Diagnostic Microbiology and Infectious Disease 75 (2013) 195–199

Contents lists available at SciVerse ScienceDirect

Diagnostic Microbiology and Infectious Disease

journal homepage: www.elsevier.com/locate/diagmicrobio

A 7-year retrospective review from 2005 to 2011 of *Propionibacterium acnes* shoulder infections in Ottawa, Ontario, Canada

Bing Wang [a], Baldwin Toye [a,b], Marc Desjardins [a], Peter Lapner [c], Craig Lee [b,*]

[a] Division of Microbiology, Department of Pathology and Laboratory Medicine, The Ottawa Hospital, Ottawa, Ontario, Canada
[b] Division of Infectious Diseases, Department of Medicine, The Ottawa Hospital, Ottawa, Ontario, Canada
[c] Division of Orthopaedic Surgery, The Ottawa Hospital, Ottawa, Ontario, Canada

ARTICLE INFO

Article history:
Received 23 July 2012
Received in revised form 21 October 2012
Accepted 25 October 2012
Available online 12 December 2012

Keywords:
Propionibacterium acnes
Shoulder infection
Bacterial culture

ABSTRACT

This study evaluated the clinical factors associated with *Propionibacterium acnes* shoulder infection and the standard culture procedures for isolating *P. acnes* from shoulder specimens by a 7-year retrospective analysis. *P. acnes* was incriminated as the second most common pathogen in 17 of 80 patients with positive shoulder cultures. All of the 17 patients had prior shoulder implant. The cumulative rates for isolating *P. acnes* were 1.9%, 1.9%, 41.9%, 96.4%, and 100% at day 1 to day 5 of incubation, respectively. The standard practice of anaerobic culture was able to detect *P. acnes* from shoulder specimens in patients with a clinical suspicion of infection. The sensitivity and specificity of prolonged incubation remain to be determined.

1. Introduction

Propionibacterium acnes is a recognized pathogen involved in postoperative shoulder infection. The prevalence of arthroplastic shoulder joint infection ranges from 3.9% to 15.4% (Lutz et al., 2005; Sperling et al., 2003). A delay in the diagnosis of *P. acnes* infection in the shoulder can be devastating and may lead to prosthesis failure, chronic pain, and even sepsis (Del Pozo and Patel, 2009; Esposito and Leone, 2008). Therefore, it is important to diagnose in a timely fashion.

P. acnes is a Gram-positive anaerobic bacillus commonly found in hair follicles. It is a member of the normal skin flora that commonly colonizes the shoulder area (Patel et al., 2009). Its low virulence and indolent clinical presentation make the diagnosis of *P. acnes* infection difficult. Because it is frequently isolated from clinical specimens as a skin commensal flora, the significance of positive cultures in clinical specimen depends on the body site from which the specimen is collected and whether the specimen was likely to have been contaminated by the commensal biota (Wade and Kononen, 2011). This organism is slow growing, requiring anaerobic culture conditions, which renders a low culture sensitivity if the incubation time is not prolonged (Hall et al., 1994). However, as it is a common skin flora, a longer incubation has the potential to yield false positives due to the contamination with normal flora. The optimal duration for culture necessary to yield a high sensitivity and specificity for diagnosis of *P. acnes* infection is not yet clear (Dodson et al., 2010; Gomes et al., 2011a,b; Levy et al., 2008). Extended incubation of joint aspirates and surgically obtained tissue has been suggested to optimize the recovery of this anaerobic bacterium. Our standard practice for anaerobic culture is 4 days' incubation for agar media and 5 days' incubation for liquid media, consistent with provincial guidelines. For shoulder specimens, thioglycollate broth media was incubated for up to 7–10 days.

The objectives of this study were the following: 1) determine which patient factors are associated with *P. acnes* infection, 2) describe the clinical features of these infections, and 3) assess the average incubation time to grow *P. acnes* from shoulder specimen using the standard practice for anaerobic culture in a 7-year retrospective analysis of septic arthritis of the shoulder at the Ottawa Hospital from 2005 to 2011.

2. Methods

Records from The Ottawa Hospital (TOH) Microbiology Laboratory (which is a regional laboratory) from January 2005 to January 2011 were reviewed to identify patients with at least 1 positive culture specimen labelled as “shoulder”, “shoulder joint fluid”, “shoulder synovial fluid”, or “shoulder joint tissue”.

This study was approved by our institutional research ethics board (protocol no. 2011644-01H).

2.1. Microbiology testing

Shoulder joint specimens were collected from patients in whom there was a high index of clinical suspicion of infection. The specimen cultures were performed using standard anaerobic methods. Specimens were inoculated onto a battery of bacteriologic media including pre-reduced CDC agar, phenylethyl alcohol agar, laked kanamycin–vancomycin agar, and thioglycollate broth media. Aerobic media were incubated aerobically for 48 h, and anaerobic agar media were incubated

* Corresponding author. Tel.: 613-737-8899x74184; fax: 613-737-8164.
E-mail address: clee@uottawa.ca (C. Lee).

