

POST OPERATIVE WOUND SEPSIS  
IN GENERAL SURGICAL WARDS  
AT THE KENYATTA NATIONAL HOSPITAL.

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BY

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SUBMITTED AS DISSERTATION FOR  
THE DEGREE OF MASTER OF MEDICINE  
(SURGERY) PART II

JULY 1981

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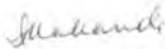
This dissertation is my original work and has not been presented for a degree in any other University.



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DR. MASIIRA-MUKASA (JULY 1981)

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## INTRODUCTION

Post-operative wound sepsis in general surgical wards continues to present a major problem in both developed and developing countries despite marked progress made in both surgery and microbiology since the times of Joseph Lister (1867). It is estimated that approximately one-third of all major surgical procedures in a busy surgical ward are complicated by post-operative wound infections (Meer 1979).

Some of these infections develop 'spontaneously' while in majority of cases there are obvious pre-disposing factors which may be found in the patient, in the environment, or as a result of the surgical procedures carried out. Before the studies of both Louis Pasteur and Robert Koch (1876 - 1886), and their application in surgical practice by Joseph Lister, nearly all surgical wounds became infected. By then however, wound sepsis per se was of secondary importance when compared to the dreaded post-operative complications such as pyemia, septicaemia, "hospital gangrene", and tetanus which for a considerable time complicated nearly 90% of all post-operative wounds (Sabiston 1973, Foster 1970, Cruickshank 1973). The extent and significance of post-operative wound sepsis by then is exemplified by the 92% mortality rate reported for amputations of the femur following trauma (during the Crimean war), as a result of "hospital gangrene". The results of injuries during the American civil war were of similar nature and mortality (Sabiston 1973).

During the early 19th century, mortality and morbidity from post-operative wound sepsis was so high that elective major operations were avoided.

Joseph Lister is generally recognised as the founder of the anti-septic principles in surgery and his paper - "THE ANTISEPTIC PRINCIPLES IN PRACTICE OF SURGERY" published in 1867 revolutionised the practice of surgery. The science of medical microbiology during the second half of the 19th century was dominated by the work of two great men, Louis Pasteur and Robert Koch whose most important contribution to medical microbiology, (made between 1876 and 1886) was the identification of bacteria as the cause of disease (Foster 1970, Vallum 1970, Cruickshank 1973).

Joseph Lister's work on "anti-sepsis" was extended by Bergmann to "asepsis" with his introduction of the principle of steam sterilization in 1886 and thereafter his elaborate aseptic ritual in 1891. Theodor Kocher emphasized the importance of contact contamination of post-operative wounds in 1890 and his work in this field led to the general use of surgical rubber gloves in the U.S.A. in the same year (Sabiston 1973).

With the introduction of antibiotics in the early part of the 20th century, the severity and complications associated with post-operative wound sepsis have certainly reduced (as compared to the times of Joseph Lister),

though post-operative wound infections still continue to present a major problem in busy general surgical wards.

With continued use of antibiotics the complexity and difficulties related to the prevention and control of post-operative wound infections have increased, due to the indiscriminate use of antibiotics and subsequent development of drug-resistance hospital organisms.

Today, post-operative wound sepsis in general surgical wards is seldom a threat to life. However it has many serious implications to the surgeon, the patient, the ward and the hospital as a whole.

To the surgeon, post-operative wound sepsis is a good measure of his success or failure in surgical practice. Post-operative wound sepsis may turn a "beautifully done job" into a "surgical catastrophe".

To the patient, post-operative wound sepsis often results in prolonged hospitalisation, sometimes with severe morbidity and even death. Post-operative wound sepsis in a busy general surgical ward, often result in severe auto or cross-infection which may rapidly spread across the ward especially in crowded wards such as those in many general surgical wards in developing countries. Post-operative wound sepsis in general surgical wards, increases the time and nursing care spent on individual patients more than it would otherwise be without the presence of infection.

Finally, post-operative wound sepsis, prolongs the patients stay on the wards, increases the hospital's

expenses on individual patients, and reduces the number of patients who can effectively be treated in the hospital through prolonged hospitalisation.

The main aims of this study were to establish the rate of post-operative wound sepsis in general surgical wards at the Kenyatta National Hospital, to determine the factors which influence this rate and to give brief recommendations as to how the problem of post-operative wound sepsis in this hospital could be managed.



MATERIALS AND METHODS

Kenyatta National Hospital is both a national referral centre and a teaching hospital - situated approximately four miles from the centre of Nairobi. The hospital has three general surgical firms (Firm I, II and III), each firm having 24 beds for male patients and 12 beds for female patients. All general surgical cases are admitted to the same wards except for severely burnt patients who are admitted to a special - Burn's Unit, paediatric patients who are admitted to female wards and some orthopaedic cases who are admitted to a special orthopaedic ward (ward 13).

This study was carried out at the Kenyatta National Hospital's general surgical wards over a three-month's period starting from 5th May, 1980 to August 15th 1980. The study included all major surgical procedures carried out at this hospital's major theatres within the above specified period with the exception of the following:-

1. All minor surgical procedures.
2. Operations on the anus and the peri-anal region.
3. All orthopaedic operations.
4. Cardio-thoracic operations.
5. Obstetrics and gynaecological operations.
6. E.N.T. and Eye operations
7. Operations on burn wounds.

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arrival on the ward, - throughout hospitalization and the first two visits to the surgical out-patient's clinic. All cases under this study were grouped into two major categories (EMERGENCY or ELECTIVE) according to the mode of admission to the ward.

The types of operations carried out within the period of study were divided into two major groups (Risk-groups) according to the likelihood of occurrence of post-operative wound infections.

1. Risk group I

These were clean operations such as:-

- . Simple uncomplicated herniorrhaphies.
- . Operations on the thyroid.
- . Cranioplasties.
- . Elective operations on the stomach and duodenum.
- . etc.

2. Risk-group II

These were potentially infected operations, or operations with high chances of being complicated by post-operative wound infections such as:-

- . Most operations on the colon and rectum.
- . Complicated acute appendicitis.
- . Operations for a perforated viscus.
- . Drainage of abscesses.
- . Operations on the prostate.
- . Elevation of depressed compound skull fractures.
- . Operations for penetrating abdominal wounds.

