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TO STUDY THE MICROBIOLOGICAL PROFILE OF SURGICAL SITE INFECTIONS IN POST OPERATIVE PATIENTS AT A TERTIARY CARE CENTRE, UTTAR PRADESH, INDIA

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ABSTRACT

Introduction:The problem of surgical site in fection(SSI),which contributesto significant morbidity and death, lengthens hospital stays, and ultimately raises healthcare expenditures, is still widespreadand common.

Aim and Objectives: To study themicrobiological profile of surgical site infections in post operative patients at a tertiary care centre, Uttar Pradesh, India.

Material and Methods: This was a Cross-sectional study conducted in a hospital setting over theperiod of 1 year 6 Monthi.e,, October 2022 to April 2024 at a Rama Medical College Hospital & Research Centre. All surgically treated patientsofbothsexeswereincluded.Patientswhoreceivedasecondsurgeryatthesamelocationforanyreason,patientsreceivingimmunosuppressantmedication,peoplewith immunodeficiency diseases, people currently taking antibiotics, and people with infectionselsewherewereallexcluded fromparticipating.Iftherewassignsofawoundinfection48hours after surgery, the patient was diagnosed with SSI. Suitable statistical analysis was carried out to analyse the data.

Results: A total no. of 99 patients underwent different types of surgeries. Out of 99 sample 52were observed to be culture positive. Among the 52 culture positivecases Gram positive bacteria was most common isolated32(32.2%) other than Gram negative bacteria 20(20.2%).The positive casesof MSSA was found to be (26.9%), CONS (17.3%), MRSA (11.5%)whereas in case of GNB,Klebsiellaoxytocaand Pseudomonas aeruginosawas found to be(9.6%), Klebsiella pneumoniae(7.6%)followed byE.coli,Proteus mirabiliswith (3.8%), and least for Staphylococcus epidermitidis , Staphylococcus lugdinensis , Citrobacter, Enterobacter and MRCONSwith (1.92%). It was observed that the site of the infection most common affected was the superficial site with (81.2%)

Conclusion: Abdominal surgeries were more likely to result in SSIs. After any type of surgery, patients who were male, with the age group of 30 years or above , had emergency surgery, had diabetes, and/or have had a lengthy hospital stay are more likely to develop SSIs.The increasing occurrence among male was attribute to the nature of the infected wounds which they come to surgical department.

Keywords: *Surgical site infection, Prevalence, Microorganisms, Hospital stay*

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1. INTRODUCTION

The invasion of organisms into tissues as a result of a breakdown in the local and systemic hostdefences that causes cellulitis, lymphangitis, abscess, and bacteremia is known as wound infection.Surgicalsiteinfections(SSIs)areinfectionsthatdevelopinsurgicalsites[1].Infectionsthatdamageeithertheincisionordeeptissueattheoperationsiteandhappenwithin30daysofsurgery,orwithina year if an implant is left in place after the procedure, are referred to as SSIs [2]. Organ/spaceinfections, deep infections, and superficial infections are the three categories according to theNationalNosocomialInfectionSurveillanceProgramme(NNIS) [3].

Thepatient'sownnaturalflora,germsfromthehospitalenvironmentthatthepatientcontractsduringtreatment, particular underlying disorders, trauma, or burns that could disrupt the mucosa or skinsurfaceareallpotentialsourcesofSSIs[4].SSIsareseverepostoperativecomplicationsthataccountfor 20% of infections connected with healthcare and happen in about 2% of surgical procedures.Accordingtonumerousresearch,SSIsarethethirdmostfrequentnosocomialinfectionafterrespiratory tract and urinary tract infections [2,5]. According to recent studies, the SSI rate variesfrom19.4% to 36.5% globally,but only from 3% to 12% in India[6-8].

SSI is still a prevalent and common issue that contributes to high rates of morbidity and mortality,lengthens hospital stays, and consequently raises healthcare expenses. Length of hospital stay,obesity, diabetes mellitus, smoking, etc. are all risk factors for SSIs. The complicated interaction ofnumerous factors determines whether a surgical wound infection may develop. The majority ofpostoperative wounds have an endogenous cause of infection. Exogenous infections are typicallypicked up through the surgical team's noses or skin flora and spread by the surgeon's hands orinappropriate sterilisation of the operating theatre, which includes preoperative, intraoperative, andpostoperativecare [9].

