Post-operative surgical wound infection

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Summary

The occurrence of post-operative wound infection was studied respectively over an eight month period in the University Hospital, Kuala Lumpur. One hundred and seventy four (3.4%) surgical wounds out of 5129 operations became infected. The clean wound infection rate was 2.9%, rising to 5.4% and 12.2% for clean-contaminated and contaminated surgical wounds respectively. Of the wound infections, 80.8% occurred within the first two weeks post-operatively. Bacteriological studies revealed that the commonest bacterial isolates were *Staphylococcus aureus* (36.1%), *Pseudomonas aeruginosa* (15.4%) and *Klebsiella* species (10.1%).

Key words: Post-operative wound infection

Introduction

After urinary tract infection, surgical wound infection is a common nosocomial infection, accounting for 25.4% of all hospital acquired infections at the University Hospital, Kuala Lumpur. The incisional wound, being a common factor to all surgeons, is a good denominator for monitoring hospital infection and hygiene. Wound infection surveillance in hospitals is necessary, and periodic review of the infection rate will keep hospital staff aware of the hazard of infection.

A survey of post-operative surgical wound infection was conducted prospectively at the University over an eight month period with the aim of obtaining an accurate monthly wound infection rate.

Method

All patients who were listed and had undergone either elective or emergency operations were followed up by an Infection Control Nurse (ICN) for incisional wound infection. Oral, rectal, vaginal, intranasal, intra aural and per urethral operations were excluded from the study. Such information were obtained from the ICN's daily rounds to all the wards; by direct reporting from the ward staff, from wound infection record books kept by wards, and also from laboratory reports of wound swabs which were taken for bacteriological examination once infection was clinically diagnosed. The wound infection was then observed and noted.

Clinical wound infection was defined as an area of inflammation over the wound with serous or purulent discharge with or without widespread cellulitis, pain and fever. Operation wounds were classified as defined by the National Research Council Study on Wound Infection and the Influence of Ultraviolet Light.[1]

Results

A total of 5129 operations were included in the survey during the eight month period. These were mainly clean operations (4380 or 85.4%).

A total of 174 surgical wound infections were recorded. The overall post-operative wound infection rate was 3.4% and the average clean wound infection rate was 2.9%; rising to 5.4% and 12.2% for clean-contaminated and contaminated surgical wounds respectively (Table 1). The majority of the infected wounds were in patients from the Orthopaedic unit (44.8%), followed by Obstetrics and Gynaecology (21.3%) and Surgery unit (20.1%) as shown in Table 2. The surgical wound infection rate was highest for Orthopaedic unit (6.5%), followed by Maternity (5.3%) and the Medical Unit (4.6%). Eighty one (47.1%) of infected patients developed wound infection in the first post-operative week. One hundred and thirty nine (80.8%) of infected patients developed clinical wound infection within two weeks post-operatively. The incidence of incisional wound infection rose steadily from the second post-operative day to reach a peak on day seven, when 29 (16.8%) wounds were diagnosed. It was observed that 96 (56%) of all infected wounds occurred between day four and day nine. Six (3.5%) of the infected wounds occurred more than three weeks post-operatively after the patients had been discharged (Table 3).

Bacteriological studies revealed that both gram positive (47.9%) and gram negative (52.1%) organisms played an important role in wound infection. The commonest bacterial isolates were *Staphylococcus aureus* (36.1%) of which 17 (9%) were methicillin-resistant strains, and *Pseudomonas aeruginosa* (15.4%). Coliforms were also commonly isolated and accounted for 30% of all the bacteria isolated from wound infection (Table 4).

