

MANAGING INTRAOPERATIVE HEMORRHAGE

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CONFLICT OF INTEREST



Nothing to disclose

LEARNING OBJECTIVES

- Increased awareness of predisposing factors for intraoperative hemorrhage
- More cognizant of modern topical agents to control bleeding
- Be able to develop a calm, stepwise approach to severe intraoperative hemorrhage

INTRAOPERATIVE MISADVENTURES

- Bowel injuries
- Ureteral injuries
- Bleeding

PREDISPOSING FACTORS

- Alcoholism – obtain LFT and coagulation studies
- HX bleeding – suspect Von Willebrand's disease – (most common congenital platelet disorder)
- Stop ASA, NSAIDS and certain medications (Coumadin, Plavix) 7 days preop
- PTS with poor nutrition are at risk

ALTERNATIVES

- Beta Carotene
 - Vitamin E, fish oil
 - Garlic, Ginko; Ginseng
 - St. John's wort
 - Stop 5 – 7 days preop
- Ang – Lee, et al: JAMA 7/2001

PREDICTIVE LAB: TESTS AND BLEEDING

- PT and PTT must be significantly prolonged
- Thrombocytopenia and hypofibrinogenemia are associated with clinical bleeding
- Platelets: 10-20,000 needed for hemostasis
50,000 needed for surgery or any invasive procedure

REDISPOSING FACTORS- INTRA OP. CONDITIONS

- Inadequate incision
- Inadequate retraction
- Inadequate anesthesia
- Low core body temperature
- Severe adhesions
- Obesity
- Large vascular tumors

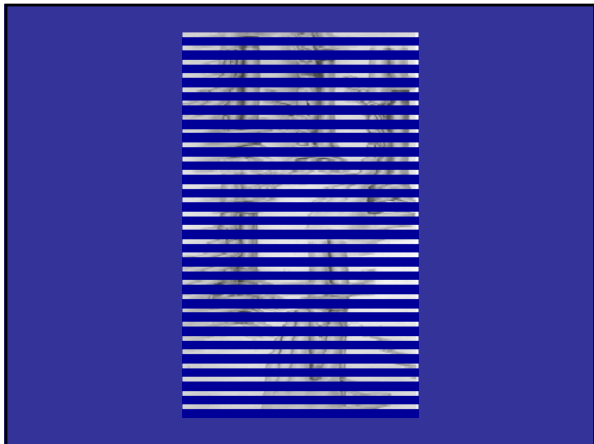


GREAT VESSEL INJURIES - CAUSES

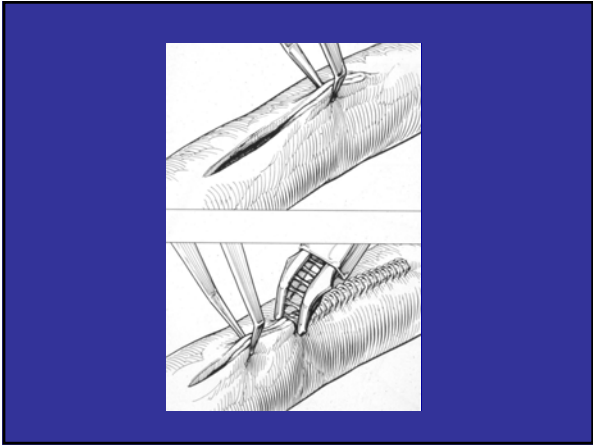
- Laceration during PA node dissection – the “fellow’s vein”
- Avulsion IM vessels when retracting the sigmoid
- Laparoscopy – needle or trocar range from 1/10,000 to 1/30,000 procedures “open procedures” about 1/10,000 operations

GREAT VESSEL INJURY - REPAIR

- Pressure – stabilize the patient
- Compression proximal and distal
- Allis clamps on torn edges – elevate
- Alternative – Satinsky or bulldog clamps
- 5-0 or 6-0 nylon or MFPP on CV needle
- Use running or mattress technique
- VCS clips (staples)









