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A Study of Incidence of Post-operative Sepsis In Iran*

by

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Inevitably hospitals have always had to contend with an infection problem because of the nature of the many diseases and the hightened susceptibility of patients as a whole. According to reports already published in other countries the gravity of the problem is most varied. For instance, there are reports of post-operative sepsis rates from 3-37% and effects on patients varying from negligible inconvenience to severe infections and death, or from a few extra days to many months in hospitals. (1, 2, 7)

The problem of hospital cross-infection is very closely connected with the emergence of antibiotic resistant strains of staphylococci with the capacity to produce out-breaks and even epidemics of suppurative diseases among hospital patients and to spread from them into the community. Although a great deal of investigetion has been carried out and

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an extensive number of publications have appeared in literature, no solution has yet been worked out. On the contrary there is a feeling that gram negative bacilli have joined staphylococci and now play a more active role in hospital cross infection than they did previously. (3,4)

Although we are certain that the problem exists in Iran, no organized study has been carried out to determine the nature and the gravity of the problem. Therefore we have organized this study in the hope that it may be a start and serve as a basis for future and further studies towards eliminating the hospital cross infections in Iran, and secondly that our findings may help the interested authorities in formulating a satisfactory programe for the control and prevention of infection in the hospitals concerned.

Materials and Methods

General Plan of the Investigation:

For this study the surgery department of Cancer Unit of Pahlavi Hospital was chosen.

This survey included 149 operations and lasted for a period of three months. From these 149 cases 133 were patients whose operation necessitated incision through the healthy skin. Among the 133 clean wound operations there were 70 males and 63 females involved and the ages ranged from 15 to 65 years of age. (table 1).

If the area on which operation was to be performed was already infected, a specimen was taken for diagnosis. This as it was explained, was not taken into account when considering the rate of sepsis. For the clean wounds, taking of specimen started on the first day of dressing and it was continued on successive dressing until the lesion completely healed or the patient was discharged.

Specimens for diagnosis were obtained with sterile cotton swabs and were promptly plated on blood agar plates. The plates were incubated at 37° C and examined after 24 hours. All pathogenic bacteria were isolated and identified. Colonies of Staphylococci were picked from plates regardless of hemolysis or chromogenecity and coagulase tests were performed on all such subcultures. The capacity to coagulate rabbit plasma was used as the only criterion for the selection of pathogenic staphylococci. (10) All coagulase positive cultures were tested for antibiotic sensitivity and in addition they were bacteriophage typed.

The 25 phages were propagated at our laboratory at the Institute of Public Health Research* and the technique of typing was similar to that proposed by Williams and Rippon. (6,11). Strains resistant to routine test dilution (RTD) of the phages were retested with 1000 RTD.

The following phages were used:

Lytic group 1	29, 52, 52A, 79, 80
Lytic group 2	3A, 3B, 3C, 55, 71
Lytic group 3	6, 7, 42E, 47, 53 54, 75, 77
Lytic group 4	42D
Additional phages	81, 187, 83A, D, 77ad, B5

The phages D, 77ad and B5 are new ones and are not yet placed in the International set, but they are sent to different laboratories throughout the world so that their usefulness could be investigated.

Specimens from objects were taken by rubbing a sterile cotton swab on their surface and then culturing the organisms obtained on blood agar plates. For sampling the air, open blood agar petri dishes were placed in different areas at the operating room. These plates were left open during the whole morning when operations were being performed. They were then taken and incubated at 37° C. The blankets were tested by sweep plate technique. The blanket was laid flat on a table or it could be sampled in its normal positions. The culture medium was pressed upside down firmly against the blanket and swept across it fairly rapidly and evenly. The movement of the edge of the plate caused particles of dust and fluff to be thrown on to the surface of the medium.

Table I

Particulars of 133 clean operations

Age	Male	Female	Total
<15	8	2	10
15–25	9	12	21
25–45	28	29	57
45–65	20	14	34
>65	5	6	11
	70	63	133

* The bacteriology laboratory of the Institute is the National representative in Iran for the bacteriophage typing of staphylococci.

RESULTS

General Incidence of Sepsis:

Out of 133 (Table II) clean wound operations there were a total of 45 (33,8%) cases of post operative sepsis. Among these there were 14 (10.5%) cases, where drainage was not used and 31 (23.3%) cases with the drainage.

Table II

Incidence of post operative sepsis during a three months period.

