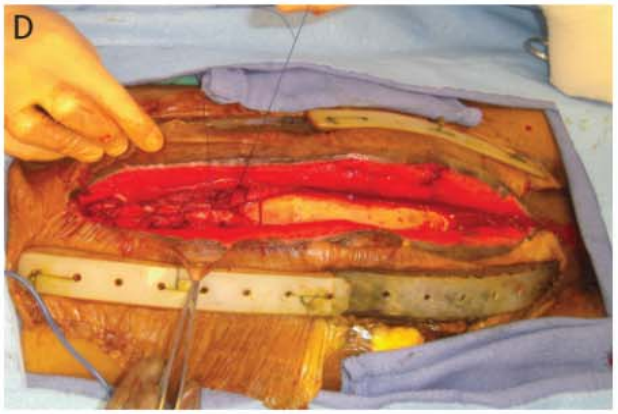
FIGURE 3





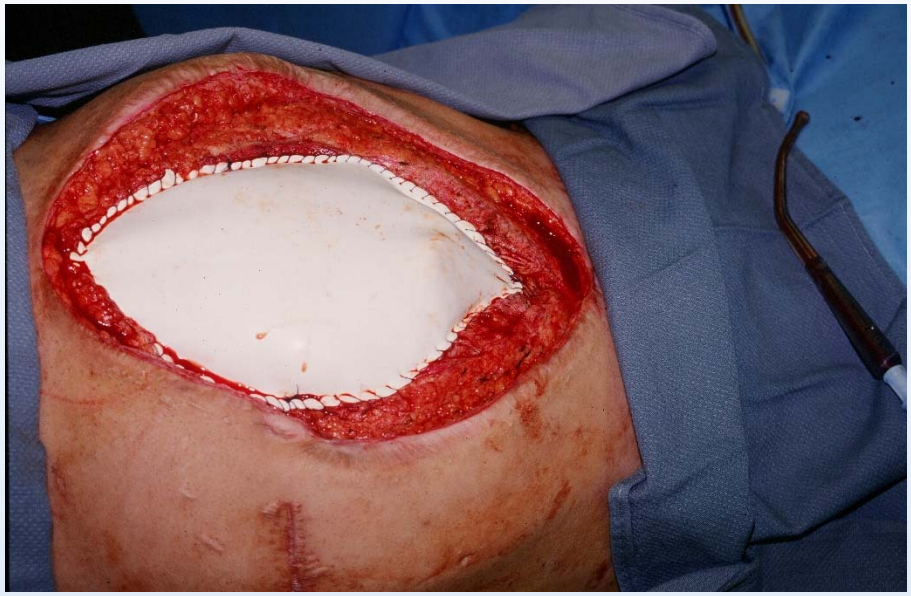
A & B. TAWT Device Inserted: Defect reduced by 54%

C. TAWT Tighten/Wash-Out: Return to OR every 48-72 hrs; Expect domain recovery 2-4cm each tightening.

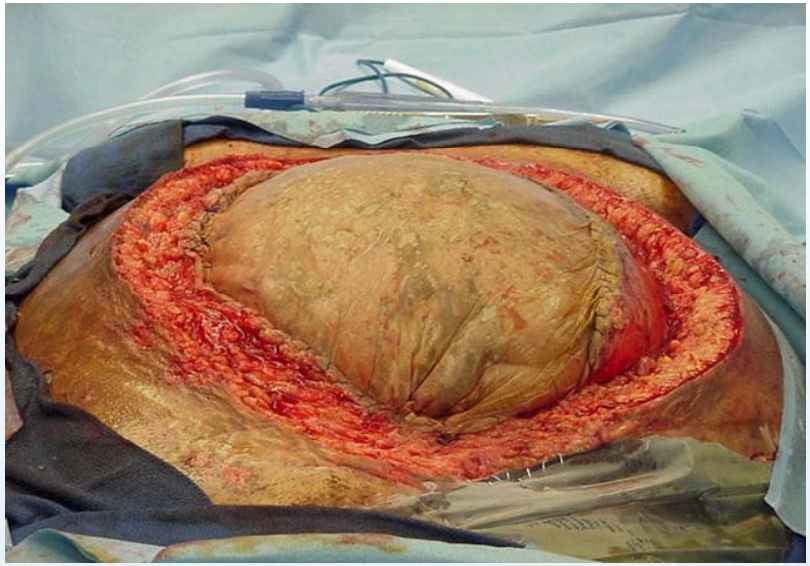


D. TAWT Removal and Primary Closure: Reinforced primary closure done in two layers with Gore® Bio A® inlay mesh when possible.

MESH CLOSURE



ABSORBABLE MESH



-STSG applied when sufficient granulation tissue

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MESH CLOSURE

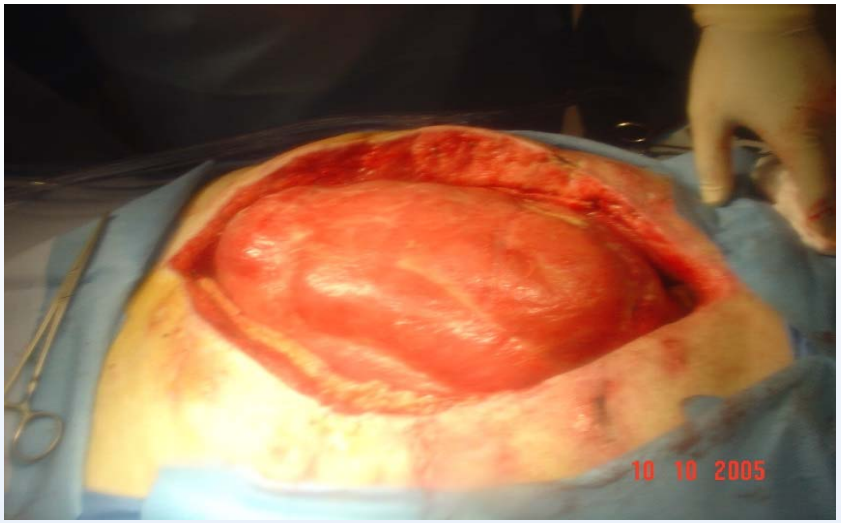
- Pros
  - Can be sutured to fascia to minimize loss of domain
  - Bridge to planned ventral hernia with delayed closure

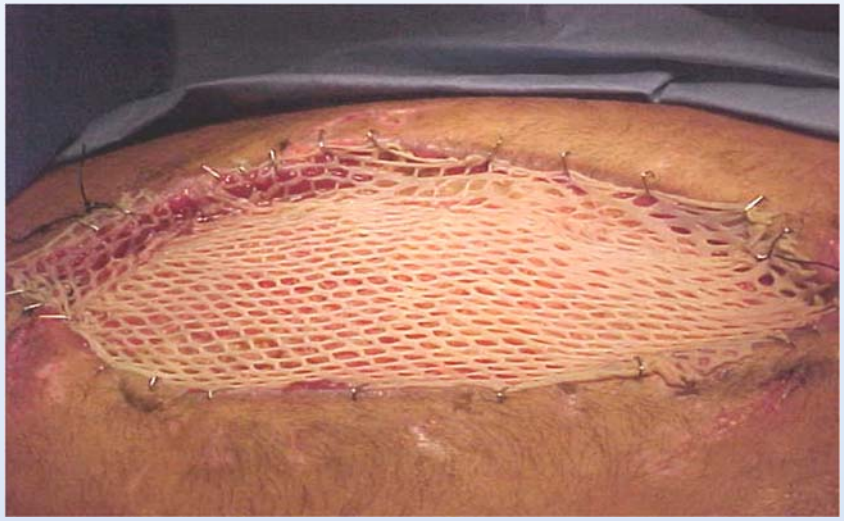
- Cons
  - Fistula formation
  - Increase HLOS

SKIN GRAFTING

-STSG can be applied directly to exposed viscera once abdominal contents "frozen"

