

Original Article

Survey of shoulder arthroplasty surgeons' methods for infection avoidance of *Propionibacterium*

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ABSTRACT

Introduction: *Propionibacterium acnes* infection after shoulder arthroplasty remains a source of morbidity. Determining practices amongst shoulder surgeons is the first step in developing infection-prevention best-practices.

Methods: A survey was sent to a shoulder fellowship alumni group to determine their arthroplasty infection prevention methods

Results: 74% completed the survey. Cefazolin (90%), vancomycin (50%) and clindamycin (18%) were the most commonly used antibiotics, 61% utilized more than one antibiotic. Most (76%) reported using an experience-based protocol learned during residency/fellowship.

Discussion and conclusion: There are no clear standards for prevention of *Propionibacterium acnes* infections in shoulder arthroplasty. There is a general non-scientific approach to the prevention of shoulder arthroplasty infection.

1. Introduction

Post-operative infection following shoulder arthroplasty is a rare, but potentially devastating complication.¹ *Propionibacterium acnes* is a gram-positive anaerobic bacillus, once thought to be a contaminant, but now known to be a pathogen frequently responsible for prosthetic shoulder infections.² Despite the common use of preoperative antibiotics and skin preparation, deep contamination with *P. acnes* has been reported.³

The most effective antibiotic for both infection prophylaxis and treatment of active *P. acnes* infections has not been elucidated as previous analysis of *P. acnes* isolates reveal varying degrees of sensitivity to various antibiotics. Koh et al. evaluated intra-operative cultures of *P. acnes* and found that cefazolin minimum inhibitory concentration (MIC) varied from 0.12 µg/mL to 0.32 µg/mL (st dev 0.125).⁴ Alternatively, analysis by Crane et al. found *P. acnes* isolates retrieved from shoulder surgery demonstrated the greatest antimicrobial susceptibility testing to penicillin G, cephalothin and ceftriaxone in terms of lowest MIC value, while several specimens demonstrated active resistance to

clindamycin.⁵ Furthermore, the antimicrobial effect of vancomycin against *P. acnes* in this study was noted as only 'fair'. Overall, the results of this study indicate that penicillins and first-generation cephalosporins (cefazolin and cephalothin) are the most effective perioperative antibiotics against *P. acnes*. The resultant lack of clear antibiotic indications in shoulder arthroplasty results in variable and non-uniform antibiotic *P. acnes* prophylaxis and infection treatment. The purpose of this cross-sectional study was to determine what current antibiotic prophylaxis protocols are employed by fellowship trained shoulder arthroplasty surgeons. Along with questioning these surgeons about their preferred antibiotic use, we also sought to determine other surgical preparation protocols related to shoulder arthroplasty. Given a lack of clear existing standards, we hypothesized that marked variation in *P. acnes* prophylaxis practice exists amongst a cohort of similarly fellowship trained shoulder surgeons.

2. Materials and methods

An on-line survey (Appendix A) was distributed via e-mail invitation

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to all members of a fellowship alumni group, The Codman Shoulder Society which consists of members of Shoulder and Elbow as well as sports medicine fellowships. The survey queried practice demographic descriptive information about the respondents such as years of experience and annual shoulder arthroplasty volume. Questions on their current practice of pre-, post- and intra-operative antibiotic use as well as other factors currently utilized in an effort to decrease post-operative infections after shoulder arthroplasty were included. Lastly, they were questioned regarding factors influencing their current practice regimen. Institutional Review Board protocol was obtained. Mean and mode comparative data with standard deviation was calculated to determine the variance and frequency of selected techniques and antibiotic choices.

3. Results

62 of 84 (74%) members completed the survey. Fifty-three members completed a Shoulder & Elbow fellowship, 19 completed a Sports Medicine fellowship and two completed a Hand fellowship (ten respondents had completed more than one fellowship).

These 62 members demonstrated a similar distribution regarding the number of years in practice (Fig. 1) with the largest group being in their first 1 to 3 years of practice (29%). The distribution regarding number of primary shoulder arthroplasties performed annually (Fig. 2) was also similar amongst groups, with the largest group performing 26 to 50 cases yearly.

Cefazolin (90%), vancomycin (50%) and clindamycin (18%) are the most commonly used parenteral antibiotics given preoperatively, while 61% of respondents utilize more than one preoperative antibiotic. Cefazolin (82%), vancomycin (27%) and clindamycin (16%) are the most common postoperative parenteral antibiotics given with 35% of surgeons utilizing more than one postoperative antibiotic. Intraoperative local antibiotic powder is not used by 59% of surgeons, while 39% apply topical vancomycin powder, and a single surgeon adds gentamycin powder intraoperatively (Fig. 3). Eighty-five percent of surgeons utilize ChloroPrep® (BD, Franklin Lakes, NJ) for surgical skin prep, while 8% use DuraPrep™ (3M™St Paul, MN)] and 6% use an Iodine based scrub. Ioban™ (3M™St Paul, MN), an antimicrobial-impregnated adhesive drape, is employed by 81% of surgeons.