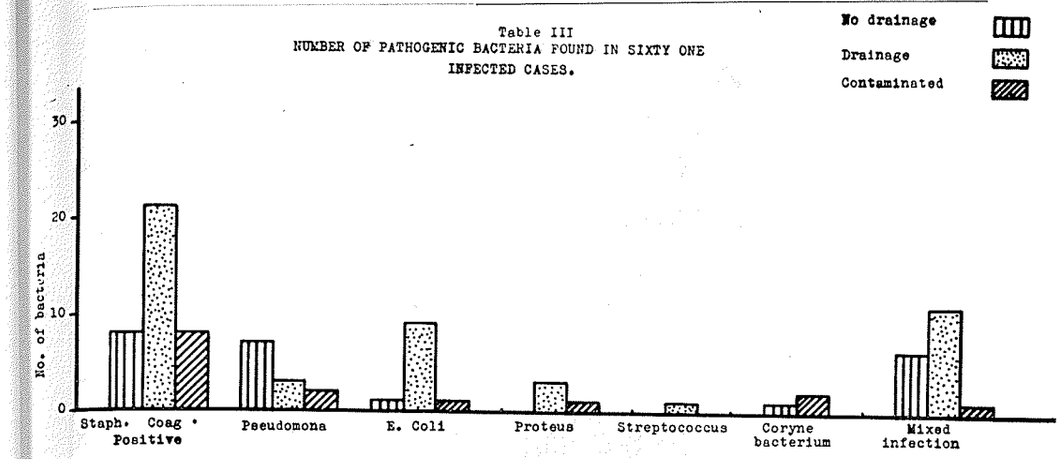
	Healthy skin with no drainage	Healthy skin with drainage	Total of clean wound operation	wounds contaminated before the operation	clean wounds not infected	Total No. of operations
No.	14	31	45	16	88	149
%	10.5	23.3	33.8	10.7	66.1	99.9

As it can be seen from table II there were 16 cases alerady infected before the operation which makes a total of 149 operation, but only the 133 clean wound operations are taken into account.

Pathogenic Bacteria Isolated:

Recently there has been an increased interest in gram negatives in connection with hospital cross infection and we can see from table III that Pseudomonas and E. coli are rivaling Staphylococcus aureus as a hospital scourge.

Table III
NUMBER OF PATHOGENIC BACTERIA FOUND IN SIXTY ONE INFECTED CASES.



Staphylococcus aureus, however, is still the number one culprit, then E. coli and Pseudomonas and possibly the fourth place is played by Proteus. Occasionally there are infections by other organisms as well. Cases with drainage were mostly infected with Staphylococcus (22 cases table III), as it was expected since infected air plays a more important role here. With Pseudomonas however it is not so much the air born infection but largely as a result of its being able to reach the skin, clothing and bedding of individual. Pseudomonas is biologically active to an extreme degree and it can live on simple substrate, survive for long periods under a wide range of environmental conditions apart from severe dehydration. It prefers humid air and therefore one should look for it around the sink, on the sponge and around the incubators of prematures. It has however, a low invasive power and thus it is often a secondary invader.

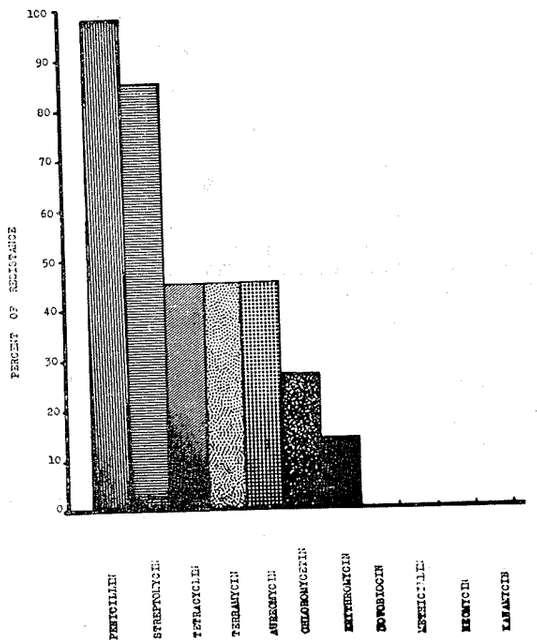
Antibiotic Sensitivity Pattern of one hundred Staphylococci:

These strains were obtained from septic lesions, carriers and the environment.

As seen in table IV, 98% of staphylococci isolated were resistant to penicillin and 85% were resistant to streptomycin. With such high rates of resistance, one indeed questions the value of such drugs under the circumstances. The 45% rate of resitstance of strains to the three antibiotics tetracycline, terramycin and aureomycin will most probably be increased still further.

