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Original Research Article

Assessment of the Incidence and Associated Co-Morbidities Which Influence the Surgical Site Wound Infection: An Observational Study

Nilesh Kumar

Tutor, Department of Microbiology, Madhubani Medical College Madhubani, Bihar, India

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Corresponding author: Dr. Nilesh Kumar
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Abstract

Aim: To assess the incidence and associated co-morbidities which influence the surgical site wound infection

Methods: This study was carried out in the Department of Microbiology, Madhubani medical college Madhubani, Bihar, India, for 1 year. All patients who underwent various surgeries namely appendicectomy, hernia operation, laparotomy, mastectomy, amputation, cholecystectomy and nephrectomy were included in this study. For the study of risk factors and risk indices necessary information was collected including age, Diabetes, preoperative hospital stay, ASA score, nature of surgery, type of anaesthesia, duration of surgery and surgical technique. Swabs were obtained from wounds and were processed without delay using standard microbiological methods.

Results: Out of 200 patients, 32 patients developed surgical site infections (16%). Out of 32 infected cases, 28 cases were culture positive (87.5%, 28/32), while 4 cases were culture negative (12.5%, 4/32). The pathogens isolated were Escherichia coli (10 isolates, 35.7%), Klebsiella spp (6 isolates, 21.4%), Coagulase negative Staphylococci (4 isolates, 14.3%), Pseudomonas aeruginosa (4 isolates, 14.3%), Staphylococcus aureus (2 isolate, 7.1%) and Proteus mirabilis (2 isolate, 7.1%). The rate of SSI increased with increase in NNIS risk index from 0 to 3 with highest rate reported in ≥2 (52.5%, 21/40) . In present study out of 22 patients with Diabetes Mellitus, 8 patients had SSI. The rate of SSI was 36.4% (8/22) in patients with Diabetes Mellitus compared to rate of SSI in patients without diabetes mellitus, which was 13.5% (24/178).

Conclusion: The risk indices, like the NNIS risk index provide information about potential risk factors for development of SSI.

Keywords: SSI, NNIS risk, co morbidities

Introduction

Surgical site infections (SSI) are commonest nosocomial infections after Urinary tract infections (UTI), responsible for increasing cost, substantial morbidity and occasional mortality related to surgical operations and continue to be major problem even in hospital with most modern facilities and standard protocols of pre operative preparation and antibiotic prophylaxis [1, 2] SSI rate has varied from a low of 2.5% to a high of 41.9%. [1]

Pathogens that cause SSI are acquired either endogenously from the patient's own flora or exogenously from contact with operative room personnel or the environment. However, the period of greatest risk remains the time between opening and closing the operating site.[3]

Research over the past century has led to the development of several intrinsic risk indexes that can be used to stratify the surgical site infections rate so that valid comparisons can be made within risk strata.

CDC developed National Nosocomial Infections Surveillance System (NNIS) risk index in the year 1991 [4] as an improvement over SENIC (Study on Efficacy of Nosocomial Infection Control) risk index which ranges from 0 to 3 points and is defined by three independent and equally weighted variables. One point is scored for each of the following when present:

- American Society of Anaesthesiology (ASA) physical status classification score >2
- Either contaminated or dirty/infected wound classification

Length of operation > T hours (where T is approximate 75th percentile of duration of the specific operation being performed) [3] Dichotomization of the American Society of Anesthesiology (ASA) score in NNIS risk index is an advantage over the SENIC risk index. Its ease for collecting and its objectivity seem advantageous. Another advantage is that the NNIS risk index uses a procedure related cut point to indicate a long duration of surgery for an individual procedure, rather than a 2 hour cut point for all procedures.[5]

ASA score is an index to assess overall physical status of patient before operation ranging from 1 to 5. It has been shown highly predictive for development of SSI. [6]

The present study was aimed at obtaining the incidence of surgical site infections and determining the factors influencing the infection rate with special reference to the NNIS risk index. Various risk factors were studied, which include Patient related risk factors viz. age, diabetes, prolonged preoperative hospital stay, American Society of Anaesthesiology (ASA) score; Operative procedure related risk factors viz. nature of surgery, type of anaesthesia, duration of surgery & type of Surgical technique.

Material and methods

This study was carried out in the Department of Microbiology, Madhubani medical college Madhubani, Bihar, India for 1 year.

Methodology

All patients who underwent various surgeries namely appendicectomy, hernia operation, laparotomy, mastectomy, amputation, cholecystectomy and nephrectomy were included in this study.