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The duration of the operation was taken to be the time interval between the onset of the skin incision and the tying of the last skin stitch, and this was clearly recorded down by the anaesthetist on the patient's anaesthetic form. For practical purposes operations were divided into two major groups. Those lasting for less than 2 hours were termed SHORT OPERATIONS and those lasting for 2 hours or more were termed LONG OPERATIONS.

Post-operatively, daily blood-pressure, pulse-rate, and temperature were recorded up to the 5th post-operative day. The wounds were examined on the 3rd post-operative day. Thereafter the state of the wound was noted daily until the patient was discharged from the ward.

In this study, all wounds with clinical evidence of infection (such as pus discharge, abscess formation or induration) including wound-ruptures (or wound gaping) or oozing from the main wound (whether serous or bloody), were considered clinically infected irrespective of bacteriological results.

On the earliest evidence of wound infection pus-swabs were taken from the main wound for culture and sensitivity. The procedure involved taking two pus-swabs from the main wound. The swabs were immediately placed in sealed sterile test-tubes and subsequently sent to the laboratory. At the laboratory an initial gram-stain was made and was followed by culture of the pus-swabs. Due to unavoidable problems it was not possible to culture the pus-swabs anaerobically.

In the preparation of this study, wound sepsis was broadly divided into two major groups:-

1. Purulent wound sepsis

A wound with clinical evidence of infection with pus discharge, abscess formation or growth of pathogenic organisms from pus-swabs taken from the main wound.

2. Non-purulent wound sepsis

A wound with a discharge or oozing but without positive cultures, or growth of non-pathogenic organisms; wound rupture or gaping, and marginal wound induration.

In this study antibiotics were mainly reserved for those operations where gross pre-operative or intra-operative contamination was assumed to have taken place, those where there had been prolonged intra-operative exposure or those where there was clinical evidence of wound infection.

All post-operative patients in this study were regularly followed up in the surgical out-patient's clinics in order to note the state and progress of the wound, carry out any necessary additional investigations or alter treatment.

## RESULTS

A total of 280 cases were initially included in this study project but during the course of study 20 patients died and 40 patients were lost through such means as defection from the wards, transfer of patients to other hospitals while still undergoing treatment, and failure of patients to turn up for out-patient's follow up especially those who had been sent home before their wounds were fully healed.

The results were thus based on a total of 220 patients who had been followed up from the beginning of the study to the end.

The various operations carried out during the course of study are listed in tables 1 and 2 according to the risk-groups.

Table 1

RISK-GROUP I

TYPE OF OPERATION	NUMBER OF TIMES DONE
Truncal vagotomy with drainage procedures. (gastro-jejunosomy or pyloroplasty)	16
Herniorrhaphy	18
Operations on the thyroid (partial, sub-total, or total thyroidectomy)	21
Partial gastrectomy	5
Total mastectomy for cancer	8
Exploratory laparatomy (Elective operations)	26
Splenectomy	7
Operations on the kidneys, adrenals and ureters	5
Operations on the bladder and bladder-neck.	9
Operations on the diaphragm	3
Craniotomy (elective cases)	7
Operations on the testis and scrotum	3
Excision of haemangioma	1
Closure of Meningocele	1
Excision of lipo-sarcoma	1
Neonatal Intestinal obstruction	1
Ramstedt's pyloroplasty	1
Total number of operations in Risk-group I	133



RISK-GROUP II

TYPE OF OPERATION	NUMBER OF TIMES DONE
Operations on the urethra	2
Operations on the prostate	28
Operations on the oesophagus (for carcinoma)	6
Elevation of depressed compound skull fractures	8
Amputations	4
Operations on the colon and rectum	7
Operations for a perforated viscus	8
Appendicectomy for acute appendicitis	14
Drainage of intra-abdominal or pelvic abscesses	7
Operations for fecal-fistula	1
Major surgical toilets	2
Total number of operations in Risk-group II	87

THE FREQUENCY OF WOUND SEPSIS  
IN ALL CASES UNDER STUDY

Table 3 shows the distribution of purulent-wound sepsis and non-purulent-wound sepsis among males and females, and the total frequency of both purulent-wound sepsis and non-purulent-wound sepsis in all post-operative cases under study.

54.6% of all post-operative wounds healed primarily, while 21.8% were complicated by purulent-wound sepsis and 23.6% were complicated by non-purulent-wound sepsis. 73.1% of all female wounds and 47.1% of all male wounds healed without any form of wound sepsis, whereas 5.9% of all female wounds and 29.2% of all male wounds were followed by non-purulent-wound sepsis. At the same time 21% of all female wounds and 23.7% of all male wounds were followed by purulent-wound sepsis.

These figures show a higher rate of post-operative wound sepsis among males than among females.

Table 3

	FEMALES		MALES		TOTAL	
	No.	%	No.	%	No.	%
No sepsis	48	73.1	72	47.1	120	54.6
Non-purulent wound sepsis	4	5.9	48	29.2	52	23.6
Purulent wound sepsis	14	21	34	23.7	48	21.8
TOTAL	66	100	154	100	220	100

THE FREQUENCY OF WOUND SEPSIS  
WITH THE TYPE OF OPERATION

The variation of purulent-wound sepsis and non-purulent-wound sepsis with the type of operation is shown in table 4.

Out of 133 operations in Risk-group I, 9.77% developed purulent-wound sepsis and 16.5% - developed non-purulent-wound sepsis, whereas out of 87 operations in Risk-group II 40.1% developed purulent-wound sepsis and 34.5% developed non-purulent-wound sepsis.

Risk-group II operations were therefore more frequently complicated by both purulent-wound sepsis and non-purulent-wound sepsis than Risk-group I operations.

Table 4

TYPE OF OPERATION	PURULENT WOUND SEPSIS		NON-PURULENT WOUND SEPSIS	
	No.	%	No.	%
Risk-group I (133 cases)	13	9.77	22	16.5
Risk-group II (87 cases)	35	40.1	30	34.5
TOTAL (220 cases)	48	21.8	52	23.6

THE FREQUENCY OF WOUND SEPSIS  
WITH AGE

The variation of purulent-wound sepsis and non-purulent-wound sepsis with age is shown in both table 5 and figures 1 and 2.

Both figures 1 and 2 show that up to 50 years the frequency of both purulent-wound sepsis and non-purulent-wound sepsis vary very little with age, but from 50 years onwards the frequency of wound sepsis increases with age.

