OBSTETRICS

Survey of American obstetricians regarding group B streptococcus: opinions and practice patterns

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OBJECTIVE: The objective of the study was to evaluate attitudes and practice patterns of obstetricians related to screening for group B streptococcal colonization and providing intrapartum antibiotic prophylaxis against early-onset neonatal infections with group B streptococcus.

STUDY DESIGN: We mailed a survey to 546 members of the American College of Obstetricians and Gynecologists, including members of the Collaborative Ambulatory Research Network and non-Collaborative Ambulatory Research Network members. Stratified random selection was used to generate samples from both of these groups.

RESULTS: The survey response rate was 60% for Collaborative Ambulatory Research Network members and 42% for non-Collaborative Ambulatory Research Network members. Of the 206 respondents who reported providing prenatal care, 97% collect screening samples at 35–37 weeks' gestational age. Anatomic sites used to collect samples were more variable: 62% include lower vagina and rectum, 26% include lower vagina and perianal skin but not rectum, and 5% include neither the perianal skin nor the rectum. First-line agents for intrapartum antibiotic prophylaxis were penicillin (71%), ampicillin (27%), and cefazolin (2%). For patients reporting a non-anaphylactic penicillin allergy, drugs used for intrapartum antibiotic prophylaxis were more varied: cefazolin (51%), clindamycin (36%), vancomycin (8%), and erythromycin (5%). For patients undergoing a labor induction starting with a cervical ripening agent, less than 40% typically give the first dose of intrapartum antibiotic prophylaxis before or at the time of cervical ripening agent administration, and 15% wait until the patient reaches the active phase of labor.

CONCLUSION: Gaps in knowledge and reported practice related to the prevention of early-onset neonatal group B streptococcus infections were similar to gaps in implementation of guidelines demonstrated in past studies. New approaches to improve implementation are warranted.

Key words: early-onset neonatal infection, group B streptococcus, intrapartum antibiotic prophylaxis, screening

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About a quarter of pregnant women are vaginally and/or rectally colonized with *Streptococcus agalactiae*, commonly known as group B streptococcus (GBS).[1] In the absence of intervention, this colonization results in early-onset (first week of life) neonatal infection in 1–2 per 1000 live births in the general obstetric population.[2]

A few decades ago, intravenous intrapartum antibiotic prophylaxis was shown to substantially reduce the incidence of early-onset neonatal GBS infection.[3-5] Since that time, there has been widespread adoption of screening of pregnant women for colonization and use of intrapartum prophylaxis, as recommended by the most recent revision of the guidelines from the Centers for Disease Control and Prevention (CDC) and key partners that include the American College of Obstetricians and Gynecologists (ACOG)[6]; the ACOG's GBS prevention statement is fully harmonized with that issued by the CDC.[7]

This change in practice has resulted in an 80% reduction in early-onset GBS infection since the early 1990s. Currently there are approximately 950 cases per year in the United States, consistent with 0.24 per 1000 live births.[8,9]

Despite this improvement in early-onset neonatal infection, a recent case series from the Active Bacterial Core surveillance system concluded that optimal implementation of the guidelines could reduce the rate by another 26–59%, with prenatal screening and intrapartum prophylaxis being the most

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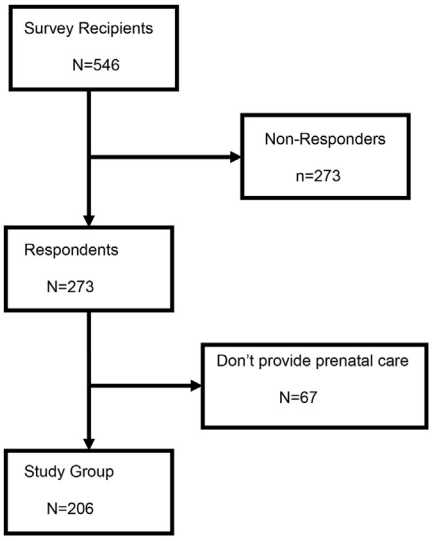
FIGURE
Derivation of the study group



Shown here is the derivation of the study group. Surveys were mailed to 546 recipients; 273 of them returned the survey, of which 67 reported not providing prenatal care. Excluding those 67 respondents left the study group of 206.

