

Significant reduction in the post cesarean delivery surgical site infection rate after use of prophylactic antibiotics in Madinah Maternity hospital, Saudi Arabia

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Abstract: Surgical site infection is the second most common health care-associated infection among women undergoing cesarean section. In this study we aimed to determine the role of prophylactic antibiotic treatment given to women when undergoing a cesarean delivery in decreasing the incidence of wound infection. A retrospective cohort study at Madinah Maternity and Children Hospital, Obstetric and Gynecology department, Madinah, Saudi Arabia, was conducted from December, 2011 to December, 2013; where 8544 medical records of women delivered by cesarean section were reviewed and the rate of surgical site infection during the year 2012 was compared with its rate during the year 2013. Total number of cesarean section cases complicated by surgical site infection in 2012 was 167 cases. During 2013 (after administration of prophylactic antibiotic to all women delivered by cesarean section), 109 cases were complicated by surgical site infection among 4470 delivered by cesarean section. Statistical analysis shows clearly that infection rates were significantly different ($p < 0.001$) between year 2012 and year 2013; with higher rate of infection in the year 2012 which was 4% compared to 2.4% during the year 2013. Enterococcus spp. were the highest isolated organisms while, Streptococcus spp. was the least isolated organisms among isolates. 16% of isolates showed resistance to ampicillin, while, all isolates were 100% sensitive to both gentamicin and vancomycin drugs. This indicated that, surgical site wound infection incidence was significantly reduced after the administration of prophylactic antibiotics for cesarean section, beside; infection control procedures are working and also improving from month to month.

[Nada Abdelmohsen Abdel-Aziz, Jehan Mohammad Al Hazmi, Muayed Mohammed Younis, Hani Adnan Ozbak, Hassan Abdullah Hemeg, Rehab Al-Rewithi, Ali Abdellah Ahmad. **Significant reduction in the post cesarean delivery surgical site infection rate after use of prophylactic antibiotics in Madinah Maternity hospital, Saudi Arabia.** *Life Sci J* 2014;11(7):833-839]. (ISSN:1097-8135). <http://www.lifesciencesite.com>. 120

Key words: Cesarean section; Surgical site infection

1. Introduction

Worldwide, 15% of births is accounted by cesarean delivery [1]. Compared to normal delivery, the risk of acquiring infection is 5-20 folds higher with a cesarean section. [2]. Several infectious consequences may occur after delivering by cesarean section such as fever, bacteremia, wound infection (surgical site infection), urinary tract infection (UTI) and other severe infections like necrotizing fasciitis or septic shock. [3]

Surgical site infection (SSI) is considered to be one of the most common hospital associated infections where it accounts for 14-16% of the total healthcare acquired infections. [4,5]

Although SSI rarely threatens life for most obstetric patients, there is a quite considerable morbidity rate. As a result, this significantly leads to

socio-economic subsequences for both healthcare services and patient [6]

The Institute for Healthcare Improvement brings a notice of many ways to decrease the rate of surgical site infections known as bundle of care. Although the bundle of care consists of four different evidence-based components, it is grouped as a single intervention and standard of care for patients having surgical operations. These components are as follow: proper antimicrobials use, proper removal of hair, blood sugar control after major open heart operation and postoperative normothermia in colorectal surgery patients [7].

There are many factors can lead to increase the risk of acquiring infection in women having cesarean section operation such as urgent cesarean delivery, examination of vagina during delivery,

monitoring of internal fetal, losing of blood, infection in urinary tract system, anemia, diabetes, the skills of the surgeon and techniques used for the operation.[8]

Surgical site infections are usually polymicrobial infections. The most common organisms isolated from infected wounds and the endometrium include coagulase negative staphylococci (CoNS), *Staphylococcus aureus*, *streptococcus species*, *Enterococcus species*, streptococcus species, gram negative rods, anaerobes, *Gardnerellavaginalis*. [9]

Using antibiotics as a prophylaxis before any obstetric and gynecological surgery is a necessary step conventional practice. Many institutions have their own established procedures. Where these applied, and available they are consistent with accepted national policy, they should be followed. [10]

Administering of prophylactic antibiotics before cesarean section has been a normal step for cesarean deliveries as it dramatically decreases endometritis and morbidity rate of maternal infections after operation especially when compared to administering of antimicrobials after umbilical cord clamping. [11] Interestingly, giving prophylactic antibiotics before cesarean delivery has no major effects on mothers or newborn babies. [12]

