Post Cesarean Section Pelvic Abscess: Case-Control Study And Lessons Learned Following An Outbreak At A Tertiary Care Teaching Hospital

N Al-Abdullah, R Kaki

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Abstract

Objectives: To study the risk factors for pelvic abscess following cesarean section.

Design: Case-control study with two-tailed univariate analysis of potential risk factors and multiple logistic regression to test the combined effects of these risk factors.

Setting: Tertiary care teaching hospital in Jeddah, Saudi Arabia.

Participants: 21 women with pelvic abscess following cesarean section and 21 matched controls who underwent cesarean section during the same time period but experienced no known surgical site infections.

Risk factors considered: Body mass index (BMI), diabetes mellitus (DM) and hypertension, type of cesarean section (elective vs. emergency), number of previous cesarean sections, allocation to labor and delivery ward, timing of rupture of the membrane, antibiotic prophylaxis, and number of per-vaginal examinations before cesarean section.

Results: All risk factors except hypertension and antibiotic prophylaxis were significant (p between 0.0001-0.05 based on Chi-square test) in the univariate analysis. In the multiple logistic regression analysis, the number of vaginal examinations (19/21 in cases vs. 11/21 in controls, odds ratio (OR) 8.6, 95% confidence interval (CI) 1.59-46.8, p = 0.01 based on student T test) and emergency cesarean section (17/21 vs. 9/21, OR 5.7, 95% CI 1.41-22.8, p = 0.01) resulted in the highest odds ratios, although allocation to the labor and delivery ward emerged as the statistically most significant risk factor (21/21 vs. 11/21, OR 2.0, 95% CI 1.27-2.87, p = 0.0001)

Conclusions: Identification of the main risk factors will help prioritize appropriate infection control measures to those at highest risk of pelvic abscess following cesarean section

INTRODUCTION

Cesarean section is one of the most commonly performed operations in women worldwide, with a gradually increasing trend especially in high and middle income countries [1,2]. Like other major operations, cesarean section is often complicated by surgical site infections (SSI) which could increase morbidity, the length of hospital stay, and hospital costs [3]. Estimates of the post cesarean section SSI rate range from 7% to 20%, depending on obstetric variables and criteria used to diagnose the infection [4-8]. Development of pelvic abscess is a rare complication following cesarean section that occurs in <1% of postpartum endometritis patients [9], corresponding to < 0.1% of all cesarean section deliveries. This particular complication often creates a diagnostic dilemma, causes significant maternal morbidities, and requires complicated and varied treatment approaches ranging from radiological imaging guided aspiration of pus to laparotomy and even hysterectomy [9-11].

King Abdulaziz University Hospital (KAUH) is a tertiary care center with an annual number of deliveries averaging 5,000, of which 21% are cesarean deliveries. Out of 1,993 cesarean sections performed between January 2013 and December 2014, we observed a significant number of 21 cases of pelvic abscesses following cesarean section,

corresponding to a high rate of 1.1% per cesarean section. This finding motivated this retrospective case-control study aimed at evaluating the risk factors for post cesarean section pelvic abscess to help prioritize preventive strategies to avoid this potentially dangerous complication in the future.

METHODS

The study was conducted at KAUH in Jeddah, Saudi Arabia, where more than 10,000 births took place in a two-year period from January 2013 to December 2014. Out of 1,993 cesarean sections in two years, 21 patients developed pelvic abscess following cesarean section. A case-control study was carried out to identify the risk factors associated with post-cesarean section pelvic abscess. All the women showing signs and symptoms of pelvic abscess following cesarean section and subsequently diagnosed radiologically were enrolled as cases and for each a post-cesarean section case during the same time period without any SSI was enrolled as a control. There were no exclusion criteria for the cases.

We considered the following risk factors and assessed their significance for the development of pelvic abscess: (1) body mass index (BMI), (2) medical conditions like diabetes mellitus (DM) and hypertension determined based on standard diagnostic criteria, (3) type of cesarean section (elective vs. emergency), (4) number of previous cesarean sections, (5) allocation to labor and delivery ward, (6) timing of rupture of the membrane, (7) antibiotic prophylaxis, and (8) number of per-vaginal examinations before cesarean section.

