

Antibiotic Sensitivity in Post Cesarean Surgical Site Infection at a Tertiary Care Centre in Eastern Nepal

Manisha Chhetry,^{a,d} Shanti Subedi,^{b,d} Sita Ghimire,^{b,d} Sabina Lamichanne,^{a,d}
Basudeb Banerjee,^{c,d} Ganesh Kumar Singh^{a,e}

ABSTRACT:

Introduction: Post cesarean surgical site infection (SSI) is one of the common complications diagnosed in 2.5%-16% of the cases and is associated with significant increase in maternal morbidity, hospital stay, costs, and psychological stress to the new parents. This study was designed to study the incidence of SSI and the antimicrobial resistance pattern in our hospital. **Methods:** This was a prospective observational study conducted from July 2015 to December 2015, in which all patients who were admitted with post cesarean SSI or developed SSI during their stay were included. Wound specimens were collected and susceptibility testing was carried out using disc diffusion technique. **Results:** The incidence of post cesarean SSI was 6.07% (47/774). Out of the 47 patients who had SSI, 35 (74.75%) had positive swab culture. The most important organism isolated was *Staphylococcus aureus* (82.85%) out of which 17 (58.62%) were MRSA strain. Resistance of *Staphylococcus* to penicillin was 84.6% whereas amikacin was found to be highly sensitive (>96%). Among the MRSA strain, resistance to ciprofloxacin, which is the currently used drug for prophylaxis, was 94%. Resistance to penicillins, cephalosporins, and clavulanate was also high. Resistance to vancomycin was also high (53%). Amikacin and chloramphenicol were found to be highly sensitive (94% and 90% respectively) in the MRSA group. **Conclusion:** MRSA is the leading cause of post cesarean SSI and is a matter of great concern. Amikacin and chloramphenicol were found to be highly sensitive in this group but unlike other studies, resistance of vancomycin was showing an increasing trend.

Keywords: cesarean section • methicillin-resistant *staphylococcus aureus* • microbial sensitivity tests • surgical wound infection

a - Lecturer

b - Assistant Professor

c - Professor

d - Department of Obstetrics and Gynecology

Nobel Medical College Teaching Hospital, Biratnagar, Nepal

e - Department of Microbiology

Nobel Medical College Teaching Hospital, Biratnagar, Nepal

Corresponding Author:

Dr. Manisha Chhetry

e-mail: manisha.chhetry2013@gmail.com

How to cite this article:

Chhetry M, Subedi S, Ghimire S, Lamichanne S, Banerjee B, Singh GK. Antibiotic sensitivity in post cesarean surgical site infection at a tertiary care centre in eastern Nepal. *Journal of Lumbini Medical College*. 2016;4(2):55-9. doi: 10.22502/jlmc.v4i2.90.

INTRODUCTION:

Cesarean delivery (CD) is the most common surgical procedure performed by obstetricians, with a rate around 15% worldwide and around 27.3% in Asia.^{1,2} One of the most common complications associated with cesarean section (CS) is infectious morbidity, out of which wound infection or Surgical Site Infection (SSI) is diagnosed in 2.5-16% of the cases. This rate depends on the pre-morbid condition of the patient as well as various surgical factors.^{3,4} SSIs have shown to increase mortality, readmission rate, and length of hospital stay.^{5,6} Post cesarean wound infections have undoubtedly been a surgeon's concern since time immemorial, but with

the increased isolation of atypical organisms and resistant strains of typical organisms, the problem has become a serious concern for care providers. Henceforth, the knowledge of common pathogens and their local antibiotic sensitivity patterns are cornerstone to the development of hospital infection prevention and control strategies.

This study was designed to study the rate of post cesarean SSI and the antimicrobial resistance pattern in our hospital.

METHODS:

This was a prospective, observational, hospital based study conducted between July 2015 to December 2015. All patients who were admitted in the postnatal ward with post cesarean SSI or developed SSI during their stay during the study period were included. Various associated risk factors were studied from their previous admission papers, labor sheets, theatre notes, discharge summaries, and history.

The diagnosis of SSI was made using the CDC clinical criteria.⁷⁻⁹ It defines SSIs as infections related to the operative procedure that occurs at or near the surgical incision within 30 days of an operative procedure meeting any of the following: purulent exudate draining from the surgical site, a positive fluid culture obtained from the surgical site that was closed primarily, the surgeons' diagnosis of infection or a surgical site that requires reopening. Patients who could be managed on outpatient basis or those who refused admission were excluded from the study.

The wound swabs were sent at the time of admission and the microorganisms and their antibiotic sensitivity patterns were studied. The patients were given standard wound care with daily wound debridement, oral antibiotics, and correction of co-morbidities along with supportive therapy. Eventually secondary closure of wound was done or in some cases wound was allowed to heal by secondary intention. All details were recorded in a pre-designed proforma.

