

THE ROLE OF THE LABORATORY IN THE DIAGNOSIS AND MANAGEMENT OF INFECTION

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The diagnosis of infection is a clinical skill. The laboratory may be an integral component in several areas when evaluating and treating an infection. First, the lab may be used as a relative means to either confirm or refute the clinical suspicions of the attending physician when there may be some equivocation. Secondly, the lab will be used to identify any potential infecting agent and guide the antibiotic therapy. In addition to the clinical assessment, one may use various lab values to help monitor the patient to ensure that there is a favorable response to therapy. Some authorities also feel that specific studies may help in determining the extent of the infectious process, particularly when there is more widespread dissemination.

However, one must be aware that trauma and surgery are stressful to the body and that in many instances, the laboratory values may respond in a manner similar to infection. Furthermore, a single laboratory result may not be particularly significant unless one has an understanding of the patient's baseline normal or else a temporal comparison. The following discussion is a review of several laboratory tests which may be used in the diagnosis or management of infection, their indications, value and limitations.

COMPLETE BLOOD CELL COUNT AND DIFFERENTIAL

With most infectious processes, one will expect to see a relative elevation in the white blood cell count and an increase in the polymorphonuclear cell and immature cell forms. The exact value of

each depends upon the baseline normal for the patient, the nature of the infection, and the immune capacity of the patient. Although one would expect the white cell count to be elevated in a manner proportionate to the status of the infection, this is not always the case. Elderly patients in particular may have lower relative values despite a similar infectious process. For example, an elderly patient with a normal white blood cell count of 3500 would have a fairly substantial relative elevation of this value with a count of 7000. However, this higher value would still be within the "normal" range for most labs. Therefore, the clinician may be misled into a false sense of security. Similar circumstances may present with any patient who may be immunosuppressed.

Another caveat, particularly in the surgical patient, is that there may be significant variations in the white cell count due to other noninfectious stimuli. It is not unusual to see white cell counts as high as 15,000 following an extended surgery on the first postoperative day simply due to surgical stress. Again, one must be careful in their assessment of the patient so that the clinical findings are taken into account. Furthermore, if one is suspicious of an infection, then serial lab studies on sequential days will provide a greater understanding of the overall trend.

The use of sequential values is particularly helpful in monitoring the response of the patient to therapy. This provides an objective guide which should correspond to the clinical impressions. As the infection resolves one will witness a reduction in the white cell count as well as a

return to a more normal differential. In addition, this study may need to be performed periodically in order to ensure that the antibiotics are not having any adverse effects upon the hematologic system.

ERYTHROCYTE SEDIMENTATION RATE (ESR)

The Erythrocyte Sedimentation Rate (ESR) is a *nonspecific* indicator of inflammation with variable sensitivity. The baseline normal for this test generally increases with age, so that older individuals, or patients with arthritic or other inflammatory processes, may demonstrate elevated values which are not associated with infection. However, if significantly elevated, this study may show some correlation to the clinical resolution of the infection, although the reduction may not be proportionate to the actual patient response. As a general rule, less emphasis is being placed on this study in more recent years.

C-REACTIVE PROTEIN (CRP)

The C-reactive protein (CRP) is another indicator of inflammation, although it is generally felt to be significantly more sensitive. Some authorities feel it may also be somewhat specific for infection. Therefore, it may have a greater value in screening for infection. In either event, this value responds more quickly to the onset and resolution of inflammation than the ESR. Therefore, it does have a greater value in monitoring. However, of great importance is the means used to assay this particular component. Many local hospitals will use a simple slide agglutination which is not very accurate. The author's own attempts to improve the technique by using different serum dilutions failed to enhance the reliability. ELISA assays appear to be a very accurate and sensitive means of determining levels. However, this modality may not be available to many clinicians.

SYNOVIAL FLUID ANALYSIS

Joint aspiration should be a consideration in any patient with an acutely painful joint. This may help to determine the exact etiology of the process. A complete guide to synovial fluid analysis is beyond the scope of this manuscript. However,

the greatest priority when aspirating a joint is to attempt to eliminate infection from the differential diagnosis. Since a very small amount of fluid will usually be recovered from the joints within the foot, one should have an idea as to which tests take priority. Since the worst possible case would be an infection, cultures should be performed first. Both aerobic and anaerobic specimens should be obtained. Of interest is a more recent report showing a much higher rate of recovery of *Neisseria* when the fluid is plated onto the agar at bedside. Additional fluid may then be used for gram stain and other studies.

ASO, ANTIDNASE-B, ANTIHYALURONIDASE

ASO, AntiDNase-B, and Antihyaluronidase antibodies are produced in response to enzymes elaborated by Group A *Streptococcus*. The ASO is the most commonly employed test and is widely available and reproducible. When the ASO as well as either the AntiDNase-B and Antihyaluronidase titers are elevated, then the diagnostic reliability is improved. However, there will still be a number of patients with an active infection who will test negative. Furthermore, recent previous streptococcal infections may result in false positive values. Within the lower extremity, one might consider utilizing these tests in patients with an acute cellulitis to try and distinguish between a staphylococcal or streptococcal origin. However, in most instances this does not make a great deal of practical significance.

TEICHOIC ACID ANTIBODIES

Teichoic acid is a component of the cell structure of *Staphylococcus*. Once infected, the body may produce antibodies against this protein. The reliability of this test is rather questionable and it takes time to obtain the results. False negatives are common and soft tissue infections may not generate enough of an insult to create a positive value. Furthermore, other bacteria besides *Staphylococcus* may contain teichoic acid as part of their cell structure.

This test is rarely if ever utilized, but may be helpful in attempting to determine the infecting organism in a patient with a proven osteomyelitis where negative cultures are obtained.

SUMMARY

This discussion was designed to demonstrate the value of various laboratory tests in assessing the patient with a potential infection, as well as realistic expectations of each. The laboratory should be used as an aid in these instances, not as the final work of diagnostic certainty.

RISK MANAGEMENT CONCERNS

1. A single laboratory result may not be particu-

larly significant unless one has an understanding of the patient's baseline normal or else a temporal comparison.

2. Although one would expect the white cell count to be elevated in a manner proportionate to the status of the infection, this is not always the case.
3. Joint aspiration should be a consideration in any patient with an acutely painful joint.