Original Article

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A Study on Pattern of Organisms Involved in Post-Operative Wound Infection

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Abstract

Introduction: Surgical site infections are among the most common complications of inpatient admissions and have serious consequences for outcomes and costs. Different risk factors may be involved, including age, sex, nutrition and immunity, prophylactic antibiotics, operation type and duration, type of shaving, and secondary infections *Methodology:* In the microbiology department, the swabs were inoculated onto blood agar plate, McConkey's agar plates and nutrient broth. Inoculated media were incubated aerobically at 37°C for 24-48 hrs. Nutrient broth was sub cultured if the original plates did not yield organisms. The bacteria isolated were identified by their morphological and cultural characteristics. *Results:* E-coli causes 86.6% of infection upto 5 days pre op hospitalisation and pseudomonas causes 60% infection in the same period. Klebsiella causes 75% of infection in 6 – 10 days pre op period. During >10 days period staphylococcus. *Conclusion:* Apart from this regular review and monitoring of the implementation of guidelines is equally important.

Keywords: Post Operative; Wound Infection; E. Coli.

Introduction

Surgical site infections are among the most common complications of inpatient admissions and have serious consequences for outcomes and costs. Different risk factors may be involved, including age, sex, nutrition and immunity, prophylactic antibiotics, operation type and duration, type of shaving, and secondary infections.

The earliest record of incidence of sepsis during post Listerian period was by Theodor Kocher (1889), who reported a sepsis rate of 2.3% out of 325 operations.

In the pre-antibiotic era, scientists like Meleny (1935) and Hund (1939) noted sepsis rates of 4.8 to 5.0% respectively. Devinish and Miles (1945) reported an infection rate of 8.4%. There was a fall in the incidence of sepsis after the introduction of antibiotics. However, Howe (1962) reported that in spite of widespread use of prophylactic antibiotics, infection rate had gone up from 1.09% in 1949 to 3.9% in 1953 and 5.3% in 1955. In 1956 he reported a fall in the rate of penicillin resistant Staphylococci, after the institution of a simple judicious program of prevention of contamination and judicious use of antibiotics [1].

Blowers et al, (1955) reported a rise of post-operative wound infection from 2% in 1949 to 10.9% in 1952. In Britain, Clarke (1957) reported a Sepsis rate of 13.6% causing a mean extra stay in hospital for 8.1 days.

The National Research Council (1964) during a 2 ½ year collaborative study of 15,613 consecutive operative procedures done in five American university centers with the support of United States Public Health Service, designated the operative wounds as Clean, Clean contaminated, Contaminated and Dirty wounds. In the 11,690 clean elective operations in this series, the average wound infection rate was 5.1% and the overall incidence rate in all types of wounds was 7.4%. The incidence of infection following 12 Hernioplasty was 19%

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whereas it was 6.1% for Hysterectomy, 6.9% for Cholecystectomy, 10% for partial Colectomy [2].

Cruse and Foord (1980) reported an incidence rate of 4.7% in a study of 62,939 operations and an incidence of 1.5% 7.7%, 15.2% and 40% in clean, clean contaminated, contaminated and dirty operations. It became apparent that the incidence of infection varied with the type of operation. They also compared the incidence of infection with risk factors such as, age, sex, type of operation, preoperative stay, wound drainage and special factors such as Diabetes [3].

Evidence, that careful Surveillance can play a role in reducing wound infection have been gradually accumulated throughout many years.7 During the 10 year study of 62,939 wounds by Cruse and Foord, a reduction in the clean wound infection rate from 2.6% to 0.6% was realized.

In Mary Olson et al, study (1990), the overall wound infection rate for a total of 1032 surgical wound infections in 40,915 wounds, at the Minneapolis VA Medical Center in the study period (1977-1986) was 4.2% for the first year and was significantly lower than this value for every subsequent year, being 2.5% in 1986 [4].

In India Anvikar et al, from Government Medical College, Agra *reported* a sepsis rate of 6.09 in 1999 [5]. Hernandez K et al, from Lima, Peru, conducted a cohort study from January to June 1998. Four hundred sixty-eight patients were enrolled. One hundred twenty-five patients developed SSIs, 18% of which were identified after discharge. The overall incidence rate (IR) was 26.7%. The IR was 13.9% for clean, 15.9% for clean- contaminated, 13.5% for contaminated and 47.2% for dirty interventions [6].

Inigo JJ et al studied surgical site infection in general surgery: 5-year analysis and assessment of the National Nosocomial Infection Surveillance (NNIS) index, there were 6,218 patients and 513 SSI (8.25%). The infection rate was 2.27% for clean surgery, 9.17% for clean-contaminated surgery, 11.40% for contaminated surgery, and 19.14% for dirty surgery [7].

Konishi T, et al studied in Department of Surgery, Kanto Medical Center, NTT-EC, Tokyo, Japan. In October 2003, total 20,948 cases from 36 institutions have been studied. SSIs occurred in 1,394 cases, this corresponds to an incidence of 6.7%. When we look at the numbers of SSIs by the organs operated on, the incidence figures in the field of gastrointestinal surgery were by far the highest ones [8].