PELVIC BLEEDING-GENERAL PRINCIPLES

- Immediate pressure – finger preferred – sponge stick is alternative
- Obtain exposure – obtain assistance
- Secure individual vessels with fine clamps and sutures
- Avoid excessive cautery
- Minimize clamps

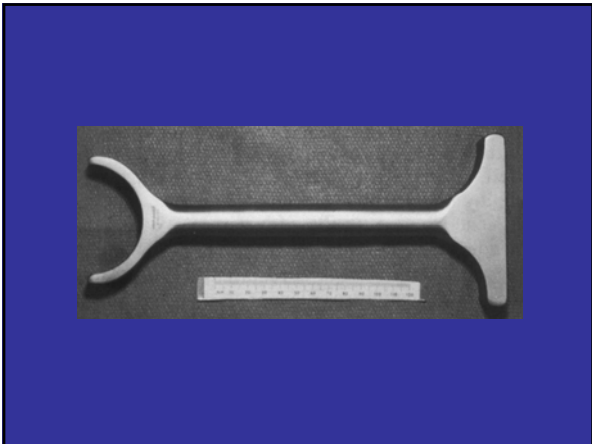
PELVIC BLEEDING – GENERAL PRINCIPLES

- Insert packs carefully to avoid tearing veins
- Place and remove packs sequentially (side to side)
- If bleeding site unrecognized – pressure on aorta
- Persistent pelvic oozing – HAL or pack
- Hot or cold packs can be used

PELVIC BLEEDING – CONN AORTIC COMPRESSOR*

- Pressure can be maintained for 1 to 2 hours without danger to extremities
- However, intermittent brief pressure interruption is recommended.

Pilling – Weck, Research Triangle Park, NC



PELVIC BLEEDING – FURTHER TIPS

- Avoid a main cause for uncontrolled bleeding - **PANIC**
- Never place clamps or sutures blindly
- Never use electrocautery for large lacerations
- Consider additional careful dissection to free vessel tip

COMPONENT REPLACEMENT, GUIDELINES

- For every 8 units RBC replaced – give 2 units (500 ml) of FFP
- >10 units RBC replaced – give 10 units of platelets – preferably at end of procedure
- PT or PTT prolonged – give 2 units of FFP
- Fibrinogen < 100 – give 2 units of cryoprecipitate

NIH Consensus, 1988

“NEW” COMPONENT REPLACEMENT

- Use FFP with ratio 1:2 with units of RBC early in resuscitation
- Continue until clinical situation stabilizes or PT clearly has no coagulopathy
- Then target component transfusion ie platelets given if count < 50,000

Holcomb, et al. J Trauma, 2007

Gonzales, et al. J Trauma, 2007

HAEMONTIES CELL SAVER

- Blood removed from operative field, anticoagulated, washed and RBC separated
- RBC reinfused through a filter
- **REQUIRES A TRAINED TECHNICIAN**
- Contraindications: malignant disease or bacterial contamination in operative field
- Accepted by many Jehovah's Witnesses

PELVIC BLEEDING- TOPICAL HEMOSTATIC AGENTS

- Thrombin
- Surgicel
- Gelfoam
- Avitene
- Fibrin glue, sealants

PELVIC BLEEDING –HEMOTATIC AGENTS

- Thrombin – powder or solution
Mech: clot formation with fibrinogen
Use: oozing vencules, capillaries – **PRESSURE**
- Surgicel – oxidized regenerated cellulose
Mech: acidity aids in vessel retraction
Use: raw surfaces - **PRESSURE**

PELVIC BLEEDING – HEMOSTATIC AGENTS

- Gelfoam – gelatin sponge
Mech: traps blood in mesh
Use: raw surfaces – **PRESSURE**
- Avitene- microfibrillar collagen hemostat
Mech: plat. aggregation and adhesion = thrombin
Use: raw surfaces – place when “dry” – **PRESSURE**
Caution: Works poorly with thrombocytopenia, avoid use near ureter

