Comparison of Four Commercial Molecular Assays for Detection of Group B Streptococcus in Antepartum Rectal-Vaginal Swab Specimens Following Broth Enrichment

ABSTRACT

Background: According to the CDC, the incidence of neonatal group B streptococcal (GBS) disease has significantly declined since the widespread implementation of intrapartum antibiotic prophylaxis for vaginal and/or cesarean delivery in pregnant women colonized with GBS. Molecular methods have evolved from lengthy time-consuming culture-dependent approaches to molecular methods that can rapidly provide results by either direct specimen testing or analysis of specimens following broth enrichment. To evaluate the performance of four commercially available assays for detection of GBS colonization, we performed a blinded comparison of assay performance using antepartum vaginal-swab specimens collected in our laboratory for routine GBS screening.

Methods: A total of 299 de-identified antepartum rectal-vaginal swab enrichment broth specimens collected from women ranging in age from 16 to 42 years were studied in this study. For standard-of-care testing, vaginal-swab specimens were inoculated in broth for approximately 48 h prior to analysis by the BD MAX GBS assay. Following analysis, remnant broth from each specimen was stored at -70°C until testing (within 4.5 h of BD MAX testing) by the ARIES GBS assay. Group B Streptococcus (GBS) positivity or negativity was determined by the BD MAX and ARIES assays, respectively. If discrepant results were obtained, the isolates were identified by nucleotide sequencing and/or culture.

Results: Ninety-five percent (95%) specimens yielded discrepant results between the BD MAX assay and ARIES GBS assay compared to the gold standard. Also, 1 invalid result was obtained. Seven discrepant results (5 false-positives and 2 false-negatives) were arbitrated by nucleotide sequencing and/or culture.

Conclusions: Prevention of neonatal GBS disease requires vigilant screening and prophylaxis practices. The comparative evaluation performed in this study produced highly accurate results that differ in part with the results obtained from comparator assays.

BACKGROUND

According to the Centers for Disease Control and Prevention (CDC), approximately 10% to 15% of pregnant women are colonized with Group B Streptococcus (GBS). GBS is a catalase-negative, facultative anaerobe that is known to harmlessly colonize the gastrointestinal and genitourinary tracts of humans. In susceptible hosts (e.g., neonates, pregnant women, and those with chronic medical conditions), GBS can serve as a versatile opportunistic pathogen that is capable of causing a variety of diseases, including urinary tract, respiratory, wound, and central nervous infections (2). Human infections generally originate from endogenous sources or are linked to vertical transmission. Historically, GBS has been a major cause of neonatal infections such as meningitis, pneumonia, and sepsis following vaginal birth from colonized mothers. Based upon the duration of time spanning from birth until the development of signs and symptoms, neonatal GBS diseases are classified as early-, late-, and very-late-onset. Early-onset GBS diseases appear within 1 to 7 days following birth, while late-, and very-late-onset infections manifest following 1 to 3 months and >3 months from birth, respectively. In late- and very-late-onset infections, focal infections such as those of the bone and/or joint are common.

CDC data indicate that since the nearly universal implementation of maternal prenatal GBS screening in the U.S., the incidence of neonatal GBS infections has been dramatically reduced (17). Effective GBS surveillance strategies entail collection of vaginal-cervical specimens from pregnant women between 35 and 37 weeks of gestation to yield GBS-positive rates of approximately 2% to 5% (15). The CDC recommends the administration of antibiotic prophylaxis to pregnant women with a positive test result to prevent infection in the newborn (19). Five percent (5%) of women may be colonized with GBS in the absence of symptoms (20), and surveillance cultures are performed on high-risk women to prevent neonatal infection. The Revised Guidelines from the CDC recommend the use of anxiolytic agents before vaginal examination to reduce the discomfort associated with the procedure (2). Human infections generally originate from endogenous sources or are linked to vertical transmission. Historically, GBS has been a major cause of neonatal infections such as meningitis, pneumonia, and sepsis following vaginal birth from colonized mothers. Based upon the duration of time spanning from birth until the development of signs and symptoms, neonatal GBS diseases are classified as early-, late-, and very-late-onset. Early-onset GBS diseases appear within 1 to 7 days following birth, while late-, and very-late-onset infections manifest following 1 to 3 months and >3 months from birth, respectively. In late- and very-late-onset infections, focal infections such as those of the bone and/or joint are common.

The aim of this study was to compare the performance characteristics of four commercially available GBS molecular diagnostic tests: the BD MAX GBS assay, the ARIES GBS assay, the illumigene GBS assay, and the Xpert GBS assay. To do so, we tested remnant antepartum rectal-vaginal-swab specimens submitted to our laboratory for routine GBS screening.

METHODS

Clinical specimens: A total of 209 de-identified, remnant antepartum rectal-vaginal swab enrichment broth specimens were enrolled in this study. Patient age range: 16 to 42 years (median, 27 years).

Standard-of-care testing: Upon receipt by the Health Division of Clinical Microbiology, vaginal-swab enriched broths were broken off into Lim broth (BD, Sparks, MD) and incubated for 18 to 24 h at 35°C in ambient air.

Following inoculation, 15±4 aliquots of well-mixed Lim broths from each sample were tested by the BD MAX™ System according to the manufacturer’s specifications.

• Comparator assay testing: Following standard-of-care testing, remnant Lim broths were stored at -70°C until testing by comparator methods.

RESULTS

• The BD MAX™ GBS (non-reference standard) detected GBS in 150/299 (50.2%) specimens.

• The ARIES™ GBS Assay detected GBS in 152/299 (51%) specimens and produced 5 discrepant results (3 false-positives and 2 false-negatives) when compared to the gold standard. Also, 1 invalid result was obtained. False-positives: In 2/3 (67%) samples, GBS was detected by either culture and/or sequencing. False-negatives: GBS was detected in all samples by either culture and/or sequencing. Invalid: Resolved by repeat testing.

• The illumigene® Group B Streptococcus Assay detected GBS in 149/299 (49.8%) specimens and resulted in 7 discrepant results (4 false-positives, 3 false-negatives, and 1 true-negative) when compared to the gold standard. False-positives: In 2/3 (67%) samples, GBS was detected by sequencing only. False-negatives: GBS was detected in all samples by either culture and/or sequencing. True-negatives: GBS was detected by sequencing only.

• The Xpert® GBS Assay detected GBS in 151/299 (50.5%) specimens and resulted in 3 discrepant results (2 false-positives and 1 false-negative) when compared to the gold standard. False-positives: In 1/3 (33%) sample, GBS was detected by sequencing only. False-negatives: GBS was detected by sequencing only. True-negatives: GBS was detected by sequencing only.

CONCLUSIONS

We thank the staff of the Indiana University Health Microbiology Laboratory for assistance with identification of the organism and culture photographs.

ACKNOWLEDGEMENTS


REFERENCES