Presence of pathogens was assessed by bacterial cultures and it was presumed that any known pathogenic bacteria identified represented the causative agents of the pelvic abscess.

STATISTICAL ANALYSIS

Data were analyzed using SPSS statistical software version 16.0 (IBM Corporation, Chicago, Illinois). Two-tailed univariate analysis of potential risk factors was performed and assessed for statistical significance ($P \leq 0.05$). The Fisher exact test was used for differences between categorical variables and the student T test for differences between continuous variables. Multiple logistic regression analysis was performed to test the combined effects of these variables on pelvic abscess.

RESULTS

Out of 1,993 cesarean sections performed between January 2013 and December 2014, 21 cases with pelvic abscess were diagnosed. Ten cases were recorded in 2013 (Figure 1), and 11 in 2014 (Figure 2). Fourteen (67%) infections were diagnosed on re-admission to the hospital, six (29%) were diagnosed in the hospital before discharge, and one (5%) was diagnosed after discharge through post-discharge surveillance. All cases with post cesarean section SSI presented with a deep incisional wound.

Univariate analyses for each potential risk factor are presented in Table 1. Univariate analysis indicated that women with DM have twice the risk of developing pelvic abscess following cesarean section compared to women without DM and that women with hypertension have 6 times the risk compared to women without hypertension, both of which were statistically significant. Women with pelvic abscess had a mean BMI of 32.1 which was significantly higher than the mean BMI of 30 in the control group. The place where the cesarean section was performed also emerged as an important risk factor. In all cases that developed pelvic abscess, the cesarean sections were done in the labor and delivery ward, which was significantly more than for the controls (i.e., 21/21 vs. 9/21, $p = 0.01$). Emergency cesarean section also appeared as risk factor for developing pelvic abscess compared to the controls (i.e., 17/21 vs. 9/21, $p = 0.01$). A history of cesarean section appeared as a negatively associated factor for the development of pelvic abscess and this was found to be statistically significant (i.e., 9/21 vs. 16/21, $p = 0.02$). The mean duration of rupture of membrane before cesarean section was significantly higher for pelvic abscess cases than for controls (i.e., 7.4 vs. 3, $p = 0.001$). Similarly, the mean number of vaginal examinations was statistically higher among the cases compared to controls (i.e., 19/21 vs. 11/21, $p = 0.01$).

In a multiple logistic regression model (Table 3), the chance of developing pelvic abscess after cesarean section was significantly greater for patients with DM (i.e., odds ratio of 2.24, 95% confidence interval 1.6-3.2). Infection is more likely in emergency cesarean sections (i.e., odds ratio of 5.7, 95% confidence interval 1.4-22.8). The risk of infection increases for patients who underwent surgery in the labor and delivery operation room.

The spectrum of commonly identified likely causative pathogens in post cesarean section SSI included *Citrobacter*

Kosri, Enterococcus faecalis, ESBL klebsiella pneumomiae, and Staphylococcus aureus.

DISCUSSION

A number of complications are associated with cesarean section, including intraoperative hemorrhage wounds and chest infections, abdominal wound dehiscence, deep vein thrombosis, anesthetic hazards, and pulmonary embolism [9]. Postpartum pelvic abscess is a very rare complication typically occurring in < 1% of patients following postpartum endometritis [9]. Patients with post cesarean metritis often form a parametrial phlegmon, which develops as an area of induration within the leaves of broad ligaments. This is caused by the cellulites of the adjacent cesarean section wound. This phlegmon rarely suppurates and forms an abscess [10]. The risk factors for post cesarean pelvic abscess are diverse and include younger age, low socioeconomic status, prolonged labor, premature rupture of membranes, multiple vaginal examinations and cephalopelvic disproportion as an indication of cesarean section [10].

In this study, we assessed the risk factors for 21 cases of pelvic abscess with an aim to formulate a preventive plan to reduce this complication. The study results demonstrate that women who deliver by emergency cesarean section have a five times higher chance of developing a pelvic abscess than those with elective cesarean section. High BMI is another factor which is statistically associated with development of abscess following cesarean section. El-Agwany (2014) described similar complications of abscess and uterine incision necrosis following cesarean section when maternal weight was more than 100 kg [11]. Four factors related to infection-prevention were found to be relevant for the development of pelvic abscess after cesarean section. Preoperative vaginal examinations, allocation of the women in labor delivery suite, long duration of rupture of membrane, and repeated per-vaginal examinations all emerged as high risk factors regarding development of pelvic abscess.