Table 1
Post-operative wound infection surveillance:
University Hospital (August 1988 – March 1989)

	Month								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total (%)
No. of operations	651	652	627	615	712	675	494	703	5129
Surgical wound type:									
clean	511	538	542	560	645	607	409	568	4380 (85.4)
clean-contaminated	126	80	72	49	60	61	79	124	651 (12.7)
contaminated	14	34	13	6	7	7	6	11	98 (1.9)
No. infected wounds:									
clean	21	18	13	19	14	10	15	17	127 (73)
clean-contaminated	8	4	0	3	2	3	8	7	35 (20.1)
contaminated	0	1	1	1	2	3	2	2	12 (6.9)
Total no. infected wounds	29	23	14	23	18	16	25	26	174
Wound infection rate (%)									
clean	4.1	3.3	2.4	3.4	2.2	1.6	3.7	3.0	2.9%
clean-contaminated	6.3	5.0	–	6.1	3.3	4.9	10.1	5.6	5.4%
contaminated	–	2.9	7.7	16.7	28.6	42.9	33.3	18.2	12.2%
Overall wound infection rate	4.4	3.5	2.2	3.7	2.5	2.4	5.1	3.7	3.4%

Table 2
Surgical wound infection rate by unit (UHKL)

Unit	No. of operations (%)	No. of infected wounds (%)	Surgical wound infection rate (%)
Orthopaedic	1205 (23.5)	78 (44.8)	6.5
Surgery	1484 (28.9)	35 (20.1)	2.4
Obstetrics & Gynaecology			
a) Maternity	454 (8.9)	24 (13.8)	5.3
b) Gynaecology	496 (9.7)	13 (7.5)	2.6
Paediatrics	707 (13.8)	13 (7.5)	1.8
Medical	216 (4.2)	10 (5.7)	4.6
Ophthalmology	494 (9.6)	1 (0.6)	0.2
Intensive Care	73 (1.4)	0	–
Overall	5129	174 (100)	3.4

Table 3
Occurrence of surgical wound infection in patients during the post-operative period

Post-operative period (days)	Number of patients with surgical wound infections
1 – 7	81
8 – 14	58
15 – 21	27
22 – 28	4
29 – 35	2

Discussion

Post-operative wound complication is a misfortune for surgical patients, leading to considerable patient morbidity, compromising the patient's recovery, increasing the cost of treatment and prolonging the patient's hospital stay by about 7–10 days.[2,5] After urinary tract infection, surgical wound infection was the commonest nosocomial infection at the University Hospital. This study showed that the overall surgical wound infection rate was 3.4%. Such a rate has been used for comparison of the surgical standard of hygiene between hospitals. Different authors have reported overall wound infection rates varying from 4.7 to 17.0 percent.[2] However, this rate will reflect the type of operations that are commonly performed within the hospital. That is, if the majority are clean operations, then the overall wound infection rate will be low, and vice-versa.

Table 4
Bacteria isolated from infected post-operative incisional wounds, University Hospital, Kuala Lumpur

Bacteria	Number of isolates (%)
Gram positive, n = 90	
Staphylococcus aureus	51 (27.1)
Methicillin-resistant Staph. aureus	17 (9.0)
Staphylococcus epidermidis	3 (1.6)
Streptococcus species	19 (10.1)
Gram negative, n = 98	
Pseudomonas aeruginosa	29 (15.4)
Klebsiella species	19 (10.1)
Escherichia coli	16 (8.6)
Proteus species	13 (6.9)
Acinetobacter calcoaceticus	10 (5.3)
Enterobacter species	8 (4.3)
Citrobacter species	3 (1.6)
Total	188

Therefore, the clean wound infection rate should be taken as the surgical standard, since the rates for clean-contaminated and contaminated operation wounds are very varied depending on the surgical site and dose of bacterial contamination at the time of surgery.[3]

