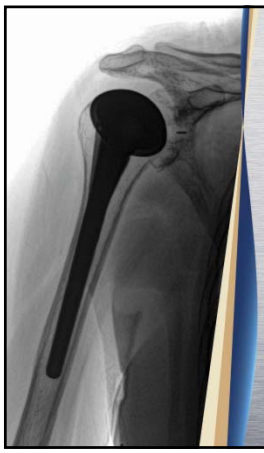

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Diagnosis and Management of Shoulder PJI

Surena Namdari MD, MSc
Associate Professor of Orthopaedic Surgery
The Rothman Institute
Thomas Jefferson University Health System
Philadelphia, PA

Disclosures

- Research Support
  - 3M
  - Aesculap
  - AO Spine
  - Biomet
  - Cempra
  - CeramTec
  - DePuy
  - Integra
  - Myoscience
  - NDRI
  - NIH
  - Novartis
  - OREF
  - Pfizer
  - Rotation Medical
  - Simplify Medical
  - Smith and Nephew
  - Stelkast
  - Stryker Orthopedics
  - Synthes
  - TissueGene
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  - Orthospace
  - Zimmer Biomet

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Disclosures

- Consultant
  - DJO Surgical
  - Miami Device Solutions
- Research Support
  - Arthrex
  - Integra Life Sciences
  - Depuy
  - Zimmer
- Royalties
  - DJO Surgical
  - Miami Device Solutions
  - Elsevier
- Board Member/Adviser
  - Biedermann Lab for Orthopaedic Research at University of Pennsylvania

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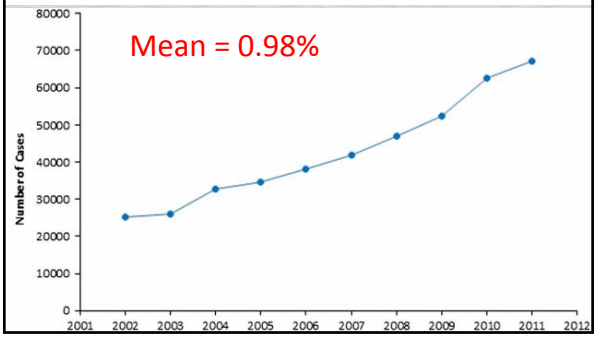
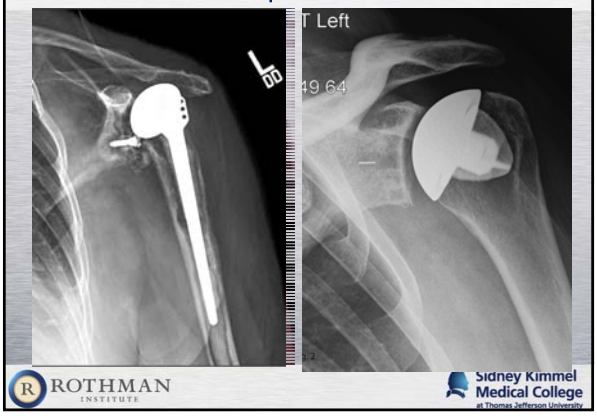
Periprosthetic shoulder infection in the United States: incidence and economic burden

J Shoulder Elbow Surg (2015) 24, 741-746

Eric M. Padegimas, MD, Mitchell Maltenfort, PhD, Matthew L. Ramsey, MD, Gerald R. Williams, MD, Javad Parvizi, MD, Surena Namdari, MD, MSc*



The problem…



The Bigger Problem: How do we define infection???