TABLE IV

PERCENT OF RESISTANT STRAINS OF HUNDRED STAPHYLOCOCCI AUREUS TO ELEVEN DIFFERENT ANTIBIOTICS



This may also be true with regards to 27% and 14% of resistance to chloromycetin and erythromycin respectively. These frequencies of resistance to antibiotics roughly reflect the relative amounts of drugs used in the wards. The only antibiotics which are still totally effective are the ones which do not as yet have a widespread use.

Antibiotic Sensitivity Pattern of Pseudomonas:

Pseudomonas strains, (table V) isolated, seem to be completely sensitive to polymyxin B and to colymycin and 50% are sensitive to neomycin and 9% sensitive to kanamycin. In vitro, sensitivity tests show complete resistance of Pseudomonas strains to penicillin, streptomycin, chloromycetin, terramycin, sulfadiazin, tetracyclin, erythromycin and aureomycin. Thus we see that Pseudomonas strains can adapt to the presence of most antibiotics and antibacterial substances and this will give them a survival advantage over others. It is a dreading thought that such strains may become resistant to the few antibiotics left.

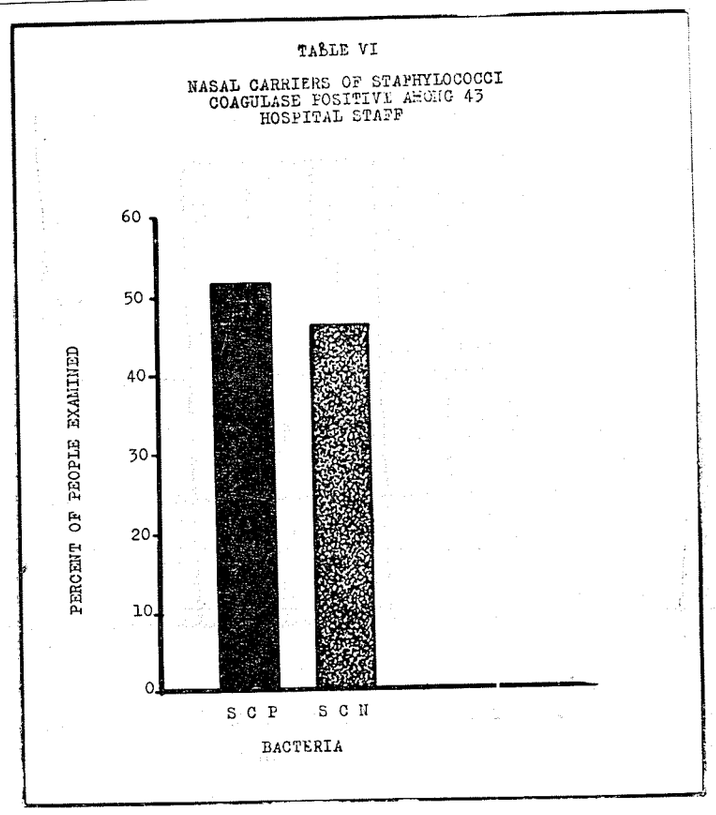
Table V

Per cent of resistant strains of 24 Pseudomona to 13 different antibiotics

	Penicillin	Chloromycin	Sulfadiazin	Terramycin	Erythromycin	Tetracyclin	Streptomycin	Aureomycin	Novobiocin	Kanamycin	Neomycin	Polymixin B	Colymycin
Number	24	24	24	24	24	24	24	24	24	22	12	0	0
Per cent	100	100	100	100	100	100	100	100	100	91	50	0	0

Nasal Carriers

Nasal cultures were made from surgeons, doctors and nurses and other persons working at the surgery department and as seen from table VI, of the 43 people examined 22 (51%) were carriers of Staphylococus aureus. This finding is in agreement with other studies performed among hospital personnel and indicates the possible role that carriers may play towards hospital cross - infection.