-Waiting for granulation bed increases risk for bowel injury/ fistula





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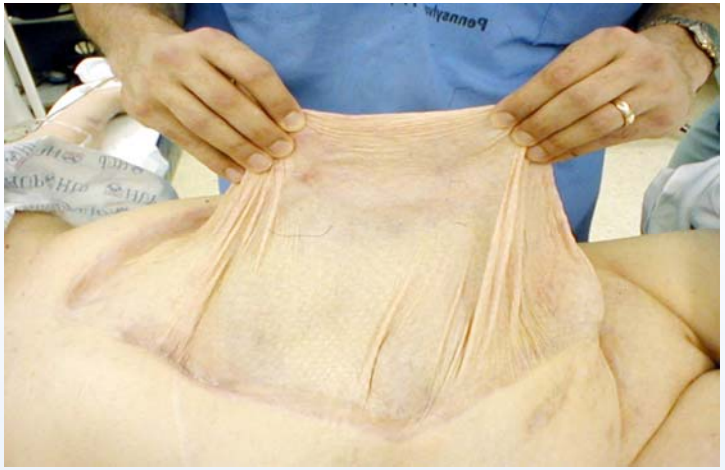
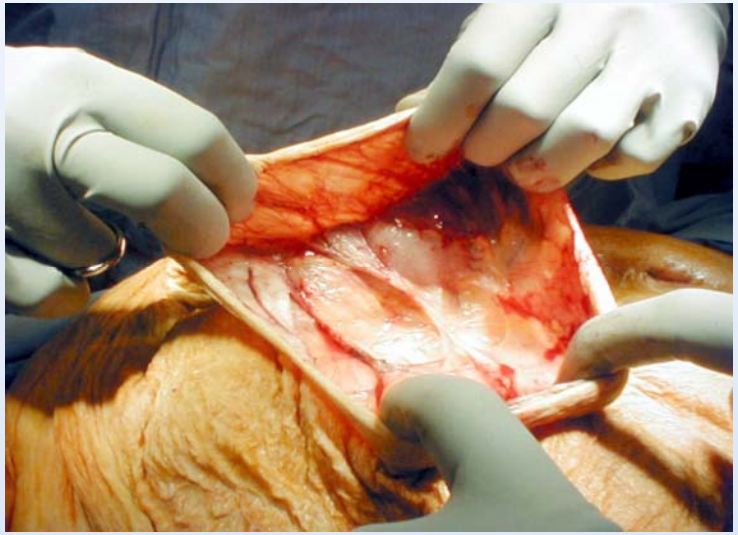
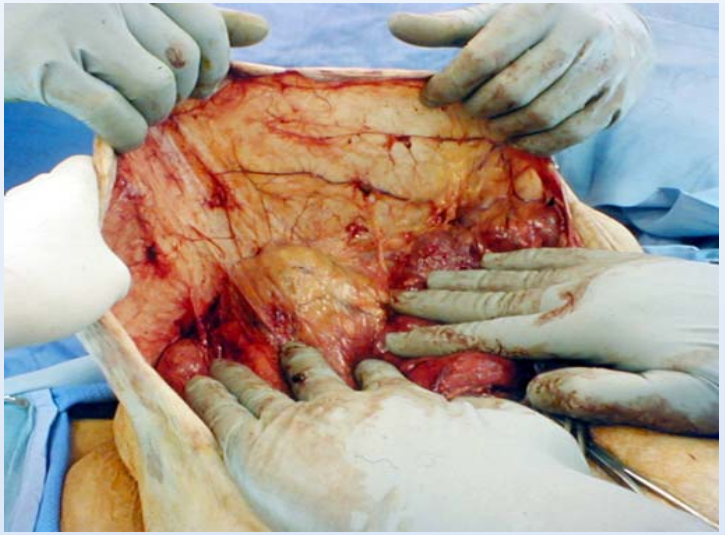
WHAT TO DO WITH THESE?

LATE DEFINITIVE CLOSURE

- Failure to close midline fascia results in giant ventral hernia with significant deformity

- 6 to 12 months allows adhesions to mature and nutritional status to recover
- When the skin graft can be elevated off underlying viscera, the abdomen is ready for closure

Underlying bowel usually easily separated from SG

Use of Biological Grafts in the Open Abdomen

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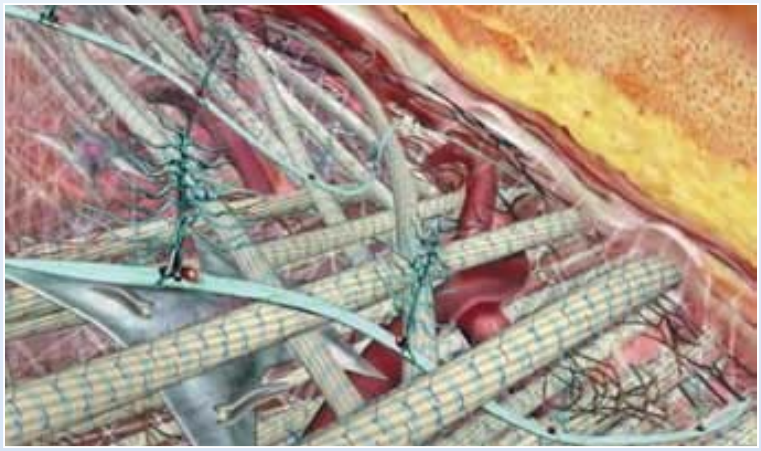
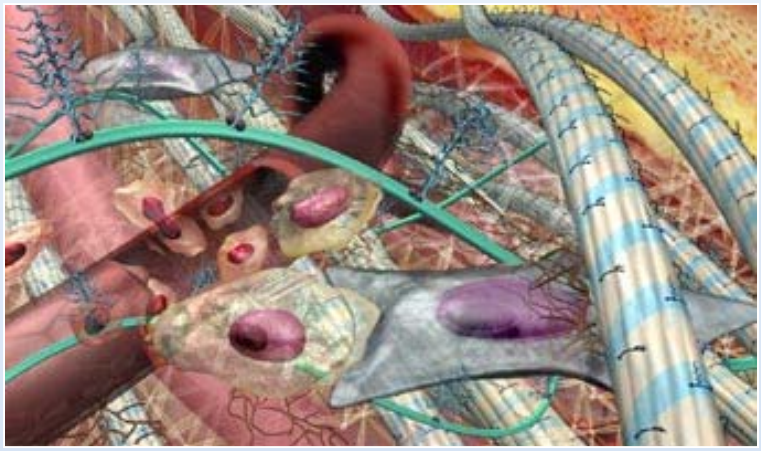
WHAT IS A BIOLOGICAL GRAFT ?

- Acellular dermal matrix
- Serves as a biologic scaffold
- Structured to direct cell repopulation
- Contains blood vessel channels (conduits for revascularization)





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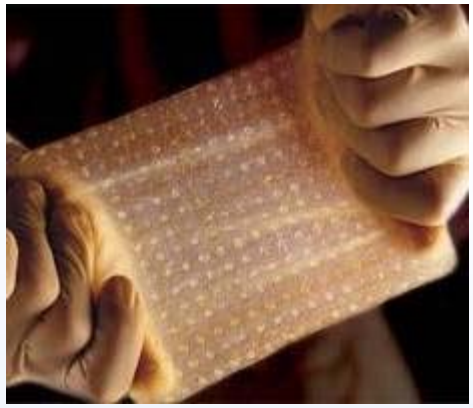
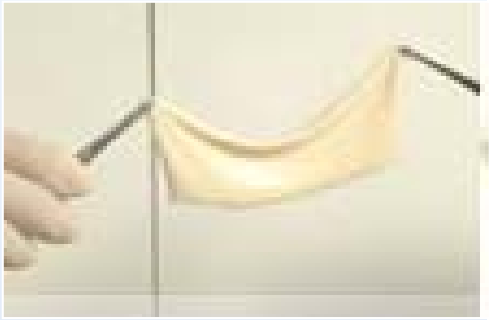
SURGISIS — Porcine small intestine – submucosa

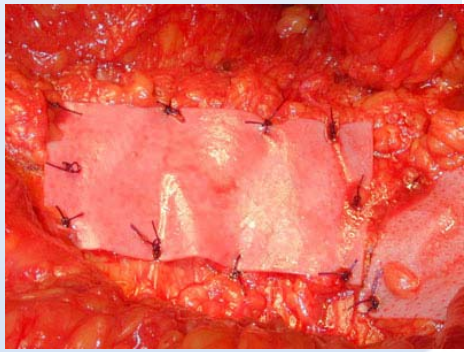


ALLODERM — Rehydration - submerge completely and soak for 20 minutes, expands 50% under tension



ALLOMAX™ — Sterile, non-cross-linked

PERMACOL — Acellular porcine collagen



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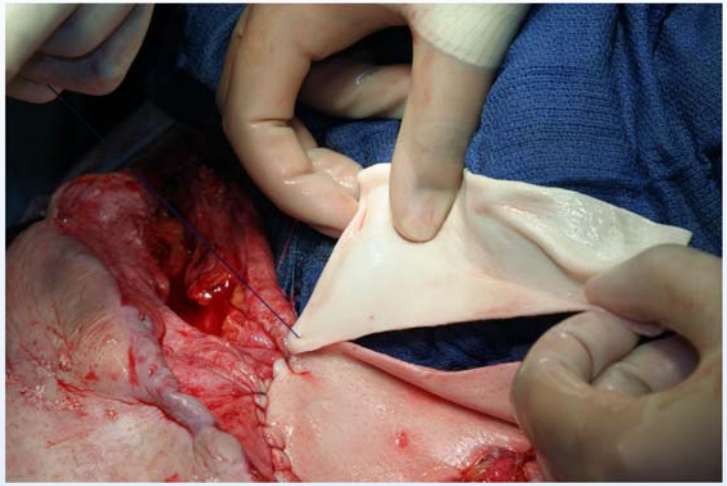
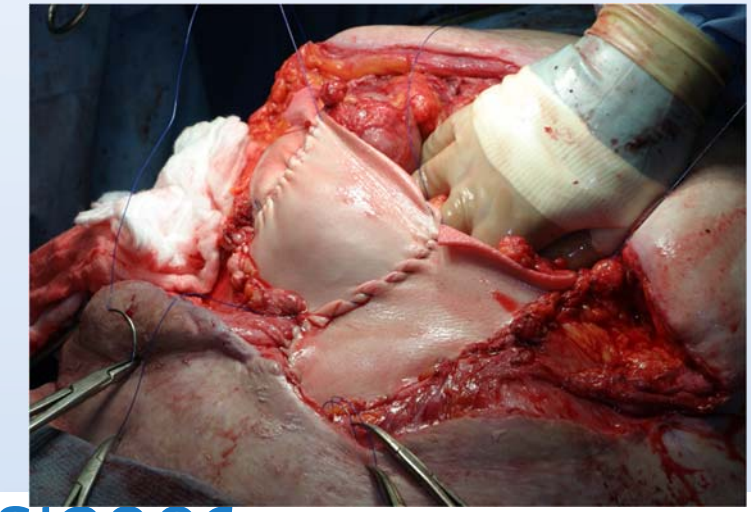
THE QUILTING ERA





