

Infections in International Pregnancy Study: Performance of the Optical Immunoassay Test for Detection of Group B Streptococcus

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We evaluated the Strep B optical immunoassay (OIA; ThermoBiostar, Inc.) for detecting light and heavy group B streptococcus colonization in 1,306 pregnant women. The women were examined at 20 to 32 weeks gestation and were from six countries. Compared to culture, the sensitivity and specificity of OIA were 13.3 and 98.4%, respectively, for light colonization and 41.5 and 97.7%, respectively, for heavy colonization.

Heavy colonization with group B streptococcus (GBS) may place women at high risk of delivering preterm, low-birth-weight infants (10, 11, 15). Earlier recognition of such high-risk women would be useful for intervention strategies. Detection of heavy colonization has traditionally relied on culture methods, which may not be feasible in some health care settings and require 1 to 3 days before results are available. Unfortunately, most rapid GBS tests have poor sensitivity (7, 13). The Strep B optical immunoassay (OIA; ThermoBiostar, Inc., Louisville, Colo.) is a rapid method which may have higher sensitivity for dense GBS colonization (14). We evaluated the performance of this test in an international, multicenter study.

We conducted the study at institutions participating in the Global Network for Perinatal and Reproductive Health (<http://www.tju.edu/obgyn/trih/global.cfm>). Centers were located in Khon Kaen and Bangkok, Thailand; Manila, The Philippines; Harare, Zimbabwe; Yangon, Myanmar; Dublin, Ireland; and Philadelphia, Pennsylvania. Participants were enrolled in the study between June 1999 and May 2001. Women attending prenatal care clinics and at 20 to 32 weeks gestation were eligible. Exclusion criteria included vaginitis symptoms, fever, vaginal bleeding, multiple pregnancy, use of antibiotics in the past 2 weeks, and active labor. Informed consent was obtained. The study was approved by institutional review boards at all study centers and supporting institutions.

At enrollment, study personnel conducted an interview and collected specimens. A sample for GBS rapid testing was collected from the cervix and lower vagina using a ThermoBiostar

swab. OIAs were read by study site laboratory personnel and by the manufacturer's laboratory personnel. OIA kits and swabs were supplied by ThermoBiostar.

Methods for GBS culture and quantitation replicated those used in the Vaginal Infections and Prematurity Study (16). After collection of the OIA specimen, a Dacron swab (Copan swab) was used to collect a specimen from the cervix and lower vagina. Samples were streaked onto blood agar plates using the four-quadrant method and then placed into Lim broth (Todd-Hewitt broth containing selective antimicrobial agents). A clean catch urine specimen was collected for GBS culture on blood agar. Suspect colonies showing β -hemolysis were identified as GBS using latex agglutination. Heavy colonization was defined as isolation of GBS from either urine or direct plating on blood agar. Light colonization was defined as isolation of GBS from Lim broth alone. Dense GBS colonization was defined as growth in the third or fourth quadrant streaked on the blood agar plate (14).

Data were entered by using Epi-Info version 6 (9) and transmitted to the Centers for Disease Control and Prevention monthly. We calculated the sensitivity, specificity, positive predictive value, and negative predictive value of the OIA using culture results as the "gold standard." The chi-square test was used to compare the results of OIA readings done by the manufacturer's staff versus the readings done by study center personnel.

We enrolled 1,306 women; their mean age was 26.6 years, and the mean gestational age was 26.3 weeks. GBS colonization was the highest in Philadelphia, Pa., (22.1%) and lowest in Yangon, Myanmar (7.1%). The rate of GBS isolation was higher from Lim broth culture than from other methods (Table 1).

Compared to culture, the sensitivity of OIA for detecting

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TABLE 1. Prevalence of GBS according to various culture methods and OIA by study center