When questioned on post-operative infections, 52% of surgeons reported no known infections, while 37% experienced infections with *P. acnes* and 31% *Staphylococcus* species (*S. aureus* or coagulase-negative staphylococcus[CNS]) (Fig. 4). Most surgeons (76%) reported protocol choices are based on recommendations learned from residency and/or fellowship while 56% used an interpretation of available literature and 56% reported personal experience as the rationale for their treatment protocol (Fig. 5).

4. Discussion

Deep periprosthetic infection following shoulder arthroplasty is a

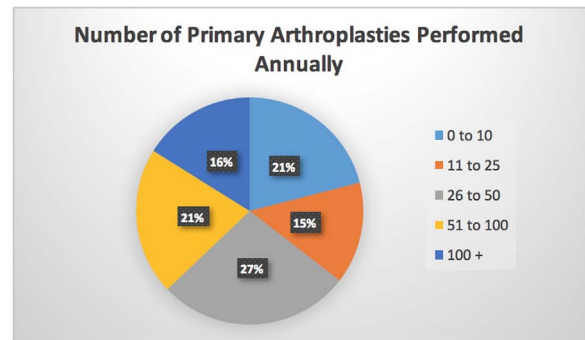


Fig. 2. Graph depicting the number of primary shoulder arthroplasties performed annually by the survey respondents.

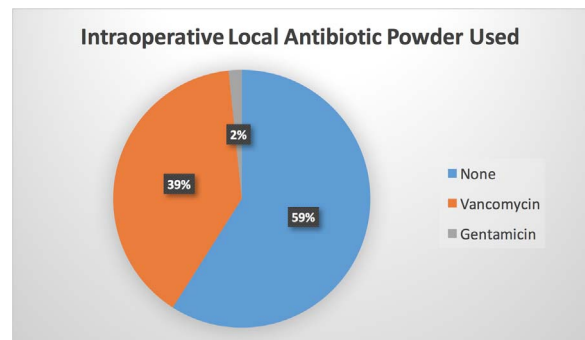


Fig. 3. Graph depicting the intra-operative local antibiotic powder use of the survey respondents.

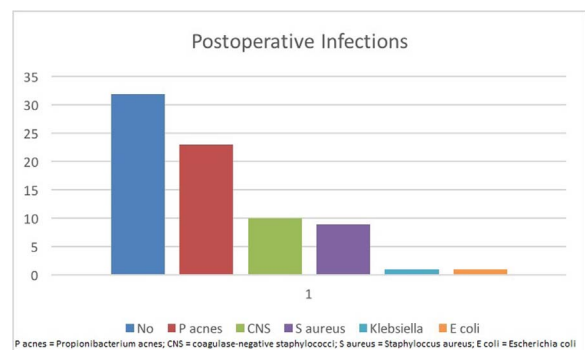


Fig. 4. Graph demonstrating the organisms responsible for the known post-operative infections by the survey respondents.

devastating yet potentially preventable problem.⁶ Patients with periprosthetic infections are typically treated with irrigation and debridement, removal of implants, placement of an antibiotic spacer, implant exchange or even resection arthroplasty¹ as antibiotic treatment alone has an unacceptably high failure rate.⁷

Over the past three decades, shoulder arthroplasty registries indicate an epidemiological shift in the most common pathogen in post-operative infection from *Staphylococcus* species to near equal incidence of *Staphylococcus* and *P. acnes*.⁸ *P. acnes* is part of the normal skin flora and as such is found frequently in the epidermal layer of planned surgical sites in primary shoulder arthroplasty cases, with higher rates in male patients.⁹ Differences in patient factors can also lead to an increase in the likelihood of a post-operative infection due to *P. acnes*. There is also a 2.5 times increase in relative risk in male patients compared to women, also due to the presence of sebaceous follicular glands.^{2,10}

P. acnes is a gram-positive, facultative, anaerobic rod that colonizes human skin, the oral cavity and genitourinary and gastrointestinal

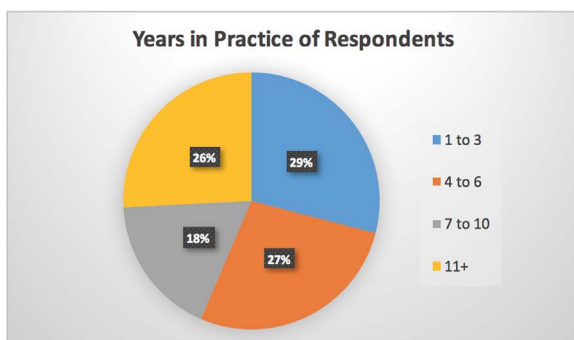


Fig. 1. Graph depicting the years in practice of the survey respondents.

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