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

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 i.e. platelets given if count < 50,000


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 venules, capillaries – PRESSURE

• Surgicel – oxidized regenerated cellulose
  Mech: acidity aids in vessel retraction
  Use: raw surfaces - PRESSURE

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
<table>
<thead>
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<th>Material</th>
<th>Cost</th>
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<tr>
<td>Gelfoam</td>
<td>$ 30</td>
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<tr>
<td>Surgical</td>
<td>$ 50</td>
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<tr>
<td>Avitene</td>
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<tr>
<td>FloSeal</td>
<td>$180/5ml</td>
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<tr>
<td>Tissel</td>
<td>$400/5ml</td>
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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 if rectus muscle
• Forceps used to press against veins
• Cautery at highest “pure cut” setting for 10 minutes
• 20 cases – all successful


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 dysfunctional, 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

• Logothetopolous (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
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
• ½ 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
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
SELECTED REFERENCES


SELECTED REFERENCES
(Continued)


SELECTED REFERENCES
(Continued)
SELECTED REFERENCES (CONTINUED)

34. Waters JH. Indications and contraindications of cell salvage. Transfusion 2004 (Supplement);44:405-442.