PATTERN OF PATHOGENS AND THEIR SENSITIVITY ISOLATED FROM SUPERFICIAL SURGICAL SITE INFECTIONS IN A TERTIARY CARE HOSPITAL

Syed Asad Ali, S. M. Tahir, Abdul Sattar Memon, Noshad A. Shaikh

Department of Surgery, Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan

Background: Infection is an important cause of morbidity and mortality in surgical patients. Rapidly emerging nosocomial pathogens and the problem of multi-drug resistance necessitates periodic review of isolation patterns and sensitivity in surgical practice. Surgical site infections (SSI) are defined as an infections that occurs at the incision site within thirty days after surgery. Objectives of the study were to determine the pattern of pathogens involved and their antibiotic sensitivity isolated from superficial surgical site infections in a teaching hospital. **Methods:** This observational study was conducted for 1 year from January 2008 to December 2008 in all 4 surgical units of Liaquat University Hospital Hyderabad which caters to patients from low socioeconomic status. Pus culture and sensitivity reports were collected prospectively from hospitalised patients who developed postoperative wound infection. The patients who developed fecal/biliary/urinary fistula or operated for malignancies, and with negative cultures were excluded from the study. Analysis was carried out using SPSS 10. **Results:** During the study period 112 pus culture and sensitivity reports were analyzed. E. coli 68 (60.7%) was the most common organism isolated followed by Klebsiella 23 (20.5%). The least frequent organism was staph. Epidermidis 1 (0.9%). All isolates were sensitive to penicillin derivatives and carbapenem. Quinolones, Aminoglycosides and Monobactum were also showing some promise in our study. However, Cephalosporins were ineffective against most of the important isolates in our study. **Conclusion:** E. coli and klebsiella were the most important isolates form SSI in our study, and penicillin derivatives and carbapenem were showing 100% antibiotic sensitivity to all of the isolates.

Keywords: Superficial Surgical site infections, E. coli, Klebsiella, Penicillin derivatives, carbapenem

INTRODUCTION

Infection is an important cause of morbidity and mortality in surgical patients. Rapidly emerging nosocomial pathogens and the problem of multi-drug resistance necessitates periodic review of isolation patterns and sensitivity in surgical practice.

Surgical site infections (SSI) are defined as an infections that occurs at the incision site within thirty days after surgery.[1]

SSI are infections of the tissues, organs, or spaces (Intraperitoneal) contacted by surgeon. Intra operative contamination of normally sterile tissues by pathogenic microbes is the most frequent triggering point of incision infection and it is unusual for SSI to present later than four weeks except in cases of surgical implants (Hip replacement etc) where it can take up to one year.[2,7]

The term SSI was proposed by the centre for disease control and prevention (CDC) in 1992 following a consensus meeting of surgical infection experts and infectious disease specialists, with an intension to encourage comprehensive surgical infection surveillance.[5]

The CDC defines two categories of SSI 1. Incisional SSI comprises all infections the surgeons has traditionally named ‘wound infection’.[2] Organ/ space SSI are post operative infections of body cavities or organs manipulated by surgeon. Incisional SSI are further classified into 2 types:

1. Superficial: The most common in modern practice and involves only subcutaneous adipose layer.
2. Deep: It is less frequent, but has more serious consequences because these infections can spread quickly to invade the body wall, fascia and muscle. Multiple organisms are often isolated from deep incisional SSI.

The pathogens isolated from SSI are usually bacteria1, however transplant recipients occasionally develop fungal SSI.

The most common organism involved is staphylococcus as it is most common normal skin flora. If gastro intestinal tract is violated then E-Coli and bacteroids are common. If urinary tract is involved group-D staphylococcus, pseudomonas and proteus are common.[8]

MATERIAL AND METHODS

This observational study was conducted for 1 year; in all four surgical emergency units of Liaquat University Hospital, Hyderabad, Pakistan, which caters to patients from low socioeconomic status. Data was collected prospectively from hospitalised patients who developed postoperative wound infection. The diagnosis of wound infection was based on developing fever, pain at the operative site, wet dressing and later appearance of frank pus from the wound site usually within 5–7 days. The patients who developed wound dehiscence, fecal/biliary/urinary fistula or operated for malignancies, and with negative cultures were excluded from the study. All these patients were assessed for co-morbidities, e.g., tuberculosis, diabetes, liver disease and other immuno-compromised disorders. Organ/space SSI are excluded on the basis of ultrasound abdomen. The swab from infected site collected under aseptic technique and transported in sterile, leak-proof container to central laboratory of university. All specimens were inoculated on 5% blood agar, MacConkey agar and Chocolate agar plates and incubated overnight at 37 °C aerobically. Bacterial pathogens were identified by conventional biochemical methods according to standard microbiological techniques. Antimicrobial susceptibility was performed on Mueller-Hinton agar by the standard disk diffusion method recommended by the National committee for clinical laboratory standards (NCCLS). The antibiotics are tested for gram-positive and gram-negative bacilli by Kirby Bauer method.

Data analysis was carried out using SPSS 10.

