Group B Streptococcal Disease Prevention Practices of Obstetrician-Gynecologists

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OBJECTIVE: To describe group B streptococcal (GBS) disease prevention practices of obstetrician-gynecologists.

METHODS: We surveyed 1019 ACOG Fellows–the 419 members of the Collaborative Ambulatory Research Network (CARN) and 600 randomly selected non-CARN Fellows.

RESULTS: There were 601 eligible respondents. More than 95% in both the CARN and the non-CARN groups reported adopting one of three GBS prevention strategies. The most commonly reported strategy was a combination approach not described in the consensus guidelines. The second most common strategy was the screening-based strategy; the risk-based strategy was third. Most respondents provided GBS information to all prenatal patients, but those using a risk-based strategy and those in solo practice were less likely to do so. Less than 60% in each group used penicillin as their first choice for GBS prophylaxis. More than 20% in each group who routinely screened for GBS did not collect both vaginal and rectal cultures. Respondents rated ACOG publications as the most important influence on their GBS prevention approach.

CONCLUSION: Almost all ACOG Fellows have adopted a GBS prevention strategy. The importance of providing GBS prevention information to all patients, use of penicillin, and collection of both vaginal and rectal cultures should be reinforced. (Obstet Gynecol 2001;98:7–13. © 2001 by the American College of Obstetricians and Gynecologists.)

During the 1970s, group B streptococcus (GBS) emerged as the leading cause of severe bacterial infections in newborns.[1,2] In an effort to reduce the incidence of GBS disease occurring in the first week of life (early-onset GBS disease), the Centers for Disease Control and Prevention, ACOG, and the American Academy of Pediatrics issued consensus guidelines for the use of intrapartum antibiotic prophylaxis in 1996.[3–5] These guidelines are referred to hereafter as the "consensus guidelines." These guidelines recommended the use of a prevention strategy based on either risk factors for early-onset GBS disease (risk-based strategy) or the results of maternal screening cultures at 35–37 weeks' gestation (screening-based strategy). The screening-based strategy also called for intrapartum prophylaxis to be given to women with risk factors when screening cultures were not available. Since the consensus guidelines were issued, the incidence of early-onset GBS disease has decreased substantially.[2] In 1997, a survey of hospitals in seven states found that the percentage with a GBS disease prevention policy increased between 1994 and 1997 (from 39% to 58%).[6] Hospitals that adopted GBS disease prevention policies in 1996 had a significantly lower incidence of early-onset GBS disease by 1997.[7] In 1998, 95% of obstetrician-gynecologists in Connecticut and 94% of obstetrician-gynecologists in Minnesota had a GBS disease prevention policy. However, significant variation was found in the choice of the prevention strategy between the two states.[8] In the 1997 hospital survey, only 83% of hospitals in Connecticut and 50% of hospitals in the Twin Cities area of Minnesota had GBS disease prevention policies. This finding suggests that the adoption of a policy to prevent GBS disease may be more common at the level of the individual provider than at institutions.

Despite the increase in GBS prevention activities and the reduced incidence of early-onset GBS disease, GBS remains a leading cause of neonatal sepsis in the United States, and preventable cases of early-onset GBS disease continue to occur.[9] Many of the previous studies of GBS prevention policies were done in areas with active surveillance programs and enhanced provider education efforts. The results of these studies may not be representative of GBS prevention practices nationwide. To better understand the GBS prevention policies of obstetrician-

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gynecologists throughout the United States, we conducted a nationwide survey of ACOG Fellows. This is the first nationwide study of prenatal care providers since the consensus guidelines were issued. Information about GBS prevention policies of prenatal care providers will be helpful in developing strategies to continue to reduce the incidence of early-onset GBS disease.

