RESULTS

RESULTS

From 819 patients admitted at General Surgery, Orthopedic and Urology departments of Benha University hospital , 82 cases developed postoperative wound infection during the period from November 1987 to April 1988.

Table (1) shows that the overall incidence of postoperative wound infection was(10.1%).

Table (2) shows the distribution of postoperative wound sepsis among the different studied departments ,the highest incidence was in Urology department (13%) ,while the least was in General Surgery department (8.8%) and it was (10.5%) at Orthopedic department, (see fig.1) .

Table (3) shows the relation between the postoperative wound infection and the age of the patients ,the highest incidence was (18.7%) among the old age patients above 60 years old , the least incidence was (7.3%) among young age below 16 years old and it was (9.5%) among middle age patients between 16-60 years old , (see fig. 2) .

Table (4) shows that in male patients, the postoperative wound infection rate was (12.9%) but the rate in female patients was (4.1%) .

The preoperative hospitalization period in relation to the incidence of postoperative wound sepsis is shown in table (5) , the highest incidence was in period more than 72 hours (18%), but the least was in period less than 72 hours (6%) ,(see fig. 3).

Table (6) shows the relation between the type of wound and the incidence of postoperative infection , the highest was (21%) with dirty wounds, while the least was with clean wounds (1.3%). It was variable with clean-contaminated wounds (6%) and contaminated wounds (11%) ,(see fig. 4) .

Table (7) shows time of development of postoperative wound sepsis, in relation to the incidence of sepsis . It developed sepsis within 48 hours in (58.5%) of postoperative wound sepsis patients and more than 48 hours in (41.5%).

Table (8) shows the relation between administration of prophylactic antibiotics and development of postoperative wound sepsis. It was (2.3%) in patients who received prophylactic antibiotics within 24 hours postoperatively ,(10.8%) in patients who received antibiotics more than 24 hours postoperatively and (12.4%) in patients who had not received antibiotics .

TABLE (1)

Incidence of postoperative wound infection during the period between November 1987 and April 1988 .

Total No. of patients	No. of postoperative wound infections	percentage
819	82	10.1 %

TABLE (2)

Incidence of postoperative wound infection in different surgical departments :

Dept.	Total No. of patient	No. of postoperative wound infections	%
General Surgery	479	42	8.8
Urology	169	22	13.0
Orthopedic	171	18	10.5

TABLE (3)

Incidence of postoperative wound infection in relation to age:

	Total	postoperative W.I.cases	percentage
Young age less than 16ys .	122	9	7.3%
Middle age between16-60ys .	612	59	9.5%
Old age more than 60ys.	75	14	18.7%

TABLE (4)

Incidence of postoperative wound infection in relation to sex :

	Total	postoperative W.I.cases	percentage
Male	549	71	12.9%
Female	270	11	4.1%

TABLE (5)

Incidence of postoperative wound infection in relation to preoperative hospitalization period .

Hospitalization period .	Total	Postoperative W.I. cases	%
Less than 72 hrs.	551	33	6
More than 72 hrs.	268	48	18

TABLE (6)

Incidence of postoperative wound infection in relation to types of wounds .

Type of wound	Total	Postoperative W.I. cases	%
Clean	150	2	1.3
Clean-Contaminated	182	11	6.0
Contaminated	335	37	11.0
Dirty	152	32	21.0

TABLE (7)

Time of development of infection in postoperative wound spesis cases :

Total No. of Sepsis.	No. of sepsis developed less than 48 hrs.	%	No. of sepsis developed more than 48 hrs.	%
82	48	58.5	34	41.5

TABLE (8)

The relation between administration of prophylactic antibiotics and development of postoperative wound sepsis.

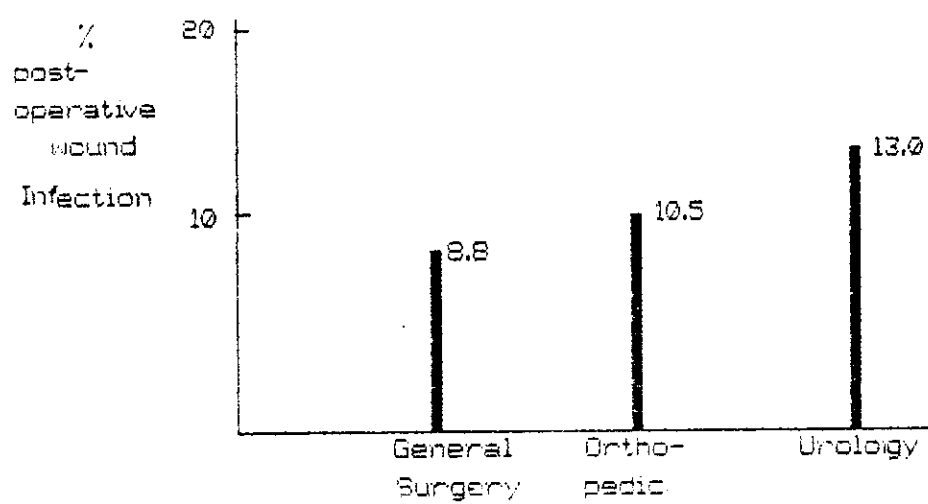| Administration of prophylactic antibiotics	No.of patients	No.of patients developed postoperative infection	%
- patients had not received antibiotics	283	35	12.4 %
- patients received antibiotics within 24 hrs. postoperatively	129	3	2.3 %
- patients received antibiotics after 24 hrs. postoperatively	407	44	10.8 %
Total	819	82	