Antibiotic prophylaxis is a general recommendation for any surgery and considered a protective factor regarding the development of SSI. In a systematic review of 86 randomized trials that compared infection outcomes after both scheduled and "in labor" cesarean delivery with or without the use of prophylactic antibiotics, prophylactic antibiotics administration reduced the risk of endometritis by approximately 60% [12]. This study compared elective cesarean section patients who took appropriate antibiotics within 30 minutes before the procedure with emergency cesarean section patients who took antibiotics after surgery and found that prophylactic antibiotics did not significantly affect the development of abscess ($p= 0.07$). This could be explained by the fact that the antibiotic prophylaxis recommended might not have covered the pathogens responsible for the abscess and recovered from the wound. Previous studies that found antibiotic prophylaxis to be statistically significant in preventing the cesarean section infections were probably conducted before the global change to more virulent pathogens such as ESBL klebsiella, which is a global threat and might require a change in institutionally recommended antibiotic prophylaxis [13,14,15]. Muin et al. (2015) reported Gardnerella vaginalis, Mycoplasma hominis and Ureaplasma in bacteriological cultures of pelvic abscess following cesarean section which were drained under radiological guidance [16]. Yamaguchi et al. (2000) considered Mycoplasma hominis to be the primary causative organism in post cesarean pelvic abscess which were resolved following transvaginal abscess drainage [17]. Several other studies suggest that giving antibiotics before surgery is highly recommended and reduces the risk of SSI [18-20].

This study found that the allocation of the women in the labor and delivery room for emergency cesarean section was another important risk factor. However, the organisms isolated from patients differed from those potentially in the labor and delivery operating room is, suggesting that the operating room was clean. Given that routine institutional prophylactic antibiotic therapy could not prevent the development of the pelvic abscess in our study, we planned a composite approach to decrease the SSI and this infection control program's SSI bundle was estimated to decrease SSI infection by 32% [6,7]. The SSI bundle included a chlorhexidine gluconate (CHG) bath before the operation, a stabilized blood glucose level, stabilized body temperature, and proper antibiotic prophylaxis administration within the 30 minutes before the operation [17,18].

The second preventive strategy for post cesarean section pelvic abscess involves staff education and training in scrub techniques and appropriate skin preparation. Appropriate skin disinfectants such as 2% chlorhexidine with 70% alcohol was effective against both gram-negative and gram-positive bacteria [22].

Treatment of all abscesses was individualized. Many of our

cases responded to antibiotics alone and only a few cases suffer from serious deep SSI leading to the complications such as abscess rupture or dissemination of infection to nearby organs. Deep SSIs required surgical intervention in the form of laparotomy and even in few cases, hysterectomy. The literature suggests that a percutaneous and vaginal needle aspiration of the pus resulted in complete recovery in similar cases [9,10,16,17]. Drainage of pus could be done by insertion of a catheter under ultrasound or computed tomography (CT) guidance for abscesses located anterior or lateral to the uterus, or via a small colostomy for patients with an abscess in the posterior cul-de-sac [9]. However, when the pelvic abscess was associated with suspected uterine wound dehiscence, there was a definite place of laparotomy for drainage purpose and even a need for hysterectomy [9,24].

Diagnosis of post cesarean pelvic abscess is often a challenge. The most cost-effective imaging study to confirm the presence of an abscess is an ultrasound examination. Pelvic ultrasound is required to confirm the diagnosis. Computed tomography scans are performed when there is doubt about the diagnosis or location of the abscess [9].

Two remote possibilities of differential diagnoses should be kept in mind while dealing with any pelvic abscess that developed following cesarean section. The first is puerperum ovarian thrombosis, which has a similar clinical manifestation as pelvic abscess but can be differentiated by doing a CT scan [25]. This requires anticoagulant therapy apart from other supportive management. The second differential diagnosis is a retained foreign body, especially gauze. This often evokes an inflammation inside and subsequent pus formation which needs an urgent laparotomy [26,27].