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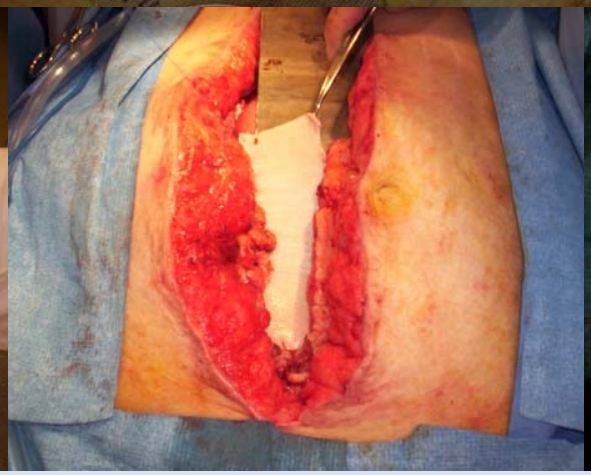
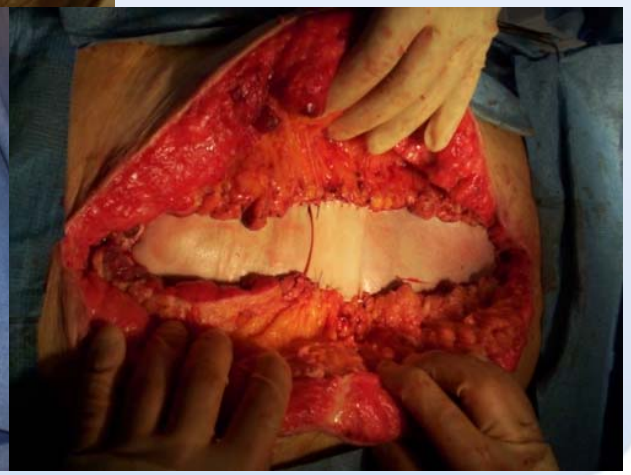
“BRIDGING THE GAP”





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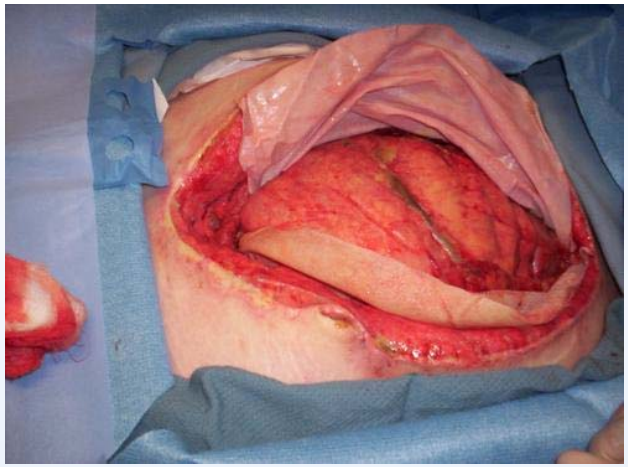

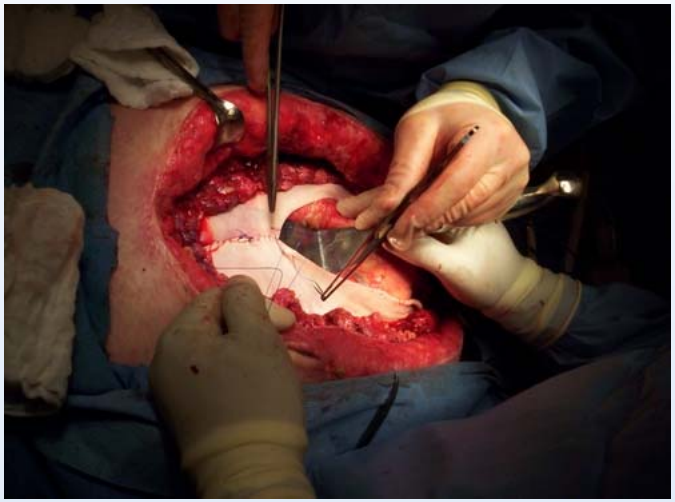

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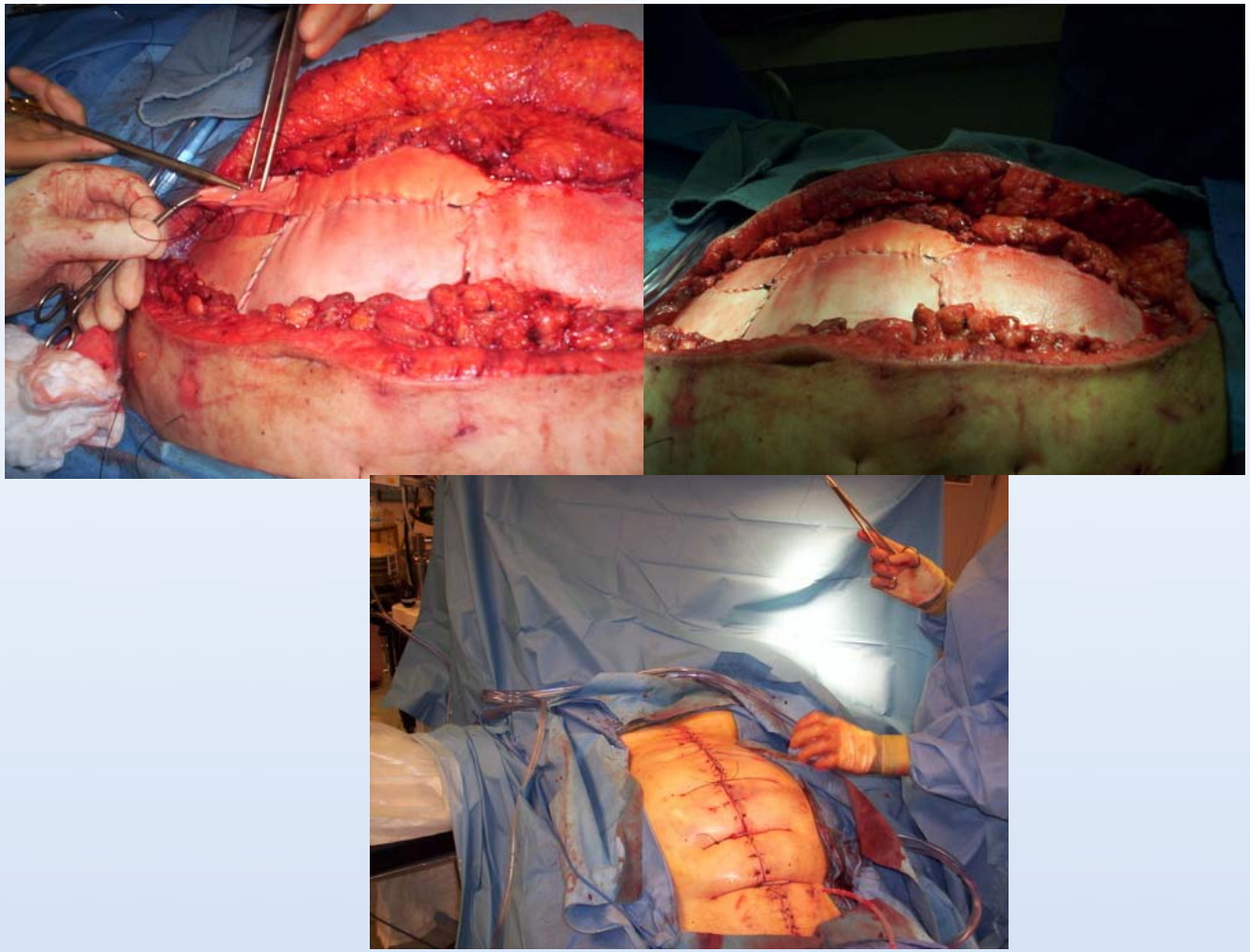

