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AEROBIC BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SENSITIVITY PATTERN OF POSTOPERATIVE WOUND INFECTIONS IN A TERTIARY CARE HOSPITAL IN SOUTH- EAST RAJASTHAN

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ABSTRACT

Background: Post-operative wound infections contribute to delay in recovery and increase risk of spread of hospital acquired infections (HAI). Surveillance of post-operative wound infections helps in determining the infection rates, risk factors and in planning the preventive strategies to ensure a quality healthcare in hospital. The present study was conducted to identify the post-operative wound infection rate, to isolate and identify the bacterial pathogens and to determine its antibiotic susceptibility pattern.

Materials and methods: Total 100 pus samples were collected from patients having post-operative wound infections from different surgical departments in Govt. Medical College, Kota during July 2015 to July 2016. Samples were processed as per standard guidelines.

Results: Out of 100 pus samples, 90 yielded growths of organisms making total 144 isolates. Out of 144 bacterial isolates (22%) were *Staph. aureus* followed by *Pseudomonas aeruginosa* (21.53%), *Escherichia coli* (13.89%) , *Klebsiella spp*. (13.19%) , *Citrobacter spp.* (9.72%), CONS (8.33%), *Proteus spp*. (5.555) , *Acinetobacter spp*. (2.77%), *Enterococcus spp.* (2.08%) and *Providentia spp*. (0.69%) Most Gram negative isolates were resistant to Amoxycillin-clavulanic acid, Gentamicin, Ceftazidime, Cefotaxime and Ciprofloxacin but aii gram negative isolates were sensitive to Imipenem and Pippercillin-tazobactum. Most Gram positive isolates were resistant to Ciprofloxacin, Ceftazidime, Cefotaxime and Cotrimoxazole but all were sensitive to Vancomycin and Linezolid and Clindamycin. Out of 32 Staph. *Aureus,* (50%) were Methicillin Resistant *Staphylococcus aureus* (MRSA) sensitive to Vancomycin, Linezolid and Clindamycin.

Conclusion: Post-operative wound infection rate was 90%. *Pseudomonas aeruginosa* and Staph. *aureus* were the most common cause of post-operative wound infections. Most isolates were multi drug resistant.

KEYWORDS revolutionized, incorporating, engaging and comprehensive

INTRODUCTION

Post operative wounds infections (POWIs) is defined as an infection occurring within 30 days after a surgical operation (or within 1 year if an implant is left in place after procedure) and affecting either incision or deep tissues at the operation site. These infections may be superficial or deep incisional infection or infections involving organ or body space. Postoperative operative wounds infections is among the most common problems for patients who undergo operative procedures and the third most frequently reported nosocomial infection in the hospital population.[1] Postoperative infections are associated with increased morbidity, mortality, prolonged hospital stay and increased economic costs for patient care.[2]

Post operative wounds infections (POWIs) have plagued surgeons since time immemorial. Infection is encountered by all the surgeons; by nature of their craft, they invariably impair the first line of host defences, the cutaneous or the mucosal barrier. The entrance of microbes into the host tissues is the initial requirement for infection.[3,4]

Infection is the clinical manifestation of the inflammatory reaction incited by invasion and proliferation of micro-organisms. Infection of wounds , are generally associated with production of pus and bacteria involved are said to be "pyogenic".The incidences of POWIs varies from hospital to hospital and also varied in different studies that have been reported from time to time. Bacterial contamination of the surgical site is a prerequisite for POWIs. Following contamination the risk of development of POWIs will depend on several factors, the most important ones being the dose and virulence of the pathogens, and host defence mechanisms The risk of POWIs increases if the surgical site is contaminated with more than 105 organism per gram of tissue . The dose required for infection can even be lower if a foreign body such as suture is present at the site, (e.g. only 102 *Staphylococci* can cause infection in the presence of silk suture).

The wounds were classified using the wound contamination class system, proposed by U.S. National Research Council (1964).[5]

1. **Clean:** Elective, primarily closed, no acute inflammation encountered, no entrance of normally or frequently colonized body cavities (gastrointestinal, oropharyngeal, genitourinary, biliary, or tracheobronchial tracts), and no break in sterile technique.
2. **Clean contaminated:** Nonelective case that is otherwise a clean, controlled opening of a normally colonized body cavity, minimal spillage or break in sterile technique, reoperation through clean incision within 7 days, negative exploration through intact skin.
3. **Contaminated:** Acute, non-purulent and inflammation encountered, major break in technique or spill from hollow organ, penetrating trauma less than 4 hours old, chronic open wounds for grafting.
4. **Dirty:** Purulence or abscess encountered or drained, Preoperative perforation of colonized body cavity, penetrating trauma more than 4 hours old.