All analysis was carried out using the statistical software SPSS version 16 for Windows. The values have been expressed as mean and standard deviation or median and inter-quartile range whichever applicable.

RESULTS:

Out of the total 2852 deliveries during the study

period, 774 (27.1%) were cesarean sections. Out of these, 47 (6%) patients were diagnosed with post cesarean SSI, according to the CDC criteria, and needed admission. Eight (17%) had undergone elective cesarean whereas 39 (83%) had emergency procedure. The mean age was 24.04 yr ($SD=4.6$). Thirty-five (74.8%) had positive swab culture and for the rest, culture was sterile. The most important organism isolated was *Staphylococcus aureus* ($n=29$, 82.9%) out of which 17 (58.6%) were MRSA variety. The sensitivity pattern is shown in Table 1 and Table 2. *Escherichia coli* were isolated in five cases (14.3%) whereas in one case (2.8%), *Klebsiella* was isolated. The sensitivity pattern is as shown in Table 3 and Table 4. Chloramphenicol and linezolid sensitivity was tested in two cases of *E. coli*. One case in each group was found to be sensitive to these drugs.

DISCUSSION:

Post cesarean SSI accounts for a considerable increase in the cost of health care and increased psychological stress to the new parents.^{10,11} Varied incidence has been quoted in other studies in Nepal

Table 1: Antibiotic sensitivity of *Staphylococcus aureus* in post cesarean SSI

Antibiotic	Staphylococcus aureus (n=29)		MRSA (n=17)	
	S	R	S	R
Cloxacillin/Cefoxitin	14 (48.3%)	15 (51.7%)	0	17 (100%)
Penicillin	4 (13.8%)	25 (86.2%)	0	17 (100%)
Cotrimoxazole	16 (55.2%)	13 (44.8%)	6 (35.3%)	11 (64.7%)
Erythromycin	14 (48.3%)	15 (51.7%)	6 (35.3%)	11 (64.7%)
Clindamycin	18 (62.1%)	11 (37.9%)	10 (58.8%)	7 (41.2%)
Gentamycin	20 (69%)	9 (31%)	12 (70.6%)	5 (29.4%)
Amikacin	28 (96.6%)	1 (3.4%)	16 (94.1%)	1 (5.9%)
Ciprofloxacin	4 (13.8%)	25 (86.2%)	1 (5.9%)	16 (94.1%)
Ofloxacin	3 (10.3%)	26 (89.7%)	0	17 (100%)
Ceftriaxone	0	29 (100%)	0	17 (100%)
Amoxicillin	1 (3.4%)	28 (96.6%)	1 (5.9%)	16 (94.1%)
Clavulanate	0	29 (100%)	0	17 (100%)
Vancomycin	12 (41.4%)	17 (58.6%)	8 (47.1%)	9 (52.9%)

S: Sensitive, R: Resistance

Table 2: Antibiotic sensitivity of *Staphylococcus aureus* to selective second line drugs

Antibiotics	Staph. aureus		MRSA	
	S	R	S	R
Tetracycline	1/2 (50%)	1/2 (50%)	1/2 (50%)	1/2 (50%)
Imipenem/Meropenem	4/4 (100%)	-	4/4 (100%)	-
Chloramphenicol	15/16	1/16	9/10 (90%)	1/10 (10%)
Linezolid	5/5 (100%)	-	2/2 (100%)	-

S: Sensitive, R: Resistance

Table 3: Antibiotic sensitivity of *E. coli* and *Klebsiella* in post cesarean SSI

Antibiotic	E.coli (n=5)		Klebsiella (n=1)	
	S	R	S	R
Penicillin	0	5 (100%)	0	1 (100%)
Erythromycin	1 (20%)	4 (80%)	0	1 (100%)
Gentamycin	3 (60%)	2 (40%)	1 (100%)	0
Amikacin	3 (60%)	2 (40%)	1 (100%)	0
Ciprofloxacin	1 (20%)	4 (80%)	0	1 (100%)
Vancomycin	1 (20%)	4 (80%)	0	1 (100%)

S: Sensitive, R: Resistance

Table 4: Sensitivity pattern of *E. coli* and *Klebsiella* to particular second line antibiotic

Antibiotic	E.coli (n=4)		Klebsiella (n=1)	
	S	R	S	R
Cloxacillin/cefoxitin	0	4 (100%)	0	1
Cotrimoxazole	0	4 (100%)	0	1
Clindamycin	1(25%)	3 (75%)	0	1
Ofloxacin	1(25%)	3 (75%)	0	1
Ceftriaxone	1(25%)	3 (75%)	0	1
Amoxicillin	0	4 (100%)	0	1
Clavunate	0	4 (100%)	0	1