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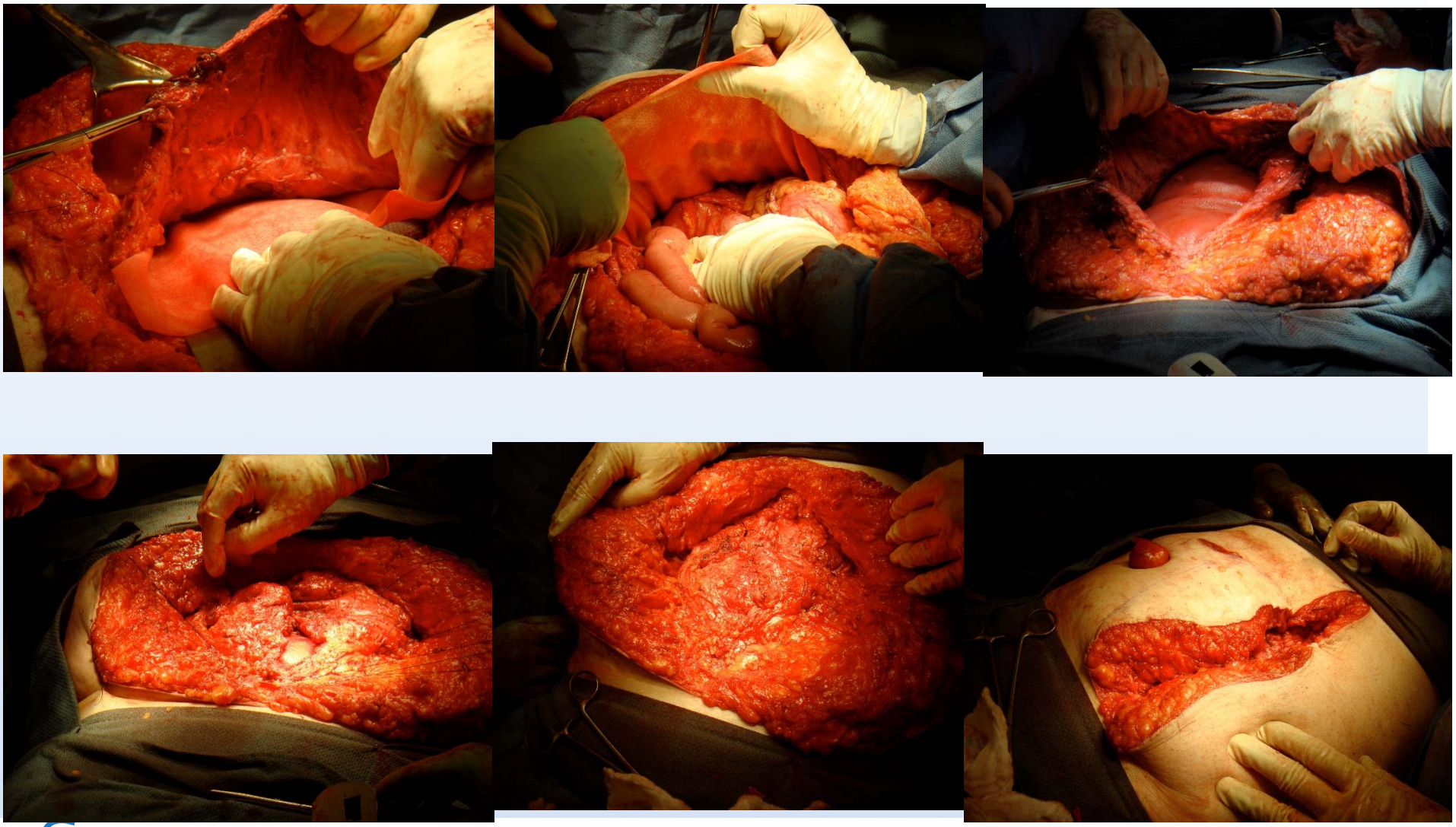
BIGGER PIECES OF BIOLOGICS



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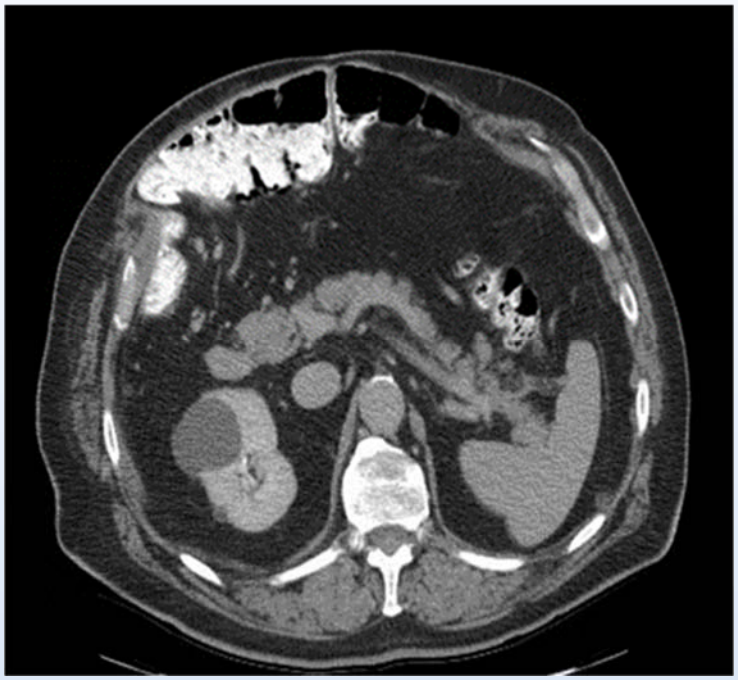
WHAT WE HAVE LEARNED



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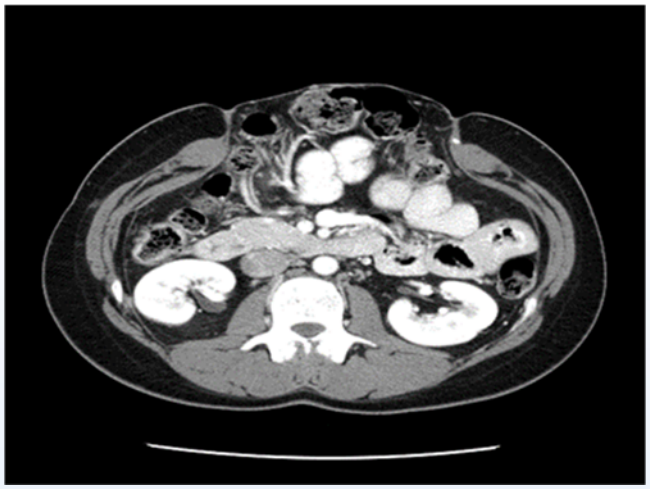
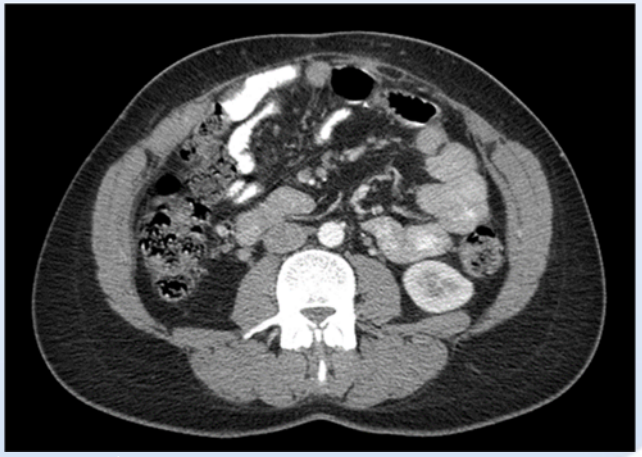
WHAT WE HAVE LEARNED





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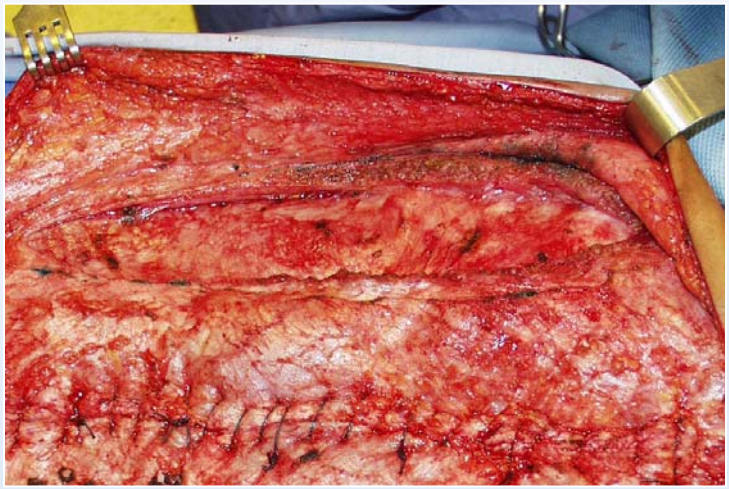
RECONSTRUCTION

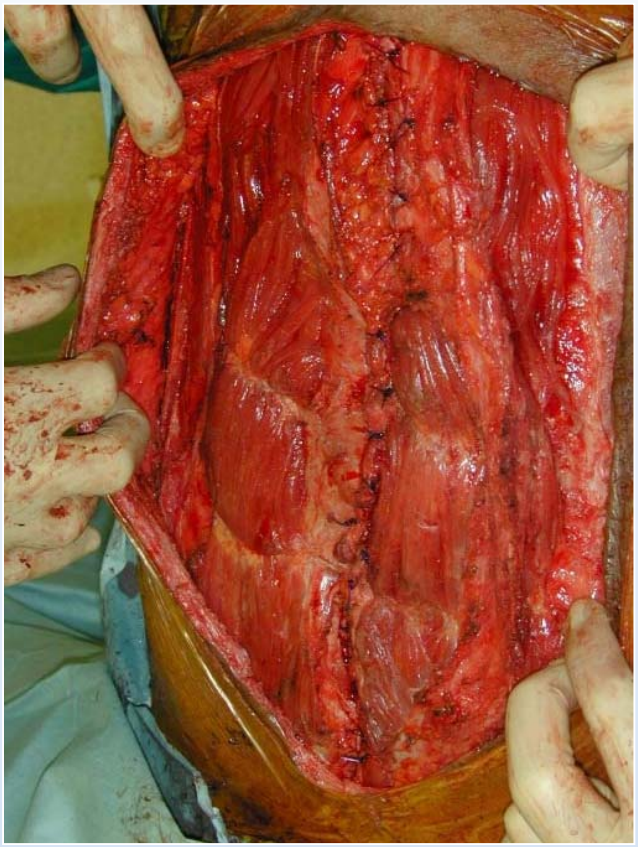
Skin flaps raised just above fascial layer (preserves blood supply)



