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Major article

Postdischarge surveillance for infection following cesarean section: A prospective cohort study comparing methodologies

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Objective: To assess how enhanced postdischarge telephone follow-up calls would improve case finding for surgical site infection (SSI) surveillance after cesarean section.

Methods: We conducted a prospective cohort study of all patients who delivered by cesarean section between April 22 and August 22, 2010. In addition to our routine surveillance, using clinical databases and electronic patient records, we also made follow-up calls to the patients at 7, 14, and 30 days postoperation. A standard questionnaire with questions about symptoms of SSI, health-seeking behaviors, and treatment received was administered. Descriptive statistics and univariate analysis were performed to assess the effect of the enhanced surveillance.

Results: One hundred ninety-three patients underwent cesarean section during this study period. Standard surveillance identified 14 infections with telephone follow-ups identifying an additional 5 infections. Using the call as a gold standard, the sensitivity of the standard methodology to capture SSI was 73.3%. The duration of the calls ranged from 1 to 5 minutes and were well received by the patients.

Conclusions: Results suggest that follow-up telephone calls to patients following cesarean section identifies 26.3% of the total SSIs. Enhanced surveillance can provide more informed data to enhance performance and avoid underestimation of rates.

INTRODUCTION

Surgical site infection (SSI) after cesarean section is 1 of the major infections that can affect patients who undergo a cesarean section (C-section) procedure.[1] Surveillance of this group of patients is vital to detect the rates of infections and those that are preventable.[2] Although most hospitals have an in-hospital surveillance program, they usually do not detect discharged patients with SSIs. Therefore, patients who develop an SSI outside the hospital might be missed.[3,4]

Consequently, the true rates of SSI in obstetric patients will most probably be underestimated.[5] Recently, there has been interest in improving postdischarge surveillance for SSIs. Most of the studies conclude that postdischarge surveillance is a very useful tool that can identify SSIs not detected during hospitalization.[2,6-10] Moreover, these studies clearly state that between 50% and 71% of post–C-section SSIs are missed when effective postdischarge surveillance systems are not put in place.[4] Other studies demonstrate that C-section SSI rates are considerably underestimated if the observation time was limited only to the hospital stay.[4,11] To this end, postdischarge surveillance for SSI after C-section would enhance the estimate of the true incidence rate of SSI. The challenge is to identify a method that can be applied universally to detect those missing instances of SSI. A variety of postdischarge surveillance methods after C-section have been used but most of them mainly encourage patients to come back to the same hospital or track patients through integrated and sophisticated databases that capture outpatient clinic visits or when they are given antibiotics through an outpatient pharmacy.[12] Most institutions do not have access to these types of databases.

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Nevertheless, the sensitivity of postdischarge surveillance for post–C-section SSI has not been rigorously evaluated. The aim of this study was to determine the sensitivity and specificity of the current surveillance methodology for post–C-section SSI at Johns Hopkins Hospital and to test the feasibility of enhanced surveillance using telephone follow-up calls.

MATERIALS AND METHODS

During the predischarge period, trained infection preventionists identify post–C-section SSIs as a part of the hospital's standard surveillance program using clinical databases and electronic patient records. They were defined using the National Healthcare Safety Network/Centers for Disease Control and Prevention criteria.[13] Moreover, between April and August 2010, all patients who underwent C-section delivery were informed in writing that a hospital staff member would contact them after discharge. Telephone follow-up calls were made to all patients at 7, 14, and 30 days after the procedure. On the day of the follow-up call, the study's investigator made 1 attempt to contact each patient during 3 distinct time windows: 9 AM-12 PM, 12 PM-3 PM, and 3 PM-6 PM. Only patients who were not reached during the first call were called again for the second or third time. If the patient did not answer any of the 3 calls, no further attempts were made until the next follow-up date. A standard questionnaire with questions about symptoms of SSI, health-care-seeking behaviors, and treatment received was administered. Patients reporting symptoms suggestive of post–C-section SSI were encouraged to seek care through their health care provider. All cases of suspect post–C-section SSI detected during follow-up calls were carefully reviewed by an infectious disease physician blinded to the study findings. Descriptive statistics and univariate analyses were performed using Stata version 11.0 (Stata Corp, College Station, TX). The study was reviewed and approved by the hospital's institutional review board.

