

# Surgical Site Infection Following Elective Caesarean Section: A Case–Control Study of Postdischarge Surveillance

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## Abstract

**Objectives:** To ascertain the incidence of postoperative surgical site infection (SSI) following elective Caesarean section (CS) and to compare demographic characteristics and antibiotic administration between infected cases and noninfected control subjects.

**Methods:** We conducted a retrospective case–control study of patients undergoing elective CS between 1996 and 2002 at a tertiary centre. Infection-control personnel attempted to contact by telephone all women who had had Caesarean sections, 1 month after their surgery. The women they reached were asked to complete a questionnaire based on CDC-validated criteria for infection to determine whether SSI had occurred. Control subjects without SSI were matched on the basis of having had an elective CS and by date of surgery. We then reviewed the hospital records of both groups.

**Results:** Over the study period, 1250 elective Caesarean sections were performed and 124 infected cases were identified, giving an overall SSI incidence of 9.9%. Of the 342 women reviewed (124 cases, 218 control subjects), 23% received prophylactic intraoperative antibiotics. Cases and control subjects differed significantly in terms of estimated blood loss, with fewer control subjects having excessive blood loss ( $P = 0.04$ ). Among those women receiving postoperative antibiotics, case subjects received a significantly higher number of doses than did control subjects ( $P = 0.003$ ). The groups did not differ significantly in terms of overall antibiotic administration or other demographic variables.

**Conclusions:** The incidence of SSI following elective CS according to postdischarge surveillance was 9.9%, which is higher than expected for a low-risk procedure. Because follow-up was not possible for all cases, this incidence may be an underestimate. Underuse of antimicrobial prophylaxis may also be a contributing factor, because prophylactic antibiotics were administered in less than 25% of cases.

## Résumé

**Objectifs :** 1) Établir l'incidence postopératoire de l'infection du champ opératoire (ICO) à la suite d'une césarienne de convenance et 2) comparer les caractéristiques démographiques et les modalités d'administration des antibiotiques qui ont été constatées chez les cas infectés à celles qui ont été constatées chez les sujets témoins non infectés.

**Méthodes :** Nous avons mené une étude cas-témoins rétrospective s'intéressant aux patientes qui ont subi une césarienne de convenance, entre 1996 et 2002, dans un centre tertiaire. Le personnel de prévention des infections a tenté de communiquer (par téléphone) avec toutes les femmes ayant subi une césarienne, et ce, un mois à la suite de la chirurgie. On a demandé aux femmes ayant répondu à l'appel de remplir un questionnaire, fondé sur les critères validés par les CDC en ce qui concerne l'infection, afin de déterminer s'il y avait eu ICO ou non. Les sujets témoins n'ayant pas connu une ICO ont été appariés en fonction du fait d'avoir subi une césarienne de convenance et de la date de la chirurgie. Nous avons par la suite procédé à l'analyse des dossiers d'hospitalisation de ces deux groupes.

**Résultats :** Au cours de la période d'étude, 1 250 césariennes de convenance ont été effectuées et 124 cas d'infection ont été identifiés, ce qui donne une incidence globale d'ICO de 9,9 %. Vingt-trois pour cent des 342 patientes dont les dossiers ont été analysés (124 cas, 218 sujets témoins) ont bénéficié d'une administration peropératoire d'antibiotiques prophylactiques. Les cas et les sujets témoins ont présenté des différences notables en matière de perte sanguine estimée, un nombre moindre de sujets témoins ayant connu une perte sanguine excessive ( $P = 0,04$ ). Parmi les femmes qui ont bénéficié d'une administration postopératoire d'antibiotiques, les cas ont reçu un nombre nettement plus élevé de doses que les sujets témoins ( $P = 0,003$ ). Les groupes n'ont pas présenté de différences notables en matière d'administration globale d'antibiotiques ou en ce qui concerne d'autres variables démographiques.

**Conclusions :** L'incidence (déterminée par la mise en œuvre d'une surveillance à la suite de la sortie d'hôpital) de l'ICO à la suite d'une césarienne de convenance était de 9,9 %, ce qui est plus élevé que prévu dans le cas d'une intervention à faible risque. Puisqu'il n'a pas été possible d'effectuer un suivi pour tous les cas, cette incidence représente peut-être une sous-estimation. Il est possible que la sous-utilisation de la prophylaxie antimicrobienne constitue un facteur contributif, car des antibiotiques prophylactiques ont été administrés dans moins de 25 % des cas.

