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

Disclosures

- Consultant: Biomet, DePuy Synthes, and Cerament
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- Fellowship Support: Biocomposites
- 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 MEGAIMPLANT/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 Hemaglobin 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 Rhem 1991

Smoking

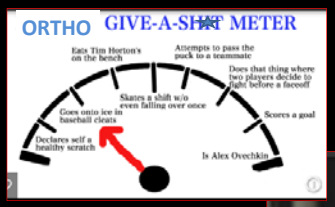
BLOOD FLOW

- VASCULAR CONSULT IF PULSE IS NOT EQUAL TO UNAFFECTED SIDE

DECIDE HOW LONG YOU ARE WILLING TO WAIT

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

- Antimalerial agents
- Captopril
- Carbamazepine
- Glucocorticosteroids
- Fenclofenac
- Gold Salts
- Penicillamine
- Phenytoin
- Sulfasalazine
- ritulximab

URGENT NEED

- Cost containment—infections are expensive!!

No Literature on Ortho Manifestations of Primary Immunodeficiency

1*Immunodeficiencies

- 0ver 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

Bonilla et al; ICON: CVID Disorders: J Allergy Clin Immunol Prac 2016

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

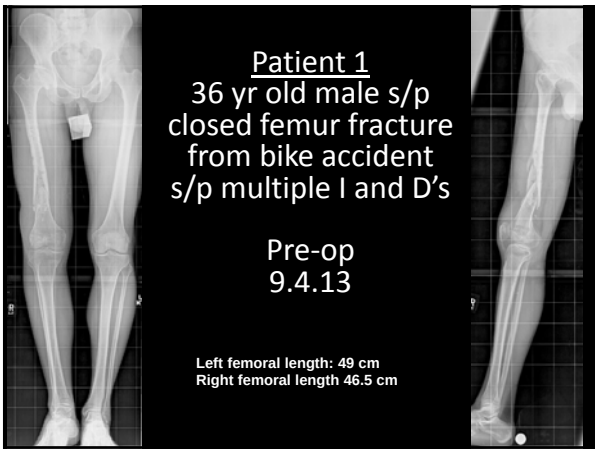
- Chronic recurring infections
  - IGG deficiency
- After consulting "family immunologist"
  - Started testing sequential "A" hosts with infection
- More IGG deficiencies

Dan Conway, MD

Tested All A Hosts

- Initial experience 6 / 9 with primary immunodeficiency

•4/6 IgG deficient

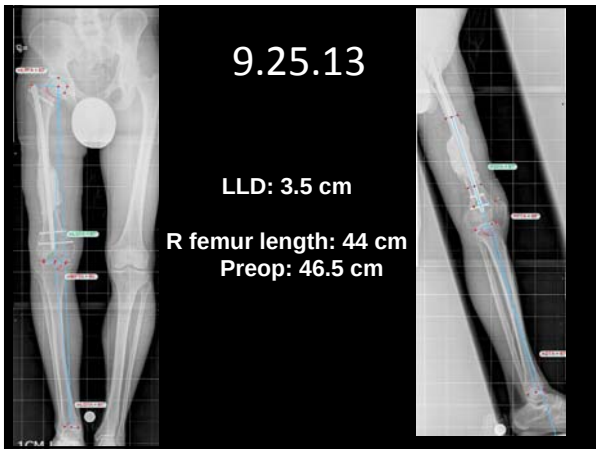


PMH:
- R hip Perthes as child

- 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)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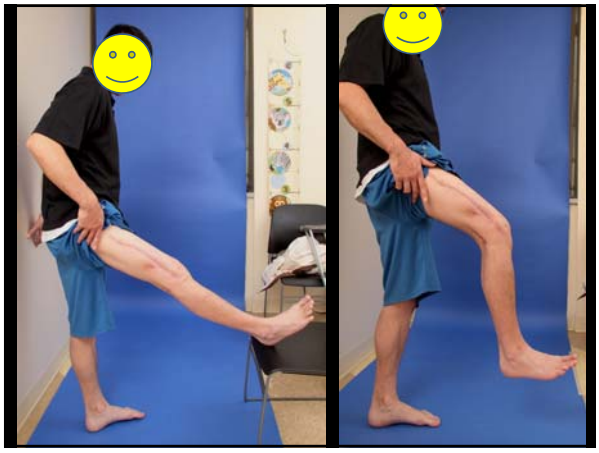
LLD: 3.5 cm
R femur length: 44 cm
Preop: 46.5 cm