RESULTS

During the study period 112 culture and sensitivity reports were analyzed. The most common surgical procedure was exploratory laparotomy, followed by appendectomies. In this study E. coli was the causative organism in 60.7% of cases followed next in frequency Klebsiella, (20%). The other isolates were Staphylococcus aureus, Pseudomonas, Enterobacter, Proteus and Staphylococcus epidermidis. The distribution is shown in Table-1.

Table–1: Causative organisms

Organism	No	%
E. coli	68	60.7
Klebsiella	23	20.5
Staphylococcus aureus	11	9.8
Pseudomonas	5	4.0
Enterobacter	2	1.7
Proteus	2	1.7
Staphylococcus epidermidis	1	0.9

Penicillin derivatives (Pipercillin/ Tazobactam) and carbapenem (Imipenem and Meropenem) are the most sensitive antibiotics covering all the organisms isolated in our study. Cephalosporins are ineffective against the common pathogens in our study and are associated with super infection except 3rd Generation which are showing some promise (Table-2).

DISCUSSION

Superficial surgical site infections are common problem in surgical practice. These are more prevalent after emergency surgical procedures. It could be attributable to the fact that most of these patients are from low socioeconomic group with maximum number of patients being elder, malnourished and majority has co- morbidities like diabetes, chronic liver disease and some are on immuno suppressive agents. Modern series continue to report 4–7 % wound infection rate on general surgical services and is responsible for the greatest delay in Hospital discharge. In fact wound infection adds approximately more than 6000 US dollars to the hospital cost and more than 7 days hospital stay with consequent delay to return to the work.[7, 9]

In this study the frequently isolated organism was E. coli (60.7%) in contrast to the Nosocomial infection national surveillance service (NINSS) survey (1997–2001) which report Staphylococcus (47%) including Staphylococcus auereus (MRSA) and Staphylococcus epidermidis (Coagulase Negative) as the most common organism causing SSI.[10,11]

An explanation to the above finding could be that in most of our surgical procedures the gastrointestinal tract was violated and results in contamination of the wound edges at the time of surgery.

The other less common but important pathogens isolated includes Klebsiella, Staph Aureus, Pseudomonas, proteus, entrobacter, and Staph epidermidis in that order.

Table-2: Sensitivity patterns of pus cultures isolates

	E-Coli (n=68)		Klebsiella (n=23)		Staph. aureus (n=11)		Pseudomonas (n=5)		Enterobacter (n=2)		Proteus (n=2)		Staph. epidermidis (n=1)	
Antibiotics	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Penicillin Derivatives[1]	60	8	19	4	11	0	5	0	2	0	2	0	1	0
Carbapenem[2]	68	0	23	0	11	0	5	0	2	0	2	0	1	0
Quinolones[3]	34	34	13	10	11	0	2	3	1	1	2	0	1	0
Monobactum[4]	54	14	13	0	7	4	2	3	1	1	2	0	1	0
Cephalosporins[5]	20	48	09	14	4	7	3	2	0	2	0	2	0	1
Aminoglycosides[6]	24	24	18	5	11	0	4	1	1	1	1	1	0	1
Macrolides[7]	0	68	0	23	4	7	0	5	0	2	0	2	0	1
Lincomycin[8]	0	68	0	23	6	5	0	5	0	2	0	2	0	1
Glycopeptides[9]	0	68	0	23	11	0	0	5	0	2	0	2	0	1
Miscellaneous [10]	4	64	3	20	0	11	0	5	0	2	0	2	0	1

S= Sensitive **R**= Resistant

1. Co-Amoxiclav, Pipracillin / Tazobactum,Ticarcillin/ Clavulanate.
2. Imipepnem, Meropenem
3. Sparfloxacin Ofloxacin Ciprofloxacin, Levofloxacin Sparfloxacin Enoxacin.
4. Aztreonam.
5. Cefotaxime, Cefixime, Cephradine, Cefperazone, Ceftizoxime, cephalexin , Ceftazidime, cefepime , Cefuroxime.
6. Tobramycin,Gentamycin, Amikacin sulphate.
7. Erythrocin, Klarithromycin
8. Clindamycin.
9. Vancomycin.
10. Fosfomycin, Fusidic Acid. Cefaperazone+Sabutam Linezolid

When considering sensitivity patterns, all strain of pathogenic E-Coli and Klebsiella showed 100% sensitivity to penicillin derivatives (Pipracillin/ Tazobactum) followed by Carbapenem (Imipenem, Meropenem). We found Staphylococcus aureus 100% sensitive to glycopeptides (vancomycin), a finding that is identical to other national studies.[12,13] Pseudomonas also showed a maximum sensitivity to penicillin derivatives (Pipracillin/Tazobactum) in our study as already reported in other international studies.[14,15] Third generation Cephalosporin (ceftazidime) and Aminoglycoside (gentimicin) has a potent anti-pseudomonas activity.[16,17] The antibiotic sensitivity of other isolates showed a variable pattern.

