

Original Research Article

Bacteriological profile and antimicrobial susceptibility in surgical site infection in elective abdominal surgeries

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ABSTRACT

Background: Surgical site infection (SSI) represents a substantial burden of disease for patients and health services. A common scenario in developing countries is that though hospital infection control programme is in place but surveillance or feedback of SSI rates is usually not implemented. Therefore, an effective surveillance programme for SSI should be a critical component of any hospital infection control programme.

Methods: This study provided documented data on SSI in our hospital. The study was carried on 100 patients admitted for elective abdominal surgery. The overall infection rate in our study was 6%. There was predominance of gram negative bacilli.

Results: The gram positive isolates showed a high level of resistance against first, second and third generation cephalosporins. The gram negative isolates showed resistance to penicillin, ampicillin and amoxicillin clavulanate, cephalosporins and quinolones.

Conclusions: The overall SSI rate in our hospital was comparatively low as compared to other Indian hospital as well as hospitals in other developing countries, indicating that a satisfactory hospital infection control programme was in place.

Keywords: Antimicrobial susceptibility in SSI, Bacteriological profile in SSI, Elective abdominal surgery, Hospital infection control, Surgical site infections

INTRODUCTION

Surgical Site Infection is the 3rd most frequently reported nosocomial infection, accounting for 14-16% of all nosocomial infections.¹

A plethora of microorganisms with different antimicrobial susceptibility pattern has been identified as the causative agents of surgical site infections which vary from time to time, hospital to hospital and with the type of surgical procedure.²

SSI's are consequence of a summation of several factors: the inoculum of bacteria introduced into the wound

during the procedure, the virulence of the contaminants, the micro environment of each wound and the integrity of the patient's host defense mechanism. Factors intrinsic to the patient, as well as those related to the type and circumstances of surgery affect the incidence of infection.³ Other factors associated with SSI are duration of pre-hospitalization, age and physical status of the patient, administration of prophylactic antibiotics, duration of surgery, tissue handling and use of drains.⁴⁻⁷

As the etiology of SSI is multi-factorial, preventing SSI is a challenge that requires implementation of routine surveillance of SSI and control measures targeting identified risk factors.⁶

METHODS

The study was carried on 100 patients admitted for elective abdominal surgery in Department of Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research, Punjab, India over a period of 12 months, after obtaining written informed consent.

Surgical site infection—either an incisional or organ/space infection occurring within 30 days after an operation or within 1 year if an implant is present, and at least one of the following;

- Purulent drainage with or without laboratory confirmation from superficial incision
- Organisms isolated from an aseptically obtained culture of fluid or tissue from superficial incision
- At least one of following signs/symptoms of infection: pain/tenderness, localized swelling, redness, or heat.

It is further divided into superficial incisional (that only involve skin and subcutaneous tissue) and deep incisional (those involving deeper soft tissue, including fascia and muscle layer).

Inclusion criteria

All patients admitted in the surgical wards undergoing elective abdominal surgery.

Exclusion criteria

- Patients presenting in emergencies with infected wounds
- Patients presenting with perforation peritonitis.

Particulars of the patient, diagnosis, indications, and operative procedures were recorded. Pus samples were collected on two sterile swabs.

RESULTS

In our study, maximum number of cases was in the age group 41-60 years (51%) with mean age being 45 years. The male: female ratio was 1.2:1.

Out of 100 cases, surgical site infection occurred in 2 cases (33.33%) of cholecystectomy operated with right subcostal incision, one case (16.66%) of prostatectomy through Pfannenstiel incision, one (16.66%) case operated with midline incision for hernioplasty, one case (16.66%) of appendectomy and one case (16.66%) of pyeloplasty. SSI was nearly 2 times in cases in whom operating time was >2 hours as compared to cases in whom operating time was <2 hours. Diabetes mellitus (66.66%) was the major risk factor that caused SSI, followed by smoking and alcohol (16.66%).

E. coli (ESBL) was the dominant organism responsible for surgical site infection in 3 cases (50%). Two cases (33.33%) were reported with *Staph Aureus*. *Pseudomonas aeruginosa* was seen in 1 (16.66%) case of surgical site infection.

In our study, there was predominance of gram negative bacilli in the clean wounds, most of them being hepatobiliary surgeries.

The gram positive isolates showed a high level of resistance to ampicillin (100%), co-trimoxazol (100%), first and second generation cephalosporin drugs (40-60%). The third generation cephalosporins were only moderately effective against the isolates (30-50%). However, combination antibiotics such as cefoperazone-sulbactam presented a better susceptibility pattern (40-70%).

Two staphylococcus isolates showed susceptibility to linezolid and rifampicin. Most of the isolates shows sensitivity to ciprofloxacin and ofloxacin (60%). Fifty percent of the isolates were sensitive to amikacin but only 20% were sensitive to gentamycin.

All the gram negative isolates showed resistance to penicillin, ampicillin and amoxicillin-clavulanate (100%). Most of the isolates showed resistance to cephalosporin group (>70%) and quinolones (70%). A few isolates showed sensitivity to a combination of ceftiofur-sulbactam (42%).

All the gram negative organisms isolated were found to be sensitive to imipenem (100%) and mostly to polymyxin B (96.2%). The newer antibiotics such as meropenem and aztreonam were found to be effective against 50-53% isolates.