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common error types.[10] We wanted to try to better understand the reasons for these errors. Therefore, the objective of this study was to evaluate the attitudes and practice patterns of obstetricians related to various aspects of screening for GBS colonization and providing intrapartum antibiotic prophylaxis against early-onset neonatal infections with GBS.

Materials and Methods

Survey questionnaires were sent to 546 ACOG fellows and junior fellows in practice between January and July 2014. Of these recipients, 246 were members of the Collaborative Ambulatory Research Network (CARN). CARN is composed of practicing obstetrician-gynecologists who volunteer to participate in survey research, and it was established to facilitate the assessment of practice patterns and development of professional education. The other 300 survey recipients did not belong to CARN (non-CARN); they were randomly selected by computer from ACOG fellows and junior fellows in practice.

The survey, accompanied by a cover letter explaining the purpose of the study and a postage-paid return envelope, was first distributed in January 2014. Four follow-up mailings were sent to non-responders. The study was approved by the Institutional Review Board of the University of Alabama at Birmingham.

The survey included demographic questions including sex, age, years in practice, board certification, and practice characteristics (type, location, patient mix, proportion of time spent doing obstetrics). Only physicians who provided prenatal care were asked to complete the survey. To assess the attitudes and practice patterns related to GBS, respondents were asked about prenatal screening, intrapartum screening, intrapartum prophylaxis, a potential GBS vaccine, and reasons for their attitudes and practice patterns regarding these topics.

Data were entered into a computerized spreadsheet (Excel 2010; Microsoft Corp, Redmond, WA). All data management and analyses were done using SAS version 9.3 (SAS Institute, Inc, Cary, NC). For responses, frequency counts, proportions, and exact 95% confidence intervals about these proportions were calculated. If a respondent provided no answer to a specific question, their data for that question were excluded both from the numerator and the denominator. In planned secondary analyses, results were stratified by physician sex and by years in practice since residency. Although physician sex is not a variable by which such data frequently are stratified, others have done so, and some have found differences in care delivered by sex.[11,12]

For pairwise comparisons, we utilized the χ^2 test of association or the Fisher exact test, as appropriate. For ordinal outcomes, we used the Cochran-Armitage trend test. Because we conducted multiple comparisons, statistical significance was evaluated at a level of $P = .01$.

Results

The survey response rate was 50.0% overall (273 of 546), with 60.2% (148 of 246) for CARN and 41.7% (125 of 300) for non-CARN. Of the 273 respondents, 206 reported providing prenatal care, 116 CARN and 90 non-CARN. Our study group was comprised of these 206 obstetricians (Figure). Of these obstetrician respondents, 91.6% reported their primary specialty as general obstetrics and gynecology, 6.4% as maternal-fetal medicine, and 2.0% as obstetrics only or other. Additional demographic data regarding these physicians are presented in Table 1. Reported descriptions of the patient populations these physicians serve are shown in Table 2.

When asked about routine timing for collection of samples, excluding urine cultures, to screen for GBS colonization, 97.1% of respondents (95% confidence interval [CI], 93.7–98.9%) reported collecting at 35-37 weeks, in compliance with the CDC guidelines. However, 4.9% of respondents (95% CI, 2.6–8.9%) also reported collecting samples at the first prenatal visit, and 0.5% (95% CI, less than 0.01% to 3.0%) reported collecting samples both at 35–37 weeks and later. There were 1.0% of respondents (95% CI, 0.4–3.7%) who reported routinely collecting samples earlier than 35 weeks and 1.5% (95% CI, 0.3–4.4%) who reported routinely collecting samples after 37 weeks. Of 204 respondents who answered the question, only 0.5% (95% CI, less than 0.01% to 3.0%) reported not screening for GBS colonization. For this and other questions, responses did not differ significantly between respondents who reported being board certified and those who did not (data not shown).

