

CLOSURE OF A DIFFICULT ABDOMEN

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Case Presentation

- 87 M c/o abd pain, N/V, obstipation x 2 days
- PMH: HTN, Afib, CHF, COPD
- PSH:
 - Ex-lap, SBR 1/22/2008
 - Ex-lap, LOA, SBR 1/29/2008
 - Tracheostomy 2/21/2008
 - Ex-lap, LOA, ventral hernia repair 3/23/2011
- SH: ex-ETOH use, ex-smoker

Admission 7/26/11

- VS: 98.7, 127/76, 100, 18
- PE: abd - distended, tympanic, rebound tenderness, surgical wound healing by secondary intention
- Labs: WBC 11.0, N 73%
- CT Abd: limited study, moderately distended small bowel loops in the mid-abdomen, small foci of free air in the ventral and lower abdomen





OR – 7/27/11

- Findings: markedly distended SB, an internal hernia, extensive adhesions forming multiple closed loop obstructions and pneumatosis intestinalis
- Operation: ex-lap, LOA, reduction of internal hernia, closure with biologic mesh
- EBL 50cc, IVF 5900cc, Albumin 500cc

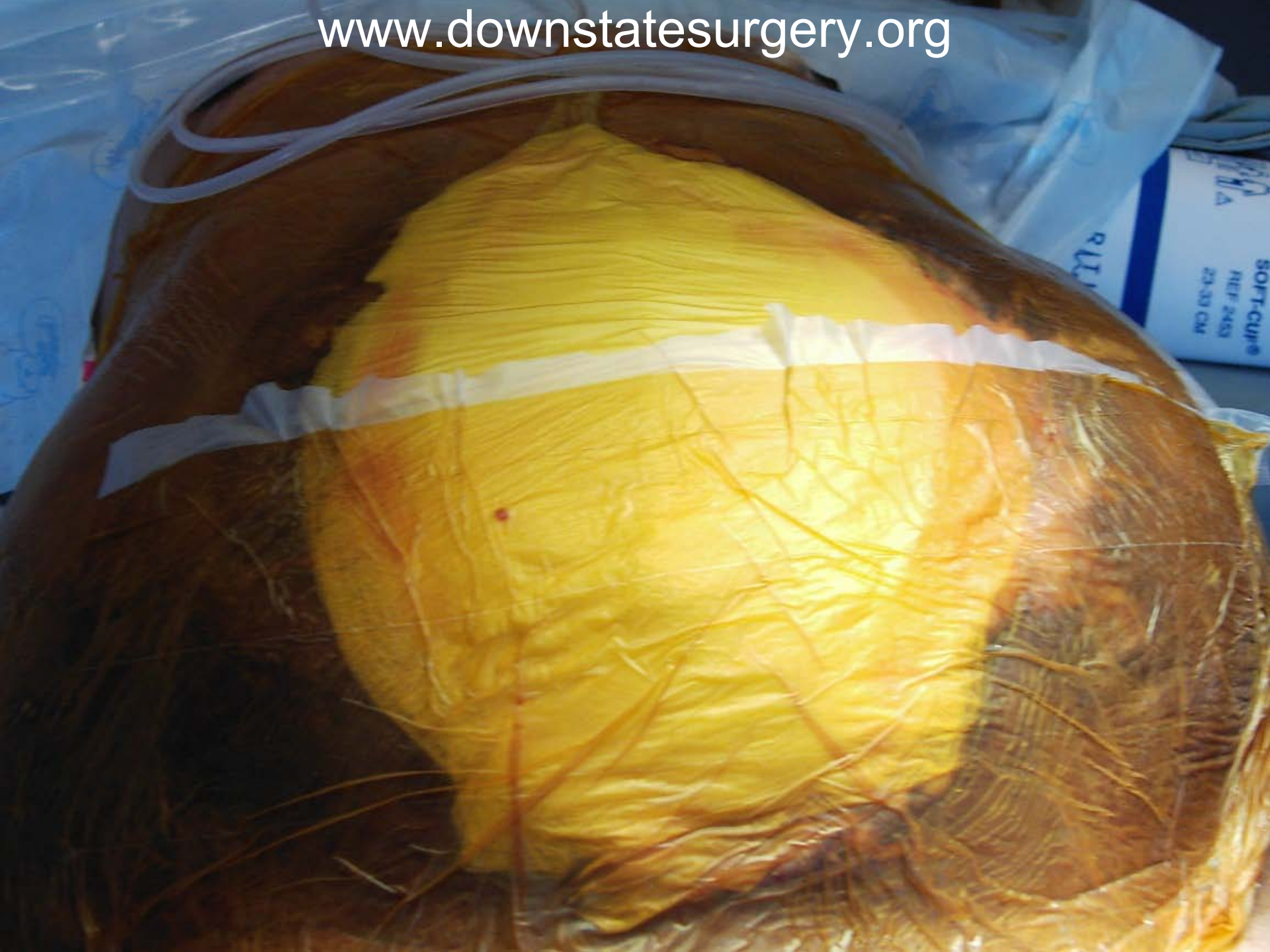
Post-Op Course

- POD3: WBC 18K (on cipro/flagyl)
- POD4: esmolol/heparin drip for Afib
- POD6: foley for retention
- POD7: TPN
- POD8: intubated for PNA
- POD10: extubated
- POD12: return of bowel function
- POD13: dehiscence, mesh infection
- POD14: OR – removal of infected mesh