Somesignificantfactorsthatcaninfluencetheincidenceofsubsequentinfectionaresurgicaltechniques, skin preparation, timing, the method of wound closure, and antibiotic prophylaxis aftercertain types of surgery. Also, many other factors have been identified as having an effect on thepotentialforinfection,andtheseshouldbeconsideredbyhealthcareprofessionalsbefore,during,andaftersurgery [10].

EstablishingworldwideincidenceofSSIsingeneralsurgicalpatientsisimperativetounderstandtheextent of the condition, its burden on society, and the demographic and clinical risk factors thatpredispose general surgical patients to develop SSIs. Such information will enable the identificationof demographic and clinical trends over time, across patient subgroups and will assist decision-makerstoimprovetheplanninganddeliveryofsurgicalcare.Therefore thepresentstudywasundertaken, to study the microbiological profile of surgical site infections in post operative patients at a tertiary care centre, Uttar Pradesh, India.

2. MATERIAL AND METHODS

Study settings and duration
This was a hospital-based, cross-sectional study carried out in the Department of Microbiology with collaboration with the Surgery Department at a tertiary care centre. The study was carried out over a period of study 1year6months from October 2022 to April 2024. The Ethical clearance was duly obtained from the Institutional Ethical Committee.

Study population and sampling technique
All the cases admitted to the surgical wards (including both elective and emergency surgery) during the study period and those who met the eligibility criteria were included in the study.

Sample size calculation
The prevalence of SSI observed in the study by Tabiriet al. was 11.5% [11]. Based on this study, consideration.

SAMPLE SIZE:- SS (n)= 4PQ/L2 Where,P=Prevalence,Q= 100-p,L= Allowable error, If the allowable error is 5 % SS (n) = 4×72x28
Sample Size (n) = 8064/81= 99

The sample size taken in our research study was 99 .

Inclusion criteria

1.Pus samples from surgical site infection of Post Operative patients of both sexes of all age group.
2. All patients from both IPD & OPD, culture positive for Staphylococcal infection was included in this study.
3. Patients of all age and gender was included in our study.
4. Samples showing Staphylococcus species as single causative agent of infection was included in this study.

Exclusion criteria

Pus samples from other than surgical site infection of patients of both sexes will be excluded in the study.

Ethical clearance

The study was carried out after getting ethical approval from the Institutional Ethical Committeeandwritten consent wasobtained from every study subject.

Data collection procedure

Data about the age of the patients,gender,demographic details,clinical details including the name of the procedure, date and duration of surgery, the experience of surgeons, ,nature of the surgery, postoperative hospital stay, and the onset of illness (SSI) were collected byreviewingthepatient's casesheet.The surgical wound dressings were removed 48 hours after the procedure. Indications of a woundinfection was taken into account if the patient displayed local inflammatory changes at the woundsite, such as edoema, redness, warmth, or discharge. If before applying the bandage, samples weretakentodetermineiftherehadbeenanydischarge.Inflammatorychangesalonewerepresentbutdidnot have any discharge, the wounds were watched for the emergence of until the patient was senthome, thewound.If inflammatory symptomsemergedwithin48hours, patientswerefollowedwiththe assistance of the corresponding surgeons. These patients also received education and followed up for the creation of SSIs through mobile phone for the development of SSIs over a period of 30 days. The suspected wound infections were cleaned with sterile normal saline, followed by 70% alcohol, and then the specimen was collected using a sterile swab. Two swabs were taken from the depth of the wound, and/or the aspirates were collected in a sterile disposable syringe and transported to the laboratory within two hours. The color, consistency, and odor of the samples were observed and recorded.A direct thin smear was made from each wound swab and/or aspirates on a clean grease-free glass slide and was air dried. It was then heat-fixed, and Gram staining was done with positive and negative control (American Type Culture Collection [ATCC] Staphylococcus aureus 25923 and Escherichia coli 25922).

The presence of pus cells and microorganisms was observed under the oil immersion (100X) objective. The samples were cultured onto nutrient agar, 5% sheep blood agar, and MacConkey agar plates by adopting standard microbiological techniqueAfter 24 hours of incubation aerobically at 37°C, plates were read, and the isolates were identified based on colony morphology, Gram stain, motility, and biochemical tests.