One intravenous dose of a narrow spectrum antibiotic (e.g. cefazolin) should be administered preoperatively to all women having cesarean section procedure in order to decrease the risk of postoperative infection.. [11, 13]

Antibiotic prophylaxis significantly minimized the occurrence of postoperative fever, infection in urinary tract system, wound infection, endometritis and severe maternal infectious complications compared to controls receiving no antibiotic treatment. [14]

According to different organizations guidelines, 1-2 gram (g) of cefazolin should be administered intravenously as antibiotic prophylaxis for women undergoing cesarean section. Clindamycin in combination with gentamicin can be given to patients having allergy to penicillins and cephalosporins. [13]

Extended spectrum antibiotic prophylaxis Extended spectrum antibiotic prophylaxis continued after operation was associated with a dramatic decrease in postpartum endometritis (16.9 versus 24.7 percent) and wound infection (0.8 versus 3.6 percent). Follow-up observational studies by the same group affirmed these findings. [15]

Antimicrobial therapy should be given at least sixty minutes before making the skin incision to ensure adequate drug tissue levels. [16]

Based on the recommendations of the Scientific Committee on Infection Control (SCIC), Centre for Health Protection and The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, intravenous administering of narrow spectrum prophylactic antimicrobials (e.g. cefazolin) for all elective or non-elective cesarean operations is effective to prevent or reduce the incidence of endometritis and wound sepsis. The recommended dose of cefazolin is 1 g but 2 grams can be given for adults with weight of ≥ 80 kilograms.

It is recommended that three doses of prophylactic antibiotic are given routinely within 24 hours for pregnant woman undergoing elective or non-elective cesarean delivery. In another word, single dose is given immediately before surgery (at the same time with anaesthesia) and two more doses after operation). This is to ensure achieving enough concentration of tissue at the time of first incision. Administration after the cord is clamped has been common practice to avoid exposing the newborn baby to antimicrobials, and to prevent compromise to the fetus in the event of maternal anaphylaxis. These issues need to be weighed against the rates of lower maternal infection if prophylactic antibiotic is administered prior to incision of the skin. [17]

The aim of this study was to see if administration of antibiotics as a prophylaxis for women having elective or non-elective cesarean delivery has an indispensable role in reducing the occurrence of wound infection in Madinah Maternity and Children Hospital (MMCH), Obs. and Gyn. department, Saudi Arabia.

2. Patients and Methods

A retrospective cohort study of women who gave birth by cesarean section at Madinah Maternity and Children Hospital (MMCH), Obstetric and Gynecology department, Madinah, Saudi Arabia, was conducted from December, 2011 to December, 2013; where 8544 medical records of women delivered by CS were reviewed and the rate of surgical site infection during the year 2012 without the use of preoperative prophylactic antibiotic cefazolin 1g I.V was compared with its rate during the year 2013 after using single dose pre operative cefazolin 1g IV.

All patients suspected of having wound infection had wound swab cultured in accordance with local practice where all suspected SSIs had swabs taken prior to commencement of antibiotics or as soon as the diagnosis is suspected. Where the culture was positive, an antibiotic sensitivity of the organism grown was carried out using standard microbiology techniques. A specially designed check

list was used. Ethics Review Committee reviewed and approved the proposal.

Statistical Analysis:

This study used Statistical Package for Social Sciences (SPSS) version 13 for statistical analysis. Frequencies, percentages were calculated. Chi-square test was used. P value <0.05 was considered significant.

Ethical consideration

The protocol of this study was approved by the Studies and Research Committee, Maternity and Children Hospital, General Directorate of Health, Madinah, Saudi Arabia.

3. Results

During the years 2012, -2013, there were 29000 deliveries in the unit; among them, 8544 (29.4%) were by CS (4074 CS through the year 2012 and 4470 CS through the year 2013). Figure (1) The women mean age was 29.5 years, with a mean gravidity of 3.90 ± 2.33.