Present State (POD15)



- VAC dressing changes q3 days
- Intubated
- On TFs
- On lovenox/digoxin for Afib
- On merrem/linezolid for multi-organism wound culture
- Plan: skin graft (good granulation tissue, clearance of infection)



Questions



Overview

- Damage Control Surgery
- Open abdomen with TAC
- Definitive closure
- Long-term reconstruction

Indications for Leaving the Abdomen Open

- Risk of IAH and subsequent ACS
- Damage Control Surgery
- Fascia cannot be closed
- Severe intra-abdominal infections or necrotizing fasciitis of the abdominal wall
- Planned repeat exploration or second look surgery



FIGURE 1 An abdomen that cannot be closed due to significant bowel edema and displacement of small intestine secondary to a massive retroperitoneal hematoma. This situation calls for a temporary abdominal closure.

Disadvantage of Temporary Abdominal Closure

- Fluid loss
- Need to keep patients intubated/sedated
- Systemic inflammatory response syndrome
- Risk of infection, sepsis, and fistula formation

Temporary Abdominal Closure

- Easily encompasses the bowel
- Is expansible but also sturdy
- Does not damage the fascia and prevents fascial retraction
- Contains and quantifies fluid loss
- Prevents adhesion formation between viscera and abdominal fascia
- Promotes removal of infectious materials
- Is quick to apply and remove
- Has a good primary fascial closure rate

Closure Technique	Description	Advantages	Disadvantages
Skin only	Serial application of towel clips or suture	Rapid	Does not prevent IAH, may interfere with radiography or angiography
Bogotá bag	3L IV bag, steri-drape, Silastic bag, plastic bag rapidly sutured to skin	Inexpensive, inert, nonadherent	Risk of evisceration, loss of abdominal domain, risk of IAH, fluid losses difficult to quantify
Absorbable mesh	Suturing of absorbable mesh to skin or fascial edges	Can be applied directly over bowel, allows for drainage of peritoneal fluid	Rapid loss of tensile strength (in the setting of infection), potentially large volume late ventral hernia, risk for bowel fistula, damage to fascial edges from repeated suturing
Whittmann patch	Suturing of artificial burr (Velcro) to fascia, staged abdominal closure by application of controlled tension	Good tensile strength, allows for easy re-exploration and eventual primary fascial closure	Poor control of third-space fluid, adherence of bowel to abdominal wall, potential for fistulas







Negative-Pressure TACs (VAC)

- **Fenestrated inner layer** of an inert, pliable material - prevents from forming adhesions to the abdominal wall, contains viscera, allows fluid movement
- **Middle layer of foam or towels** - helps generate suction, keeps the bowel moist, provides support
- **Outer layer** to create an airtight seal around the entire apparatus and enable measurement of fluid loss and generation of negative pressure through the dressing