MATERIALS AND METHODS

In February 2000, questionnaires were mailed to the 419 ACOG Fellows who participate in the Collaborative Ambulatory Research Network (CARN). The network is a group of ACOG Fellows who voluntarily participate in surveys to help ACOG monitor prevailing clinical obstetric and gynecologic practices. Members receive approximately four ACOG sponsored surveys annually on a range of topics. They have been chosen to reflect the age and gender distribution of all ACOG Fellows. Because CARN participants are not randomly selected and may not be representative of all ACOG Fellows, questionnaires were also mailed to a random sample of 600 ACOG Fellows who had not previously been selected to participate in an ACOG survey. A second mailing was sent to nonresponders from both groups approximately 1 month after the first.

Survey responses were entered into an EpiInfo database, 6.04c (Centers for Disease Control and Prevention, Atlanta, GA), using a data check file to limit data entry errors. Continuous variables were categorized as follows: the percentage of patients in the practice with Medicaid was divided into categories of low (0–9%), medium (10–49%), and high (50% or higher) because each of these categories included clusters of responses. Similarly, the number of deliveries per year was divided into categories of low (2–99), medium (100–199), and high (200 or more). The year of residency completion was also divided into three categories: residency completed after the consensus guidelines were published (1996 or later), residency completed between 1980 and 1995, and residency completed before 1980.

The CARN and non-CARN groups were treated as two simple random samples. All members of the CARN group were sampled and a small proportion of the non-CARN ACOG membership (40,735) was sampled. The responses for the two groups were analyzed separately in the univariate analysis. The univariate analysis was conducted for the following outcomes: collection of both vaginal and rectal screening cultures, collection of screening cultures at 35–37 weeks' gestation, use of penicillin as a first-line agent for prophylaxis, provision of GBS information to all patients, and choice of prevention strategy. The choice of prevention strategy was analyzed on the basis of the three most common responses: risk-based and screening-based, both included in the consensus recommendations, and a third strategy that provided intrapartum prophylaxis for women who had a positive screening culture for GBS and also for women with a negative screening culture who had a risk factor (ie, delivery at less than 37 weeks' gestation, intrapartum fever greater than or equal to 38C, or membrane rupture 18 or more hours before delivery).

For each of these variables, the independent variables assessed were gender, year of residency completion, practice type, practice location, annual number of deliveries performed, and percentage of patients with Medicaid. The differences for the categoric measures were assessed using the χ^2 test. The median two-sample test was used to detect differences in the continuous measures. Univariate data analysis was done using the Statistical Analysis System 8 software, (SAS Institute, Cary, NC).

Because several of the independent variables were correlated, logistic regression analysis was conducted to control for potential confounding. This analysis was conducted using SUDAAN (Research Triangle Institute, Research Triangle Park, NC) to stratify the CARN and non-CARN groups and account for the impact of clustering of responses within these groups. The responses of the two groups were weighted to account for the difference in the size of the populations from which they were drawn. Regression models included all the independent variables listed above, with the exception of the annual number of deliveries, which was not associated with any of the dependent variables in the univariate analysis ($P > .10$).

RESULTS

Completed surveys were received from 348 of the CARN members (83%) and 354 of the non-CARN ACOG Fellows (59%). For both groups, those who responded did not differ significantly from the nonrespondents with regard to age or gender. Respondents who had not seen obstetric patients in 1999 (45 CARN respondents [13%] and 56 non-CARN respondents [16%]) were excluded, leaving 303 eligible respondents from the CARN group and 298 from the non-CARN group. The CARN respondents were older (median age 45 years and 42 years, respectively, $P < .001$) and had completed residency earlier (median year of completion 1986 and 1990, respectively, $P < .001$) than the non-CARN respondents. The other demographic and practice characteristics of the respondents did not differ between the two groups (Table 1).