Despite modern surgical techniques and the use of antibiotic prophylaxis, Post operative wounds infections (POWIs) is one of the most common complications encountered in surgery. They places a significant burden on both the patient and health system. POWIs delays recovery and often resulting in the need for further surgical procedures. POWIs is thus a major cause of morbidity, prolonged hospital stay, and increased health costs. Surveillance of post-operative wound infections helps in determining the

infection rates, risk factors and in planning the preventive strategies to ensure a quality healthcare in hospital.[3]

MATERIAL AND METHODS

Source of data

It is a descriptive study, which is be conducted on all the pathogens isolated from samples of patients who attend the outpatient (OPD)/inpatient (IPD) of various surgical departments Of Govt. Medical College Kota between September 2015 to August 2016.

Sample size

Total 100 patients were selected in this study that were operated for clean and clean-contaminated surgeries from Departments of Orthopaedics, Surgery and Obstetrics and Gynaecology .Each patient was followed from the time of admission till discharge from the hospital.

Surgical sites were considered to be infected according to the set of clinical criteria recommended by the surgical wound infection task force [5] which includes:

Superficial Incisional Surgical Site Infection

1. Purulent drainage from the superficial incision.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3. At least one of the following signs or Symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision are deliberately opened by surgeon, unless culture of incision is negative.
4. Diagnosis of superficial incisional surgical site infection by the surgeon or attending physician.

Deep Incisional Surgical Site Infection

1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38°C), localized pain, or tenderness, unless culture of the incision is negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathology or radiologic examination.
4. Diagnosis of deep incisional surgical site infection by a surgeon or attending physician.

Inclusion criteria: Samples collected from all post- operative surgical wound infections and burn patients.

Exclusion criteria: Wounds which are closed and primarily healed are excluded.

Collection of Material

The wounds were examined for suggestive Signs/Symptoms of infection in the post-operative period, during wound dressing or when the dressings were soaked, until the patients were discharged from the hospital and also in the Out-patient departments after discharge.

When infection was clinically suspected, the area around the surgical wound was cleaned with 70% ethyl alcohol. The exudates were collected from the depth of the wound using two sterile cotton swabs. One swab for direct gram staining and other for aerobic bacterial culture. All the specimens collected were transported immediately to the laboratory for further processing.

Methods

The samples collected were processed as follows, according to the standard procedures.[6,7,8]

a) Direct microscopic examination of Gram stained smear.
b) Inoculation of the samples onto different culture media for aerobic and microaerophilic organisms.
c) Preliminary identification of growth.
d) Bio-chemical tests.
e) Antibiotic sensitivity testing done using disk diffusion test according to CLSI guidelines. [9]

RESULT

In this study 144, bacteria were isolated from 100 cases.In 90 cases direct gram staining of all the cases co-relate with growth with culture. All the isolates were aerobic and facultative anaerobes. Monomicrobial (57.78%) isolates were more than polymicrobial isolates (31.11%) The incidences of gram negative organisms (67.36%) were more than gram positive organisms (32.63%).

Table- 1 Comparison between patterns of isolates with wound category

Type of surgery	Monomicrobial		Polymicrobial		Total
Clean	01	50%	01	50%	02
Clean and contaminated	39	92.86%	03	7.14%	42
Contaminated	12	54.54%	10	45.45%	22
Dirty	00	0%	14	100%	14
Total	52	57.78%	28	31.11%	90

Over all most common isolate is *Staph. Aureus* (22.22%), followed by *Pseudomonas aeruginosa* (21.53%), *Escherichia coli* (13.89%) , *Klebsiella spp*. (13.19%) , *Citrobacter spp*. (9.72%), CONS (8.33%), *Proteus spp.* (5.55%) , *Acinetobacter spp.* (2.77%), *Enterococcus spp.* (2.08%) and *Providentia spp.* (0.69%) as depicted in table no- 2.

Among the total 144 isolates , *Staph. aureus* and *Pseudomonas aeruginosa* were the most common isolates from post operative wounds from orthopaedic department while *E.coli* was the most common isolate in cases from general surgical department as depicted in table no-2.

