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Antibiotic Prophylaxis for Cesarean Delivery: Survey of Maternal-Fetal Medicine Physicians in the U.S.

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Abstract

Objective—To briefly describe practices concerning antibiotic prophylaxis for cesarean delivery among maternal-fetal medicine (MFM) physicians in the United States (US).

Methods—A 10-item self-administered survey about their routine use of antibiotics for cesarean delivery was mailed once only to a random sample of 1000 US-based fellows of the Society of Maternal-Fetal Medicine (SMFM) in November 2009.

Results—There were a total of 250 respondents from 40 US states between 10/09 and 4/2010, corresponding to a response rate of 25%. Among respondents, 95.5% reported routine use of a cephalosporin only (including 84.4% who reported use of cefazolin) as antibiotic prophylaxis for cesarean delivery; less than 3% reported use of an extended spectrum regimen such as cefazolin +azithromycin. Pre-incision administration of antibiotics was reported by 83.6% compared to 15.0% who reported giving prophylactic antibiotics after umbilical cord clamp. Administration of a single dose of antibiotics was reported by 96%.

Conclusion—The majority of MFM specialists in the US report routine use of a single prophylactic dose of a 1st generation cephalosporin prior to incision for cesarean delivery.

Introduction

For nearly 30 years a narrow spectrum antibiotic (commonly cefazolin) given after delivery of the baby and clamping of the umbilical was the standard of care to prevent infections associated with cesarean delivery (1, 2). However, over the last 5 years, a number of studies associated pre-incision administration of antibiotics with improved effectiveness and no evidence of fetal harm (3,4). Furthermore, use of an extended-spectrum regimen (addition of a 2nd antibiotic of a different class to the standard) given after cord clamp is also associated with decreased post-cesarean infections (3,5-7). Prior to the recent American College of Obstetricians and Gynecologists (ACOG) Committee Opinion recommending prophylactic antibiotics before cesarean incision (8), we conducted a survey of US-based fellows of the Society of Maternal-Fetal Medicine (SMFM). The purpose was to describe existing practices concerning antibiotic prophylaxis for cesarean delivery in order to current

standards and guide future research. Our primary interests were types of regimen used, timing of administration and number of doses of prophylactic antibiotics for cesarean delivery. The findings also provide useful baseline information for monitoring and evaluating adherence to the new ACOG Committee Opinion. We present herein a brief report of our survey methods and findings.

Methods

We conducted an IRB-approved descriptive survey of US based fellows of the SMFM. The SMFM membership is primarily made up of MFM sub-specialists (MFM physicians typically provide leadership direction for obstetric practice and research). A brief 10-item self-administered anonymous questionnaire (see appendix) was developed and pre-tested among 4 MFM faculty members at our center. The survey included questions about type, timing and number of doses of prophylactic antibiotics and limited demographic information, and afforded respondents the opportunity to write in comments to clarify their answers.

From an official membership list (including all membership categories) obtained from the SMFM (N=2222), we excluded all those with affiliate (n=32), associate (n=302), MFM fellow-in-training (n=173), resident (n=114), emeritus (n=49) and international (n=157) membership status. The study questionnaires (and enclosed prepaid return envelopes) were sent to 1000 randomly selected among 1395 US-based regular members or fellows through a single postal mailing in October of 2009. Responses were received during the 6 month period ending in April of 2010.

Statistical analyses were performed using SAS version 9.1 [Cary, NC: SAS Institute Inc., 2002-2003]. Proportions and mean (\pm SD) were used as appropriate to present the descriptive characteristics of the study sample. Reported prevalence (and 95% CI) was computed for each antibiotic practice. Chi-square tests were used to compare the prevalence of the pre-precision use of antibiotics by demographic subgroups. A p-value of <0.05 was considered statistically significant. We estimated that 250 respondents would be needed to measure a conservative reported prevalence of $50\pm 5\%$ (i.e. delta of 5%) for each practice with 95% confidence. Assuming a 25% response rate to a single mailing, 1000 mailed surveys would be needed to accomplish the estimated sample size.