Data analysis

The data obtained were entered in Microsoft Excel (Microsoft Corp., Redmond, WA), and the results were analyzed using SPSS (Statistical Package for the Social Sciences) version 21 (IBM Corp., Armonk, NY). All the data collected in the current study was categorical, so they were expressed in a table as frequency and percentage. Also, the figures were expressed as a pie chart. The association between risk factors and the presence of SSI was assessed using the Chi-square test. With a 95% confidence interval, a p-value of less than 0.05 was considered statistically significant.

3. RESULTS

A total of 99 patients underwent different types of surgeries,SSIs were more common in the males (72.7%)as compared to the females (27.2%)Including elective as well as emergency procedures, during the study period..The number of cases that developed SSIs in relation to the type of Organism is shown in Table 1.

Site of Surgery	Types of Surgeries	No.of Surgeries, n
Abdomen	Appendectomy	9(9.09%)
	Herniarepair	5(5.05%)
	Exploratorylaparotomy	4(4.04%)
	Cholecystectomy	26(26.2%)
	Lowersegmentcesariansection	1(1.01%)
	Hysterectomy	1(1.01%)
	Sphincterotomy	

Pelvis	Hemorrhoidectomy Fistulectomy Hipreplacement	1(1.01%) 4 1(1.01%)	Table
Urogenital	Transurethralresectionofprostate Urethroscopylithotripsy	1(1.01%) 1(1.01%)	
Breastand axilla	Modifiedradical Mastectomy Fibroadenomaexcision	1(1.01%) 1(1.01%)	
Skin,bone,andjoints	Kneereplacement Varicosevein Openreductionandinternalfixation	7(7.07%) 40(40.4%)	
Eye	Intraocularlensimplantation	00	
Ear,nose, Throat	Tonsillectomy	1(1.01%)	
	--		
Neurosurgery	--		
Total		99	

Table.1Total number of Pus Sample from post operative cases of wound for culture other isolates

Types of organism	Numbers of isolates	Percentage
MSSA	14	26.9%
CONS	09	17.3%
MRSA	06	11.5%
Klebsiella Oxytoca	5	9.6%
Pseudomonas Aeruginosa	5	9.6%
Klebsiella Pneumoniae	04	7.6%
Escerichia coli	02	3.8%
Proteus Mirabilis	02	3.8%
Staphylococcus Epidermidis	01	1.9%
Staphylococcus Lugdinensis	01	1.9%
MRCONS	01	1.9%
Citrobacter	01	1.9%
Enterobacter	01	1.9%

Graph 1. Graphical representation of the types of Organism

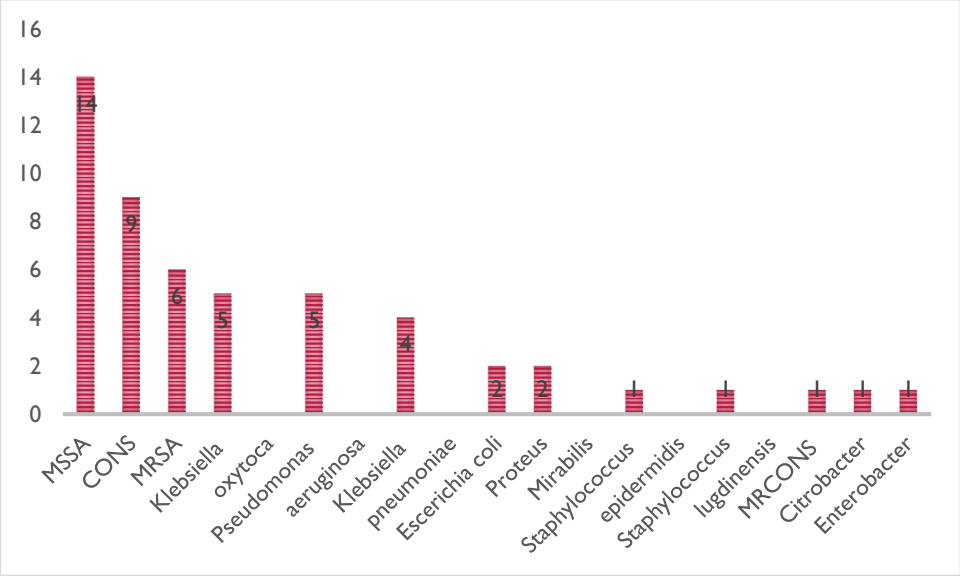

Table2. Age wise distribution of all isolates

S.no	Age	No.of Isolates(n=99)	Percentage
1	0-10	12	12.1%
2	11-20	14	14.1%
3	21-30	14	14.1%
4	31-40	10	10.1%
5	41-50	25	25.2%

