Is it necessary to change instruments between sampling sites when taking multiple tissue specimens in musculoskeletal infections?

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ABSTRACT

INTRODUCTION Surgical debridement of orthopaedic infections allows biopsy for microbiology and facilitates successful treatment. It is recommended that biopsy instruments are changed when taking multiple samples. This study compared assessed cross-contamination between biopsy sites when using same instruments to take tissue samples from multiple sites.

MATERIALS AND METHODS During the surgical debridement, we defined five sampling sites and marked them with diathermy. Two sampling techniques were performed on same patient to minimise any potential bias arising from the type of host and the severity of infection. First, fresh instruments were used for each biopsy site. Second, the instruments used in the first sampling site were reused to take samples from the remaining sites. By comparing the microbiology results of the samples taken by each technique for each site we determined cross-contamination with microorganisms.

RESULTS Fifteen patients with foot and ankle infections (mean age 56 years) were included. Ten patients were diabetic and five had neuropathies. Cross-contamination between sampling sites occurred in eight cases when the same instruments were used to take biopsies ($P = 0.002$, Fisher's exact test). One or more microorganisms were involved in cross-contamination and the latter always occurred between two consecutive sites rather than sites that were further apart.

CONCLUSION It is important to use fresh instruments for each biopsy site when taking multiple samples in musculoskeletal infection as cross-contamination might occur otherwise and affect microbiological studies.

KEYWORDS

Tissue sampling – Multiple samples – Orthopaedic infections – Sampling instruments

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Introduction

Deep infections in orthopaedic surgery vary in the degree of complexity and can occur at soft tissues, bone and joint levels. Some infections can also be polymicrobial in nature which poses a challenge to surgeons and microbiologists. Antibiotics alone are not often effective unless combined with adequate surgical debridement of infected and necrotic tissues. Surgical debridement allows biopsy for both microbiology and histopathology and facilitates successful treatment.

Standards for microbiology have developed in the field of infected prosthetic joint replacements and included sampling of multiple infected sites (five to six samples).^{1,2,4,5} Studies have shown that four samples seeded on three culture media are sufficient in the diagnosis of prosthetic joint

infections.³ It is also recommended that fresh instruments of biopsy are used for each site. The alternative option would be the use of the same instruments in each site. To our knowledge, the recommendation whereby the sampling tool should be changed between each sampling site has been purely based on expert opinion rather than evidence. This study compared the two sampling techniques in infected foot and ankle surgery cases.

Materials and methods

All patients undergoing surgical debridement of chronic foot and ankle infections were included. The two sampling techniques were performed on same patient to minimise any potential bias arising from the type of host and the severity of infection.

During the surgical debridement, we defined five sampling sites (numbered sites 1–5) and marked them with diathermy. The first sampling was done by taking tissue specimens from the marked sites using fresh blades and forceps for each. In the second sampling, we reused the blade and forceps that were used in site 1 and collected specimens from sites 2–5 again (Fig 1). Overall, site 1 had only one specimen taken by fresh instruments but sites 2–5 had two specimens each (one taken by fresh instruments and one taken by the same instruments used in site 1).

By starting tissue sampling from all sites using fresh instruments for each, we determined the presence or absence and type of microorganism at each site. By comparing the microbiological results of the specimens taken from sites 2–5 using fresh instruments first and then the reused instruments, we identified cross-contamination caused by the reused instruments. For instance, if more microorganisms were identified at a site on the specimen taken by the reused instruments, this additional microorganism was considered as being transferred by the reused instruments provided the microorganism was isolated already at a precedent site when biopsied with fresh instruments.

All microbiology samples were handled by a senior microbiology consultant (co-author) who has a special interest in musculoskeletal infections.

Results

In total, 15 patients undergoing debridement for foot and ankle infection were prospectively enrolled in the study. The mean age of the patients was 56 years (range 21–78 years). There were nine females and six males. Infected cases included 13 feet and 2 ankles. There were ten patients with diabetes and five with lower limb neuropathies (Charcot Marie tooth, spina bifida).

