Concepts on Prevention of Infection and the Megaprosthesis

Janet D. Conway, MD
Head of Bone and Joint Infection
Rubin Institute for Advanced Orthopaedics
Baltimore, Maryland, USA

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• I WILL NOT be discussing “off-label” uses for products or devices.

FACT

• THE INCIDENCE OF INFECTION IS HIGHER FOLLOWING THE USE OF MEGAPROSTHESES

• WHAT CAN WE DO TO AVOID THIS???
• MODIFIABLE FACTORS
• NONMODIFIABLE FACTORS

NONMODIFIABLE FACTORS
• USE OF A MEGA IMPLANT/FOREIGN BODY
• TISSUE BED

MODIFIABLE FACTORS
• THE HOST
• THE OPERATIVE ENVIRONMENT
• THE IMPLANT SELECTION
OPERATING ENVIRONMENT

• Antibiotic cement for reimplant
• Limit blood transfusions (use of TXA)
• Change suction tips
• New blade after incision
• Glove change after 90 min/and cement use
• Decrease operative time
• Limit OR traffic

Parvisi and Gehrke, Consensus Mtg, 2013

Host Status

A: no compromise
B: compromised
C: nonsurgical candidate

Cierny et al, Cont Orthop 1985;10:5

A HOST
The B host (Systemic)

- Diabetes Mellitus
- Steroid use
- Smoker
- Malnutrition
- Immune compromise
- Advanced Age

The B host (local)

- Chronic Venous Insufficiency
- Radiation fibrosis
- Scarring
- Neuropathy

The B host Combo (S/L)
The C host
Treatment worse than the disease
Severely medically debilitated

DEALBREAKERS
• JEHOVAHS WITNESS
• HEART VALVE
• CIRRHOSIS

MORE DEALBREAKERS
• Noncompliant
• Mentally challenged
• Incarcerated

Don’t put frames on these patients!
Proper Candidate Selection

• Evaluate all patients at least twice before operating

Know your patient

Patient resources
• Coping ability
• Caregiver
• Proximity to hospital
• Social Support

Optimizing the B host
Relatively Modifiable Factors

- Diabetic control
- Nutrition
- Steroid/immunosuppressive TX
- Smoking
- Blood flow
- Obesity

DIABETES

- Get Hemoglobin A1c < than 7%
- Glucose levels < 200mg/L

Marchant et al, JBJS AM 2009

NUTRITION

- Risk of wound complication 7X higher with albumin levels <5g/dl
- 5X higher with lymphocyte count <1500cells/mm3

Green et al, J Arthroplasty 1991
OBESITY

- BMI >40: 4-5X more likely to have a periprosthetic infection

  - Dowsey and Choong, CORR, 2009

Immunosuppressive Drugs

- Stop 1-2 weeks preop
- Restart 1-2 weeks post op

  - Howe et al, JAAOS, 2006

Controversial

- Methotrexate
- Preoperative Mupirocin

  - Kalmeijer et al, Clin Inf Dis 2002
  - Perhala et al, Arthritis Rheum 1991
Smoking

BLOOD FLOW

- VASCULAR CONSULT IF PULSE IS NOT EQUAL TO UNAFFECTED SIDE

DECIDE HOW LONG YOU ARE WILLING TO WAIT

MY WIFE SAID SHE'D BE READY IN 5 MINUTES
WHEN IS AN “A” HOST REALLY NOT AN “A” HOST?

Why do we care as orthopaedic surgeons??

Unusual: Infections in A hosts
Patients always want to know: “Doc, Why me??”
NEED to optimize our host

Secondary Causes of Immunodeficiency
- Hep C,B
- HIV
- Malnutrition
- Chemotherapy
- Nephrotic syndrome
- Protein losing enteropathy

Drugs causing Hypogammaglobulinemia
- Antimalarial agents
- Captopril
- Carbamazepine
- Glucocorticosteroids
- Fenclofenac
- Gold Salts
- Penicillamine
- Phenytoin
- Sulfasalazine
- rituximab
URGENT NEED

- Cost containment—infecteds are expensive!!

No Literature on Ortho Manifestations of Primary Immunodeficiency

1*Immunodeficiencies

- Over 240 varieties of Primary Immunodeficiency
  - CVID — most common: 20-50% (USA, Europe, Latin American)
  - Age of Onset — 34% before age 10 — rest present in 3rd decade — Europe: mean age 35
  - Estimated Prevalence: 1-5/100,000

AVERAGE DELAY IN DIAGNOSIS: 4-6 YEARS

ENT
• Chronic recurrent sinusitis
• Paper published about ENT diagnosis of PI

Average cost of an infection in PI patient
• In PI patients—$38,574 per hospitalized pt w/ infection (2010)
• With treatment—IGG decreases the number of infections, normalizes life span, decreases number of infections

Menzin et al, ClinicoEconomics and Outcomes Research, 2014
When did I start realizing Primary Immunodeficiencies were important?

First Case

- Chronic recurring infections
  - IGG deficiency
- After consulting “family immunologist”
  - Started testing sequential “A” hosts with infection
- More IGG deficiencies

Dan Conway, MD

Tested All A Hosts

- Initial experience 6 / 9 with primary immunodeficiency

- **4/6 IgG deficient**
Patient 1
36 yr old male s/p closed femur fracture from bike accident s/p multiple I and D's

Pre-op
9.4.13

Left femoral length: 49 cm
Right femoral length: 46.5 cm

PMH:
  – R hip Perthes as child
  • Meds:
    – Zyvox, Cefipime, Oxycodone
  • All:
    – Vanc, Zosyn sensitivity
  • PSH:
    – Multiple R femur sx’s
  • SH/FH:
    – Denies tobacco, EtOH, recreational drug use. Lives with family, including 7 children

A Host???