RECONSTRUCTION

Tissue coverage may be achieved with skin flaps alone

If fascia can close without excess tension, close primarily in standard manner



RECONSTRUCTION

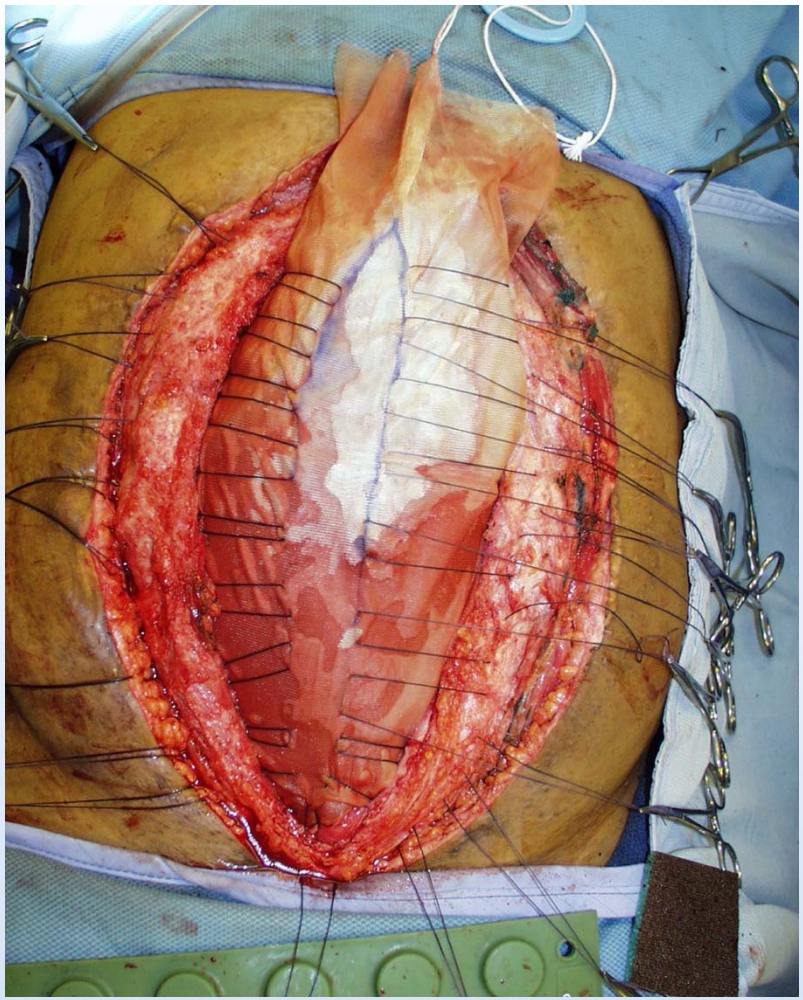
Prosthetic Mesh

- Suturing mesh to edges of fascial defect provides additional strength

- Skin may be closed over mesh

- Granulation tissue may be allowed to develop through mesh and with secondary wound grafting

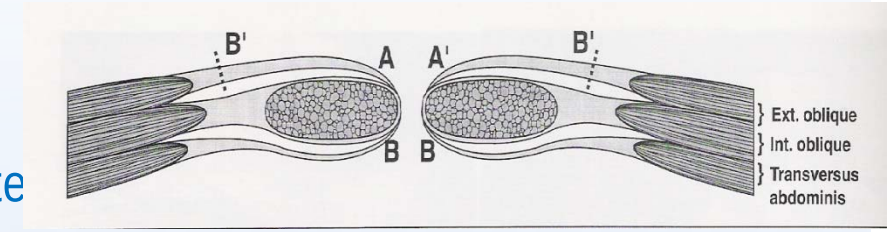
- Mesh should not be used in abdominal or local tissue infections



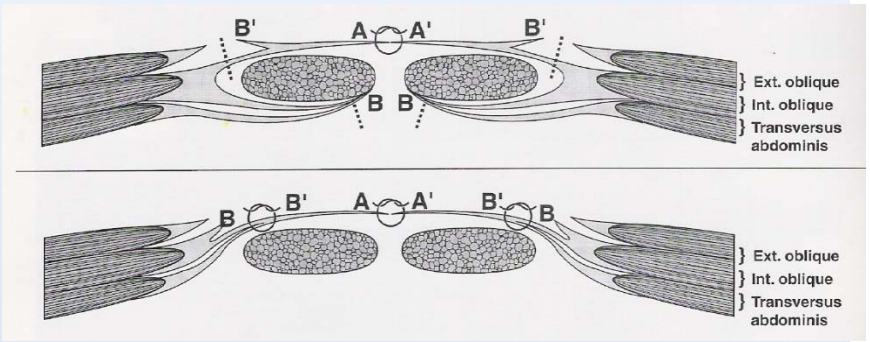
Reconstruction

COMPONENTS SEPARATION

- Internal oblique incised lateral to rectus and posterior rectus sheath incised down to arcuate line



- Lateral cut edge of post sheath brought anteriorly and sutured to lateral anterior fascial layer



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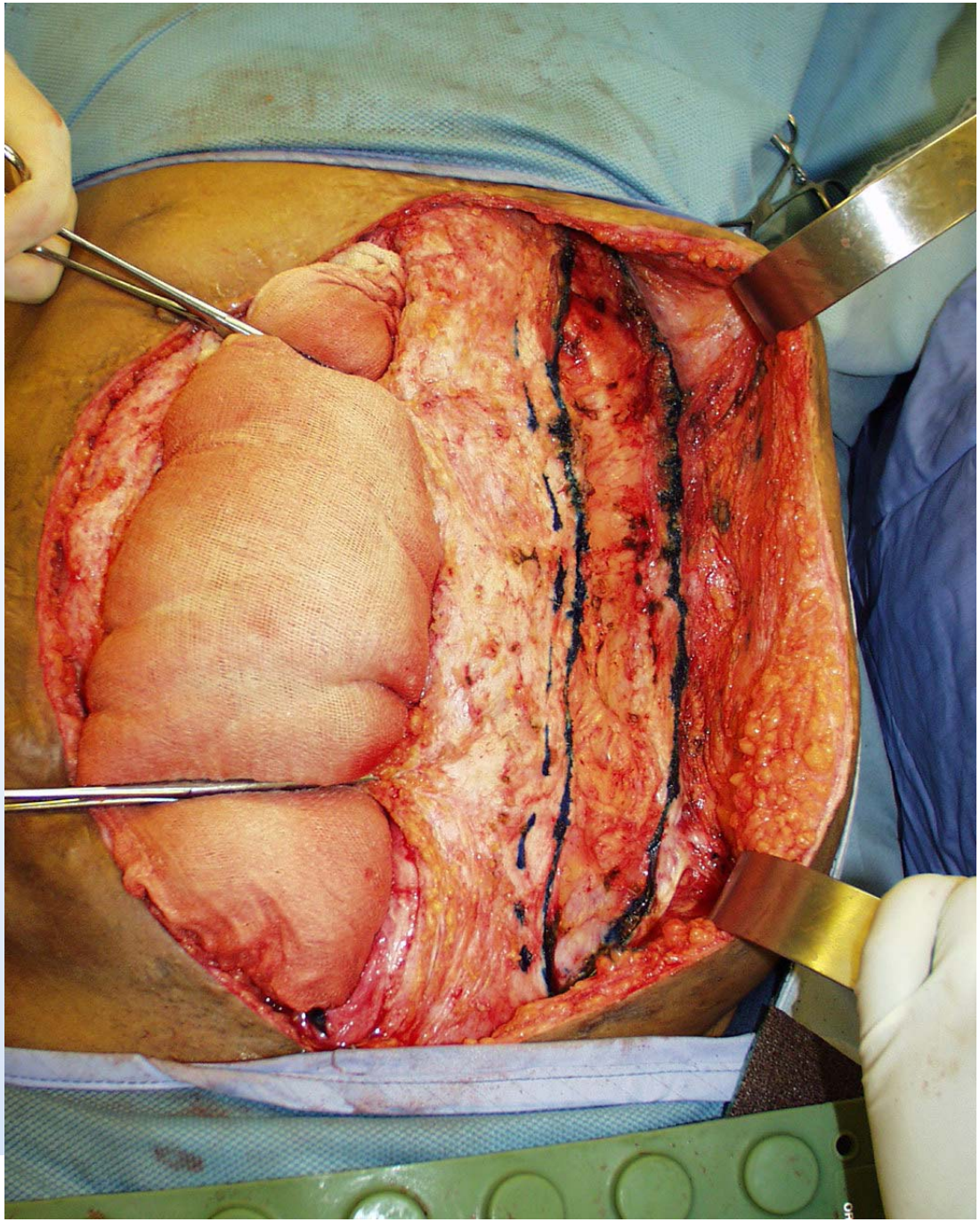
Reconstruction

If adequate fascia is not available after division of the external oblique aponeuroses,abdominal wall strength may be achieved by a variety of additional approaches.



