RESULTS

Our study was carried out in Pediatrics Intensive Care Unit (P.I.C.U) of the Pediatrics Department at Banha University Hospital from ***(August, 2007 to May, 2009).***

Our study included 600 diseased patients admitted to the P.I.C.U, 362 were males and 238 were females, their ages ranged between one month and 18 years.

They were divided into 2 groups according to presence or absence of nosocomial infection.

Group I (With evidence of nosocomial infection): They were 150 patients (81 Males, 69 Females), their ages ranged from one month to 18 years.

Group II (With no evidence of nosocomial infection): They were 450 patients (281 Males, 169 Females).

Table 1 and Figure 1, shows the distribution of cases with evidence of nosocomial infection according to the age, were 75 patients (75%) were less than 1 year of age, 40 patients (26.7%) were in the range of 1-6 years, 21 patients (14%) were in the range of 6-12 years and 14 patients (9.3%) were above 12 years of age **(Figure 1).**

Table 2, shows the distribution of cases with evidence of nosocomial infection according to the sex distribution were 81 patients

(54%) were males and 69 patients (46%) were females and Z=0.98, and there was no statistical significant difference (P>0.05).

Table 3 and Figure 2, shows the distribution of the nosocomial infection according to the cause of admission, 42 patients (28%) were having nosocomial infection because of chest problems, 29 patients (19.3%) due to cardiac problems, 17 patients (11.4%) due to GIT problems and complications, 20 patients (13.3%) due to renal problems, 22 patients (14.7%) due to CNS problems, other problems that have induced nosocomial infections (Such as postoperative, DKA and organophosphorus poisoning) were found in 20 patients representing about 13.3% of the total number of the patients.

Table 4 and figure 3, shows the distribution of the nosocomial infection according to the causative organism, 50 patients (33.3%) were found to have the Staphylococci as the causative organism, 9 patients (6%) streptococci, 23 patients (15.3%) pseudomonas, 17 patients (11.4%) E. Coli, Klebseilla and Candida were found in 38 and 13 patients respectively.

Table 5, shows the samples of the Staphylococci (n=50 patients), were 40 patients (80%) were having coagulase positive Staphylococci and 10 patients (20%) were having coagulase negative staphylococci, with a highly-significant difference (P<0.001).

Table 6 and Figure 4, shows the number of the methicillin resistant s. aureus (MRSA) isolated from the total samples of the s. aureus, 17 (42.5%) were MRSA, 23 (57.5%) were MSSA, and 0 samples were VISA (total n=40 [coagulase positive s. aureus]).

Table 7 and Figure 5, shows the different sources from which the Staphylococci were isolated, the highest percentage was that of staphylococci isolated from the skin with a percentage of 30%, respiratory infections, blood stream infections and CNS infections were having a descended percentage of 26%, 24% and 20% respectively.

Table 9 and Figure 6, shows the results of the performed cultures for screening of the P.I.C.U. equipments and environments, 5 samples of the suction straps were cultured and 3 (60%) were found to be positive in culture where the other 2 samples (40%) were found to be negative in culture. Five ambu bag masks (3 +ve and 2 –ve), 4 oxygen connections (3 +ve and 1 –ve), wall and floors had 3 +ve samples and 2 –ve samples in culture, I.V. cannula (12 +ve and 2 –ve) and the endotracheal tubes were found to be (5 +ve and 2 –ve). No statistically significance were found for suction traps, ambu bag masks, oxygen connections, walls & floors and endotracheal tubes ($P>0.05$), the only statistical significant difference was found for the I.V. cannula and for the total number of performed cultures ($P<0.01$).

Table 10, shows the distribution of the isolated microorganisms from the P.I.C.U. equipments and environmet according to their character (Either Gram + ve or Gram –ve), the 3 +ve samples of the suction straps were 1 having Staphylococci, 1 having klebsiella and one having pseudomonas, ambu bag masks samples were (2 staphylococci and 1 klebsiella), oxygen connections samples (1 staphylococci, 1 streptococci and 1 klebsiella), walls and floors samples (1 pseudomonas, 1 E. Coli and 1 Proteus), I.V. cannula samples (3 staphylococci, 2 sterptococci, 5 klebsiella, 1 pseudomonas and 1 was having E. coli in isolation), the

endotracheal tubes samples were 5 in total 2 of them were identified of having staphylococci, 2 identified of having streptococci and the last sample was having klebsiella (all 5 samples are having gram +ve organisms).

Tables 11 and 12, are showing both the prevalence of staphylococci respiratory infection as regarding the presence of mechanical ventilation and nosocomial staphylococcal blood stream infection as regarding the presence of central venous line, table 11 shows statistical significance between the patients with mechanical ventilation and those without mechanical ventilation ($P<0.01$). Table 12, also shows a statistical significance but with a lower P value ($P<0.05$).