The most prevalent organism seen in our samples was *Staphylococcus aureus*, followed by anaerobes and enterococcus. In total, cross-contamination between sampling sites occurred in eight cases when specimens were taken by the

reused instruments and no cross-contamination was seen when samples were taken by fresh instruments for each site. This result was statistically significant ($P = 0.002$, Fisher’s exact test). Cross-contamination occurred once in five cases, twice in two cases and three times in one case (Table 1). In cross-contaminations, only one microorganism was transferred by the biopsy instruments in seven cases and two microorganisms in one case. Cross-contamination, when present, always occurred between two consecutive sites rather than between sites that were further apart. The results are summarised in Table 1.

Discussion

To our knowledge, this is the first study to compare two tissue sampling techniques in foot and ankle infection. Both techniques were carried out in the same patient using well-defined sampling sites. This helped to eliminate any potential bias that could be related to the severity of infection and patient-related comorbidities. Our results showed that fresh scalpel and forceps are required for each sampling site to avoid transferring contamination from one site to another. Contamination in our study was shown to occur by the instruments carrying microorganism directly from the preceding sampling site. Biopsy techniques highlight the distribution of the microorganism within the infected areas. Whether or not samples were taken by fresh instruments would not change the overall number or type of flora responsible for the infection. The importance of taking the biopsy with fresh instruments is to delineate the extent of infection (for example between superficial and deep tissues) that might help to map the extent of surgical debridement.

We are aware that the evidence presented in this article lacks the strength of a large sample size. However, it has been carried out using prospective collection of data with a standardised protocol for tissue sampling and data analysis. the strength of our study is that both biopsy techniques were conducted on the same tissues and thus eliminating any

Figure 1 The five sites of tissue sampling are marked. Site one had one sample taken by fresh instruments. Sites 2–5 had two samples taken (one by fresh instruments and one by the same instruments used in site 1)

Table 1 Details of cross-contamination and number and type of microorganisms seen when samples were taken by reused instruments.

Patient	Cross-contaminated sites (n)	Microorganisms transferred (n)
1	2	1 (<i>Staphylococcus aureus</i>)
2	1	1 (anaerobes)
3	0	0
4	3	2 (<i>S. aureus</i> , anaerobes)
5	0	0
6	1	1 (<i>Enterobacter Cloacae</i>)
7	2	1 (<i>S. aureus</i>)
8	0	0
9	1	1 (anaerobes)
10	1	1 (<i>S. aureus</i>)
11	0	0
12	0	0
13	0	0
14	0	0
15	1	1 (<i>S. aureus</i>)

potential bias in relation to the site and the severity or the complexity of infection.

References

1. Atkins BL, Athanasou N, Deeks JJ *et al.* Prospective evaluation of criteria for microbiological diagnosis of prosthetic-joint infection at revision arthroplasty. The OSIRIS Collaborative Study Group. *J Clin Microbiol* 1998; **36**(10): 2,932–2,939.
2. Osmon DR, Berbari EF, Berendt AR *et al.* Diagnosis and management of prosthetic joint infection: clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis* 2013; **56**: e1–e25.
3. Bémer P, Léger J, Tandé D *et al.* How many samples and how many culture media to diagnose a prosthetic joint infection: a clinical and microbiological prospective multicenter study. *Clin Microbiol* 2016; **54**(2): 385–391.
4. Peters EJ, Lipsky BA. Diagnosis and management of infection in the diabetic foot. *Med Clin North Am* 2013; **97**: 911–946.
5. Société de Pathologie Infectieuse de Langue Française; Collège des Universitaires de Maladies Infectieuses et Tropicales; Groupe de Pathologie Infectieuse Pédiatrique *et al.* Recommendations for bone and joint prosthetic device infections in clinical practice (prosthesis, implants, osteosynthesis). *Med Mal Infect* 2010; **40**: 185–211.