Anatomic sites routinely used to collect samples for prenatal screening were more variable: of the 204 respondents who answered the question, 62.3% (95% CI, 55.2–68.9) reported sampling from the lower vagina and rectum (in compliance with the CDC guidelines), and 25.5% (95% CI, 19.7–32.1) reported collecting from the lower vagina and perianal skin but not the rectum. There were 4.9% (95% CI, 2.4–8.8) of respondents who reported collecting from site(s) that included neither the perianal skin nor the rectum and 7.4% (95% CI, 4.2–11.8) who

reported collecting from the rectum and/or perianal skin but not the vagina. Among respondents, 3.9% (95% CI, 1.7−7.6) included the cervix in the sites from which the sample is routinely collected.

Anatomic sites routinely used to collect samples for prenatal screening did not differ by physician sex ($P = .199$) or whether in practice more or less than 15 years ($P = .232$). The following factors related to decisions about sites for collection of samples were listed as important or somewhat important by a majority of respondents: compliance with guidelines (94.1%), hospital/group practice policy (75.0%), maximize identification of colonized patients (91.2%), and medicolegal concerns (59.8%). Tolerability/patient comfort was listed as important or somewhat important by 40.6% of respondents.

These responses were not significantly different when comparing respondents who reported routinely collecting samples from the lower vagina and rectum with those who reported collecting samples from the lower vagina and perianal skin but not the rectum, although answers related to maximizing identification of colonized patients (95.3% vs 82.7%; $P = .014$) and tolerability/patient comfort (35.7% vs 54.9%; $P = .019$) approached significance.

When asked about which test they used for prenatal screening for GBS colonization, 67.0% of respondents (95% CI, 60.0−73.5) reported using culture, 12.5% (95% CI, 8.3−17.9) reported using polymerase chain reaction (PCR), and 9.5% (95% CI, 5.8−14.4) reported using both culture and PCR. There were 10.0% (95% CI, 6.2−15.0) who were unsure of which test they used, and 1.0% (95% CI, 0−3.6) reported using different tests, depending on the patient's insurance.

The CDC guidelines call for prenatal screening. However, intrapartum screening, using nucleic acid amplification techniques such as PCR, is available. Most respondents (67.2%; 95% CI, 61.4−72.5) reported that none of their intrapartum patients are screened for GBS colonization, and only 4.8% (95% CI, 2.2−8.9) reported screening more than half of their intrapartum patients for GBS colonization.

Most respondents (70.7%; 95% CI, 63.8−76.8) reported using penicillin as their first-line agent for intrapartum antibiotic prophylaxis. Ampicillin (27.4%; 95% CI, 21.3−34.1) and cefazolin (2.0%; 95% CI, 0.5−5.0) were the other drugs reported as being used as first-line agents for prophylaxis. Those who reported using ampicillin as first-line agents were significantly more likely to consider availability of the drug as important or somewhat important in their decision to use it than those who reported using penicillin as first line

TABLE 1
Survey respondent demographic data

Variable	Statistic
Age, y	48.3 ± 11.9
Years in practice after residency	16.4 ± 12.4
Sex	
Female	66.0%
Male	34.0%
Board certified[a]	82.5%
Type of practice[a]	
Solo private practice	14.2%
Obstetrician-gynecologist partnership/group	47.6%
Multispecialty group	13.7%
Military/government	1.0%
University full-time faculty and practice	15.2%
HMO/staff model	3.9%
Other	4.4%
Practice location[a]	
Urban-inner city	19.0%
Urban-non−inner city	26.3%
Suburban	33.2%
Midsized town	16.1%
Rural	5.4%
Percentage of clinical activities	
Obstetrics	50% (40-60)
Gynecology	50% (35-60)
Percentage of time spent in various areas	
Clinical	90% (80-95)
Teaching	2% (0-10)
Research	0% (0-0)
Administrative	5% (0-10)

Data are presented as mean ± SD, proportion of n, or median (first quartile to third quartile). Some proportion totals do not sum exactly to 100% because of rounding.