Table 13 and Figure 7, shows the drugs sensitivity and resistance of s. aureus to different antibiotics, the sensitivity of the s. aureus to antibiotics was highest against the vancomycin with 100% of the coagulase +ve staphylococci (40 samples), and lowest against cefuroxine 11 samples (27.5%). The resistance to antibiotics was highest against the cefuroxine and lowest against amikin, the highly statistical significant difference between resistance and sensitivity of antibiotics was found for the amikin, and the non-significant difference between resistance and sensitivity was found for both the methicillin and the cefotaxine. Rest of antibiotics use showed significant difference between resistance and sensitivity with a ranging values.

Table 16 and Figure 8, shows the antibiotic resistance of MRSA and MSSA.

Table 18, shows the MRSA strains isolated from different sources (Total no. of MRSA=17), skin and postoperative infections were having the largest share in the sample contributing with 7/17 samples, respiratory infections, blood stream infections and CNS infections are contributing by 5, 3, and 2 samples in a descending frequency of order.

Table 19 and Figure 9, shows the final outcome in relation to the 17 patients of MRSA, 10 patients were cured while unfortunately, the other 7 died.

Table 1. Distribution of cases w ith evidence of nosocomial infection according to age.

Age (Years)	No. of patients	Percentage
Less than 1 yr.	75	50.0 %
1 to 6 yrs.	40	26.7 %
6 to 12 yrs.	21	14.0 %
12 yrs+ (and above).	14	9.3 %
Total	150	100.0 %

Figure (1) **Distribution of cases with evidence of nosocomial infection according to age.**

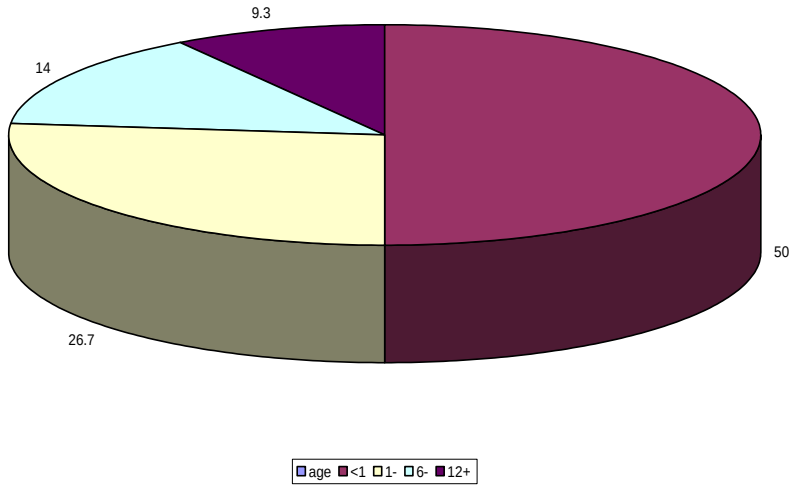

Table 2. Distribution of cases with evidence of nosocomial infection according to sex.

Sex (Male, Female)	No. of patients	Percentage	Z	P
Males	81	54.0 %	0.98	0.05 **NS**
Females	69	46.0 %		
Total	150	100.0 %		

Table 3. Distribution of cases with evidence of nosocomial infection according to the cause of admission.

Causes	No.	Percentage
Chest problems.	42	28.0 %
Cardiac problems.	29	19.3 %
GIT problems and complications.	17	11.4 %
Renal problems.	20	13.3 %
CNS problems.	22	14.7 %
Others (Post-operative problems, DKA organophosphrous poisoning).	20	13.3 %
Total	150	100.0 %

Figure (2) Distribution of cases with evidence of nosocomial infection according to the cause.

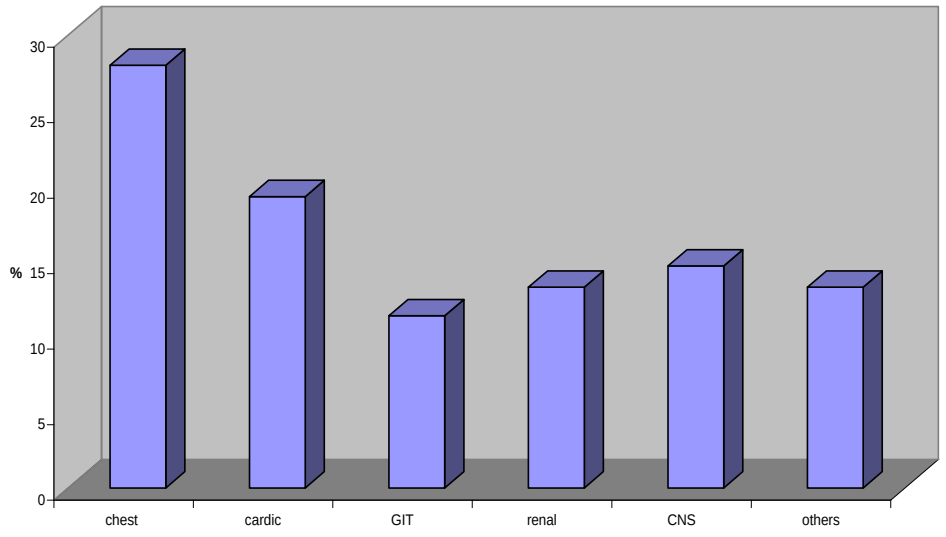

Table 4. Nosocomial infection according to the causative organism.