Cephalosporins are ineffective against most of the pathogens isolated in our study and are associated with super infection. Different Cephalosporin groups have different propensities for promoting super infection. Demographically we are witnessing an increasing proportion of hospitalised elderly patients who are much more susceptible to such super infections. This may be due to extensive and over use of the Cephalosporins in last two decades as documented in other studies.[18] Quinolones, aminoglycosides and monobactum showed average spectrum of sensitivity for isolated organisms.

It is with above evidence and data in mind; that microbiologists and pharmacists develop a new ‘standard surgical regime’ for prophylaxis and empirical therapy when results of pus culture and sensitivity are pending. There are compelling evidence that Cephalosporins are ineffective against the common pathogens causing SSI and it is time for surgeons to court ‘new’ antibiotics effective against today’s pathogens for both prophylaxis and empirical therapy.

CONCLUSION

This study gives us an insight to the current state of causative pathogens and their sensitivity from superficial incisional SSI in our university hospital.

We suggest that surgeon, pharmacist, Epidemiologist and microbiologist, to take their local infecting organism/sensitivity pattern into account when formulating prophylaxis as well as empirical therapy guideline for individual surgical site. We also suggest that the chosen antibiotic must have antimicrobial susceptibility for the common prevalent stains of micro-organisms.

REFERENCES

1. Mangrum AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Infect Control Hosp Epidemiol 1999;20:250–80.
2. Lee J. Wound infection surveillance for quality improvement In: Fry D (ed) Surgical infection. New York: Little brown; 1995. p.145–59.
3. Lee J. Wound infection surveillance. Surg Clin North Am 1992;6:643–56.
4. Garabaldi RA, Cushing D, Lerer T. Risk factors for postoperative infection. Am J Med 1991;91(3B):158S–163S.
5. Horan TC, Ganes RP, Martone WJ, , Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. Infect Control Hosp Epidemiol 1992;13:606–8.
6. Lee J, Olson M. Wound infection surveillance for 85,260 consecutive operations. J Surg Outcomes 1999;2:27–42.
7. Olson M, Lee J. Continuous, ten year wound infection surveillance: results, advantages, and unanswered questions. Arch Surg 1990;125:794–803.
8. Weber DJ, Raasch R, Rutala WA, Nosocomial infection in the ICU, the growing importance of antibiotics resistance pathogens. Chest 1999;115(3 suppl):34S–41S.
9. Olson M, O’Connor Schwartz ML. Surgical wound infections. A 5-year prospective study of 20,193 wounds at the Minneapolis VA Medical Center. Am Surg 1984;199:253–9.
10. Surveillance of surgical site infections in English hospitals 1997–2001. Nosocomial Infection National Surveillance Service (NINSS). PHLS publications 2001.
11. Crowcroft NS, Ronveaux O, Monnet DL, Mertens R. Methicillin resistant Staphylococcus aureus and antimicrobial use in Belgian Hospitals. Infect Control Hosp Epidemiol 1999;20:31–6.
12. Qureshi AH, Rafi S, Qureshi SM, Maqsood. The current susceptibility pattern of MRSA to conventional anti-staphylococcus antimicrobials at Rawalpindi. Pak J Med Sci 2004;20:361–4.
13. Majeed MT, Izhar M. Glycopeptides sensitivity pattern in staphylococci isolated from clinical specimens in a tertiary care hospital. Ann KE Med Coll 2005;11:263–7.
14. Livermore DM, Mushtaq S, James D, Potz N, Walker RA, Chariett A, *et al*. In vitro activity of piperacillin/Tazobactam and other broad spectrum antibiotics against bacteria from hospitalized patients in the British Isles. Int J Antimicrob Agents 2003;22:14–24.
15. Karlowsky JA, Draghi DC, Jones ME, Thornsberry C, Friedland IR, Sahm DF. Surveillance for antimicrobial susceptibility among clinical isolates of pseudomonas aeuroginosa and acinetobacter baumannii from the hospitalized patients in the United States. 1998 to 2001. Anti Microb Agents Chemother 2003;47:1681–8.
16. Zelenitsky SA, Harding GK, Sun S, Ubhi K, Ariano RE. Treatment and outcome of pseudomonas aeuroginosa bacteraemia: an antibiotic pharmacodynamic analysis. J Antimicrob Chemother 2003;52:668–74.
17. Rizvi MF, Hassan Y, Memon AR, Abdullah M, Rizvi MF, Saleem F, *et al*. Pattern of Nosocomial infection in two intensive care Hospital in Karachi. J Coll Physicians Surg Pak 2007;17(3:136–9.
18. Morgan M. Surgery and cephalosporins: A marriage made in heaven or time for Divorce? The Internet J Surg 2006;8(1). URL: http://www.ispub.com/journal/the_internet_journal_of_surgery/volume_8_number_1/article/surgery_and_cephalosporins_a_marriage_made_in_heaven_or_time_for_divorce.html

Address for Correspondence:

Dr. Syed Asad Ali, Assistant Professor of Surgery, Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan. Tel: +92-22-2780773, Cell: +92-301-3630330. **Res:** Qamar House Lajpat Road, Hyderabad, Pakistan.
Email: sasadalishah@gmail.com