Table 5

AGE GROUP IN YEARS	PURULENT WOUND SEPSIS		NON-PURULENT WOUND SEPSIS	
	No.	%	No.	%
0 - 9 (15 cases)	3	20	3	20
10 - 19 (20 cases)	2	10	3	15
20 - 29 (46 cases)	10	21	11	23
30 - 39 (51 cases)	10	19	10	19
40 - 49 (28 cases)	6	21	5	18
50+ (60 cases)	17	26	20	30
TOTAL (220 cases)	48	21.8	52	23.6

FIGURE 1

VARIATION OF PURULENT-WOUND SEPSIS WITH AGE

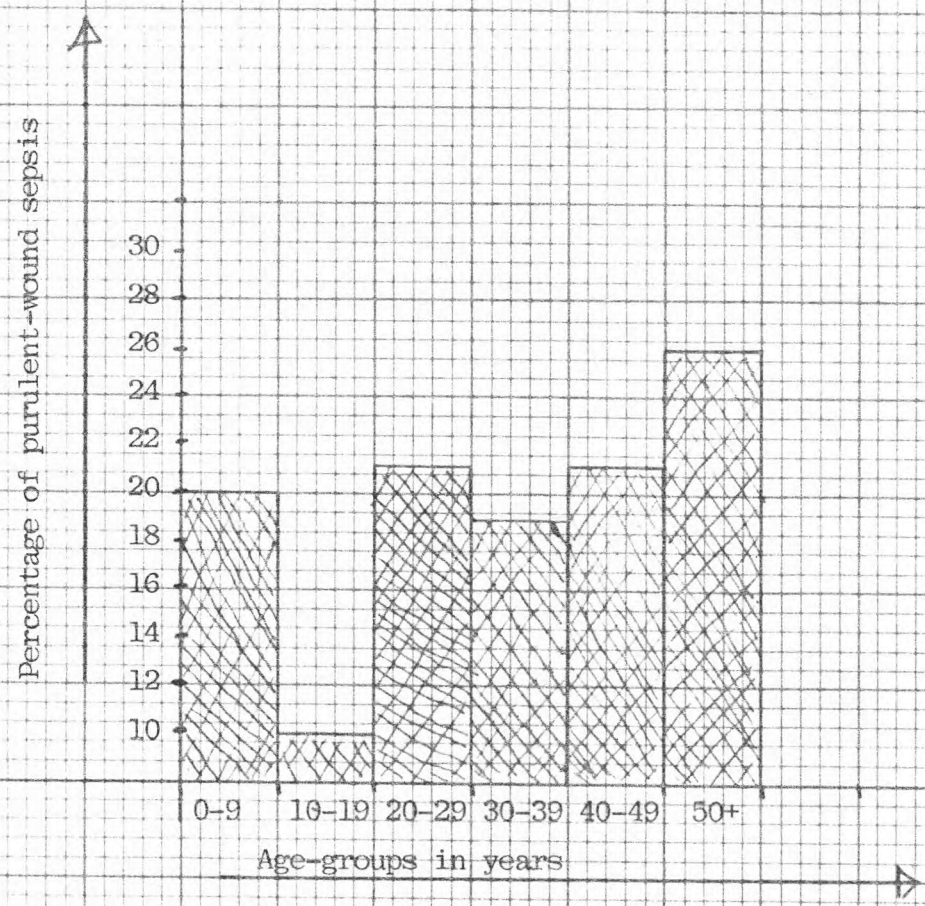
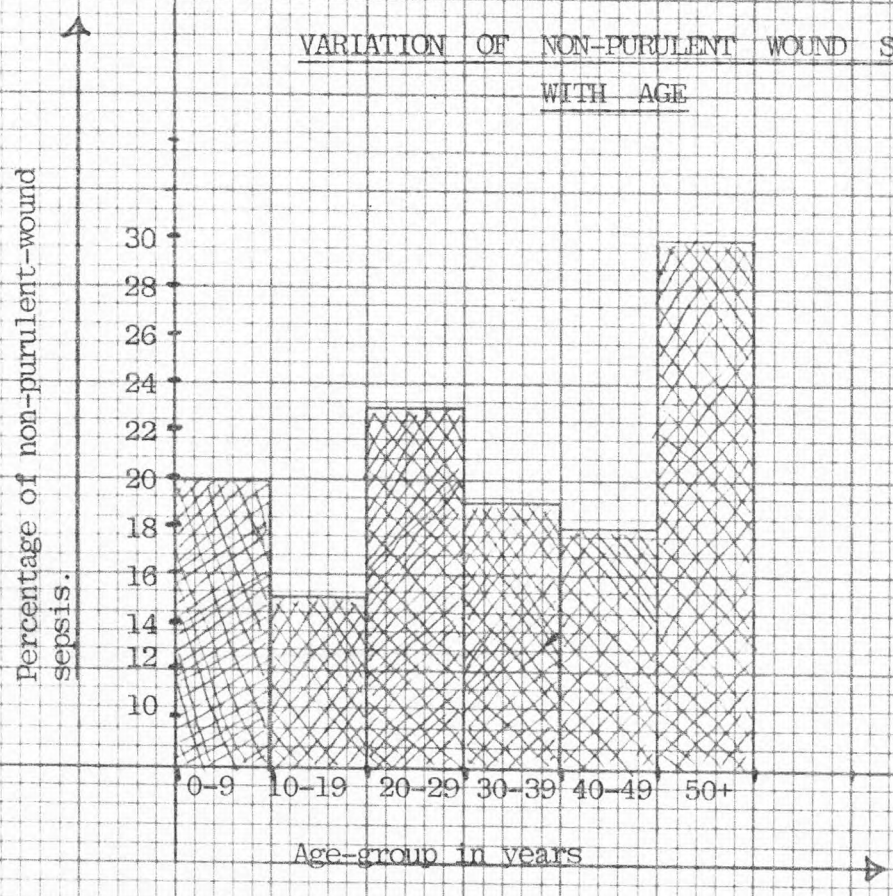


Figure 2

VARIATION OF NON-PURULENT WOUND SEPSIS WITH AGE



THE FREQUENCY OF WOUND SEPSIS  
WITH THE CATEGORY OF THE PATIENT

Table 6 shows the frequency of wound sepsis among patients who underwent elective surgical procedures and those who underwent emergency operations.

Out of 100 elective operations 20% developed purulent-wound sepsis and 22% developed non-purulent-wound sepsis, whereas out of 120 emergency operations 23.3% - developed purulent-wound sepsis and 25% developed non-purulent-wound sepsis.