More than 95% of the respondents in each group reported adopting one of the three GBS prevention

Table 1. Characteristics of Respondents to the Group B Streptococcal Disease Prevention Survey*

Characteristic	CARN group (n = 303)	Non-CARN group (n = 298)
Sex		
Male	56.2	61.4
Female	43.8	38.6
Year of residency completion†		
Median	1986	1990
Pre-1980	28.2	19.4
1980–1995	56.5	52.2
1996–2000	15.3	28.3
Practice setting		
Urban	36.3	35.9
Suburban	40.9	36.2
Rural	17.5	17.1
Primary practice structure		
Solo	23.4	22.5
Single specialty group	48.8	49.0
Multispecialty group	11.9	10.7
University	9.9	7.4
Other	5.9	10.4
Number of deliveries in 1999		
Median	127	120
2–99	22.9	24.3
100–199	49.0	54.2
200+	28.1	21.5
Medicaid		
Median	20	20
0–9%	28.3	31.5
10–49%	40.7	42.2
50%+	31.0	26.3

CARN = Collaborative Ambulatory Research Network.

* Values represent the percentage of respondents in the category; the percentages may not total 100% because all responses may not be listed.

† $P < .001$ for CARN vs non-CARN comparison, median two-sample test.

strategies. The most common GBS strategy used by both groups was the third strategy, which included routine screening and prophylaxis for women with positive screening cultures and some women with a negative screening result (Table 2). The second most common strategy was the screening-based strategy; the risk-based strategy was the third most common. Approximately two thirds of the respondents in both groups provided information about GBS to all patients. Providers who routinely collected screening cultures were more likely to provide information to all patients than were those who used the risk-based strategy (85% compared with 24% for CARN and 81% compared with 19% for non-CARN, $P < .0001$ for both groups). Fifty-eight percent of the CARN respondents and 48% of the non-CARN respondents reported using penicillin as their first choice for prophylaxis ($P < .05$). More than 67% of the providers in each group who used penicillin as a first-line agent indicated that the recent shortages of intravenous penicillin G had influenced their prevention practices. Most of these indicated that they had switched to ampicillin when penicillin was unavailable. For penicillin-allergic patients, more than 75% of the respondents in both groups used clindamycin for prophylaxis. The next most common alternative agent for penicillin-allergic patients was erythromycin or a cephalosporin (each was used by approximately 10% of the respondents in both groups).

Almost 70% of the respondents in each group reported using a strategy that involved collecting routine screening cultures. To evaluate the screening practices, we analyzed the responses to questions about anatomic sites and the timing of culture collection. The consensus guidelines recommend collection of both vaginal and rectal cultures to improve the sensitivity of the screening test. Of those who routinely collected screening cultures, more than 95% in both groups collected vaginal cultures, but only 72% of CARN respondents and 81% of non-CARN respondents collected rectal cultures (Table 3). The guidelines also discouraged cervical cultures because they are less sensitive than vaginal cultures. Al-

Table 2. Percentage of Survey Respondents Using Various Group B Streptococcal Disease Prevention Policies

Policy	CARN group (n = 303)	Non-CARN group (n = 298)
Current GBS prevention policy		
Risk-based	26.4	25.5
Screening-based	34.3	28.5
Third strategy*	35.6	41.3
None	0.0	0.0
Other/missing	3.6	4.7
Prenatal patients who receive GBS information		
All	66.3	63.1
Some	26.1	29.5
None	5.0	4.0
Missing	2.6	3.4
Antibiotic preference for first-line agent†		
IV penicillin G	58.4	47.6
IV ampicillin	38.3	48.0
Other/missing	3.3	4.4
Indications for prophylaxis		
All four correct‡		
Yes	92.5	94.7
No	7.5	5.3

CARN = Collaborative Ambulatory Research Network; GBS = group B streptococcal disease; IV = intravenous.

* Prophylaxis for women with positive screening cultures as well as women with negative cultures and a risk factor.

† $P = .03$ for comparison between CARN and non-CARN for use of penicillin vs any other antibiotic.

‡ Providers using risk-based strategy only (CARN group, n = 80; non-CARN group, n = 76).