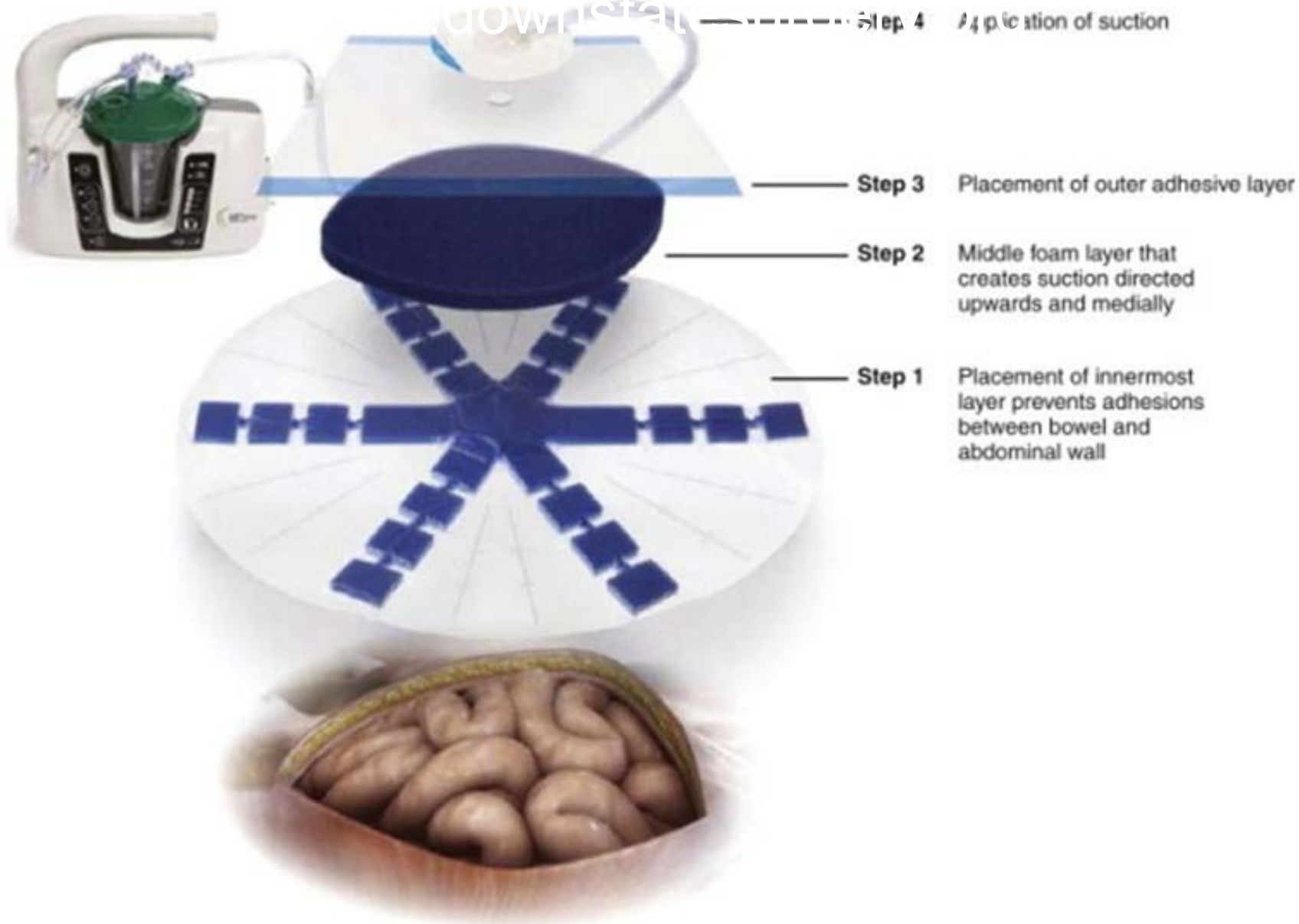


FIGURE 2 The ABThera VAC system (Kinetic Concepts, Inc.) that is currently replacing their VAC open abdomen system. Recently introduced in the United States, the ABThera features a foam that extends out laterally to assist in volume removal.



FIGURE 3 Placement of innermost layer for the ABThera VAC which uses an innermost layer with an embedded foam that fans out laterally, which makes it easier to apply and also assists in lateral paracolic fluid and effluent removal.



FIGURE 5 Application of a VAC dressing after two take-backs and construction of an ileostomy. Note the ostomy is placed very laterally.



FIGURE 6 The Barker vacuum-pack technique. **A**, The polyethylene sheet is perforated multiple times with a scalpel blade. **B**, The sheet is placed over viscera and beneath the peritoneum/abdominal wall. **C**, A moist towel is placed over the polyurethane and positioned below the skin edges. **D**, Suction drains are placed. **E**, An outer adhesive dressing is applied, and the drains are hooked up to wall suction.

Outcomes of Vacuum-Based Temporary Abdominal Closures

- Primary fascial closure rate 70-80%
- Mean closure time is 6-10 days
- 15% complication rate
 - Fistula formation 5-7%
 - Intra-abdominal abscess 4-6%
 - Delayed small bowel obstruction 4%

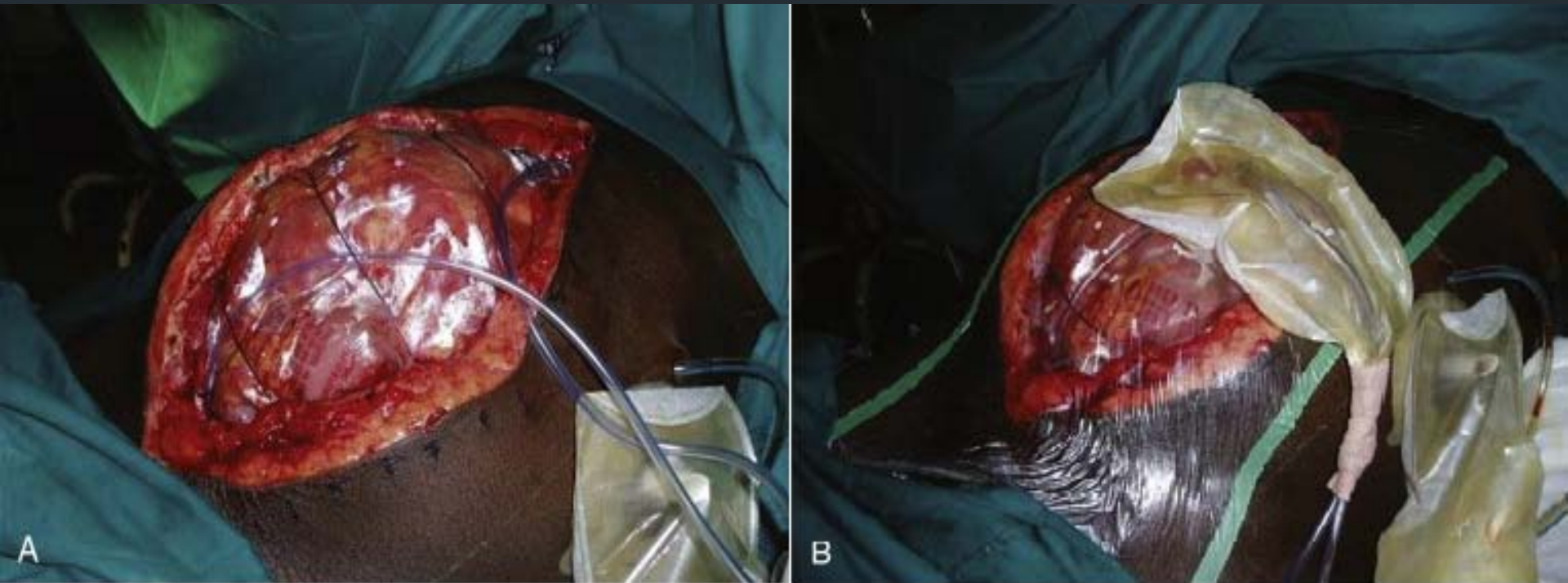


FIGURE 7 Modified sandwich vacuum-pack technique from South Africa. A sturdier inner plastic material is used, and suction is generated using nasogastric tubes. Three large fascial sutures are also placed. To ensure an airtight seal, the nasogastric tubes are brought through the outer adhesive layer through ostomy bags.