Nearly 42-57% of the gram-negative organisms showed sensitivity against aminoglycoside drugs such as amikacin, kanamycin, tobramycin and netilmicin but to a lesser extent with gentamycin (26%).

DISCUSSION

The overall infection rate in our study was 6%. This is in agreement with two Indian studies done on surgical wounds conducted in Aurangabad and Mumbai, which showed an almost similar SSI incidences of 6.1% and 8.95% respectively.^{8,9} Reports from other developed countries showed a lower SSI rates ranging from, 3.1% in UK, 4.3% in Netherland and 7.6% in Japan.¹⁰⁻¹² Lower SSI rates in developed countries as compared to developing countries indicate better implementation of infection control practices along with availability of proper surveillance system. Use of antimicrobial prophylaxis in different studies might also lead to variations in incidence of SSI.

The clean wound infection rate is a very good indicator that can sensitively indicate the overall status of hospital infection and therefore can be used as a surveillance yardstick to evaluate the current situation as well as the efficacy of a hospital control programme. In the present study the clean wound infection rate was found to be 50%, which corresponds to the findings reported in various studies.^{8,13,14} However as all the patients undergoing surgical procedures had received antibiotic prophylaxis, the revealed infection rate may be of concern.

Most common bacteria isolated in our study was *Escherichia coli* (50%) followed by *Staphylococcus aureus* (33.33%). Other bacterium isolated was *Pseudomonas aeruginosa* (16.66%). *E. coli* (ESBL) was also the most frequently isolated microorganism as reported in some studies.⁸⁻¹² Some other workers have found *Pseudomonas aeruginosa* as the principal offender of SSI.^{15,16}

In our study gram negative bacilli were more predominant in the classes of wounds other than clean wounds. NNIS system data had revealed that gram positive pathogens were most frequently associated with SSIs.¹⁷ However studies in Brazil and Ethiopia and few other studies reflect the increasing trend in gram-negative pathogens as a cause of SSIs in some settings.^{8,12,18,19}

Antimicrobial susceptibility pattern of Gram Positive isolates

All the gram positive isolates in our study were resistant to ampicillin (100%) although a few were found to be sensitive to penicillin (20%) and a combination of amoxicillin- clavulanate (20%). In effectiveness of penicillin in gram positive isolates has been reported in other studies also.^{8,9,13,20,21} In our study, 50% of the isolates were sensitive to amikacin whereas only 20% of the isolates exhibited sensitivity to gentamicin. An even lower susceptibility of only 1.1% has been reported by Anvikar et al.⁸

A high level (40-60%) of resistance was observed against first and second-generation cephalosporins while third generation cephalosporins were more effective (30-50%) against the isolates. Most of the isolates were sensitive (60%) to quinolones and all of the isolates (100%) were sensitive to linezolid and rifampicin. None of the gram-positive isolates were found to be vancomycin resistant in our study. This is consistent with other studies that reported nearly all the gram-positive isolates as sensitive to vancomycin.^{9,22}

Antimicrobial susceptibility pattern of Gram negative isolates

In the present study, all the gram negative isolates were found to be resistant to penicillin, ampicillin and amoxicillin-clavulanate (100%). Similarly Anvikar et al

also reported 100% of the isolate to be resistant to ampicillin.⁸ Giacometti et al showed more than 50% of the Gram negative isolates to be resistant to ampicillin, however <20% were resistant to amoxicillin and clavulanate combination.²²

Most of the isolates in our study showed resistance to cephalosporins (>70%), however 42% of them were sensitive to cefoperazone-sulbactam combination. This was comparable to a study done in Vietnam, that reported 88% resistance to a third generation cephalosporin.¹⁵ In another study from Italy most isolates were found to be susceptible to ceftriaxone.²² Most of the gram negative isolates in our study showed high resistance to quinolones (70%). A still higher resistance of almost 100% to ciprofloxacin was reported in a study by Sohn et al.¹⁵ In contrast, another study done in Italy reported only 16.3% - 24.8% resistance to Ciprofloxacin over a period of 6 years.²²

In the present study, it was observed that 42-57% of the isolates were sensitive to aminoglycoside group of drugs. Of all the aminoglycoside drugs, maximum resistance was found against gentamicin (73.1%). This was comparable to a study, which reported gentamicin resistance ranging from 60-89%.⁸ Another study reported a still higher resistance (92%) to gentamicin in gram-negative isolates.¹⁵ In our study the sensitivity pattern to other aminoglycosides was 42.3% sensitivity to amikacin and netilmicin, 53.8% to kanamycin and 57.7% to tobramycin.

All the isolates were found to be sensitive to imipenem (100%) and 96.2% were found to be sensitive to polymyxin B. Similar effectiveness of imipenem against gram-negative isolates was reported by Giacometti et al in Italy (90.5- 93.9%).²² The newer antibiotic such as aztreonam were found to be effective against 50% isolates.

Variations in drug resistance patterns in different studies are due to variations in the local pattern of drug prescriptions, cost and availability of drugs.

CONCLUSION

The overall SSI rate in our hospital was comparatively low as compared to other Indian hospital as well as hospitals in other developing countries, indicating that a satisfactory hospital infection control programme was in place.

Study highlights the importance of an ongoing surveillance programme to monitor SSI rates and also to assess risk factors like duration of surgery, type of surgery etc. and thus provide feedback of appropriate data to surgeons to prevent SSI.

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