Predictors of Surgical Site Infections of the Abdomen in Lagos , Nigeria

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ABSTRACT

Background: The issue of nosocomial infection constitute a significant burden on any health care facility particularly in resource constrained centers of many developing countries.

Objectives : A prospective cross sectional study was designed to determine the baseline surgical site infection rate following abdominal surgeries, determine the influence of various factors on infection rates, evaluate the predictive value of the **ASA**, SENIC, NNIS indices on infection rates and identify the common aerobic and anaerobic organisms responsible for such infections .

Methods: One hundred and forty four consecutive patients who had abdominal surgeries were studied at the Lagos University, Teaching Hospital over a one year period . Demographic, clinical and other parameters were obtained with aid of a proforma. Those who developed surgical site infection had swabs taken for aerobic, anaerobic cultures and antimicrobial sensitivity .

Results: Wound infection rate was 17.4%. Surgeries involving the small bowels and the colon made up 75% of all infected cases. The predominant organisms isolated were *Pseudomonas, enterobacter, proteus species* . *Bacteroides* was the most frequently isolated anaerobic organism. The predictive factors for infection were long surgeries, surgical procedures classified as contaminated or dirty, high ASA(American society of Anaesthesilogist) scores, SENIC(Study of Efficacy of Nosocomial Infection control), NNIS(National Nosocomial Infection Surveillance index) scores.

Conclusion: The predictive scores can be utilized to identify high risk surgeries and institute appropriate measures to reduce surgical site infections.

Key words: Abdominal surgical site infections , risk factors

INTRODUCTION

Despite advances, sepsis still complicates a significant proportion of modern surgical procedures[1-3]. Wound infection is known to occur as result of change in the complex interplay of factors that normally prevent microbial invasion of tissues. Surgical wound infection occurs following a disruption in the protection afforded by intact skin in the presence of significant bacterial challenge and a compromised local or systemic defence mechanism . For abdominal surgeries there is added risk of wound contamination by enteral contents. This tend to be worse particularly in developing countries because limited infrastructural support. There are non standardized breaches in the aseptic technique, and lack of functioning nosocomial infection units in many hospitals[4]. The inappropiate use of antimicrobials in addition to widespread abuse of antibiotics by the general population creates a high surgical site infection rate in the hospitals of many developing countries[5,6].

The infected surgical patient tend stay in hospital longer with its attendant risks, suffer double economic jeopardy in terms loss of revenue from absence from work and increasing hospital bills[7,8].

In our center there was no regular nosocomial infection surveillance or audit prior to the commencement of this study. A study of the surgical site infection among patients undergoing abdominal, surgeries at the Lagos University teaching hospital which is a federal government owned 637 bedded tertiary health care center was therefore designed. The study aimed to determine the incidence and predictors of such infections and their common bacterial agents. It is also expected that some guidelines aimed at reducing the burden of wound infection among these patients would be developed based on this work.

METHOD

A prospective study was carried out on all patients who had abdominal surgeries over a year period (1st of June 1999 to 31st of May 2000) . Informed consent was obtained from all patients recruited. Ethical committee approval was obtained from the Ethics committee of the Lagos University teaching hospital before the commencement of the study . Paediatric patients and others who had surgeries done by other teams were excluded from the study. All relevant biodata were obtained from all the patients with aid of a designed proforma. Operative details such as incision length, traditional wound classification, type of closure, use of drains, as well as the SENIC and NNIS scores of each procedure was noted. Post operative events, complications and outcome of post discharge surveillance were recorded.

The CDC (Center for Disease Control USA) criteria for surgical site infection was used in this study. All wounds were inspected on the 5th day on earlier if indicated . Swabs or aspirate of wound discharges were taken and processed within one hour of collection . When this was not feasible , the aerobic swabs were placed in Stuarts transport medium and Roberstson cooked meat broth for anaerobic culture.

All specimen were processed at the Microbiology research laboratory of the College of Medicine, University of Lagos according to standard microbiological procedures. Antibiotic sensitivity was done on only on the aerobic cultures using standard disc agar diffusion technique (Kirby– Baur method)[5]. The progress of the patients was monitored. Those discharged from the ward were followed up in the outpatient department for minimum period of six months.