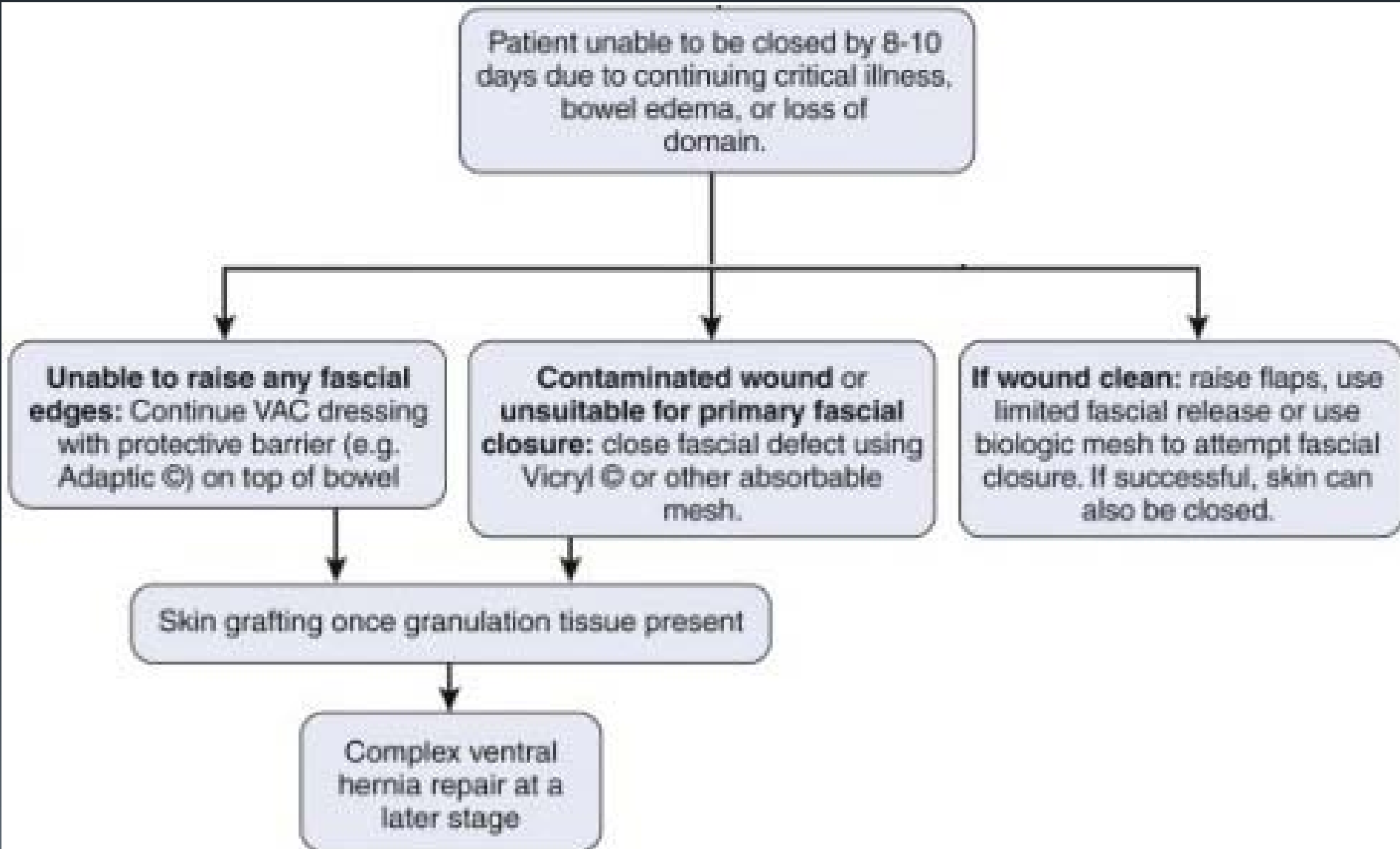
Initial Management

- Stabilize, resuscitate, and prepare the patient for the next step toward closure of the abdomen
- Return to the OR within 48 to 72 hours for re-exploration and possible definitive closure
- If cannot be closed on the first trip back to the OR, the same principles that dictated leaving the patient open in the first place will apply

Subsequent Take-Backs to OR

- Every 2-3 days return to OR for washouts
- Each visit the fascia is brought together by tension-free sutures
- By the 3rd-4th visit, fascial approximation is usually possible
- Patients who remain open at day 8 are unlikely to have a primary closure
- Increased risk for serious complications, including wound infections and fistulas

Alternative Closure Techniques



Definitive Closure of the Abdomen

- 1st choice – primary closure
- Optional retention sutures
- Avoid closure under tension



FIGURE 10 Open abdomen after several days of a temporary abdominal closure, where the fascia cannot be primarily closed and a mesh closure is required.