Reilly J et al conducted a procedure-specific surgical site infection rates and post discharge surveillance in Scotland in 2006 Dec, from study information, PDS data were available for 12,885 operations (59%). A total of 2,793 procedures (13%) were associated with passive PDS and 10,092 (46%) with active PDS. The SSI rate among the 8,825 operations with no PDS was 2.61% (95% confidence interval [CI], 2.3%-3.0%, which was significantly lower than the SSI rate found among the 12,885 operations for which PDS was performed 6.34% [95% CI, 5.9%-6.8%] [9].

Nicola Petrosillo et al. studied, surgical site infections in Italian Hospitals: a prospective multicenter study in 2008, SSI occurred in 241 (5.2%) of 4,665 patients, of which 148 (61.4%) during in-hospital and 93 (38.6%) during post discharge period [10].

Methodology

An elaborate study of these cases with regard to date of admission, history, clinical features date of surgery, type of surgery, emergency or elective, preoperative preparation and postoperative management is done till patient is discharged from hospital, and then followed up the patient on OPD basis for any signs of wound infection.

The wounds were examined for suggestive Signs/ Symptoms of infection in the post operative period, during wound dressing or when the dressings were soaked. In history, presenting complaints, duration, associated diseases, coexistent infections at a remote body site, personal history including diet, smoking, and alcoholism were noted.

Operative findings which include, type of incision, wound contamination, drain used and its type, and duration of operation were studied. Postoperative findings which included, day of wound infection, day of 1st dressing and frequency of change of dressing.

Findings on the day of diagnosis of wound infection were noted which included fever, erythema, discharge, type and colour and the exudates was collected from the depth of the wound using sterile cotton swab and was sent to microbiology department for culture and sensitivity.

In the microbiology department, the swabs were inoculated onto blood agar plate, McConkey's agar plates and nutrient broth. Inoculated media were incubated aerobically at 37°C for 24-48 hrs. Nutrient broth was sub cultured if the original plates did not yield organisms. The bacteria isolated were identified by their morphological and cultural characteristics.

The samples collected were processed as follows:

a. Direct microscopic examination of gram stained smear.
b. Inoculation of the samples onto different culture media for aerobic and anaerobic organisms.
c. Preliminary identification.
d. Bio-chemical tests.

Antibiotic sensitivity.

Results

Outof36 infected cases15caseshad E-coliinfection, 5hadpseudomonasand staphylococci, 2 had MRS A and 4 Klebsiella, 3 had infection with citrobacter and other organisms. E-coli was the most common isolated organismac counting for 41.67% of cases followed by pseudomonas and staphylococci.

Staphylococcus iscommonly isolated in clean (100%) cases. Pseudomonas is commonly isolated among clean contaminated (80%) cases. E. coliis most commonly isolated with contaminated (76.6%) cases. Klebsiella was associated with clean contaminated (100%) cases.

E-coli causes 86.6% of infection upto 5 days pre hospitalisation and pseudomonas causes 60% infection in the same period. Klebsiella causes 75% of infectionin 6–10 days pre opperiod. During >10 days period staphylococcus.

Table 1: Incidence of organism isolated

Organism	No. of Cases	Percentage
Pseudomonas	**5**	13.89%
Staphylococci	**5**	13.89%
MRSA	**2**	5.56%
Ecoli	**15**	41.67%
Klebsiella	**4**	11.11%
Citrobacter	**3**	8.33%
Others	**2**	5.55%
TOTAL	**36**	

Table 2: Organisms isolated in wound types

Type	Clean	Percentage	Clean contaminated	Percentage	Contaminated	Percentage
E-coli	0	0	4	26.67%	11	73.33%
Staphylococci	5	100%	0	0	0	0
Pseudomonas	0	0	4	80%	1	20%
MRSA	1	25%	2	50%	1	25%
Klebsiella	0	0	4	100%	0	0
Citrobacter	3	100%	0	0	0	0

Table 3: Comparison of organisms isolated with pre operative hospitalisation

Duration of Hospitalisation	Up to 5 days		5-10 days		>10 days	
	NO.	%	NO.	%	NO.	%
E-coli	13	86.67	2	13.33	0	0
Staphylococci	2	40	0	0	3	60
Pseudomonas	3	60	2	40	0	0
MRSA	2	50	0	0	2	50
Klebsiella	1	25	3	75	0	0
Citrobacter	2	66.67	1	33.33	0	0

Ecoli is most sensitive for Imepenem (93.3%), amikacin and netilmycin (80%) followed by piperacillin-tazobactum (73%), azithromycin (66%) and linezolid (60%) sensitive.

Staphylococci is most sensitive for linezolid (100%) followed by imipenem, ceftazidime and cefotaxim and ceftriaxone (80%).

Pseudomonas is most sensitive for imipenem (100%), followed by piperacillin, amikacin and cefotaxim (80%).

MRSA is most sensitive to vancomycin (100%) followed by clindamycin and linezolid (75% each).

