SCIENTIFIC ARTICLE

Acute Deep Infections of the Upper Extremity: The Utility of Obtaining Atypical Cultures in the Presence of Purulence

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Purpose In the setting of acute deep upper extremity infections, evidence is lacking to guide the decision whether to send atypical cultures (fungal and acid-fast-bacillus [AFB]) during surgical debridement, especially in the presence of purulent fluid that is commonly observed with typical bacterial infections. Our purpose was to determine the frequency of positive atypical cultures and the frequency with which they alter treatment, and identify factors associated with positive atypical cultures.

Methods We retrospectively identified 100 adult patients undergoing surgical debridement of acute deep infections of the upper extremity in which fungal and/or AFB cultures were sent. Necrotizing and superficial infections were excluded. Descriptive statistics were used to describe patient characteristics, infection diagnoses, number of cultures sent with corresponding rates of positivity, and treatments. Cohorts with positive and negative atypical cultures were compared with bivariate analysis for all collected variables.

Results One or more immunocompromising comorbidities were present in 46% of patients. Diagnoses included soft tissue abscess (46%), suppurative flexor tenosynovitis (22%), septic arthritis (21%), osteomyelitis (9%), and septic bursitis (2%). Aerobic bacterial, anaerobic bacterial, fungal, and AFB cultures were sent in 100%, 99%, 94%, and 82% of patients, respectively. Corresponding rates of positivity were 74%, 34.3%, 5.3%, and 2.4%, respectively. Atypical cultures were positive for 7% of patients and 2.9% of all atypical tests sent. Antibiotic treatment was influenced by atypical culture data for 4% of patients. For patients with positive atypical cultures, purulence was observed during surgery in 86% of cases. Bivariate analysis demonstrated symptom duration greater than 7 days as potentially associated with atypical culture positivity.

Conclusions Intraoperative purulence at the time of surgical intervention should not deter the surgeon from obtaining atypical cultures. As expected, atypical cultures are infrequently positive given the rarity of associated diseases. Symptoms greater than 7 days may predict a higher incidence of atypical culture positivity for patients being treated surgically within 30 days of initial symptom onset. *(J Hand Surg Am. 2017;■(■):1.e1-e8. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Diagnostic IV.

Key words Acid-fast bacillus/AFB, culture, debridement, fungal, infection.

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Deep infections of the hand, wrist, and elbow are an important clinical entity that may result in patient morbidity and loss of productivity.[1–13] Treatment with surgical irrigation and debridement (I&D) is standard to address closed-space infections, including abscesses and those with intra-articular or flexor tendon sheath involvement.

Bacterial, rather than atypical pathogens (fungus or acid-fast bacillus [AFB]), are typically responsible for acute deep space infections of the hand and wrist,[6] and the utility of ordering aerobic and anaerobic cultures has been established.[1] In the setting of overt purulence observed upon incision and drainage, the surgeon may question the utility of obtaining atypical cultures for acute, deep infections. Data describing the clinical utility of these additional tests might prove useful for practicing hand surgeons.

The primary purpose of this study was to determine the incidence of positive fungal and AFB cultures in a patient sample undergoing surgical debridement of acute deep infections of the hand, wrist, and elbow with a focus upon the relevance of observed intraoperative purulence. Secondarily, we aimed to identify patient and disease factors that affect the positivity of atypical cultures.

METHODS

After obtaining institutional review board approval for this retrospective cohort study, we reviewed 203 consecutive patients treated with surgical debridement for acute deep space infections of the hand, wrist, and elbow by 1 of 3 hand fellowship–trained orthopedic surgeons (2 of which are authors [D.R.S. and D.J.B.]) at an urban academic medical center. This was a sample of convenience. Patients who underwent I&D in the operating room between October 2013 and December 2015 were considered for inclusion. Patients were identified by a query of Current Procedural Terminology codes specific for treatment of deep space infections (Appendix A; available on the *Journal*'s Web site at www.jhandsurg.org) and were included only if they had undergone debridement of a deep space infection about the elbow or distally (diagnoses included abscess, septic arthritis, septic flexor sheath infection, osteomyelitis, and septic bursitis). Patients with diagnoses of superficial infections of skin or nail structures (paronychia, eponychia, cellulitis, erysipelas) and necrotizing infections were excluded.

Adult patients ($\geq$ 18 years of age) with an acute onset of symptoms were considered for inclusion (subacute and chronic infections with symptoms $>$ 30 days were excluded). Documentation of intraoperative microbiological cultures by category, including bacterial (aerobic and/or aerobic) plus at least 1 atypical culture (fungal and/or AFB), was required for inclusion. At our institution, intraoperative cultures must be entered into the electronic record before the laboratory will accept them; therefore, accurate identification of obtained culture types is possible for each patient (all culture types automatically appear in the brief operative note). For patients undergoing serial debridements, only the index cultures were included. Following application of these inclusion and exclusion criteria (Appendix B; available on the *Journal*'s Web site at www.jhandsurg.org), 100 patients were identified for further analysis.

For each patient, clinical, operative, and microbiological documentation was reviewed. Demographic data were recorded including age, sex, body mass index, and comorbidities that may affect susceptibility to infection (diabetes, cardiac disease, organ transplant recipient, human immunodeficiency virus–positive status, rheumatological disease on disease-modifying anti-rheumatic drugs [DMARDs], active malignancy, obesity, smoking, use of immunosuppressant medications, illicit intravenous (IV) drug use, end-stage renal disease). Disease-specific data were also recorded, including infection type (abscess, septic arthritis, flexor sheath infection, osteomyelitis, septic bursitis), preoperative symptom duration, preoperative antibiotic treatment, preoperative debridement in the emergency room, and presence of purulence observed at the time of surgery. Infections were classified as subjectively purulent if the operative note included 1 of 5 possible descriptors: "pus," "purulence," "purulent," "seropurulent," or "cloudy." Infections for which there was only isolated mention of "fluid" or "serous fluid" were not counted as purulent. Postoperative follow-up duration was recorded as the time between the index procedure and the last clinical encounter related to the infection. Charts were reviewed regarding the interpretation of positive atypical cultures.

Descriptive statistics were used to summarize patient demographic and disease-specific data. The average number of cultures sent per patient and respective results were reported separately for each of the 5 infection diagnosis types (abscess, flexor tenosynovitis, septic joint, osteomyelitis, and septic bursitis). The reported culture data were obtained from operating room cultures only (not from emergency department procedures). The results of fungal and AFB stains were also reviewed. To account for patients with multiple fungal or AFB cultures sent, culture positivity