

A Study of Surgical Site Infections (SSI) In Emergency Surgeries in A Tertiary Care Hospital

Mukta M. Deshmukh *, P.R. Bhise **

* Dr Panjabrao Deshmukh Memorial Medical College

** Dr Panjabrao Deshmukh Memorial Medical College, Amravati

DOI: 10.29322/IJSRP.10.07.2020.p10370

<http://dx.doi.org/10.29322/IJSRP.10.07.2020.p10370>

Abstract- Background :Surgical site infections are one of the most commonly reported nosocomial infections and are responsible for increasing morbidity, cost,rarely mortality related to operative procedures. The SSI rates reportedly range from 2.5% to 41.9% globally. Present study was conducted to study the prevalence of SSI in patients undergoing Emergency surgeries, to know the common causative organisms with their antibiotic susceptibility patterns.

Methods: Samples of purulent discharge received from the post- operative patients were processed for culture & sensitivity. Identification of isolates& Antibiotic susceptibility was done as per SOP.

Results 106 (22.08%) out of 490 emergency surgeries were having SSI. The SSI rate from emergency LSCS was 18.8 , abdominal surgeries 26.3 , orthopedic surgeries 28.7.The most common isolate from obstetrics surgeries was Staphylococcus aureus (33.3%)&E.Coli (21.1%). The most common isolate from abdominal surgeries was E.Coli 42.8% & Pseudomonas aeruginosa (17.2%).E.coli isolates were susceptible to Carbapenems & Amikacin. Staphylococcal isolates were susceptible to Linezolid &Vancomycin.

Conclusion : Prevalence of SSI in Emergency surgeries was found to be 22.08 % .E.Coli being the most common organism in abdominal surgeries &MRSA was the most common isolate from LSCS & orthopedic surgeries. Carbapenems and Amikacin were the most effective antimicrobials for enterobacteriaceae isolates ,whereas Linezolid &Vancomycin were effective for MRSA isolates.

Index Terms- Surgical site Infections , Emergency surgery

I. INTRODUCTION& LITERATURE SURVEY

Surgical Site Infections (SSI) are defined as the infections occurring at the incision sites within 30-90 days or one year (if implant is placed) after operative procedure. They are responsible for high morbidity & rarely mortality since centuries. Joseph Lister in 1860 introduced antiseptic surgery resulting in remarkable reduction in morbidity. Recent SSI prevalence reported range from 2.5% to 41.9 % Globally.^{1,2}

CDC has developed National Nosocomial Infection surveillance system^{13,14}, which classifies Surgical site infection into three types. Superficial incisional SSI, Deep incisional SSI , Organ/Space SSI

Superficial incisional SSI are defined as the infections occurring within 30 days of operative procedure involving skin & subcutaneous tissue & having purulent drainage or culture positive discharge , pain or tenderness or swelling at the site.

Deep incisional SSI are defined as infections occurring within 30 days or 90 days of operative procedure involving deep soft tissue, having purulent drainage from deep incision or fever and localized pain ,tenderness or abscess formation or other evidence of infection.

Organ/space SSI is defined as infection occurring within 30 days or 90 days or 1 year(in case of implants) after the operative procedure, Involving any part of anatomy other than incisional site, purulent drainage from drain or stab wound into organ or positive culture of aspirate from organ/space &other evidence of infection of organ/space.

Wound class is an assessment of the likelihood and degree of contamination of a surgical wound at the time of the operation. It should be assigned by a person directly involved in performing the operation or rarely by the inspecting physician.

Wound Class	Examples
Clean	Mastectomy, vascular hernias
Clean contaminated	Gastrectomy, Hysterectomy
Contaminated	Rupture appendectomy, Bowel resection
Dirty	Traumatic wounds, Intestinal fistula resection

Emergency operative procedure is defined as non-elective, unscheduled operative procedure which does not allow for standard immediate preoperative preparation normally done within the facility of scheduled operation like skin preparation.

Recently it has been defined as a procedure that is documented as per the facility's protocol to be an Emergency or Urgent procedure.¹⁴

Sources of SSI can be endogenous from patient's own flora or exogenous from Hospital environment. Certain organisms are being excluded from SSI criteria like Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus, Pneumocystis or Organisms associated with latent infections.

Factors influencing SSI rate –There are various factors which affect the SSI rate, like extremes of age, preexisting illness, type of wound, duration of surgery, pre & post operative stay, category of surgery i.e. elective or emergency. Various studies^{4,5,6,7} have shown the prevalence of SSI varying from 15.2-25.8% in emergency surgeries to 4.76 to 7.4 % in elective surgeries.

AIM & OBJECTIVES of the study were as follows.