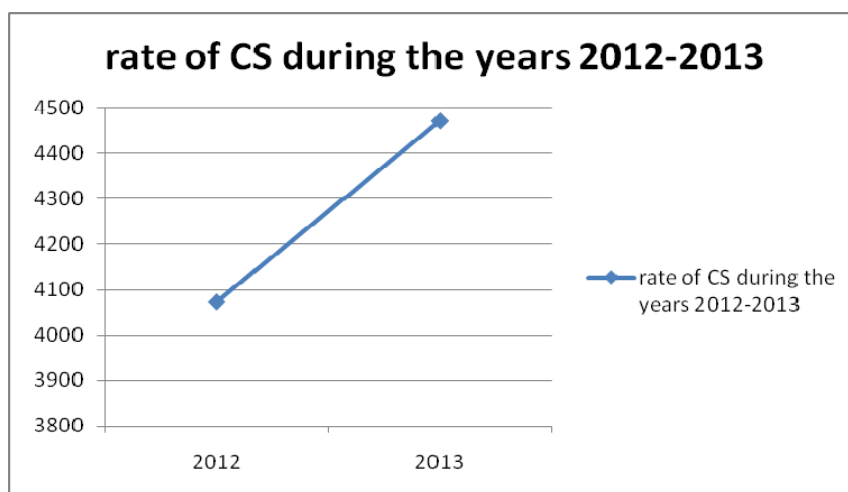


Fig. (1) Rate of CS during the years 2012-2013

Total number of CS cases complicated by SSI in 2012 (during this period, no prophylactic antibiotic was given to women prior to CS) was 167

cases among 4074 CS (4.1%), while 3907 (95.9%) had no evidence of wound infection. Figures (2 and 3).

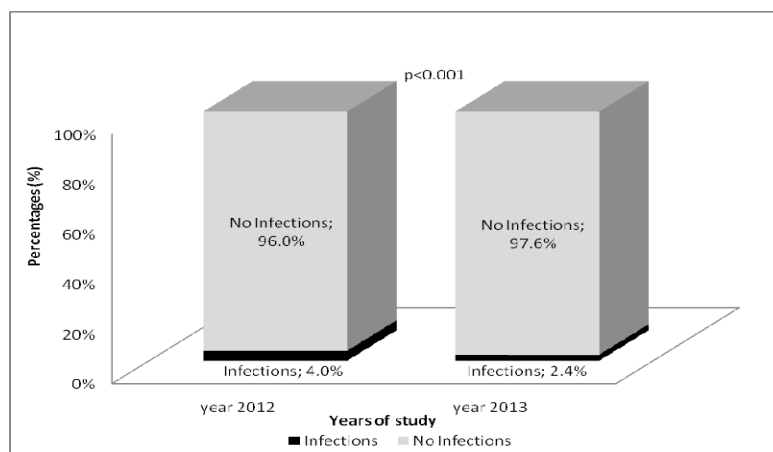


Fig. (2) Percentages of infected and non-infected wounds after caesarean in the years 2012 and 2013.

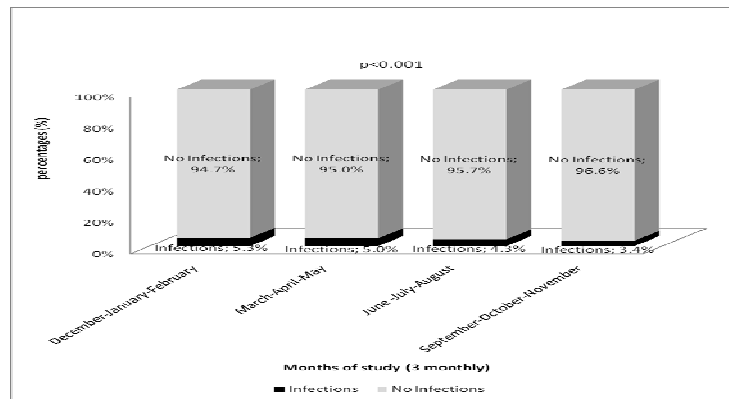


Fig. (3) Percentages of infected and non-infected wounds after cesarean in the year 2012.

During 2013 (after administration of prophylactic antibiotic to all women delivered by CS), 109 cases were complicated by SSI among 4470 delivered by CS (2.4%), while the remaining cases 4361 (97.6%) didn't show manifestations of SSI.

Statistical analysis shows clearly that infection rates were significantly different ($p < 0.001$) between year 2012 and year 2013; with higher rate of infection in the year 2012 which was 4% compared to 2.4% during the year 2013. Figures (2 and 4).