8/1/14

- Preop Arthroscopic LOA
- 11 months post bone graft

2016

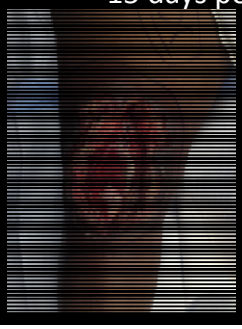
- Knee ROM 105°
- WBAT
- Hip pain: old Perthes
- Healed femur
- IvIG q month

Patient 2

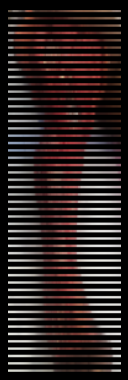
- 67 y.o. BF s/p Primary R TKA 1/11/16
  - HTN
  - BMI: 42
  - Prediabetic
  - Hx of breast Ca 2003

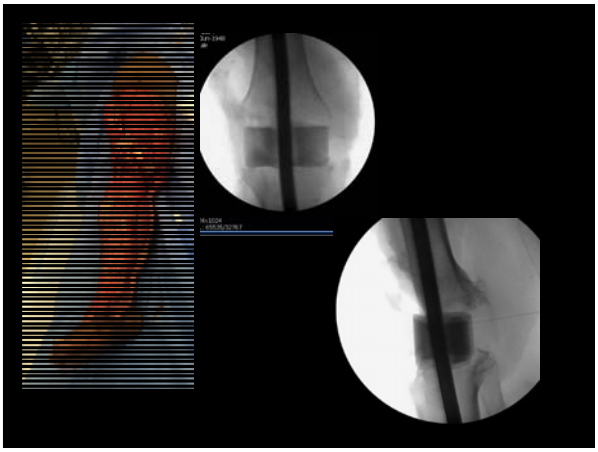
- 1/17/16: WBC's 23,000
- 1/19/16: Wash out for "skin Necrosis"
  - Culture : Proteus
- 1/22/16: washout Poly change
  - WBC's 30,000

1/26/16: WBC 28,000
Necrotizing fasciitis
15 days post Primary TKA



IgM Deficiency:
17 mg/dl (40-230)





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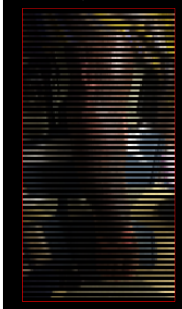


Current Protocol

- 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

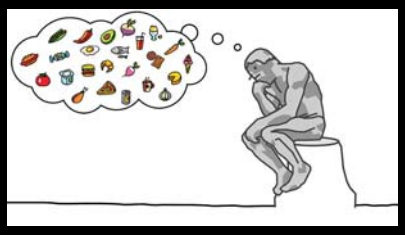
Treatment

- 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……

CAN OF WORMS???

What do we do now?

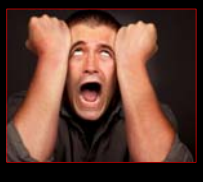
- Test EVERYONE?
- Does the RISK of infection and all its CONSEQUENCES justify the COST of immunology testing???

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

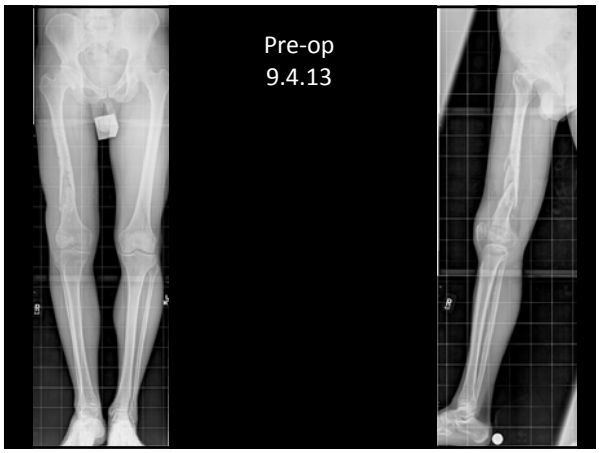
No Literature on Orthopaedic infections as a manifestation of primary Immunodeficiency