Emergency operations were therefore more frequently complicated by post-operative wound infections than elective operations.

Table 6

Number of patients	<u>ELECTIVE OPERATIONS</u>				Number of patients	<u>EMERGENCY OPERATIONS</u>			
	Purulent wound-sepsis		non-purulent wound sepsis			Purulent wound-sepsis		Non-purulent wound-sepsis	
	No.	%	No.	%		No.	%	No.	%
100	20	20	22	22	120	28	23.3	30	25

THE FREQUENCY OF WOUND SEPSIS WITH  
THE DURATION OF PRE-OPERATIVE HOSPITALIZATION

Table 7 shows the variation of both purulent-wound sepsis and non-purulent-wound sepsis with the duration of pre-operative hospitalisation, and this is represented in figure 3.

Figure 3 shows that the frequency of wound sepsis gradually rises as the duration of pre-operative hospitalization increases.

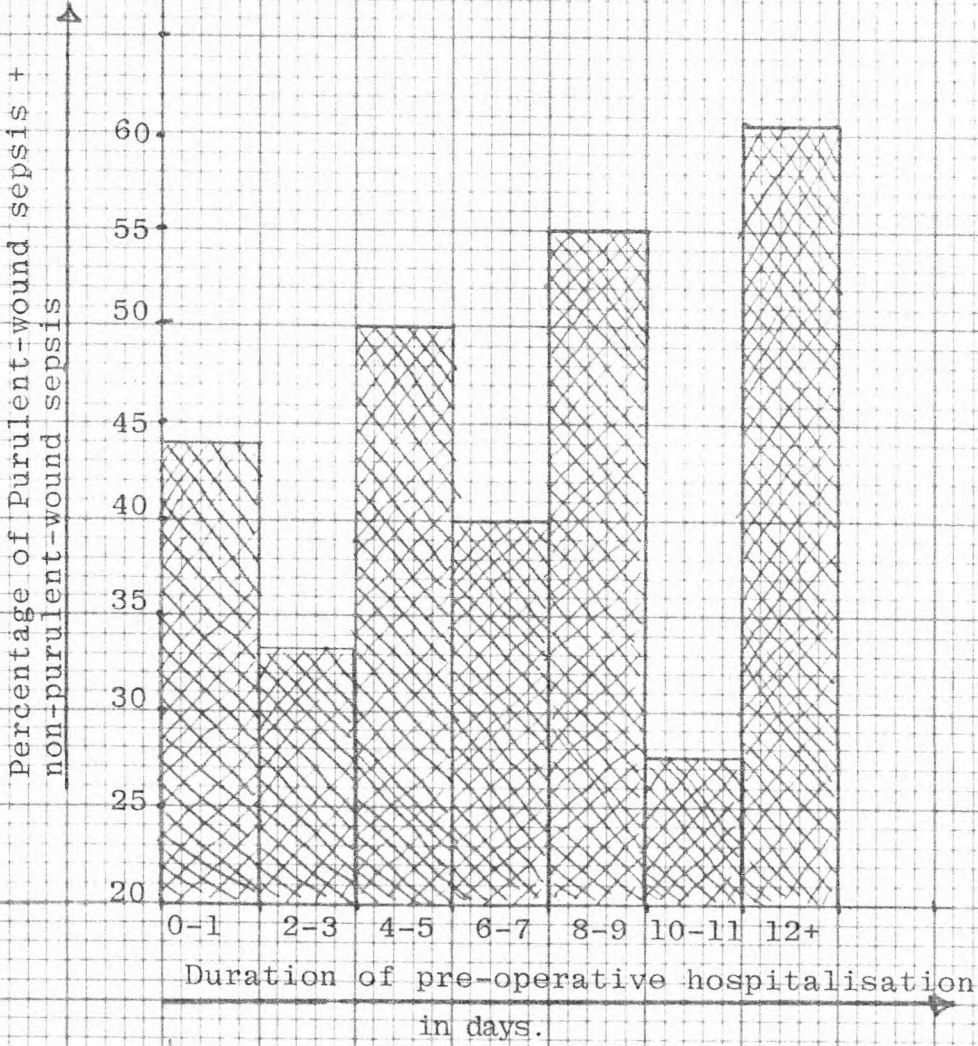
Table 7

DURATION OF PRE-OPERATIVE HOSPITALIZATION (IN DAYS)	NUMBER OF PATIENTS	NUMBER OF PURULENT WOUND SEPSIS AND NON-PURULENT WOUND SEPSIS	%
0 - 1	52	23	44.2
2 - 3	39	13	33.3
4 - 5	20	10	50
6 - 7	20	8	40
8 - 9	20	11	55
10 - 11	22	6	27.2
12+	47	29	60-1



FIGURE 3

VARIATION OF WOUND SEPSIS  
WITH THE DURATION OF PRE-OPERATIVE  
HOSPITALIZATION



THE FREQUENCY OF WOUND SEPSIS  
WITH THE DURATION OF OPERATION

Table 8 shows the variation of both purulent-wound sepsis and non-purulent-wound sepsis with the duration of the operation.

Out of 85 operations in Risk-group I lasting for less than 2 hours 24.7% developed wound sepsis, whereas out of 48 operations in the same Risk-group lasting for 2 hours or more 27% were complication by wound sepsis.

At the same time out of 74 operations in Risk-group II lasting for less than 2 hours 63.5% were followed by wound sepsis whereas out of 13 operations in the same Risk-group lasting for 2 hours or more 69.2% were complicated by wound sepsis. Therefore, in Risk group I operations the duration of the operation influenced very little the rate of wound sepsis whereas in Risk-group II operations the rate of wound sepsis increased with the duration of operation.

Table 8

RISK GROUPS	DURATION > 2 HOURS			DURATION < 2 HOURS		
	Number of operations	Purulent-wound sepsis and non-purulent wound sepsis		Number of operations	Purulent-wound sepsis and non-purulent wound sepsis	
		No.	%		No.	%
I 133 (cases)	85	21	24.7	48	13	27
II 87 (cases)	74	57	63.5	13	9	69.2

THE FREQUENCY OF WOUND SEPSIS  
WITH THE USE OF A DRAIN

The variation in frequency of wound sepsis with the use of a drain is shown in table 9. In this context a drain include any form of external drainage system used after any operation either to drain the operated organ or the operative field.