New Definition for Periprosthetic Joint Infection

From the Workgroup of the Musculoskeletal Infection Society

Javad Parvizi MD, Benjamin Zmistowski BS, Elie F. Berbari MD, Thomas W. Bauer MD, PhD, Bryan D. Springer MD, Craig J. Della Valle MD, Kevin L. Garvin MD, Michael A. Mont MD, Montri D. Wongworawat MD, Charalampos G. Zalavras MD

Clin Orthop Relat Res (2011) 469:2992–2994

MusculoSkeletal Infection Society MSIS

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Prognostic Factors for Bacterial Cultures Positive for *Propionibacterium acnes* and Other Organisms in a Large Series of Revision Shoulder Arthroplasties Performed for Stiffness, Pain, or Loosening

Paul Pottinger, MD, Susan Butler-Wu, PhD, Moni Blazej Neradilek, MS, Andrew Merritt, MD, Alexander Bertelsen, PAC, Jocelyn L. Jette, BS, Winston J. Warme, MD, and Frederick A. Matsen III, MD

- 56% positive cultures
- 70% positive for P. acnes

The more cultures you send, the more likely you are to get positive cultures

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Propionibacterium acnes: an underestimated etiology in the pathogenesis of osteoarthritis?

Ofer Levy, MD, MCh (Orth), FRCS[a,*], Shabnam Iyer, MBBS, MD, DTM&H, FRCPath[b], Ehud Atoun, MD, MCh (Orth)[a], Noel Peter, MRCS[a], Nir Hous, MD[a], Dave Cash, BSc (Hons)[b], Fawaz Musa, MBChB, FRCPath[c], A. Ali Narvani, FRCS (Orth & Trauma)[a]

J Shoulder Elbow Surg (2013) 22, 505-511

- N=55, 42% positive P. acnes joint cultures in primary arthritis

Propionibacterium acnes in primary shoulder arthroplasty: rates of colonization, patient risk factors, and efficacy of perioperative prophylaxis

Chuan Kong Koh, MBChB[a,*], Jonathan P. Marsh, MD, FRCSC[b], Dragana Drinković, MD, FRCPA[c], Cameron G. Walker, PhD[d], Peter C. Poon, MBChB, FRACS[a]

- N = 22, 73% positive P. acnes deep and superficial cultures

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Propionibacterium Persists in the Skin Despite Standard Surgical Preparation

J Bone Joint Surg Am. 2014;96:1447-50

Michael J. Lee, MD, Paul S. Pottinger, MD, Susan Butler-Wu, PhD, Roger E. Bumgarner, PhD, Stacy M. Russ, and Frederick A. Matsen III, MD

- 70% rate of persistence of Propionibacteria after skin preparation

Decolonization of Propionibacterium acnes from the skin of the shoulder with oral Doxycycline: a randomized controlled trial

[Unpublished]

Surena Namdari, Thema Nicholson, Javad Parvizi, Matthew Ramsey

- No Drug: 22/37 positive P. acnes cultures (59%)
- Doxycycline: 16/37 positive P. acnes cultures (43%)

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Diagnosis

Serum

Synovial Fluid

Tissue

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Serum

The challenge of *Propionibacterium acnes* and revision shoulder arthroplasty: a review of current diagnostic options

J Shoulder Elbow Surg (2016) 25, 1034–1040

Margaret V. Shields, BS[a], Leath Abdullah, BS[b], Surena Namdari, MD, MSc[c,*]

- *WBC, CRP, and ESR commonly normal*

Serum Interleukin-6 as a Marker of Periprosthetic Shoulder Infection

J Bone Joint Surg Am. 2014;96:41-5

Diego Villacis, MD, Jarrad A. Merriman, MPH, Raj Yalamanchili, BS, Reza Omid, MD, John Itamura, MD, and George F. Rick Hatch III, MD

- Sensitivity 14%, specificity 94%

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Synovial Fluid

Leukocyte esterase in the diagnosis of shoulder periprosthetic joint infection

J Shoulder Elbow Surg (2015) 24, 1421-1426

Gregory N. Nelson, MD[a,*], E. Scott Paxton, MD[b], Alexa Narzikul, BS[c], Gerald Williams, MD[c], Mark D. Lazarus, MD[c], Joseph A. Abboud, MD[c]