6	51-60	11	11.1%
7	60-70	09	9.09
8	≤71	04	4.04
9	Total	99	100%

Graph 2.Gender wise distribution of all the isolates

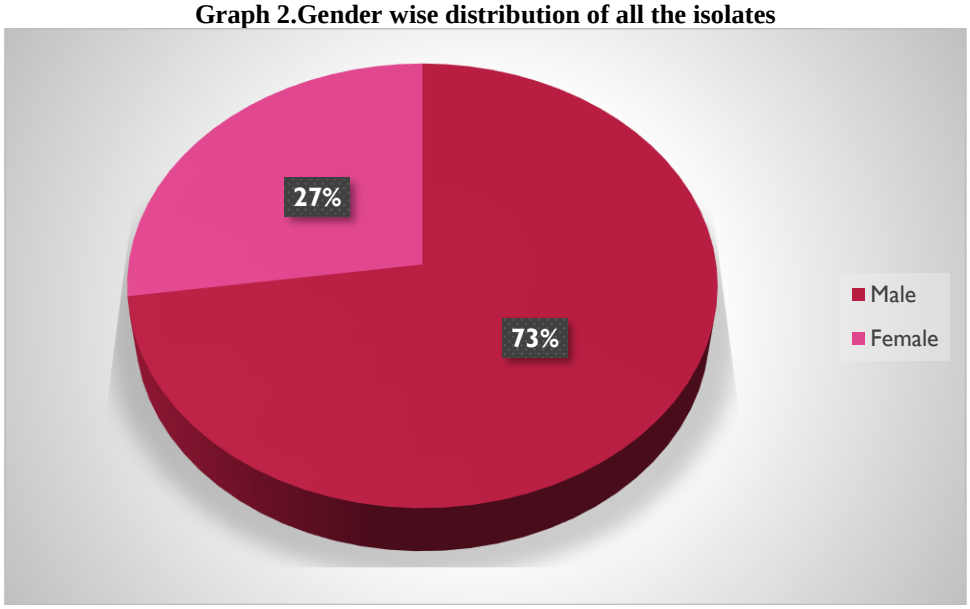

Table .3 Distribution of SSI cases of all the isolates

S.no	Type of wound	Numbers(n=99)	Percentage
1	SUPERFICIAL INCISIONAL SSI	92	92.9%
2	ORGAN SPECIFIC	00	0%
3	DEEP	07	7.07%

Table .4 Distribution of SSI cases in elective surgery and emergency surgery

Types of Surgery	Numbers	Percentage
ELECTIVE SURGERY	40	40.4%
EMERGENCY SURGERY	59	59.5%

4. DISCUSSION

Surgicalsiteinfections(SSI),oneofthemostcommoncausesofnosocomialinfectionsareacommoncomplication associated with surgery, with a reported incidence rates of 2-20% [12]. They areresponsible for increasing the treatment cost, length of hospital stay and significant morbidity andmortality.Despitethetechnicaladvancesininfectioncontrolandsurgicalpractices, SSIstillcontinuetobeamajorproblem,eveninhospitalswithmostmodernfacilities[13].Theseinfectionsareusuallycaused by exogenous and/or endogenous micro organisms that enter the operative wound eitherduring the surgery (primary infection) or after the surgery (secondary infection). Primary infectionsareusually moreserious,appearing within five to seven days ofsurgery[14]

Bacteriological studies have shown that SSIs are universal and the etiological agents involved mayvary with geographical

location, between various procedures, between surgeons, from hospital tohospitaloreven in different wards ofthesamehospital [13].

Out of the total of99 patients showed local signs and symptoms and were suspected to havepostoperative wound infections. These cases were evaluated and followed up. Among them, theculture positive was observed in 52cases.. The current status of SSIsidentified in their hospital concurs with the studies of Golia et al. [15] and Iqbal et al. [16]whoreported the prevalence rate as 4.3%, 5.4%, and 7.3%, respectively, which were in accordance to thecurrent study. There were other studies performed by the other research investigators which were incontrasttothepresentstudywhere,Kumaretal.[8]andAl-Mulhimetal.[17]reportedintheirstudythattheoverallprevalencerateofSSIswas2.5%,whichwaslesserthanonethirdofourpresentstudyrate.