Figure (1)

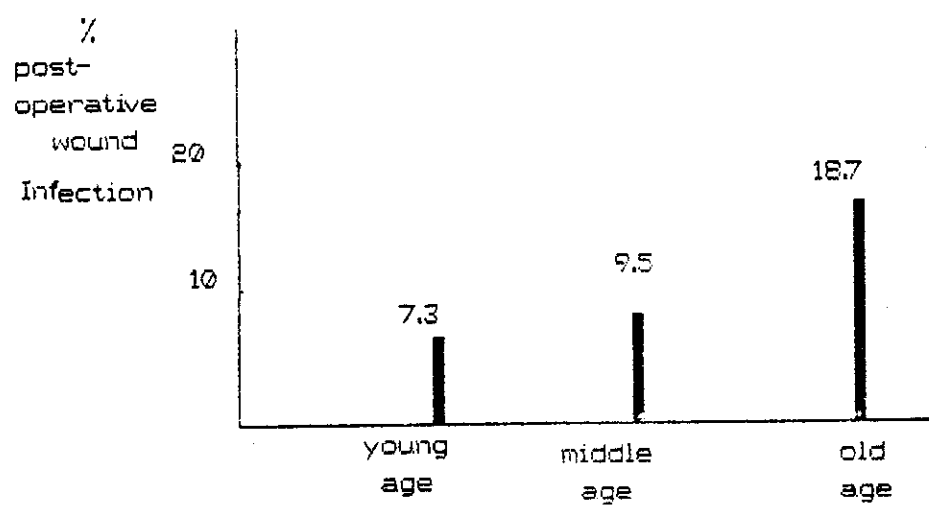Incidence of postoperative wound infection in different surgical depts.

Figure (2)

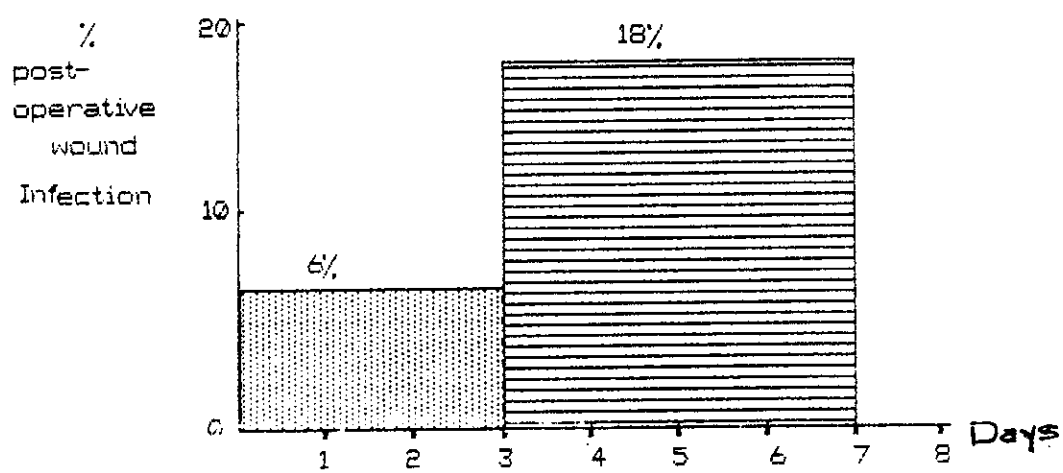Incidence of postoperative wound infection in relation to age .

Figure (3)

Incidence of postoperative wound infection in relation to preoperative hospitalization period .
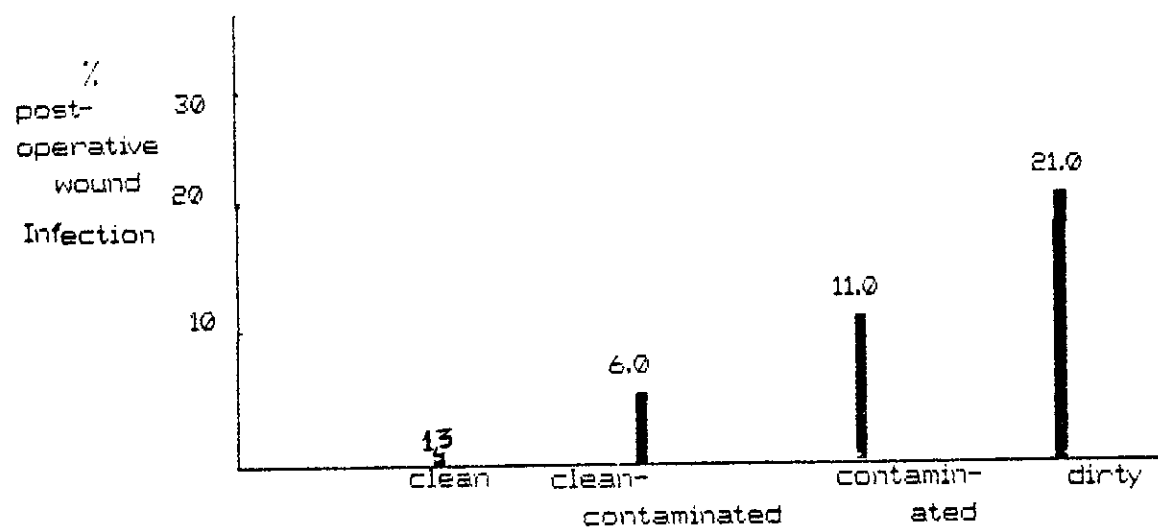
Figure (4)

Incidence of postoperative wound infection in relation to type of wound .

