The Local Application of Vancomycin in Spine Surgery: Changes to Bacterial Resistance Profiles

UCSF Orthopaedic Surgery Inman Abbott Lecture

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Disclosure

I have no relevant disclosures

Infections in Spinal Surgery

• Berven et al.:
  – 6628 Hospital Visits Identified
  – Cumulative Incidence of SSI was 2.9%

• Scoliosis Research Society
  – 108,419 Procedures
  – SSI rate of 2.1%

Vancomycin Powder in Spine Surgery

• Sweet et al.:
  – 1732 Consecutive Thoracic and Lumbar Posterior Instrumented Fusions
    • 821 received standard 24 hours of perioperative cephalaxin
    • 911 received standard perioperative cephalaxin + 2 grams of Vancomycin
  – Standard Cephalexin: 21 infections (2.6%)
  – Cephalexin + Vancomycin: 2 infections (0.2%)
Vancomycin in Spine Surgery

- Molonari:
  - 1512 consecutive spinal surgeries
  - All received 1 gram Vancomycin beneath the fascia
  - 15 patients (0.99%) infection rate

- Sweet et al:
  - 1001 posterior cervical spine surgical procedures from 1995 to 2010 retrospectively reviewed
  - Infection rate of 0% in group with the addition of 500mg of Vancomycin

Determining Resistance to Vancomycin in Spinal Surgery

- Research within the Department of Orthopaedic Spine Surgery

  - Two part:
    1. Global changes to bacterial resistance patterns at a tertiary academic spine center
    2. Retrospective Data Analysis of all patients from 2011 to current

      - Statistical correlation between Vancomycin use and Vancomycin resistant microbe development

Part 1: Global Changes to Microbial Resistance Profiles

- 126 bacteria were isolated from 81 surgical site infections from 2007-2013
- Bacterial resistance profiles were analyzed by epoch

Determining Microbial Resistance Patterns to Vancomycin in Spine Surgery

Microbiologic Profile of SSI in Spine Surgery 2007
(No Vancomycin resistance isolates)
Determining Microbial Resistance Patterns to Vancomycin in Spine Surgery

Microbiologic Profile of SSI in Spine Surgery 2008
(One Vancomycin Resistant Isolate - Enterococcus Faeceium)

- Staph Aureus (MSSA)
- Staph Aureus (MRSA)
- Staph Epidermidis (MSSE)
- Staph Epidermidis (MRSE)
- Enterobacter Cloacae
- Propionibacterium Acnes
- Eschericia Coli
- Klebsiella pneumonia
- Klebsiella Oxytocca
- Corynebactereium
- Acinetobacter lwofii
- Citrobacter freundii
- Enterococcus faecealis
- Proteus Mirabalis
- Enterococcus faeceium (Vancomycin Resistant)
- Citrobacter Koserii
- Peptostreptococcus
- K. Pneumonia
- Pseudomonas

- Microbiologic Profile of SSI in Spine Surgery 2009
(No Vancomycin Resistant Isolates)

- Staph Aureus (MSSA)
- Staph Aureus (MRSA)
- Propionibacterium Acnes
- Staph Epidermidis (MRSE)
- Eschericia Coli
- Pseudomonas
- Corynebacterium
- Enterococcus faecealis
- Proteus Mirabilia

Sweet’s Article Presented

Determining Microbial Resistance Patterns to Vancomycin in Spine Surgery

Microbiologic Profile of SSI in Spine Surgery 2010
(No Vancomycin Resistant Isolates)

- Staph Aureus (MSSA)
- Staph Aureus (MRSA)
- Citrobacter freundii
- Staph Epidermidis (MRSE)
- Eschericia Coli

Microbiologic Profile of SSI in Spine Surgery 2011
(No Vancomycin Resistant Isolates)

- Staph Aureus (MSSA)
- Staph Aureus (MRSA)
- Citrobacter freundii
- Staph Epidermidis (MRSE)
- Eschericia Coli

- Microbiologic Profile of SSI in Spine Surgery 2012
(No Vancomycin Resistant Isolates)
Determining Microbial Resistance Patterns to Vancomycin in Spine Surgery

Microbiologic Profile of SSI in Spine Surgery 2013
One Vancomycin Resistant Isolate - Enterococcus Faeicium

- Staph Aureus (MSSA)
- Staph Aureus (MRSA)
- Staph Epidermidis (MSSE)
- Staph Epidermidis (MRSE)
- Enterobacter Cloacae
- Propionobacterium Acnes
- Escherichia Coli
- Klebsiella Pneumonia
- Klebsiella Oxytoca
- Corynebacterium
- Acinetobacter Lwoffi
- Citrobacter Freundii
- Enterococcus Faecalis
- Proteus Mirabilis
- Enterococcus Faecium (Vancomycin Resistant)
- Enterococcus Faecium (Vancomycin Sensitive)
- Citrobacter Koserii
- Pseudomonas
- Peptostreptococcus
- Streptococcus Anginosus
- Morganella Morgani

Bacterial Resistance Patterns

- No patient given local application of Vancomycin developed a vancomycin resistant microbe
Conclusions

• Part 1:
  • Vancomycin resistant Microbes are rare in spine surgical site infections (2)
  • There has not been a significant increase in Vancomycin resistant surgical site infections since Sweet’s study was introduced
• Part 2:
  • There was no significant correlation between Vancomycin placed intra-operatively and Vancomycin resistant microbes

Discussion

1. How do bacteria become resistant to antibiotics:
   • Preventing the antibiotic from getting to its target
   • Changing the target
   • Destroying the antibiotic
2. Transformation, plasmid, transposons, mutation
3. Antibiotic effects on resistance:
   1. Bacteriostasis
   2. Exposure of bacteria to subtherapeutic antibiotic
      1. Selection for resistant bacteria

Vancomycin Application

1. Produce high antibiotic levels at the site of the possible infection, yet safe drug levels in the systemic circulation
   • Vancomycin:
      - Bactericidal: when concentration is 4 x MIC
      - Example:
        - 2 x MIC for common spine pathogen (MRSA)
          - Trough of 32-40
          - High Risk of Toxicity

Limitations/Future

• Short term follow up
  - Necessary step
• Continue follow up globally and for each patient that receives Vancomycin application
• Thank you:
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