Percutaneous Fluoroscopic Synovial Biopsy as a New Diagnostic Test for Periprosthetic Infection after Shoulder Arthroplasty: A Feasibility Study

J Quon, K Hynes, P Lapner, A Sheikh
The Ottawa Hospital
University of Ottawa
Disclosures

• Neither I nor my immediate family members have a financial relationship with a commercial organization that may have direct or indirect interest in the content.
Purpose

1) To describe a novel technique (percutaneous fluoroscopic synovial biopsy) of diagnosing post operative shoulder infections

2) To report preliminary data on use of this technique
Background

- Reported infection rates in TSA are 0.4-3.9%; Reverse TSA 5.1%; Hemi-arthroplasty 1.0%

- Devastating complication requiring prolonged antibiotics and further surgery

- Functional outcomes are diminished after infection is treated

- 15-29% rate of unexpected positive cultures at time of revision surgery


Background

- *Propionibacterium acnes* is the most prevalent organism in post-operative shoulder infections (36-70%)

- *P. acnes* preferentially colonizes shoulder surgical sites compared with the hip and knee.

- Clinical presentation lacks classic signs/symptoms of infection

- 10-50% reported detection rate of *P. acnes* with joint aspiration


Background

- CRP and ESR have low sensitivity for diagnosis of shoulder arthroplasty infection when compared to hip, knee and spine

- Current gold standard is open (intra-operative) tissue sampling

- Need for a pre-operative test to diagnose infection

- Synovial biopsy has been shown to be superior to aspiration and CRP in diagnosis of peri-prosthetic hip and knee infections


Synovial Biopsy Technique

- Performed by MSK Radiologist in fluoroscopy suite
- Patient positioned supine
- Sterile technique (disinfect skin, drape)
- 1% Xylocaine infiltrated at two sites
- 18-G spinal needle advanced to axillary recess of glenohumeral joint (3 samples) and rotator interval (2 samples)
- If fluid is present, an aspirate is obtained
Synovial Biopsy Technique

- **22-G Chiba biopsy needle** used to obtain samples

- Sent in sterile saline as one specimen to microbiology for analysis; aspirate sent separately if available

- A small amount of contrast injected confirming intra-articular positioning after aspiration and synovial samples taken as contrast can be bacteriostatic
Methods

• Prospective series of 14 patients undergoing workup for chronic glenohumeral infection
  – humeral head replacement (4), TSA or rTSA (4), shoulder arthroscopy for biceps tenodesis or cuff repair (4), Latarjet procedure (1), ORIF proximal humerus fracture (1)

• Patients had pain and/or stiffness without other identifiable cause (i.e. loosening, implant failure, fracture)

• 6 females, 8 males, Mean age 61

• All patients underwent percutaneous synovial biopsy (pre-op) and intra-operative biopsy (gold standard)
  – One MSK radiologist performed all of the synovial biopsies.
  – One orthopedic surgeon performed all of the open biopsies.
Results

- $\frac{4}{14} = 29\%$ positive (open biopsy) out of all clinically suspicious presentations
  - All infections occurred in arthroplasty patients

- Cultures kept for 5-16 days with average time to positive culture of **6 days**.

- Confirmed infections: 3 *P. acnes* (75%) and 1 coagulase negative staph aureus (25%)

- Mean time from index surgery: 33 months (range 0.5 to 204 months)
Results

- **3/14** had positive percutaneous fluoroscopic synovial biopsy, all of which grew the same organism at the time of OR

- In **75%** of infections, synovial biopsy accurately identified the infection pre-operatively
  - Sensitivity 75%, Specificity 100%

- No complications or morbidity associated with synovial biopsy
Limitations

- Standardized culture time of 14 days required to reliably grow P. acnes
- 5 separate samples should be standard for synovial biopsy as well as for OR
- Limited ability to compare to aspirate, as most often, no fluid is present
Discussion

• Synovial biopsy can accurately diagnose post-operative shoulder infection.

• No morbidity associated with the procedure

• Significant morbidity associated with uncertainty of diagnosis (i.e. multiple revision surgeries)

• Limited clinical ability to predict positive infection pre or intra-operatively
Discussion

- Need for standardized protocol and collection of more data

- Small numbers due to low incidence of post-operative shoulder infection
  - Additional surgeons or centers required for recruitment
**Conclusion**

- Synovial Biopsy can be used as a non-invasive means to diagnose shoulder infection

- Synovial biopsy had a high concordance rate of 75% compared to open biopsy

- Lower cost of percutaneous biopsy vs. intra-operative

- Shoulder synovial biopsy is a novel technique not previously described in the literature.

- This pilot study allows us to plan a multi-center study in order to validate this diagnostic test
Thank you

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