The data obtained were analysed using computer based EPI- info version 6. The level of statistical significance were assessed with the chi square test, t test, and confidence level set at 95% and level of significance taken as $P< 0.05$ and results illustrated with figures and tables.

RESULTS

One hundred and forty four consecutive patients who qualified for the study were recruited over a one year period . 25 (17.4%) developed abdominal wound infection over the study period .

There were 88 males and 56 females with a male : female ratio of 3:2. The mean age of the patients was 32.97 ± 13.72 years, the youngest patient was 13 years while the oldest was 70 years .

The patient had various diagnoses as shown in Figure 1. Eleven patients died during the course of the study Two of these had clinically infected wounds while the remaining nine were not infected till death. During follow up at the out patient department, four patients developed incisional hernia of which three were in the infected group. The various variables which were found not to be stastistically significant in the development of surgical site infections include the time of shaving , type of wound closure use of drains , and timing of surgery (elective vs emergency) (tables 2 to 5). Antibiotic was used in all patients studied , the choice was at the discretion of the operating surgeon for varying durations.

The mean incision length of the all patients studied was 18.6 ±7.7cm with a range of 5cm in some epigastric hernia and 40cm in a massively distended obese abdomen. The mean incision length in infected cases was 21.1± 6.1cm while the mean in non infected cases is 18.0cm ±7.9 cm. This difference is not statistically significant p=0.07.

The mean duration of all surgical procedures was 136.05 ±63.75 minutes. The mean duration in those who developed infection was 165.64 minutes while in the non infected group it was 129.84minutes (p=0.01)

The infection risk indices such as ASA, traditional wound classification, SENIC, NNIS scores were strongly associated with the development of wound infection in this work $p<0.05$ (table 6)

Gram–ve organism such as *Pseudomonas and Enterobacter* were the most frequently isolated aerobe ,while *Bacteroides* was the most common isolated anaerobe.

Table 1
Diagnoses of patient studied

Diagnoses	*no*	*No infected*	*% infected*
Penetrating injury	40	8	20
Appendicitis	27	0	0
Peritonitis	22	4	13.5
Intestinal obstruction	16	4	25
Cholelithiasis	8	0	0
Blunt abdominal injury	7	0	0
Abscess	4	2	50
Hernia	4	2	50
Obstructive Jaundice	3	0	0
Gastric Outlet Obstruction	3	0	0
Enterocutaneous fistula	3	3	100
Duodenal ulcer	2	0	0
Colorectal ca	2	1	50
Sigmoid volvulus	1	0	0
Achalasia	1	0	0
Colostomy closure	1	0	0
Total	**144**	**25**	17.4

Table2
Influence of timing of surgery on wound infection rates

Timing of surgery	*Infected n(%)*	*Non infected n(%)*	Total(%)
Elective	2(5.3)	36(94.7)	38(100)
emergency	23(21.7)	83(78.3)	106(100)
total	25	119	144

P=0.02

Table 3
Influence of time of shaving on wound infection rates

Time of shaving	*Infected n(%)*	*Non infected n(%)*	Total n(%)
<1 hrto incision time	22(20.9)	83(79.1)	105(100)
e"12hrs to incision time	3(77)	36(92.3)	39(100)
Total	25	119	144

P=0.02

Table 4
Influence of type of fascia closure on wound infection rates

Type of closure	*Infected n(%)*	*Non infected n(%)*	Total n (%)
Layered	6(20.2)	25	31(100)
Mass closure	19(26)	55(74)	74(100)
Total	25	80	105

P=0.48

Table 5
Influence of use of drains on wound infection rates

Use of drains	*Infected n(%)*	*Non infected(%)*	Totaln(%)
Drain used	3(10)	27(90)	30(100)
Drain not used	22(19.3)	92(80.7)	114(100)
Total	25	119	144

P=0.28

Table 6

Risks indices for infection

ASA group	*Infected*	*Non infected*	*total*	**%Infected**
1	1	50	51	2
2	13	37	50	26
3	10	27	37	27
4	1	5	6	16.7
				p=0.003
Traditional wound classification				
Clean	3	53	56	5.4
Clean-contaminated	9	44	53	17.0
Contaminated	6	14	20	30
Dirty	7	8	15	46.7
				P=0.0007
SENIC Scores				
1	1	43	44	2.3
2	10	51	61	16.4
3	13	24	37	35.1
4	1	1	2	50
				P=0.0008
NNISScores				
0	2	9	41	4.9
1	5	45	50	10
2	13	30	43	30.2
3	1	5	10	50
				P=0.0003