Staph. aureus show resistance to Amoxy-clavulanic acid , Ciprofloxacin , Gentamicin and Cotrimoxazole while all were sensitive to Vancomycin and Linozolid as depicted in table no-3.

Among the total 32 isolates of Staph. *aureus* , 16 strains were resistance to Cefoxitin and they were labled as MRSA. (Methicillin Resistance Staph. aureus) All strain of MRSA was sensitive to Vancomycin, Linozolid and Clindamycin. All isolated strains of *Enterococcus spp.* and *CONS* were sensitive to Vancomycin and Linozolid as depicted in table-3.
All the isolated gram negative bacteria including *Pseudomonas aeruginosa* , *E.coli, Klebsiella spp., Proteus spp. Acinetobacter spp., and Citrobacter spp.* , all were resistance to commonly used antibiotic like Gentamicin, Ceftriaxone, Cefotaxime, Ceftazidime, Ciprofloxacin and Cotrimoxazole while sensitive to Imipenem and Piperacillin-tazobactum as depicted in table-3.

Table-2: Frequency of pathogenic bacteria isolated from post operative wounds infection

Organism	Orthopedic procedures	%	Obs-gynaecology	%	General surgery	%	Total
Staph.aureus (N=32)	20	63%	8	25%	4	13%	32 (22.22%)
Pseudomonas aeroginosa (N=31)	16	52%	10	32%	5	16%	31 (21.53%)
E.coli (N=20)	2	10%	5	25%	13	65%	20 (13.89%)
Klebsiella spp. (N=19)	10	53%	3	16%	6	32%	19 (13.19%)
CONS (N=12)	3	25%	3	25%	6	50%	12 (8.33%)
Proteus spp.(N=08)	4	50%	0	0%	4	50%	08 (5.55%)
Acinetobacter spp. (N=4)	2	50%	0	0%	2	50%	04 (2.77%)

Citrobacter spp. (N=14)	12	86%	1	7%	1	7%	14 (9.72%)
Providentia spp. (N=1)	1	100 %	0	0%	0	0%	01 (0.69%)

Enterococcus (N=3)	1	33%	0	0%	2	67%	03 (2.08%)
Total	71	49%	30	21%	43	30%	144

Table-3 Antibiotic sensitivity pattern of aerobic bacterial isolates

Organism	Total	AMC	AK	GEN	CIP	CX	LZ	VA	COT	CD	PIT	CAZ	CTX	IPM
Staph .aureus	32	03	19	07	05	16	32	32	11	30	18	12	13	NA
		9.37%	59.3%	28.8%	15.6%	50%	100%	100%	34.3%	93.7%	56.2%	37.5%	40.6%	
CONS	12	05	09	05	05	07	12	12	08	11	10	06	07	NA
		41.6%	75%	41.6%	41.6%	58.3%	100%	100%	66.66%	91.7%	83.3%	50%	58.3%	
E.coli	20	NA	15	06	06	NA	NA	NA	02		20	10	09	20
			75%	30%	30%				10%		100%	50%	10%	100%
Pseudomona aeruginosa	31	NA	20	07	07	NA	NA	NA	05		25	12	10	30
			64.55%	22.5%	22.5%				16.1%		80.6%	38.7%	32.25%	96.7%
Klebsiella spp.	19	NA	16	03	07	NA	NA	NA	01		15	12	09	16
			84.2%	15.7%	36.8%				5.2%		78.9%	63.15%	47.37%	84.21%
Acinetobacter spp.	04	NA	03		01	NA	NA	NA			03	02	02	03
			75%		25%						75%	50%	50%	75%
Proteus spp.	08	NA	05			NA	NA	NA			06	06	04	06
			62.5%								75%	75%	50%	75%
Citrobacter spp.	14	NA	09			NA	NA	NA			10	04	05	12
			64.3%								71.3%	28.6%	35.7%	85.7%
Providentia spp.	01	NA	01			NA	NA	NA			01	01	00	01
			100%								100%	100%		100%
Enterococcous spp.	03	NA	01	01	03	NA	NA	03	01		02	02	01	03
			33.33%	33.33%	100%			100%	33.33%		66.66%	66.66%	33.33%	100%
Total	144		109	32	39				31					

DISCUSSION

There is several predisposing cause to the emergence of the postoperative infected wounds. The patients characteristics which favour the postoperative wound infections include coincident remote site infection or colonisation, use of systemic steroids, diabetic mellitus and history of smoking, obesity and old age. The poor nutriention, transfer of certain of certain blood products before and after the surgery, pre operative hospitalization can also add into it.