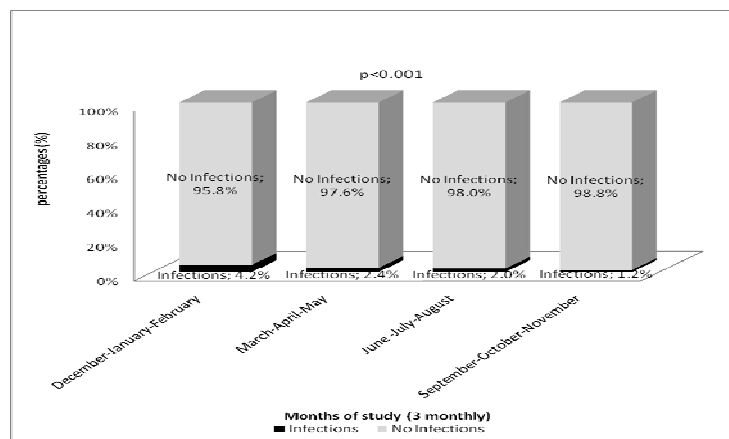


Fig. (4) Percentages of infected and non-infected wounds after caesarean in the year 2013

Regarding differences of infection rates between different months of the year 2012, it was found that infection rates were not significantly different ($p > 0.05$). Regarding year 2013, infection

rates were significantly different ($p < 0.001$) between the months of year; with higher rate of infection in December-January-February (4.2%) and lower rate (1.2%) in September-October-November. Figure (5).

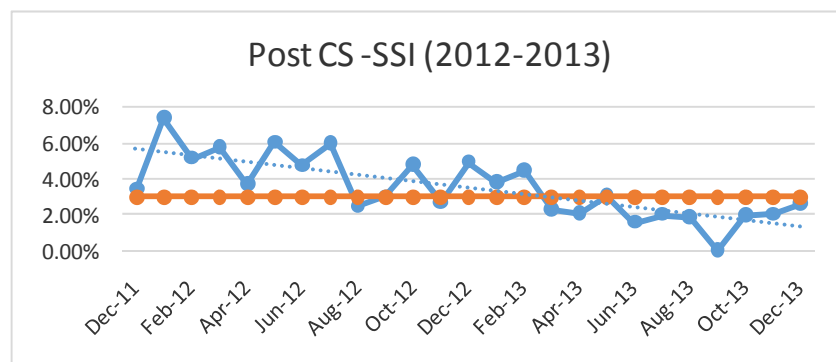


Fig. (5) Percentages of SSI after caesarean in 2012 -2013

Out of the 276 cases with SSI during 2012 - 2013, 189 (69%) of culture yielded no growth. Enterococcus spp. were isolated from 27 (10.5%) of cases. In 13 (4.5%) Pseudomonas species was grown,

while 12 (4%) produced *E. coli* and Klebsiella species, and 2% each for *Staph aureus* and MRSA. Streptococcus spp. was the least isolated organisms (1.8%) among isolates from SSI. Table (1).

Table (1). Types of organisms isolated from post CS- SSI

Type of the organism	Number	Percentage (%)
<i>Staph. aureus</i>	6	2%
Methicillin-resistant staph aureus (MRSA)	6	2%
<i>Escherichia coli</i>	12	4%
Klebsiella species	12	4%
<i>Pseudomonas Areoginosa</i>	13	4.5%
Enterococci	27	10.5%
Coagul. negative staphylococci	6	2%
Streptococcus species	5	1.8%
No growth	189	69%
Total	276	100%