For the study of risk factors and risk indices necessary information was collected including age, Diabetes, preoperative hospital stay, ASA score, nature of surgery, type of anaesthesia, duration of surgery and surgical technique.

Swabs were obtained from wounds and were processed without delay using standard microbiological methods.[7]

Results

In present study of 200 patients, 20 patients had undergone Appendicectomy, 35 patients had undergone Hernia operation, 45 patients had

undergone Laparotomy, 20 patients had undergone Mastectomy, 25 patients had undergone Amputation, 35 patients had undergone Cholecystectomy and 20 patients had undergone Nephrectomy. Out of 200 patients, 32 patients developed surgical site infections (16%). Out of 32

infected cases, 28 cases were culture positive (87.5%, 28/32), while 4 cases were culture negative (12.5%, 4/32). The pathogens isolated were *Escherichia coli* (10 isolates, 35.7%), *Klebsiella spp* (6 isolates, 21.4%), *Coagulase negative Staphylococci* (4 isolates, 14.3%), *Pseudomonas aeruginosa* (4 isolates, 14.3%), *Staphylococcus aureus* (2 isolate, 7.1%) and *Proteus mirabilis* (2 isolate, 7.1%). The rate of infection was highest in age group more than 55(36.4%, 8/22). Table-1 show that in elective surgery the rate of infection increased with increase in preoperative hospital stay. The infection rate in patients having pre-operative hospital stay 0-1 days was 5.5% (2/36), in patients with pre-operative hospital stay 2-6 days was 12.8% (12/94) and in patients with pre-operative hospital stay 7-13 days was 33.3% (4/12).

Table 1: Correlation of Infection rate with pre- operative hospital stay

Pre-op. hospital stay (days)	Patients	Infected patients	Infected Rate (%)
0-1	36	02	5.5
2-6	94	12	12.8
7-13	12	04	33.3

ASA score more than 2 was associated with high rate (29.8%, 28/94) of infection [Table-2]

In patients with emergency surgery the infection rate was 24.14% (14/58) while in patients operated electively the rate was 12.68% (18/142).

Table 2: Infection rate with ASA score

ASA score	Total No. of patients	No. of infections	Infection Rate (%)
1	10	0	0
2	96	04	4.2
≥3	94	28	29.8

As per our study SSI rate increases with the increase in the surgical wound class [Table-3]

Table 3: Rate of SSI by surgical site class

Class	Patients	Infections	Infection rate
Clean	66	02	3
Clean	70	08	11.4
Contaminated			
Contaminated	20	04	20
Dirty/infected	44	18	40.9

As shown in Table-4, a longer duration of surgery is associated with higher infection rate. The rate of SSI increased with increase in NNIS risk index from 0 to 3 with highest rate reported in ≥2 (52.5%, 21/40). In present study out of 22 patients with Diabetes Mellitus, 8 patients had SSI. The rate of SSI was 36.4% (8/22) in patients with Diabetes Mellitus compared to rate of SSI in patients without diabetes mellitus, which was 13.5% (24/178).

Table 4: Correlation between duration of surgery and rate of SSI

Surgery	Duration (minutes)	Patients	Infected Patients	Infection Rate (%)
Appendicectomy	0-60	15	0	0
	>60	5	2	40
Hernia operation	0-120	28	2	7.1
	>120	7	1	14.3
Laparotomy	0-120	26	5	19.2
	>120	19	6	31.6
Mastectomy	0-180	12	1	8.3
	>180	8	2	25
Amputation	0-120	20	2	10
	>120	5	3	60
Cholecystectomy	0-120	28	2	7.1
	>120	7	2	28.6
Nephrectomy	0-240	15	2	13.3
	>240	5	2	40

Discussion

The present study was carried out in 200 patients who underwent various surgeries (namely Appendicectomy, Hernia operation, Laparotomy, Mastectomy, Amputation, Cholecystectomy and Nephrectomy). The rate of SSI varies greatly worldwide and from hospital to hospital. The rate of SSI varies from 2.5% to 41.9% as per different studies.[1] The present study shows SSI rate 16% which is comparable with rate of SSI reported by Syed Mansour Razavi (17.4%)[8]. A lower rate of infection is reported by Anvikar AR et al (6.1%).2

In present study patients were divided in six age groups. The rate of SSI was highest (36.3%) in age group >55 years which is comparable to other studies. [9, 10]. This is due to poor immune response, existing co morbidities in old patients and reduced compliance with treatment.

