Peri-Operative Considerations: Antibiotics, Hemostasis, Adhesion Prevention and DVT Prophylaxis

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Objectives

• Enumerate rationale for peri-operative antibiotic prophylaxis and when indicated

• Enumerate surgical principles for maintaining hemostasis and methods of achieving hemostasis

• Describe critical steps and effective products in preventing surgical adhesions

• Describe indications and risk stratification for DVT prophylaxis
Antibiotic Prophylaxis - Background

• SSI occur in 5% of surgical patients with increased LOS, costs and disability

• Appropriate antibiotic use decreases risk of SSI by augmenting host immunity

• Overuse led to emergence of antibiotic resistant bacteria
Antibiotic Prophylaxis - Background

• Most SSI bacteriology-endogenous flora from skin or vagina

• Endocervix breach is associated with low risk of infection except in patients with prior PID

Surgical Wound Classification System

Class I/Clean: An uninfected operative wound in which no inflammation is encountered and the alimentary, genital, and uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage.

Class II/Clean-contaminated: An operative wound in which the alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the appendix and vagina are included in this category, provided there is no evidence of infection or major break in technique is encountered.

Class III/Contaminated: Operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered.

Class IV/Dirty-infected: Operative sites involving existing clinical infection or perforated viscera. This definition suggests that the organisms causing the postoperative infection were present in the operative field before the operation.

ACOG Practice Guideline No104 May 2009
Antibiotics use - General Principles

• Not indicated:

  • Diagnostic laparoscopy or exploratory laparotomy - no breach of vagina or urinary system (level A, B)

  • Diagnostic and operative hysteroscopy; prevalence of infection (B)

  • Endocarditis prophylaxis or prior history of prosthetic joints (A)
Antibiotics use - General Principles

• When indicated:

  • Use Cephalosporins (Cefazolin) - broad coverage, half-life 1.8 hours, cheap

  • Administer within 1 hour of incision

  • Only re-dose for surgery > 3 hours, EBL > 1500cc

  • Discontinue use post-operatively (cardiac)

ACOG Practice Guideline No104 May 2009
**Antibiotics - other considerations**

- Morbid obese (BMI 35 or greater)
- Bacterial vaginosis is a known risk factor for cuff cellulitis post hysterectomy
- Penicillin anaphylaxis in 0.2% with a case fatality of 0.0001%
  - Generally avoid Cephalosporins even though beta-lactam cross sensitivity risk is low

ACOG Practice Guideline No104 May 2009
## Antibiotic Prophylactic Regimens by Procedure

### Table 1

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Antibiotic</th>
<th>Dose (single dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysterectomy</td>
<td>Cefazolin&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1 g or 2 g IV</td>
</tr>
<tr>
<td>Urogynecology procedures, including those involving mesh</td>
<td>Clindamycin&lt;sup&gt;3&lt;/sup&gt; plus gentamicin or quinolone&lt;sup&gt;4&lt;/sup&gt; or aztreonam</td>
<td>600 mg IV, 1.5 mg/kg IV, 400 mg IV, 1 g IV</td>
</tr>
<tr>
<td></td>
<td>Metronidazole&lt;sup&gt;3&lt;/sup&gt; plus gentamicin or quinolone&lt;sup&gt;4&lt;/sup&gt;</td>
<td>500 mg IV, 1.5 mg/kg IV, 400 mg IV</td>
</tr>
<tr>
<td>Laparoscopy</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagnostic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tubal sterilization</td>
<td></td>
</tr>
<tr>
<td>Laparotomy</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagnostic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Endometrial ablation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estrone</td>
<td></td>
</tr>
<tr>
<td>Hysterosalpingogram or Chromotubation</td>
<td>Doxycycline&lt;sup&gt;3&lt;/sup&gt;</td>
<td>100 mg orally, twice daily for 5 days</td>
</tr>
<tr>
<td>IUD insertion</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Endometrial biopsy</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Induced abortion/dilation and evacuation</td>
<td>Doxycycline</td>
<td>100 mg orally 1 hour before and 200 mg orally after procedure</td>
</tr>
<tr>
<td></td>
<td>Metronidazole</td>
<td>500 mg orally twice daily for 5 days</td>
</tr>
<tr>
<td>Urodynamics</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: IV, Intravenously; IUD, Intrauterine device;
* A convenient time to administer antibiotic prophylaxis is just before induction of anesthesia.
* Acceptable alternatives include cefotetan, cefoxitin, cefotivm, or ampicillin-sulbactam.
* A 2 g dose is recommended in women with a body mass index greater than 35 or weight greater than 100 kg or 220 lb.
* Antibiotics of choice in women with a history of immediate hypersensitivity to penicillin.
* Ciprofloxacin or levofloxacin or moxifloxacin.
* If patient has a history of pelvic inflammatory disease or procedure demonstrates dilated fallopian tubes. No prophylaxis is indicated for a study without dilated tubes.
Use of Guideline Based Antibiotic Prophylaxis in Women Undergoing Gynecologic Surgery
Wright J et al 2013