There was another study which was also in contrast to the present study by Setty et al. [18] whichreportedthe prevalencerate to bequitehigh with21.66%and22.2%respectively.

In the present study it was observed that the ratio of Males 72 (72.7%) was more as compared to thatoffemales27(27.2%).ThisstudywassimilartothestudyperformedbytheotherresearchinvestigatorVikrant Negi et al.,[19]where Males (74.6%) were more commonly affected than females (25.5%)andthesexratiomale: femalewas2.9:1.AstudybyHernandezetal.,in2005conductedinaPeruvian Hospitalreported moreoccurrences among males(65.6%)[20].In contrast, a study done by Shanmugam et al. reported almost equal occurrences among females(52%) and males (48%) [21]. The increasing occurrence among males was attributable to the natureoftheinfected wounds with which they come tosurgical departments.The increasing occurrence among male was attribute to the nature of the infected wounds which they come to surgical department. Inthecurrentstudyitwas observedthatthemaximumnumberofisolatesfoundwereintheagegroupof41-50yearsofagefollowedby0-10 yearsofageandleastintheagegroupof≤71yearsofage.This study was similar to the study performed by the other author [19] where the 31 -50 years wasaffected the most. The patients with age >50 years had a higher incidence of SSI (51.8%) incomparisontoanincidenceof12.4%amongthepatientswhowere≤30yearsof age.Advancingageis an important factor for the development of SSIs, as in old age patients there is low healing rate,lowimmunity,increasedcatabolicprocessesandpresenceofco-morbidillnesslikediabetes,hypertension,etc [22].

Other research investigators, Owens et al. [23] and Bharatnur et al. reported that a greater number ofSSIsoccurredamong36-50years(1.3timeshigherriskofacquiringSSIsthantheoneswhowereintheagegroupof10-35years).Similarly, ahighrateofinfectionwas notedinthelateragegroupsbyMundhada et al. [24]. It was also observed that there were increase cases in the emergency ward(85.7%).The increased rate of SSI in emergency surgeries may be due to a very narrow time spanwithout proper patient preparation and surgical preparedness as well as contaminated wounds as incases of road traffic accidents. The same have been cited in most of the studies done earlier on SSIs.Tabirietal.alsoreportedthatemergencycaseshadahighernumberofSSIs(23.8%)ascomparedto elective cases (7.4%)[11]. In another study done by Dessie et al., SSIs were reported in 61.7% of emergency cases and 38.3% of elective cases [25]. In the present study, it was observed that superficial and deep SSIs were observed with the ratio of 57.1% and 42.8% respectively. There was no SSIs observed in the organ site. There was another study which was similar to our study where the rate of SSI in superficial was more with 69 (59.4%) and 47 (40.5%), respectively. Superficial SSI was found to be higher. Kumar et al. [8] reported that superficial incision SSI was more prevalent (215 cases, 55.9%) followed by deep incisional SSI (169 cases, 44%), and van Walraven et al. [26,27] reported the same that a majority of these (n= 8188, 57.5% of all SSIs) had a superficial component. This is discordant with the study by Dessie et al., who reported superficial SSI as 42.1% and deep SSI as 57.9% (112 cases) [25].

In the present study a total no of 99 patients underwent different types of surgeries. Patients who 59 emergency surgery have a higher risk of getting SSI than those who underwent elective surgery. In the present study it was also observed that MSSA (26.9%) CONS (17.3%) MRSA (11.5%) Klebsiella oxytoca&Pseudomons aeruginosa (09.6%) Klebsiella pneumoniae(7.6%) was the most common isolate followed by E.coli ,Proteus mirabilis (3.8%), and least for Staphylococcus epidermitidis , Staphylococcus lugdinensis , Citrobacter, Enterobacter with MRCONS(1.92%) . It was observed that the site of the infection most common affected was the superficial site with (81.2%).There was the another studywhich was in support to the present study where E. coli (46.4%) was the commonest gram negativebacteria isolated followed by P. aeruginosa (15.9%) and Citrobacter spp(15.9%) [19].Similarobservationshavebeenreportedbyvariousotherauthorsalso[28-30].FewstudieshavereportedP.aeruginosaasthemostfrequentisolateinSSI[31,32]whichremainsathirdmostisolatedstrain inthis study.