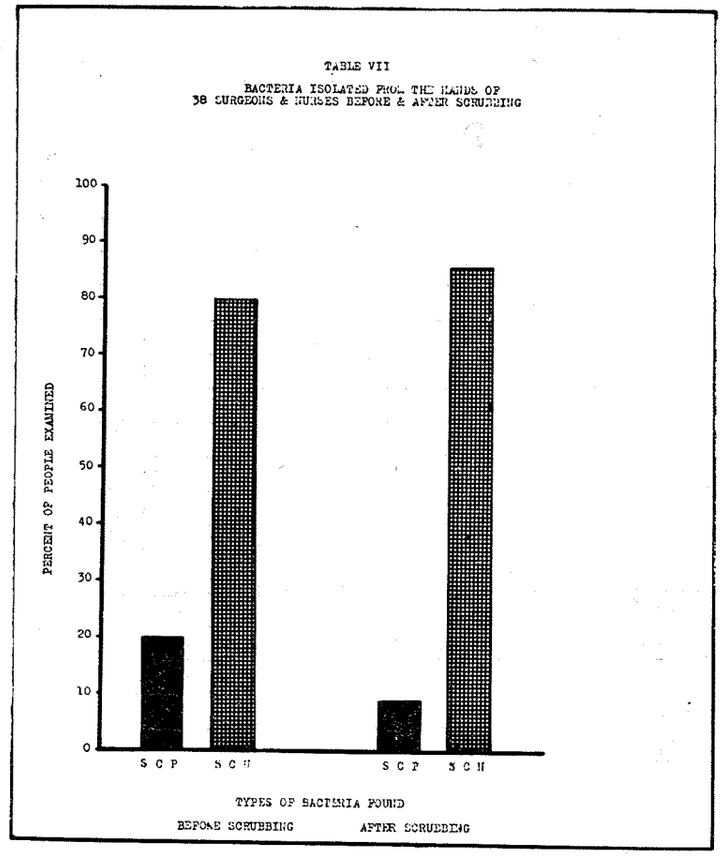


SCP = Staphylococcus Coagulase positive

SCN = Staphylococcus Coagulase negative

Hand Carriers

Also in another experiment (table VII) the cultures were taken from the hands of 38 surgeons and nurses before and after scrubbing. Eight persons (21%) had Staphylococcus aureus before scrubbing and still 4 persons (10.5%) remained positive after scrubbing. Hand scrubbing here when performed correctly should have included three washings with hot water, soap and brush and each time lasting five minutes. Two other washings without the use of brush should have followed.



SCP = Staphylococcus Coagulase Positive

SCN = Staphylococcus Coagulase Negative

Bacteriological Sampling of the Objects and Environment

Environment also plays an important role in dispersing pathogenic bacteria. The environment may be divided into air, solid surface and textiles and solutions and fabrics. Each is infected by the patient or the carrier and in turn will infect others. Table VIII shows the result of bacteriological sampling taken from the air and variety of the objects at the hospital.

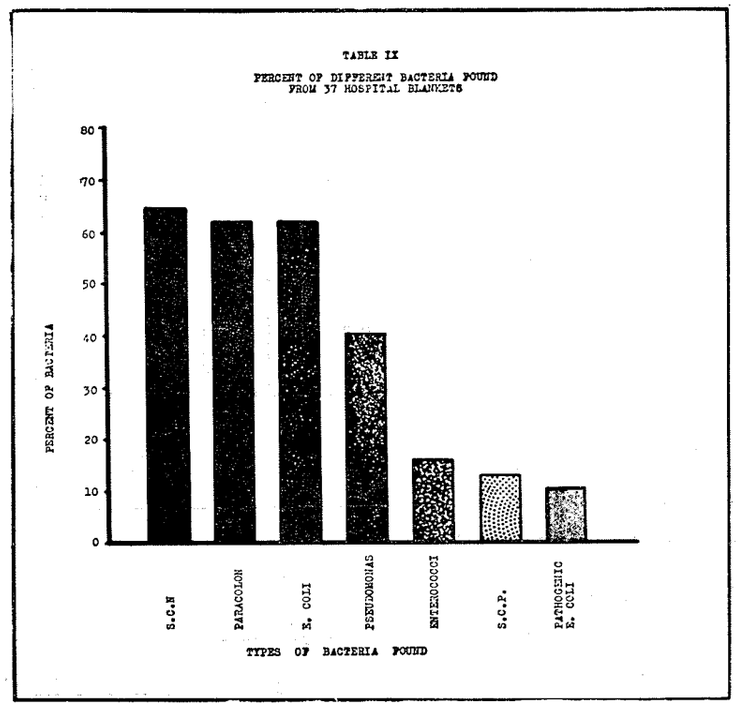
TABLE 8
TYPES OF BACTERIA ISOLATED FROM OBJECTS AND ENVIRONEMENT AT SURGERY DEPARTMENT