Out of 124 operations where no drain was left in-situ 27.4% developed post-operative wound sepsis while out of 96 operations where a drain was used 68.7% developed post-operative wound sepsis. The use of a drain therefore significantly increased the frequency of post-operative wound sepsis.

Table 9

Number of Operations	<u>WITHOUT DRAIN</u>		<u>WITH A DRAIN</u>		
	Purulent-wound sepsis and non-purulent-wound sepsis		Number of Operations	Purulent-wound sepsis and non-purulent wound sepsis	
	No.	%		No.	%
124	34	27.4	96	66	68.7

THE FREQUENCY OF WOUND SEPSIS WITH  
PROPHYLACTIC USE OF ANTIBIOTICS

The variation of frequency of wound sepsis with the use of prophylactic antibiotics is shown in table 10.

Out of 100 cases in Risk-group I where no prophylactic antibiotics were used 32% developed wound sepsis while out of 33 cases in the same Risk-group where prophylactic antibiotics were used 27.2% developed post-operative wound sepsis. At the same time out of 50 operations in Risk-group II where no prophylactic antibiotics were used 66% developed post-operative wound sepsis, whereas out of 37 operations in the same Risk-group where prophylactic antibiotics were used 70% developed post-operative wound sepsis.

Prophylactic antibiotics therefore, did not significantly alter the frequency of post-operative wound sepsis in both Risk groups I and II.

Table 10

Risk groups	WITHOUT ANTIBIOTICS			WITH ANTIBIOTICS		
	Number of Operations	Purulent-wound sepsis and non-purulent wound sepsis		Number of Operations	Purulent-wound sepsis and non-purulent wound sepsis	
		No.	%		No.	%
I (133 cases)	100	32	32.0	33	9	27.2
II (87 cases)	50	33	66.0	37	26	70.1

Table 11

TYPES AND FREQUENCY OF  
ORGANISMS ISOLATED

TYPE OF ORGANISMS	NUMBER OF TIMES ISOLATED
E. Coli	16
Klebsiella	14
Staph. aureas	12
Proteus	12
Pseudomonas	8
Staph. Albus	7
Strep. Fecalis	7

DISCUSSION

The frequency of post-operative wound sepsis differs from hospital to hospital, furthermore the frequency of sepsis even in one particular hospital may vary from time to time in the course of the year.

The nature of operation(s) appears to be the major factor that determines the frequency of post-operative wound sepsis. Thus operations such as those on the large bowel, appendix, prostate, biliary system, etc., are associated with a higher risk of being infected than operations such as knee arthrotomies (for torn menisci), un-complicated simple herniorrhaphies, operations on the thyroid, or elective operations on the stomach and the duodenum.

In highly specialised centres where certain types of operations are concentrated in special units (i.e. burn unit, urology unit, gastro-enterology unit etc.) the rate of post-operative wound sepsis varies from one unit to another and certain units (i.e. burns unit, urology unit) have to work with a high rate of post-operative wound sepsis (Meer 1979). It is therefore necessary for each hospital to establish its rate of post-operative wound sepsis and to compare this rate with those obtained at other hospitals. The position should then be periodically reviewed to determine the bacteriological pattern and to establish whether the rate of infection is rising or falling.



In East-Africa and in Kenya in particular very little work appears to have been done on post-operative wound infections, and it was thought that such a study, carried out here at the Kenyatta National Hospital for a limited period of time would be extremely useful.

In this discussion, the rate of wound sepsis is considered first, and thereafter the factors which were considered to influence this rate are discussed in details.

#### THE FREQUENCY OF WOUND SEPSIS

From table 3 the overall frequency of wound sepsis was 21.8%. The rate of sepsis is higher among males (23.7%) than among females (21%). This difference in the rate of sepsis is probably due to an increased rate of Risk-group II operation among males than among females, and a large population of male patients as compared to female patients.

Kenyatta National Hospital like many similar medical institutions in the developing world has a very high rate of post-operative wound sepsis as compared to many similar institutions in the developed countries.

Jepsen et al (1969) in their study of post-operative wound sepsis in general surgical wards at the Municipal Hospital Copenhagen, found the rate to be 19.1% and Davidson et al (1971) in their computer analysis of post-operative wound infections at the Department of Surgery,

University of Aberdeen, found the rate of sepsis to range between 8.8% and 14.1%.

Cruse (1977) in Canada found the rate of sepsis to vary from 4.9 to 6.1%. In his study on the frequency of post-operative wound sepsis at Muhimbili General Hospital, Dar-es-Salaam, Shija (1976) found the rate of post-operative wound sepsis to be 23.3%.

The current rates of post-operative wound sepsis in various parts of the world are summarized in table 12.

Table 12

AUTHOR	COUNTRY	NUMBER OF PEOPLE STUDIED	SEPSIS RATE
MASIIRA-MUKASA	Kenya	220	21.8%
J.K. SHIJA	Tanzania	227	23.3%
MYBURG	South Africa	?	17.0%
PETER CRUSE	Canada	63,000	4.9% - 6.1%
S.K. CLARKE	England	382	13.6%
M.R.C.	U.S.A.	15,673	7.5%
ROUND TREE	Australia	198	14.0%
G. Davidson et. al.	England	1,000	8.8% - 14.1%
B. Jepsen et. al.	Denmark	845	19.1%

Compared to results from other countries, Kenyatta National Hospital has a very high rate of post-operative wound sepsis (Table 12). This high rate of wound sepsis may be related to the following:-

1. There is permanent over-crowding on the wards with virtually no isolation of patients especially those with septic wounds. This encourages cross-infection.
2. Theatres are over-used, so that some vital aseptic precautions are so often over-looked.
3. Most operations especially emergency operations and in particular those carried out at night are performed by junior doctors with limited experience and skills. Their aseptic techniques may not be up to the required standards.
4. The majority of patients admitted to the general surgical wards are of low social-economic status, usually suffering from other debilitating conditions and so often come late in the course of a disease.

All these factors encourage poor wound healing and infections.

#### THE TYPE OF OPERATION (RISK-GROUP)

Table 4 shows a higher rate of wound sepsis among Risk-group II operations (40.1%) than among Risk-group I operations (9.77%).

Jepsen et al (1969) and Davidson et al (1971) found the type of operation to be the most important factor that

determined the frequency of post-operative wound sepsis.

Gibson (1971) and Cruse (1977) arrived at almost similar conclusions.