FIBRIN GLUE - HEMOSTATIC AGENT

- Biodegradable tissue adhesive
 - Equal amounts of cryoprecipitate and thrombin
 - Used in cardiovascular surgery, trauma
 - 2 cases catastrophic gyn. bleeding successfully managed
- Malviya, Deppe: Obstet Gynecol 2/88**



FIBRIN SEALANTS

- TISSEL VH- Baxter Healthcare Corporation
- CROSSEAL- Johnson and Johnson Wound Management
- Equally effective

INDICATIONS FOR FIBRIN SEALANT

- C-V surgery- (COSEAL)
- Prevention and RX of CSF leaks in neurosurg.
- Thoracic surgery- prevention and RX of air leaks
- Trauma surgery, prostatectomy
- Reconstructive surgery, ex. face lifts
- Axillary node dissection

Albala, Lawson: J Am Coll Surg 4/06

FLOSEAL MATRIX

- Collagen derived granules plus topical thrombin
- A high viscosity gel for hemostases
- Effective on wet/actively bleeding tissue
- “Package to patient” in 2 minutes
- Hypogastric v. (Carlson)

FLOSEAL MATRIX

- When hydrated with blood, granules expand. Thus, continuous contact with bleeding – tamponade effect
- 20% “swelling” by 10 minutes

Baxter Health Care Corp

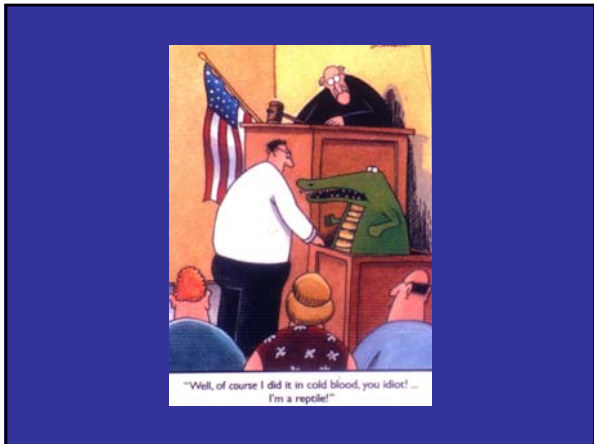
ADVERSE EVENTS

- If injected directly into a vessel, FloSeal can cause clotting
- Use in infected patients, can result in abscess
- Rare allergy to bovine thrombin can lead to antibodies against Factor V - **hemorrhage**



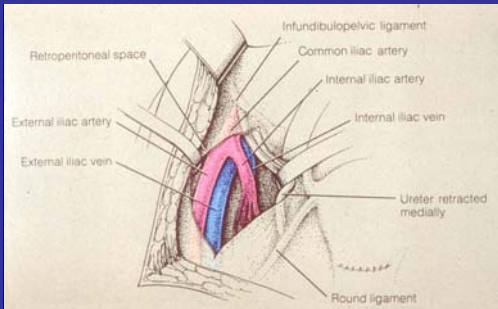
APPROXIMATE COSTS

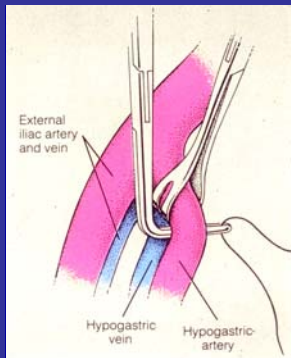
Gelfoam	\$ 30
Surgical	\$ 50
Avitene	\$100
FloSeal	\$180/5ml
Tissel	\$400/5ml



HYPOGASTRIC ARTERY LIGATION

- Identify common iliac bifurcation
- Retreat ureter medially
- Pass right angle clamp distal to post. division
- Pass clamp lateral to medial – “hug” artery
- O silk sutures x 2
- Palpate femoral pulses
- Consider ligation ovarian a. with intact uterus
(medial mesosalpinx)





HYPOGASTRIC ARTERY LIGATION

- ↓ in pulse pressure is most dramatic change
 - Bilateral yields 85% reduction
 - Unilateral yields 77% ipsilateral
 - ↓in mean arterial pressure
 - Bilateral yields 24% reduction
 - Unilateral yields 22% ipsilateral
- Burchell, 1986**