NATURE OF OBJECTS	S.C.P.	S.C.N.	PSEUDOMONAS	E. COLI	PARA COLON	ENTEROCOCCI
STERILIZED COTTON & GAUZE		+				
BED PAN				+	+	
BED_SIDE TABLE				+	+	
HANDLE (WINDOW)		+			+	
HANDLE (DOOR)				+	+	
FLOOR UNDER THE BED					+	
FLOOR (OP. ROOM)		+				
MEDICINE TRAY		+		+		+
NORMAL SALIN				+	+	
POWDER						
DRESSING CART				+	+	
AIR (OP.ROOM)		+				
SOAP		+				
STERILE TOWEL		+				
EMESIS BASIN BEFORE USE			+			
EMESIS BASIN AFTER BEING USED					+	
FORCEPS STERILE		+				
CATCUTTE		+				
FORCEPS FOR HANDLING STERILE MATERIAL		+				
OPERATING TABLE			+		+	
BASIN		+			+	
STERILIZED WATER						
DETOL SOLUTION 5% FOR KEEPING THERMOMETER			+			
STERILE CONTAINER		+			+	
CART USED FOR OP EQUIPMENT						

It is particularly interesting to note the presence of Pseudomonas at the operating table, and also in 5% detol solution in which thermometers are kept. E. coli and Paracolon are isolated from number of objects.

It should be realized that this is the result of one sampling. Repeated sampling may lead to isolation of more pathogenic bacteria from more objects. As shown in table IX when blankets were studied separately it was found that they were indeed contaminated. From 37 blankets examined only two (5.4%) did not have any pathogenic bacteria. Sixty percent of them had E. coli and paracolon and 40% had Pseudomonas,

16% had Enterococcus and 13% had Staphylococcus aureus. One sixth of E. coli isolated were pathogenic E. coli and therefore one's mind is immediately turned towards maternity hospital and infant diarrhea.

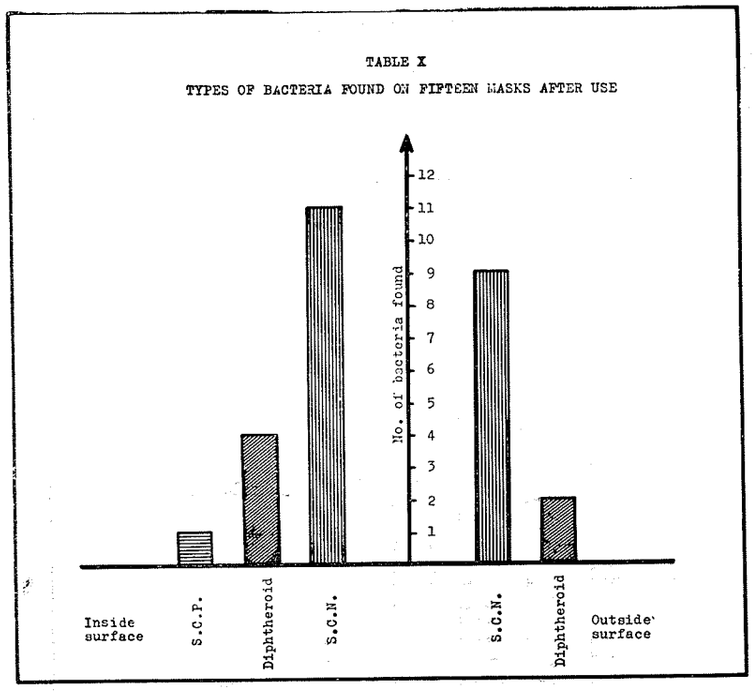


Bacteria Isolated from used masks

Masks certainly have their usefulness when used correctly. when used incorrectly as is often the case, they could act as a source of infection rather than a means to prevent the spread of infection. As seen in table X, from fifteen masks examined one had Staphylococcus coagulase positive on the inside surface and in this particular case no pathogenic bacteria could be isolated from the outside surface. However it is quite concievable that many pathogenic bacteria would be isolated from the outside surface of masks which hang around the necks of surgeons and physicians for a numher of hours.

TABLE X

TYPES OF BACTERIA FOUND ON FIFTEEN MASKS AFTER USE



SCP = Staphylococcus Coagulase Positive

SCN = Staphylococcus Coagulase Negative

Phage types of staphylococci

One of the most important steps towards the prevention of hospital cross infection is to trace the source of infection. Therefore in the case of staphylococci the identity of the strains is essential. Biochemical classification does not help us here because they only go as telling us whether a strain is pathogenic or not and even this is not for certain. Serological classification within the species gives a limited amount of information but fails to provide a descrimination fine enough to recognize strains isolated from widely separated places. Thus it had to fall on bacteriophage to provide us with specific technique to tell us the identity of two germs in the same species.

Since the staphylococci were isolated from three different sources i.e. from septic lesions, from carriers and from objects and environment,

the phage types of strain from each source are presented separately in table XI, XII & XIII.