Results

Among the 1000 US-based SMFM fellows who were mailed surveys, there were exactly 250 respondents (25% response rate) located in 40 US states. Demographic and other characteristics of the study sample are presented in Table 1. The vast majority of respondents were MFM sub-specialists (98%) who continue to perform cesareans (92%); most respondents were male and based at academic centers; the main US regions were equally represented. The mean number of years of post-residency experience among respondents was nearly 22 years.

The primary study outcomes, the prevalence and 95% CI reported for each antibiotic prophylaxis practice, are presented in Table 2. The majority of SMFM fellows reported use

of a cephalosporin as a single agent (95.5%) for cesarean prophylaxis; 84.4% reported using a first generation cephalosporin such as cefazolin. Only 2.9% reported routine use of an extended-spectrum regimen (comprising azithromycin in addition to the standard cephalosporin). Regarding the timing of administration of prophylactic antibiotics, 84.6% reported giving antibiotics prior to cesarean incision while 15.0% give antibiotics after cord clamp (in addition, 1 respondent reported both modes of practice at separate hospitals). A large majority of physicians (96.3%) routinely give only 1 dose, and only 3.7% reported giving multiple doses of prophylactic antibiotics. For those who did give multiple doses of antibiotics, reasons given (as comments) included prolonged surgery and obesity.

In additional analyses, we examined the reported prevalence of administration of prophylactic antibiotics prior to incision by demographic characteristics (Table 3). There were no differences by number of years since residency training or type of practice. However, more male SMFM members (90.7 vs. 73.2%; $p<0.001$) and those practicing in the Midwest region compared to all other regions combined (95.8% vs. 82.3%; $p=0.012$) were significantly more likely to report giving prophylactic antibiotics prior to incision. These differences remained significant after adjusting for all demographic characteristics.

Discussion

The results from this survey suggest that almost all US-based SMFM fellows routinely use a single prophylactic dose of a cephalosporin, commonly a first generation agent, to prevent post-cesarean infections. This is consistent with both longstanding and recent recommendations for cesarean antibiotic prophylaxis (1,2,8-10). However, despite longstanding recommendations in favor of a first generation cephalosporin, about 11% of fellows reported use of a second generation cephalosporin, which may be more expensive but not more effective than the first generation cefazolin.

Although our study was completed prior to the recent ACOG Committee Opinion specifically recommending that prophylaxis be given prior to cesarean incision (8), a large majority of MFM physicians (85%) did report giving prophylactic antibiotics prior to incision. This represents a major change from longstanding standards to give prophylactic antibiotics for cesarean only after umbilical cord clamp in order to avoid fetal exposure. Our findings almost certainly reflect ongoing shifts in institutional policies in response to recent publications suggesting that pre-incision antibiotics may reduce post-cesarean infections by up to 50% when compared with administration after umbilical cord clamp (4,10-16).

Recent studies also suggested that extended-spectrum antibiotic prophylaxis may reduce post-cesarean infection when compared with single agent prophylaxis given after cord clamp (3,5-7). However, our survey results indicate that very few MFM physicians (<3%) use extended prophylaxis. This may be primarily due to the lack of data specifically suggesting any advantage to extended prophylaxis over single agent prophylaxis when both are administered prior to incision. To our knowledge, pre-incision use of extended prophylaxis for cesarean has not been evaluated (based on a query of the full PubMed database using the keywords “cesarean”, “antibiotics” and “prior to incision”. Therefore, given the current ACOG recommendation to use pre-incision antibiotic prophylaxis for cesarean delivery,

studies are needed to determine whether an extended spectrum regimen given prior to incision is both beneficial and safe for the mother and fetus (3,8).