For the most nosocomial wound infections, the endogenous flora of patients which is present on the body surfaces and viscera may become the source of infections.

In the this study, out of total 100 postoperative cases selected from different surgical departments which were clinically suspected infected, 90 cases gave growth on culture. So isolation rate in our study was 90% as comparison to many other Indian studies because in most of the cases in our study belongs to orthopaedic department where patients undergo surgical procedures of clean and contaminated in nature as surgical debridement and external fixation. Anvikar et.al noted the profound influence of endogenous contamination from the analysis of wound categories, in which the rate in clean contaminated surgical site infections was enormously high than that in clean surgical wounds. They noted an infection rate of 4.4% in clean and 10.60% in clean contaminated.10 In India, incidence of post operative wounds infection varies from 10-25% .11 In the present study, among the total ninety culture positive cases as per Table no-1 show that 57.78% are monomicrobial and 31.11% are polymicrobial in nature which are comparable to many Indian studies.10,11,12 In present study, most of the surgical procedures are related to orthopaedic department and surgical wards mostly including contaminated and dirty type of surgeries like external fixation and debridement and laprotomies respectively. In the present study, gram negative isolates were more as compare to gram positive as depicted in table-2.

Among the total 144 isolates in present study, *Staph. aureus* was the most common isolates followed by *Pseudomonas aeruginosa, E.coli, Klebsiella spp. , Citrobacter spp., CONS, Proteus spp., Acinetobacter spp.,* as depicted in table-2. This observation is similar to findings from East central Africa by Bercion et al[14] who reported *Staphylococcus aureus* as the most frequent species isolate followed by *E.coli* and *Pseudomonas aureginosa,* while Anvikar et al from developing country.[10] documented that *Klebsiella pneumoniae* was the commonest bacteria isolated from the postoperative wounds which showed *Klebsiella pneumonia* as the emerging hospital acquired pathogen.

In the present study, most of the isolated Staph. *aureus* were resistance to Amoxy-clavulanic acid, Gentamicin, Ceftazidime and Cefotaxime . While all strain were sensitive to Clindamycin, Vancomycin and Linezolid as depicted in table-3. If we talk about Cefoxitin resistance , 50% *Staph. aureus* are sensitive to Cefoxitin and 50% are resistance. In this study MRSA isolation rate is 50% which is higher than study by Jeene Amatya et al.[18] but some equal to studies done by Kyati Jain et al.[12] Result of present study is lower than Kapil et al[15] ,Shilpi Arora et al [16] and Sarita Yadav et al.[17] In this study gram negative bacteria displayed high rates of resistance to common prescribed inexpensive antibiotics such as, Ciprofloxacin, sulphamethaxazole / Trimethoprim, Cefotaxime, Ceftazidime, Gentamicin and amoxicillin/clavulanic acid, as depicted in table-3.This findings are in consistent with previous studies e.g. Jeena Aamatya et al[18] and Kumari et al.[19]

All gram negative isolates were sensitive to Imipenem and Pippercillin-tazobactum which were comparable to many Indian studies.[18,19]

CONCLUSSION

The postopearative wound infection is the commonest nosocomial infection only after the urinary tract infection.In this study *Staph. aureus* and *pseudomonas aeruginosa* were the most common isolates among the postoperative wounds infections.The majority of *E.coli* isolates were from the infection following abdominal surgery. Isolation rate for MRSA was 50% and all the strain of MRSA were sensitive to Vancomycin , Linezolid and Clindamycin. *Pseudomonas aeruginosa, E.coli, Klebsiella spp*.and *Cirtobacter spp.* Showed maximum susceptibility to Imipenem and

Pipracillin-tazobactum. Gram negative bacteria showed maxium resistance against Ciprofloxacin, Cefotaxime, Ceftazidime, Gentamicin and Cotrimoxazole.This mark resistance of isolates to commonly used antibiotics signifies the need for judicious and rational use of these drugs, strict asepsis along the proper hygiene to prevent the emergence of antibiotic resistance strains. We believe that the data of present study may provide useful guidelines for choosing the effective therapy against the isolate from the postoperative wound infections. It is advisable to scrutinize the postoperative wound infection in each and every hospital to evolve the control strategies.

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