ORIGINAL ARTICLE J. Med. Sci. (Peshawar, Print) July 2013, Vol. 21, No. 3: 141-144

SURGICAL SITE INFECTIONS, PATHOGENS AND SENSITIVITY AFTER EMERGENCY CAESARIAN SECTIONS

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ABSTRACT

Objective: To determine the frequency and antibiotic susceptibility pattern of pathogens involved in surgical site infections (SSI) after emergency C-sections.

Material and Methods: In this cross-sectional study, all women undergoing Emergency C-Section from April 2012 to September 2012 who fulfilled the inclusion criteria were included. Pus culture and sensitivity reports were collected prospectively from hospitalized patients who developed post-operative surgical site infection SSI.

Result: Out of the 241 women enrolled, 29(12%) patients had SSI. Staph aureus (24%) and Staph epidermis (20%) were the most frequent pathogens involved. All pathogen isolates were sensitive to Gentamicine, except the least frequent pathogens take Group B Streptococcus and Enterobacter. Penicillin derivatives were found to be effective as well. Cephalosporin and Quinolones were ineffective against most of the frequent isolates in our study.

Conclusion: The selection of antimicrobial agents for empirical and prophylactic use should take into account the expected flora and bacterial resistance patterns.

Key Words: Wound, infection, bacteria, antibiotic, sensitivity.

INTRODUCTION

Caesarean Section (C-Section) involves making an incision in the abdomen to allow for the delivery of an infant from the uterus[1]. Although C-sections are performed in a sterile environment, the risk of infection always exists. One of the most common sites of infection following C-Section is the incision area. Since the skin is a host to a variety of bacteria, infection can set in easily. SSI is defined as an infection that occurs at the incision site within thirty days after surgery[2]. It involves the tissues, organs, or spaces (intraperitoneal) that come into contact with the surgeon. Intra-operative contamination of normally sterile tissue by pathogenic microbes is the most frequent cause of incision infection. The term SSI was proposed by the Centre of Disease Control and Prevention (CDC) in 1992[3]. The CDC defines two categories of SSI.

- Incisional SSI comprises all infections the surgeon has traditionally named 'wound infection'.
- Organ/space SSI- is the postoperative infections of body cavities or organ manipulated by surgeon.

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Pathogens isolated in SSI vary according to the surgical site. Staphylococcus is the most commonly isolated bacteria in SSI as it is the most common normal skin flora[4]. If the gastrointestinal tract is involved then E. coli and bacteroids are common[5]. If the urinary tract is involved, then Group-D Staphylococcus, Pseudomonas and Proteus are common[6]. SSI caused by cervical-vaginal flora are associated with prolonged labour, higher number of vaginal examination, fetal monitoring and with pathogens isolated from endometrium at C-Section. In contrast, SSI caused by S. aureus is not associated with prolonged labour, nor is S. aureus isolated from endometrial samples at C-section[7].

SSI complicate up to 9.1% of C-Sections[8,9]. SSI results in increased hospitalization periods with an associated increase in financial and health implications[10]. There are multiple risk factors associated with infection after C-section. A major risk factor for post-operative SSI is emergent C-section as compared to elective C.section[12]. In addition, poor aseptic surgical techniques, prolonged operative time, labor lasting more than twelve hours, premature rupture of membranes, diabetes, anemia, skin disease at incision site, staphylococcus carriers and inappropriate pre-operative antibiotic prophylaxis also contribute to SSI[13,14,15].

Emergency C-section is a commonly performed procedure in our population, and post-op SSI leads to an increased financial burden. Infection by multiple drug resistant bacteria has become a serious problem in developing countries owing to poor

infection prevention programs, crowded hospital environments and irrational prescription of antimicrobial agents. In order to remedy this, we designed this study to help us in determining the local trends of common bacteria, their antibiotic sensitivity and frequency of post C-section SSI which will guide us to devise certain recommendations regarding empirical use of antibiotics and pre-operative preparation of patients to reduce the rate and morbidity associated with emergency C-sections.

MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at Obstetrics and Gynaecology Department of Hayatabad Medical Complex, Peshawar. The study was conducted prospectively for six months, from April 2012 to September 2012. Patients were admitted through outpatient or emergency department. The total sample size was 241 patients. Consecutive sampling (non probability) technique was used for sample collection. The study was conducted after approval from our hospitals ethical and research committee. All women undergoing emergency C-section, irrespective of indication (mal presentation, failure to progress, fetal distress, obstructed labor, ante partum hemorrhage) were included in the study. Patients with malignancy, diabetes, history of taking steroids, body mass index greater than 29 Kg/m^2 and all elective cases of C-section were excluded from the study. All the patients included in the study had emergency C-section by 2^{nd} or 3^{rd} year's trainee on their emergency duties. All C-section wounds were cleaned with iodine solution and covered with sterile gauze and adhesive tape. Post-operatively, all patients were followed up till 7^{th} post-operative day to detect SSI. The diagnoses of wound infection was based on pain, swelling, redness and discharge of purulent material at the operative site. Organ/space SSI was excluded on the basis of abdominal ultrasound. Swabs were taken from the site of infection and transported in sterile leak-proof containers to the hospital laboratory for culture and antibiotic sensitivity. Data was collected and analyzed using SPSS version 10.0.

RESULTS

The sample size for this study was 241, out of which 29(12%) patients developed SSI post-operatively as shown in Table 1. As shown in Table 2, out of 29 infected cases, 24(83%) patients were in the age group 21-40 years, while most (68%) patients were multiParous. 62% of the patients were un-booked. 65% of emergency C-section were carried out by 2^{nd} and 3^{rd} year trainee registrar. Frequencies of common bacteria among 29 SSI patients were analyzed. As shown in Table 3, S. aureus 7(24%) was most frequent isolate followed by Coagulase negative Staphylococci 6(20%). The least frequent organisms were group-B Streptococci and Enterobacter (7% each).

Antibiotic sensitivity shows the most commonly isolated gram-positive bacteria to be sensitive to Gentamicine and amoxicillin (except Group B streptococci which was sensitive to amoxicillin and cephalosporin .The patterns of sensitivity in gram

Table 1: Frequency of wound infection. (n=241)

		Frequency	Percentage
Wound Infection	Yes	29	12%
	No	212	88%
Total		241	100%

Table 2: Socio-demographic characteristics of patients with SSI

Age	No. of patients & percentage
<20 years	3(10%)
21-30 years	13(45%)
31-40 years	11(38%)
41-50 years	2(7%)
Parity	
Primi Para	9(32%)
Multi Para	20(68%)
Booking status	
Booked	11(38%)
Unbooked	18(62%)
Surgeon	
2^{nd} and 3^{rd} Year Trainee	19(65%)
4^{th} Year Trainee	10(35%)

Table 3: Frequency of common bacteria in SSI. (n = 29)

Common Bacteria	No. and percentage
Staphylococcus Auras	7(24%)
Coagulase Negative Staphylococci	6(20%)
Entercococus	5(17%)
E.coli	4(14%)
Pseudomonas	3(10%)
Enterobacter	2(7%)
Group B streptococci	2(7%)
Total	29

negative organisms (E.coli and Pseudomonas) were mostly to penicillin derivatives (tazobactam) and amino glycosides (Gentamicin). However, Enterobacter isolated in two cases were sensitive only to cephalosporin.

DISCUSSION

SSI is a common complication in post-operative patients. Frequency of SSI after C-section reported in literature ranges from 3% to 15% depending on the surveillance methods used to identify infection[16,17]. Generally patients undergoing emergency C-section are at higher risk of infection[18,19,20]. This is due to inadequate preparation time owing to maternal or fetal distress. Similar results have been found by others[21]. In our study the incidence of SSI in emergency C-section was 12% which is relatively higher than the 8% documented in a regional study[22]. However it is lower than the 22% documented in another regional study[19]. This cannot be quoted as the exact value as studies have shown that 28% of infections occurred by day 14 and 90% by day 21. In our setup, most patients are discharged on day five, therefore studies on a larger scale and with increased post-operative follow-up will be required to determine the true incidence. In a study carried out in Nigeria, women with previous C-section associated SSI preferred vaginal deliveries in sub-sequent pregnancies[11].

In our study, 83% of patients with SSI were in the age group 21-40 years. Similar results were found in another study done by Odd DE et all[23], in which 76% were in age group 21-40 years. Majority of women were multiParous as compared to PrimiPara, which is similar to the results of a study conducted in Karachi[19]. The increase in SSI in our study could be attributable to the fact that most of these patients are of low socioeconomic group, malnourished, un-booked, and the emergency C-section being carried out by 2nd and 3rd year trainees.