RESULTS

Between April 22 and August 22, 2010, a total number of 193 patients underwent C-section operations at our institution. The mean age was 28.5 years with 56% percent of the patients being African American. In addition, more than half of the study population was considered obese, with a mean body mass index of 33.3. Furthermore, the total number of procedures that were emergent were 62%. All patients received preoperative antibiotics; 54% received cefazolin and 26% received penicillin. The hospital length of stay ranged from 2 to 10 days and the mean length of hospital stay was 4 days (see Table 1).

Table 1
Demographic information of patients who have undergone a cesarean section with and without resulting surgical site infection (SSI)*

Characteristic	SSI detected (n = 19)	No SSI detected (n = 174)	*P* value†
Age			.09
Mean ± SD	25.8 (6.7)	28.8 (6.9)	
Median (range)	24 (16-35)	29 (15-43)	
Race			.88
African-American	14 (74)	94 (54)	
White	4 (21)	51 (29)	
Asian	1 (5)	12 (7)	
Hispanic	0 (0.0)	7 (4)	
Other	0 (0.0)	6 (3)	
Unknown	0 (0.0)	4 (2)	
Body mass index‡			.39
Mean ± SD	34.8 (7.8)	33.1 (9.4)	
Median (range)	32 (17-73)	34 (23-56)	
Prophylaxis received			.44
Cefazolin	9 (8.7)	95 (91.4)	
Penicillin G	6 (11.5)	46 (88.5)	
Ampicillin	0 (0.0)	12 (100.0)	
Clindamycin	1 (10.0)	9 (90.0)	
Azetronam	1 (11.1)	8 (88.9)	
Vancomycin	1 (50.0)	1 (50.0)	
Combination therapy	0 (0.0)	2 (100.0)	
Unknown	1 (50.0)	1 (50.0)	
Operation scheduling			1.00
Planned	7 (36)	67 (90.5)	
Emergency	12 (63)	107 (89.9)	
Days to discharge postoperation			.30
Mean ± SD	4.1 (1.6)	3.7 (1.0)	
Median (range)	4 (3-9)	4 (2-10)	

NOTE. Values are presented as n (%) unless otherwise noted.
*Includes 21 people who never answered a postdischarge surveillance telephone call.
†Comparison of means using Student *t* test for continuous outcomes. Differences in proportion for categorical outcomes compared using χ^2 test or Fisher exact test.
‡Body mass index data missing for 2 patients.

During the 4-month study period, a total of 956 telephone calls were made to 177 patients. Five hundred thirty-four calls (56%) were made between 9 AM and 12 PM, 260 calls (27%) were made between 12 PM and 3 PM, and 162 telephone calls (17%) were made between 3 PM and 6 PM. Between 9 AM and 12 PM 52% of calls were answered, 37.3% were answered between 12 PM and 3 PM, and 37.6% were answered between 3 PM and 6 PM.

One hundred twenty-six patients (65.3%) were interviewed for all 3 follow-up times; 11.9% were interviewed twice and only 5.2% responded to a single call. Seventeen percent of patients did not answer the telephone or did not provide a working telephone number.

In general, the minimum duration of follow-up calls was 1 minute and the maximum time spent on any call was 5 minutes. For the 7-day follow-up telephone call, the mean duration was 2.3 minutes, for the 14-day follow-up call, it was 1.9 minutes, and for the 30-day follow-up, it was 1.7 minutes. It is worth noting that the median call time was 2 minutes for all 3 follow-up calls. For patients who had an SSI after C-section, the mean duration time of the call was 3.2 minutes.