S: Sensitive, R: Resistance

with an incidence of 12.6% in a study done by Shrestha et al. at Dhulikhel hospital whereas 2.7% in another study done in Patan hospital.^{12,13}

The risk factors for wound infections are multi-factorial with causes encompassing patient related factors, procedure related factors, and iatrogenic factors as well.¹² The presence of more than one risk factor or factors in combination

increases the likelihood of poor prognosis in the form of increased hospital cost and stay. Emergency procedures, where the surgery was unplanned, were more likely to develop SSI. This is in accordance with studies done elsewhere.¹² Among the patient related factors, those with prolonged rupture of membranes, malnutrition, and anemia, and those presented in labor were at high risk of having SSI. The commonly identified surgery related risk factors were prolonged surgery, competency and experience of surgeon, and the method of placenta removal.

The most common organism identified in our study was *Staphylococcus aureus* followed by *E. coli* and *Klebsiella*. This is similar to NNIS service survey data that reported *staphylococcus aureus* as the most common (47%) causative organism causing SSI.¹⁴ The species of microorganisms causing SSI were similar to other studies but over a period of time, more resistant strains have emerged.^{15,16} Out of the total cases of *Staphylococcus aureus*, 58.62% were MRSA. The hospital incidence of MRSA in a study done in 2015 was found to be 53.57%.¹⁷ This is higher when compared to the study done by Pandey et al. in *Staphylococcus* isolates from hospital where the rate of MRSA was 26.12%.¹⁸ Similar result was found by Baral et al. in a study done in BPKIHS from eastern Nepal.¹⁹ MRSA was isolated at the rate 75.5% from clinical samples in a study conducted by Rijal et al. in Pokhara Valley.²⁰ Similar study done in western parts of Nepal by Tiwari et al. also had shown alarmingly high (69.1%) rate of MRSA isolate which the authors have attributed to indiscriminate use of antibiotics and its accessibility.²¹

Staphylococcus aureus is one of the important organisms in SSI, more so because of the emergence of virulent antibiotic resistant strains. In the present study, the resistance of *Staphylococcus* to penicillin was 84.6%. Ineffectiveness to penicillin has been reported in other studies as well.^{16,22,23} Overall, in the *Staphylococcus* group, amikacin was found to be highly sensitive (>96%) followed by second line drugs imipenem/meropenem, and linezolid (100%). Overall resistance to vancomycin was found to be 58% unlike other studies.^{16,18,19}

Among the MRSA strain, resistance to ciprofloxacin, which is being currently used for prophylaxis was 94% and resistance to penicillins, cephalosporins, and clavulanate was also high (88%-100%); thus making the commonly used drugs fall out of favor. The resistance to penicillin and cephalixin was high in other studies as well.^{18,19} Unlike this study, resistance to ciprofloxacin was

only 17% in the study done by Pandey et al., 12% in another study done by Baral et al. at BPKIHS in eastern Nepal, as well as various studies in the western world.^{18,19,24} On the other hand, amikacin and chloramphenicol were found to be highly sensitive in the MRSA group (94% and 90% respectively), similar to other studies where resistance as low as 2-5% have been reported.^{18,19,25} Chloramphenicol is a broad spectrum antimicrobial which is less frequently used nowadays due to its bone marrow toxicity and also because of the availability of other safer first line drugs. Its infrequent use presently may be the reason of low resistance of this drug.

Among the second line antibiotic sensitivity, linezolid was found to be highly sensitive (95-100%) whereas vancomycin was found to be sensitive in 47% unlike other studies from various parts of Nepal where vancomycin was found to be highly sensitive in MRSA group.^{16,18,19}

CONCLUSION:

MRSA is the leading cause of post-cesarean SSI and is a matter of great concern. Amikacin and chloramphenicol were found to be highly sensitive but resistance of vancomycin was showing an increasing trend. Rational use of antimicrobials, active surveillance and reporting of SSI, implementation of infection control strategies, and their periodic review is the need of the hour.

Conflict of interests: None declared.

Acknowledgment:

1. Residents, interns, and nursing staffs in the postnatal ward.
2. Dr. Yogendra Gupta

REFERENCES:

