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A STUDY OF BACTERIOLOGICAL AETIOLOGICAL AGENTS IN POST OPERATIVE ABDOMINAL WOUND INFECTIONS IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background and Objectives: Surgical Site Infection (SSI) continues to be a major healthcare-associated infection. **Primary objective:** To isolate, identify and study the aerobic bacteriological spectrum of Abdominal Surgical Site Infection.

Secondary objective:

1) To study the antibiotic sensitivity pattern.

2) To detect multidrug resistant strains in abdominal Surgical Site Infection.

Materials and Methods:

A total of 139 patients with post operative wound infections were included in this study during the course of one year from 1/10/16 to 30/09/2017. The study group included patients who underwent surgical procedure in a tertiary care hospital and developed Surgical Site Infection while in Hospital or after discharge within 30 days post surgery. These patients were followed up closely from the period of developing SSI to the time of discharge and during follow up in the hospital. Specimens such as double swabs for open surgical wounds and aspirates for localized infections were collected. Double swabs were inoculated into the following media: 5% Sheep Blood agar (SBA), MacConkey agar (MA), Salt agar (SA) and Glucose broth. Needle aspirates were also inoculated into Chocolate Agar (CA) in addition to the above media. The organisms were identified by conventional biochemical reactions and antibiotic sensitivity was done according to the CLSI guidelines 2017. **Results:** Out of the 139 cases in the study, the incidence of SSI's following abdominal surgeries were 41.7 %. The commonest age group for developing SSI was spread equally in the age groups between 51 – 60 and 61 – 70 years (20.14% each). Of the risk factors, Diabetes mellitus (40.28%) were associated with SSI's in 56 patients. Maximum number of cases were after Staging Laparotomies / Tumor excision for GIT Carcinoma- 48 (35.25%). 13.66 % cases were after Appendicectomy; LSCS - 12.23 %, Laparotomy- Peritonitis 10.79 %, Laparotomy- Intestinal obstruction 3.59 %, Herniorraphy 9.35 %, Tubectomy 3.59 %, TAH 7.19 %, Laparotomy -Abdominal injury 0.71 % and others 4.31 %. There were 58 (41.7%) of cases with microbial isolates and 81 (58.3%) cases were sterile. S.aureus was the predominant organism in Abdominal Surgical Site Infection 20 (34.48%), followed by E.coli and Klebsiella pneumoniae 15 (25.85%) each. Out of 15 Klebsiella pneumoniae 53.33 % were ESBL producers and 33.33 % were MBL producers. Where as in 15 E.coli isolates, 80 % were ESBL producers and 6.67 % MBL producers. **Discussion:** Surgical Site Infection (SSI) are the most common Health care associated infection in low and middle income countries. Surgical Site Infection was found to be higher in patients above 50 years of age which can be due to multiple factors like a low healing rate, malnutrition, mal-absorption, increased catabolic processes and low immunity. Diabetes mellitus is a major risk factor associated with Surgical Site Infections. Patients requiring prolonged hospitalization were more prone to Surgical Site Infections. Enterococcus which is a member of the normal flora of the Gastrointestinal and Genitourinary tract in humans is an emerging pathogen in abdominal Surgical Site Infections. **Interpretation and Conclusion:** The prevalence of multidrug resistant organisms is to be considered as a warning sign for the emerging spread of antibiotic resistance and the need for urgent implementation of strict antibiotic policy and infection control measures. Identification of SSI's involves interpretation of clinical and laboratory findings, and it is crucial that a surveillance programme uses definitions that are consistent and standardized; otherwise inaccurate or uninterpretable SSI rates will be computed and reported.

KEYWORDS : Health care-associated infection, multidrug-resistant organisms, Surgical Site Infection.

INTRODUCTION

Infection has always been a feature in human life and sepsis in modern surgery is a significant problem in healthcare.[1]The incidence of infection varies from surgeon to surgeon, from one hospital to another, between different surgical procedures, and most importantly, from one patient to another.[2]

In 1992,CDC has renamed post operative wound infection as Surgical Site Infections.[3,4,5]The United States Center for Disease Control and Prevention (CDC) has definedSurgical Site Infection (SSI) as infection related to an operative procedure that occurs at or near the surgical incision (Incisional or organ/space) within 30 days of the procedure or within 90 days if prosthetic material is implanted at surgery.There may also be microbiological evidence of wound infection from cultures obtained aseptically from wound fluid or tissue.[4] Surgical Site Infection (SSI) are the most common Health care associated infections (HAI) accounting for approximately 31% of all Health care associated infections and 38% of all nosocomial infections based on CDC's National Nosocomial Infections Surveillance (NNIS) system.[4,6,7,8,9,10]Approximately 5% of patients develop an Surgical Site Infection after surgery.[11]The rate of Surgical Site Infection varies from 2.5% to 41.9% as per different studies.[10]Surgical Site Infection is associated with a mortality rate of 3%with 75% of Surgical Site Infection associated deaths directly attributable to the Infection.[12]It is estimated that approximately half of Surgical Site Infection can be prevented by application of evidence based strategies.[13]

AIMS AND OBJECTIVES

Primary Objective

To isolate, identify and study the aerobic bacteriological spectrum of abdominal Surgical Site Infection.