This study has several limitations. Development of any postoperative complication is inherently related with factors not considered in this analysis, like intraoperative blood loss, duration of surgery, level of training of the healthcare team including the surgeon, nurse and anesthetist, and level of postoperative care. Consideration and comparison of these factors in the two groups might reveal some additional information. Furthermore, selection of controls may have introduced unknown biases, which could have influenced the results. Finally, large sample sizes would improve the statistical robustness of the results.

In conclusion, this study identified the most important risk factors for post cesarean section pelvic abscess and allows infection control measures to prioritize patients at highest risk. We suggest that the infection control team should reinforce the SSI bundle for all women considered for cesarean section and recommend educating the obstetric physicians about the importance of prophylactic antibiotics within 30 minutes before surgery. There is also a need to improve post-discharge SSI surveillance to identify the complications earlier. Moreover, educating the patients about the need to maintain a normal body weight during pregnancy as well as adequate control of glycemic status appear to be important primary approaches to prevent any postoperative complications including the development of post cesarean section pelvic abscess.

Table 1

Risk factors associated with post cesarean section surgical site infections

Risk factors	**Cases N= 21**	**Controls N=21**	**Odds ratio (95% confidence interval)**	***P* value, based on chi-square test**
Diabetes mellitus	4	0	2.2 (1.57-3.18)	0.05*
Hypertension	5	1	6.25 (0.66-59)	0.09
Average body mass index in kg/m^2 (standard deviation)	32.1 (±6)	30.0 (±6)	-----	0.05*
Emergency cesarean section	17	9	5.7 (1.41-22.76)	0.01*
Previous cesarean section	9	16	0.23 (0.06 -0.88)	0.02*
Antibiotic prophylaxis	13	18	0.27 (0.06-1.22)	0.07
Labor and delivery operation room	21	11	2.0 (1.27-2.87)	0.0001*
Vaginal examination	19	11	8.6 (1.59-46.8)	0.01*
Average rupture of membrane in hours (standard deviation)	7.4 (±17)	3 (±6)	-----	0.0001*
Average number of vaginal examinations	6 (±3)	4 (±2)	-----	0.0001*

* Denotes significant difference at 0.05 significance level

Table 2

Results of the logistic regression analysis

Risk factors	Cases N= 21	Controls N=21	Odds ratio	95% Confidence interval	**P* value
Diabetes mellitus	4	0	2.2	1.57-3.18	0.05
Emergency cesarean section	17	9	5.7	1.41-22.76	0.01
Labor and delivery operation room	21	11	2.0	1.27-2.87	0.0001
Number of vaginal examinations	19	11	8.6	1.59-46.8	0.01

Figure 1

Number of cesarean section [C/S] infections in 2013

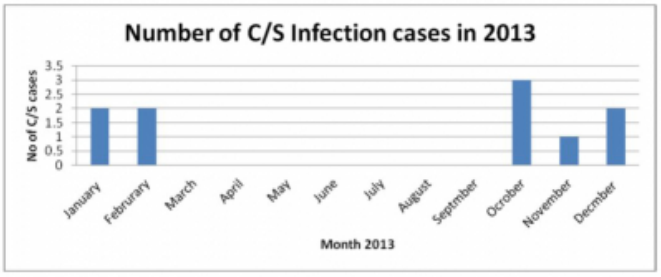
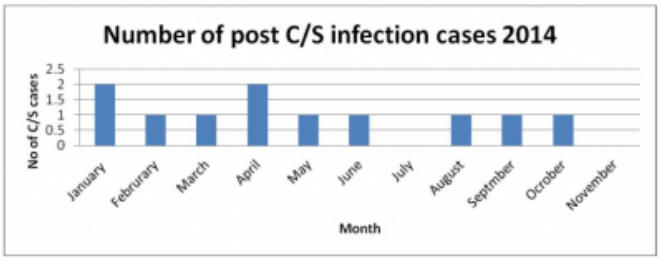


Figure 2

Number of cesarean section [C/S] infections in 2014



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Author Information

Nabeela Al-Abdullah
Department of Infection Control and Environmental Health; Department of Public Health, College of Nursing, King Abdulaziz University Hospital
Jeddah, Saudi Arabia

Reham Kaki
Department of Infection Control and Environmental Health; Department of Medicine, King Abdulaziz University Hospital
Jeddah, Saudi Arabia