DISCUSSION

The infection rate of 17.4% in this study is high, when compared to other workers[10,11] though still within the rates quoted for many developing countries[12-14] However surgical site infection rates are difficult to compare as intrinsic patient factors , local practice patterns and study designs affect this. When all wound classes were compared with that of the SENIC study the rates were still higher (clean-5.4%vs2.9%, clean-contaminated-17vs3.9%., contaminated- 30vs8.9%, dirty-46.7vs12.6%) like many other reports from other developing countries. As noted earlier in our background, continuous surveillance of nosocomial infection had been absent in our hospital prior to this work .Surgical staff in many developing countries have barely adequate operating theatre equipments and basic wound care supplies. In addition there are few hospitals that have functioning administrative structure for infection surveillance or nosocomial infection policy in place. In those who do, the challenge is maintaining the recommended guidelines. This high rate may also be related to the gastrointestinal involvement of most of the surgeries (76.7%).

In our population, we have also observed that high prevalence of malnutrition, infectious diseases and antibiotic abuse may further contribute to our surgical site infection rates.

Emergency surgeries are generally expected to be at a greater risk of developing surgical site infections compared to elective procedures as shown in our work . This has been previously reported[14,15] and may reflect a generally less stringent attention to asepsis during emergency procedures or a more probable explanation may be related to the contaminated or dirty nature of many emergency surgeries.

It is expected that overnight shaving be associated with the development of infections compared with immediate preoperative shaving. The association of shorter preoperative shaving times with infection found in this study may actually be due to the non independent nature of this variable in this work . The shaving is done less than one hour to the surgery time if the surgery is emergent or done the night before if it was an elective.

The use of drains and the type of fascia closure were not associated with development of higher wound infection rates in this study. Other reports have found that open or closed drain for a duration longer than 9 days is associated with greater risk of infection(none of our patients had drains longer than one week).While the overall sample of our study may be small , the influence of such extrinsic risk may not be obvious where majority of the surgical procedures were contaminated to some degree. Many studies[16-18] which confirmed the increased risk of sepsis with use of drains did not indicate the type of operations ,type of drains, route of drainage relative to the wound duration of drainage and other important variables which may influence the risk of sepsis. Most procedures that necessitate drainage imply that either there was significant peritoneal soilage or a real risk of the development of infection .

Longer incision lengths were not a significant risk factor for the development wound infection in this study (p=0.07) as would have been expected in contrast to other reports. There might have been other confounding variables such perioperative antibiotic use which influenced this.

Recently certain indices have been developed to predict the risk of wound sepsis. The value of traditional classification into clean, lean-contaminated, contaminated and dirty operations has been established over many years and was further validated in this work (p=0.0007). It primarily asseses the degree of wound contamination that occurs during surgical procedures. The ASA score while primarily designed to asses intraoperative mortality risk of surgery and anaesthesia has been found to apparently evaluate the intrinsic risk for the development of wound infection in the post operative period (p=0.003),

SENIC (p=0.0008) and NNIS (p=0.0003) scores were more highly predictive of the risk of infection than the ASA scores or the traditional wound classification as validated by many other workers[13,15,20]. These indices probably represent a summation of the most important variables critical to development of wound sepsis including the traditional class of surgery, the duration of surgical procedure, ASA scores, and the presence or absence of more than one diagnosis.

These indices were validated in our study as highly predictive of surgical site infection as in other reports. These not only accurately predict infection rates but also allow cross center comparison of such rates among various scores.

CONCLUSION

Though limited by a small sample size and our limitation to extrinsic risks, our study highlights the keys issues concerning surgical site infections within the context of a public hospital in sub Saharan Africa. Lack of structured infection control programmes, poor antibiotic prescription practices, adversely affects infection rates .While the NNIS and SENIC indices would certainly help in identifying high risk cases. General strengthening the infection control policies and providing appropriate feedback to clinicians will also be needed to reduce the surgical site infection rates.

The authors do not have any conflict of interest in this study

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