• Perspective database of data from >500 acute hospitals in the US- 2003-2010

• Among 545,332 women who underwent procedures that required prophylaxis, 87% received appropriate antibiotics, 2.3% received “other”, 10.6% received NO prophylaxis

• Among 491,071 women who had procedures for which antibiotics were not indicated, 40% received antibiotics
Hemostasis- Background

• Peri-operative identification of at-risk patients
  • Inheritable bleeding disorders (easy bruising, gum or dental bleed, HMB)
  • Acquired bleeding disorders
    • Antiplatelet (ASA): stop 7-10 days
    • Clopidogrel: 5-7 days
    • Newer agents (Apixaban): 1-5 days
    • Warfarin; 5 days (and bridging)
    • Heparin: 12-24 hours
Hemostasis

- Surgical technique critical
  - Correct identification of surgical planes
  - Traction & counter-traction
  - Sharp dissection
  - Retroperitoneal space dissection
Hemostasis - Small Vessel/Diffuse Bleeding

• Mechanical Methods
  • Pressure with blunt grasper
  • Endoscopic clip application (5mm, 10mm)
  • Linear stapling devices
  • Pre-tied suture loops
  • Simple ligature or suturing - intra and extracorporeal
Hemostasis

- Energy induced hemostasis through thermal tissue destruction (Monopolar, Bipolar, ultrasonic)
  - Collagen uncoiling and re-annealing (45°C)
  - Irreversible protein denaturation (60°C)
  - Carbonization with drying and shrinkage (80°C)
  - Cellular vaporization (90-100°C)
  - Complete oxidation of protein and lipids with eschar formation (>125°C)
Hemostasis

- Topical agents are physical or biologically active agents
- Primarily for diffuse bleeding
- May not be used intravascularly (thrombogenic) or in confined spaces (compression)
Hemostasis

• Physical agents:
  • Matrix provides a stimulus that activates platelets and extrinsic clotting pathway
  • Acts as scaffold for thrombus formation
  • Less effective if bleeding is brisk
  • Oxidized regenerated cellulose (Surgicel), Gelatin matrix (Gelfoam, Surgifoam), Microporous polysaccharide spheres (Arista), Microfibrillar collagen (Avitene)
Hemostasis

• Biologic agents
  • Topical thrombin available as a lyophilized powder
  • Fibrin sealant consists of concentrated fibrin/factor VII and a solution of thrombin and calcium
  • Tranexamic acid administered systemically pre-operatively
Adhesion Prevention

• Adhesions associated with infertility, chronic abdominal/pelvic pain and small bowel obstruction

• Most common cause of SBO in women is post-surgical adhesions

• >50% of women with SBO had a preceding gynecological procedure (hysterectomy, myomectomy, ovarian cystectomy)
Adhesion Prevention

- Prophylaxis for every surgical patient:
  - Meticulous surgical technique in minimizing tissue trauma, achieving hemostasis, reducing SSI and foreign contaminants
  - Use least invasive method when feasible; laparoscopic > vaginal > abdominal
  - Limit packing, crushing and tissue manipulation
  - Surgery as last resort!
Adhesion Prevention

• For patients at risk for adhesions, consider use of adhesion barrier
  • Multiple surgeries (abdominal and pelvic)
  • Severe pelvic endometriosis
  • Myomectomy
  • Pelvic inflammatory disease
Adhesion Prevention

- Barrier methods with demonstrated effectiveness:
  - Hyaluronic acid derivatives: OR 0.31 (0.19-0.51)
  - Hyaluronic acid and carboxy-methyl membrane: OR 0.15 (0.05-0.43, p<0.001)
  - Polyethylene glycol: OR 0.27 (0.11-0.67)
  - Oxidized regenerated cellulose: OR 0.30 (0.12-0.79)
**Adhesion Prevention**

- Methods without demonstrated effectiveness*
  - Pharmacological agents: Steroids, Antihistamines, Heparin, NSAIDs
  - Barrier methods: Crystalloids, Dextran, GoreTex (limited evidence)
  - Irrigation

*RCOG Guidelines: Scientific Impact Paper No 39 May 2013*
DVT Prophylaxis

• VTE occurs in 15-40% of patients undergoing major surgery in the absence of prophylaxis.

• Most PE are associated with “silent DVT” with a case fatality of 12%.

• Appropriate prophylaxis reduces fatal PE by 65% in general surgical patients.