Closure When Fascia Cannot be Primarily Reapproximated

- Raise skin flaps
- Release lateral obliques
- Full component separation not recommended in an acute setting
- Mesh (biologic, absorbable, composite)

Biologic Mesh

- Promotes tissue regeneration and revascularization
- Can be used in a contaminated field, but not in heavily infected fields (matrix disintegrates)
- Has a tendency to develop significant laxity
- Overlying skin wound should be closed to promote incorporation of the mesh
- Hernia rate with Alloderm is ~17%
- Few complications are reported

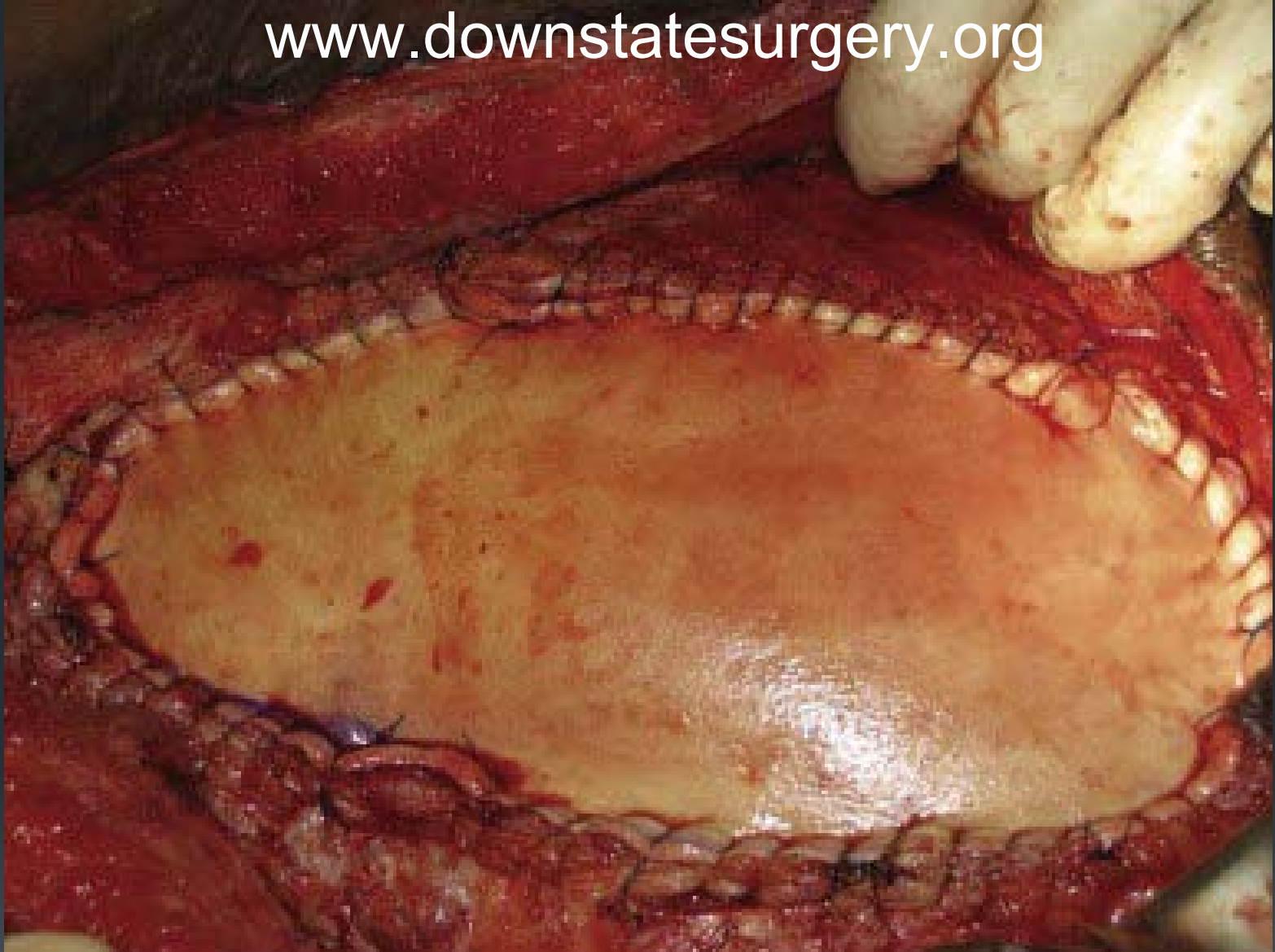


FIGURE 9 HADM (Alloderm) used as an interposition mesh where the fascia could not be primarily closed. Note that the HADM is placed, stretched, and sutured in as tautly as possible.