Secondary Objectives

1. To study the antibiotic sensitivity pattern.
2. To detect multidrug resistant strains in abdominal Surgical Site Infection.

MATERIALS AND METHODS

A descriptive study was conducted in the departments of Microbiology and General Surgery in a tertiary care centre in South Kerala in 139 patients who developed abdominal Surgical Site Infection within 30 days of surgery who required readmission for a one year period. Patients developing infection occurring 30 days after surgery, with dirty wounds, stitch abscess and those who did not give consent were excluded. These patients were followed up closely from the period of developing SSI to the time of discharge and during follow up in the hospital. Details of these patients including clinical details and investigations were entered in the approved proforma.

Double swabs were taken after thorough cleaning the surgical wound site with sterile saline with appropriate aseptic precautions to avoid specimen contamination. Fine needle aspirate were taken from localised soft tissue infections after thorough cleaning the site with 70% ethyl alcohol. The samples so collected were transported to the Microbiology laboratory and processed immediately.

The specimens were inoculated into 5% Sheep Blood agar (SBA),Mac Conkey agar (MA), Salt agar (SA) and Glucose broth.Gram stained smears were made from different types of colonies and the organisms were identified by conventional biochemical reactions. Antibiotic susceptibility testing was done according to CLSI M100. D test was done for Staphylococcus aureus isolates. ESBL detection was done by double disc synergy test and Carbapenemase by combined Imipenem EDTA method.

RESULTS

As per the inclusion and exclusion criteria, specimens were taken from 139 post operative patients who had undergone abdominal surgery.

TABLE-1: Distribution of cases according to gender

GENDER	NUMBER	%
MALE	59	42.45
FEMALE	80	57.55
TOTAL	139	100

Distributions of cases in relation to gender are shown in Table 1. Of the total cases fifty nine(42.45%) were males and eighty(57.55%)were females.Male: female ratio was **1:1.3.**

TABLE 2: Distribution of cases according to age group

Age group	Number	%
21-30	26	18.70
31-40	21	15.10
41-50	27	19.42
51-60	28	20.14
61-70	28	20.14
71-80	7	5.04
> 80	2	1.44
Total	139	100

Table 2 show the age distribution of patients. Maximum numbers of patients were in the age group between 51- 60 and 61 - 70 years (20.14% each).

TABLE 3: Distribution of cases according to the type of surgical procedure

Type of surgery	Number	Percentage
Staging Laparotomy/ Tumor excision- GIT Carcinoma	48	35.25
Appendicectomy	19	13.6
LSCS	17	12.23
Laparotomy-Peritonitis	15	10.79
Laparotomy-Intestinal obstruction	5	3.59
Herniorraphy	13	9.35
Tubectomy	5	3.59
TAH	10	7.19
Laparotomy-Abdominal injury	1	0.71
Others	6	4.31
TOTAL	139	100 %

From Table 3,it can be seen that maximum number of cases were following Staging Laparotomy/ Tumor excision for GIT Carcinoma in 48 patients(35.25%).

TABLE 4: Analysis of culture positivity

Result	Number	%
Culture positive	58	41.7
Culture negative	81	58.3
Total	139	100 %

From Table 4 it is seen that there were 58 (41.7%) culture positive isolates and 81 (58.3%) sterile cases.

Table 5: Distribution of culture positivity according to the type of surgical procedure

Type of surgery	Number	Percentage
Staging Laparotomy/ Tumor excision- GIT Carcinoma	27	46.55
Appendicectomy	11	18.97
LSCS	6	10.34
Laparotomy-Peritonitis	5	8.62
Laparotomy-Intestinal obstruction	2	3.44
Herniorraphy	3	5.17
Tubectomy	2	3.44
TAH	1	1.72
Laparotomy-Abdominal injury	1	1.72
Others	0	0
TOTAL	58	100 %

From Table 5,it can be seen that maximum number of culture positive cases were after Staging Laparotomy/ Tumor excision for GIT Carcinoma in 27 patients (48.26%).