VTE Prophylaxis

Common major risk factors:
- Age >60 years
- Cancer diagnosis
- Previous VTE
- Immobilization
- Inherited thrombophilias

VTE risk factors

- Surgery
- Trauma (major or lower extremity)
- Immobility, paresis
- Malignancy
- Cancer therapy (hormonal, chemotherapy, or radiotherapy)
- Previous venous thromboembolism
- Increasing age
- Pregnancy and the postpartum period
- Estrogen-containing oral contraception or hormone therapy
- Selective estrogen receptor modulators
- Acute medical illness
- Heart or respiratory failure
- Inflammatory bowel disease
- Myeloproliferative disorders
- Paroxysmal nocturnal hemoglobinuria
- Nephrotic syndrome
- Obesity
- Smoking
- Varicose veins
- Central venous catheterization
- Inherited or acquired thrombophilia
### VTE- Inherited Thrombophilia

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Prevalence in the General Population</th>
<th>Prevalence in Patients With Thrombosis</th>
<th>Testing Methods</th>
<th>Can Patients Be Tested During Pregnancy?</th>
<th>Is the Test Reliable During Acute Thrombosis?</th>
<th>Is the Test Reliable for Patients Using Anticoagulant Therapy?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor V Leiden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterozygous</td>
<td>5%</td>
<td>20%</td>
<td>Activated protein C resistance assay</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Homozygous</td>
<td>0.02%</td>
<td>—</td>
<td>DNA analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Prothrombin gene mutation G20210A</td>
<td>2–3%</td>
<td>6%</td>
<td>DNA analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Antiphospholipid antibody</td>
<td>1–2%</td>
<td>5%</td>
<td>Functional assay (eg, dilute Russell viper venom time)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protein C deficiency</td>
<td>0.2–0.5%</td>
<td>3%</td>
<td>Protein C activity</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Protein S deficiency</td>
<td>0.03–0.13%</td>
<td>3.2%</td>
<td>Protein S total and free antigen</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Antithrombin-III deficiency</td>
<td>0.2–0.4%</td>
<td>Less than 1%</td>
<td>Antithrombin-III activity</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Acquired hyperhomocysteinemia</td>
<td>—</td>
<td>8–25%</td>
<td>Fasting plasma homocystine</td>
<td>Yes</td>
<td>Unclear</td>
<td>Yes</td>
</tr>
<tr>
<td>Methylenetetrahydrofolate reductase 677T carriers (homozygous)</td>
<td>10%</td>
<td>25%</td>
<td>DNA analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

VTE- Intervention

- Graduated compression stockings
- Pneumatic compression devices
- Low dose unfractionated heparin
  - Anti thrombin + Antifactor Xa activity
  - 5000iu 2 hour pre-op, BID or TID until full ambulation
  - Two-thirds reduction in fatal PE
  - Minor bleeding, HIT
VTE- Interventions

• LMWH- Dalteparin (2500u) or Enoxaparin (40mg) s.c
  • Greater bio-availability and longer half-life
  • Predominant factor Xa activity
  • Rarely associated with HIT
  • 2% incidence of DVT in general surgery, urology and GYN surg cohort
  • Initiate 12 hours before surgery or within 6-12 hours post op until full ambulation

Agnelli G et al. Ann Surg 2006;243:89-95
# VTE- Risk Stratification

<table>
<thead>
<tr>
<th>Level of Risk</th>
<th>Definition</th>
<th>Successful Prevention Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Surgery lasting less than 30 minutes in patients younger than 40 years with no additional risk factors</td>
<td>No specific prophylaxis; early and “aggressive” mobilization</td>
</tr>
<tr>
<td>Moderate</td>
<td>Surgery lasting less than 30 minutes in patients with additional risk factors; surgery lasting less than 30 minutes in patients aged 40–60 years with no additional risk factors; major surgery in patients younger than 40 years with no additional risk factors</td>
<td>Low-dose unfractionated heparin (5,000 units every 12 hours), low molecular weight heparin (2,500 units dalteparin or 40 mg enoxaparin daily), graduated compression stockings, or intermittent pneumatic compression device</td>
</tr>
<tr>
<td>High</td>
<td>Surgery lasting less than 30 minutes in patients older than 60 years or with additional risk factors; major surgery in patients older than 40 years or with additional risk factors</td>
<td>Low-dose unfractionated heparin (5,000 units every 8 hours), low molecular weight heparin (5,000 units dalteparin or 40 mg enoxaparin daily), or intermittent pneumatic compression device</td>
</tr>
<tr>
<td>Highest</td>
<td>Major surgery in patients older than 60 years plus prior venous thromboembolism, cancer, or molecular hypercoagulable state</td>
<td>Low-dose unfractionated heparin (5,000 units every 8 hours), low molecular weight heparin (5,000 units dalteparin or 40 mg enoxaparin daily), or intermittent pneumatic compression device/graduated compression stockings + low-dose unfractionated heparin or low molecular weight heparin</td>
</tr>
</tbody>
</table>

VTE- High Risk

• For the high risk population:
  • 2 or more risk factors
  • Dual prophylaxis
    • Unfractionated heparin + SCDs 4x more effective than heparin alone
    • LMWH+SCDs have similar efficacy
    • 40% will develop VTE >21 days post surgery

Agnelli G et al. Ann Surg 2006;243:89-95
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