Absorbable Mesh

- If the wound is infected
- If the fascial defect is extremely large

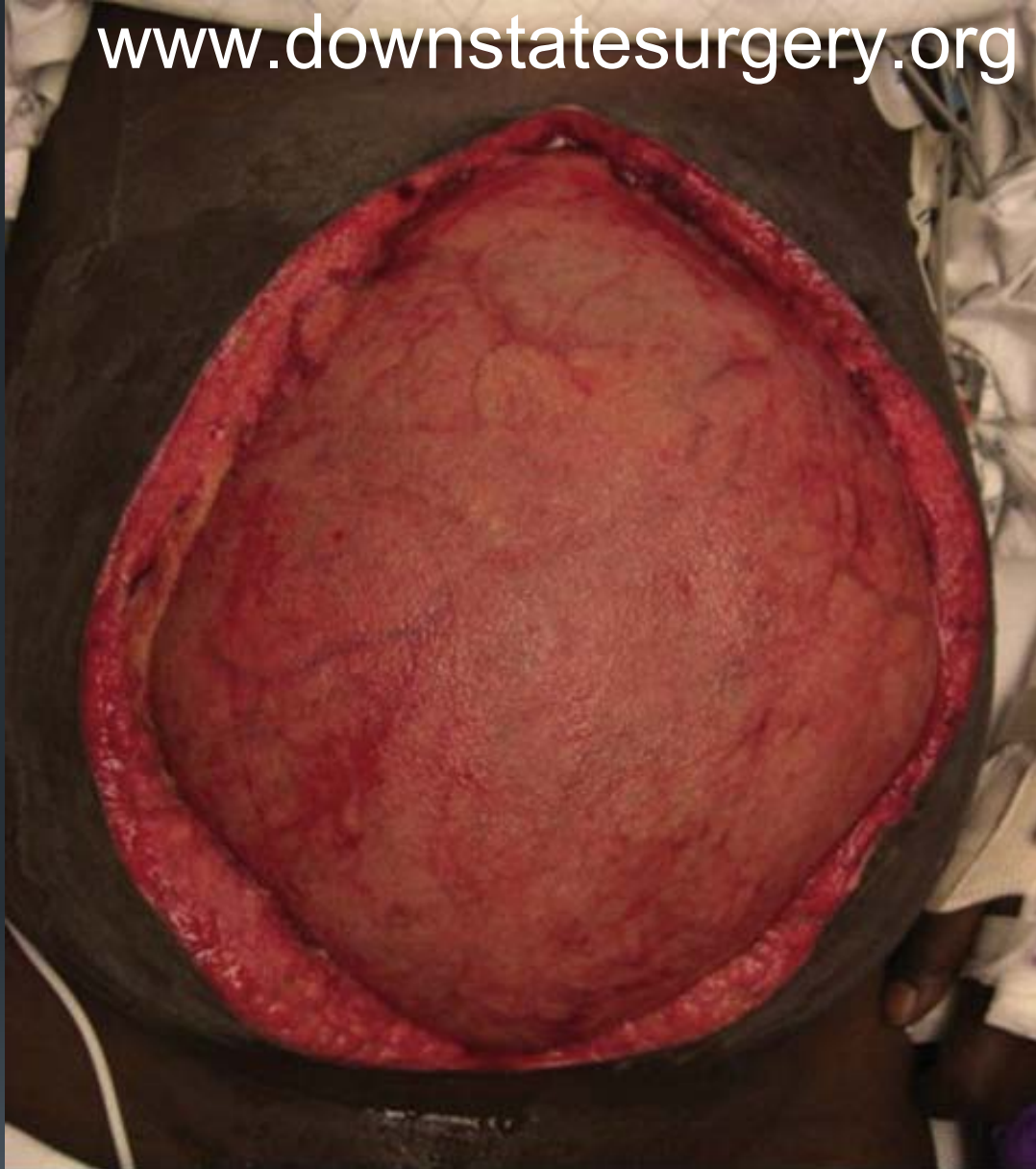


FIGURE 11 Open abdomen with fascia completely retracted. Healthy granulation tissue above the bowel allows direct placement of a split-thickness skin graft without underlying mesh. The patient will develop a large ventral hernia.

Long-Term Management and Closure

- Allow sufficient time for remodeling of any adhesions
- Key indicator - ability to completely pinch the skin away from the underlying mesh
- Obtain assistance from plastic surgeons if tissue expanders or complex tissue rearrangement is required
- Patients develop large ventral hernias after an open abdomen



FIGURE 12 Large ventral hernia after closure of the fascia with Vicryl mesh (Ethicon) and placement of split-thickness skin graft.