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Reconstruction

Mobilization is accomplished by bilateral division of the external oblique aponeuroses via parasagittal incisions.

If division provides adequate fascia, approximation of subcutaneous tissue and skin may then be carried out for wound closure.

COMPLICATIONS OF THE OPEN ABDOMEN

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FACTORS CONTRIBUTING TO FISTULA

Bowel exposure to air

Negative pressure directly on viscera

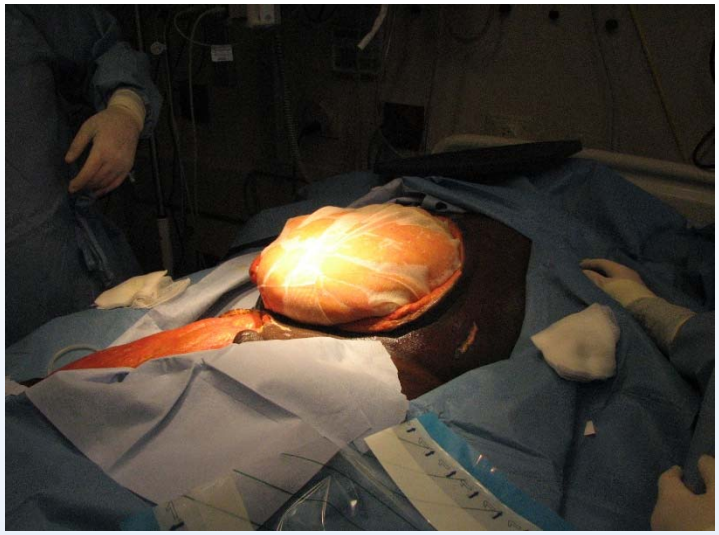
Bowel adherence to mesh

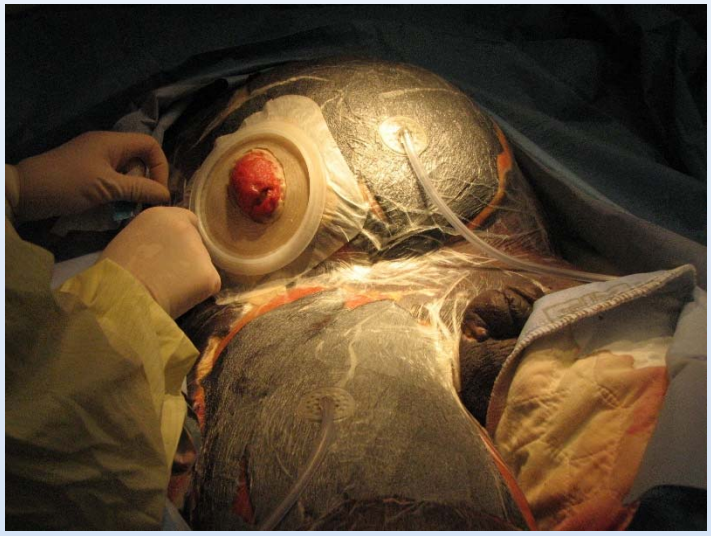
ENTERO-CUTANEOUS FISTULA

- Wound contamination
- Stoma appliances do not stick

Treatment

- Aggressive nutritional support
- TPN
- Somatostatin





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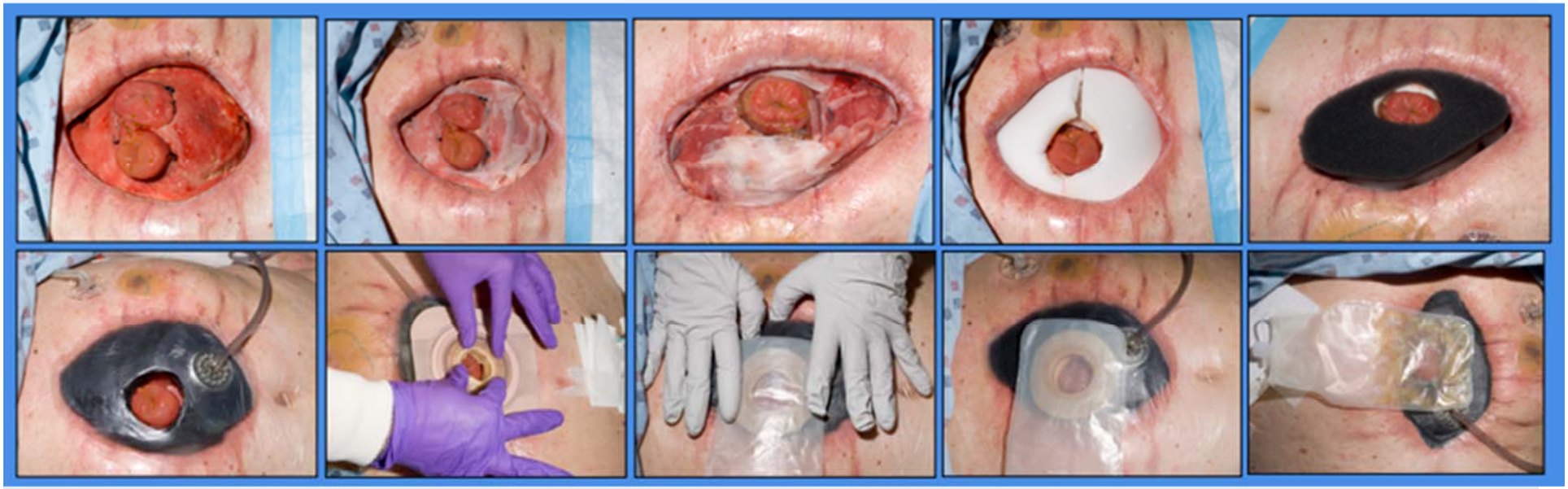

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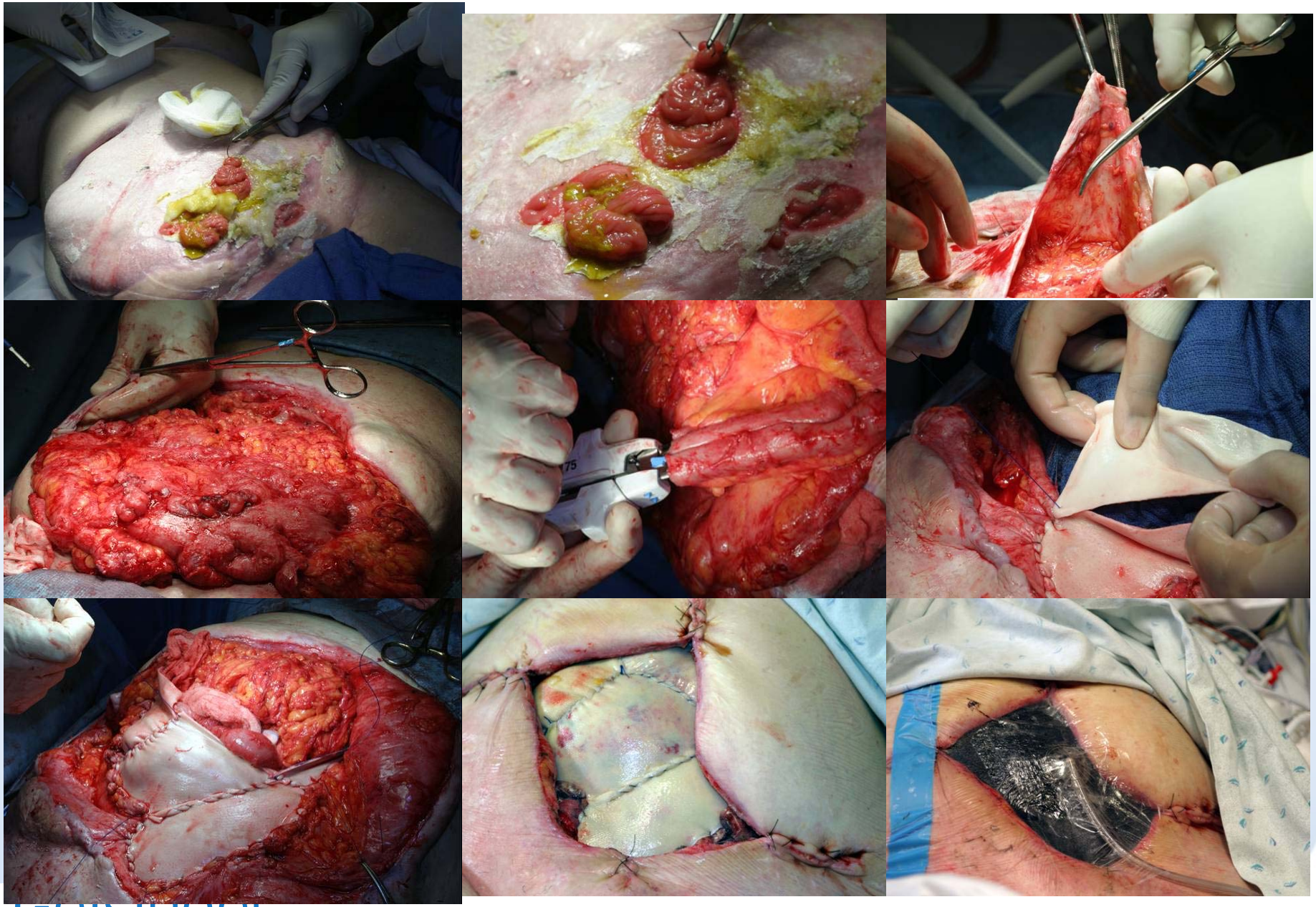