Our study has a number of limitations. First, our findings are based on self-reported practices – we did not directly observe cesarean deliveries or validate reported practices by reviewing records. Therefore, some over- or under-reporting is possible. Second, although the response rate of 25% is not surprising for single-mailed surveys, our findings may be biased if physicians with a specific practice pattern were more or less likely to respond compared with others. Because the demographic distribution of the respondents (e.g., gender, practice setting and US region) represented what should be expected for the study population, we believe the impact of any bias is minimal and unlikely to change results. Third, we surveyed only fellows or members of the SMFM based in the US; therefore, our findings may not be generalizable to all obstetric providers in the US. The mean number of years of post-residency practice (22 years) reflects both 2-3 years of post-residency sub-specialty training and an additional 2-5 years for newly qualified MFM specialists to gain board certification and become fellows or regular members (as opposed to associate fellows) of the SMFM. Therefore, our study sample did not include recently qualified MFM physicians. Given the relatively small pool of associate members (n=302) a dramatic variation in practice among this sub-group would be needed to change our findings. Since the SMFM membership provides leadership for obstetric practice, we speculate that selected results, such as the 85% reported use of pre-incision prophylaxis, may represent an overestimate if all obstetric providers including general obstetricians are considered.

Overall, these results represent a snapshot of existing practices as reported by SMFM fellows at the time of the conduct of the study from 9/2009 to 4/2010. It is likely that practice patterns have evolved further especially following the new ACOG Committee Opinion calling for routine use of pre-incision antibiotic prophylaxis for cesarean delivery (8). Future investigations should verify that the use of pre-incision antibiotic prophylaxis approaches 100%. The use of first generation cefazolin should also be encouraged and verified. The effectiveness and safety of extended-spectrum regimens given prior to incision should be further evaluated in clinical trials.

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Table 1

Demographic Characteristics of Responding US-based SMFM Fellows

Demographic	Frequency	%
Performs Cesareans	231/250	92.4
Professional Category		
<i>Maternal-Fetal Medicine</i>	242/245	98.8
<i>General Ob/Gyn</i>	2/245	0.8
<i>Other Ob-Gyn Specialist</i>	1/245	0.4
Primary Practice Type		
<i>University/Academic</i>	133/244	54.5
<i>Private Practice</i>	67/244	27.4
<i>Public/Community</i>	35/244	14.3
<i>Other</i>	9/244	3.7
Years since residency training		
<i>Mean *</i>	21.8 ± 7.4	
<i>Range</i>	5-45	
Gender		
<i>Male</i>	162/245	66.3
<i>Female</i>	83/245	33.7
US Region		
<i>South</i>	62/242	25.6
<i>West</i>	68/242	28.1
<i>Northeast</i>	63/242	26.0
<i>Midwest</i>	49/242	20.3

* Mean±SD

Table 2

Frequency of reported practices concerning antibiotic prophylaxis

Practice	n/N	Prevalence (%)	95% CI
Antibiotic Regimen			
<i>Cephalosporin (any)</i>	234/245	95.5	92.1, 97.7
<i>1st Generation (cefazolin)</i>	207/245	84.5	79.3, 88.8
<i>2nd Generation</i>	27/245	11.0	7.4, 15.6
<i>Penicillin</i>	2/245	0.8	0.1, 2.9
<i>Extended Spectrum (any)</i>	7/245	2.9	1.2, 5.8
<i>Azithromycin + Cephalosporin</i>	7/245	2.9	1.2, 5.8
<i>Azithromycin + Penicillin</i>	0	0	
<i>Metronidazole + Any</i>	0	0	
No Routine Antibiotics	2/245	0.8	0.1, 2.9
Timing of Administration			
<i>Before Incision</i>	208/246	84.6	79.4, 88.8
<i>After cord clamp</i>	37/246	15.0	10.8, 20.1
<i>Both</i>	1/246	0.4	0.1, 2.2
Number of Doses			
<i>Single dose</i>	234/243	96.3	93.1, 98.2
<i>Multiple</i>	9/243	3.7	1.7, 6.9

Table 3

Prevalence of reported use of Pre-incision Prophylaxis stratified by demographic characteristics

Characteristic	Prevalence (%)	p-value
Practice Type		
<i>Academic</i>	83.5	.421
<i>Private or other</i>	87.2	
Years of Practice		
5-15	77.2	.156
16-20	92.1	
21-27	83.6	
28-45	85.5	
Gender		<0.001
<i>Male</i>	90.7	
<i>Female</i>	73.2	
Region		
<i>South</i>	77.1	.058
<i>West</i>	85.3	
<i>Northeast</i>	84.1	
<i>Midwest</i>	95.8	