- *Sensitivity of 30% and a specificity of 67%*

α-Defensin as a predictor of periprosthetic shoulder infection

J Shoulder Elbow Surg (2015) 24, 1021-1027

Salvatore J. Frangiamore, MD, MS, Anas Saleh, MD, Matthew J. Grosso, MD, Mario Farias Kovac, MD, Carlos A. Higuera, MD, Joseph P. Iannotti, MD, PhD, Eric T. Ricchetti, MD*

- *Sensitivity of 63% and a specificity of 95%*

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On the horizon: cytokine profiles

Neer Award 2015: Analysis of cytokine profiles in the diagnosis of periprosthetic joint infections of the shoulder

Salvatore J. Frangiamore, MD[a], Anas Saleh, MD[a], Matthew J. Grosso, MD[b], Mario Farias Kovac, MD[a], Xiaochun Zhang, MD[c], Thomas M. Daly, MD[c], Thomas W. Bauer, MD, PhD[d], Kathleen A. Derwin, PhD[a], Joseph P. Iannotti, MD, PhD[a], Eric T. Ricchetti, MD[a,*]

J Shoulder Elbow Surg (2017) 26, 186–196

Synovial Fluid

IL-6, TNF-α, and IL-2: sensitivity = 80%
specificity = 93%

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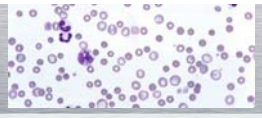
Sensitivity of Frozen Section Histology for Identifying *Propionibacterium acnes* Infections in Revision Shoulder Arthroplasty

J Bone Joint Surg Am. 2014 Mar 19;96(6):442-7.

Matthew J. Grosso, BS, Salvatore J. Frangiamore, MD, Eric T. Ricchetti, MD, Thomas W. Bauer, MD, PhD, and Joseph P. Iannotti, MD, PhD

- 10 wbc / HPF = 72%sensitive / 100% specific for P. acnes

Need Tissue



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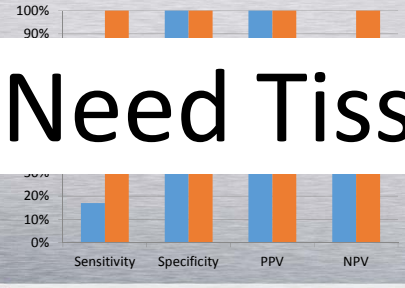
Arthroscopic Tissue Culture for the Evaluation of Periprosthetic Shoulder Infection

J Bone Joint Surg Am. 2014 Dec 3;96(23):1952-8.

Matthew F. Dilisio, MD, Lindsay R. Miller, MPH, Jon J.P. Warner, MD, and Laurence D. Higgins, MD



Need Tissue

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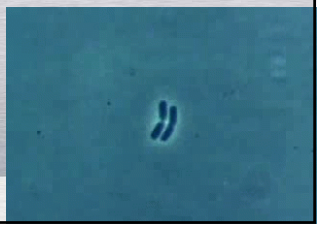
On the horizon: PCR / NGS

Neer Award 2017: A rapid method for detecting *Propionibacterium acnes* in surgical biopsy specimens from the shoulder

J Shoulder Elbow Surg. 2017 Feb;26(2):179-185

Scott Holmes, MSc[a], Ana M. Pena Diaz, MSc[b], George S. Athwal, MD, FRCSC[a,c], Kenneth J. Faber, MD, FRCSC[a,c], David B. O'Gorman, PhD[a,c,*]

- Primers designed to amplify a unique region of 16S rRNA gene in *P acnes*
- Optimized to detect DNA
- 24 hour results



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Journal of Clinical Microbiology

***Propionibacterium acnes*: Disease-Causing Agent or Common Contaminant? Detection in Diverse Patient Samples by Next-Generation Sequencing**