HMO, health maintenance organization.

[a] There were x missing values for each of these characteristics: board certified (n = 12), type of practice (n = 2), and practice location (n = 1).

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TABLE 2
Survey respondent descriptions of their patient populations served

Variable	Statistic
Race	
White	60% (40–75%)
Black	10% (5–30%)
Hispanic	10% (4–20%)
Asian	2% (0–5%)
Native American	0% (0–1%)
Other	0% (0–2%)
Patient education[a]	
<12 y	6.4%
High school degree	48.8%
College degree or advanced degree	27.6%
Unknown or population is too varied to respond accurately	17.2%
Source of payment	
Private insurance	60% (35–80%)
Medicaid	23.5% (6–40%)
Medicare	5% (1–10%)
Unfunded	1% (0–75%)

Data are presented as median (first quartile to third quartile) or proportion of n. Because of this fact, the category totals equal 100% for patient education but not for the other variables.

[a] There were 3 missing values for the variable, patient education.

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($P = .006$). Other factors were not rated differently between respondents in those 2 groups (Table 3).

For patients reporting a history of a nonurticarial rash when exposed to penicillin, the drugs that respondents reported using most often for intrapartum antibiotic prophylaxis were cefazolin (51.2%; 95% CI, 44.1–58.3), clindamycin (36.3%; 95% CI, 29.7–43.4), vancomycin (7.5%; 95% CI, 4.2–12.0), and erythromycin (4.5%; 95% CI, 2.1–8.3).

There were no significant differences between proportions of respondents who rated various factors as important or somewhat important regarding the choice of agent in this situation when stratifying results by those respondents who reported using cefazolin (the drug suggested by the CDC guidelines) and clindamycin (the next most common option and one that the guidelines recommend against) for intrapartum antibiotic prophylaxis in patients who report a history of a nonurticarial rash reaction to penicillin (Table 4).

Of note, 94.3% of those who reported using clindamycin (95% CI, 86.0–98.4) responded that compliance with guidelines was important or somewhat important in making that choice. Similarly, there were no significant differences between proportions of respondents who rated various factors as important or somewhat important regarding choice of agent in this situation when stratifying the results by those respondents who reported using cefazolin and vancomycin, and numerically all proportions were lower in the vancomycin group (data not shown).

As Table 5 shows, respondents varied widely regarding the time to give the first dose of intrapartum antibiotic prophylaxis for patients undergoing inductions of labor (the question asked respondents to assume the induction started with a cervical ripening agent). Less than 40% of respondents reported typically giving the first dose prior to, or at the time of the administration of, the cervical ripening agent, and 15% reported waiting to give the first dose until the patient reached the active phase of labor.

Assuming a safe, effective maternal vaccine against GBS were available and were recommended by the Advisory Committee on Immunization Practices, a minority of respondents strongly agreed or agreed on the following: that a GBS vaccine would be easier to implement than intrapartum antibiotic prophylaxis (45.9%; 95% CI, 38.9–52.9), that the vaccine would be acceptable to their patients (49.8%; 95% CI, 42.7–56.8), that they would recommend the vaccine as an adjunct to intrapartum antibiotic prophylaxis (43.6%; 95% CI, 36.6–50.7), that they would recommend the vaccine only if it replaced intrapartum antibiotic prophylaxis (44.8%; 95% CI, 37.9–51.9), and that they would recommend the vaccine for nonpregnant patients (25.7%; 95% CI, 19.9–32.3). However, most respondents strongly agreed or agreed that they would recommend the vaccine for pregnant patients (63.2%; 95% CI, 56.2–69.9) and that their office is set up to administer vaccines (81.8%; 95% CI, 75.8–86.8).