** Microorganisms isolated from wound sepsis :

_____

Table (9) shows that among 82 cases of postoperative wound infections there were 53 cases with single infection and 29 cases with mixed infections. The table shows distribution of single and mixed wound infections among the different departments studied .

Table (10) shows that the frequency of coagulase - negative staphylococci was (17.1%) , and coagulase-positive was (29.8%) .

Table (11) shows that Staphylococcal infection had the highest rate (43.9%) ,Pseudomonas pyocyanea incidence was (23.2%), followed by E.coli (17.1%), Proteus species (14.6%) ,Streptococcus faecalis, Klebsiella aerogenes (12.2%) for both, Citrobacter (7.3%) ,Anaerobic streptococci (1.2%) and Bacteroides fragilis (2.4%) ,(see fig. 5) .

Table (12) shows that Staphylococci ,Proteus, Klebsiella . E.coli and Pseudomonas constitute the major microorganisms in postoperative wound infection in General Surgery department at Benha University Hospital , followed by Strepto coccus faecalis and Citrobacter . Anaerobic Streptococcus was present in one case and Bateroides also was present in two cases. (see fig. 6).

TABLE (9)

No. of single and mixed colonization in postoperative wound infection cases in relation to different surgical depts.

Dept.	Single	Mixed	Total
General Surgery	29	13	42
Urology	10	12	22
Orthopedic	14	4	18
Total	53	29	82

TABLE (10)

No. of coagulase +ve and coagulase -ve strains of Staphylococci in relation to single and mixed wound infections .

	Total	Coagulase +ve	Coagulase -ve
Single infection	53	5	9
Mixed infections	29	9	13
Total	82	14 (17.1%)	22 (26.8%)

TABLE (11)

Types of isolated organisms ,No. of strains and their incidence in postoperative wound infection cases .

Organism	Totat no. of strains	Incidence of infected cases
Staphylococci	36	43.9 %
Streptococcus faecalis	10	12.2 %
E . coli	14	17.1 %
Pseudomonas pyocyanea	19	23.2 %
Klebsiella aerogenes	10	12.2 %
Citrobacter	6	7.3 %
Proteus species	12	14.6 %
Bacteroides fragilis	2	2.4 %
An.Strept.	1	1.2 %

TABLE (12)

Organisms isolated from postoperative wound sepsis in (42) cases in General Surgery department .

Organism	Number of cases	Percentage
Staphylococci	6	14.2 %
Streptococcus faecalis	2	4.8 %
E . coli	5	12 %
Pseudomonas pyocyanea	4	9.5 %
Klebsiella aerogenes	4	9.5 %
Citrobacter	3	7.1 %
Proteus species	5	12 %
Staph. + Proteus	3	7.1 %
Staph.+Klebsiella	5	12 %
Staph.+Strept. faccalis	1	2.4 %
E. coli+Strept. faecalis	2	4.8 %
Staph.+Anaerobic streptococci	1	2.4 %
Pseudomonas + Bacteriodes fragilis	2	4.8 %

TABLE (13)

Organisms isolated from postoperative wound infections in (22) cases in Unology department.

Organisms	No. of cases	Percentage
E. coli	4	18.2%
Citrobacter	3	13.6%
Pseudomonas pyocyanea	4	18.2%
Proteus species	2	9.1%
Staph. + str. faecalis	2	9.1%
Staph. + E. coli	1	4.5%
Staph.+ pseudomonas	4	18.2%
Staph + proteus	2	9.1%

TABLE (14)

Organisms isolated from postoperative wound infections in (18) cases in Orthopedic department.