National Academy of Science [10] reported higher rate of infection in patients with Diabetes mellitus which is similar to our study.

Prolonged preoperative hospital stay was found to be associated with higher rate of infection. Prolonged preoperative hospital stay leads to colonization with antimicrobial resistant micro organisms and itself directly affects patient's susceptibility to infection either by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization. Anvikar AR[2] and Lilani SP[1] also reported higher rate of SSI in patients with prolonged preoperative hospital stay.

ASA score is highly predictive for development of SSI. In the present study risk of SSI was increased with ASA score more than 2 (29.8%). Culver et al [6] also reported ASA score more than 2 associated with higher rate of SSI. ASA score is associated with other risk factors i.e. Diabetes mellitus, obesity, malnutrition, other infection, smoking etc. Surgical sites were classified using CDC's criteria. In present study, rate of SSI is increased with surgical site class. Seyd Mansour Razavi et. al. also showed similar results.[8]

The infection rate is higher in patients undergoing emergency surgery than in elective surgery as reported by other

workers. [1, 2] Emergency surgeries were usually performed by junior doctors, more often with complication & have more dirty cases.

In present study each operative procedure was divided into two groups: more than 75th percentile of NNIS duration cut point & less than 75th percentile. 3 Our finding of higher rate of SSI with increasing duration of surgery was consistent with finding of other workers. [1, 8, 2] The simplest explanation for an increased infection rate with longer procedure is that a longer exposure time will increase the level of contamination of the wound and subsequently the degree of damage to the tissues, and greater fatigue among the members of surgical team will lead to breaks in sterile technique.

The rate of SSI also varies from surgeon to surgeon. The skill and experience of surgeon directly affects the degree of contamination of the surgical site through breaks in technique or inadvertent entry in to a viscous. The skill of surgeon also affects the condition of surgical site and therefore its resistance to infection. In our study the rate of SSI was 19.6% in operations performed by junior doctors compared to rate in operations performed by senior consultants (12.9%). Anvikar A.R. [2] also reported higher rate of infection in operations performed by junior doctors. SSI rates were compared with NNIS risk index in present study. The rate of SSI increased with increase in the risk index from 0 to 3 with highest rate reported in risk indices 2 & 3. NNIS risk index is highly predictive for the development of SSI.

Conclusion

The risk indices, like the NNIS risk index provide information about potential risk factors for development of SSI. In infection control programs study of risk indices helps in surveillance & control efforts. Surveillance of surgical site infections with feedback of appropriate data to surgeons would be desirable to reduce SSI rates.

References

1. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian J Medical Microbiology 2005; 23(4):249-252.
2. Anvikar A.R., Deshmukh A.B., Karyakarte R.P., Damle A.S., Patwardhan N.S., Malik A.K., et al. A one year prospective study of 3280 surgical wounds. Indian J Medical Microbiology 1999; 17(3):129-132.
3. Edward S. Wong. Surgical site infections. *In:* C. Glen Mayhall, editors. Hospital Epidemiology and Infection control. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 1999. Pp189-210.
4. Flavia F.E., Carlos E.F.S., Tania C.M.C., Mariangela C. Applicability of the National Nosocomial Infections Surveillance System Risk Index for the Prediction of Surgical Site Infections. A review. The Brazilian J of Infectious Diseases 2007; 11(1):134-141.
5. Robert Haley. Nosocomial infection in surgical patients: Developing valid measures of intrinsic patient risk. The Americal J of Medicine. 1991; 91(supp-3B):145-151.
6. David H.Culver, Teresa Horan. Surgical wound infection rates by wound class, operative procedure & patient risk index. Tr. American J of Medicine 1991; 91(supp 3B): 152-157.
7. Monica Cheesebrough. Microbiological tests. *In:* Monica C, editor. District Laboratory Practice in Tropical Countries. Part 2. Low price edition. Cambridge University Press, UK 2000; pp80-85.
8. Seyd Mansour R., Mohammad I., Ahmad S.K., Ali J. Abdominal surgical site infections: Incidence and

risk factors at an Iranian teaching hospital. BMC Surgery 2005; 5(2):1-5.
9. Desa L.A., Sathe MJ. Factors influencing wound infection. Journal of Postgraduate Medicine 1984; 30(4):231-236.
10. National Academy of Science/ National Research Council. Post operative wound infections: Influence of ultraviolet irradiation of the operating room & of various other factor .Annal of Surgery. 1964; 160(supp2):1-132