ASIAN JOURNAL OF BIOMEDICAL & PHARMACEUTICAL SCIENCES

e-ISSN: 2249-622X

RESEARCH ARTICLE

Applicability of Risk Indices on Surgical Site Infections in Abdominal Surgery

R. Ashok[1*], V. Lakshmi[1], R.A. Sastry[2]

[1]Department of microbiology, Nizam's institute of medical sciences, Hyderabad

[2]Department of surgical gastroenterology, Nizam's institute of medical sciences, Hyderabad

Received:
22th Aug 2013
Received in revised form:
30th Aug 2013
Accepted:
5th Sept 2013
Available online:
15th Sept 2013

OPEN ACCESS

Online ISSN 2249–622X
http://www.jbiopharm.com

ABSTRACT

Background: One of the major complications after surgery is surgical site infection (SSI). The development of SSI is major cause of morbidity and mortality in surgical patients. Two indices of intrinsic infection risk have been proposed to predict SSI and to control for baseline differences among patients, allowing appropriate comparisons of infection rates: the Study of the Efficacy of Nosocomial Infection Control Index (SENIC) and National Nosocomial Infection Control Surveillance (NNIS) index. This would allow appropriate interhospital comparisons and a better use of infection rates as indicators of health care quality.

Materials and methods: A prospective study conducted in the departments of Microbiology in collaboration with Surgical Gastroenterology. Total 816 patients were included in the study during April 2003 to Dec 2004. Epi info software is used for analysis.

Results: 113 (13.9%) patients developed SSI. Both the indices have good explanatory and predictive power for the detection of SSIs in univariate analysis. To delineate whether the SENIC index added explanatory information to the NNIS index (or vice versa), we regressed each variable on the other. Logistic regression analysis confirmed the stratified analysis: residual of the NNIS index added discriminating ability to the SENIC index, whereas residuals of the SENIC index did not improve the predictive power of the NNIS index.

Conclusions: The NNIS index had a better ability than the SENIC index for discriminating and predicting risk of SSI in gastrointestinal surgery.

Keywords: SENIC index, NNIS index, SSI AND Gastrointestinal surgery.

1. INTRODUCTION:

Surgical Site Infection (SSI) is the most frequently reported infection among surgical patients, accounting for 14 –15% of all nosocomial infections among hospitalized patients (1). These infections cause substantial morbidity and mortality and increase hospital costs, but surveillance programs and feedback of surgeon-specific rates to surgeons can lead to reduction in SSI rates. An important component of these programs includes stratification of SSI rates according to risk factors associated with SSI development (2). There are different systems developed to stratify and predict SSI. Surgical wound classification was the only variable used to predict SSI. Two CDC efforts- the Study on the Efficacy of Nosocomial Infection Control study (SENIC) and the National Nosocomial Infections Surveillance (NNIS) system, incorporated other predictor variables into SSI risk indices (3).

The ideal risk index would be simple additive scale that could be calculated at the end of surgery and would predict the patients who are at high risk of SSIs (4). However, both the SENIC project and NNIS systems have improved on this simple risk index (5). The importance of measuring patient risk index would allow appropriate interhospital comparisons and a better use of infection rates as indicators of health quality. In addition, the risk index should be validated prospectively on specific services or individual hospitals to document that predicts a patient's risk accurately (4).

The present study is to understand the value of these two indices as summary measures of risk indices for SSI, we compared their ability to predict patients who would develop SSI in the study patients undergoing gastrointestinal surgery. The aim of the present study is to

*Corresponding author: Dr. Ashok R | Sr. Microbiologist, King Faisal Hospital, Rwanda |
Email: ashokrnims@yahoo.co.in | Contact: +250-783099128

determine the applicability of various risk indices in predicting SSIs in gastrointestinal surgery.

2. MATERIALS AND METHODS

The study was carried out in the Department of Microbiology in collaboration with Department of Surgical Gastroenterology (SGE) of Nizam's Institute of Medical Sciences (NIMS), Hyderabad, Andhra Pradesh, India. The Ethical committee of the Institute approved the study protocol. The study population was recruited from patients admitted for gastrointestinal/abdominal surgery to the services of Surgical Gastroenterology between April 2003 and December 2004. A total of 816 patients were enrolled in the study.

