DOI: 10.7860/IJARS/2020/44369:2578

Original Article

Surgery Section

A Prospective Study of Surgical Site Infection at Vasavi Hospital, Bangalore, Karnataka, India

VIJAYA DODDAIAH[1], A MOHAN[2], SRIVATSA SUBRAMANYA[3], KARTHIK KRISHNA[4], VENKATESH RATHOD[5]

ABSTRACT

Introduction: Surgical Site Infection (SSI) is an infection which develops within 30 days after a surgical procedure or one year after the placement of an implant and the infection appears to be associated with surgery. SSI is related with complications like increased readmission rates, length of stay and cost.

Aim: To find out the incidence rate of SSI, aetiology and their antibiogram.

Materials and Methods: A prospective study of 947 patients (454 male and 493 female) who underwent surgery at Vasavi Hospital, Bangalore, Karnataka, India, from February to December 2019 formed the study group. Age, sex, type of surgery, month wise, section wise, duration of surgery, prophylaxis given, elective or emergency etc., were noted. Pathogen isolated from SSI cases was identified and their antibiogram were recorded.

Results: Of the 947 patients, 239 (25.24%) belonged to General Surgery, 301 (31.78%) Orthopaedics, 187 (19.75%) Gynaecology, 124 (13.09%) Urology, 40 (4.22%) ENT, 20 (2.11%) Oncology and 36 (3.80%) Miscellaneous. SSI rate in the present study was 0.21%. Two patients (females) aged 66 and 33 years developed deep infection at the site of incision, with purulent discharge that was operated from orthopaedic department. Pathogens isolated were *Staphylococcus aureus* (MSSA) and *Streptococcus pyogenes*. Isolates were sensitive to routinely used antibiotics.

Conclusion: SSI rate of 0.21% was been achieved by stringent quality control measures, training of hospital staff and continuous surveillance of infections.

Keywords: Antibiogram, Nosocomial infection, *Staphylococcus aureus*

INTRODUCTION

SSIs are known to be one of the most common causes of nosocomial infections worldwide [1]. There may be two sources of infectious agents i.e., endogenous or exogenous source. Endogenous sources are body sites like skin, nose, mouth, gastrointestinal tract or vagina that are occupied by microorganisms. Exogenous sources are health care workers, tools, medical devices or from the surroundings [2]. The occurrence of SSI depends on site of surgery, duration of surgery, type of surgery (elective/emergency), age of the patient, co-morbid condition like diabetes and immune status of patient. There is paucity of data from small corporate hospitals in India on SSI. This prospective study was undertaken to determine the rate of SSI, causative pathogen and their antibiogram which would help the hospital, to improve the standards in reducing the rate of SSI.

MATERIALS AND METHODS

This prospective study was carried out from February to December 2019 in a 100 bedded secondary health care hospital with the occupancy of 30 to 40 beds at a time. The study was approved by the Institutional Ethical committee dated on 10/1/2019 (Ref:VHEC3;2019-2020). Informed consent was obtained from the study subjects. A total of 947 (454 males, 493 Females) patients, who underwent surgeries formed the study group.

Inclusion criteria: All patients of either sex admitted for surgical wards (Orthopaedics, General Surgery, Urology, Gynaecology, Oncology and miscellaneous) of the hospital for elective or emergency surgeries of clean procedures were included.

Exclusion criteria: Patients with infected/open wounds, who underwent surgery, were excluded from the study.

Age, sex, department of surgery, duration of surgery, antibiotics prophylaxis, and history of diabetes was recorded by the infection control nurse. In suspected cases of SSI, purulent discharge from operated site wound were collected and sent for culture and antibiogram. Bacterial isolates were identified by proteomic studies (MALDI TOF/MS-Biotyper) and antibiogram by VITEK2-Compact.

STATISTICAL ANALYSIS

Data was entered in Microsoft Excel and analysed. The values were presented in number and percentages.

RESULTS

Age of the study group ranged from 4 to 93 years. Females were 493 (52.06%) and males 454 (47.94%). Age, sex and department wise distribution of the operated patients is shown in [Table/Fig-1].

Out of 947 patients, two patient developed SSI. Duration of the surgeries is shown in [Table/Fig-2]. [Table/Fig-3] shows the month-wise distribution and rate of SSI. Detail of the patients who developed deep wound infection (SSI) at the site of operation is shown in [Table/Fig-4]. Pathogen isolated from cases of SSI and the antibiogram are shown in [Table/Fig-5].

A 911 (96.2%) were elective and 36 (3.8%) emergency surgery. Emergency cases were all caesarean section. All patients included in the study received prophylactic antibiotics of cefuroxime within one hour prior to surgery.