Table 3. Group B Streptococcal Disease Prevention Practices of Respondents Who Obtain Prenatal Cultures*

Practice	CARN group (n = 211)	Non-CARN group (n = 206)
Culture sites		
Vagina	95.7	95.2
Rectum	72.5	80.6
Vagina and rectum	70.6	79.1
Urine	20.4	25.2
Cervix	10.9	17.0
Laboratories used for screening		
Multiple laboratories	41.2	41.7
Hospital laboratory	28.9	32.0
One private reference laboratory	26.1	21.4
Other/missing	3.8	4.9
Time of collection†		
35–37 weeks' gestation	93.8	94.0
How culture results are determined when patient is in labor†		
Prenatal records (preprinted box)	62.2	68.7
Prenatal records (no standard location)	24.4	16.4
Computer retrieval	7.2	6.5
Other	6.2	8.5

CARN = Collaborative Ambulatory Research Network.

* Values represent the percentage of respondents who report following the practice.

† n = 209 and n = 201, respectively, because of missing data.

most 11% of the respondents in the CARN group and 17% of the respondents in the non-CARN group reported collecting cervical cultures for GBS. However, most of these physicians collected vaginal cultures as well. Only 2.4% of the respondents in the CARN group and 4.8% of the respondents in the non-CARN group cultured the cervix and not the vagina. Approximately 94% of the respondents in both groups collected screening cultures at the recommended time of 35–37 weeks' gestation. The respondents used a variety of different laboratories to process the screening cultures. More than 40% of the providers in both groups used multiple laboratories, and approximately 30% used a hospital laboratory and 25% a single private laboratory. Approximately 70% of the providers in both groups had standardized systems for determining the results of the screening cultures during labor (either standard location in prenatal records or computerized laboratory information).

To evaluate the prevention practices of the providers using the risk-based strategy, we analyzed the responses to the questions about indications for antibiotic prophylaxis. Of the respondents using the risk-based strategy, more than 92% in both the CARN and the non-CARN groups used all four recommended indications assessed in the questionnaire (ie, premature delivery before 37 weeks, prolonged rupture of membranes 18 hours or more before delivery, GBS bacteriuria, and previous delivery of an infant with GBS disease).

The respondents were asked to rate the importance of a variety of educational influences on their current GBS prevention strategy. The responses were rated on a four-point scale (1 = important, 2 = some influence, 3 = minimal influence, and 4 = not an influence). For both CARN and non-CARN respondents, ACOG publications were rated as the most influential. The ACOG publications were the only influence for which the median response was 1 for both groups. Other significant influences were reading journals, continuing medical education activities (median response = 1 for the CARN group and 2 for the non-CARN group), Centers for Disease Control and Prevention publications, peers and partners (median response = 2 for both groups), and textbooks and residency training (median response = 3 for the CARN group and 2 for the non-CARN group). The median response for hospital policy was 3 for both groups, and the median response for lawsuits and health maintenance organization policy was 4 for both groups.

We conducted multivariable analyses to explore further the factors associated with the choice of prevention strategy. Providers in suburban settings were more likely than providers in urban settings (the reference group) to use the third strategy, which provided prophylaxis to culture-positive women and to culture-negative women with a risk factor, rather than either of the two strategies recommended in the consensus guidelines (adjusted odds ratio [OR] 2.82, 95% confidence interval [CI] 1.51, 5.26). Among the providers who used either this third strategy or the screening-based strategy, the type of laboratory used to process the GBS cultures was not associated with the choice of strategy. Among the providers who used either the risk-based or the screening-based strategy, the only factor that independently predicted the choice of strategy was the type of practice. Academic obstetricians were significantly more likely to choose the risk-based strategy than were providers working in obstetrics and gynecology groups, the reference group (adjusted OR 7.14, 95% CI 1.37, 33.3).

