



Clinical Laboratory Department POLICY AND PROCEDURE

POLICY NUMBER: 1088
VERSION: 3

SUBJECT: CAMP Test

Purpose and Principle:

The CAMP (Christie-Atkins-Munch-Peterson) test is used to aid in the identification of bacterial organisms isolated from patient specimens and provide guidance to the selection of appropriate antimicrobial therapy. A lytic phenomenon is observed when Group B streptococcus (*Streptococcus agalactiae*) is grown in a zone of staphylococcal beta-toxin activity on sheep blood agar. The weak beta-hemolysis of Group B Strep (*Streptococcus agalactiae*) synergistically combines with the beta hemolysis of a strain of *Staph aureus*. The lysis produced has a distinct “arrowhead” appearance that characterizes a positive CAMP test. The test is used for the presumptive identification of Group B streptococci.

Rhodococcus equi is a rare and often fatal human pathogen, where most infections occur among compromised hosts deriving from environmental exposure. Most patients have a slowly progressive granulomatous pneumonia with lobar infiltrates, frequently developing to cavitating lesions. Other sites of infection include abscesses of the central nervous system, pelvis, and subcutaneous tissue, and lymphadenitis. Factors for delayed diagnosis include the relatively nondescript bacteriologic profile of *R. equi*. This organism is partially acid fast, strictly aerobic, **gram-positive bacterium displaying rod-to-coccus pleomorphism**, with fragmenting and occasionally palisading forms. Colonies on blood agar from clinical specimens can be mucoid and coalescing. Typical **salmon pink** pigmentation develops on blood agar, but often only after 2-3 days or more of incubation. Helpful in identifying *R. equi* is a **synergistic hemolysis resembling the CAMP test (or inhibition of the hemolytic zone of *S. aureus*)**. This is useful especially as it may rule out group B streptococci.

Archanobacterium haemolyticum infection is often reported from screening of patients with pharyngitis. Most cases involve pharyngitis and/or tonsillitis, and approximately 50% are exudative. Diagnosis of cases often occurs only after recurrent infections, which are thought to be related to incorrect initial diagnosis, resulting in less-than-optimum treatment. Symptoms resemble those of beta-hemolytic streptococci or viral infection. The spectrum of disease ranges from sore throat to, in rare cases, a life threatening membranous pharyngitis resembling diphtheria. An erythematous morbilliform or scarlatin rash of the trunk, neck, or extremities is associated with 20-25% of cases, enhancing the possibility of misdiagnosis as streptococcal infection or penicillin allergy. In addition, central nervous system infections, sepsis, endocarditis, and osteomyelitis have been reported. Archanobacterium are **pleomorphic gram-positive rods**, slender at first, sometimes clubbed, or in angular arrangements. Coccal forms predominate as the organism grows. The organism is facultatively anaerobic. Growth is enhanced in blood and in the presence of CO₂. It is **catalase negative**, urease negative, esculin hydrolysis negative, nonsporeforming, and nonmotile. On BAP, at 24 hours, colonies are tiny and little or no hemolysis is observed. At 48-72 hours, the hemolysis zone is about 1mm in diameter. It is usually isolated from anatomical sites containing profuse mixed bacterial flora, such as throat and heavily colonized wounds. The organism grows relatively slowly. Because of this, the colonies can be overlooked for hemolytic activity when examined after 24 hours of incubation. Colonies are circular, opaque and whitish. Colonies feature a black opaque dot in the center, which remains if the colony is

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scraped aside. Demonstration of phospholipase D production by the **reverse CAMP test** is useful in the identification of *A. haemolyticum*. The test is performed by streaking the *Staph aureus* strain on sheep blood agar and the test strain perpendicular to it. After 24-48 hours of incubation, inhibition of the staphylococcal hemolysis is seen around the *A. haemolyticum* streak.

The CAMP test is also useful for *Listeria*. Here *Listeria monocytogenes* and *Listeria seeligeri* both produce a positive CAMP test when streaked perpendicular to *Staph aureus*. *Listeria* are **catalase positive, small gram-positive rods that show a distinctive tumbling motility**. The hemolysis of these 2 species of *Listeria* is enhanced, while other *Listeria* species is not.

Procedure:

1. A pure culture or well-isolated colony of a gamma or beta streptococcus to be tested grown on a blood agar plate is needed.
2. Using an inoculating needle or the edge of a loop, streak *Staph. aureus* ATCC 25923 (HDH #2) in a straight line across the center of a sheep blood agar plate (BAP).
3. Inoculate single streaks of the suspect beta-hemolytic group B streptococcus or other isolates to be tested perpendicular to the hemolytic strain of *Staph aureus*, taking care to make sure the lines come close but do not touch.
4. Incubate the BAP under elevated CO₂ conditions for 18-24 hours at 35°-37°C.
5. Observe for evidence of "arrowhead" shaped zone of increased beta hemolysis at the junction between a positive streptococcus and the staphylococcus streak.

Quality Control:

Streptococcus agalactiae, ATCC 13813 (HDH #43) = positive control

Streptococcus pyogenes, ATCC 19615 (HDH # 3) = negative control

QC is to be tested on the same plate as the patient specimen on each day of use.

Reporting Results:

"Arrowhead" hemolysis by the test organism is interpreted as being a presumptive Group B Streptococcus (*Streptococcus agalactiae*). No "arrowhead" hemolysis is a negative test for group B streptococcus. Identification of group B streptococci must also be based on: gram stain of gram positive cocci consistent with streptococci, colonial morphology, and beta hemolysis, resistance to bacitracin (Taxo A) if this is tested, no hydrolysis to bile esculin if tested, and a negative catalase reaction. Group A streptococcus will produce "arrowhead" hemolysis anaerobically, and *S. epidermidis* that produces a delta toxin may also produce hemolysis. Although the extent of beta hemolysis is less, *Listeria monocytogenes* also produces a positive CAMP test. *Listeria*, though is a gram positive bacillus.

References:

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