PELVIC BLEEDING: HYPOGASTRIC VEIN AREA

- Retract ureter out of harm's way
- Identify obturator nerve – protect
- Clip obturator a. and v.
- Use a running 2-0 MFFP suture

PELVIC BLEEDING: CLAMP PLACED BUT UNABLE TO PLACE SUTURE

- Leave clamp on
- Pack
- ICU – stabilize
- Reoperate 48 hours

**PRESACRAL VEIN INJURY -
CAUSE**

- Presacral neurectomy
- Sacrocolpopexy
- Posterior exenteration

**PRESACRAL VEIN INJURY-
MANAGE**

- Sew in “sandwiches” of Avitene alternating with Gelfoam
- Bipolar cautery or bone wax
- Stainless steel thumb tacks

Khan, 1987

Pastner and Orr, 1990

Timmons, 1991



PRESACRAL VEIN – “WELDING”

- Harvest 2x1 cm of rectus muscle
- Forceps used to press against veins
- Cautery at highest “pure cut” setting for 10 minutes
- 20 cases – all successful

Xu and Lin, 1994-Miklos, 1996 – Harrison, 2003

MAST SUIT

- Use to stabilize **PT** while preparing for surgery
- Transfers blood to vital organs, promotes venous return
- Inflate legs, then abdomen – up to 48 hours
- Contraindications: Pul. edema, left ventricular dysfunction, rupture of diaphragm.

ARTERIAL EMBOLIZATION

- Angiographic insertion of Gelfoam pledgets or endospheres
- 90% effective in postop. hemorrhage
- Has no significant effect on later fertility if done for P.P. hemorrhage
- Can be done intraoperatively

EMBOLIZATION CAUTIONS

- Can require 1 to 2 hours to perform.
- Inappropriate in PTS with severe hypovolemic shock
- **Complications:** 6 to 8%
 - P.O. fever (2-3 days)
 - Reflux of embolic material, none target embolization
 - Foot ischemia, late rebleeding

PELVIC BLEEDING: PERSISTENT - PACK

- Logothetopoulos (parachute) pack
- Masterson pack
- “Pack and Go”

PACKS FOR INTACT UTERUS

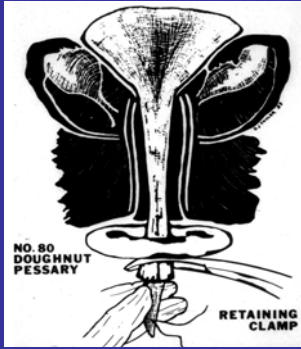
- Foley
- Torpin
- Bakri tamponade balloon (also for GTN)

MASTERSON'S PACK

- Pack with Kerlex or large gauze
- Bring pack out through vagina or separate stab wound
- Disadvantage: If not gently teased off with saline drip assistance, vessels or bowel may be torn and injury not recognized.







**PELVIC BLEEDING: PACK AND GO
(DAMAGE CONTROL SURGERY)**

- 2 inch gauze or Kerlex – tightly pack over fibrin glue bed from side to side
- Towel clip or running suture- **skin only**
- Place patient in ICU – stabilize
- Reoperate and remove pack about 48 hours
- Use saline drip assistance





**NEW – EVITHROM
(HUMAN THROMBIN)**

- Derived from pooled human plasma
- “An aid to hemostasis – oozing blood and minor bleeding from capillaries”
- Topical, and safety = to bovine thrombin
- Approved by FDA
- US distributor – Johnson and Johnson

**RECOMBINANT
ACTIVATED FACTOR VII A**

- Originally developed to treat hemophilia
- IV dose of 60 micrograms/kg bolus
- 2 case reports of successful control

Danilo’s, et al: *Obstet Gynecol* 6, 2003
Bouwmeester, et al: *Obstet Gynecol* 6, 2003