Among providers who routinely collected screening cultures, none of the factors assessed in the multivariable analysis was associated with the collection of both vaginal and rectal cultures or the collection of cultures at 35–37 weeks' gestation. Because of the strong association in the univariate analysis, the choice of prevention strategy was included in the multivariable model of factors predicting which respondents provided GBS information to all prenatal patients. The choice of strategy was by far the most important predictor. Compared with respondents who used the risk-based strategy, those who

used the screening-based strategy (adjusted OR 45.7, 95% CI 17.9, 122.0) or the third strategy (adjusted OR 26.4, 95% CI 10.2, 68.0) were significantly more likely to provide the information to all prenatal patients. The respondents in suburban practices were more likely than those in urban practices (the reference group) to provide GBS information to all prenatal patients (adjusted OR 2.85, 95% CI 1.30, 6.23). Compared with those in obstetrics and gynecology groups, the respondents in solo practices were less likely to provide GBS information to all patients (adjusted OR 0.33, 95% CI 0.14, 0.74), and those in multispecialty groups were more likely to do so (adjusted OR 4.17, 95% CI 1.38, 12.6).

The respondents who completed their residency before the consensus guidelines were issued were more likely to use an antibiotic other than penicillin for prophylaxis than those who completed their residency in 1996 or later (residency completed 1980–1995, adjusted OR 1.90, 95% CI 1.16, 3.10; residency completed 1979 or earlier, adjusted OR 2.73, 95% CI 1.51, 4.94). Compared with respondents in obstetrics and gynecology partnerships (the reference group), those in university-based practices were less likely to use an antibiotic other than penicillin for prophylaxis (adjusted OR 0.48, 95% CI 0.23, 0.99), and solo practitioners were significantly more likely to use an antibiotic other than penicillin for prophylaxis (adjusted OR 1.74, 95% CI 1.10, 2.74). Participation in CARN remained significantly associated with the use of an antibiotic other than penicillin (compared with non-CARN respondents, adjusted OR 1.69, 95% CI 1.17, 2.45).

DISCUSSION

The results of this survey suggest that virtually all ACOG Fellows have adopted one of three strategies to prevent early-onset GBS disease. The most common strategy used by the survey respondents was neither of the approaches recommended in the consensus guidelines (ie, risk- or screening-based approaches), but a third strategy that provides intrapartum antibiotics to all GBS-colonized women and women with negative screening cultures who develop risk factors. Using this strategy, women with negative screening cultures for GBS and rupture of membranes at least 18 hours before delivery or delivery at 35–37 weeks' gestation are given prophylactic antibiotics; using the consensus screening-based strategy such women are not offered prophylaxis. It is difficult to estimate the number of additional women who would receive antibiotics as a result of this most commonly used strategy, but in one study, 9% of women delivering at term had membrane rupture more than 18 hours before delivery.[10] Another study found that in 5.3% of term deliveries, membrane rupture was longer than 18 hours before delivery.[11] Eighty percent of these women, or between 4.2% and 7.2% of all term deliveries, would be expected to have negative GBS screening cultures. The benefit of prophylaxis for these patients is uncertain and would depend on the sensitivity of the screening cultures as used in clinical practice. However, women who had risk factors but were not identified as GBS carriers by prenatal cultures using selective methods had a substantially lower risk of having a child with early-onset GBS disease than women who were GBS carriers without risk factors.[3,12] Additional information about why the plurality of the respondents have chosen a GBS prevention strategy that was not discussed in the consensus guideline would be helpful for the future evaluation of GBS prevention activities. It is possible that physicians have chosen this strategy because of concerns about the reliability of screening cultures or patient preferences. It is also possible that the rationale for the strategies recommended in the consensus guidelines was not adequately disseminated.

