

# Wound Infection Surveillance: A Six-Month Prospective Study

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## SUMMARY

*Infection in surgical wounds must be kept to a minimum. Surveillance of surgical wounds helps to reduce the infection rate. A six-month prospective study was carried out at the Department of General Surgery, Sheikh Zayed Hospital, to determine the wound infection rate. A total of 251 wounds were assessed. These wounds were categorised according to the degree of contamination during surgery. Anorectal cases were excluded from the study. The wounds were assessed using the Southampton Wound Assessment Scale. The wound infection rates were found to be comparable to international figures. Our infection rate of 3.3% corresponds to international figures of 2.6% (3). We recommend that continuing surveillance is necessary to further reduce the wound infection rates.*

*Key words: Wound infection, Southampton Wound Assessment Scale, Wound surveillance*

## INTRODUCTION

Work in a surgical ward necessarily means that we have to deal with patients with wounds. Infection rates are an indicator of the quality of care. If care is not exercised, surgical wounds will get infected. The acceptable incidence of wound infection in a surgical ward is of the order of 4.0 to 17% internationally<sup>1,2</sup>. This includes wounds of all categories. Semmelweis, a Viennese gynaecologist, was the first to reduce infection in his patients by employing hypochlorite solution for hand washing<sup>5</sup>. Later studies by Cruse and Foord confirmed that wound surveillance reduces wound infection rates<sup>1,3</sup>. A prospective study was carried out in Surgical Unit I at the Sheikh Zayed Hospital to determine the rate of infection, and to see whether this correlates with acceptable international standards.

## PATIENTS AND METHODS

This study was carried out with the participation and assistance of the Department of Microbiology, Sheikh Zayed Hospital. The study

period was of six months, from October 1996 to March 1997. Surgical Unit I, Sheikh Zayed Hospital, is a 35-bed acute surgical ward with a 1 in 2 emergency on call rota. A wide range of surgical procedures are performed. Patients undergoing planned surgery as well as emergencies were included. Anorectal cases were excluded from this study.

A total of 251 patients (age range 3-83 years, mean 43 years) were enrolled in this study. There were 115 males (age range 3-80 years, mean 41.5 years), and 136 females (age range 10-83 years, mean 46.5 years) (Table 1). 45.8% of the patients were males and 54.2% were females.

Table 1: A break-up of the patients according to age and sex.

	No.	Percent	Age range	Mean age
Males	115	45.8	3-80	41.5
Females	136	54.2	10-83	46.5
Total	251	100	3-83	43

The operative procedures were categorised as being clean, clean contaminated, contaminated and dirty, depending upon the degree of contamination during surgery (Table 2)<sup>2,5</sup>. There were 128 patients in the first category. Eighty-three patients had clean contaminated surgery. In these, a hollow viscus was opened, but there was no evidence of gross infection. Contaminated surgery was performed in 17 patients. These patients had localised infection or had spillage of bowel content during the procedure. Those 23 patients categorised as undergoing a dirty procedure had gross infection or perforated viscera preoperatively.

**Table 2: Types of wound tabulated according to the degree of contamination. Tables 2a to 2d show the details of the procedures performed according to this classification.**

Wound type	Number of cases	Percent
Clean (Table 2 a)	128	51
Clean contaminated (Table 2 b)	83	33
Contaminated (Table 2 c)	17	7
Dirty (Table 2 d)	23	9
Total	251	100

**Table 2a: Clean cases.**

Procedures	Number	Infected cases
Open Cholecystectomy	39	1
Groin hernia repair	40	0
Thyroidectomy	11	0
Ventral hernia repair	6	0
Mesh repair of incisional hernia	4	1
Laparoscopic cholecystectomy	4	0
Mastectomy	4	0
Appendectomy (Normal appendix)	4	0
Breast lumpectomy	3	0
Splenectomy	3	0
Nephrectomy	2	0
Exploration for retroperitoneal mass	2	0
Exploration for intestinal obstruction	2	0
Mesh repair of inguinal hernia	1	0
Lord's operation for hydrocoele	2	0
Exploration for ruptured tubal pregnancy	1	0
Total	128	2 (1.6%)