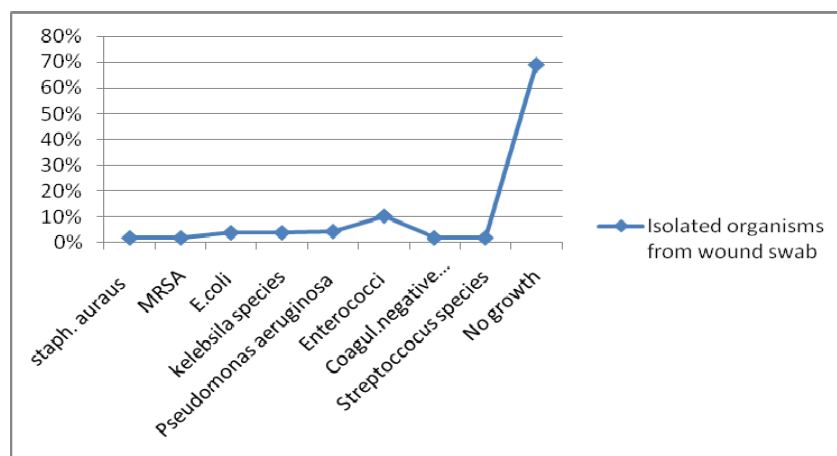


Fig. (6). Isolated organisms from wound swab

Regarding antibiotic sensitivity pattern, out of 87 isolated organisms, 14 (16%) showed resistance to ampicillin, 10 (11.4%) were resistant to Trimethoprim/Sulphamethoxazole, 4 (4.5%) resistant to cephalothin, and 2 (2.2%) each for (aztreonam-cefoxitin - ceftazidim - ciprofloxacin - clindamycin). Erythromycin and piperacillin showed high sensitivity rates (only one resistance for each). All isolated organisms were 100% sensitive to both gentamicin and vancomycin drugs.

4. Discussion:

In our study, the CS rate was high (29.4%) during the years 2012-2013. In other study from a tertiary hospital in Riyadh, Saudi Arabia, CS deliveries constituted 19.05% of all deliveries between June 1, 2008, and February 2011. [18]

In this study, the prevalence of SSI following CS during year 2012 before approval of the

regulations for administration of prophylactic antibiotic cephazolin, was 4%. In comparison with other studies, Jido and Garba, reported a higher rate of SSI of 9.1%. Moreover, Ward et al. in a multi-center collaborative study of SSI following CS in the UK reported SSI of 8.9%. [19-20]

In the current study, during 2013, our hospital approved the use of prophylactic antibiotic cephazolin routinely preoperative to all women before CS. The prevalence of SSI during this period was significantly reduced to 2.4%.

Our results agree with meta-analyses review done by Bastu and Gulmezoglu, which concluded that, administering antibiotic prophylaxis has dramatically decreased incidence of endometritis (by two thirds to three quarters) and wound infection (by up to three quarters) following both elective and non-elective cesarean delivery. The administering of antibiotics prophylaxis prior to or next to clamping of

the cord for women undergoing cesarean section seems to be equally effective as well. [21]

A systematic review of 86 randomized trials recommended a single intravenous dose of a narrow spectrum antibiotic (e.g., cefazolin) should be administered preoperatively to all women undergoing cesarean delivery to reduce the risk of postoperative infection. [11]

Another study reported that antibiotic prophylaxis significantly reduced the incidence of postoperative fever, endometritis & the relative risk of endometritis was reduced by approximately 60 percent after scheduled cesarean delivery. [14]

In this study, *Enterococcus* spp. were the most prevalent organisms isolated from SSI (10.5%) while, *Streptococcus* spp. was the least isolated organisms (1.8%) among isolates from SSI.

In contrast to our study, Olsen et al. reported that, *S. aureus* was isolated in 31.8% of the cultures and was shown to be the predominant agent in post-cesarean wound infection. (22) While other study from Nigeria reported gram negative enteric bacilli as the predominant organisms (accounted for 29.5% of the cultures). [23]

In this work, most isolated organisms showed high resistance to penicillin, while gentamicin and vancomycin were the most sensitive drugs to all isolates.

This article indicated that, surgical site wound infection incidence was significantly reduced after the administration of prophylactic antibiotics for both elective and non-elective cesarean section, beside; infection control procedures are working and also improving from month to month.

Beside administration of antibiotic prophylaxis, other strategies for prevention of SSI in CS patient could include preparation of patients for surgery, keeping all instruments used for operation sterilized, surgical hand preparation of surgeons and their teams before operation and taking care of incision site after operation. Other strategies also include: surveillance on surgical site infection, screening of patients for presence of high blood sugar prior to surgery and therefore to implement a protocol for controlling blood sugar before, during and after operation. Furthermore, a multidisciplinary teamwork approach is required for successful implementation of procedures for prevention and/or reduction the incidence of surgical site infections (SSI). [18]

Acknowledgments

We greatly appreciate the vital contributions of Maha Hazmi and Abeer allasi, secretaries of Obstetric and Gynecology department, Madinah Maternity and Children Hospital (MMCH), Madinah,

Saudi Arabia, for their help in collection of the current data.

Conflict of interest

The authors report no financial affiliations or other conflicts of interest related to the subject of this study

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7/11/2014