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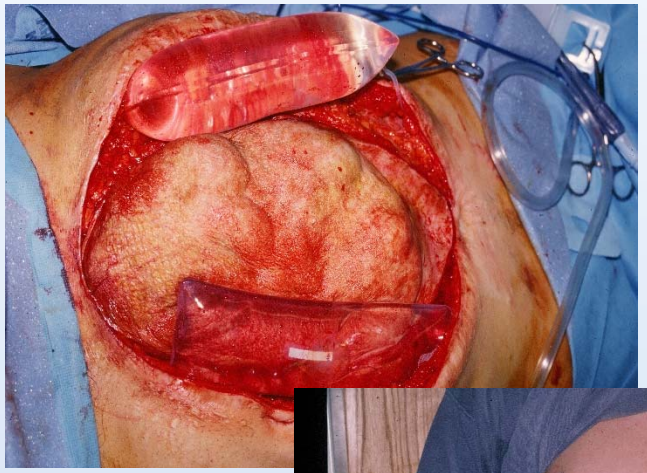
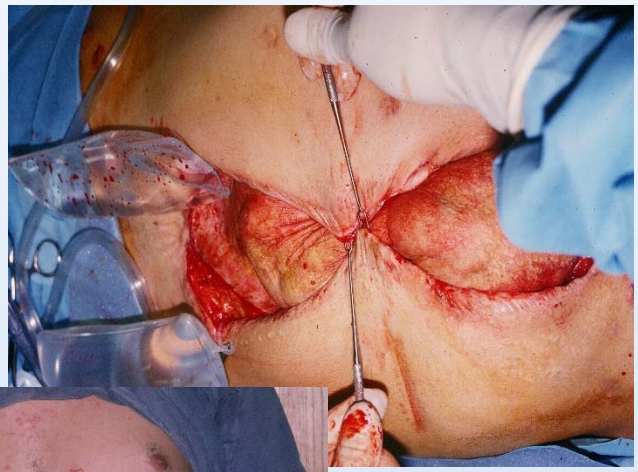


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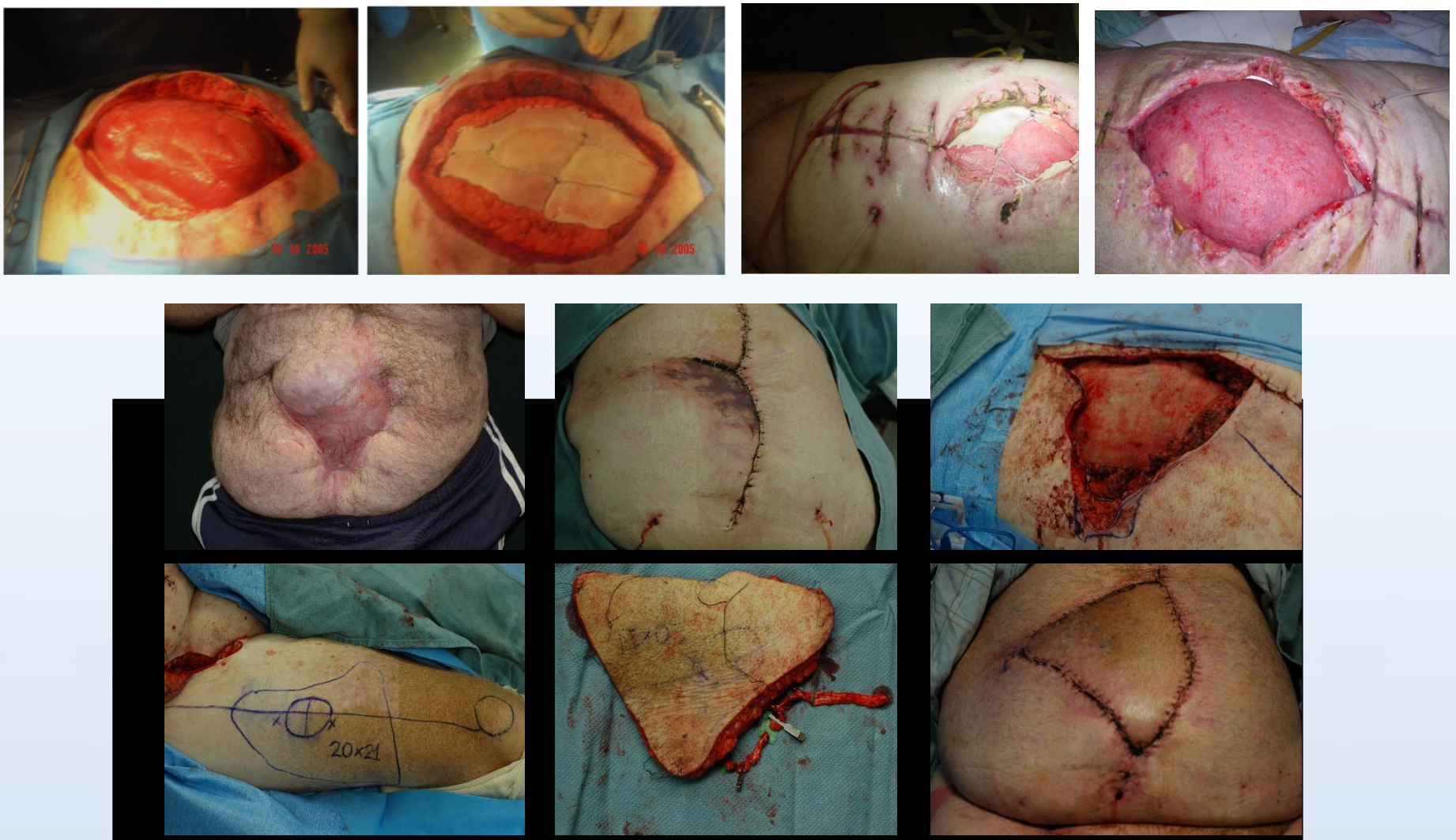
Conclusion



Reconstruction of these massive ventral hernia defects requires complex and creative planning and an approach

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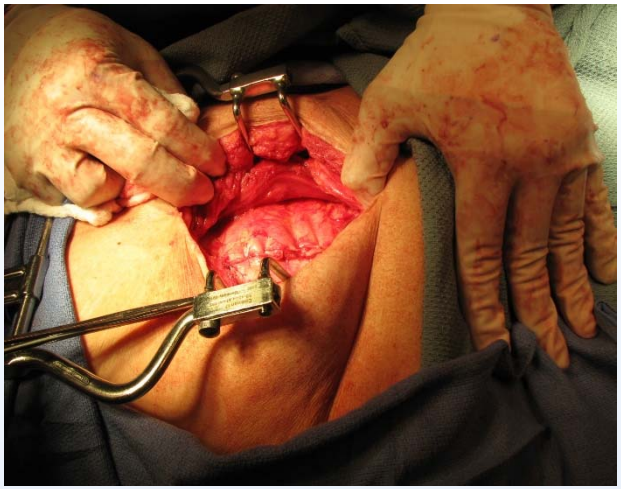
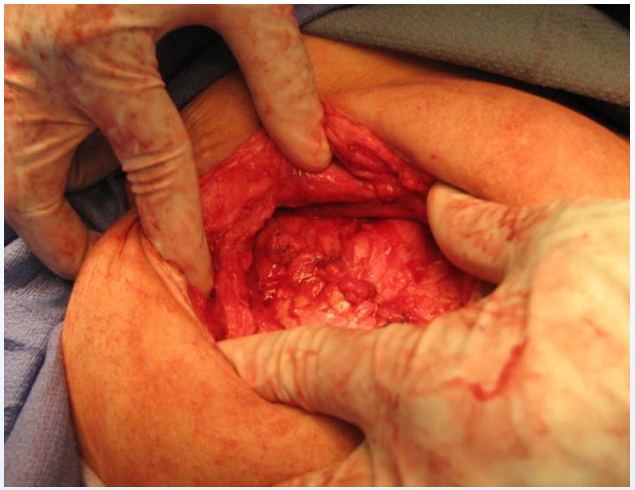
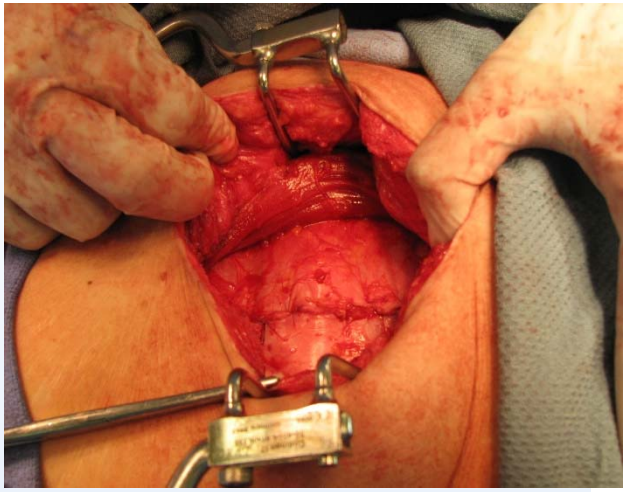
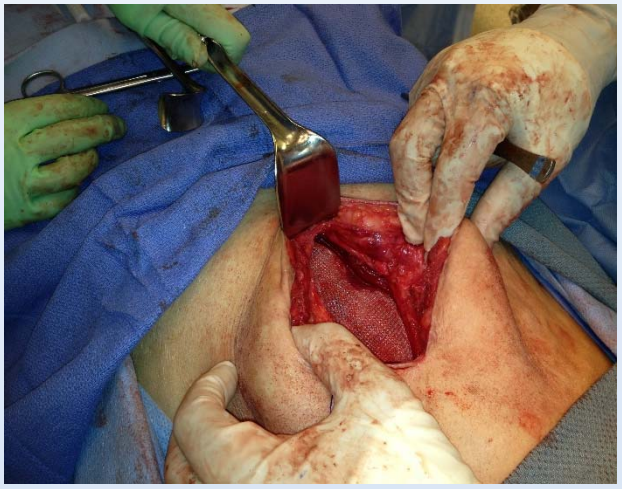
Conclusion