Höjor et al (1977) found non-wound infectious complications (i.e. septicaemia, intra-abdominal abscesses and pulmonary infections) to be more common following Risk-group II operations than Risk-group I operations.

However Kelly (1980) in his study of wound infections at the Bristol Royal Infirmary failed to demonstrate any association between the type of operation and the occurrence of post-operative wound sepsis.

The high rate of sepsis among Risk-group II operations is due to the fact that these are either potentially infected operations, or operations that carry high chances of both endogenous and exogenous contamination due to the nature of the underlying pathology or the operation itself. However other factors may possibly be involved such as drains which are so often used in these operations and these may increase the likelihood of infection.

#### THE AGE

Figure 1 and 2 shows that up to 50 years, age has generally no effect on the frequency of wound sepsis. However above 50 years the frequency of wound sepsis increases with age. The relationship between age and post-operative wound sepsis has for a long time been a subject of much controversy.

Some workers argue that other factors (such as the type of operation) must be considered along with age in determining the relationship between the age and the frequency of post-operative wound sepsis, since certain operations were more likely to be performed under particular age-groups than others.

For example, Jepsen et al (1969) failed to find any relationship between age and frequency of post-operative wound sepsis. They argued that for age to have any effect on the frequency of wound sepsis, the type of operation must be taken into account since certain operations were peculiar to certain age groups. They agreed however that age per se was of importance as regards to the severity of infection.

On the other hand Davidson et al (1971) found that up to 60 years, age had no effect on the frequency of wound sepsis, but above 60 years the rate of wound sepsis progressively increased with age. Cruse (1977) and most of studies carried out in the U.S.A. found the frequency of post-operative wound sepsis to increase with age.

A possible explanation for the sharp rise in the rate of sepsis after the age of 50 years may be the nature of operations performed above this age, or the physiological changes of aging which predisposes to delayed healing and subsequent wound infection. Another equally convincing

explanation may be that the rise in the rate of wound sepsis above 50 years as shown in figures 1 and 2 is not a true one but an apparent one due to grouping together of all patients above 50 years into one age-group.

#### THE DURATION OF PRE-OPERATIVE HOSPITALIZATION

Table 7 and figure 3 shows a gradual increase in the frequency of wound sepsis with the duration of pre-operative hospitalization. This is what has been generally observed from most studies on post-operative wound sepsis.

For example, Cruse (1977) found that with one day pre-operative hospitalization the infection rate was 1.1%, with one week's pre-operative hospitalization the rate rose to 2% and with two week's pre-operative hospitalization the infection rate was 4.3%.

Jepsen et al (1969), Meer (1979) and William (1970) found the frequency of post-operative wound sepsis to increase with the duration of pre-operative hospitalization.

It is reasonable to assume that the longer the patient stays on the ward the greater are the chances of becoming colonised by hospital organisms. Therefore prolonged pre-operative hospitalization would naturally result in a rise in post-operative wound sepsis.

CATEGORY OF THE PATIENT

This study showed that emergency operations were more frequently complicated by post-operative wound sepsis than elective operations (table 6).

Davidson et al (1971) and William (1970) found emergency operations to be more complicated by post-operative wound sepsis than elective operations.

The high rate of sepsis among emergency operations may be due to the following factors:-

1. The majority of emergency operations fall in category of Risk-group II operations where they stand higher chances of developing post-operative wound sepsis.
2. Emergency operations are often subject to other debilitating conditions which directly or indirectly favours development of post-operative wound sepsis.
3. Most emergency operations at the Kenyatta National Hospital are usually performed by junior doctors whose surgical techniques are limited. At the same time and especially at night some vital aseptic techniques are often over-looked by the tired and hurried surgeon.

On the other hand, elective operations are usually fully "worked-out" either as out-patients or as in-patients

before surgery. The operations are usually performed by senior surgeons or junior doctors under supervision. The incidence of post-operative wound sepsis in these cases is markedly low.

#### THE DURATION OF OPERATION

This study showed that the duration of operation had little effect on the frequency of wound sepsis in Risk-group I operations, however in Risk-group II operations the duration of operation significantly influenced the frequency of wound sepsis with a higher rate of sepsis among operations lasting for more than 2 hours than among those lasting for less than 2 hours (Table 8). Cruse (1977) found the rate of sepsis to approximately double with every one hour of the duration of operation. Furthermore he found that in operations performed at night the rate of sepsis tripled with every hour of the duration of operation. He attributed this higher rate of sepsis at night to loss of perfect operating technique because of both weariness and hastiness on the part of the surgeon.

Jepsen et al (1969) found a higher rate of sepsis among operations lasting for more than 2 hours than among those lasting for less than 2 hours.

However Davidson et al (1971) found no relationship



between the duration of operation and the frequency of post-operative wound sepsis.

The higher rate of wound sepsis among operations lasting for more than 2 hours (than among those lasting for less than 2 hours) may be due to prolonged exposure which encourages both endogenous and exogenous wound contamination and this is more marked in Risk-group II operations which are usually more likely to be infected by virtue of either the disease process itself or the operative procedure carried out.

Prolonged exposure of tissues at operation increases the likelihood of both endogenous and exogenous wound contamination. At the same time tissues become increasingly damaged by exposure to air, by sponges and swabs and by other various instruments used during the operation.

All these encourages development of post-operative wound sepsis.

#### THE USE OF DRAINS

In this study the use of drains significantly increased the frequency of post-operative wound sepsis (Table 9).

Cruse (1977) found drained operations to be more frequently complicated by post-operative wound sepsis than undrained operations, and in addition he found that open drains were associated with a higher rate of wound sepsis

than closed or vacuum drains and that drains brought out through the main wound were followed by a higher rate of wound sepsis than those brought out through a separate stab-wound.

Jepsen et al (1969) and Davidson et al (1971) found a higher rate of wound sepsis in operations where drains were left in-situ than among those where no drain was used.

Meer (1979) and Rains et al (1968), in addition to a higher rate of sepsis among drained operations, found the rate of wound sepsis to be higher with the use of open drains than with closed drains and the rate of sepsis to marked increase with the duration of the drain.

Drains especially open ones allow organisms from outside to reach the operated site and the operation wound. This is more likely if drains are brought out through the main wound rather than through a separate stab-wound, or if drains are left in-situ for long periods. The sources of infection are usually the dressings, the patient himself, the drained material (i.e. pus) or the container into which the drained material collects.