Klebsiella is most sensitive for imipenem and ceftazidime (100%) followed by amikacin,

netilmycin,azithromycin and ciprofloxacin (75%).

Citrobacter is most sensitive to amikacin, netilmycin and imipenem (100% each).

Overall imipenem and amikacin are the most sensitive antibiotics.

E-coliismostresistanttogentamycin (6%) followed by cefixime, ceftriaxone, cefotaxim (13% each) and doxycycline (20%). Staphylococci Is Most Resistant To cefixime (100%) followed by other antibiotics, pseudomonas is most resistant to doxycycline (100%), chloramphenicol, cefixime (20% each) followed by other antibiotics, MRSA is resistant to most of the commonly used antibiotics especially gentamycin, doxycycline, ceftrixone. Klebsiella Is Most Resistant To Dox, ceftriaxone andlinezolid (0%) followed by other antibiotics and citrobacter is most resistant for cefotaxime.

Over allgentamycin, cefiximeand doxycyclinare the most resistant antibioticsnoted.

Discussion

Most common organism isolated in our study is E-coli 41.67%, followed by staphylococci 13.8%, and pseudomonas 13.8%.

Similar finding are obtained in some studies like Umesh S. Kamat 121 2008. Seventy-nine per cent (79.33%) of the isolates were gram-negative bacteria; pseudomonas being the commonest one, followed by Staphylococcus pyogenes in the prospective study of surgical site infections in a teaching hospital in Goa. Pseudomonas was most common isolate in other studies like Mofikoya Bo et all Bacterial Agents of Abdominal Surgical Site Infections in Lagos Nigeria in 2009.

25(17.4%) of the 144 patients studied developed surgical site infections. *Pseudomonas* was the most frequently cultured aerobic organism in 28% (n=7) of the cultures, while *Bacteroides* species was the most common anaerobe isolated.

Our findings of a predominance of gram–ve bacilli are similar to that of other workers. In most cases of SSI the organism is usually patient's endogenous flora. In abdominal surgeries the opening of the gastrointestinal tract increases the likelihood of coliforms, gram negative bacilli which was our finding in this study. This group of organisms tends to be endemic in hospital environment by being easily transferred from object to object, they also tend to be resistant to common antiseptics and are difficult to eradicate in the long term. This group of organisms is increasingly playing a greater role in the many hospital acquired infections.

In our study Ecoli is most sensitive for Imepenem (93.3%), Amikacin and Netilmycin (80%) followed by Piperacillin-Tazobactum (73%). Azithromycin (66%) and Linezolid (60%).

Staphylococci is most sensitive for Linezolid (100%) followed by Imipenem, Ceftazidime and Cefotaxim and Ceftriaxone (80%). Pseudomonas is most sensitive for Imipenem (100%), followed by Piperacillin, Amikacin and Cefotaxim (80%) MRSA is most sensitive to Vancomycin (100%) followed by Clindamycin and Linezolid (75% each).

Overall Imipenem and Amikacin are the most sensitive antibiotics.

E-coli is most resistant to Gentamycin (6%) followed by Cefixime, Ceftriaxone, Cefotaxim (13% each) and Doxycycline (20%). Staphylococci is most resistant to Cefixime (100%) followed by other antibiotics, pseudomonas is most resistant to Doxycycline (100%), Chloramphenicol, Cefixime (20% each) followed by other antibiotics, MRSA is resistant to most of the commonly used antibiotics especially Gentamycin, Doxycycline, Ceftriaxone.

Mofikoya Bo et al had Pseudomonas species 37.5% sensitive for Ceftaxidine followed by 12.5% Ceftriaxone, and it was most resistant for Cefotaxime.

Umesh S. Kamat 2008 had pseudomonas species 21.4% sensitive for Cephoperazone- sulbactum combination. The proportion of bacteria resistant to all antibiotics for which tested was as high as 63.93% (39/61).

Most of the study showed that virtually all of the pathogens were resistant to the commonly prescribed antibiotics such as Ampicillin and Doxycyclin. The cultured aerobes also demonstrated less than 50% sensitivity to the cephalosporin's tested (Ceftaxidine, Cefuroxime and Ceftriaxone) in over 80% of the infected patients. This finding further supports the well known high prevalence of multiple antibiotic resistant nosocomial pathogens in our environment and may reflect the widespread abuse of antibiotics in the general population.

The relative frequency of different isolates also varied between different studies. Thus, it can be concluded that the organisms that cause SSIs change from place to place and from time to time in the same place. The antibiotic sensitivity testing of different isolates showed multidrug resistance by most of the isolates. The review of literature indicates that there is gradual increase in drug resistance to many antibiotics in most of the organisms which are

isolated from surgical patients. Our study reveals that though SSIs have been widely studied since a long time, they still remain as one of the most important causes of morbidity and mortality in surgically treated patients. The steps taken to reduce SSIs are still not adequate. Proper infection control measures and a sound antibiotic policy should reduce SSIs in the future.

Conclusion

- E- coli was the commonest organism isolated.
- Eachandevery hospital should adoptanantibiotic policy and strictadherence to thesame is necessary.

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