Table XI

Type distribution of staphylococci from septic lesions

Group	No. of strains	Percentage
Group I:		
52/52A/80	2	3.17
52A	2	3.17
29/52/80	1	1.6
Total group I	5	7.94
Group II:		
3A/3C	1	1.6
3A/3C/71/80	1	1.6
3C/55/81	1	1.6
3B/55/71	1	1.6
3B/3C/55/71	3	4.7
Total group II	7	11.1
Group III:		
71/83A	1	1.6
55/75	5	4.7
55	2	3.17
B/5/83A	2	3.17
71/75	1	1.6
42 B/55	1	1.6
54/6/7/47/83A/77 ad	2	3.17
Total group III	12	19
Group IV	0	0
Mixed group	4	6.3
Non typable	31	49.2
Type 81	2	3.17
Type 77 ad	2	3.17
Total strains	65	

A sseen in Table XI there does not appear to be one particular type that is causing most of the infections.

The largest numbers in septic lesions are among the non typables i.e. 31 from 63 strains are non typable. 5 from group I, 7 from group II, 12 from group III, 4 from mixed group, 2 from type 81 & 2 from the type 77ad.

Table XII

Type distribution of Staphylococci
From environment

Group	No. of strain	Percentage
Group I		
52/52A	1	11.1
80	1	11.1
Group II	0	0
Mixed group		
52/52 A/81/42 E	1	11.1
Non typable	6	66.6
Total strains	9	

Among the strains from the environment also the largest numbers (6 strains) isolated are the non typables. Two strains from group I. none from group II and one from III. Seven of the 9 strains are from the blankets one from the floor of the operating room and one from the outside surface of the mask.

Table XIII

Type distribution of staphylococci
among 43 staff of surgery department

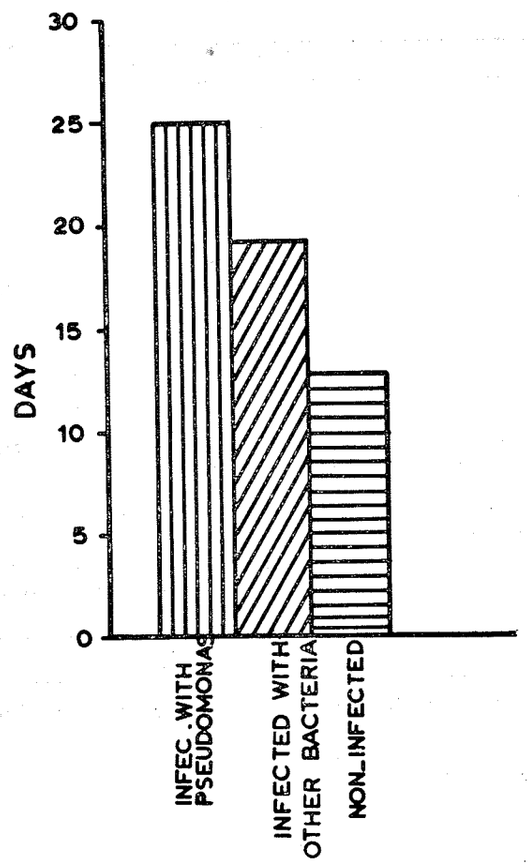
Group	No. of strains	Percentage
Group I		
52/52A/80	3	10.7
Group II		
3B/3C	1	3.57
Group III		
75	1	3.57
7	2	7.14
42 E	1	3.57
54/75/77/77 ad	1	3.57
83 A	1	3.57
Total group III	6	21.42
Group IV	0	0
Mixed group		
29/52/52A/7/80/81	2	7.14
Non typable	16	57.14
Total strains	28	

From the twenty eight strains listed here 22 are from the nassal carriers at the surgery department and six from the hands of the team at the operating room.

As shown from table XIII, the carriers also seem to have a similar pattern of distribution i.e. 16 strains from none typables, 3 from group I, 1 from group II, 6 from group III and 2 strains from mixed group.

Therefore as we can see from these phage typing studies there is no phage group of Staphlococcus predominant in any of the catagories studied. This shows that there is not one specific source of infection, such as a particular carrier or an open wound at the hospital.

TABLE 14
AVERAGE STAY AT THE HOSPITAL



Length of stay in Hospital

Table 14 is based upon the length of time that 133 patients stayed at the hospital. It will be seen that the average length of time for those whose clean wound did not get infected is 13 days.

The patients whose wound became infected with Pseudomonas stayed almost twice as long i.e. 25 days. The rest of the patients whose wounds became infected with other bacteria, their average length of stay at hospital was 18 days. Therefore we can see that apart from the danger and discomfort to the patient, infections caused at the hospital are also causing much extra work and expense for the hospital itself. The patient also suffers economically by being away from his work.