**Table 2b: Clean contaminated cases.**

Procedures	Number	Infected cases
Appendectomy (Mild to moderate infection)	37	0
Cholecystectomy, exploration and bypass for obstructive jaundice	15	3
Cholecystectomy for acute cholecystitis	8	0
Small bowel resection and anastomosis	7	2
Gastrectomy for carcinoma	4	0
Colonic resection and primary anastomosis	3	0
Whipple's procedure	1	1
Exploration for ovarian cyst torsion	1	0
Repair of strangulated ventral hernia	1	0
Toilet mastectomy for infected tumour	1	0
Devascularisation of gastric fundal varices	1	0
Abdomino-perineal resection	1	0
Above knee amputation	1	0
Duodenostomy for bleeding D.U.	1	0
Pyelolithotomy	1	0
Total	83	6 (7.2%)

**Table 2c: Contaminated cases.**

Procedures	Number	Infected cases
Appendectomy	5	0
Mastectomy for infected and ulcerated carcinoma	3	0
Cholecystectomy and CBD exploration for cholangitis	2	1
Lower limb amputations for wet gangrene	2	1
Removal of infected prosthetic mesh	1	0
Resection and anastomosis of gangrenous small bowel	3	0
Closure of ileal fistula	1	0
Total	17	2 (11.8%)

The wounds were assessed every day by the same observer (Rabbani, S.), and the findings corroborated by one of the authors (Nur, N A). The

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Southampton Wound Assessment Scale (Figure 1) (6) was used to grade the wounds as being in grades 0, I, II, III, IV or V. (Table 3).

**Table 2d: Dirty cases.**

Procedures	Number	Infected cases
Laparotomy for perforated appendix	12	3
Small bowel resection and anastomosis for enteric perforation	8	3
Laparotomy for ruptured liver abscess	1	1
Laparotomy for small bowel perforation after penetrating trauma	1	0
Laparotomy for biliary peritonitis	1	0
Total	23	7 (30.5%)

**Table 3: Grading of the wounds**

Grade	Clean		Clean contaminated		Contaminated		Dirty	
	No.	%	No.	%	No.	%	No.	%
0	80	62.5	42	51	4	23.5	5	20
I	20	15.5	20	24	2	11.8	3	16
II	21	16.5	12	14	4	23.5	3	12
III	5	4	3	4	5	29.4	5	24
IV	2	1.5	5	6	2	11.8	6	24
V	-	-	1	1	-	-	1	4
Total	128	100	83	100	17	100	23	100

Note: The wounds entered in Grades I, II and III of the Southampton wound assessment scale ultimately entered Grade 0 (Normal healing).

## RESULTS

Two out of 128 (1.6 %) wounds were infected in the clean surgery category. In the clean contaminated surgery category, there were 6 wound infections (7.2%) out of a total of 83 patients. Two out of 17 wounds in the contaminated surgery category were infected (11.8%). There were 7 wound infections out of the 23 patients (30.5%) in the dirty surgical procedure category (Table 4).

Grade	Appearance
0	Normal healing
I	Normal healing with mild bruising or erythema:
A	Some bruising
B	Considerable bruising
C	Mild erythema
II	Erythema plus other signs of inflammation:
A	At one point
B	Around sutures
C	Along wound
D	Around wound
III	Clear or haemoserous discharge:
A	At one point only (<2cm)
B	Along wound (>2cm) Large volume Prolonged (>3days)
IV	Pus:
A	At one point only (<2cm)
B	Along wound (>2cm)
V	Deep or severe wound infection with or without tissue breakdown, haematoma requiring aspiration

**Fig. 1: The Southampton Wound Assessment Scale**

**Table 4: Incidence of wound infection. The percentage figures are for the individual categories of the type of surgery.**

Wound Type	Total Number	Infected	Percentage
Clean	128	2/128	1.5
Clean contaminated	83	6/83	7.2
Contaminated	17	2/17	11.8
Dirty	23	7/23	30.5
Total	251	17/251	6.8

The organisms isolated in the clean surgery category were *Staphylococcus aureus* and *Escherichia coli*. In the clean contaminated and contaminated surgery patients, we obtained *S. aureus*, *E. coli*, *Pseudomonas* and *Klebsiella*. The isolates in the 7 infected wounds in the dirty surgery category were *E. coli*, *Pseudomonas*, *Klebsiella*, *Proteus* and *Streptococcus* species (Table 5). Multiple organisms were isolated from the infected wounds in a majority of cases.