TABLE 6: Categorisation of risk factors

CATEGORY	NUMBER	%
No risk	54	38.85
Diabetes mellitus	56	40.29
H/o Previous surgery	8	5.76
Emergency surgery	15	10.80
Age 70 yrs	6	4.32

Table 6 shows Diabetes mellitus with 56 cases (40.28%) was the predominant risk factor for developing SSI.

TABLE 7: Distribution of isolates

ISOLATE	NO.	%
E.coli	15	25.85
Klebsiella pneumoniae	15	25.85
MSSA	13	22.41
MRSA	7	12.07
Enterococcus faecalis	4	6.90
Pseudomonas aeruginosa	2	3.44
Streptococcus pyogenes	1	1.72
Acinetobacter baumannii	1	1.72
TOTAL ISOLATES	58	100 %

Table 7 shows that *S.aureus* was the predominant organism in abdominal Surgical Site Infectionin 20 patients (34.48%);

followed by *E.coli and Klebsiella pneumoniae*(25.85% each).

TABLE 8: Antibiotic sensitivity pattern of Gram positive isolates

Disc	Strength	ISOLATES							
		MSSA- 13		MRSA- 7		S.pyogenes- 1		E.faecalis - 4	
		NO.	%	NO.	%	NO.	%	NO.	%
PENICILLIN	10 IU	2	15.38	0	0	1	100	0	0
AMPICILLIN	10μg	NT	NT	NT	NT	NT	NT	1	25
1ST GENERATION CEPHALOSPORINS	30 μg	13	100	0	0	0	0	0	0
GENTAMICIN	10 μg	7	53.85	5	71.43	NT	NT	0(120 μg)	0
ERYTHROMYCIN	15 μg	7	53.85	1	14.28	0	0	NT	NT
COTRIMOXAZOLE	1.25/ 23.75 μg	8	61.54	4	57.14	NT	NT	NT	NT
CEFOXITIN	30 μg	13	100	0	0	NT	NT	NT	NT
AMIKACIN	30 μg	11	84.62	7	100	NT	NT	NT	NT
3RD GENERATION CEPHALOSPORINS	30 μg	NT	NT	NT	NT	1	100	NT	NT
VANCOMYCIN	30 μg	13	100	7	100	0	0	4	100
RIFAMPICIN	5 μg	13	100	7	100	NT	NT	NT	NT
CLINDAMYCIN	2 μg	7	53.85	1	14.28	0	0	NT	NT
LINEZOLID	30 μg	13	100	7	100	0	0	4	100

NT - Not tested

TABLE 9: Antibiotic sensitivity pattern of Gram negative isolates

Disc	Strength	ISOLATE							
		Klebsiellapneumoniae -15		E.coli- 15		P.aeruginosa- 2		Acinetobacterbaumannii- 1	
		NO.	%	NO.	%	NO.	%	NO.	%
Ampicillin	10 μg	15	0	15	0	NT	NT	0	0
Gentamicin	10 μg	5	37.51	10	66.67	1	50	0	0
Cephalosporin 1st Gen.	30 μg	1	7.14	1	6.67	NT	NT	0	0
Ciprofloxacin	5 μg	5	37.51	1	6.67	1	50	0	0
Ceftriaxone	30 μg	2	14.29	2	13.33	NT	NT	0	0
Ceftazidime	NT	NT	NT	NT	NT	1	50	NT	NT
Amikacin	30 μg	8	57.14	15	100	1	50	0	0
Cefoperazone +Sulbactam	75 μg / 30 μg	10	71.43	14	93.33	2	100	0	0
Piperacillin +Tazobactam	100 μg / 10 μg	10	71.43	14	93.33	2	100	0	0
Meropenem	10 μg	10	71.43	14	93.33	2	100	0	0
Imipenem	10 μg	10	71.43	14	93.33	2	100	0	0
Colistin	MIC	15	100	15	100	2	100	1	100
Tigecycline	10 μg	15	100	15	100	NT	NT	1	100

Table 10:Distribution of mechanisms of drug resistance among gram negative isolates

Resistance Mechanism	P.aeruginosa (2)		A.baumannii (1)		K.pneumoniae (15)		Escherichia coli(15)	
	Number	%	Number	%	Number	%	Number	%
ESBL	1	50	1	100	8	53.33	12	80
MBL (Cabapenemase producing)	NIL	-	1	100	5	33.33	1	6.6

Because of the increased resistance pattern to 3rd generation Cephalosporins, class I ESBL was tested for gram negative isolates using double disc method. ESBL was expressed by 8*(53.33%) of K. pneumoniae,* 12 *(80%)* of E.coli,1*(100%) A.baumannii* and *1(50 %)P.aeruginosa*. MBL(Carbapenemase producing) was expressed by1 (6.66%) of E.coli,5(33.33%) *K. pneumoniae)*and1*(100%) A.baumannii* as shown in Table 10 .

