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Value of Throat Swab in Diagnosis of Melioidosis

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Throat swab (TS) cultures were performed for 1,011 patients with melioidosis and 3,524 healthy subjects or patients with other diseases. The specificity of TS culture for the diagnosis of melioidosis was 100%, and the overall sensitivity was 36% (24% for sputum-negative patients and 79% for sputum-positive patients). Direct plating of the TS specimen on Ashdown's medium was rapid (colonies were usually evident within 24 h) but only 63% sensitive compared to the results of primary culture in a selective broth. A throat swab should be cultured in all cases of suspected melioidosis.

Melioidosis is an infection caused by the environmental bacterium *Burkholderia pseudomallei*. It is an important cause of morbidity and mortality in rural communities in areas of endemicity, such as northeast Thailand, where melioidosis accounts for approximately one-fifth of all community-acquired septicemias (2). The majority of cases in adults are septicemic. The lung is the most commonly affected single organ and is either the primary focus or is where disease occurs secondary to disseminated infection. Clinical diagnosis may be difficult because of the diversity of disease presentations. Culture of *B. pseudomallei* from suitable specimens therefore remains the "gold standard" for the definitive diagnosis of melioidosis, although more rapid diagnostic methods have been developed (7). Throat swabs have previously been shown to be useful for the diagnosis of melioidosis in children (3). A positive throat swab culture may be the first indication that a patient has melioidosis. Retrieval of specimens on throat swabs is a simple, noninvasive method of obtaining specimens for culture, particularly if sputum is not available. The sensitivity and specificity of throat swab culture for the diagnosis of melioidosis across the full age range of the population in an area of endemicity have not been previously defined.

We have therefore examined retrospectively the results of four studies that we conducted in northeast Thailand in which throat swab cultures for *B. pseudomallei* were performed routinely. Data from these prospective screening studies were combined. These studies were of (i) hospitalized children aged between 1 month and 14 years (1,000 patients) in Ubon Ratchathani (3) (study 1); (ii) hospitalized adults in Ubon Ratchathani with suspected melioidosis (study 2); (iii) adult volunteers who comprised 330 healthy people screened at home and 700 adults attending hospitals as outpatients (200 of whom had diabetes mellitus, the major risk factor for melioidosis) (study 3); and (iv) hospitalized adults in northeast Thailand (Ubon Ratchathani [excluding patients included in study 2], Srisaket, Surin, and Khon Kaen) as part of a case-control study of risk factors for melioidosis (4). Melioidosis was confirmed by the isolation of *B. pseudomallei* from any body fluid (other than throat swab specimens).

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Throat swabs were collected from each subject by careful swabbing of the pharynx and fauces with a cotton-tipped swab following visual inspection. All swabs were then transported to the laboratory immediately and in study 2 were inoculated onto Ashdown's selective agar (1) (containing gentamicin at 5 mg/liter) and into a selective broth medium (SB) containing colistin at 50,000 U/liter (6). In studies 1, 3, and 4 they were inoculated directly into SB. The SB was incubated at either 37 or 42°C for 48 h and was then subcultured onto Ashdown's agar. All plates were incubated at 37°C in air for up to 4 days. Suspect colonies were identified as described previously (5).

Over 4,500 subjects were screened (Table 1). There were no positive throat swab cultures among the 3,524 subjects who did not have melioidosis. Thus, the upper 95% confidence interval for the prevalence of asymptomatic carriage is approximately 1/10,000. Overall, the sensitivity for all patients with culture-confirmed melioidosis was 36.1% (365 of 1,011 patients), and the specificity and positive predictive value were each 100%. In study 2, direct plating was compared with primary culture in SB; 192 plates with direct cultures were positive, whereas 303 SB preenriched cultures were positive, giving a sensitivity of 63% and a specificity of 100%. The time to plate positivity was usually less than 24 h.

Paired sputum and throat swab specimens for culture were collected from 253 patients with confirmed melioidosis, of whom 239 (95.2%) were sputum culture positive for *B. pseudomallei*. For 14 patients *B. pseudomallei* was isolated from throat swabs but not from sputum. Of the 239 sputum culture-positive patients, 188 were also positive by culture of the throat swab. Thus, compared to the results of sputum culture, culture of throat swabs had a sensitivity of 78.7%. Of the 790 patients

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TABLE 1. Throat swab culture results from four prospective studies

Study no.	No. of patients who did not have melioidosis	No. of culture-positive throat swab specimens from patients without melioidosis	No. of melioidosis patients	No. (%) of culture-positive throat swab specimens from patients with melioidosis
1	1,000	0	17	8 (47)
2	1,118	0	790	303 (38.4)
3	1,030	0		
4	376	0	204	54 (26.5)
Total	3,524	0	1,011	365 (36.1)

with melioidosis in study 2, 188 had positive sputum cultures. Among the remaining 602 patients who either were sputum culture negative or could not provide a sputum sample, *B. pseudomallei* was isolated from throat swabs from 142 (23.6%) of these patients.

Paired throat swab and blood culture results were available for 656 melioidosis patients. Overall, just over half of these patients had positive throat swab cultures (51.5%) and almost half were septicemic (47%) (Table 2). Patients with positive blood cultures for *B. pseudomallei* were more likely to have positive throat swab cultures than those who were not septicemic (189 of 318 [59.5%] versus 149 of 338 [44.1%] [$P < 0.001$, χ^2 test]).

Throat swab culture on selective medium is a simple, noninvasive, inexpensive, and useful diagnostic screening test for patients with suspected melioidosis. Direct plating on Ashdown's medium was rapid and specific but was only 63% sensitive compared with the results of primary culture in SB. As colonies are usually evident after 24 h of incubation, diagnosis by use of the throat swab culture may also be more rapid than diagnosis by use of a nonautomated blood culture. Delay in the institution of specific treatment for *B. pseudomallei* infection is an important contributor to a fatal outcome. Both direct plating and preenrichment in selective broth should be performed for suspected cases. Cultures are often positive for patients with pulmonary or disseminated melioidosis and may be positive for a significant number of patients who are unable to expectorate or who are not bacteremic. The throat swab should be complementary to other methods of diagnosis. In patients with pulmonary melioidosis, sputum culture will identify an additional 20% of cases compared with the proportion identified by throat swab culture, but many patients are too ill to expectorate adequate samples. The throat swab culture also identified an additional 6% of patients with pulmonary melioidosis for whom sputum cultures were negative. It was also positive for over half of all septicemic patients. Throat swab culture is particularly valuable for use with children or obtunded patients. In this area of endemicity, we did not identify asymptomatic carriage of this environmental saprophyte in the oropharynges of healthy individuals or in diabetics (the major risk group for melioidosis) who were otherwise well. Thus, a throat swab culture that is positive for *B. pseudomallei* indicates disease and warrants immediate antibiotic treatment for melioidosis. For all patients with suspected melioidosis, a throat swab specimen should be taken and cultured on appropriate selective medium.

TABLE 2. Blood cultures and throat swabs

Blood culture result	No. (%) of throat swabs:		
	Positive	Negative	Total
Positive	189 (59.4)	129 (40.6)	318
Negative	149 (44.1)	189 (55.9)	338
Total	338 (51.5)	318 (48.5)	656

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