RECOMB. FACTOR VII A IN TRAUMA

- 301 PTS: Placebo vs NovoSeven
- Fewer transfusions and lower rates of massive transfusion in treatment group
- Equal amount of thromboembolic events

Boffard, et al: J Trauma 7/2005

NOVOSEVEN (NOVO-NORDISK)

- No randomized gyn trials
- 1/2 life is about 2 hours
- Start low with 40 to 60 micrograms/kg bolus IV
- Repeat every 2 hours

AE with r VII A

- Thromboembolic events in elderly with ASD – strokes, MI
- COSTS: NovoSeven is expensive - about \$1400/milligram

CASE REPORT

- 27 y/o with prior section – US suspicious for placenta “adherent to bladder”
- Classical “C section”
- Placenta densely adhered to bladder
- Placenta left in situ
- No methotrexate given

CASE REPORT (CONT.)

- 8 weeks later – abnormal fibrinogen, PTT, and D & E attempted
- Massive bleeding – immediate - TAH
- G.O. consult for cuff bleeding - HAL
- Bleeding persisted – 65 units packed RBC plus cell saver
- “Pack and Go” over fibrin glue – skin closed with towel clips
- Reexploration in 36 hours - hemostatic

SUMMARY MUMC SERIES

- EBL – 4,000 – 16,000 ml (mean 7,667 ml)
 - None had posterior accreta, increta or percreta
 - All survived
- Inge, et al. J Pelvic Surg, 2000

PREDISPOSING CAUSES OF ACCRETA

- Prior Cesarean delivery
- Prior previa (50% in MUMC series)
- Prior myomectomy
- Prior uterine surgery
- Maternal age > 35
- Asherman's syndrome

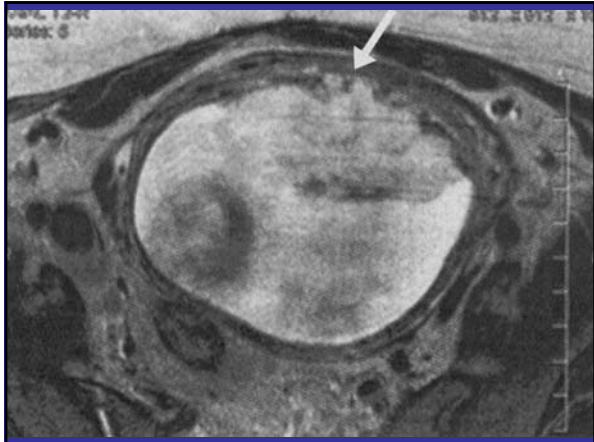
PLACENTA ACCRETA

- 10 fold increase in last 50 years
- 1 per 533 pregnancies
- Accounts for 50% of emergency hysterectomies (previously 10%)
- Increasing cause of PP hemorrhage

Diedy: 2002 – Wu, 2005

DIAGNOSIS: SIGNS AND RADIOGRAPHS

- Hematuria
- Unexplained elevated maternal AFP
- Elevated serum creatinine kinase
- Abnormal TVS color doppler
- MRI



PREOP. RECOMMENDATIONS

- Physician experienced in radical pelvic surgery should be available
- Experienced anesthesiologists, T and X 4 - 6 units, aggressive blood product replacement
- 2 large bore IV, fluid warmers. Consider Swan
- Set up cell saver with tech. available
- Bair Hugger
- Position in Allyn stirrups
- Fixed table retractors - Bookwalter

INTRAOP. RECOMMENDATIONS

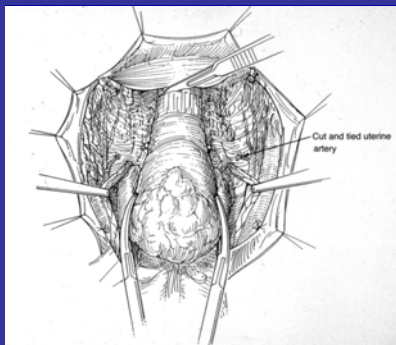
- Midline abdominal incision
- "Classical" uterine incision – avoid placenta
- Leave placenta in situ if TAH deemed necessary
- Bilateral HAL, prior to TAH (or have embolization catheters in place)