Standard hospital surveillance identified 14 out of 193 (7.2%) patients with SSI, and the telephone calls identified an additional 5 patients (10%) who did not return to Johns Hopkins Hospital for follow-up care. Using the call as the gold standard, the sensitivity of the standard methodology to capture SSI was 73.3%. Out of the total SSI identified, 11 out of 19 (58%) were organ/space, 1 (5.2%) was deep, and 36% (7 out of 19) were superficial (based on CDC criteria).[14] Although the standard surveillance underreported SSI by 26% when compared with telephone follow-ups, the chance-corrected agreement (kappa) between the 2 methods was 0.84 (95% confidence interval, 0.68-0.98), indicating very good agreement: 14 infections were detected by both methods and none of them misidentified any, as was confirmed by the infections diseases physician.

DISCUSSION

Infections, including SSI after C-section, are associated with significant morbidity and mortality. However, with increasingly short hospital stays, our findings are in agreement with other studies that have found that the incidence of SSI is underestimated when a postdischarge surveillance strategy is not employed.[3,7-9] We found that an ICP is able to identify discharged patients with an SSI using a standardized set of questions asked over the telephone and that doing so takes relatively little time. The average duration of telephone calls that detected suspected post–C-section SSI was 3.2 minutes. The calls included questions about where the patient had sought care, what the patient had been told by the care provider, and what treatment the patient had received. It is noteworthy that the women were extremely appreciative of the calls because they

believed the hospital cared enough about their condition to contact them. Moreover, this study made it possible to identify more cases than what was normally identified through traditional infection prevention surveillance methodology. This was obvious through the rate detected: 10% by the telephone interview surveillance compared with the traditional surveillance methodology, which yielded a rate of 7.3%. Although the 5 patients who developed SSI and were not detected by chart review comprised only 2.5% of the cohort (5 of 193), these patients represented 26.3% (5 of 19) of all the patients who developed a post–C-section SSI. In other words, in every 100 C-section procedures there were 2.6 missed cases. Despite the 73% sensitivity of the traditional surveillance methodology, both methods had very good degrees of agreement (97%) because they both identified all the negative cases with a specificity of 100%.

In this study, the compliance rate of answering at least a single telephone call was 82.4% (159 out of 193), 12% (23 out of 193) answered 2 calls, and 56% (126 out of 193) answered 3 calls. Fewer than 10% of the patients (16 out of 193) did not answer their telephone or had no working telephones. In the literature, a few published reports directly address the use of telephones to follow-up with patients.[15-17] However, none of them investigated patients undergoing C-section. Importantly, the duration of the telephone calls in our study ranged from a single minute minimum to 5 minutes. Taylor et al[15] reported a maximum call time of 23 minutes. We found the call time for patients who did not demonstrate signs or symptoms of SSI was even shorter during the second and third call (1.9 minutes and 1.7 minutes, respectively). This is because the latter group of patients had no complaints and they had become familiar with the questions they were asked during the previous calls. On the other hand, patients who had developed an SSI had longer telephone call time with a mean duration call time of 3.2 minutes. It is worth noting that the longest telephone call (5 minutes) was with a patient who had a low level of English proficiency.

As was stated previously, the calls were not burdensome to patients. In fact, almost all of the patients appeared to welcome the concept of telephone contact. This result is similar to findings in other studies that used telephone interviews indicating that telephone interviews can be an optimum study approach in the detection of post–C-section SSI after discharge.[15-17] Some studies suggest that postdischarge contact with patients provides them with an opportunity to discuss a potential issue with a provider before it becomes more serious.[18] In the case of our study, SSIs were identified and patients were advised to seek medical attention at an early stage. Consequently, this also allowed the infection preventionists to gather further data to enhance hospital infection prevention efforts.

It was always assumed that postdischarge surveillance is not easy to perform; can be expensive; is labor intensive; and requires a dedicated, trained staff member. In contrast, we found that conducting a telephone interview to do postdischarge surveillance after a C-section required little time, was feasible, and more importantly helped in the detection of more cases in comparison to the more traditional surveillance methodology.