Careful reconstructive planning has led to the successful

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Conclusion

- **Damage control surgery is one of the major advances in surgical techniques in the past 20 years.**

- **Principles of damage control have not been readily accepted by surgeons around the world.**

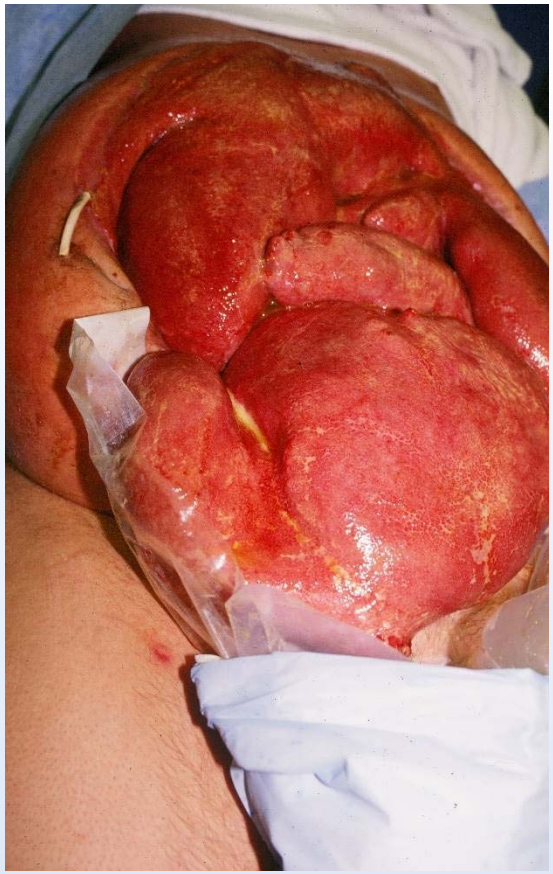
- **Damage control goes against most standard surgical teaching practices - that the best operation for a patient is one, definitive procedure.**

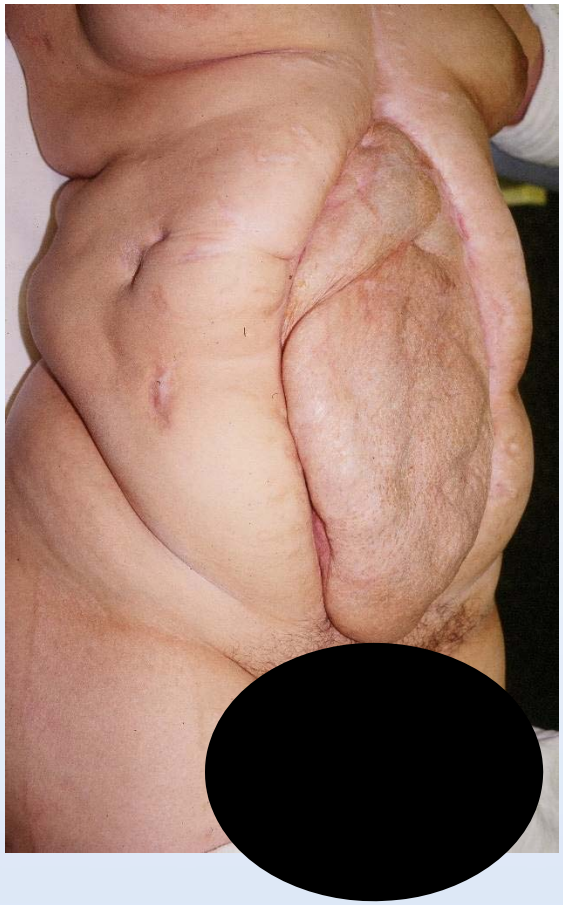
Conclusion

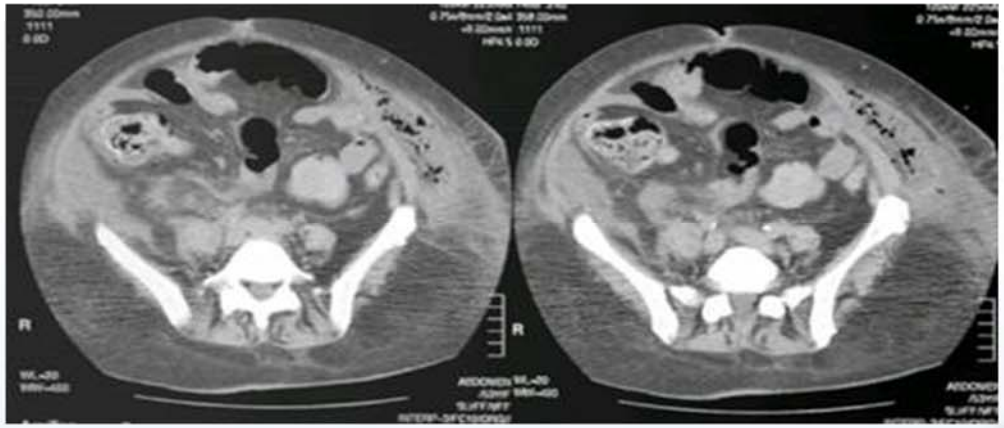
- It is now well recognized that multiple trauma patients are more likely to die from their intraoperative metabolic failure than from a failure to complete operative repairs.

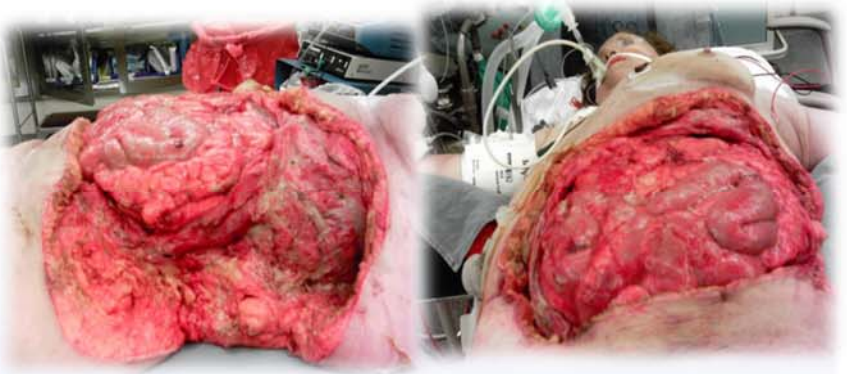
- Patients with major exsanguinating injuries will not survive complex procedures such as formal hepatic resection or pancreaticoduodenectomy.

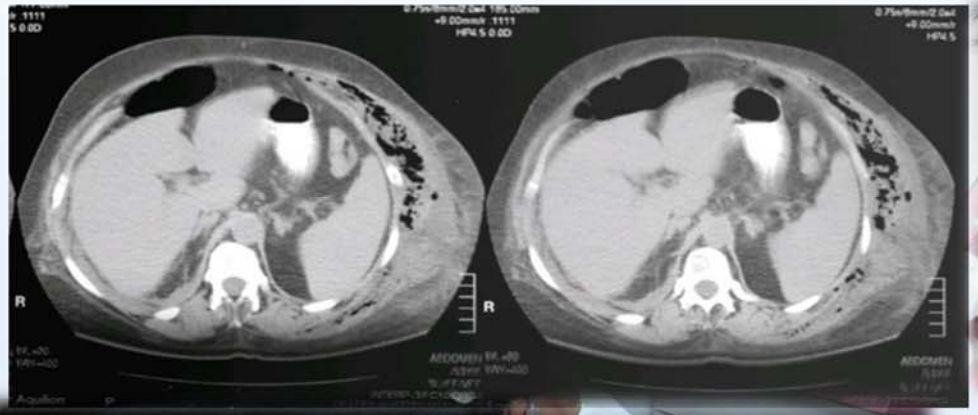
- The operating team must undergo a paradigm shift in their 'mindset' if the patient is to survive such devastating injuries.











WHY WE DO IT !

THANK YOU

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