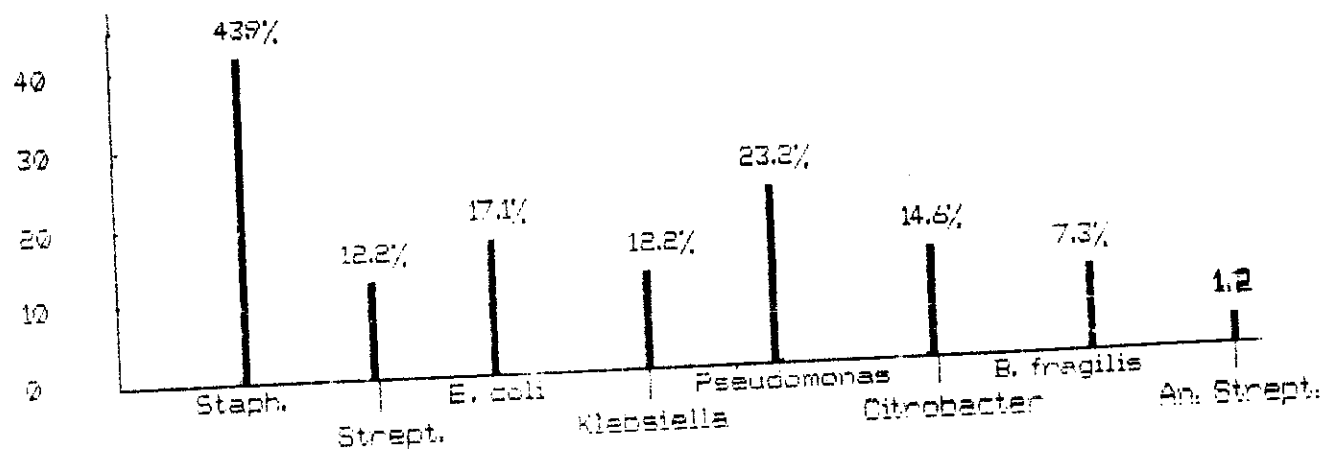| Organisms	No. of cases	Percentage
Staphylococci	8	44.5%
Streptococcus faecalis	1	5.6 %
E. coli	1	5.6 %
Klebsiella aerogenes	1	5.6 %
Pseudomonas pyocyanea	3	16 .1%
Staph. +str. faecalis	1	5.6 %
Staph. + pseudomonas	2	11. 2%
Staph. +str. faecalis	1	5.6 %

Figure (5)

Incidence of postoperative wound infection in relation to type of isolated
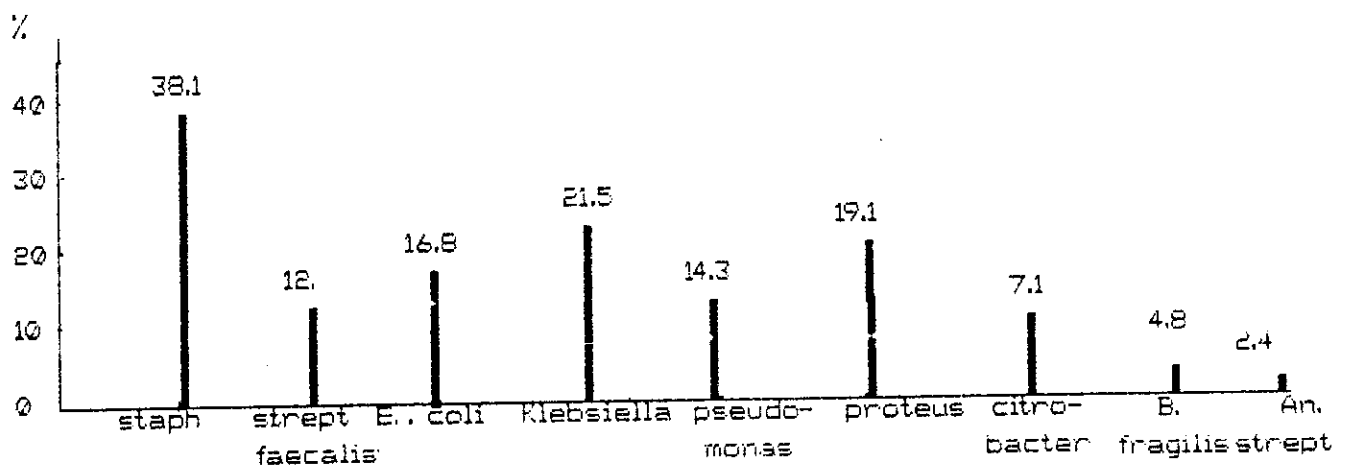organisms .

Figure (6)

Incidence of different isolated organisms from postoperative wound
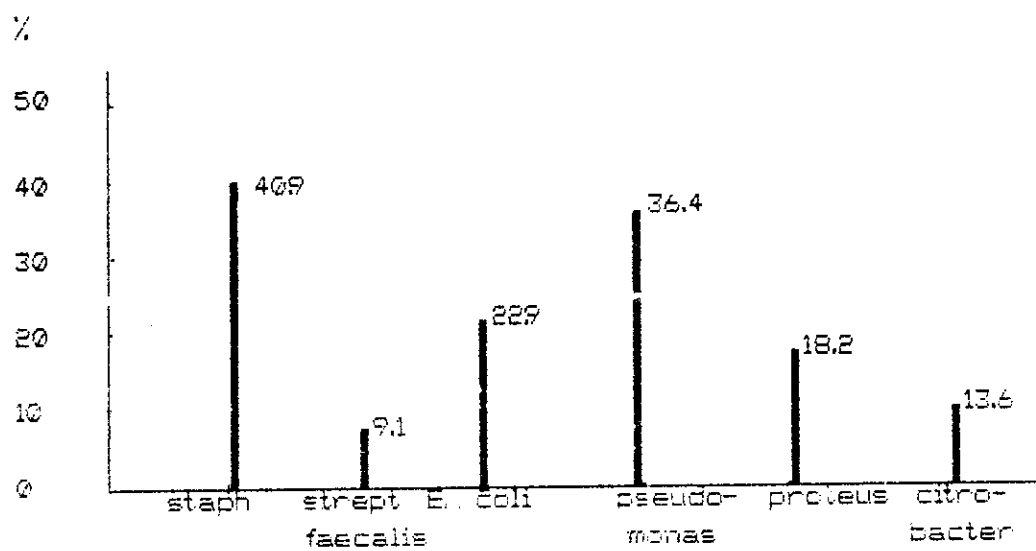sepsis in General surgery dept.

