Antimicrobial Prophylaxis in Digestive Surgery
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Prophylaxis Antibiotic
Miles and Burke
Laid the scientific basis for the use of prophylactic antibiotics in surgery

- Antibiotic must be present before bacteria is introduced.
- Given shortly before surgery

Antimicrobial Prophylaxis
- The goal is to prevent SSI by reducing the burden of microorganisms at the surgical site during the operative procedure.
- Antibiotic must be present before bacteria is introduced.
- Patients who receive prophylactic antibiotics within one to two hours before the initial incision have lower rates of SSI than receive antibiotics sooner or later than this window.
- Antimicrobial therapy administered in the setting of contaminated wounds is not considered prophylactic; in such cases a therapeutic course of antimicrobial therapy is warranted.
**Prophylaxis Antibiotic**

- Single dose sufficient
  - Further dose waste of resources & more complication
  - Long surgeries, multiple doses
- Antibiotic must be active against common expected pathogens
- Stop dosing when side effects outweigh benefits
- Prophylactic Antibiotic cover – decisive period
  - Body responds to a breach in defense after the decisive period
  - Decisive period last up to 4hrs

**Surgical Side Wound Infections (SSI)**

- The second most common healthcare-associated infection
- Among surgical patients, SSIs are the most common nosocomial infection, accounting for 38 percent of nosocomial infections
- It is estimated that SSIs develop in 2 to 5 percent of the more than 30 million patients undergoing surgical procedures each year
- The cost of SSIs is substantial

**Pathophysiology**

Whether a wound infection occurs after surgery depends on a complex interaction between the following:

1. Patient-related factors (e.g., host immunity, nutritional status, the presence or absence of diabetes)
2. Procedure-related factors (e.g., implantation of foreign bodies, degree of trauma to the host tissues)
3. Microbial factors (tissue adherence and invasion)
4. Perioperative antimicrobial prophylaxis
General Principles in the prevention of SSIs

- A number of interventions have been used over the years to reduce the risk of SSIs, including:
  - Preoperative showering with antimicrobial soaps
  - Preoperative application of antiseptics to the skin of the patient
  - Washing and gloving of the surgeon's hands
  - Use of sterile drapes
  - Use of gowns and masks by operating room personnel

- The most important factors are meticulous operative techniques and timely administration of effective preoperative antibiotics

Preventing SSI

Antibiotic prophylaxis
- Drugs - which when, how many doses?
- Non antibiotic measures - evidence based
  - Hair removal
  - Normothermia
  - Oxygen supplementation
  - Normoglycemia

Hair-Removal Techniques and SSIs

Preoperative Strategies to Limit SSIs: Skin Surface Preparations

Antiseptic showers
- Reduced bacterial counts by $3.5 \log_{10}$ from baseline\(^1\)
- No evidence that they affect SSIs\(^2\)

- Skin preparation in the operating room (OR)
  - Usually iodophors, alcohol-containing products, or chlorhexidine gluconate\(^2\)


Perioperative Normothermia

- 200 CRS patients
  - Control: Routine intraoperative thermal care (mean temperature 34.7° C)
  - Treatment: Active warming (mean temperature 36.6° C)

- Incidence of SSI
  - Control 19% (18/96)
  - Treatment 6% (6/104); \(P=0.009\)


Supplemental Oxygen

- 500 CRS patients
  - 80% or 30% inspired oxygen during operation and for 2 hours post surgery
  - All patients received prophylactic antibiotics

- Results
  - Arterial and subcutaneous \(P_{O_2}\) higher in 80% oxygen group
  - Lower incidence of SSIs with higher supplemental oxygen (5.2% vs 11.2%; \(P=0.01\))

SSIs and Glucose Levels (cont)

- 1,000 cardiothoracic surgery patients with preoperative hemoglobin A1c (HbA1c) levels measured
  - 300 known diabetic patients
  - 42 with undiagnosed diabetes

- Incidence of SSI
  - Diabetes (known and undiagnosed) 5.8% (20/342)
  - Without diabetes 1.5% (10/658)
  - Diabetes with HbA1c ≥8% 7.9% (10/126)
  - Diabetes with HbA1c <8% 4.0% (7/174)


SSIs and Post-op Glucose Levels

<table>
<thead>
<tr>
<th>Glucose level (mg/dL)</th>
<th>Infected patients (n=72)</th>
<th>Noninfected patients (n=802)</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;200 (referrent)</td>
<td>35 (49%)</td>
<td>651 (72%)</td>
<td>1.00</td>
</tr>
<tr>
<td>200–249</td>
<td>21 (29%)</td>
<td>154 (17%)</td>
<td>2.54</td>
</tr>
<tr>
<td>250–299</td>
<td>11 (15%)</td>
<td>69 (8%)</td>
<td>2.97</td>
</tr>
<tr>
<td>≥300</td>
<td>5 (7%)</td>
<td>28 (3%)</td>
<td>3.32</td>
</tr>
</tbody>
</table>


SSIs and Glucose Levels


Deep Infection Rate, %

- 1.3%
- 1.6%
- 2.5%
- 6.7%

P=0.002

Day 1 Blood Glucose (mg/dL)
Antimicrobial Prophylaxis

Antimicrobial agent to prevent or reduce infection

Ideally
- Targeted antibiotic
- Narrow spectrum agent
- Targeting few pathogens
- Short term