Preoperative and patient related factors, intraoperative and surgery related factors and postoperative and management related factors were noted in detail as per a standardized proforma prepared according to the CDC guidelines. At the end of the surgery the surgical procedure was classified as per the CDC guidelines by the operating surgeon. (3).

The surgical sites were examined on the 2nd postoperative day and daily then on for pain, redness, warmth, swelling and purulent drainage. SSIs were diagnosed and defined by the surgeon as per the CDC definition (3). All patients' charts, including laboratory reports were reviewed six times a week. Patients readmitted were also surveyed for infections. Post-discharge examination of the surgical site was performed for all patients in the out patient clinic for any evidence of SSIs. This surveillance was extended upto 30 days after discharge in order to detect SSIs that may have appeared after discharge. However, it was logistically difficult to follow up those patients who did not attend the post-discharge check up.

The variables used for both the indices were shown in the table: 1. The SENIC index and NNIS index were calculated at the end of the surgery. The SENIC risk index ranges from 0-4 and NNIS risk index ranges from 0-3. The results were analyzed using EPI INFO version 5, 2002. It was downloaded from the CDC web site www.cdc.gov/epiinfo and stored in the computer.

SLNO	VARIABLE	NNIS	SENIC
1	WOUND CLASS	CONTAMINATED/DIRTY	CONTAMINATED/DIRTY
2	ABDOMINAL OPERATION	-	+
3	DURATION OF OPERATION	LENGTH OF OPERATION > T HOURS*	OPERATION LASTING MORE THAN 2 HOURS
4	ASA GRADE	>3	-
5	DISCHARGE DIAGNOSIS	-	PATIENT HAVING ≥ 3 DISCHARGE DIAGNOSIS IF PRESENT, SCORES 1 POINT

Table: 1 Variables used in different risk index

*75th percentiles (an operation with duration of surgery more than T hours, where T depends on the operative procedure being performed) (7).

3. RESULTS

The overall infection rate in both the indices is 13.9%. Application of NNIS and SENIC risk indices to the patients with SSIs in the present was shown in the table: 2 & 3 respectively. Both the indices have good predictive power for the detection of SSIs by univariate analysis ($p<0.001$).

To delineate whether the SENIC index added explanatory information to the NNIS index (or vice versa), we regressed each variable on the other. We developed a measure of the unique information in the second variable (information not shared, or residual) by regression of the primary index on the second variable (that is, making the primary index an independent predictor of the second index) and by computing a set of residuals. By definition, residuals have zero correlation with the primary index. Lastly, we ran a logistic regression that predicted risk for surgical wound infection as a function of primary index (either the NNIS index or the SENIC index) and the residual secondary variable (SENIC residuals and NNIS residuals, respectively). The p valve on the residual indicated whether it significantly improved the explanatory power of the primary index.

After completion of the evaluation for one of the two indices, we repeated the analysis using the second index as the primary explanatory variable and using the residual of the first index.

The risk of infection, according to the NNIS index, is detailed in the table: 2. The risk of infection, according to the SENIC index, is detailed in the table: 3. The results of logistic regression analysis confirmed the results from stratified analysis were shown in the table: 4. The residuals of the NNIS index added statistical significance to the SENIC index ($p<0.01$). In contrast, residuals of the SENIC index did not add any meaningful information to the NNIS index ($p=0.7$).

NNIS risk index	With SSI		p-value	Without SSI	
	No	%		No	%
0	12	2.7	0.001	436	97.3
1	35	15.2		194	84.8
2	52	47.3		57	52.7
3	14	48.3		15	51.7
TOTAL	113	13.9		703	86.1

Table: 2 Applying NNIS risk index to patients with SSIs in present study

SENIC risk index	With SSI		p-value	Without SSI	
	No	%		No	%
0	0	0	0.001	63	100
1	10	2.8		344	97.2
2	27	11.6		206	88.4
3	41	39.4		63	60.6
4	35	57.4		26	42.6
Total	113	13.9		703	86.1

Table: 3 Applying study SENIC risk index to patients with SSIs in present study.