Discussion

As we pointed out in our introduction one of the primary reasons for organizing this study was to set an example as to how an investigation of similar nature could be formulated and carried out. In this manner hospitals throughout Iran could learn to know their problems regarding hospital cross infection, and we strongly believe that the realization of the problems and risks is itself a positive step towards the prevention. Here during this investigation we have showed the rate of sepsis, the prevalent types of pathogenic bacteria in the hospital and their antibiotic sensitivity pattern. We have also showed through methodical experiments many loop holes which may contribute towards the spread of infection.

It is difficult to state the acceptable rate of post operative sepsis of clean wounds, however the 33 per cent rate that we have shown is undoubtedly quite high. The reasons for such high rates are multiple, but certainly the emergence of drug resistant pathogenic bacteria is the starting point in the chain of hospital cross – infection.

It appears that here in Iran we are repeating the same mistake of Americans & European countries instead of benefiting from their bitter experience. This study indicates that the wide spread and indiscriminate use of antibiotics have led to the emergence of highly virulent drug resistant bacteria, as shown in table IV and V, and thus begins the vicious circle of infection within the hospital.

Although as mentioned the reasons and factors which contribute towards hospital cross infection are varied and complex, but the authors feel certain that the observance of certain basic rules will lower the rate of post operative sepsis within the hospital significantly. It is on this basis that the authors are listing the following recommendations:

A) To decrease acquired bacterial resistance:

1 – The first principle is to confine antibiotic treatment to patients seriously needing it.

2 – To reserve erythromycin & sometimes novobiocin exclusively for infections resistant to other antibiotics in the hope that this much restricted use may preserve their utility as long as possible.

3 - To use as wide a variety as possible so that none is used enough to promote any high degree of resistance.

4 - To abandon an antibiotic to which resistance has appeared and to substitute another in its place.

B) Asceptic Technique:

Observance of asceptic rules is one of the most basic steps towards the prevention of hospital cross infection. These include:

1 - Correct handling of infected patients and safe disposal of their infected materials i.e. Garbages, feces, vomites, dressings, and clothings.

2 - Disinfection of bath and urine bottles.
Hexachloraphene or other germicidal solution can be used for washing baths and some can be added to urine bottles before use. After use the bottles can be allowed to stand for one hour before being rinsed and washed.

3 - When the patient is discharged, all the bedding must be changed and disinfected, by the addition of some germicide to washing water e.g. savlon.

4 - Blankets and other wollen material which cannot be washed in hot water can be sterilized either by washing with cirrasol OD or by treating with moist formaldehyde vapour in an autoclave chamber (12,13).

5 - Proper dressing of wounds. Special septic set containing the necessary instruments for changing dressings are most practical. All septic dressings are firmly wrapped in waxed paper bags or other suitable paper, sealed, marked and sent to an incinerator for burning.

6 - Face masks should be changed as frequently as possible with a 30 minute maximal use time or as often as it would be practical. This would prevent the collection of bacteria on the mask which otherwise would act as a source of infection.

7 - A ten - minute timed antiseptic soap and water scrub is more nearly effective in producing a sterile incision site than any thing else that has been done for the skin preparation. A tincture of Zephiran chloride 0.1 per cent solution can be used and there is proof of its auxilary value.

8 - Hand Scrub. For all practical purposes, there should be three washings with hot water, soap and brush each lasting at least a few minutes.
washing with fresh Zephiran solution, followed by drying powder and gown and gloves.

9 - The number of people present in the operating room should be kept to a minimum and none of them should wear street clothes. Conversely, scrub suits must be considered contaminated if they are worn on the wards. Conversation, particularly while leaning over an exposed incision must be kept to a minimum. Personnel with staphylococcal skin or respiratory infection must avoid entry into the operating room.

C) General care of the environment and instruments:

1 - Sterilizers should be controlled periodically, since imperfect sterilization is a very obvious source of infection.

2 - Solutions and drugs can becom contaminated. Antihiotic resistant staphylococci and pseudomonas may grow in antibiotic preparations such as penecillin ointment or in streptomycin solutions.

3 - Thermometers should be kept in suitable germicidal solution and such solutions should be changed frequently.

4 - Autoclaving of all linen and night gowns before they are sent for washing is essential. The same cart should not be used to transport clean & dirty linen.

5 - Cleaning the environment. A good hot water and soap mopping diminishes the number of pathogenic organism in the area, particularly if a detergent germicide mixture is added. This cleaning should be carried out every day.