Preoperative antibiotics are warranted

✓ if there is a high risk of infection or
✓ if there is high risk of deleterious outcomes should infection develop at the surgical site (immune compromise, cardiac surgery, and/or implantation of a foreign device)

Timing of prophylaxis

- Antimicrobial therapy should be administered within 60 minutes prior to the surgery to ensure adequate drug tissue levels at the time of initial incision
- This practice also reduces the likelihood of antibiotic-associated reactions at the time of induction of anesthesia
- If the 60 minute window for prophylaxis has past, administration of antimicrobial therapy 30 to 60 minutes prior to surgery appears to be more effective than administration immediately before surgery
Repeat dosing

• Antibiotic concentration > MIC pathogen at the time of incision and throughout the procedure

• In general, repeat antimicrobial dosing following wound closure is not necessary and may increase antimicrobial resistance

• Repeat dosing is indicated every one to two half-lives of the drug in patients with normal renal function
  ✓ for procedures lasting more than four hours
  ✓ or in the setting of major blood loss
Prophylaxis Antibiotic Indication

• Clean wound with prosthesis
• Clean Contaminated

Class I Wound (Clean)

• Atraumatic wound without inflammation
• Do not enter GI, GU, biliary, or respiratory tract
• 1.5% infection rate

Class II Wound (Clean-Contaminated)

• Respiratory, GI, GU, or biliary tract entered under controlled conditions
• 7.5% infection rate expected
Class III Wounds (Contaminated)

- Traumatic wounds
- Breaks in sterile technique
- Gross spillage from GI tract
- Acute, nonpurulent inflammation
- 15% anticipated infection rate

Class IV Wounds (Dirty)

- Old traumatic wounds
- Devitalized tissue
- Clinical infection present
- Perforated viscus
- 40% expected infection rate

SENIC Risk Index

- Abdominal operation
- Operation greater than 2 hours
- Class III or IV surgical wounds
- Three or more diagnosis at time of discharge

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk of Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1%</td>
</tr>
<tr>
<td>1</td>
<td>3.6%</td>
</tr>
<tr>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>3</td>
<td>17%</td>
</tr>
<tr>
<td>4</td>
<td>27%</td>
</tr>
</tbody>
</table>
Classification SSI

Digestive Surgery

- Among the highest risk procedures for SSI due to the presence of intraluminal bacteria
- The regimen should include activity against enteric gram-negative bacilli, anaerobes, and enterococci
- Bowel preparation consists of two components: mechanical bowel preparation and administration of antibiotics (ciprofloxacin plus metronidazole)

Oesophagogastric Surgery

- Organisms encountered: Enterobacterium, Enterococci
- Prophylactic regimen: Second generation cephalosporin & Metronidazole
Biliary Surgery

- Organisms encountered: Enterobacterium, Enterococci
- Prophylactic regimen: One dose second generation cephalosporin

Small Bowel Surgery

- Organisms encountered: Enterobacterium, Anaerobes
- Prophylactic regimen: Second generation cephalosporin & Metronidazole

Colorectal Surgery

- Organisms encountered: Enterobacterium, Anaerobes
- Prophylactic regimen: Second generation cephalosporin & Metronidazole
Surgical Prophylaxis

<table>
<thead>
<tr>
<th>Wound Classification</th>
<th>Antibiotic</th>
<th>PCN Allergy</th>
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<tbody>
<tr>
<td>I</td>
<td>1st generation Cephalosporin</td>
<td>Vancomycin Clindamycin</td>
</tr>
<tr>
<td>II-Biliary, GU, Upper Digestive</td>
<td>1st generation Cephalosporin</td>
<td>Vancomycin Clindamycin</td>
</tr>
<tr>
<td>II-Distal Digestive</td>
<td>2nd generation Cephalosporin</td>
<td>Aztreonam and Clindamycin/Flagyl</td>
</tr>
<tr>
<td>III/IV</td>
<td>Generally Therapeutic</td>
<td></td>
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Digestive Division
Cipto Mangunkusumo Hospital 2012

• First Line
  – Metronidazole
  – Gentamycin
• Second Line
  – Ampicillin-Sulbactam
  – Cephalosporin third Generation
  – Carbapenem

Clean Contaminated

RSUPN-CM
MARCH 2013

• 67 Abdominal Operation
• 28 procedures used Prophylaxis Antibiotic
  – LCC & Biler operation = 15
  – Incisional biopsy n debulking tumor = 5
  – Elective Hernia repaired with mesh = 4
  – Colostomy = 4
• Prophylaxis Ab. : Genta + Metronidazol = 23 Cases
  Cefazolin & Doripenem One case
• SSI debulking tumor cases
Antibiotic Prophylaxis - Caveats

- You can’t kill everything
- Adverse drug effects
- Select resistant pathogens
- C diff colitis
- Select more virulent pathogens
- Avoid drugs/classes that are used for therapy

Surgical Prophylaxis Summary

- It’s not the tool it’s the craftsman
- Is an adjunct to, not a substitute for, good surgical technique
- Decrease SSI
- Focus on likely pathogens - what are you cutting?
- Narrow spectrum, long half life drugs
- Single pre-op dose adequate for most
- Dose timing - pre-incision,
  Short Term better (> 72 hours)

Thank You For Your Attention