0732-8893/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.diagmicrobio.2012.10.018

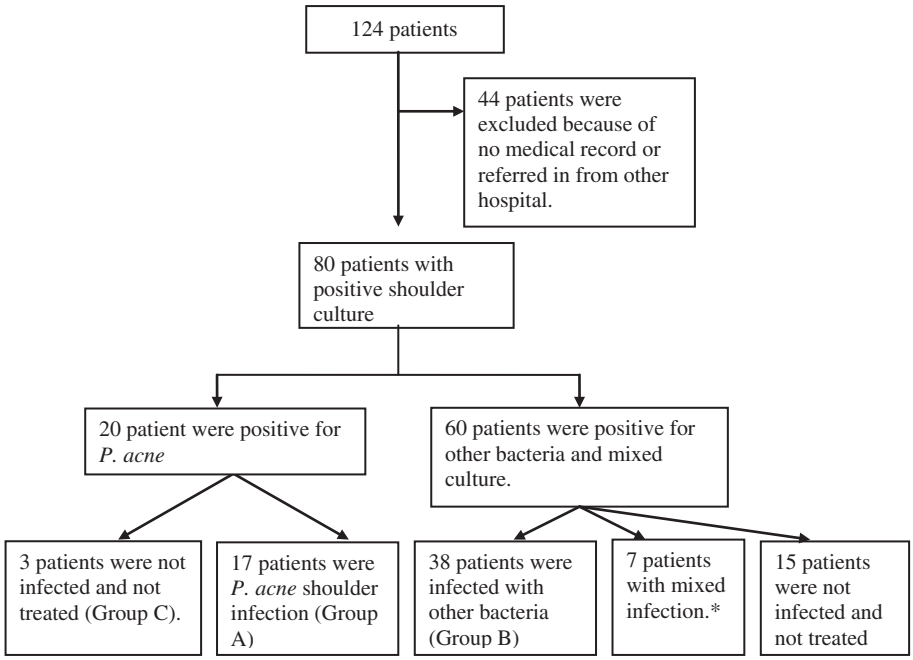

Fig. 1. A flowchart illustrates the patient populations. *Seven patients were mixed infection including (1) *S. aureus* + *P. acnes*, (2) *S. aureus* + group B streptococcus, (3) CoNS + *Corynbacterium* spp., (4) 2 patients with CoNS + *P. acnes*, (5) *E. coli* + CoNS, and (6) CoNS + *Peptostreptococcus* spp.

anaerobically for 4 days; Thioglycollate broth media was incubated for up to 7–10 days at the request of the orthopedic surgeon. All bacterial isolates were identified using standard microbiological methods, and the API rapid ID 32A was used to identify anaerobes including *P. acnes*. Routine susceptibility testing of *P. acnes* was not performed.

2.3. Retrospective patient chart review

All cases with positive shoulder cultures from TOH were considered for inclusion in the study. All non-TOH cases with positive shoulder cultures were excluded from the analysis. The postoperative joint infection was categorized as early (infection develops within 3 months after index surgery), delayed (infection develops 3–24 months after index surgery), or late infection (infection develops more than 24 months after index surgery) (Zimmerli et al., 2004; Trampuz and Widmer, 2006; Esposito and Leone, 2008). A true shoulder infection was defined as follows: clinical presentation with any of the following including fever, joint pain, localized swelling, redness or drainage, plus more than 1 shoulder culture growing *P. acnes* and/or other bacteria from synovial fluid or tissue specimen, or 1 positive shoulder culture with presentation described above with no alternative diagnosis.

Group A included patients with *P. acnes* shoulder infections, Group B consisted of patients with non–*P. acnes* shoulder infections, and Group C were patients who had no infection with a positive shoulder culture of *P. acnes* (contamination) (Fig. 1).

2.4. Data and statistical analyses

The data were analyzed using Epinfo software (http://www.cdc.gov/epiinfo/). Fisher's exact test and chi-square test were used in comparing the characteristics between *P. acnes* infections (Group A) and other bacterial infections (Group B). $P < 0.05$ was considered to be statistically significant.

3. Results

3.1. Culture characteristics of shoulder specimen

A total of 124 patients with positive shoulder cultures were identified. Forty-four patients were excluded because of absence of medical records or they were referred-in specimens from other hospitals. Of the remaining 80 patients with positive shoulder joint cultures, *P. acnes* was recovered as the sole isolate from 20 of 80 patients (25%), representing the most common bacteria isolated from shoulder joints. The other bacteria isolated from shoulder joint specimens are described in Table 1.

The 80 patients included the following 3 groups: Group A consisted of 17 patients, Group B consisted of 38 patients, and Group C consisted of 3 patients (Fig. 1). The rest of the 22 patients had a mixed infection or alternative diagnosis. There was an average of 3 positive shoulder cultures per patient for *P. acnes* in Group A.

For the 62 patients fulfilling the definition of shoulder infection, *P. acnes* (17, 25.4%) was the second most common pathogen in shoulder infections, after *Staphylococcus aureus* infection (19, 30.6%). The remaining shoulder infections included 6 Gram-negative infections (15.8%), 6 beta-hemolytic streptococcal infections (15.8%), 5 coagulase-negative staphylococcal infections (13.2%), 1 anaerobic (*Clostridium septicum*) infection (2.6%), 1 *Neisseria meningitidis* infection (2.6%), and 7 mixed bacterial infections (11.3%).

The average incubation time for the culture to become positive for *P. acnes* in the clinically significant specimens was 3.5 ± 0.8 days. The cumulative positive rates for isolating *P. acnes* from the clinically significant specimens were 1.9%, 1.9%, 41.9%, 96.4%, and 100% at day 1 to day 5 of incubation, respectively.

3.2. P. acnes shoulder infection more frequently involved an implant compared to other bacterial shoulder infections

Compared to other bacterial septic shoulder (Group B), *P. acnes* shoulder infection (Group A) occurred more frequently in male gender ($P < 0.01$), patients with *P. acnes* shoulder infection had significantly higher rates of prior shoulder implants ($P < 0.01$) and prosthetic joint infection ($P < 0.01$), and the majority of patients with *P. acnes* shoulder infections occurred after 3 months of index surgery ($P < 0.05$) (Table 2).

In the 17 patients with *P. acnes* shoulder infection, the most frequent clinical presentations were joint pain and drainage, followed by local swelling and localized redness. The imaging study including plain film with/without computed tomography study showed joint