SSI in our study was confirmed by microbiological studies in 29 cases. S. aureus was isolated in 24% of the cultures, followed by Coagulase negative staphylococcus (20%). It is similar to the Nosocomial Infection National Surveillance Service (NINSS) survey (1997-2001), which reports S. aureus and S. epidermidis as the most common organisms causing surgical SSI[24]. A study by Shriyan et al[25] and Nwachukwu et al[26] also found S. aureus as the most common organism causing post-operative wound infection. The usual source of infection with this skin derived pathogen is from exogenous sources or from the patient's own flora. Carriage of S.aures in the anterior nares of the surgeon and patient has been identified as a risk factor for these infections[27]. Infection with these organisms may also be due to contamination from the environment (e.g. contamination of surgical instruments). Thus, 25% of wound infection associated with Staphylococci represents a potentially preventable condition that presumably arises from exogenous sources[28].

Other less common but important pathogens isolated in our study were E.coli, Pseudomonas, Enterobacter, Entercococus, and Group-B Streptococci. Although a study conducted by Ricky et al[29] and a local study by Syed Asad Ali et al[5] found E. coli, Pseudomonas and Klebsiella as the most frequent organisms from SSI, which is in contrast to our study. Syed Asad Ali et al gave the explanation that the gastrointestinal tract was involved during appendectomies, which might result in contamination of the wound edges at the time of surgery. Other workers isolated more gram negative organisms like E. coli, Pseudomonas, Proteus, and Klebsiella in C-section wound infection[30]. The variation in the spectrum of causative pathogens means that prophylactic antibiotics though effective may fail when the wrong agent is used or used inappropriately.

All the isolates in our study were sensitive to Gentamicine, except the least frequent organism Group-B Streptococcus and Enterobacter which were sensitive to Amoxicillin and Cephalosporins only. Cephalosporins were ineffective against most important isolates in our study, a finding that is identical to the study by Syed Ali et al[5]. This may be due to extensive and overuse of cephalosporin's (ceftriaxone) in our patients as it is provided free to admitted patients. In our study Staphylococci showed maximum sensitivity to Gentamicine and Amoxicillin, while Pseudomonas and E.Coli showed maximum sensitivity to higher order penicillin derivatives (Tazobact), a finding that is identical to the study by Livermore et al[31]. The nature of isolates and their antibiotic susceptibility pattern tends to change from place to place and from time to time, therefore the selection of antimicrobial agents for prophylactic use should take into account the expected flora and bacterial resistance patterns. Such type of surveillance study will serve as a guide to implement infection prevention practices.

CONCLUSION

Proper infection control measures are essential to control postoperative SSI. Furthermore selection of antimicrobial agents for empirical and prophylactic use should take in to account the expected flora and bacterial resistant patterns.

REFERENCES

1. Dodd JM, Reid K. Tocolysis for assisting delivery at caesarean section. Cochrane Database Syst Rev 2006; 4: CD004944.
2. Mangrum AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Infect Control Hosp Epidemiol 1999; 20: 250-80.
3. Horan TC, Ganes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of Nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. Infect Control Hosp Epidemiol 1992; 13: 606-8.

4. Shriyan A, Nayak N. Aerobic Micro-Organisms In Post- Operative Wound Infections And Their Antimicrobial Susceptibility Patterns. Journal of Clinical and Diagnostic Research. 2010; 4: 3392-96.

5. Ali SA, Tahir SM, Memon AS, Noshad A. Shaikh pattern of pathogens and their sensitivity isolated from superficial surgical site infections in a tertiary care hospital. J Ayub Med College Abbotabad. 2009; 21(2): 80-82.

6. Weber DJ, Raasch R, Rutala WA, Nosocomial infection in the ICU, the growing importance of antibiotics resistance pathogens. Chest 1999; 115: 34-41.

7. Emmons SL, Krohn M, Jackson M, Eschenbach DA. Development of wound infections among women undergoing cesarean section. Obstet Gynecol. 1988; 72(4): 559-64.

8. Jido TA, Garba ID. Surgical-site infection following cesarean section in Kano, Nigeria. Ann Med Health Sci Res 2012; 2: 33-36.

9. Opoien HK, Valbo A, Grinde-Anderson A, Walberg M. Post caesarean surgical site infections according to CDC standards: Rates and risk factors. A prospective cohort study. Acta Obstet Gynecol Scand 2007; 86: 1097-102.

10. Donowitz LG Wenzel RP. Endometritis following caesarean section. A controlled study of the increased duration of hospital stay and direct cost of hospitalization Am J Obstet Gynecol 1980; 137: 467-69.