DISCUSSION

Healthcare Associated Infections (HAIs) remain as an important public health concern [3]. In India, SSI is one of the leading causes of morbidity and mortality [4]. In the present study maximum number surgical patients were found among 31-40 (20.59%) and 21-30 (20.38%) years. Females 493 (52.06%) were more than the males 454 (47.94%). Age and gender has no significant role in the development of SSI. 96.2% patients were on elective and

Department-N (%)	Age (years) / Sex	≤10	10-20	21-30	31-40	41-50	51-60	61-70	≥70	Total
General Surgery- 239 (25.24 %)	Male	8	2	20	25	39	24	10	18	146
	Female	2	5	27	17	13	7	13	9	93
Orthopaedics - 301 (31.78%)	Male	19	20	23	32	30	17	24	23	188
	Female	1	7	14	10	10	23	24	24	113
Gynaecology -187 (19.74%)	Female	0	7	76	55	26	15	4	4	187
Urology -124 (13.09%)	Male	3	4	6	26	12	7	5	13	76
	Female			7	9	13	10	7	2	48
ENT -40 (4.22%)	Male	4		5	6	1	1	1		18
	Female	2	3	7	9	1				22
Oncology -20 (2.11%)	Male	1				3	2	3	1	10
	Female	1		2	2	1	2	2		10
Miscellaneous -36 (3.80%)	Male		3		2	1	4	3	3	16
	Female	2		6	2	3	2		5	20
Total 947	Male	35	29	54	91	86	55	46	58	454
	Female	8	22	139	104	67	59	50	44	493

[Table/Fig-1]: Distribution of age, sex and department wise surgery patients of the study group.

Duration of surgery in hours	N	%
≤1	416	43.9
1 to 2.30	367	38.7
>2.30 to 3.30	94	9.9
>3.30	70	7.3

[Table/Fig-2]: Shows the duration of surgery.

Month	N	Infection	Rate/100
February	73	0	0
March	81	0	0
April	92	0	0
May	83	1	1.2
June	83	0	0
July	102	0	0
August	90	0	0
September	67	0	0
October	89	0	0
November	109	1	0.9
December	78	0	0
Total	947	2	0.21

[Table/Fig-3]: Month wise distribution and rate of SSI cases.

Details of the patient	Case no. 1	Case no. 2
Age	66	33
Sex	Female	Female
History	Osteoarthritis both knee	Fracture right tibia
Co-morbidities	Diabetes, hypertension, Hospital stay of eight days.	Non-diabetic, hospital stay of three days.
Operation and duration	Total knee arthroplasty 2.15 hours with antibiotic prophylaxis.	Open reduction and internal fixation with plates and screws. 2.15 hours. With antibiotic prophylaxis
2nd admission	15 days after the operation, fever and swelling, pain in left knee with signs of deep infection. Aspiration and wound debridement done. Pus sent for culture and antibiogram. *Streptococcus pyogenus* isolated. Treatment inj levoflox 500mg iv od for nine days.	Three months after the operation, pain and swelling in the right knee with signs of deep infection. Incision and drainage, impregnated beads insertion was done. Pus sent for culture and antibiogram. Staphylococcus aureus isolated. inj linozolid 600 mg iv bd for 1day, then oral tab linid 500 mg od for three weeks.

[Table/Fig-4]: Details of the two patients with SSI.

Antibiogram	*Streptococcus pyogenes* Case no. 1	*Staphylococcus aureus* (MSSA) Case no. 2
Ciprofloxacin	-	S
Levofloxacin	S	S
Erythromycin	S	S
Gentamycin	-	S
Tetracycline	-	S
Tigecycline	-	S
Teicoplanin	-	S
Vancomycin	-	S
Clindamycin	S	R
Linezolid	-	S
Trimethoprim/sulfamethozole	-	S
Daptomycin	-	S
Penicillin	S	
Ampicillin	S	
Cefotaxime	S	
Azithromycin	S	
Cefoxitin	-	S

[Table/Fig-5]: Pathogen isolated from SSI and their antibiogram.

(3.8%) on emergency surgery. Maximum numbers of patients were from orthopaedic department (31.78%). Details of patients who developed SSI is shown in the [Table/Fig-4]. In the first case, age, History of diabetes and prolonged surgery with implant, hospital stay for eight days, which might have played a role in the causation of SSI, as reported by others [2,3]. High blood sugar level is one parameter significantly associated with SSI as in the present case of SSI. The sencod case was with no History of diabetes, hospital stay of three days, but prolonged orthopaedic surgery with implant [3]. Placement of implants and prolonged surgery are significant factor in the causation of SSI as in present study, has also been reported by others [2,3,5,6]. Length of hospitalisation prior to surgery with exposure to hospital environment and duration of postoperative stay are the factors in the causation of SSI [5]. No infection was found in surgeries lasting for less than one hour in present and Lilani SP et al., study [5].