COMMENT

This study was designed to evaluate the attitudes and practice patterns of obstetricians related to various aspects of screening for GBS colonization and providing intrapartum antibiotic prophylaxis against early-onset neonatal infections with GBS. The overwhelming majority of obstetricians reported collecting screening samples as recommended by the CDC guidelines at 35–37 weeks. However, the method with which these samples are collected were noncompliant with the CDC guidelines in more than one-third of the cases.

The most common alternate sample type was vaginal/perianal, which some studies suggest is equivalent to vaginal/rectal sampling for screening cultures

for GBS colonization[13-15] and may be associated with less patient discomfort. If vaginal/perianal sampling was compliant with the CDC guidelines, only 12% of respondents would sample in a noncompliant manner. It is puzzling to note that a small percentage of obstetricians reported not sampling from either the rectum or the perianal skin and that some sample from the cervix.

Regarding the choice of drug for intrapartum antibiotic prophylaxis, the reported practice was well aligned with the guidelines for patients with no allergy to penicillin. However, for patients with a reported mild rash reaction to penicillin, the reported practice varied widely and displayed opportunities for improvement, with barely more than half of respondents reporting using cefazolin as recommended by the CDC guidelines.

More than one-third of the respondents reported using clindamycin for patients with a reported mild rash reaction to penicillin, a practice that specifically is discouraged by the CDC guidelines because of increasing resistance of GBS to this antibiotic. Furthermore, the vast majority of those respondents choosing clindamycin in this situation listed compliance with guidelines as a factor that was important or somewhat important in making that choice.

Because strains of GBS increasingly have become resistant to most of the alternative agents, this particular clinical situation is one in which there is the potential for improvement in compliance with the guidelines and an anticipated further decrease in the rate of early-onset GBS infections. Further education on this point and understanding of barriers to appropriate agent choice for women with mild penicillin allergy are needed.

Another opportunity for improvement that our survey uncovered relates to timing of the first dose of intrapartum antibiotic prophylaxis. When asked about treatment of a patient undergoing a labor induction initiated with a cervical ripening agent, 15% of the respondents said that they would delay prophylaxis until the patient reached the active phase of labor. Because the active phase of labor can only be diagnosed retrospectively, the median duration from 4 to 10 cm dilation in parous women is less than 2.5 hours,[16] and women undergoing induced labors proceed from 4 to 10 cm dilation more rapidly than those with spontaneous onset of labor,[17] that approach would lead to some patients having received less than the recommended 4 hour minimum of prophylaxis before delivery, even though they had been in the labor and delivery unit for much longer.

That occurrence would lead to the infant having blood cultures and a complete blood count assessed.[6] More importantly, it might be that a preventable case of early-onset infection could occur. Although guidelines cannot practically cover all possible clinical scenarios, almost one fourth of pregnant women in the United States undergo labor inductions.[18] Rather than making the case for the specific scenario of labor induction to be covered in future revisions to the CDC guidelines, we believe that this finding highlights a need for further education regarding the fact that there are no data supporting harm from more than 4–6 hours of exposure to intrapartum antibiotic prophylaxis.

Finally, if an effective vaccine against GBS becomes available, we demonstrated a willingness among American obstetricians to incorporate it into practice. More than 80% of respondents reported that their offices were set up to give vaccines. Moreover, greater than 60% would recommend the vaccine for their pregnant patients. However, should recommendations regarding a future vaccine involve administration to nonpregnant patients or include a combination of intrapartum prophylaxis and vaccination rather than one or the other, our data demonstrate that there likely would be less enthusiasm from practicing obstetricians.