1. Betran AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, et al. Rates of caesarean section: analysis of global, regional and national estimates. *Paediatr Perinat Epidemiol.* 2007;21(2):98-113.
2. Lumbiganon P, Laopaiboon M, Gülmezoglu AM, Souza JP, Taneepanichskul S, Ruyan P, et al. Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-08. *Lancet.* 2010;375(9713):490-9. doi: 10.1016/S0140-6736(09)61870-5.
3. Owen J, Andrews WW. Wound complications after cesarean sections. *Clin Obstet Gynecol.* 1994;37(4):842-55.
4. Kamat AA, Brancazio L, Gibson M. Wound infection in gynecologic surgery. *Infect Dis Obstet Gynecol.* 2000;8(5-6):230-4. doi: 10.1155/S1064744900000338.
5. Clarke B, Vine R. Australian Commission on Safety and Quality in Health Care (2011). *Windows into Safety and Quality in Health Care 2011*, ACSQHC, Sydney.
6. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol.* 1999;20(11):725-30.
7. Consensus paper on the surveillance of surgical wound infections. The Society for Hospital Epidemiology of America; The Association for Practitioners in Infection Control; The Centers for Disease Control; The Surgical Infection Society. *Infect Control Hosp Epidemiol.* 1992;13(10):599-605.
8. Horan TC, Gaynes 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(10):606-8.
9. Draft guideline for the prevention of surgical site infection, 1998--CDC. Notice. *Fed Regist.* 1998;63(116):33168-92.
10. Whitehouse JD, Friedman ND, Kirkland KB, Richardson WJ, Sexton DJ. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: adverse quality of life, excess length of stay, and extra cost. *Infect Control Hosp Epidemiol.* 2002;23(4):183-9.
11. Perencevich EN, Sands KE, Cosgrove SE, Guadagnoli E, Meara E, Platt R. Health and economic impact of surgical site infections diagnosed after hospital discharge. *Emerg Infect Dis.* 2003;9(2):196-203.
12. Shrestha S, Shrestha R, Shrestha B, Dongol A. Incidence and risk factors of surgical site infection following cesarean section at Dhulikhel Hospital. *Kathmandu Univ Med J.* 2014;12(46):113-6.
13. Pandit A, Sharma P, Yangzom K. Incidence of caesarean wound infection in Patan Hospital, Nepal. *Journal of Nepal*

- Medical Association. 2003;42(149):280-3.
14. Health Protection Agency. Surveillance of Surgical Site Infection in England: October 1997- September 2005. London: Health Protection Agency; 2006.
15. Schaberg DR, Culver DH, Gaynes RP. Major trends in the microbial etiology of nosocomial infection. *Am J Med.* 1991;91(3B):72S-75S.
16. De D, Saxena S, Mehata G, Yadav R, Dutta R. Risk Factor Analysis and Microbial Etiology of Surgical Site Infections Following Lower Segment Caesarean Section. *International Journal of Antibiotics.* 2013;2013:283025.
17. Singh GK, Chaudhari BK, Parajuli KP. Phenotypic study of Macrolide-Lincosamide-Streptogramin B Resistance in *Staphylococcus aureus* and their relationship with Methicillin-Resistant *Staphylococcus aureus* (MRSA) at Tertiary Care in Eastern Nepal. *Journal of Nobel Medical College.* 2015;5(1):1-5. doi: <http://dx.doi.org/10.3126/jonmc.v5i1.15745>.
18. Pandey S, Raza MS, Bhatta CP. Prevalence and antibiotic sensitivity pattern of methicillin- resistant- *staphylococcus aureus* in Kathmandu Medical College Teaching Hospital. *Journal of Institute of Medicine.* 2013;34(1):13-7.
19. Baral R, Khanal B, Acharya A. Antimicrobial susceptibility patterns of clinical isolates of *Staphylococcus aureus* in Eastern Nepal. *Health Renaissance.* 2011;9(2):78-82.
20. Rijal KR, Shrestha N, Pahari N, Shrestha B, Paudel B, Nepal A, et al. Methicillin Resistant *Staphylococcus Aureus* in patients visiting Western Regional Hospital, Pokhara. *Journal of Institute of Medicine.* 2008;30(1):21-5.
21. Tiwari HK, Das AK, Sapkota D, Sivrajan K, Pahwa VK. Methicillin resistant *Staphylococcus aureus*: prevalence and antibiogram in a tertiary care hospital in western Nepal. *J Infect Dev Ctries.* 2009;3(9):681-4.
22. Shapiro M, Munoz A, Tager IB, Schoenbaum SC, Polk BF. Risk factors for infection at the operative site after abdominal or vaginal hysterectomy. *N Engl J Med.* 1982;307(27):1661-6.
23. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. *Indian J Med Microbiol.* 2005;23(4):249-52.
24. Farzana K, Hameed A. Resistance patterns of clinical isolates of *Staphylococcus aureus* against five groups of antibiotics. *J Research Science.* 2006;17(1):19-26.
25. Diekema DJ, Pfaller MA, Schmitz FJ, Smayevsky J, Bell J, Jones RN, et al. Survey of infections due to *Staphylococcus* species: frequency of occurrence and antimicrobial susceptibility of isolates collected in the United States, Canada, Latin America, Europe, and the Western Pacific region for the SENTRY Antimicrobial Surveillance program, 1997-1999. *Clin Infect Dis.* 2001;32(Suppl 2):114-32.