In the present study rate of SSI was 0.21% which was lower than the other report from India [2,3,5-7]. A study by Subramanian KA et al., and Ganguly PS et al., from Aligarh reported an estimated infection rate of 24.8% and 38.8%, respectively [8,9]. In USA rate of SSI is 2.8% and in European countries 2-5% [10]. Global

estimates of SSI have varied from 0.5 to 15%. High rate of SSI reported from India, reflects poor consciousness about the HAIs and infection control practices [11]. One of the reason for lower percentage of SSI in the present study, may be majority of the cases were elective surgery and prophylaxis with cefuroxime was given within one hour prior to surgery. This low rate was achieved by strict institutional control measures and surveillance of infections continuously.

Pathogens isolated from two cases of SSI with deep infections were *Streptococcus pyogenes* and *Staphylococcus aureus* which were sensitive to routinely used antibiotics. *Staphylococcus aureus* and *Streptococcus pyogenes* has been reported by various authors as causative agents of SSI [2,3,5,6]. Colonisation of anterior nares with *Staphylococcus aureus* and throat with *Streptococcus pyogenes* may act as source of infection. Most of the other studies have also reported gram negative bacilli as the causative agents of SSI [2,3,5,8,12].

Limitation(s)

This was a short period study of 11 months only on SSI.

CONCLUSION(S)

This study presents the findings of a prospective study undertaken in a small corporate hospital. SSI is the index of health care system of any hospital. This study will provide baseline estimates for subsequent comparisons. With good infection control practices and training of hospital staff continuously, present study SSI rates were much lower than others.

Acknowledgement

Authors are grateful to Dr. Shivashankar GN, Medical Director for the support and encouragement for this study. Special thanks to Infection control nurse Mrs. Vinutha TM for her dedication and commitment. Thanks to Mr. Arjun J Rao IT department for helping in the preparation of this manuscript.

REFERENCES

[1] Avalos BS. Knocking out nosocomial infections. Nursing. 2004;34(11):24-25.
[2] Bhalla GS, Grover N, Singh M, Mishra D. Antimicrobial susceptibility profile of surgical site infection isolates from a tertiary care center in West India. J Mar Med Soc. 2019:21:69-74.
[3] Jain A, Tolpadi A, Chaudhary B, Chaudhary A, Misra A. A study of surgical site infections in a tertiary care hospital. Int Surg J. 2019:6(11):3911-15.
[4] Arora A, Bharadwaj P, Chautuvedi H, Chowbey P, Gupta S, Leaper D, et al. A review of prevention of surgical site infections in Indian hospital based on global guidelines for the prevention of surgical site infection, 2016. J Patient Saf Infect Control. 2018;6:1-12.
[5] 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.
[6] Kumar A, Rai A. Prevalence of surgical site infection in general surgery in a tertiary care centre in India. Int Surg J. 2017;4(9):3101-06.
[7] Mekhla, Firoz Rajiv Borle. Determinent of superficial site infections in abdominal surgeries at a rural teaching Hospital in Central India. A prospective study. J Family Med Prim Care. 2019;8(7):2258-63.
[8] Subramanian KA, Prakash A, Shiniwas A, Bhujwala. Postoperative wound infection. Indian J Surg. 1973;35:57-64.
[9] Ganguly PS, Khan Y, Malik A. Nosocomial infections and hospital procedures. Indian J Community Med. 2000;25(1):39-43.
[10] Delinger EP, Ehrankrannz NJ. Surgical infections, in hospital infections, 4th edn. Edited by Bennett JV, Brachmann PS. Lipincott-Raven Publishers, Philadelphia.
[11] Kamat US, Fereirra AM, Kulkarni MSD, Motghare D. A prospective study of surgical site infection in a teaching hospital in Goa. Indian J Surg. 2008;70:120-24.
[12] Patil SM, Sravan Kumar K, Rajesh K. Surgical site infections in a rural hospital: A prospective study. IJSS J Surg. 2016;2:1.

PARTICULARS OF CONTRIBUTORS:
1. Consultant Microbiologist, Department of Microbiology, Vasavi Hospital, Bangalore, Karnataka, India.
2. Consultant Urologist, Department of Urology, Vasavi Hospital, Bangalore, Karnataka, India.
3. Consultant Orthopaedics, Department of Orthopaedics, Vasavi Hospital, Bangalore, Karnataka, India.
4. Medical Superintendent, Department of Anaesthetist, Vasavi Hospital, Bangalore, Karnataka, India.
5. Consultant Orthopaedics, Department of Orthopaedics, Vasavi Hospital, Bangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Vijaya Doddaiah,
No 15, 70th cross, 14th Main, 1st stage, Kumaraswamy Layout, Bangalore-560078, Karnataka, India.
E-mail: vijayadanand@rediffmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 19, 2020
- Manual Googling: Jul 10, 2020
- iThenticate Software: Sep 19, 2020 (08%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 18, 2020**
Date of Peer Review: **Apr 07, 2020**
Date of Acceptance: **Jul 30, 2020**
Date of Publishing: **Oct 01, 2020**