According to Cruse (1977), if drains are to be used at all they should preferably be vacuum or closed drains, which should be brought out through a separate stab-wound away from the main wound and which should not

be allowed to remain in-situ for more than 48 hours whenever possible.

#### THE USE OF PROPHYLACTIC ANTIBIOTICS

In this study there was no significant difference in the rate of wound sepsis between those operations in which prophylactic antibiotics were used and those where no antibiotics were given; this was irrespective of the Risk groups (Table 10). The value of prophylactic antibiotics in surgery is a subject of much controversy and from time to time different workers come up with different results and recommendations.

For instance Cruse (1977), Kelly (1980), and Jepsen et al (1969) found no difference in the rate of wound sepsis between cases where prophylactic antibiotics were given and those where no antibiotics were given. Rains et al (1968) condemned prophylactic use of antibiotics. Bates et al (1980) found no difference in the rate of post-operative wound sepsis with the use of prophylactic-metronidazole in patients who had undergone appendicectomy, and Halsall et al (1980) found no value of prophylactic metronidazole in preventing wound sepsis following elective cholecystectomy.

However Meer (1979) found that prophylactic antibiotics were effective in catheterised patients and in his study he

concluded that prophylactic antibiotics significantly reduced the overall rate of wound sepsis. Stone et al (1976) found that prophylactic antibiotics significantly reduced the rate of post-operative wound sepsis in operations on the stomach, colon and the biliary system.

Higgins et al (1980) found a combination of metronidazole and co-trimoxazole to significantly reduce the incidence of post-operative wound sepsis and anastomotic leakage in colo-rectal surgery.

Condon (1975) in his review of the current reports of randomized controlled studies on the prophylactic use of antibiotics in surgery in particular gastro-intestinal surgery, has come out strongly in favour of prophylactic use of antibiotics in surgical practice especially gastro-intestinal surgery. In his opinion, prophylactic antibiotics if used properly significantly reduces the rate of post-operative wound sepsis without increasing the incidence or the complexity of wound infections. In this study prophylactic antibiotics did not significantly influence the frequency of post-operative wound sepsis, however it is difficult to tell whether prophylactic antibiotics actually increased the rate or the complexity of wound infections.

THE BACTERIOLOGICAL PATTERN

In this study the commonest organism to infect post-operative wounds was *E. coli*. This was followed by *Klebsiella*, *Staph. aureas*, *Proteus*, *Pseudomonas*, *Staph-albus* and *Strep. fecalis* respectively (Table 11).

This pattern is quite different from those seen elsewhere.

Jepsen et al (1969) found *Staph. aureas* to be the commonest organism causing post-operative wound sepsis. This was followed by *E.coli*, *Staph. albus* and *Strep. fecalis* respectively. *Klebsiella*, *Proteus*, and *Pseudo-monas* were relatively infrequent. Shija (1976) found *Proteus* to be the commonest organism infecting post-operative wounds (34.8%). This was followed by *Klebsiella* (17.4%), *Staph. aureas* (13%) and *Pseudomonas* respectively.

## CONCLUSIONS

The results of this study gives rise to the following conclusions:-

1. The general surgical wards at the Kenyatta National Hospital have a very high rate of post-operative wound sepsis compared to other similar wards especially in developed countries. The rate of wound sepsis is significantly higher among males than among females.
2. The operations most likely to be complicated by post-operative wound sepsis are those where:-
  - a. The patient is an elderly.
  - b. The patient is admitted as an emergency.
  - c. The patient has a long pre-operative hospitalization.
  - d. The operation is contaminated or potentially contaminated, is performed by a junior doctor and the operation time exceeds 2 hours.
  - e. A drain is used after the operation.
3. prophylactic antibiotics have no effect on the frequency of wound sepsis, though they may determine the severity of infection.
4. Post-operative wound sepsis results in prolonged hospitalization of patients and this reduces the total number of patients effectively treated in the general surgical wards.
5. Post-operative wound sepsis poses a serious problem to

Kenyatta National Hospital's general surgical wards and steps need to be taken urgently to bring this rate down to reasonable acceptable levels.

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RECOMMENDATIONS

The following recommendations are suggested as preliminary steps in an attempt to reduce the high rate of post-operative wound sepsis on general surgical wards.

1. Health Education through Community Health services, public media, public lectures, home visiting and in health institutions. Health Education is one of the most important tools in drawing the attention of the public to the value of its own health.
2. Over-crowding on the wards should be reduced to a minimum and an attempt should be made to isolate patients especially those with infective lesions.
3. Both pre-operative and post-operative hospitalization should be as short as circumstances will allow. This would reduce the chances of wound contamination by ward organisms.
4. Meticulous aseptic technique in theatre should be the aim of every doctor. Emergency operations and in particular those done at night should preferably be performed by senior experienced surgeons or junior doctors under supervision wherever possible. In all operations the operation time should be cut down to a minimum and intra-operative contamination of the operative field should be avoided at all costs.



5. If a drain is to be used at all it should preferably be a closed or vacuum one which should be brought out through a separate stab-wound away from the main wound and should not be allowed to remain in-situ for more than three days.
6. Antibiotics should be reserved for specific indications and their administration should preferably be guided by culture and sensitivity results. "Blind" antibiotic therapy in surgical practice is to be condemned.
7. A working committee should urgently be set up comprising of surgeons, theatre staff, Public Health nurses, and microbiologist to keep periodic surveillance of post-operative wound sepsis on general surgical wards and to give recommendations on how to manage this problem.

REFERENCES

1. Alexander Wesley, J. Surgical infections. Surgical clinics of North America 60(1) Feb. 1980.
2. Bates, T., Touquet, V. R. H., Tulton, M.K. Prophylactic metronidazole in appendicectomy British J. Surgery 67 (8): 547-550, Aug. 1980.
3. Clarke, J. S. The results of a prospective randomised double-blind clinical study on pre-operative oral antibiotics in colonic surgery. Annals of Surgery 186 (3): 251-259, Sep. 1977.
4. Condon Robert, E. Surgical infections and antibiotics. Surgical clinics of North America 55(6), Dec. 1975.
5. Cruickshank Robert, Duguid, J.P., Marmon, B.P. Pioneers in Microbiology. Medical microbiology, pp. 3 - 5, (C) 1973.
6. Cruse Peter, J.E. Some factors determining wound infections. Hospital acquired infections in surgery, pp. 79 - 85 (C) 1977.
7. Davidson, A.I.G., Clark, C., Smith, G. Post-operative wound infections: A computer analysis. British J. Surgery 58 (5): 333 - 337, May 1971.
8. Foster, W.D. History of medical microbiology (C) 1970.

