Management of the Infected Hip & Knee Arthroplasty Utilizing the Double Set-Up Procedure

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“In Mrs. Smith you have a very difficult problem, but I know a colleague... (Translated: IDIOT) who may be willing to take this on.”

Influences In My Formative Years
- L. Dorr, MD and Kelly Vince, MD
- Swiss AO Experience
- T. Bernasek, MD and K. Gustke, MD
- Trial and Error
- FINALLY...
George Cierny, MD
1947-2013
Master of Infection Management

All you need to know about infection management...

Stages of Infection

- Type I - Medullary osteomyelitis
- Type II - Superficial osteomyelitis (Acute)
- Type III - Localized osteomyelitis
- Type IV - Diffuse osteo includes prosthesis
### Stages of Infection

- **Type I**: Perineurum
- **Type II**: Neurium
- **Type III**: Sequestrum
- **Type IV**: Necrotic tissue

### Patient Physiologic Classification

- **A host**: Healthy w/out healing deficiencies
- **B host**: Compromised by one or more **local** or **systemic** factors
- **C host**: Morbidity of care exceeds their illness & surpasses capacity to w/stand curative treatment (treatment worse than disease)

### B Host Adverse Factors: Extremity **Local Compromise**

- Chronic Lymphedema
- Venous Stasis
- Major Vessel disease
- Arteritis
- Radiation Fibrosis
- Retained foreign bodies (suture, buckshot)

**Cierny**
Host Adverse Factors:
**Extremity Local Compromise***
- Multiple incisions (Skin bridges)
- Soft tissue loss (prior trauma)
- Synovial-cutaneous fistulas
- Subcutaneous abscesses (2.5cm in diameter)
- Prior peri-articular fractures (high energy)
- RSD
- Long-standing active infection (> 3 months)


Adverse Factors:
**Systemic Significant Compromise**
- Malnutrition
- Chronic Hypoxia
- Malignancies
- Diabetes Mellitus
- Extremes of Age (>70 years)
- Chronic Tobb use (+40 pack yr history)
- Current Tobb use
- Major organ failure

**Cierny Adverse Factors:
**Systemic Significant Compromise***
- Low Neutrophil counts (< 1000)
- Low CD4 T cell counts (< 100)
- Intravenous drug abuse
- Chronic Active Infections (other sites)
- Abnormally low serum protein/albumin
- Hepatitis

***McPherson et al
A, B, C Staging: Directs Treatment

- Palliation
- Amputation
- Resection
- Fusion
- Prosthetic Salvage
- Staged Reimplantation

Cierny Double Set-Up Surgical Technique

Definition: Dr. Minter’s Double Set-Up
Definition: Cierny’s Double Set-Up

- Defined dirty & clean sides
- Total debridement & temporary wound closure
- OR team exchanges gloves & gowns
- Patient re-prepped/draped
- New sterile instrumentation used for 2nd part
- Clean table covered until 2nd portion of surgery resumes
- CPT code 27599

Type II Infection Management
Acute Superficial Osteomyelitis

Acute (Type II) Infected Joint Replacement

- Prosthetic Salvage (Regardless of Host)
- Total synovectomy
- Remove all braided suture
- Poly exchange
- Clorpactin Pulse Lavage/Scrub tissues
### IRRIGATION/LAVAGE

Irrigate w/ 3 Liters Clorpoint soln

- Brand of Oxychlorosene, NA
- 2gm vial (4gm/liter)
- Physiologic Bleach
- Bactericidal
- Viricidal
- Fungicidal
- Sporicidal

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### Acute (Type II) Infection

- Metal implant swabbed with Phenol (1 min)
- Follow on with Isopropyl Alcohol scrub/rinse (1 min)
- Final Saline Lavage/Scrub
- Double Set-Up

### Clean Side: Acute (Type II) Infection

- New Poly insert & Femoral head
- Stimulan Beads
- Deep drains & monofilament suture (PDS)
Acute (Type II) Infection