1. To study the prevalence of SSI in post-operative patients with emergency surgeries.
2. To study the micro organisms associated with SSI and their antimicrobial susceptibility pattern.
3. To compare prevalence of SSI in surgical, obstetric and orthopedic emergency surgeries.

II. MATERIAL & METHODS

This cross sectional study was conducted in the Department of Microbiology Dr. P. D.M.M.H. Research centre Amravati from January 2018 to Dec. 2018. Patients who underwent Emergency surgeries in the departments of Surgery, Obstetrics & Orthopedic were included in the study. The study was approved by Institutional Ethical committee.

Inclusion & Exclusion criteria-

Samples received from patients with elective surgeries were excluded.

Samples obtained during surgical procedure were excluded.

Samples from incision site, aspirates from the post operative wounds from emergency surgery patients were included in the study.

III. PROCEDURE :-

Purulent discharge swabs, Aspirates from the incision sites received in the Department of Microbiology were processed & identification of isolates was done as per Standard Operative Procedures. Isolates were identified by performing different biochemical tests and confirmatory tests as per standard operative procedures.¹⁵ Antibiotic Susceptibility testing was carried out as per CLSI guidelines 2017 by Kirby-Bauer disc diffusion method¹⁶

IV. RESULTS & DISCUSSION:-

490 patients who underwent surgical, obstetrics & orthopedic emergency surgeries were included in the present study. 106 (22.08%) patients were suspected as having SSI.

The different types of surgeries were appendectomy, laprotomy for Intestinal obstruction, Intestinal perforation(148), Emergency LSCS(276), orthopedic surgeries for fractures, mainly multiple fractures (56.) (Table 1)

Table 1 Numbers of Different types of Emergency surgeries

S. No.	Type of Surgery	Number	Suspected SSI
1.	Appendectomy	85	28
2.	Intestinal Perforation	63	19
3.	LSCS	276	51
4.	Multiple Fractures	56	16

Out of 106 , 92 cases (87.6 %) were Culture positive. Overall prevalence of SSI in emergency surgeries in this study was found to be 22.08%. (Table 2)

Some Indian studies have reported the SSI prevalence in emergency studies ranging from 7.9 to 52.1 %.^{2,3,4,5,7,9.} In our study prevalence of SSI in Emergency LSCS was 18.8% .Some other studies it ranges from 6.03% to 23.08%^{10,11,12} Devjani De.etal reported SSI in Emergency LSCS as 23.08% , R.K Talukadar et al 6.03% , K.Vijaya A Padmaja reported 9.18% .

Table 2: Distribution of Culture positive Samples received from different types of Surgeries

Type of Surgery	No. of Samples received	No. Of Culture Positive
Obstetrics (LSCS)	51	46
Surgical Appendectomy Int. obstruction	39	35
Orthopedic	16	11
Total	106	92

In present study SSI prevalence from Surgery was 26.3 % , compatible with study by M.K Maheshwari from Meerut 23.8% ,and 24.14 % as per study by Patel Sachin M. from Ahmadabad ..Other studies with abdominal surgeries showed variations in SSI from 7.9 to 52.1 %^(3,5,9)The study from Aurangabad by Shahane V. et al have reported 7.9 % , Barnali Kakati et al reported it to be 15.2 % . Maximum of 52. 1% SSI was reported by Santosh M Patil from Sangareddy Telangana

In orthopedic surgeries our study showed the prevalence of SSI was found to be 26.7 % , the type surgeries were mostly trauma surgeries e.g. multiple fractures. Other studies showed SSI prevalence ranging from 3.7 to 25.8⁽⁶⁾

The commonest isolate from abdominal surgeries was Escherichia coli 30.3% Some other studies also E. coli as a common isolate 38.4 % -- Santosh Patil et al in 2016 ,35.7% Patel Sachin et al in 2012, 31.2 % -- VarshaShahane et al in 2012, 34.8% -- Gamal A khair et al in 2011,PankajkumarVerma et al has reported maximum of 71. 05 % E. coli isolates , where the SSI rate was also very high 66 % in abdominal surgeries e.g. Exploratory laprotomy with peritoneal lavage. Higher rate of isolation of E. coli from abdominal surgeries may be because ,the type of surgeries were mostly appendectomy or laprotomy for intestinal obstruction in which cases these wounds may be classified as contaminated causing endogenous infections. Which is like other studies, where E. coli or Klebsiella are the common infecting agents. Other studies where the common isolates from abdominal surgeries were E. Coli & Klebsiella are Barnalib Kakati et al 41.17 % , Gamal Khairy et al 35 % (Table 4)

