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Inter-hospital comparison of rates of surgical site infection following caesarean section delivery: evaluation of a multicentre surveillance study

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SUMMARY

Background: Short postoperative stays following caesarean section delivery make it difficult to assess accurately the risk of surgical site infection (SSI). Methods of case-finding that minimize variation are required to support effective surveillance systems, especially where used for benchmarking.

Aim: To evaluate the efficacy of case-finding methods for SSI following caesarean delivery and their utility in establishing benchmark rates of SSI.

Methods: Hospitals conducted surveillance over one or two 13-week periods. Patients were reviewed during their inpatient stay, post partum by community midwives and via patient questionnaire at 30 days post delivery. To estimate the reliability of case-finding methods, case-note reviews were undertaken in a random sample of four hospitals.

Findings: A total of 404 SSIs were detected in 4107 caesarean deliveries from 14 hospitals. The median time to SSI was 10 days, 66% were detected in-hospital or by community midwives, and an additional 34% were patient-reported. The rate of SSI was 9.8% but the proportion of patients followed up varied significantly between centres. The estimated sensitivity and specificity of case-finding was 91.4% [95% confidence interval (CI): 53.4–98.4] and 98.6% (95% CI: 98.4–98.8), the positive predictive value 91.0% (95% CI: 82.4–96.1) and negative predictive value 98.6% (95% CI: 93.9–99.5).

Conclusions: Combined case ascertainment methods are a feasible way to achieve active post-discharge surveillance and had high negative and positive predictive values. Additional SSIs can be detected by patient questionnaires but rates of SSI were strongly influenced by variation in intensity of both healthcare worker- and patient-based case-finding. This factor must be taken into account when comparing or benchmarking rates of SSI.

Introduction

Caesarean section is an increasingly performed surgical intervention. In the 1980s about 10% of births in England were by caesarean section delivery; however, by 2008 almost

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150,000 caesarean deliveries were performed annually, accounting for a quarter of births.[1] Although frequently life-saving, this mode of delivery can result in infection and associated complications and healthcare costs.[2–4]

Surveillance and feedback of data on rates of infection have been proposed as important instruments in driving improvements in quality of practice. In particular, a number of surveillance systems enabling rates of SSI to be benchmarked have demonstrated significant reductions in a range of surgical procedures including caesarean delivery.[5,6] However, if such benchmark systems are to be effective in facilitating valid comparison of rates of SSI, they need to be based on standard surveillance methods that can reliably detect SSI and minimize variation in sensitivity and specificity of case-finding between participating centres.[7] In addition, many surveillance systems have relied on identification of infections during the inpatient stay, as such infections are both easier to detect and standard case definitions can be applied consistently. Since SSI may take several days to become apparent and the average length of postoperative stay in hospital following caesarean delivery has declined to 3 days or less, methods that assure active post-discharge surveillance are a prerequisite for effective surveillance of SSI following caesarean delivery. This is particularly important when making comparisons between centres, although there is a paucity of evidence on the efficacy of different methods in detecting SSI or the impact of post-discharge surveillance on the validity of benchmarking rates of infection.[8] The Health Protection Agency's Surgical Site Infection Surveillance System (SSISS) in England has captured data on a range of surgical procedures since 1997. Case-finding had mostly focused on the inpatient stay until standard methods of post-discharge surveillance were introduced in 2008 which included detection of SSI in patients readmitted to hospital and an optional post-discharge patient questionnaire (PDQ).[9] The aim of this study was to evaluate: the ability of these standard surveillance methods to reliably identify SSI following caesarean delivery; the efficacy of using the community midwife to identify SSIs post discharge in the context of their statutory requirement to visit post-partum women up to the 10th day after delivery; and the utility of these methods in establishing benchmark rates of SSI.

Methods

Fifteen hospitals that had participated in SSISS were recruited in response to a request for volunteers to capture data on SSI following caesarean delivery for at least one of two 13-week surveillance periods between April and September 2009. All patients who underwent a caesarean delivery during the defined period were eligible for inclusion in the surveillance, and demographic and surgical data were captured on each patient. Systematic review of these patients to detect SSI was then conducted by local trained surveillance personnel during the hospital stay and through a wound surveillance record completed by the community midwife during their standard post-partum follow-up care. Hospitals were encouraged to assign surveillance co-ordinators from both infection control and maternity departments. The surveillance co-ordinators at each hospital attended training on the surveillance methods and definitions of SSI. Community midwives were then trained locally by the surveillance co-ordinator. Inter-rater reliability was not assessed. The community midwife visited each patient the day after discharge and at day 5 and day 10 after delivery, although more frequent visits occurred if warranted by the condition of the mother or baby. In addition, patients were asked to complete a wound surveillance post-discharge questionnaire (PDQ) at 30 days after caesarean delivery. This was given to the patient on discharge, posted, or administered by telephone at 30 days, with postal or telephone reminders made if the PDQ was not returned. Patients who reported signs and symptoms indicative of SSI on this questionnaire were contacted by the surveillance co-ordinator to determine whether these met the case definitions. SSIs detected by midwives and hospital doctors were defined according to modified Centers for Disease Control and Prevention definitions used by the SSISS surveillance system in the UK since 1997 (Table I). These criteria were adapted for identifying patient-reported infections.[10] SSIs were categorized as healthcare professional-detected (during the admission, on readmission, at outpatient clinic or by community midwife) or, where only detected in the PDQ, patient-reported SSIs. Where SSIs were reported by both healthcare professional and patients these SSI were classified as healthcare professional-detected SSI. A proportion of patients who reported no problems with their wound on the PDQ were followed up to confirm that they had no SSI.

A multinomial linear mixed model was used to study the relationship between the observed rate of SSI and proportion of patients reviewed by community midwife or with PDQ returned. The model included detection categories (PDQ, healthcare professional and no-SSI), survey period as addition factor and hospital as random effect to take into account extra variation that was not explained by the detection method. These random effects were allowed to vary by detection method and termed category-specific hospital effect. The model benefited from borrowing strength over both hospitals and detection category in determining the significance of the effect.

Since it was not possible to review the records of all patients included in the surveillance, the sensitivity and specificity of the surveillance methods in identifying cases of SSI was estimated by selecting four hospitals at random and subjecting a sample of their data to a 'gold standard' method. This comprised review of the clinical records (hospital case notes, patient-held postnatal notes, community midwife records and patient PDQs) by two expert assessors to find evidence for the presence of SSI that met the case definitions. Records were selected for inclusion in the review by taking a random sample (without replacement) of 10% of patients where no SSI had been reported ('test-negative' cases), together with all patients reported to have an SSI ('test-positive' cases). Where clinical records were missing the patient was excluded from the review. The values from test-negative cases and test-positive cases were treated as two samples from two independent binomial distributions. A simple logistic linear mixed effect model was fitted to the data from two populations (distributions). The linear predictor also included hospital random effect to account for the extra variation not explained by fixed effects. The estimated values along with predicted random effects were used in predicting non-sampled cases and these were added to sample cases to determine the best linear unbiased-type estimates for prevalence, sensitivity, specificity, positive