Rapid Diagnosis of Septic Arthritis by Coagglutination

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Pneumococcal capsular antigens were detected and serotyped by coagglutination in joint fluids and serum of a patient with septic arthritis within 1 h of obtaining the specimens. Pneumococcal antigens continued to be detected by coagglutination for 3 days, whereas cultures and Gram stains were negative after 1 day of antibiotic therapy.

Coagglutination (CoA) is a new rapid slide agglutination test which can be used for rapid detection of bacterial antigens in body fluids (6, 10). Antigens from Streptococcus pneumoniae, Haemophilus influenzae, Neisseria gonorrhoeae, and other Streptococcus species can be detected with CoA reagents (4). Commercial reagents (Phadebact; Pharmacia Diagnostics, Piscataway, N.J.) are currently available for CoA. However, when body fluids with high protein content such as serum and purulent exudates are tested with CoA, positive reactions occur with the control reagent of Phadebact (staphylococci sensitized with sera from nonimmunized animals). We describe an adaptation of CoA for detection of pneumococcal antigens in fluids with high protein content which we applied to joint fluids and serum for rapid diagnosis of septic arthritis due to S. pneumoniae.

Two types of reagents were used for CoA testing. First, clinical specimens were tested for pneumococcal antigen with the Phadebact Pneumococcus Test, which is prepared with polyvalent serum against 83 pneumococcal serotypes. Clinical specimens in which pneumococcal antigens were detected were then tested with type-specific reagents prepared in our laboratory by the method of Kronvall (6). Briefly, antisera against pneumococcal capsular antigens were adsorbed to the Cowan I strain of Staphylococcus aureus ATCC 12598. We prepared 14 group- or type-specific CoA reagents, each of which contained antiserum against a different group or type included in the current pneumococcal vaccine formulation (antisera were obtained from Statens Seruminstitut, Copenhagen, Denmark) (8). Preliminary testing with purified pneumococcal antigens (generously donated by Lederle Laboratories, Pearl River, N.Y.) disclosed that the Phadebact reagent and our group- or type-

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peripheral leukocyte count was 15,800 cells per mm^3 with a left shift. The radiological examination showed no evidence of pneumonia.

Aspirates of the eight above-noted joints were all grossly purulent. The left knee aspirate contained 150,000 leukocytes per mm^3, with 96% neutrophils, a protein concentration of 4 g/dl, a glucose concentration of 6 mg/dl, and no crystals; a Gram stain showed gram-positive diplococci. CoA of the initial joint aspiration was completed within 1 h after the specimens were obtained. All aspirates were strongly positive with both the Phadebact and the group 23 reagents. Group 23 pneumococcal antigen was also detected by CoA in the patient serum. However, joint fluids and serum which had not been pretreated by our method also gave nonspecific positive reactions with both the control reagent prepared in our laboratory and the Phadebact control reagent. After addition of EDTA and heating, a positive reaction was observed with both the Phadebact and the group 23 reagent, whereas the reaction was negative with both control reagents. Likewise, no reaction was observed with our other 13 group- or type-specific CoA reagents after EDTA and heating, whereas untreated serum and joint fluid gave false-positive reactions with these reagents. Blood cultures and multiple joint fluid cultures grew S. pneumoniae group 23 (confirmed by Quellung reaction).

The patient was treated with intravenous penicillin for 20 days. Therapeutic joint aspirations were also performed. Group 23 pneumococcal antigen was detected by CoA in several joint aspirates for 3 days after initiation of antibiotic therapy, whereas cultures and Gram stains of the joint fluids were negative for bacteria after 24 h of therapy.

Adequate antibiotic therapy of septic arthritis is dependent on prompt identification of causative organisms. In adults the most common causes of septic arthritis are N. gonorrhoeae, S. aureus, and various streptococci, including S. pneumoniae (9). Microscopic examination of joint fluid smears is very helpful in establishing a presumptive etiological diagnosis, although staphylococci and streptococci cannot be accurately differentiated by Gram stain (5). Culture of joint fluids often takes days to yield results. Thus, frequently antibiotic therapy is begun empirically and may not prove appropriate. Our case exemplifies that with a rapid diagnostic method such as CoA, appropriate antibiotics can be given without undue delay. Although other rapid diagnostic techniques such as counterimmunoelectrophoresis may be used to detect bacterial antigens in joint aspirates (2), CoA offers several advantages. CoA takes only minutes to perform, does not require expensive equipment or large amounts of antisera, and it can detect S. pneumoniae group 7 and type 14 (both common causes of severe pneumococcal disease), which are missed by counterimmunoelectrophoresis using standard buffer systems (1a). We describe a simple technique to eliminate nonspecific reactions due to high protein content in clinical specimens such as serum and joint fluid.

Our case also illustrates that pneumococcal antigens may be detected in body fluids by CoA even after specimens have been rendered culture-negative by antibiotic therapy. Pneumococcal capsular antigens were detected in joint fluids 3 days after initiation of antibiotic therapy, whereas cultures and Gram stains of joint fluids were negative for bacteria after 24 h of antibiotic therapy. Moreover, typing of pneumococcal antigens in clinical specimens can be done rapidly by CoA. Such typing has clinical and epidemiological relevance in that it distinguishes "vaccine failures" from cases of pneumococcal disease due to non-vaccine types in vaccinated patients (7). It should be emphasized, however, that of the 14 antisera provided by Statens Serum Institut which we used for preparation of CoA reagents, only the sera for types 1, 2, 3, 4, 8, 14, and 25 were type specific. The other sera (for groups 6, 7, 9, 12, 18, 19, and 23) were not type specific because these antisera contained antibodies to the vaccine-related strains as well as to the vaccine strains. Thus, our CoA reagents differentiated between vaccine plus vaccine-related strains and all others. Likewise, there is not full protection between vaccine and vaccine-related strains (8).

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LITERATURE CITED