TABLE 11: Outcome of patients who developed SSI

OUTCOME	MCH	%
Expired	3	2.16
Improved	136	97.84
Total	139	100

From Table 11, it can be seen that of the 139 cases 136 (97.84%) patients survived and 3 (2.16%) expired.

DISCUSSION

A total of 139 patients having post operativeSurgical Site Infection were studied during the course of one year from1/10/2016 to 30/09/2017.

Based on distribution of cases according to gender, there were 80 (57.55%) female patients and 59 (42.45%) male patients. Male: female ratio was **1:1.3**.From the male to female ratio, there was no significant association observed.

The most common age group in this study for developing Surgical Site Infection was spread equally in the 51 – 60 and 61 – 70 year groups (20.14% each). This may be due to the increased occurrence of Gastrointestinal and Genitourinary tract carcinomas (35.25%) in these age groups.

A study by Dr.Sujatha.T.L[14]reported that 56.9% were in the age group 21 to 30 years, since majority of the cases in their study were Caesarean sections.

Studies from India at different places have shown the Surgical Site Infection rates to vary from 6.09% to 38.7%.[15,16,17,18]In this study, there were 41.7% culture positive cases of SSI. Recent studies have reported rate of Surgical Site Infection as 2.8% in USA and 2--5% in European countries.[15]Study by Dr.Sujatha.T.L[14]yielded 52% positive culture report.

Various literature and studies have reported causes for culture negative Surgical Site Infection as antibiotic treatment prior to surgery and infections due to fastidious organisms like

Mycoplasma species, Mycobacteria and Legionella species. Polymicrobial infections were not seen in this study.

From the categorization of risk factors, Diabetes mellitus was associated with Surgical Site Infection in 56 patients (40.28%). This data correlates with other studies by Patel Sachinet al[19], Cruse and Foord[20] and Cahil[21]. This may be due to factors like a reducedhealing rate, malnutrition, malabsorption, increased catabolism and a poor immunity[22].

There were a total of 58 isolates in this study. *Staphylococcus aureus* was the predominant Gram positiveisolate in 20 patients, accounting for 34.48%. Sagila.S.G[23]reported *S.aureus* as main pathogen in Gastrointestinal and Gynecological surgeries including Lower Segment Caesarian Section. Shittu et al[22], Naveen KikkeriHanumanthaSetty[24] had reported similar findings.

Of the 20 *S.aureus*isolates, seven were MRSA (35%). All Enterobacteriaceae isolates showed high resistance to multiple antimicrobial agents tested but all were highly sensitive to Imipenem. Eighty eight percent of enteric gram negative rods were multi-drug resistant. Most common Gram negative isolates from Surgical Site Infection were found to be highly resistant to third generation cephalosporins frequently used for surgical prophylaxis.

A study by Dr.Sujatha.T.L[14]reported thatall isolates of *Staphylococcus aureus* were resistant to Penicillin and were sensitive to Cloxacillin and Amikacin. Sagila.S.G's[23]study reported that 30.14% *S.aureus* were resistant to Cefoxitin.

Interpretation and Conclusion:

Out of the 139 cases in this study, the incidence of Surgical Site Infectionfollowing abdominal surgeries was 41.7%. Of the 58 culture positive cases, major isolate was *S.aureus* (34.48%); followed by equal incidence by *E.coli* and *Klebsiellaspp* (25.85%) each.

Of the risk factors, Diabetes mellitus (40.28%) were associated with Surgical Site Infectionin fifty six patients, followed by history of previous surgery mostly Lower Segment Caesarian Section in 5.76 % cases and 4.32% patients above age of 70 years.

Surgical Site Infectionfollowing abdominal surgeries were associated with poor basic infection control measures, lack of surgical aseptic precautions, prolonged hospital stay etc.Surgical Site Infectionincreases morbidity, mortality and economic costs and produce a substantial burden to patients and health care system.

The prevalence of multidrug resistant organisms is to be considered as a warning sign for the emerging spread of antibiotic resistance and the need for urgent implementation of strict antibiotic policy, antibiotic stewardship programmes and infection control measures. Identification of Surgical Site Infection involves interpretation of clinical and laboratory findings, and it is crucial that a surveillance programme uses definitions that are consistent and standardized; otherwise inaccurate or uninterpretable Surgical Site Infection rates will be computed and reported.

Advances in infection control technologies like use of high-efficiency particulate air (HEPA) filters in operation theaters, improved surgical techniques, use of non absorbable sutures, shortening duration of surgery, proper asepsis, appropriate use of antibiotics, good hospital infection control measures, control of malnutrition and Diabetes mellitus can help in controlling Surgical Site Infections .

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