**Table 5: Organisms isolated from infected wounds.**  
Most of the isolates were mixed infections.

Wound category	Infected wounds	Organisms isolated
Clean	2/128	<i>S. aureus</i> , <i>E. coli</i>
Clean Contaminated	6/83	<i>S. aureus</i> , <i>E. coli</i> , <i>Pseudomonas</i> , <i>Klebsiella</i>
Contaminated	2/17	<i>S. aureus</i> , <i>E. coli</i> , <i>Pseudomonas</i> , <i>Klebsiella</i>
Dirty	6/23	<i>E. coli</i> , <i>Pseudomonas</i> , <i>Klebsiella</i> , <i>Proteus</i> , <i>Streptococcus</i> spp.

## DISCUSSION

Ever since man has been practicing the art of surgery, the fear of infection has been the greatest deterrent in the progress of this science. After the advent of anaesthesia, the practice of safe surgery depended on the fact that infection could be avoided. Ignaz Semmelweis, a Hungarian gynaecologist practicing in Vienna in the mid-nineteenth century first realised that infection was transmissible due to the contaminated hands of the doctors attending women during childbirth. He significantly reduced infection rates by employing hypochlorite solution for hand washing<sup>5</sup>.

By the late 1860s Joseph Lister was using carbolic acid as a disinfectant. He was aware of the germ theory of disease as presented by Louis Pasteur, and worked incessantly to apply these principles to surgery. He was able to reduce the infection rate from 70% to a more acceptable level. His teachings were accepted slowly and are the single most important advancement responsible for reducing the mortality in modern surgery<sup>5</sup>. In the 1880s von Bergmann introduced autoclaves and aseptic surgery. By 1899, Kocher was able to report a wound infection rate of only 2.3% in his thyroid surgery<sup>2</sup>.

In 1961, John Burke showed by experiments the importance of prophylactic systemic antibiotics in the prevention of wound infection<sup>7</sup>. These studies eventually led to the universal agreement on the use of antibiotic prophylaxis in the peri-operative

period<sup>5</sup>. To be effective, the antibiotics should be present in the circulation at least within 3 hours of the infection<sup>8</sup>.

Our study shows an infection rate of 3.3%. This corresponds to 2.6% as quoted by Cruse and Foord at the commencement of their study<sup>1</sup>. The best way to reduce the rates of wound infection is by continuous wound surveillance<sup>6</sup>. Further studies by Cruse and Foord have shown that the wound infection rate fell from 2.6% to 0.6% by the last year of their data collection<sup>3</sup>. This was a ten-year prospective study, and included 62,939 wounds. Condon et al. and several other large studies have corroborated these findings<sup>4,6</sup>. Further data is being collected to determine a fall in the wound infection rates with continued wound surveillance.

The importance of wound infection is mainly due to two reasons. One is the obvious increase in morbidity of the operative procedure, and the second is the economic implications of wound infection<sup>2</sup>. This complication usually causes a prolonged hospital stay along with its attendant costs of dressings and drugs. Convalescence is prolonged, causing a delay in the return to work and activities of normal living.

## CONCLUSION

This study shows our overall infection rate for clean and clean contaminated cases to be 3.3%. This corresponds to 2.6% as quoted by Cruse and Foord at the beginning of their study<sup>1</sup>. Deputing dedicated hospital staff for wound surveillance has been claimed to reduce the incidence of wound infections. This is not necessarily the case. The reference method, with regular ward visits thrice a week for discussions and review of microbiology reports, does not require dedicated staff and is accurate, but it is time-consuming<sup>6</sup>. Our study has only been able to look at inpatient wound infections. The important problem of the patient who develops wound infection at home has not been addressed. Further studies are necessary to determine our reduction in wound infection with continued surveillance. This study is already in progress. A method to ascertain outpatient wound infection will have to be devised. The possible methods are by telephonic or postal questionnaire, or by domiciliary visits. All are labour intensive.

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