As in any research study, this study has several strength and limitations. A key strength is that patients were called at 3 time intervals, which enhanced the chances of reaching them. This was clear with the compliance rate of answering at least a single call that exceeded 80% of the total calls. The main limitation was the patients who did not answer the telephone or did not have a working telephone number (8.3% of the studied population). Some of those patients could have had an SSI but were not detected. The small group of patients who did not answer telephone calls or had nonworking numbers might represent part of the nature of the socioeconomic status of Baltimore as a city, and reflects another limitation of the study. It is possible that these patients did not provide accurate contact information because of their mistrust of the medical community or because they do not have the means to sustain a working telephone. Hence, if a postdischarge surveillance via telephone was applied in a population more accepting of the medical community, the detection rate might have been even higher. The final limitation of the study was the small sample size and this was associated with the duration of the study. If the study was conducted for a longer duration, more cases could have been detected and of course the conclusion might have been more comprehensive.

We found that postdischarge surveillance is a useful tool in the identification of potentially preventable harm. Enhanced surveillance can provide more informed data to enhance performance and avoid the underestimation of post–C-section SSI rates. Moreover, the use of telephone interviews for improved surveillance was easy and feasible. Finally, it is important to state that this method should be used in other populations before it can become more generalizable.

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References

1. Warda VP, Charlett A, Fagan J, Crawshaw SC. Enhanced surgical site infection surveillance following Caesarean section: experience of a multicentre collaborative post-discharge system. J Hosp Infect 2008;70:166-73.
2. Barbut F, Carbonne B, Truchot F, Spielvogel C, Jannet D, Goderel I, et al. Surgical site infections after cesarean section: results of a five-year prospective surveillance. J Gynecol Obstet Biol Reprod (Paris) 2004;33:487-96.
3. Holtz TH, Wenzel RP. Post-discharge surveillance for nosocomial wound infection: a brief review and commentary. Am J Infect Control 1992;20:206-13.
4. Sands K, Vineyard G, Platt R. Surgical site infections occurring after hospital discharge. J Infect Dis 1996;173:963-70.
5. Gravel-Tropper D, Oxley C, Memish Z, Garber GE. Underestimation of surgical site infection rates in obstetrics and gynecology. Am J Infect Control 1995;23:22-6.
6. Killian CA, Graffunder EM, Vinciguerra TJ, Venezia RA. Risk factors for surgical site infections following cesarean section. Infect Control Hosp Epidemiol 2001;22:613-7.
7. Oliveira AC, Lima Ade P. Post-discharge surgical site infection surveillance in a hospital in Brazil. Am J Surg 2007;193:266-8.
8. McIntyre LK, Warner KJ, Nester TA, Nathens AB. The incidence of post-discharge surgical site infection in the injured patient. J Trauma 2009;66:407-10.
9. Oliveira AC, Ciosak SI, D'Lorenzo C. Post-discharge surveillance and its impact on surgical site infection incidence. Rev Esc Enferm USP 2007;41:653-9.
10. Johnson A, Young D, Reilly J. Caesarean section surgical site infection surveillance. J Hosp Infect 2006;64:30-5.
11. Opøien HK, Valbø A, Grinde-Andersen A, Walberg M. Post-cesarean surgical site infections according to CDC standards: rates and risk factors. A prospective cohort study. Acta Obstet Gynecol Scand 2007;86:1097-102.
12. Sands KE, Yokoe DS, Hooper DC, Tully JL, Horan TC, Gaynes RP, et al. Detection of postoperative surgical-site infections: comparison of health plan-based surveillance with hospital-based programs. Infect Control Hosp Epidemiol 2003;24:741-3.
13. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care–associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control 2008;36:309-32.
14. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1999;20:250-78.
15. Taylor EW, Duffy K, Lee K, Hill R, Noone A, MacIntyre I, et al. Surgical site infection after groin hernia repair. Br J Surg 2004;91:105-11.
16. Wilkinson S, Sloan K. Patient satisfaction with colorectal cancer follow-up system: an audit. Br J Nurs 2009;18:40-4.
17. McNeish J, Lyle D, McCowan M, Emmerson S, McAuley S, Reilly J. Post-discharge surgical site infection surveillance by automated telephony. J Hosp Infect 2007;66:232-6.
18. Aiken AM, Wanyoro AK, Mwangi J, Mulingwa P, Wanjohi J, Njoroge J, et al. Evaluation of surveillance for surgical site infections in Thika Hospital, Kenya. J Hosp Infect 2013;83:140-5.