**Key Words:** Caesarean section, elective, antibiotic prophylaxis, surgical site infection

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## **INTRODUCTION**

The single most important risk factor for postpartum maternal infection is delivery by Caesarean section (CS), and rates of surgical site infection (SSI) following CS of up to 30% have been reported.<sup>1</sup> With approximately one-quarter of all births in Canada occurring by CS and with increasing demand for elective CS, surgical site infection presents a potentially significant burden on the health care system.

Current recommendations by the American College of Obstetricians and Gynecologists<sup>2</sup> and our institution's infection prevention service to reduce rates of SSI include administration of a single dose of first-generation cephalosporin at the time of cord clamping during emergency CS (performed after rupture of membranes or labour). This is based on the proven efficacy of antibiotic prophylaxis and the high baseline risk of infection in these patients. Controversy exists, however, regarding the value of antibiotic prophylaxis for elective CS (performed prior to rupture of membranes or labour), because of the inconsistent efficacy of prophylactic antibiotics reported in the literature and the assumption that SSI rates are lower than those following emergency CS. A recent meta-analysis<sup>3</sup> recommended antibiotic prophylaxis for populations in which the incidence of SSI is more than 5%. Although the mean rate for SSI following CS without risk factors is less than 5%, according to the National Nosocomial Infection Surveillance System (NNIS), other studies have reported rates as high as 10% to 25%.<sup>1</sup> Variability in reported infection rates partly reflects differences in the duration and methodology of surveillance, as well as the definition of infection. It has been reported that more than one-half of SSIs become apparent after discharge from hospital, and the US Centers for Disease Control (CDC) suggests that postdischarge surveillance is important to determine whether an SSI occurred.<sup>4</sup> Most studies reporting SSI rates have been limited to inpatient data only and may significantly underreport infection rates as a result. To help guide future decisions about antibiotic prophylaxis, this study sought to determine the incidence of surgical site infection following elective CS at a tertiary care centre through a method of postdischarge telephone surveillance. Infected case subjects and noninfected control subjects were then compared for demographic variables and antibiotic administration.

## **METHODS**

After obtaining ethics approval from the Health Research Ethics Board at the University of Alberta, a retrospective case-control study was conducted at the Royal Alexandra Hospital, a tertiary care centre, involving women who delivered between 1996 and 2002.

Prospective postoperative infection surveillance over this time period was performed by an infection-control team consisting of infection-control nurses and physicians. Surveillance was suspended between 2000 and 2001, because infection-control resources were diverted to other regional activities. One month after each Caesarean section, infection-control personnel made up to 3 attempts to contact the women by telephone. A questionnaire based on CDC-validated criteria for diagnosis of surgical site infections<sup>4</sup> was administered by telephone and then reviewed by the infection-prevention service committee to classify patients as infected or noninfected. Surgical site infections were further classified as superficial incisional (involving skin and subcutaneous tissues), deep incisional (involving deeper tissues including fascia or muscle), or organ/space (involving organs or spaces other than the incision that were opened or manipulated during the surgical procedure). The CDC-validated criteria for diagnosis of infection<sup>4</sup> include the following: (1) purulent drainage; (2) organisms isolated; (3) pain, tenderness, swelling, redness, and (or) heat, with wound being opened by surgeon; or (4) superficial infection diagnosed by a surgeon or attending physician.

Infected cases were then reviewed to determine whether the CS had been performed on an elective (prior to rupture of membranes or labour) or emergency (following rupture of membranes or labour) basis. A chronological list of all elective Caesarean sections performed over the same time period was then obtained from the Northern and Central Alberta Perinatal Outreach Program. Based on the date of surgery, 2 noninfected control subjects were chosen for each infected case by selecting the women who underwent CS immediately before and after each case. Hospital records of both cases and control subjects were then reviewed for demographic characteristics and antibiotic administration.

Fisher's exact test was used to perform statistical analysis comparing categorical demographic variables, and the Wilcoxon rank-sum test was used to compare continuous variables owing to non-normality.

## **RESULTS**

During the observed time period, 4285 Caesarean sections were performed. Of these, 1250 (29%) were elective, defined as occurring before labour or rupture of membranes. Successful postdischarge telephone contact was made in 66% of women, and 124 infected cases were identified, giving an overall SSI incidence of 9.9% (Figure 1).

When the charts of the 124 infected women were reviewed, superficial wound infections accounted for 79% of SSIs, deep tissue infections for 4%, and organ/space infection for 17%. The organ/space infections comprised endometritis (15%) and generalized sepsis (2%). When these numbers were applied to the whole study population,

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