Other isolates were *Staphylococcus aureus* (21.7 %), *Enterococcus* species (7.06 %), *Pseudomonas aeruginosa* (7.06 %), *Klebsiella pneumoniae*, *Acinetobacter baumannii*. (Table 3)

In our study the common isolate from LSCS patients was *Staphylococcus aureus* (21.6 %). Other studies showed difference in the common isolates from LSCS surgeries, K.Vijaya et al 21.7%, Devjani et al 22.7%, R.K.Talukadar et al 37.9%. Devjani et al have reported commonest isolate *Acinetobacter baumannii* 32.03%. (Table 5)

Table 3: Organisms isolated in different types of Surgeries

Isolate	Type of Surgery			Total no. of Isolates
	Abdominal	LSCS	Orthopedic	
<i>Escherichia coli</i>	19	9	0	28
<i>Staphylococcus aureus</i>	0	20	4	24
<i>Enterococcus</i> species	6	2	2	10
<i>Pseudomonas aeruginosa</i>	2	6	2	10
<i>Klebsiella pneumoniae</i>	7	2	0	09
<i>Acinetobacter</i> Sp.	0	5	2	07
<i>Proteus</i> spp.	1	2	0	03
<i>Streptococcus Pyogenes</i>	0	0	1	01

Table 4: Comparison of common isolates in Abdominal Surgeries with other studies

Author & year	E. coli	Klebsiella	Enterococcus
Present study (2018)	30.3 %	9.61%	7.06 % %
BarnalibKakati et al (2013)	41.17 %	9.80%	7.84 %
GamalKhairy et al (2011)	35 %	Other common isolate was <i>Pseudomonas</i> 25 %	
Patel Sachin et al, (2012)	35.7%	21.4%	-
Verma P et al 2017	71.6 %	-	-

Table 5: Comparison of common isolates in Emergency LSCS in other studies

Author & year	S.aureus	E.coli	Acinetobacter
Present study 2018	21.7%	9.78%	5.43 %
K.Vijaya et al 2013	21.1%	41.7%	-
Devjani De et al 2013	22.7%	-	32.03%
R.K.Talukadar et al, 2015	37.9%	18.3%	7.9 %

Antibiotic susceptibility Pattern:

In our study For gram negative isolates Carbapenems (Imipenem&Meropenem) were the better antimicrobials with 88.8 to 90 % susceptibility. Susceptibility of Amikacin 60 to 82.1 % Piperacillin- Tazobactam 66 to 80 % Cephalosporins have significantly low susceptibility ranging from 22 to 32 % (Table 6)

Table 6: Antimicrobial Susceptibility of Gram negative isolates

Isolate	No. of isolates susceptible to different Antimicrobials					
	Gentamicin	Amikacin	Cephalosporins	Ciprofloxacin	PIT	Carbapenems
E.Coli (28)	15 53.5%	23 82.1%	09 32.1%	10 35.7%	21 75%	25 89.3%
Pseudomonas (10)	06 60%	06 60%	03 30%	04 40%	08 80%	09 90%
Klebsiella (9)	06 66.6%	07 77.7%	02 22.2%	04 44.4%	06 66.6%	08 88.8%

In gram positive isolates 66.6 % of Staphylococcal isolates were MRSA, but all the isolates were susceptible to Vancomycin. Linezolid (93.7 %) Amikacin (81.3 %) were other better antimicrobial agents. 50 % of Enterococci were Vancomycin resistant. (Table 7)

Table 7: Antimicrobial Susceptibility of Gram positive isolates.

Isolate	No. of isolates susceptible to different Antimicrobials					
	Ampicillin	Amikacin	Erythromycin	Ciprofloxacin	Linezolid	Vancomycin
MRSA (16)	04 25%	13 81.3%	06 37.5%	05 31.2%	15 93.7%	16 100%
MSSA (06)	03 50%	06 100%	03 50%	04 66.6%	06 100%	06 100%
Enterococcus (10)	03 30%	04 40%	02 22.2%	05 50%	09 90%	05 50%

Different other also report similar type of antimicrobial susceptibility pattern. Birendrak.jain et al, SantoshM.Patil et al reported 50 % MRSA Resistance to more than three antimicrobials (MDR) is 33.3 % by Birendra Jain et al. VarshaShahane et al reported concordant results of Carbapenem, Amikacin & Cephalosporin Susceptibility as 100 % ,78 % & 10 % respectively. Barnali Kakati et al also reported more than 66 % resistance to all generations of Cephalosporins , but 100 % susceptibility to Imipenem (Table 8)