Antibiotic Therapy

• All isolates considered pathogens

• Ideal antibiotic has 1:1 ratio between MIC and mean bactericidal concentration

• 6 weeks of antibiotics for A&B hosts

Type IV

B Host Infection Management

Diffuse Osteomyelitis Involving Prosthesis

Type IV Infected Joint Replacement

• All prosthetic components removed

• Primary Amputations or palliative treatment for compromised type C hosts w/ inadequate bone & soft tissue reserves

• All cement, cement plugs, sutures and nonviable tissue excised
Type IV Infected Joint Replacement

- Saucerize or resect more rather than less bone
- Medullary canal/Metaphyseal surfaces:
  - Biopsy (frozen section)
  - Culture
  - Ream
  - Lavage

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Methods

• A retrospective review of medical records involving only TKA & Knee limb salvage procedures utilizing double set up were reviewed from 7/2008-5/2012.

• The post-operative outcomes were then compared to re-infection rates in available current literature.

The Impact of use of Double Set-up on Infection Rates in Total Knee Replacement and Limb Salvage Procedures

J. Waterman, J. Minter

• 18 patients
• 17 successful (no recurrence of infection)
• 13 Type B host & 4 Type A host & 1 C
• 1 recurrence requiring amputation (Type C host)
• 11 men, 7 women
• Age at final surgery ranged from 40-80 y.o. w/ mean of 61 yrs
• Double set up procedure utilized at initial presentation & reimplantation (Cierny protocol)

Discussion

• Only 1 recurrence of infection in our study which was our C-host patient
• 5.5% recurrence rate of infection in our series
• W/in our literature review our series closely mirrors Cierny’s studies. In Cierny’s work infection reoccurrence occurred in all C patients and in some B patients.
• Our results showed no infection reoccurrence in B patients and our only failure was in our single C-host
Standard PMMA Mixtures

- Antibiotic cement: (slow set/HV)
  - 40 gram bag (1 gm Gentamycin/bag)
  - 2.4 grams Tobramycin/bag
  - 2 grams Vancomycin/bag
- Add some liquid monomer
- Utilized appropriate sens. ATB’s/Fungicidal meds

Ca SO4 Mixtures

- Stimulan Beads
  - Utilized in all cases
  - 30 gm bead tray
  - 3-4.8 mm beads
  - Antibiotic specific
  - Vanc (alternative)

Ca SO4 Mixtures

- Antibiotic seroma concentrations remain above pathogen MICs for >3 weeks (Cierny)
- Intracapsular & Intra-Med
- Beads resorb by +6 weeks
- Stimulan (handles all antifungal/antibacterial meds)
Quickie Case Examples

Type B host/Type 4 Osteo: Case Example

- Synovial-cutaneous fistulas
- Subcutaneous abscesses (2.5cm in diameter)
- RSD (Primarily chronic narcotic use)
- Diabetes Mellitus
5 Months later: 2nd Stage
- Normalized Labs
- Hgb A1c < 7
- Negative Synovasure test
- Set up for limb salvage surgery
- Plastic Surgeon on stand-by

5 Months later: 2nd Stage
- Neg Frozen sections
- Neg post op cultures
- Intra-op issue
  - Required Medial Gastroc flap

10 months later...
Emotional Aspects of Infection Management: "Why me Lord?"

- Patients w/ poor health have poor results
- Postoperative infections are viewed as failures
- Fear of failure leads to collapse of reason
- Preoperative: risks are left unacknowledged
- Postoperative: early wound problems leading to deep infection are overlooked

Emotional Aspects of Infection Management

- Missed diagnoses lead to complications, treatment delays & prolonged patient suffering
- Utilizing staging system defines treatment process
- Staging brings clarity of thought to surgeon in conflict & restructures performance to do what is right for the patient.

Summary

- Patients in our case series have lower infection rates than those quoted in recent publications.
- Results mirror Cierny’s CORR paper
- Appropriate ATB therapy (Systemic & Local)
- Double set-up procedure w/ aggressive surgical debridement in combination w/ other infection reducing protocols such as post-op antibiotic regimens may help further reduce recurrent infection in recalcitrant infected revision cases.
In Conclusion

THANK YOU