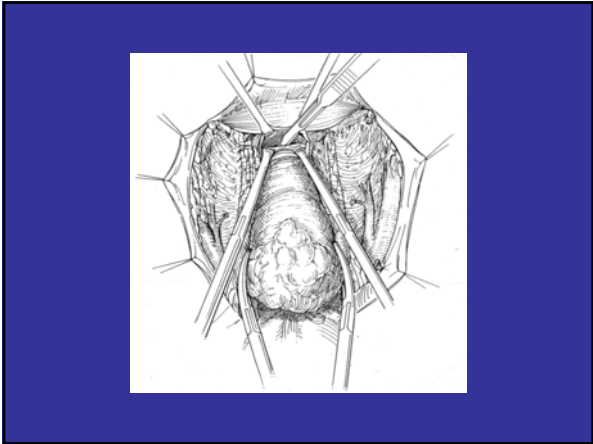
INTRAOP. RECOMMENDATIONS (CONT.)

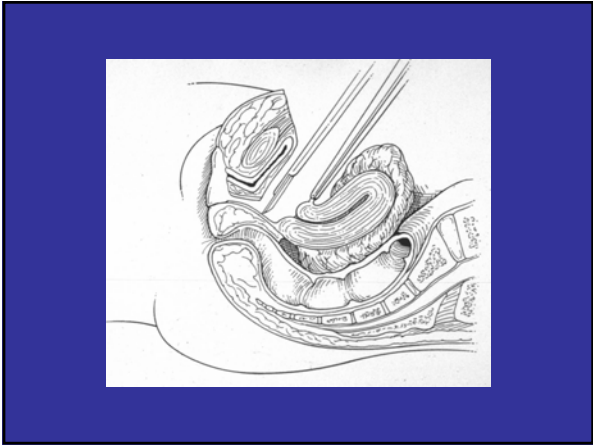
- Bleeding persists after HAL and TAH – secure arterial pumpers
- Bleeding persists – fibrin glue and “Pack and Go”
- Close skin only, not fascia, with towel clips or running suture

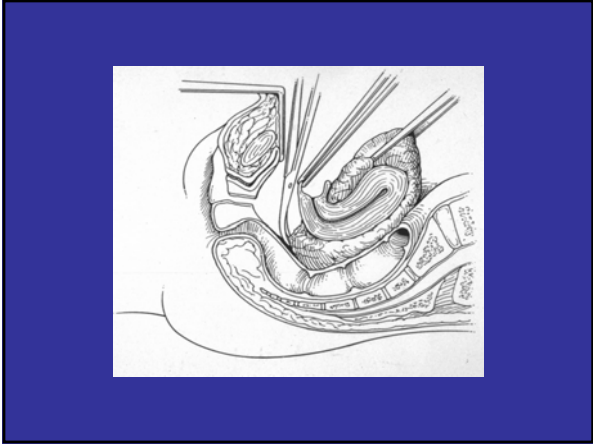
TIPS ON HYSTERECTOMY

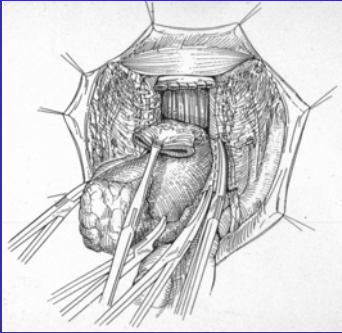
- Anterior insertion:
 - Develop spaces
 - Modified radical hyst.
 - Secure all pedicles – bladder attachment last
- Posterior insertion “reverse hyst.”











POSTOP RECOMMENDATIONS

- Fluid resuscitation in ICU to correct acidosis, coagulopathy, hypothermia
- Swan – Ganz in individual patients
- When coagulopathy controlled, DVT prophylaxis
- If “Pack and Go” – reoperate in 36 to 72 hours when all parameters are corrected



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