Recurrent Infection Patients

Chronic Osteo Patients

Primary

- Childhood– over 100 etiologies
  - B cell
    - Antibody deficiencies
  - T cell
- Wide Range of clinical presentation


Pre-op
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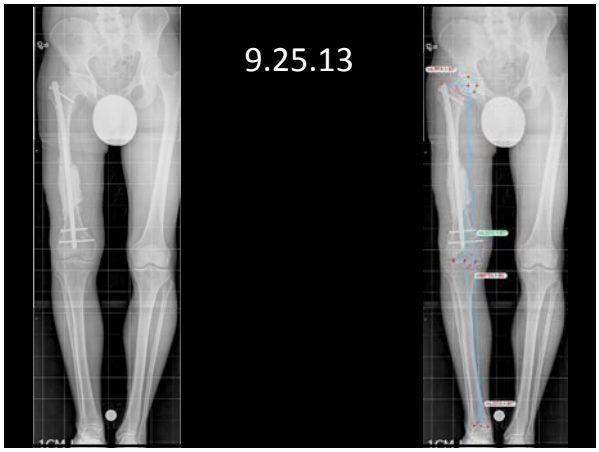
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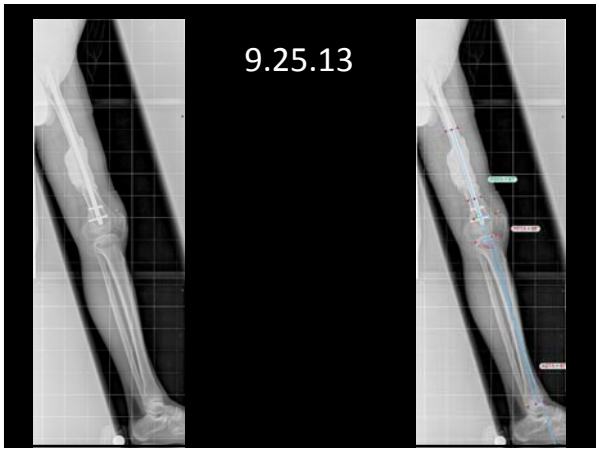
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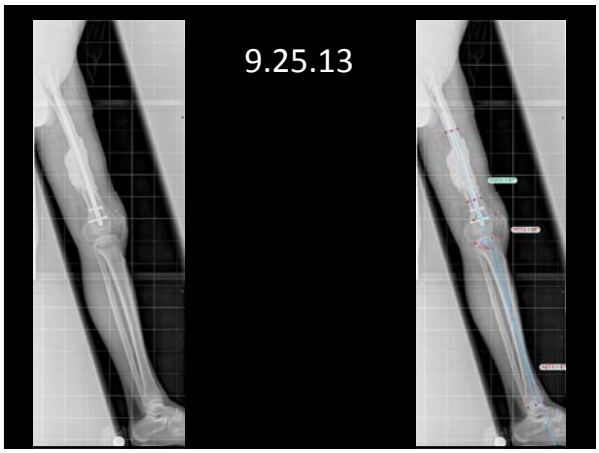
JH

- 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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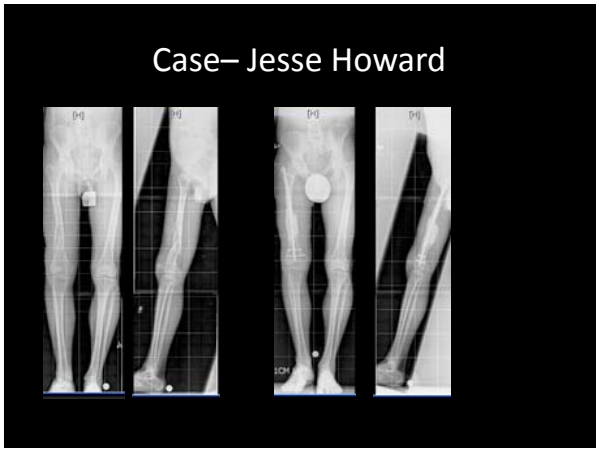
Case– Jesse Howard

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 B HOSTS WITHIN A REASONABLE PERIOD OF TIME

How to be a Good Host: Preoperative Considerations