Figure (7)

Incidence of different isolated organisms from postoperative wound sepsis in Urology dept.
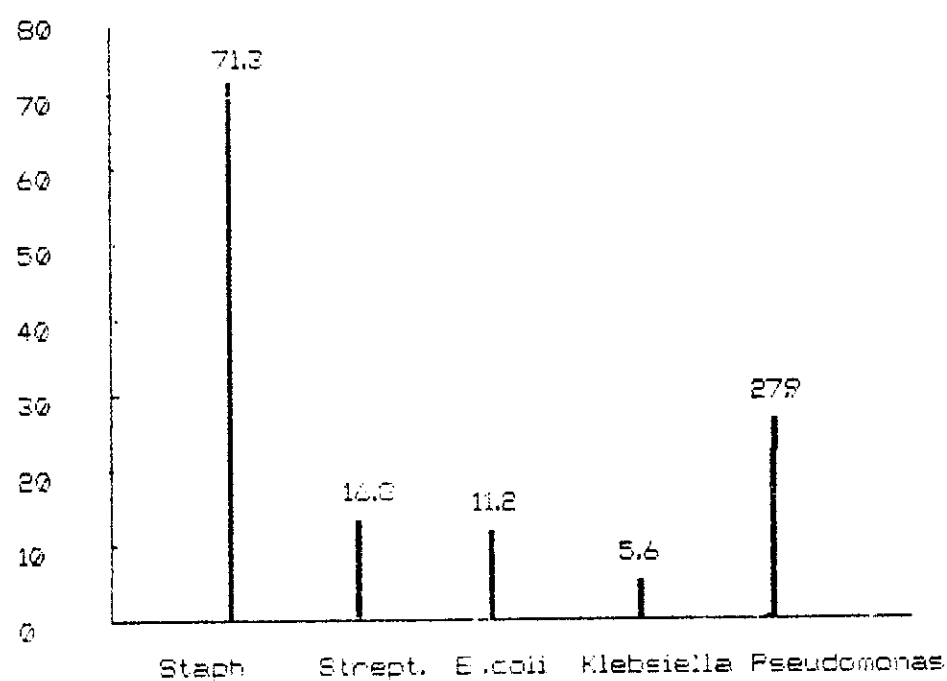
22

Figure (8)

Incidence of different isolated organisms from postoperative wound sepsis in Orthopedic dept.

Table (13) shows that Staphylococci, Proteus, Pseudomonas and E.coli had the highest rate of postoperative wound sepsis in Urology department, followed by Citrobacter and Streptococcus faecalis. (see fig. 7).

Table (14) shows that Staphylococci and Pseudomonas pyocyanea constitute the major microorganisms in postoperative wound infection in Orthopedic department, followed by Streptococcus faecalis, E.coil and Klebsiella (see fig. 8).

** Microorganisms isolated from the theatre and the surgical wards:

_____

Table (15) shows the microorganisms isolated from nasal carriers among ten persons in the operation theatre . It also shows the microorganisms on open plates in different parts of the operating theatre . the bacteriological sampling of inaminate objects revealed no growth.

Table (16) shows the number and types of microorganisms isolated from surgical personnel, and open plates in dressing rooms and **wards.**

Only **station** glass sample from Urology department revealed Pseudomonas pyocyanea **contamination.**

TABLE (15)

Number and types of microorganisms isolated , in the operation theatre , from personnel ,inaminate objects and air :

Subjects	No. of specimens	No. of infected specimens	Types of organisms
I- Personnel :			
1- Surgeons	4	3	Staph. 2 Klebsiella 1
2- Anaesthetist	2	2	Staph. 1 Strept. 1
3- Nurses	2	1	Staph. 1
4- Workers	2	2	Staph. 1 Diphteroid 1
II- Inaminate objects:			
1- Instruments	2	-	--
2- Dressings	2	-	--
3- Disinfectants	2	-	--
III- Air :			
1- Instruments table	1	1	Staph. Anthracoid Neisseria
2- Anaesthetic table	1	1	Staph. Diphteroid Klebsiella
3- Autoclave room	1	1	Staph. Anthracoid Proteus Micrococci
4- Dust	1	1	Staph. Niesseria Anthracoid

Table (16)

No. and types of organisms isolated from different surgical wards from personnel, inaminate objects and air of the wards .