Like all survey studies, there is the potential that our data are biased by the fact that we cannot evaluate nonresponders. However, we minimized this effect by sending 4 follow-up mailings, and we did achieve a reasonable response rate. In addition, our method of selecting survey recipients yielded a study group comprised

TABLE 3
Factors listed as important or somewhat important regarding drug choice

Factor	Ampicillin (n = 55)	Penicillin (n = 142)	*P* value
Availability	81.5%	60.6%	.006
GBS antibiotic resistance	90.9%	81.0%	.090
Antibiotic resistance of other bacteria	33.3%	45.8%	.115
Compliance with CDC guidelines[a]	92.7%	93.7%	.758
Concerns about adverse events from other agents	59.3%	47.5%	.142
Cost of antibiotic	54.6%	45.8%	.269
Dosing interval	46.3%	36.2%	.195
Hospital/group practice policy	74.6%	73.9%	.931
Medicolegal concerns	60.0%	56.3%	.641
Pediatrician's approach to the care of the infant	54.6%	47.9%	.402
Placental transfer	58.2%	43.6%	.066
Tolerability/side effects	76.4%	61.0%	.042

CDC, Centers for Disease Control and Prevention; *GBS*, group B streptococcus.

[a] Verani et al.[6]

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TABLE 4
Factors listed as important or somewhat important if rash to penicillin

Factor	Cefazolin (n = 103)	Clindamycin (n = 73)	*P* value
Availability	73.5%	68.6%	.479
GBS antibiotic resistance	89.2%	85.7%	.491
Antibiotic resistance of other bacteria	56.0%	40.6%	.049
Compliance with CDC guidelines[a]	96.0%	94.3%	.718
Concerns about adverse events from other agents	69.0%	53.6%	.042
Cost of antibiotic	48.5%	38.6%	.198
Dosing interval	37.6%	37.7%	.994
Hospital/group practice policy	68.3%	68.6%	.972
Medicolegal concerns	56.4%	55.7%	.926
Pediatrician's approach to the care of the infant	47.5%	47.1%	.961
Placental transfer	54.5%	45.7%	.261
Tolerability/side effects	67.3%	58.6%	.242

CDC, Centers for Disease Control and Prevention; *GBS*, group B streptococcus.

[a] Verani et al.[6]

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of a diverse group of obstetricians that is representative of the overall population of American obstetricians.

Intrapartum antibiotic prophylaxis is a success story for modern obstetrics, having decreased the rate of early-onset GBS infections by more than 80%. However, the findings of our study are in agreement with those of Verani et al[10] that there is still room for improvement. We speculate that the necessary complexity of the CDC guidelines may partially explain the gap between optimal and actual implementation. However, this gap between optimal and actual implementation has been stubborn, having been first reported by Van Dyke et al[19] from 2003–2004 data.

Perhaps the Prevent Group B Strep app for tablets and smart phones recently released by the CDC and endorsed by ACOG and other key guidelines partners (http://www.cdc/gov/groupbstrep/guidlines/prevention-app.html) will help with more ideal implementation of the guidelines. Additionally, incorporating guideline-concordant clinical decision support within electronic health records holds promise as another tool for timely delivery of patient-specific guidance directly to clinicians. However, decision support algorithms will need to be detailed enough to deal with subtle differences. For example, electronic red flags triggered by ordering cefazolin for women with a history of a mild allergic reaction to penicillin could actually hinder optimal implementation of the CDC guidelines. ■

TABLE 5
Responses regarding first dose of intrapartum antibiotic prophylaxis

Answer	Proportion	95% CI
Prior to cervical ripening agent	9.1%	5.5–14.1
When ripening agent is administered	26.4%	20.4–33.1
When oxytocin is started	19.8%	14.5–26.1
When having contractions	26.9%	20.9–33.7
When the membranes are ruptured	1.0%	0.1–3.6
When in active phase of labor	15.2%	10.5–21.0
Other	1.5%	0.3–4.4

The question assumed a patient undergoing an induction of labor started with a cervical ripening agent. There were 9 respondents who did not answer this question.

CI, confidence interval.

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