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QUESTION 1: What is the optimal methodology for obtaining intraoperative cultures?

RECOMMENDATION: Each tissue sample should be collected using separate sterile instruments and transferred directly into culture bottles and transferred to the laboratory as soon as possible. A minimum of three and maximum of five intraoperative cultures (periprosthetic tissue) should be obtained. It is preferable that samples are obtained from the implant-bone interface, whenever possible. Swab cultures should be avoided due to their poor diagnostic accuracy. Synovial fluid should also be collected and placed into blood culture bottles, where possible.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 96%, Disagree: 4%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

The accurate identification of the microorganism(s) responsible for periprosthetic joint infection (PJI) is a pivotal step in the management of this complication. In addition to confirming the diagnosis, this will enable the administration of specific antibiotics to help optimize infection eradication and joint salvage. Failure to identify the correct microorganism can result in potentially toxic, expensive treatments, as well as possible failure of PJI erdication [1,2]. Consensus is therefore needed to establish standard methods for intraoperative sampling in order to determine the best type of samples to be cultured, the optimal number of tissue specimens and the most suitable method of sample transportation to the laboratory.

With regards to the method of obtaining intraoperative cultures, previous studies have demonstrated that tissue cultures have a higher sensitivity and specificity than swab cultures for diagnosing PJI and therefore swabs should be avoided [3–5]. The most suitable intraoperative samples consist of tissue samples, synovial fluid and prosthetic components or entire prostheses. Each tissue sample should be collected using separate surgical instruments in order to prevent sample cross contamination and to obtain true independent samples [6]. The biopsies should be taken from the synovial lining and periprosthetic tissues with the aim of targeting visibly inflamed or abnormal tissue [7]. Preference should be given to sampling the membrane at the implant-bone interface as such samples are most likely to yield positive results [8–10]. When histological examination of the periarticular tissues is planned, it is helpful to obtain paired samples for histopathological and microbiological examination from the same area in order to enable correlation of results.

The optimal number of intraoperative specimens required to maximize the likelihood of identifying the infecting organism has been extensively investigated. Earlier studies suggested that the highest sensitivity and specificity was achieved by obtaining five or six samples [11–15]. Recent studies have used different culture media in an attempt to reduce the number of samples required and thereby decrease the technical and financial impact of this diagnostic modality. In a prospective multicenter study, Bemer et al. demonstrated that the minimum number of samples required to confirm PJI daignosis can be decreased to four, as long as each sample is cultured using three different media, including a blood culture bottle [10]. Peel et al. [16] also demonstrated that a high level of accuracy for PJI diagnosis is obtained when three periprosthetic tissue specimens are inoculated into blood culture bottles, or four periprosthetic tissue specimens are cultured using standard plate and broth techniques. Gandhi et al. [17] also used receiver-operating characteristic (ROC) curve analysis to demonstrate that the optimal sample number necessary to yield a positive test result was four. We therefore recommend that four tissue samples are obtained to provide the best sensitivity without compromising specificity.

Whenever possible, synovial fluid should be sent for analysis as it can be used for both culture as well as the detection of commonly-used PJI biomarkers [18]. With regards to detection of the infecting organism, the sensitivity of the synovial fluid inoculated into blood culture bottles is higher than traditional culture [4,19,20].

There are no conclusive studies evaluating the performance of transport media for orthopaedic samples as the performance of transportation systems differed depending on temperature, holding time and bacterial strains. In general, good preservation of samples has been reported for media held at 4°C [5]. Specimens should reach the laboratory as soon as possible and experimental models suggest that there is a significant loss of the bacterial yield after a six-hour delay [21]. The latter study suggested that the optimal time for samples to reach the laboratory is approximately two hours.

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