Subjects	General surgery ward			Urology ward			Orthopedic ward		
	No. of specimen	Infected specimen	Organisms	No. of specimen	Infected specimen	Organisms	No. of specimen	Infected specimen	Organisms
I-Personnel:									
1-Doctors	1	1	Staph.	1	1	Staph.	1	1	Staph.
2-Nurses	1	1	Klebsiella	1	1	Strept.	1	1	Staph.
3-Workers	1	1	Strept.	1	1	Staph.	1	1	Strept.
II-Inaminate objects:									
1-Instruments	1	-	-	1	-	-	1	-	-
2-Dressings	1	-	-	1	-	-	1	-	-
3-Disinfect- ants	1	-	-	1	1	Pseudomonas	1	-	-
III-Air:									
1-Dressing room	1	1	Staph Diphteroid Proteus	1	1	Staph Anthracoid Neisseria Micrococci	1	1	Staph. Diphteroid Neisseria Micrococci
2-Patients room	1	1	Staph Anthracoid Klebsiella	1	1	Staph Diphteroid Anthracoid Neisseria	1	1	Staph Diphteroid Neisseria Klebsiella

TABLE (17)

Incidence of organisms isolated from nasal carriers among theatre and wards personnel.

	No of infection specimens	Staph .	Strept	No.of specimens
I- Theatre				
1. surgeons	3	2	-	4
2. Anaesthetists	2	1	1	2
3. Nurses	1	1	-	2
4. Workers	2	1	-	2
II Wards				
1. Doctors	3	3	-	3
2. Nurses	3	1	1	3
3. Workers	3	1	2	3
	17 (89.5%)	10 (52.6%)	4 (21%)	19

TABLE (18)

The variety of organisms isolated from the nose and the skin of postoperative wound sepsis patients .

Type of organisms	Patients (82)			
	Nose		Skin	
Staph.coagulase+ve	3	3.6%	5	6%
Staph.coagulase-ve	6	7.3%	10	12%
Streptococci	2	2.4%	4	4.8%
Klebsiella	-	-	2	2.4%
Proteus	1	1.2%	1	1.2%
E.coli	-	-	2	2.4%

Table (17) shows that out of nineteen of personnel, seventeen were nasal carriers (89.5%) (eight persons from the operating theatre and nine from different surgical wards studied).Ten out of the seventeen nasal carriers were staphylococcal carriers (52.6%) ,six of them were doctors ,two nurses ,two workers , while four out of the nasal carriers were Streptococcal carriers (21%) , one of them was doctor, one nurse and two workers.

Table (18) shows the variety of organisms isolated from nose and skin of 82 postoperative wound sepsis patients, 29 out of them were skin carriers ,5 of them were Staphylococci (coagulase +ve) (6%) , 10 were Staph. (coagulase -ve) (12%) . 2 were Klebsiella, (2.4%) ,2 were E.coli (2.4%) and one was Proteus (1.2%) .12 out of postoperative wound sepsis patients were nasal carriers , 3 were Staph. (coagulase +ve) (3.6%) ,6 were Staph. (coagulase -ve) (7.2%) ,2 were Streptococci (2.4%) and one was Proteus (1.2%) .

** Antibiogram of isolated organisms:

The antibiotic susceptibility of the isolated aerobic strains to the various used antibiotics is shown in table (19).

Table (20) shows the incidence of different antibiotics susceptibility to the isolated strains.

We demonestrated that Penicillin G (10 units) sensitive strains were 3.7 % , Ampicillin (10 ug) sensitive strains were (18.7%). The highest effect of Amikin (30 ug) on the isolated strains (86%) followed by Tobramycin (10ug) (72%) ,Gentamycin (10ug) (64.5%) and Cephaloridine (30ug) (60.7%) ,(see fig.9).

Table (21) shows the antibiogram of isolated Anaerobic strains. Bacteroides fragilis strains were only sensitive to Erythromycin (15ug) ,Metronidazol (5ug) ,Rifampicin (15ug) ,but they were resistant to Chloramphenicol (30 ug) ,Penicillin G (2 units), Kanamycin (1000ug) ,Neomycin (1000ug) and Colistin (10ug) . Anaerobic streptococcus strain was susceptible to Penicillin G, Erythromycin ,Rifampicin ,Kanamycin, Neomycin and Chloramphenicol.

Table (19)

Incidence of antibiotics susceptibility to the isolated organisms :

Type of antibiotic	Staph. coag+ve (14)	Staph. coag-ve (22)	Strept. faecalis (10)	E.coli (14)	Citro-bacter (6)	K. aero-genes (10)	Pseudo-monas (19)	Proteus (12)
Penicillin G	-	-	20%	-	-	-	-	16.7%
Ampicillin	-	-	50%	57%	-	30%	-	33.4%
Amoxicillin	-	-	50%	71%	16.7%	30%	-	33.3%
Erythrom-ycin	57%	50%	30%	14%	-	20%	-	25%
Cephalori-dine	71%	59.1%	80%	78.6%	66.6%	70%	63.2%	83.3%
Streptomy-cin	14.3%	4.5%	40%	7.1%	-	20%	26.3%	58.3%
Gentamycin	57.1%	45.5%	70%	71.4%	66.7%	70%	789%	66.6%
Tetracycl-in	16.6%	13.6%	20%	-	-	10%	10.5%	16.6%
Chloramph-enicol	16.6%	10%	30%	28.6%	16.6%	10%	15.8%	25%
Tobramycin	78.6%	72.6%	70%	92.9%	83.3%	70%	52.6%	66.7%
Amikin	85.7%	72.7%	80%	100%	100%	90%	89.5%	83.3%

TABLE (20)

Antibiogram of isolated strains from postoperative wound infection cases.