Bacteriological studies have shown that SSIs are universal and the etiological agents involved mayvary with geographical location, between various procedures, between surgeons, from hospital tohospital or even in different wards of the same hospital [2]. In the recent years there has been agrowing prevalence of gram negative organisms as a cause of serious infections in many hospitals.Inadditionirrationaluseo fbroadspectruma ntibioticsandresultinganti microbialresistance

(AMR) has further deteriorated the condition in this regard. Although there are many programmes centeredto basic key principles of surgical care and antibiotic prophylaxis, there are still some unresolvedissues regarding some aspects in antibiotic prophylaxis in surgical care patients drug dose inobesepatients,specifictimings ofantibioticadministration, roleofantiMRSA prophylaxisetc.

5. CONCLUSION

Surveillance of SSI along with feedback from surgeons will help to reduce the SSI rate and thissurveillancesystemshouldbedevelopedinallhospitalsandalsoguidelinesforantibioticuseamongsurgical patients should also be developed and strictly followed which may provide the estimate ofincidenceof SSI.

Limitation

One of the study's limitations was that the wound swabs from SSIs were not subjected to fungalcultures or anaerobic bacterial profiles. It is possible to carry out further prospective research in thisarea.

REFERENCES

1. Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical siteinfectionsamongpatientsundergoingmajorsurgeryatBugandoMedicalCentreinNorthwesternTanzania..BMC Surg.2011;11:21
2. Afaq N et al. Unveiling the Antimicrobial Potential of Ricinus communis: A Comprehensive Review of Its Relevance to Surgical Site Infection (SSI) Pathogens.Cureus. 2025 Dec 21;17(12):e99803. doi: 10.7759/cureus.99803
3. Tabiri S, Yenli E, Kyere M, Anyomih TT. Surgical site infections in emergency abdominalsurgeryat TamaleTeaching Hospital, Ghana.World JSurg.2018; 42:916–922.
4. Shah K, Singh S, Rathod J. Surgical site infections: incidence, bacteriological profiles and riskfactors in a tertiary care teaching hospital, western India. Int J Med Sci Public Health. 2017;6:173–176.
5. ShahaneV,BhawalS,LeleU.Surgicalsiteinfections:Aone-yearprospectivestudyinatertiarycarecenter.Int J Health Sci (Qassim).2012;6(1):79-84.
6. RakaL,KrasniqiA,HoxhaF,MusaR,MulliqiG,KrasniqiS,etal.SurgicalsiteinfectionsinanabdominalsurgicalwardatKosovoTeachingHospital.JInfectDevCtries.2007;1(3):337-41.
7. Shah K, Singh S, Rathod J: Surgical site infections: incidence, bacteriological profiles and riskfactors in a tertiary care teaching hospital, western India. Int J Med Sci Public Health. 2017;6:173-6. 10.5455
8. Kumar A, Rai A: Prevalence of surgical site infection in general surgery in a tertiary care centreinIndia .IntSurg J. 2017;4:3101. 10.
9. SanjayKR,PrasadMNN,VijaykumarGS:Astudyonisolationanddetectionofdrugresistancegram negative bacilli with special importance to post operative wound infection. J MicrobialAntimicrob.2010; 2:68-75.
10. GottrupF,MellingA, Hollander DA:An overview of surgicalsite infections:aetiology,incidence and risk factors. World Wide Wounds.2005;5:11-5.
11. Tabiri S, Yenli E, Kyere M, Anyomih TT: Surgical site infections in emergency abdominalsurgeryat TamaleTeaching Hospital, Ghana. World J Surg. 2018;42:916-22.
12. HohmannC,EickhoffC,RadziwillR,SchulzM.Adherencetoguidelinesforantibioticprophylaxisinsurgerypatientsin Germanhospitals:amulticentreevaluationinvolvingpharmacyinterns. Infection. 2012; 40(2):131–37.
13. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. JHosp Infect. 2008; 70(Suppl 2):3–10.
14. PradhanGB,AgrawalJ.Comparativestudyofpostoperativewoundinfectionfollowingemergencylowersegmentcaesa reansectionwithandwithoutthetopicaluseoffusidicacid.Nepal Med Coll J.2009; 11(3):189–91.
15. Golia S, Kamath ASB, Nirmala AR: A study of superficial surgical site infections in a tertiarycarehospitalat Bangalore.Int J Res Med Sci. 2014, 2:647-52.
16. Iqbal F, Younus S, Asmatullah, Zia OB, Khan N: Surgical site infection following fixation ofacetabularfractures. HipPelvis. 2017, 29:176-81.
17. Al-Mulhim FA, Baragbah MA, Sadat-Ali M, Alomran AS, Azam MQ:Prevalence of surgicalsiteinfection in orthopedic surgery: a5-year analysis. Int Surg. 2014; 99:264-8.
18. Setty NKH, Nagaraja MS, Nagappa DH, Giriyaiah CS, Gowda NR, Naik RDML: A study onsurgical site infections (SSI) and associated factors sin a government tertiary care teachinghospitalin Mysore, Karnataka.Int JMed PublicHealth. 2014; 4:171.
19. VikrantNegi, ShekharPal, DeepakJuyal,MuneshKumarSharma, and NeelamSharma.BacteriologicalProfileofSurgicalSiteInfectionsandTheirAntibiogram:AStudyFromResource Constrained Rural Setting of Uttarakhand State, India. J Clin Diagn Res. 2015; 9(10):DC17–DC20.
20. Hernandez K, Ramos E, Seas C, Henostroza G, Gotuzzo E: Incidence of and risk factors forsurgical-siteinfectionsinaPeruvianHospital.InfectControlHospEpidemiol. 2005;26:473-7.

