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Evaluation of surgical antibiotic prophylaxis at a large, tertiary medical center

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Background
- Studies estimate surgical site infections (SSIs) contribute to ~1 million additional inpatient days per year and SSI mortality rate has been estimated to be 3%.
- Even a single SSI can have a large impact on a patient and institution. The cost of a single SSI is estimated to be upward of $25,000 and increases the length of hospital stay by ~10 days.
- The Surgical Care Improvement Project (SCIP), a CMS program, was initiated in 2006 to provide standard quality measures to help reduce SSIs.
- Advances in infection control practices including stricter adherence to antimicrobial prophylaxis after the introduction of SCIP has led to a 17% decrease in SSIs reported to the NHSN from 2008-2014.
- Although large strides have been made toward limiting SSIs, surveillance remains an important component for continued reduction.
- Additionally, this institution has identified inappropriate or less than optimal prophylaxis as a potential contributor in several SSI cases.
- Recent studies have shown that facility-specific SSI monitoring and auditing, as well as pharmacist involvement in perioperative antibiotic selection, has demonstrated reduction in rates of SSIs.

Purpose
- This retrospective analysis aims to review surgical antimicrobial prophylaxis for appropriateness based on patient-specific factors and hospital system guidelines.
- Primary outcome: compliance to Providence hospital system guidelines. Contributing factors:
  - Compliant antibiotic selection
  - Hysterectomy: Cefazolin plus metronidazole
  - Colorectal: Cefazolin plus metronidazole
  - Spinal: Cefazolin if MRSA PCR negative and no history of MRSA

Objectives
- This study is a single-center retrospective chart review.
- The study was reviewed and approved by the Institutional Review Board (IRB) at our institution.
- Electronic health record (EHR) was used to perform chart review and identify the study population.
- Study population: Patients who underwent hysterectomy, colorectal, or spinal surgery
- Study period: June 1st, 2019 through August 31st, 2019

Hysterectomy
- N=141
- 62 (44%) achieved the primary outcome

Antibiotic Regimen
- Cefazolin/Metronidazole 62 (44%)
- Cefazolin 61 (43%)
- Clindamycin/Gentamicin 9 (6%)
- Clindamycin/Vancomycin 3 (2%)
- Cefazolin/Vancomycin 1 (0.7%)
- Vancomycin 1 (0.7%)
- Gentamicin 1 (0.7%)
- Ceftriaxone 1 (0.7%)

Factors for Non-Compliance to the Primary Outcome
- NON-COMPATible REGIME
- INAPPROPRIATE ALLElRY REGIME
- INAPPROPRIATE DOSE
- MRSA NAAT

Colorectal
- N=36
- 21 (58%) achieved the primary outcome

Antibiotic Regimen
- Cefazolin/Metronidazole 22 (60%)
- Piperacillin/Tazobactam 6 (17%)
- Cefazolin 4 (11%)
- Ceftriaxone/Metronidazole 1 (3%)
- Levofloxacin 1 (3%)
- Levofloxacin/Metronidazole 1 (3%)
- Cefazolin/Gentamicin 1 (3%)

Factors for Non-Compliance to the Primary Outcome
- NON-COMPATible REGIME
- INAPPROPRIATE ALLElRY REGIME
- INAPPROPRIATE DOSE
- MRSA NAAT

Spinal
- N=147
- 71 (48%) achieved the primary outcome

Antibiotic Regimen
- Cefazolin 125 (85%)
- Vancomycin 15 (10%)
- Clindamycin 1 (0.7%)
- Nafcillin 1 (0.7%)
- Ceftriaxone 1 (0.7%)
- MRSA PCR status within 30 days of surgery
  - Positive 4 (3%)
  - Negative 106 (72%)
  - Not obtained 31 (21%)

Factors for Non-Compliance to the Primary Outcome
- NON-COMPATible REGIME
- INAPPROPRIATE ALLElRY REGIME
- INAPPROPRIATE DOSE
- MRSA NAAT OR MRSA colonization

Inappropriate Allergy Regimens
- Hysterectomy
  - Patient 1: Only allergic to sulfa antibiotics
  - Patient 2: Penicillin allergy listed as rash, previously tolerated piperacillin/tazobactam
  - Patient 3: Amoxicillin allergy listed as rash
  - Patient 4: Cefpodoxime allergy listed as rash, previously tolerated cefazolin
  - Patient 5: Penicillin allergy listed as unknown severity, previously tolerated cephalaxin
  - Patient 6: Amoxicillin allergy listed as unknown severity, previously tolerated cefalexin
  - Patient 7: Penicillin allergy listed as mild rash

- Colorectal
  - Patient 1: Penicillin allergy listed as unknown severity, previously tolerated cefazolin
  - Patient 2: Penicillin allergy of mild severity

- Spinal
  - Patient 1: Cephalosporin allergy listed as rash

Antibiotic Ordering Method Used

Discussion

Clinical Outcomes
- Primary outcome adherence issues varied by type of surgery.
- For hysterectomy, 62 of 141 surgeries (44%) achieved the primary outcome.
- Primary contributor of non-compliance being selection of an antibiotic regimen inconsistent with system-wide guidelines.
- Cefazolin monotherapy was considered non-compliant in the setting of this analysis. Cefazolin monotherapy was considered compliant, 118/141 surgeries (84%) would have achieved the primary outcome.
- For colorectal surgeries, 21 of 36 (58%) achieved the primary outcome.
- Primary contributor of non-compliance being inappropriate antibiotic regimens and dose timing.
- Additionally, it was identified that history of resistant infections may not be accounted for when making antibiotic prophylaxis choices, with 3 SSIs resulting from multi-drug resistant organisms in patients with MDRD history.
- For spinal surgeries, 71 of 147 (48%) achieved the primary outcome.
- Primary contributor of non-compliance being no MRSA PCR within the 30 days prior to surgery.
- For all surgeries, education on true penicillin allergies and cross-reactivity rates could provide benefit.
- Allergy regimens given for non-severe allergies:
  - Hysterectomy 7 instances
  - Colorectal 2 instances
  - Spinal 1 instance

Study Limitations
- Retrospective chart review with select data collected manually.
- This data represents a snap-shot in time during a three month period.

Conclusions
- Each surgery requires a unique intervention.
- Consistency as an institution regarding surgical antibiotic selection is needed and adherence to institutional EPIC order sets could improve antibiotic selection.
- Thorough evaluation of allergy severity may result in less allergy regimens (with worse clinical trial outcomes) being used.
- Evaluation of relevant patient history, including history of MDROs or MRSA colonization via PCR, may result in more optimum choices.
- PPCM E Coli susceptibilities are ~88% and may warrant alternate antibiotics, in select surgeries, based on surgeon discretion.

Going Forward
- Cyclic auditing resulted in increased discussion/education.
- Changes still being considered by surgery leadership.
- Future data collection will be performed once changes are implemented to determine improved guideline adherence.

References