Antibiotic tested	susceptible strains	percentage
1.Penicillin G.	4	3.7%
2.Ampicillin.	20	18.7%
3. Amoxicillin.	23	21.5%
4.Erythromycin.	25	23.4%
5.Cephaluridine.	65	60.7%
6.Streptomycin .	22	20.6%
7.Gentamycin.	69	64.5%
8.Tetracycline.	12	11.2 %
9.Chloramphenicol.	19	17.8%
10.Tobramycin.	77	72%
11.Amikin.	92	86%

TABLE (21)

Antibiogram of isolated Anaerobic strains .

Antibiotic tested	Bacteroides fragilis (2)	Anaerobic strept. (1)
Penicillin G	R	S
Erythromicin	S	S
Kanamycin	R	S
Neomycin	R	S
Colistin	R	R
Rifampicin	S	S
Mitronidazol	S	S
Chaloramphenicol	R	S
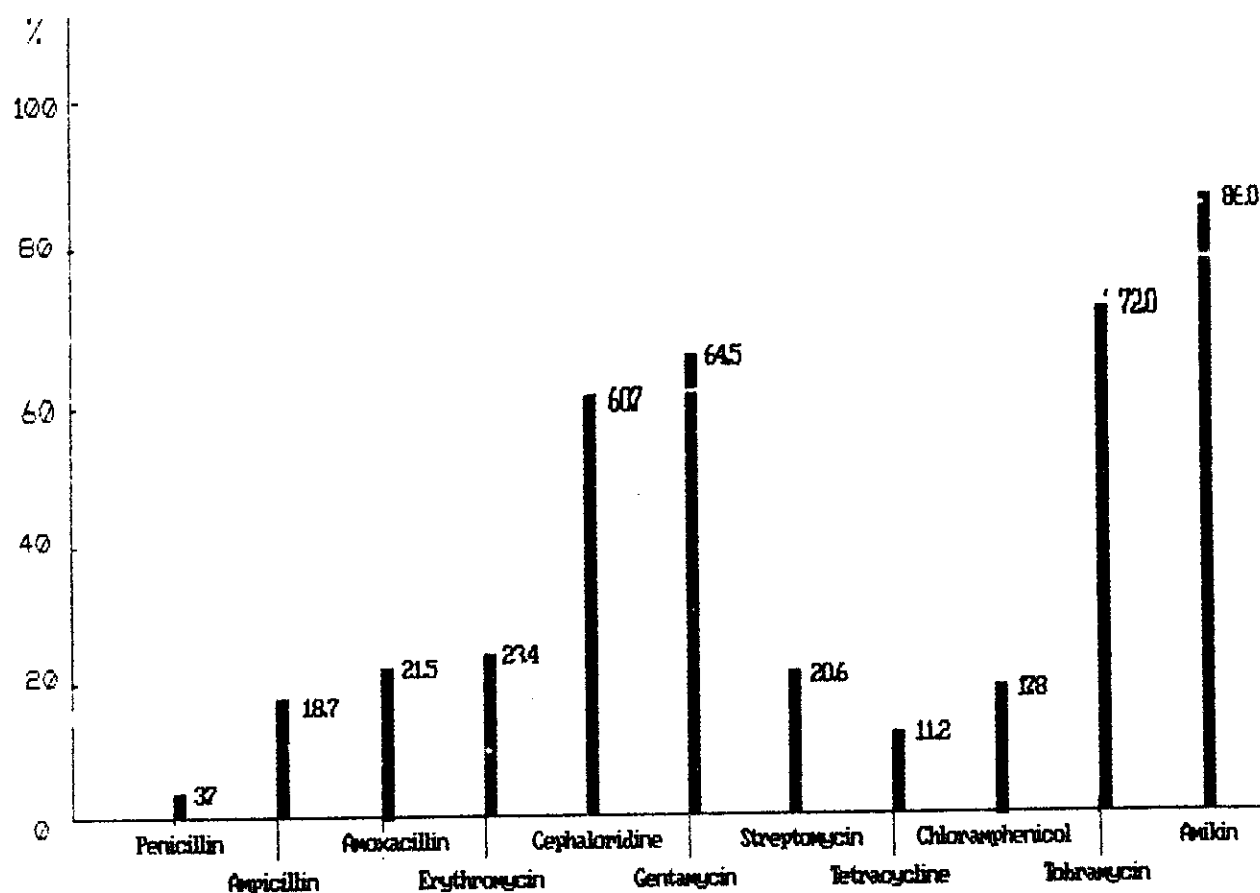
Figure (9)

Antibiogram of isolated strains from postoperative wound infection cases .

DISCUSSION

DISCUSSION.

The postoperative wound sepsis is still one of the most common complication in surgery nowadays . Different authors have reported that the overall wound infection rate in different countries . It was varied from 4.7 to 17.0 percent (Cruse and Foord 1980) .The incidence of postoperative wound sepsis differs from country to country and from one hospital to another .