9. Gibson, G.L. Infections in hospital (C) 1971.
10. Halsall Andre, Welsh, L., Christopher, N.R.,  
Craven, J.L., Hopton, D.S., Peel, N.R.  
Prophylactic use of metronidazole in preventing  
wound sepsis after elective cholecystectomy.  
British J. Surgery 67 (8): 551-552, Aug. 1980.
11. Higgins, A.T., Adam Hewis, Paul Noone. Single and  
multiple dose(s) co-trimoxazole and  
metronidazole in colo-rectal surgery. British  
J. Surgery 67 (2): 90 - 92, Feb. 1980.
12. Höjer, H., Bröte, L., Gillquist, J. A fourteen-months'  
study of severe non-wound infectious complications  
in general surgery. Acta Chir. Scand. 143 (2):  
85 - 89, 1977.
13. Jepsen Ole., Olesen Larsen, Frolund Thomsen. Post-  
operative wound sepsis in general surgery.  
Acta Chir. Scand. 396: 80 - 97, 1969.
14. Kelly, M.J. Wound infection: a clinical and  
experimental demonstration of synergy between  
aerobic and anaerobic bacteria. Ann. Roy. Col.  
Surg. Eng. 61 (1): 52 - 57, Jan. 1980.
15. Meer, P.D. Infection in hospitals. British J.  
Hosp. Med. 22 (3): 272 - 276, Sept. 1979.
16. Pork Hiram, C., Stone, H. Hospital acquired infections  
in Surgery (C) 1977.

17. Rains, A.J. Copper, W.M. Hospital infections.  
A short textbook of surgery, pp. 5 - 8 (C)  
1968.
  18. Sabiston David, C. Surgical infections and choice  
of antibiotics. Textbook of surgery,  
(C) 1973.
  19. Shija, J.K. The incidence and pattern of sepsis among  
surgical in-patients at Muhimbili General  
Hospital, Dar-es-Salaam. East African Med.  
J., 58 (3): 153 - 159, March 1976.
  20. Stone Harlan, Hooper, A.C., Laura, B.A. Antibiotic  
prophylaxis in gastric, billiary and colonic  
surgery. Annals of surgery 184 (4): 443 -  
452, Oct. 1976.
  21. Vollum, R.L., Jamison, D.G., Cummuns, C.S. Historical  
survey of general bacteriology. Fairbrother's  
textbook of bacteriology, pp. 1 - 10 (C) 1970.
  22. William, R.E.O., Blowers, R., Garrod, L.P. Hospital  
infections: Causes and prevention (C) 1970.
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APPENDIX

A-STUDY OF POST-OPERATIVE WOUND SEPSIS IN  
GENERAL SURGICAL WARDS AT K.N.H.

NAME OF PATIENT.....

AGE.....

SEX.....M                      F.

TRIBE.....

OCCUPATION.....

SOCIAL CLASS.....(LOW/MIDDLE/HIGH/UNKNOWN.....)

ADDRESS(LOCATION).....

WARD.....I.P. NO.....BED NO.....

DATE OF ADMISSION.....

CATEGORY OF PATIENT (EMERGENCY/ELECTIVE/TRANSFER).....

PROVISIONAL DIAGNOSIS.....

FINAL DIAGNOSIS.....

INTERCURRENT DEBLITATING CONDITION OR DISEASE

(ANAEMIA, DEHYDRATION, MALIGNANCY, HYPERTENSION, HEART

DISEASE, RENAL DISEASE, DIABETES MELITUS, OBESITY, CACEXIA, STEROIDS ET

1.....

2.....

3.....

4.....

5.....

PRE-OPERATIVE

1. TEMPERATURE.....

2. PULSE RATE.....

3. BLOOD PRESSURE.....

4. OTHERS.....

WERE PRE-OPERATIVE ANTIBIOTIC USED? (YES/NO).....

IF SO, TYPE, DOSAGE AND DURATION.....

PRE-OPERATIVE PREPARATION

1. INVESTIGATIONS

1. HB.....

2. UREA.....

3. ELECTROLYTES.....

4. OTHERS.....

DATE OF OPERATION.....

THEATRE INTO WHICH OPERATION WAS DONE.....

TIME OPERATION WAS STARTED.....

TIME OPERATION ENDED.....

NATURE OF OPERATION.....

TYPE OF OPERATION (CATEGORY).....

(a) CLEAN OPERATION.....

(b) HIGH CHANGES OF INFECTION.....

ANY FOREIGN MATERIAL LEFT IN SITU? (YES/NO)

(a) TYPE OF MATERIAL.....

(b) DURATION.....

POST OPERATIVE TEMPERATURE/BP/PR/

1st DAY, TEMP.....P.R.....BP.....

2nd DAY, TEMP.....P.R.....BP.....

3rd DAY, TEMP.....P.R.....BP.....

4th DAY, TEMP.....P.R.....BP.....

5th DAY, TEMP.....P.R.....BP.....

6th DAY, TEMP.....P.R.....BP.....

7th DAY, TEMP.....P.R.....BP.....

ANY ABNORMALITY OF ANY ABOVE SUBSEQUENTLY?(YES/NO)

IF SO, STATE NATURE AND DATE.....

DURATION OF PATIENT'S STAY ON THE WARD.....

(I.E. FROM DATE OF ADMISSION TO DATE OF DISCHARGE).....

WERE STITCHES REMOVED AT TIME OF DISCHARGE (YES/NO)

WAS THE WOUND INFECTED?(YES/NO)

TYPE OF INFECTION

(a) N - P - W - 1.....

(b) P - W - 1.....

WAS ANTIBIOTIC THERAPY USED POST-OPERATIVELY? (YES/NO)

(a) TYPE OF ANTIBIOTIC.....

(b).DURATION OF THERAPY.....

WAS THE WOUND FULLY HEALED AT THE TIME OF DISCHARGE? (YES/NO).....

OUT-PATIENT FOLLOW UP

(a) 1st VISIT.....

(b) 2nd VISIT.....

(c) 3rd VISIT.....

(d) SUBSEQUENT VISITS.....

ANY POST-OPERATIVE INVESTIGATIONS DONE? (YES/NO)

NATURE

1.....

2.....

3.....

4.....