Table 8 : Comparison of Antimicrobial susceptibility in different studies

Study by Author	Reported resistance/Susceptibility	
	MRSA	Gram Negative Isolates
Birendra Jain et al	50%	MDR – (Resistant to more than 3 antimicrobials)—33.3 %
Devjani De et al	23.8 %	100 % Susceptibility to Imipenem 20-39 % to Cephalosporins
VarshaShahane et al	-	Amikacin – 78 % Imipenem 100 % Cephalosporins -10 %
SantoshM.Patil	50%	-
BarnaliKakati et al	28.7 %	Imipenem 100 % Cephalosporins -34 %

V. CONCLUSION

Higher Prevalence of SSI in Emergency surgeries - 22.08 % .E. Coli being the common organism in abdominal surgeries. MRSA being commonly isolated from LSCS & orthopedic surgeries. According to the susceptibility pattern ,lesser options for antimicrobial agents for treatment. Therefore active surveillance is needed to target the risk factors which can be minimized by practicing preoperative , Intraoperative & postoperative preventive measures as per WHO guidelines

REFERENCES

- [1] Patel SM, Patel MH, PatelSD, Kinariwal DM,Vegad MM. Surgical site Infections: Incidence & Risk factors in a tertiary care hospital Western India. NJCM 2012;3(2):193-96.
- [2] Stephen A,Jerome A,MustaphaI,KuewaRA,Mawufemor, BurgiS;Post operative Surgical site Infection in aSurgery Ward of Tertiary Care hospitalin North Ghana Inter National Journal of Research & Health sciences2014;2(1)207-12
- [3] ShahaneV,BhawalS,LeleU;Surgical site Infections:A one Year Prospective study in a tertiary care center,IntJHealthSci.(Qassim)2012 Jan 6(10:79-84
- [4] Maheshwari MK,PandeyS, BhatnagarAK,AgrawalaA;A post operative study of Surgical Site Infection in elective & Emergency abdominal surgery in CSSH, Meerut. Journal of Advance Researches in Biological Sciences 2013;5(4)414-18
- [5] Kakati B,AshishK,GuptaP, SachanPK,ThakuriaB;Surgical site abdominal wound infections Experience at north Indian Tertiary care HospitalJIACM2013;14(1)13-19
- [6] JainBK.,BanerjeeM;Surgical Site Infections and its risk factors in Orthopedics: I A prospective study in teaching Hospital of Central India.Int.J Res Med 2013;2(1)110-13
- [7] KhairyGA,KambalAM,AbdullahA,MohammadY,AlShehri,ZubaideAM,MohammadYA, Faisal AA,OmerYE,AmalAA;Surgical Site Infection in Teaching Hospital: A prospective study:JTU Med Sc2011;6(2)114-20
- [8] VermaPK,SinghA,ShahiKS,KalaSR,JaiswalA ;Post operative wound infection in Emergency Abdominal Surgeries PARIPEX-INDIAN JOURNAL OF RESEARCH 2017;6(4)46-48
- [9] .PatilSM,KumarSK,RajeshK;Surgical Site Infections in a Rural Hospital:A prospective Study IJSS Journal of Surgery, 2016;2(1) 11-14
- [10] De Devjani,SaxenaS,MehtaG,YadavR,DuttaR;Risk factor Analysis and Microbial Etiology of Surgical Site Infectins following Lower Segment Caesarian Section.International journal of Antibiotics, 2013.
- [11] TalukadarRK, GharphaliaDJ,Acharjee U;Surgical siteinfrctions following Emergency LSCS-to find out the incidence, risk factors &commonly Associated Bacteria.Sch.J.App.Med.Sci.2015;3(8A)2794-2801.
- [12] K Vijaya,A Pdmaja,P.Anusha,N Vivekanand;Surgical Site Wound Infection in Emergency and Elective LSCS A comparative study. Sch.J.App.Med.Sci.2015;3(9D)3412-17.
- [13] CDC procedure-associated module SSI Jan2016-9 1-28.
- [14] CDC National and healthcare-Associated Infections Progress report, Published March 2014, available at <http://www.cdc.gov/HAI/pdfs>.
- [15] ColleJG,FraserAG,MarmionBP,SimmonsA. Mackie and Mc Carteny Practical Medical Microbiology.14th edition Edinburgh: Chuechill Livingstone;1996.p.113-49.
- [16] CLSI.Performance Standards for Antimicrobial Susceptibility Testing: Twenty sixth Informational Supplement. CLSI document M100-S26. 2017.

AUTHORS

First Author – Mukta M. Daeshmukh , MBBS M.D. Microbiology,Associate Professor, Department of Microbiology, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra State , India, Mail-muktamdeshmukh@gmail.com.

Second Author – Pramod R. Bhise MBBS M.D. Microbiology Professor & Head, Department of Microbiology, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra State , India, Mail- pramodrbhise@gmail.com.