In our study 82 cases out of 819 developed postoperative wound sepsis (10.1%) .The higher rate was in urology department (13.0 %) it is due to prolonged preoperative hospitalization period and urinary tract infection in the patients operated up on. The least incidence was in general surgery department (8.8%), it could be attributed to precautions in the operating theatre , short preoperative hospitalization period and the routine using of prophylactic antibiotics.

In the present study ,the incidence was higher in age above 60 years old (18.7%), also it was (18 %) in patients staying more than 72 hours preoperative due to the fact that it given chance for cross infection to occur .

Old age and prolonged preoperative hospitalization are real risk factors , this was previously observed by Cruse and Foord in Foothills Hospital wound study, (1980) .

In the present study , the incidence of postoperative wound infection was higher in patients who had not received prophylactic antibiotics (12.4%) , it was least in patints who received antibiotics (2.3%).This was also observed by Lleoyd and Richard in (1985) .

In order to produce its effect the prophylactic antibiotics must be present in the wound at the time of introduction of bacteria. The most common causative organism in the studied departments in Benha University Hospital , was Staphylococci (43.9 %) , coagulase +ve (17.1%) & coagulase – ve (26.8 %) .

The Gram-negative bacilli came next in frequency , Pseudomonas pyocyanea was the higher incidence (23.2%). This was also noted by Altemeier et al., (1976),and Thomas (1979) .

In the present study ,Staphylococci (coagulse + ve, coagulase – ve)were the commonest organism from nasal swabs collected from personnel .also from the skin of patients . This was observed before by Howe and Mariston (1962). and Lidwell (1986).

In the present study ,Pseudomonas was isolated from one sample of stavlon , the same was noted by Ayliffe in (1980), who stated that Pseudomonas and other bacteria may multiply in deteriorating solutions of stavlon .

Our work showed that no bacterial growth from inaminate objects samples .This has been proved that routine sterilization (boiling and autoclaving of the inaminate objects of the theatre and wards were efficient methods of sterilization) .

Antibiogram of isolated strains of staphylococci strains revealed their sensitvity to amikin (85.7%).This observed by Robert and Wise ,(1973),

who reported that staph. aureus was more sensitive to amikin (97.9%). This antibiotic is expensive and less popular , so its resistance is still lower than other aminoglycosides .

This study revealed that all Staphylococcus strains were resistant to pencillin G, ampcillin and amoxicillin .Their sensitivity to streptomycin were 14 3 % and 16 6% to tetracyclins and chloramphenical .

This was also observed by Finland (1972) .Haley et al.,(1982),who reported that penicillin G- resistant staph. aureus strains from clinical infection is always due to penicillinase production, they now constitute above 70-90 % of the total staph. aureus isolates in

community in U.S.A.

As regards the antibiogram of isolated strains of Enterobacteriaceae (E.coli, Klebsiella, Citrobacter , and Proteus) the highest sensitivety was to amikin . This was also reported by Bodey and Stewart , (1973) , who noted that amikin is similar in spectrum to gentamyein and tobramycin .

It was active against isolates of resistant gram - ve bacilli such as E. coli, Klebsiella , and Proteus species . Amikin have been reported by Price et al.,(1974), to be active against 90% of Enterobacteriaceae, Pseudomonas . Staphylococcus aureus strains which are known to be resistant to one of aminoglycosides.

In our work , the isolated strains of Enterobactriaceae were resistant to penicillin G, tetracycline, chloramphenicol and Erythromycin .These results agree with Eickaff,(1966),Sadath et al., study, (1970).

The antibiogram of isolated strains of Pseudomonas, showed that they were sensitive to amikin 89.5 % tobramycin 52.6 % gentamycin 78.9 % and cephalosporins 63.2% .

This **was also** observed by Gould and Wise ,1985, who reported that the antibiotics with activity against Pseudomonas include aminoglycosides such as gentamycin, tobramycin , netilmicin and amikin , and the newly developed third generation of cephalosporins .

In general , Stephen and Sellgnein,(1978) have found that resistance of gram negative organisms to tobramycin was 41% and only 6% to amikin , this agree with the present study.

Fingold et al. , (1982), stated that Bacteroides fragilis are usually sensitive to erythromycin, rifampicin, **Linkomycin** , metronidozal and chloramphenical but they were resistant to penicillin , colistin , Kanamycin and vancomycin ,these results agree with our study .

Prevention and control of infections is a line of defence for illness. Evaluation of control measurs could be summarized as the following :

1- Because of the prolonged preperative hospitalization is incriminated in occurence of postoperative wound infection it should be minimized .

2 - In our hospital , the number of visitors and the time of visits are not limited, its restriction is highly recommended .

3- There is no clear antibiotic policy in our hospital, and this leads to the developmenet of multiresistant strains . Antibiotics should be used according to culture sensitivity test of isolated organism .

Short coarse of prophylactic antibiotic few hours after operation is recommended .

4 - Proper disinfection and sterilization of the operating theatres are strongly recommended, also continuous bacteriological serveillance of the surgical wards and operating theatre , as well as of staff carriers are indicated for proper control of the emergence of resistant strains and their harmful effects .

5 - A thorough washing with a suitable disinfectant before operations ,wearing perfect masks , gloves, gowns during operations are strongly recommended .

6 - We recommend to trace the source of infection in the next studies.