J Clin Microbiol. 2016 Apr;54(4):980-7

Sarah Mollerup,[a] Jens Friis-Nielsen,[b] Lasse Vinner,[a] Thomas Arn Hansen,[a] Stine Raith Richter,[a] Helena Fridholm,[a] Jose Alejandro Romero Herrera,[b] Ole Lund,[b] Søren Brunak,[b,c] Jose M. G. Izarzugaza,[b] Tobias Mourier,[a] Lars Peter Nielsen,[d] Anders Johannes Hansen[a]

- **Our results show that P. acnes can be detected in practically all sample types**
- **Possible Contamination from:**
  - the patient
  - hospital personnel
  - lab personnel
  - during sample processing and analysis

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Explant, Mechanical Debridement, Irrigation

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Future surgery after revision shoulder arthroplasty: the impact of ~~X~~nexpected positive cultures

J Shoulder Elbow Surg (2017)

Eric M. Padegimas, MD[a], Cassandra Lawrence, BS[a], Alexa C. Narzikul, BA[a], Benjamin M. Zmistowski, MD[a], Joseph A. Abboud, MD[b], Gerald R. Williams, MD[b], Surena Namdari, MD, MSc[b,*]

- N = 28 culture positive, 89 culture negative
- 2 of 28 (7.1%) patients with UPCs required future surgery,
  - 1 case of positive cultures (1/6) during revision
- 18 of 89 (20.2%) patients without UPCs required 25 additional surgeries
  - 3 cases of positive cultures during revision

Abx Protocol:

- 18 of 28 (64.3%)patients received IV antibiotics for 6 weeks postoperatively
- 10 of 28 (35.7%) received a routine 2-week empirical antibiotic regimen

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Antibiotics?

Single-Stage Revision Is Effective for Failed Shoulder Arthroplasty with Positive Cultures for Propionibacterium

J Bone Joint Surg Am. 2016;98:2047-51

Jason E. Hsu, MD, Jacob D. Gorbaty, MD, Ian J. Whitney, MD, and Frederick A. Matsen III, MD

- **N = 27 Culture positive, 28 Control**
- **11% reoperation in both groups, 0 for infection**
- **Abx protocol:**
  - high index of suspicion: IV ceftriaxone and IV vancomycin for 3 weeks
  - low index of suspicion: oral amoxicillin and clavulanate for 3 weeks
  - if 2+ cultures became positive: IV ceftriaxone and/or vancomycin and oral rifampin for 6 weeks followed by amoxicillin and clavulanate or doxycycline for a minimum of 6 months

42% antibiotic side effects (GI, derm, leukopenia)

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Dual-Stage Revision

- >70 % converted to arthroplasties
- No difference in infection recurrence
- No difference in range of motion
- No reoperations for infection

(mean 4 years)

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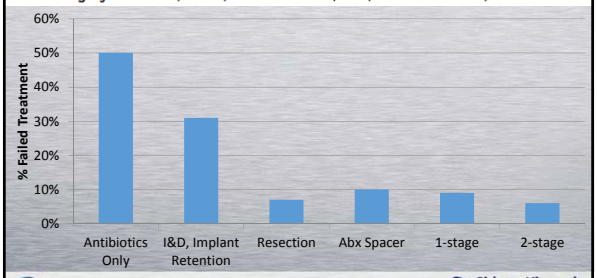
Outcomes in the treatment of periprosthetic joint infection after shoulder arthroplasty: a systematic review

J Shoulder Elbow Surg (2016) 25, 1337–1345

Gregory N. Nelson, MD[a,*], Daniel E. Davis, MD[b], Surena Namdari, MD[b]



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Conclusions

Diagnosis

- No ideal serum test
- No ideal point of care testing
- Need tissue
- High rate of positive cultures in primary and revision surgery
- *Cytokine Pofiles/PCR / Next Generation Sequencing?*

Treatment

- Explant, mechanical debridement, irrigation
- Single-stage sufficient for most, +/- antibiotics
- Dual-stage for obvious infection/aggressive organisms
- *Alter treatment based on host?*

Thank You

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