6 - Sun light and ventilation. An abundance of sun light and fresh moving air has probably the best sterilizing effect of any method of cleaning the air of hospitals and their physical structures. Sunning and airing of a room and its contents for a period of 24 hours after a patient has been discharged is effective. Articles which can not be treated in another manner without harming them should be exposed to the sun and air of the out doors for 24 hours or moer.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D) Carriers:

The role of asymptomatic carriers of staphylococci coagulase positive is not entirely clear. Most studies reveal 40 - 70 percent of hospital personnel are such carriers. It would be not only impractical but impossible to remove all these people from patient care. It might be wise however, to do periodic nasal culture of personnel in the critical hospital areas, in order to detect long term carriers and to do phage typing if the infection rate seems unduly high. In this way we could treat the carrier or temporarily change their position if it appears that patients are at great risk in that particular critical area. Nasal carriers could if necessary be treated with Neobacrin ointment (Neomycin and Bacitracin) or Nase-ptin cream (Neomycin and Chlorhexidine). This, however, should be applied with caution since it has the risk of creatig resistant strains.

E) Education:

Principles of asepsis and basic rules in prevention of hospital infection should be explained to all those concerned. Bacteriologist play a very important role in this respect, but the task has become rather difficult since most doctors, surgeons & nurses look upon them as something of a nuisance. The reason is that doctors & surgeons & nurses are all very busy people with complex and often arduous responsibilities. To these people bacteriologist must often appear as the final irritant that cannot be endured. However the bacteriologists must learn the language of heavily burdened surgeons and clinicians & nurses. They must clarify the dangers and the gravity of the situation by presenting well documented and interesting evidence through short & organized studies. Such studies should be published and placed at the disposal of all the staff so that they could visualize the dangers, the discomfort, the extra work and the extra expense which are brought about by infections originating at the hospital. In such manner one hopes that each individual working at the hospital would have an understanding of the problem and would realize how best he or she could contribute towards the prevention of hospital cross infection.

SUMMARY

A survey was carried out to determine the incidence of sepsis after surgical operation. A total of 133 cases were studied. 33 percent of elean wounds were affected by some post operative sepsis and yielded pathogenic bacteria on culture. Staphylococcus aureus was the most common pathogen but pseudomonas and E. coli were also common. Cultures were taken from the staff, the environment and objects and an attempt was made to show the significance of each in connection with hospital cross infection. Finally certain recommendations were made in the hope that the observance of these specific rules would significantly lower the rate of sepsis at the particular hospital concerned.

RESUMÉ

Une étude fut éffectuer dans le but de déterminer l'incidence des infections post _ opératoires. Sur une totale de 133 cas étudiés, 33% des blessures asceptiques firent l'objet d'un infection post _ opératoire. On trouva en culture des bactéries pathogéniques. Le staphylococcus aureus était l'agent pathogène le plus commun, mais on trouva aussi des colibacilles et des pseudomonas. On fit des prélèvements sur le personnel, l'entourage et des objets, et des cultures furent faites pour démontrer la relation de ces derniers avec les infections existant dans un hôpital. Enfin certaines recommandations furent faites dans l'espoir que l'observation de certaines règles précises et spécifiques aiderait à réduire considérablement le nombre d'infections post - opératoires dans les hôpitaux.

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Cardiac Arrythmias in Acute and Chronic Renal Failure ✿

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Cardiac arrythmias are frequent complication in acute and chronic renal failure but the exact incidence of arrythmias remain the subject of considerable debate.

Cardiac arrythmias are mostly of supra – ventricular tachycardia, particulary paroxismal auricular premature contraction, auricular tachycardia and auricular fibrillation which may occur at any stage of the course of the disease, if B.U.N. remains elevated for over a long period of time.

In many instances some specific causative factors can be found, among those, electrolyte imbalances, sustained hypertention, focal degenration of myocardium, pericarditis, and digitalisation appear to be the most potentially dangerous cause of arrythmias.

We have therefore studied cardiac arrythmias in series of patients with acute and chrohic renal failure of varying ethiology with the purpose of identifying the incidence and most common causes of these arrythmias.

Twenty patients (8 with acute renal failure and 12 with chronic renal failure.) were the subject of our studies.

The evaluation of cardiac arrythmias was suported by appropriate physical examination, serial E.C.G. and chest X rays, daily determination of electrolytes and cardiac muscle biopsy or post mortem examination of the heart of the patients immidiately after death.

In our series of patients, the following causes were held responsible for their cardiac arrythmias:

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