The overall surgical wound infection rate varied from 0.2% for the Ophthalmology unit to 6.6% for the Orthopaedic unit. Such variation is reflected by the common types of surgery that are carried out by the unit. Studies on various risk factors have shown that ward facilities and practices have little or no influence on wound infection and that the variation in the clean wound infection rate was due to differences in operating technique.[2,6] It would be most interesting to inform each surgeon of their clean wound infection rate, but this was not possible as there were usually more than one surgeon per surgery. There were 24 wound infections at the Maternity unit. Two were infected tubal ligation wounds. Twenty-two wounds became infected among 450 women who had undergone a caesarian section. This operation wound is classified as clean, but the observed wound infection rate for caesarian section was 4.9% which is higher than the overall clean wound infection rate of 2.9% for the whole University Hospital. This could probably due to several factors peculiar to the caesarian section which are associated with an increased risk of wound infection. For example, amniotic fluid bacterial contamination from cervical-vaginal flora, labour, prolonged rupture of membranes, number of vaginal examinations and length of internal fetal monitoring pre-operatively.[5]

Clean wound infection rates vary from hospital to hospital, usually between 3% and 5%.[4] In comparison, the University Hospital's clean wound infection rate of 2.9% was an acceptable level, reflecting satisfactory standards in surgical techniques, operating theatre hygiene and overall patient care in the wards. However, other hospitals may be more strict in maintaining clean wound infection rates of less than 2% and may show concern if the rate exceeds that limit.[3]

Microbiological identification revealed that both gram positive (47.9%) and gram negative (52.1%) organisms played an equally important role in wound infection. *Staphylococcus aureus* was the single most important species, followed by *Pseudomonas aeruginosa* and coliform organisms. At the University Hospital, 10% of all *Staphylococcus aureus* isolated were methicillin-resistant (MRSA), but in this surgical wound infection study, one third of the *Staphylococcus aureus* consisted of MRSA. This indicates that MRSA plays an important role in wound infection. Streptococci particularly *Streptococcus pyogenes* and *Streptococcus faecalis* were also commonly seen. Wounds infected by gram negative bacilli are mainly endogenous in origin.[4] The genera and species most frequently identified are *Pseudomonas aeruginosa,* Klebsiella species, *Escherichia coli,* Proteus, Acinetobacter and Enterobacter species.

The clean wound infection rate may be used to measure the effectiveness of various methods of reducing contamination at the operative site, such as skin preparations, pre-operative shaving, showering, use of different skin drapes, antiseptics and prophylactic antibiotics. Periodic surveillance of surgical wound infection incidence needs to be carried out to see that standards are maintained. Further studies may be necessary in determining the risk factors that influence the wound infection rates, including current surgical practices and the relevant patient and ward parameters, like age, sex, ethnic origin, wound type, length of pre-operative stay, length of incision, type of drainage used, number of occupied beds in the ward, patient to staff ratio and wound dressing practices. It is also important to note other special patient risk factors e.g. diabetes, malnutrition, steroid therapy and obesity.[2,5,6] Such information will provide knowledge on infection risk in patients and lead to possible ways of reducing contamination and infection in surgical wounds.

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References

1. National Academy of Sciences – National Research Council Division of Medical Sciences Ad Hoc Committee of the Committee on Trauma: Post-Operative Wound Infections: The influence of ultraviolet irradiation of the operating room and various other factors. Ann Surg 1964; 160 Suppl 2:1
2. Cruse P. Surgical infection: Incisional wounds. In: Bennett JV and Brachman PS, eds. Hospital Infections 2nd. ed. Little Brown, Boston/Toronto, 1986: 423–436.
3. Cruse P. Wound infection surveillance: Rev Infect Dis 1981 Jul; 3(4): 734–737
4. Ayliffe GAJ. Review of airborne spread of pathogens in the operating room. Infect Surg 1981 Jan: 39–43
5. Emmons SL, Krohn M, Jackson M, Eschenbach DA: Development of wound infections among women undergoing caesarean section. Obstet Gynecol 1988 Oct; 72:559–564
6. Bibby BA, Collins BJ, Ayliffe GAJ. A mathematical model for assessing risk of post operative wound infection. J Hosp Infect 1986; 8:31–39