



**2009 OTA Annual Meeting
Manchester Grand Hyatt
San Diego, CA**

Basic Science Focus Forum

Symposium V: Infection

Douglas D, Level I

**7:30am – 8:40am
Thursday, October 8, 2009**

**Moderators: Theodore Miclau, III, MD
Mark E. Shirtliff, PhD**

**Faculty: Andrew H. Schmidt, MD
Joseph C. Wenke, PhD
Lawrence X. Webb, MD
Graeme A. O'May, PhD**

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Disclosure: Faculty disclosure can be found starting on page 67 of the 2009 OTA Annual Meeting program.

The Use of BMPs in the Setting of Infection: Unsafe or Advantageous?

Andrew Schmidt, MD

After fracture fixation, a retained orthopedic implant may be a reservoir of bacteria due to the propensity of bacteria to form biofilms.

Pathophysiology of implant-related infections

- Surface is electrochemically active and proteins rapidly adsorb onto the surface.
- The same surface is available for bacterial or eukaryotic cell adhesion

“The Race for the Surface”

- Metal surfaces rapidly covered with proteins.
- Bacteria attracted by nutrients concentrated at implant surfaces
- Stimulated by adhesion to proliferate and to excrete a polysaccharide coating.

Biofilm Facts

- Adherent *Staphylococcus* organisms are more resistant to antibiotics than the same strains grown in a non-adhered state.
- Bacteria survive within biofilms even when exposed to antibiotic levels 100 - 1000x greater than MIC
- Even sensitive bacteria may have reduced sensitivity to a given antibiotic when in a biofilm.

However, in the case of a fracture, an orthopedic implant may be necessary to maintain stability of the fracture, which has been shown to decrease the risk of infection and contribute to eradication of infection when it occurs.

Infected Fractures: The Role of Fracture Stability.

- The presence of a foreign-body increases the risk of infection.
- Experience suggests that internal fixation of open fractures reduces the infection rate.
- Rabbit model: Tibia fractures were stabilized with either a dynamic compression plate (stable group) or a loose intramedullary rod (unstable group), and inoculated with *S. aureus*.
- The infection rate was double in the unstable group (71% versus 35%).

Why?

- Internal fixation reduces ongoing soft tissue damage caused by fx instability
 - Promotes vascular invasion
 - Improves microcirculation

- Makes the wound a less hospitable environment for bacterial growth.

Treating an infection is much easier when the fracture is healed as compared to an infected nonunion

Therefore, any intervention that promotes fracture healing, even in the presence of infection, would be of benefit and dramatically simplify the problem of infection after internal fixation.

Question: Do BMP's maintain their osteoinductive ability in the presence of infection?

The results of a series of animal studies are presented that suggest that both OP-1 (BMP-7) and BMP-2 do maintain their ability to promote healing of both acute and chronically – infected critical bone defects.

***** Note: This is off-label used of BMP *****

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Basic Science Fracture Forum:
Musculoskeletal Infection Overview

Title: **Bugs, Bone and Biomaterials**

Lawrence X Webb MD
MCCG/Mercer University
Macon, GA

October 7 – 8, 2009

Manchester Grand Hyatt, Douglas Pavilion D

Overview – demographics and cost

3 Interacting Variables

Bacteria--- Inert Surface--- Host Cells

Bacteria and the Inert Surface

Normal Bacterial Ecologies

Planktonic vs adherent state and the pure laboratory culture

Microbiology of the tooth

A silk suture

Same Problem in other areas: Marine biofouling, Oil Pipes,

Bacteria, Inflammation, and the cascade of cellular death

Chaos Theory and the Imperative of the Carbon Cycle

Differential adherence of bacteria to different surfaces and differential antibiotic sensitivities of bacteria contingent on the type of surface they are adherent to

Host -- Inert Surface interactions

Differential adherence papers

High antibiotic concentration strategies

The Bead Pouch

Inert Surface – Host Tissue Interactions

Blood Supply Beneath a plate—alteration of design

Fibronectin

Reactivity of Metal to biologic tissues Stainless Steel vs Titanium

Conditioning Films

The Race for the Surface

Colonization of Orthopaedic Implants

Host ---Bacterial Interactions

Emergence of Resistance

Facultative Intracellular Bacteria as a mechanism for Indolence
--The Bacterial Trojan Horse

Nanotechnology

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