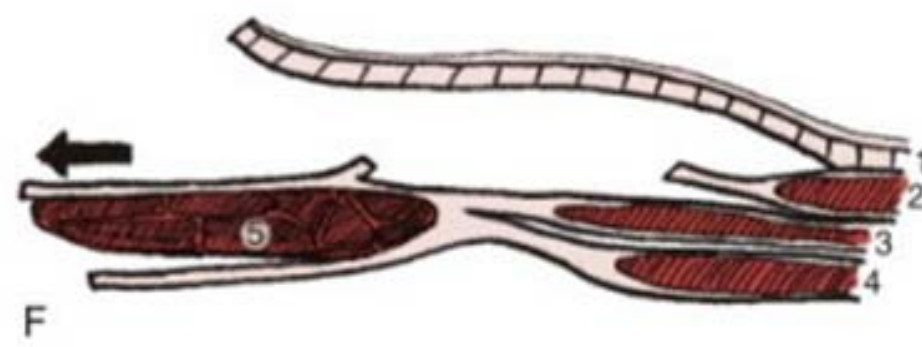
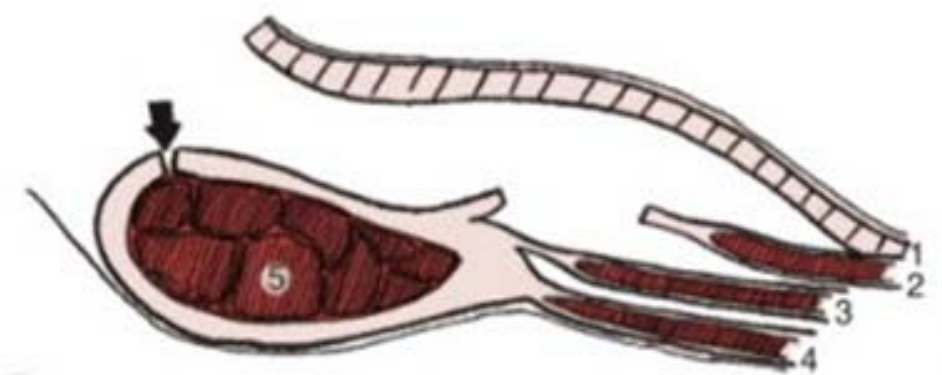
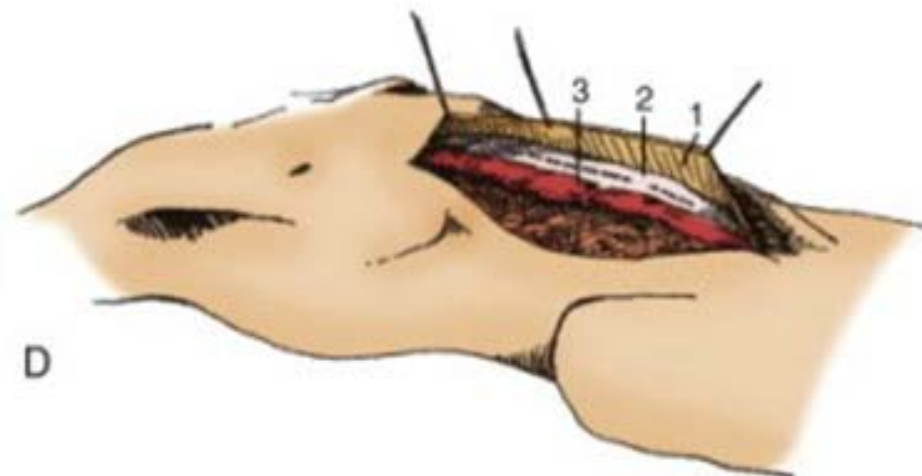
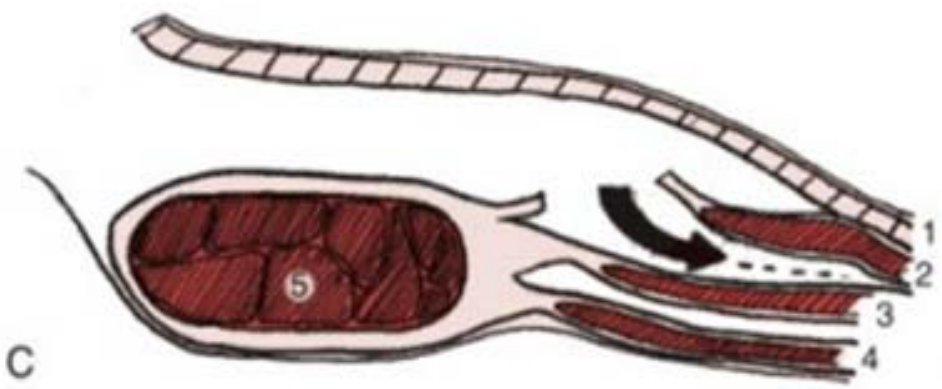
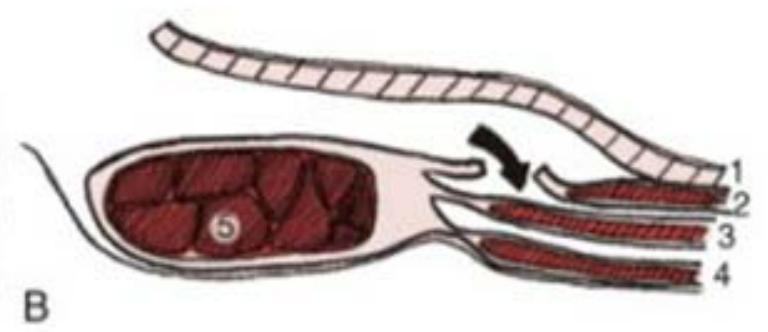
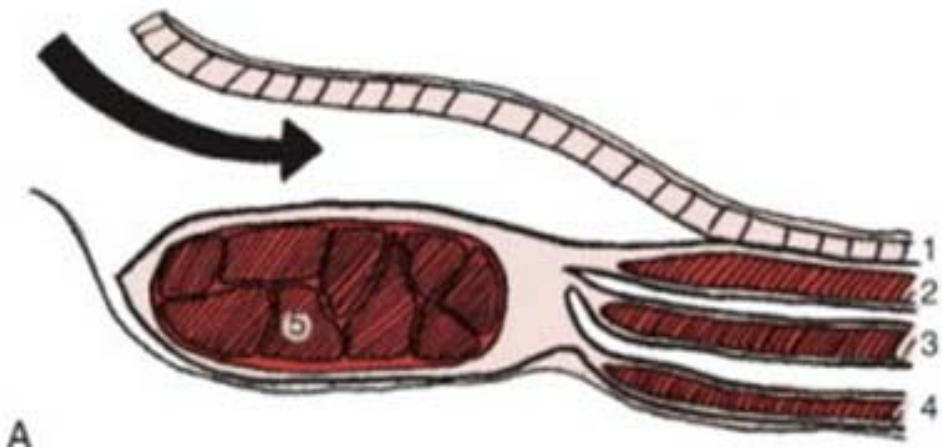
FIGURE 13 The overlying skin graft can be easily pinched and lifted off the underlying structure, suggesting that the patient is ready for a ventral hernia repair. Note placement of tissue expanders.