11. Chama CM, El-Nafaty AU, Idrisa A. Caesarean morbidity and mortality in Maiduguri, Nigeria. J Obstet Gynaecol 2000; 20: 45-48.

12. Mitt P, Lang K, Peri A, Maimets M. Surgical-site infections following cesarean section in an Estonian university hospital: Postdischarge surveillance and analysis of risk factors. Control Hosp Epidemiol 2005; 26: 449-54. Infect Control Hosp Epidemiol 2005; 26: 449-54.

13. Johnson A, Young D, Reilly J. Caesarean section surgical site infection surveillance. J Hosp Infect 2006; 64: 30-35.

14. Kofman NS, Sheiner E, Levy A, Holcberg G. Risk factors for wound infection following cesarean deliveries. Int J Gynaecol Obstet 2005; 90: 10-15.

15. Killian CA, Graffunder EM, Vinciguerra TJ, Venezia RA. Risk factors for surgical-site infections following cesarean section. Infect Control Hosp Epidemiol 2001; 22: 613-17.

16. Yokoe DS, Noskin GA, Cunningham SM, et al. Enhanced identiûcation of postoperative infections. Emerg Infect Dis 2004; Nov; 10(11): 1924-1930.

17. Chaim W, Bashiri A, Bar-David J, Shoham-Vardi I, Mazor M. Prevalence and clinical significance of postpartum endometritis and wound infection. Infect Dis Obstet Gynecol 2000; 8: 77-82.

18. Pallasmaa N, Ekblad U, Tallberg AA, Uotila J, Raudaskoski T, Ulander VM, et al, Caesarean delivery in Finland; maternal complications and obstetric risk factors. Acta Obstet Gynecol Scand 2010; 89(7); 896-902.

19. Ghazi A, Karim F, Muhammad A, Ali T. Maternal morbidity in emergency versus elective caesarean section at tertiary care hospital J Ayub Med Coll Abbottabad 2012; 24(1).

20. Haider G, Zehra N, Munir AA, Haider A. Frequency and indications of C/S in a tertiary care hospital. Pak J Med Sci 2009; 25(5): 791-6.

21. Isibor OJ, Oseni A, Eyaufe A. Incidence of aerobic bacteria and Candida albicans in post operative wound infections. Afr J Microbiol Res. 2008; 2: 288-91.

22. Raees M, Yasmeen S, Jabeen S, Utman N, Karim R. emergency versus elective caesarean section. J Postgrad Med Inst 2012; 27(1): 55-62.

23. Odd DE, Rasmuseen F, Gunnel D, Lewis G, Whitelaw A. A cohort study of low APGAR score cognitive outcomes. Pediatrics 2004; 114: 1584-90.

24. Surveillance of surgical site infections in English hospitals 1997-2001. Nosocomial Infection National Surveillance Service (NINSS). PHLS publications 2001.

25. Shriyan A, Nayak N. Aerobic Micro-Organisms In Post- Operative Wound Infections And Their Antimicrobial Susceptibility Patterns. Journal of Clinical and Diagnostic Research. 2010; 4: 3392-96.

26. Nwachukwu, NC. Antibiotic Susceptibility Patterns of Bacterial Isolates from Surgical Wounds in Abia State University Teaching Hospital (ABSUTH), Aba – Nigeria. Research Journal of Medicine and Medical Sciences. 2009; 4(2): 575-79.

27. Perl TM, Roy MC. Postoperative wound infections: risk factors and role of Staphylococcus aureus nasal carriage. J. chemotherapy 1995 Jul; 7 Suppl 3: 29-35.

28. Emmons SL, Krohn M, Jackson M, Eschenbach DA. Development of wound infections among women undergoing cesarean section. Obstet Gynecol. 1988 Oct; 72(4): 559-64.

29. Ricky R. Sarvan, Kikani MK, Assudani J, Sanjay JM. Bacteriogical study of post operative wound infections and antibiotic susceptibility pattern of the isolates. Biennial J of GAPM, path and laboratory medicine, 2012.

30. Ogunsola FT, Oduyebo O, Iregbu KC, Coker AO, Adetunji A. A review of nosocomial infection at the Lagos university teaching hospital: Problems and strategies for improvement. J Nig Infect Contr Assoc 1998; 1: 14-20.

31. Livermore DM, Mushtaq S, James D, Potz N, Walker RA, Chariett A, et al. In vitro activity of piperacillin/Tazobactam and other broad spectrum antibiotics against bacteria from hospitalized patients in the British Isles. Int J Antimicrob Agents 2003; 22: 14-24.