Study site (no. of samples)	Prevalence (%) of GBS by method			
	Lim broth culture	Blood agar culture	Urine culture	OIA
Dublin, Ireland (203)	11.8	3.5	3.5	3.5
Yangon, Myanmar (226)	7.1	0.4	0.0	0.4
Manila, The Philippines (200)	6.0	0.0	2.5	5.0
Bangkok, Thailand (200)	12.0	3.0	3.5	1.5
Khon Kaen, Thailand (200)	14.5	8.0	4.0	4.5
Philadelphia, Pa. (68)	19.1	16.2	14.0	14.7
Harare, Zimbabwe (209)	11.7	5.3	4.9	7.7
All study sites (1,306)	10.9	4.0	3.5	4.3

any GBS colonization was 25.7% (95% confidence interval [CI], 19.0 to 33.6%) and ranged from 6.3% (95% CI, 0.3 to 32.3%) in Yangon, Myanmar, to 53.3% (95% CI, 27.4 to 77.7%) in Philadelphia, Pa. OIA sensitivity was 13.3% for lightly colonized women, 41.5% for heavily colonized women, and 68.4% for densely colonized women (Table 2). OIA sensitivity and specificity were 50.0 and 97.6%, respectively, compared with culture on blood agar and 26.8 and 98.4% compared with Lim broth. The OIA was positive in 1.4% of women who were negative by all culture methods. OIA test readings performed by the manufacturer and by study site personnel were similar (kappa of 0.701); the sensitivities from study site personnel and manufacturer readings was 29.7% (95% CI, 22.5 to 37.9%) and 25.7% (95% CI, 19.0 to 33.6%), respectively.

Our study demonstrated that the sensitivity of OIA to detect GBS colonization compared with that of culture was low, although the sensitivity of OIA in detecting heavy or dense colonization was higher than its sensitivity for detecting light colonization. Our findings confirm earlier work that found reliance on blood agar alone was insensitive for detecting light colonization and that comparing rapid detection methods with blood agar alone falsely elevated the sensitivity of these tests. Enrichment broth media, such as Lim broth, enhance GBS growth while suppressing growth of other bacteria, thus improving identification in specimens with low bacterial inoculum (3, 6).

In previous studies, the performance of the OIA has been compared with selective broth media. The specificity was uniformly high, 85 to 98%, similar to the 98.4% in our study. Conversely, previously reported test sensitivities varied widely but were generally higher (37 to 81%) (2, 5, 7, 12–14, 17–19)

than the value we found (26.8%). The most important reason for this variability may be the extent to which the subjects were colonized. The sensitivity of the OIA has been higher (61 to 100%) when compared with third- and fourth-quadrant positive blood agar cultures (2, 5, 7, 12–14). Our finding was within this range (68.4%).

Our study had limitations, as it did not evaluate the performance of the OIA 4 to 5 weeks before delivery or at delivery, when it would have the most clinical value (8). However, the average gestational age for our participants was 26.3 weeks, a time when the fetus is considered viable in many centers, making our data potentially useful for evaluating the role of GBS in preterm birth. We did not collect specimens from the rectum; collecting both rectal and vaginal cultures increases the detection of GBS carriage in pregnant women (1). If we had collected rectal specimens, we would have identified more GBS carriers, and the OIA performance would have been worse.

In conclusion, the low sensitivity of the Strep B OIA may limit its usefulness for detecting GBS in pregnant women, although the best performance of the test is in women who are heavily colonized and who therefore may be at highest risk for complications due to GBS infection. New tests, such as the newly licensed PCR test, may provide other options (4). For now, culture of specimens from the rectum and lower vagina remain the gold standard for detecting GBS colonization in pregnant women (8).

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TABLE 2. Diagnostic performance of OIA for detection of vaginal carriage of GBS compared to culture in women with light, heavy, and dense GBS colonization (n = 1,306)

GBS colonization level ^a	Performance characteristic ^b			
	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Light	13.3 (7.1, 22.9)	98.4 (97.5, 99.0)	37.9 (21.3, 57.6)	94.1 (92.5, 95.3)
Heavy	41.5 (29.7, 54.4)	97.7 (96.6, 98.4)	48.2 (34.8, 61.8)	97.0 (95.8, 97.8)
Dense	68.4 (43.5, 86.4)	96.5 (95.2, 97.5)	24.5 (14.2, 38.6)	99.5 (98.8, 99.8)

^a The GBS colonization levels were defined as follows: light, isolation of GBS from Lim broth alone; heavy, isolation of GBS from either urine or direct plating on blood agar; dense, growth in the third or fourth quadrant streaked on the blood agar plate (14).

^b The four performance characteristics, sensitivity, specificity, and positive and negative predictive values, are all given as percentages. The 95% CIs are given in parentheses.

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