Repair of Hernia after an Open Abdomen

- Place tissue expanders prior to surgery if necessary
- Excise the skin graft and completely remove mesh
- Perform lysis of adhesions to release viscera from overlying fascia
- Re-approximate fascia
- Place onlay mesh on top of the fascia for reinforcement
- Place drains under skin flaps

Definitive Fascial Closure

- Raise large skin flaps, dissect skin and subcutaneous tissue from anterior fascia
- Perform component separation
 - Longitudinally transect external oblique aponeurosis
 - Posterior sheath of the rectus may be similarly transected to gain further length
- Mesh can be placed as an underlay or as an interposition graft (biologic mesh preferred)



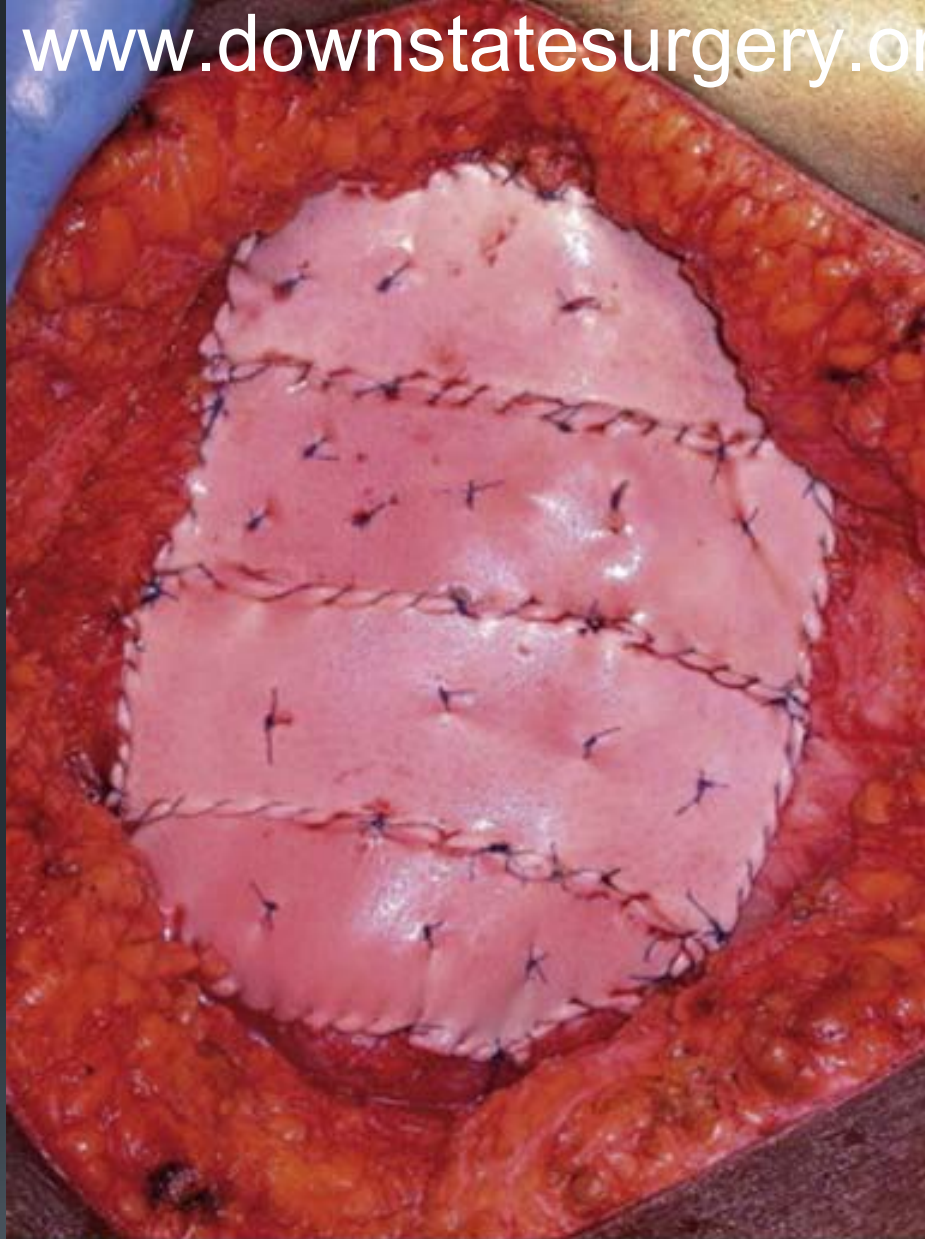


FIGURE 15 HADM (Alloderm) onlay mesh placed after component separation technique was used to primarily repair a large ventral hernia. Note that the HADM extends out laterally past all fascial incisions.

Temporary closure of the open abdomen: a systematic review on delayed primary fascial closure in patients with an open abdomen.

Boele van Hensbroek P, Wind J, Diikgraaf MG, et al.

- Literature review of 154 abstracts of TAC techniques
 - vacuum-assisted closure
 - vacuum pack
 - artificial burr
 - Mesh/sheet
 - silo
 - skin closure
 - dynamic retention sutures (DRS)

Temporary closure of the open abdomen: a systematic review on delayed primary fascial closure in patients with an open abdomen.

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- Highest FC rates and lowest mortality rates
 - Artificial burr -- 90% & 17%
 - DRS -- 85% & 23%
 - VAC -- 60% & 18%

References

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