  • IgM deficient: 9.8 mg/dl (40-230)
  • IgA deficient: 12.7 mg/dl (68-378)
  • IgG deficient: 450 mg/dl (694-1618)
9.25.13

LLD: 3.5 cm
R femur length: 44 cm
Preop: 46.5 cm
8/1/14
• Preop Arthroscopic LOA
• 11 months post bone graft

2016
• Knee ROM 105°
• WBAT
• Hip pain: old Perthes
• Healed femur
• IvIG q month
Patient 2

- 67 y.o. BF s/p Primary R TKA 1/11/16
  - HTN
  - BMI: 42
  - Prediabetic
  - Hx of breast Ca 2003

- 1/17/16: WBC’s 23,000
- 1/19/16: Wash out for “skin Necrosis”
  - Culture: Proteus
- 1/22/16: washout Poly change
  - WBC’s 30,000

- 1/26/16: WBC 28,000
  Necrotizing fasciitis
  15 days post Primary TKA
IgM Deficiency: 17 mg/dl (40-230)
Current Protocol

- Test all patients entering my practice who have infections

Lab List

- CBC w diff
- IgG, IgM, IgA, IgE
- CH50
- Tetanus, HIB, Measles, antibody
- SED Rate
- CRP
- ANA
- RF
- ANCA
- C3, C4
Current Numbers
• 53 patients with infection
• 62% (33/53) with immunological abnormalities

A HOST
• 72% (13/18) with abnormalities

B HOST
• 86% (30/35) with abnormalities
Abnormalities Detected

- IgG (low)
- IgM (low)
- IgE (high)
- IgA (low)
- ANA (+)
- Total Complement (low)
- RF (+)

% abnormals with IgG Deficiency

- A: 46% (6/13)
- B: 17% (5/30)

Any Abnormalities

- Hematology / immunology referral
Treatment

- Replenish deficiencies (IgG)
- Boost nutrition status
- Cover with antibiotics before, during, and after clean surgery
- Recheck levels q month

Success Rate

- These patients can be treated successfully for infection eradication
- Treat deficiencies
- Monitor immune status

Is this FOOD FOR THOUGHT?

OR......
What do we do now?
• Test EVERYONE?
• Does the RISK of infection and all its CONSEQUENCES justify the COST of immunology testing???

COST DIFFERENTIAL
• Extra blood tests cost: $600 /patient
• Infection cost: $30,000-50,000 /Patient
NEW AGE OF HEALTH CARE

• Surgeon PENALIZED for infections

• Now we may have a better answer for the “WHY ME?” question!!!

Preop checklist for high-risk patients??

• Preop Antibiotics
• Preop immunoglobulin

Bottom Line

• OPTIMIZE YOUR HOST!
• If you don’t check it, you won’t know
• Don’t operate without checking your patient’s immune system
Conway Patient Pearls

• Reconstruction/Reimplantation is rarely an emergency and can be scheduled
• Don’t torture yourself with a plan the patient can’t handle

THANK YOU

Thank You
Don’t operate without checking your patients immune system
• We All check for secondary causes
• Now check the primary

No Literature on Orthopaedic infections as a manifestation of primary Immunodeficiency
Recurrent Infection Patients

Chronic Osteo Patients

Primary

- Childhood—over 100 etiologies
  - B cell
    - Antibody deficiencies
  - T cell
- Wide Range of clinical presentation
9.4.13
Left femoral length: 49 cm
Right femoral length: 46.5 cm
LLD: 1.5 cm (acetabular compensation)

9.25.13
LLD: 3.5 cm
R femoral length: 44 cm
Preop: 46.5 cm

9.25.13

9.25.13
JH

- Bike accident in January: closed right femur fracture
  - operated on elsewhere. He had an infection of the surgical site.
- I&D + Revision surgery – ex-fix & wound VAC
- + draining sinus lateral thigh

JH

- 36 y/o male
- Diagnosis
  - Infected right femoral nonunion with osteomyelitis
  - s/p resection of 11 cm segment of femoral osteomyelitis and intramedullary rod fixation of femur fracture with antibiotic-coated intramedullary rod 9.6.13: Masquelet stage 1
- Planned procedure
  - Rod exchange
  - Bone graft segmental defect
  - Lengthening
TISSUE BED OPTIMIZATION

- HYPERBARIC OXYGEN PRE AND POST OP
- INCISIONAL WOUND VACS

HOST CLASSIFICATION

- OPTIMIZING YOUR PATIENT

The Role of Undiagnosed Primary Immunodeficiency in Orthopaedic Infection

Janet D. Conway, MD
Rubin Institute for Advanced Orthopedics
Sinai Hospital of Baltimore
OBVIOUS CAUSES OF ORTHOPAEDIC COMPLICATIONS/INFECTION

• Smoking
• BMI > 40
• Diabetes
• Dialysis patients
• Steroid use

CONCLUSION

• CLASSIFY YOUR HOST TO DETERMINE SUCCESS OF OPERATIVE INTERVENTION
• IMPROVE YOUR HOSTS WITHIN A REASONABLE PERIOD OF TIME

How to be a Good Host: Preoperative Considerations