DxWound

CogenDx

Clinical Bulletin: DxWound Staphylococcus Tests

Description

Staphylococcus aureus (S. aureus) is the most common pathogen associated with skin and soft tissue infections (SSTIs).[1] DxWound identifies certain *Staphylococcal* species, along with the antibiotic resistance gene *mecA* and the virulence gene *lukF-PV* (Panton-Valentine Leukocidin virulence factor, PVL).

An antibiotic resistance gene is a gene present in bacteria that mediates resistance to a specific antibiotic or class of antibiotics. *mecA* is an antibiotic resistance gene associated with *Staphylococcus* species, including *Staphylococcus aureus, Staphylococcus lugdunensis, Staphylococcus epidermidis* and other Coagulase-Negative Staphylococci (CoNS). The *mecA* gene mediates oxacillin/methicillin resistance. When *mecA* is present in staphylococcal species, then methicillin resistance may be present. For example, when *mecA* is present in *Staphylococcus aureus*, then Methicillin-resistant *Staphylococcus aureus* may be present.

Panton-Valentine Leukocidin (PVL) is a virulence factor encoded by two genes: *lukS-PV* and *lukF-PV*. The presence of PVL in *S. aureus* appears to be associated with increased infection severity, with PVL-positive infections being more likely to lead to necrosis and more likely to require surgery.[2-4]

Indications for Ordering

The DxWound *Staphylococcal tests* can be useful for any patient suspected of having a *Staphylococcal* skin and soft tissue infection (SSTI) based on the clinician's determination of medical necessity. The DxWound tests can identify *S. aureus, S. epidermidis* and *S. lugdunensis* directly from a wound sample without the need for culture enrichment. The presence of *mecA* may indicate resistance to oxacillin/methicillin and all ß–lactams with the exception of cephalosporins with anti-MRSA activity.[5] When *S. aureus* and *mecA* are both detected, then MRSA may be present. The presence of PVL may suggest increased infection severity.[2-4] In a patient with clinical signs and symptoms of infection, these *Staphylococcal* tests may help clinicians quickly target antibiotic therapy.

Methodology

DxWound is a polymerase chain reaction (PCR)-based assay which analyzes microbial DNA using species-specific DNA sequences, such as 16S rRNA sequences for bacterial detection. Similarly, sequences specific to the virulence (lukF-PV, PVL) and *mecA* genes are also analyzed.

DxWound utilizes a swab for sample collection. The process is simple. First, cleanse and debride the wound as necessary. The Levine technique is then suggested for collection of the sample. The tests are performed on a sample taken directly from the wound. The swab sample is collected in an inactivating solution that kills the microorganisms at the same time as protecting the microbial DNA, thus preserving the wound microbiome in time at the point of specimen collection. (For more information, see Technical Specifications bulletin). DNA is detected directly from the patient specimen without culture enrichment.

All DxWound tests have ≥95% accuracy and ≥99% reproducibility. The accuracy and reproducibility of DxWound tests were defined by either comparison to culture reports for wound samples and/or by correct identification of known organisms or antibiotic resistance genes in reference samples obtained from the FDA-CDC antimicrobial resistance isolate bank, commercial vendors, and research laboratories.

Clinical Use

S. aureus is the most common pathogen associated with SSTIs[1], with MRSA becoming increasingly common in both the inpatient setting (hospital acquired infections) and the outpatient (community) setting.[6] In one study, almost 80% of positive SSTI cultures detected *S. aureus*, and about 50% of those were MRSA.[7] MRSA has been tied to increased hospital lengths of stay, increased healthcare costs, is an independent risk factor for mortality[8,9] and is now predictably resistant to all ß–lactam antibiotics except ceftaroline.[5] As such, MRSA is considered a serious threat by the CDC.[10] According to Amin et al.,[6] "the increasing incidence of SSTIs in both ambulatory and hospital settings, coupled with the increase of MRSA as a causative pathogen, demands optimal management of these infections to improve outcomes."

S. aureus can also express virulence factors that are associated with increased infection severity.[2] The presence of the PVL virulence factor in *S. aureus* is associated with infections that are more likely to lead to necrosis and more likely to require surgical treatment.[2-4]

Coagulase negative staphylococci are the second most common cause of surgical site infections following *S. aureus*, with *S. epidermidis* representing the most common species. While often times considered contaminants, *S. epidermidis* is increasingly associated with clinically significant infections including wound and surgical site infections and has a propensity for biofilm formation leading to infections on valves, shunts and prostheses. Methicillin resistance is often observed (75-90% of hospital isolates) in *S. epidermidis* and resistance to other antimicrobials is also common leading to challenges in selecting appropriate antimicrobial therapy.[11,12]

The failure of empiric therapy is a concern in treatment of SSTIs. One study suggested that as many as 16.6% of acute SSTIs, 34.1% of chronic or ulcerative infections, and 26.7% of surgical site infections had initial treatment failure. It has been shown that antimicrobial therapy which is not targeted to the causative pathogen within 48-hours of presentation is an independent risk factor for treatment failure.[13, 14]

Clinicians can use the DxWound *Staphylococcal* results to help them quickly target antibiotic therapy, ideally within that important 48-hour window.

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Test Interpretation

These tests identify if *Staphylococcus* spp, the *mecA* gene or PVL gene are present. The DxWound report provides specific information about the *mecA* gene and its association to resistance to oxacillin/methicillin and all ß–lactams with the exception of cephalosporins with anti-MRSA activity. If *mecA* is present in staphylococcal species, then methicillin resistance may be present. For example, when *mecA* is present in *Staphylococcus aureus*, then Methicillin-resistant *Staphylococcus aureus* may be present.

The DxWound report also indicates that if PVL is detected, there may be increased infection severity and the potential need for surgical intervention. Clinically, these test results may help clinicians quickly target antibiotic therapy. It is important to note that these tests do not detect all known antibiotic resistance mechanisms or virulence factors, nor do they definitively identify which organism is associated with an antibiotic resistance gene.

Limitations

- These tests detect the presence of genes and do not detect whether the genes are expressed.
- These tests do not detect all known antibiotic resistance mechanisms, nor do they identify with which organism an antibiotic resistance gene is associated. It is possible that an antibiotic resistance gene is associated with an organism that is not included in the test.
- It is possible that *mecA* is associated with an organism that is not included in the test.
- The use of PCR to test *S. aureus* isolates for the presence of the *mecA* gene can result in a small percentage of strains (3%) testing positive for *mecA* but being highly susceptible to methicillin-like antibiotics.[15, 16]
- The DxWound Genetic Analysis Report does not make recommendations for treatment. All test results should be evaluated in the context of the patient's individual clinical presentation.

Technical Assistance

For technical assistance with interpretation or to speak with one of our clinical support specialists, scientists, or clinical pharmacists, please call Client Services at 877-866-0603, Monday – Friday 5:00am to 5:00pm (Pacific Time).

Reporting

All test results are reported, generally, within 1 business day of specimen receipt. These results are available in the online portal as a DxWound Report.

How To Order

Using a CogenDx test requisition (paper or electronic), medically necessary tests are ordered by individual test based on patient-specific elements identified during the clinical assessment and documented in the patient's medical record by the provider. Submit swab specimen in the collection device provided according to the directions in the Specimen Collection Manual. A completed Documentation for DxWound Testing form is required with each order.

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