21. Shanmugam G, Rangam S, Kayalvili K, Sundaram L: Prevalence of surgical site infections andantimicrobial sensitivity pattern in patients attending a Tertiary Care Hospital in South India: aprospectivestudy. JPatient Saf Infect Control. 2017; 5:12-7.
22. Khan AKA, Rashed MR, Banu G. A Study on the Usage Pattern of antimicrobial agents for theprevention of surgicalsite infections(ssis) ina tertiary care teachinghospital. J Clin DiagnRes.2013; 7(4):671–74.
23. Owens CD, Stoessel K: Surgical site infections: epidemiology, microbiology and prevention . JHospInfect. 2008; 70:3-10.
24. MundhadaAS,TenpeS:Astudyoforganismscausingsurgicalsiteinfectionsandtheirantimicrobial susceptibility in a tertiary care government hospital. Indian J PatholMicrobiol.2015; 58:195-200.
25. DessieW,MulugetaG,FentawS,MihretA,HassenM,AbebeE:Patternofbacterialpathogensand their susceptibility isolated from surgical site infections at selected referral hospitals, AddisAbaba,Ethiopia.Int J Microbiol.2016; 2016:2418902.
26. Nivitha Mohan, Dhanalakshmi Gnanasekar, Sowmya TK, Anand Ignatious. Prevalence andRisk Factors of Surgical Site Infections in a Teaching Medical College in the Trichy District ofIndia.Cureus 2023; 15(5): e39465.
27. VanWalravenC,MusselmanR:Thesurgicalsiteinfectionriskscore(SSIRS):amodeltopredicttherisk ofsurgical site infections. PLoS One. 2013, 8:e67167.
28. AhmedMI.Prevalenceofnosocomialwound infectionamongpostoperativepatientsandantibioticspatterns atteaching hospital inSudan.NAmJMedSci.2012; 4(1):29–34.
29. Mulu W, Kibru G, Beyene G, Datie M. Postoperative nosocomial infections and antimicrobialresistancepatternsofbacterialisolatesamongpatientsadmittedatFelegeHiwotReferralHospital,Bahirdar, Ethiopia.Ethiop JHealthSci.2012; 22(1):7–18.
30. Chakarborty SP, Mahapatra SK, Bal M, Roy S. Isolation and identification of vancomycinresistant Staphylococcus aureus from postoperative pus sample. Al Ameen J Med Sci. 2011;4(2):152–68.
31. MasaadehHA,JaranAS.Incidentof Pseudomonasaeruginosa inpost-operativewoundinfection.AmJInfect Dis.2009; 5:1–6.
32. SohnAH,ParvezFM,VuT,HaiHH,BichNN,LeThuTA.Prevalenceofsurgical-siteinfectionsandpatternsofantimicrobialuseinalargetertiary-carehospitalinHoChiMinhCity,Vietnam.Infect Control Hosp Epidemiol.2002; 23(7):382–87.