SENIC index (Ref: 0)	p-value
1	0.9
2	0.9
3	0.9
4	0.9
Residual NNIS index	0.01
NNIS index (Ref: 0)	
1	0.001
2	0.001
3	0.001
Residual SENIC index	0.7

Table: 4 Logistic regression analysis for SENIC & NNIS risk indices

4. DISCUSSION

Surgical infection rates are indicators of health care quality. There are two measures of intrinsic patient risk in surgical patients: that have been extensively applied, the SENIC index and the NNIS index. These indices allow adjustment for differences in patient's susceptibility to infection among different hospitals or services, thus permitting appropriate comparisons (6, 7). It has been found that both indices are good predictors of SSI, (8, 9) with the NNIS index appearing to have a better predictive power for risk of infection than SENIC index (6). On contrary, Haley found that the predictive power for SSI of the NNIS index was substantially less than that of SENIC index, when both indices were compared using the original databases from which they were calculated (6, 10, 11).

In the present study, we have compared the ability of these indices to predict SSI. Our results suggest that the NNIS index is better for discriminating risk than is the SENIC index. Using stratified analyses (by using EPI INFO, version 6.0, CDC, Atlanta), the SENIC index did not convey any additional information for predicting SSI. The results from logistic regression analysis confirmed the stratified analysis: the NNIS index added discriminatory ability to the SENIC index, where as residuals of the SENIC index did not improve the predictive ability of the NNIS index. These facts were not observed for non-abdominal surgery.

Current study was performed on the patients admitted to a SGE service, where as the SENIC study and NNIS study were based on patients admitted to all surgical services. In our study population, 816 (81%) patients underwent abdominal operations, and 113 (13.8%) of them infected. When compared to literature the SSI rate in the present study was within the normal range. The fact that one of the variables (abdominal surgery) scored in the SENIC index did not behave as a risk factor for SSI in our population may be one explanation of why the SENIC index showed a lower predictive ability than did the NNIS index. The similar finding was report from southern Spain by Rodriguez et al. (8).

In conclusion, our results suggest that the NNIS index is better than the SENIC index for discriminating and predicting the risk of surgical wound infection in abdominal/gastrointestinal surgery.

7. REFERENCES

1. Emori TG, Gaynes RP. An overview of nosocomial infections, including the role of the microbiology laboratory. Clin microbial Rev 1993;6:428-442.
2. Campos ML, Cipriano ZM, Freitas PF (2001). Suitability of the NNIS Index for Estimating Surgical-site infection Risk at A Small University Hospital in Brazil. Infection Control Hospital Epidemiology, 22(5): 268-272.
3. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR (1999). Guideline for prevention of surgical site infection. Infection Control Hospital Epidemiology, 20(4): 247-278.
4. Roy MC, Perl (1997). Basics of Surgical site infection surveillance. Infection Control Hospital Epidemiology, 18(9): 659-668.
5. Smyth AM, Emmerson (2000). Surgical Site Infection Surveillance. Journal of Hospital Infection, 45:173-184.
6. Alvarez F, Farinas C, Prieto D, Rodriguez (2000). Applicability of Two Surgical-site Infection Risk Indices to risk of sepsis in surgical Patients, Conception. Infection Control Hospital Epidemiology, 21(10) 633-638.
7. Culver DH, Teresa C, Gaynes RP, *et al* (1991) Surgical Wound Infection Rates By Wound Class Operative Procedure, and Patient Risk Index. The American Journal of Medicine, 91(3B): 152S-157S.
8. Rodriguez DM, Arenas MS, Cuadros MM, Gallego GM (1997). Nosocomial Infections in Surgical Patients: Comparison of Two Measures of Intrinsic Patient Risk. Infection Control Hospital Epidemiology, 18(1): 19-23.
9. Rodriguez DM, Ortega G, Liorca J, Lecuona M, Dierssen T, Arenas S, Sierra A (1999). Nosocomial infection, indices of intrinsic infection risk, and in-hospital mortality in general surgery. Journal of Hospital infection, 41: 203-211.
10. Haley RW (1993). Measuring the intrinsic risk of wound infection in surgical patients. Problems in general surgery, 10:396-417.
11. Haley RW, Culver DH, Morgan WM, White JW, Emori TG, Hooton T (1985). Identifying patients at high risk of surgical wound infection. A simple multivariate index of patient susceptibility and wound contamination. Am J Epidemiol, 121 (2): 206-15.

Conflict of Interest: None Declared

Cite this article as:
R. Ashok, V.Lakshmi, R.A. Sastry. Applicability of Risk Indices on Surgical Site Infections in Abdominal Surgery. Asian Journal of Biomedical and Pharmaceutical Sciences, 2013, 3: (23), 20-22.