More than 40% of the respondents indicated that they do not use penicillin for intrapartum GBS prophylaxis. Ampicillin, the most common alternative agent, is listed as an acceptable alternative in the consensus guidelines. Ampicillin has a wider spectrum of activity than penicillin and could potentially contribute to the development of antibiotic resistance in other important perinatal pathogens, such as *Escherichia coli*. Several studies have suggested that the use of ampicillin prophylaxis could lead to infections with resistant organisms and poor patient outcomes.[13–15] A recent commentary from the Infectious Disease Society for Obstetrics and Gynecology addressing controversies in current practice recommended the use of penicillin instead of ampicillin for GBS prophylaxis.[16] The impact of GBS prophylaxis, especially the use of ampicillin, on antibiotic resistance in perinatal infections should continue to be monitored. Most providers who use penicillin noted that the recent shortage of penicillin G for intravenous use[17] forced a change in their GBS prevention practices. Alternative sources of intravenous penicillin G have been identified, and the supplies should now be adequate.[18] Most respondents reported using clindamycin for prophylaxis for women with penicillin allergy. Clindamycin is recommended in the consensus guidelines for prophylaxis for women allergic to penicillin, but there is evidence that the percentage of GBS isolates resistant to clindamycin is increasing.[16,19,20] Given the large percentage of providers using clindamycin, continued monitoring of GBS resistance patterns is warranted.

The effectiveness of the screening-based strategy depends on the sensitivity of the screening cultures. In one

study, the yield of vaginal cultures for GBS was only 60% of the yield of vaginal and rectal cultures combined.[21] Twenty-one percent of the non-CARN and 29% of the CARN respondents who routinely performed screening cultures did not collect both vaginal and rectal cultures. These data are consistent with findings from Connecticut, in which 29% of obstetricians reported that they did not collect both vaginal and rectal cultures. In Minnesota, however, only 9% of obstetricians reported that they did not culture both sites.[8] Efforts to educate providers about the importance of proper screening techniques are needed. Another important determinant of the sensitivity of the screening cultures is the laboratory technique. A recent survey of microbiology laboratories in three states found that many laboratories do not use the optimal techniques for GBS isolation.[22] As noted above, a lack of confidence in the sensitivity of the screening cultures could be one reason that some respondents provide prophylaxis to women with negative culture results and a risk factor for having an infant with early-onset GBS disease.

The consensus guidelines recommended that patients be informed of the GBS prevention strategy used by their prenatal care provider. Respondents to this survey using the risk-based strategy and those in solo practice were less likely to provide information about GBS to all their patients. Patients can play an important role in GBS prevention. If women are aware of the GBS prevention strategy being used, they can help providers implement that strategy most effectively. For example, in situations in which the risk-based strategy is being used, women who are aware of the risk factors for GBS disease can help ensure that they receive prophylaxis if needed.

This study was subject to several limitations. First, the responses were not validated by a review of the clinical records. It is possible that the actual practices differ from the survey responses. To further evaluate the practice of GBS prevention, an evaluation of the delivery records in a sample of births in eight states is ongoing. Second, although the response rate was quite high for a survey of physicians, the survey respondents may not be representative of all the obstetrician-gynecologists in the United States. We were able to compare the respondents with the nonrespondents and found that they were similar with respect to age and gender. Because we did not attempt any additional contact with the nonrespondents, we were unable to assess any other characteristics. Third, we sampled ACOG Fellows for this survey. Although the great majority of obstetrician-gynecologists in the United States are ACOG Fellows, ACOG Fellows may not be representative of all prenatal care providers. The survey of prenatal care providers in Minnesota found significant differences between the GBS prevention policies of obstetricians and those of family practitioners but not those of certified nurse midwives.[8] Additional studies of these groups would be needed to determine the full spectrum of GBS prevention policies in the United States.

Nearly all the respondents to this survey of ACOG Fellows had adopted an early-onset GBS prevention strategy. Differences were found between the prevention practices recommended in the consensus guidelines and those reported by some respondents. The most commonly reported strategy for GBS prevention was not one of the two recommended strategies. Additional information about why providers have chosen an alternative strategy is needed to guide future GBS prevention recommendations. Educational efforts to reinforce the GBS prevention recommendations, particularly the use of penicillin, collection of both vaginal and rectal cultures, and provision of information about GBS to all patients, may be warranted. This study has identified groups for which efforts to promote the GBS prevention recommendations could be targeted. Respondents reported that ACOG publications had the most influence on their current approach to GBS prevention.

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