Causative organism	No	Percentage
Staphylococci.	50	33.3 %
Streptococci.	9	6.0 %
Pseudomonas.	23	15.3 %
E. Coli.	17	11.4 %
Klebseilla.	38	25.3 %
Candida.	13	8.7 %
Total	150	100.0 %

Figure (3) Nosocomial infection according to the causative organism.

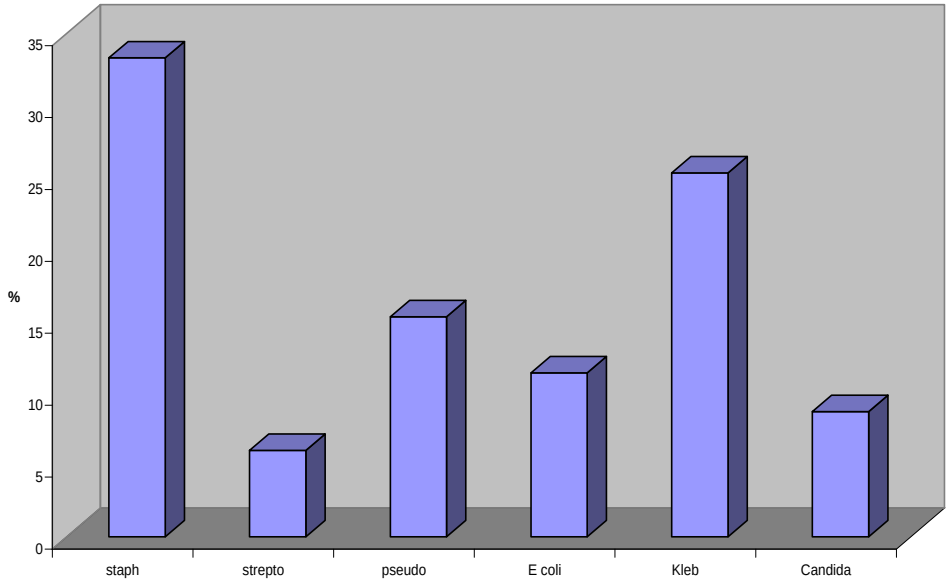

Table 5. Number and percentage of staphylococci according to coagulase.

Coagulase	No.	Percentage	Z	P
Positive S. Cocci.	40	80.0 %	4.24 %	<0.001 **HS**
Negative S. Cocci.	10	20.0 %		

Table 6. Number of (Methicilin Resistant S. Aureus) isolated from S. Aureus.

S. Aureus	No.	Percentage
MRSA	17	42.5 %
MSSA	23	57.5 %
VISA	0	0 %
Total	40	100.0 %

Figure (4) Percentages of MRSA & MSSA

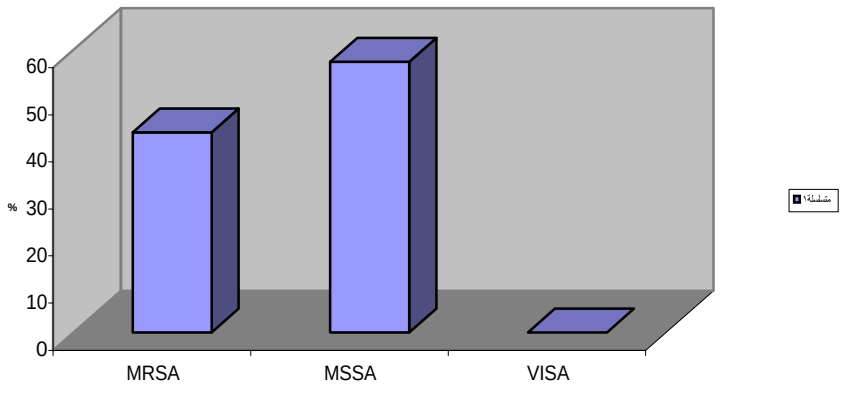

Table 7. Staphylococci isolated from different sources.

Source of infection	No	Percentage
Blood Stream.	12	24.0 %
Respiratory.	13	26.0 %
CNS.	10	20.0 %
Skin.	15	30.0 %
Total	50	100.0 %

Figure (5) Staphylococci isolated from different sources

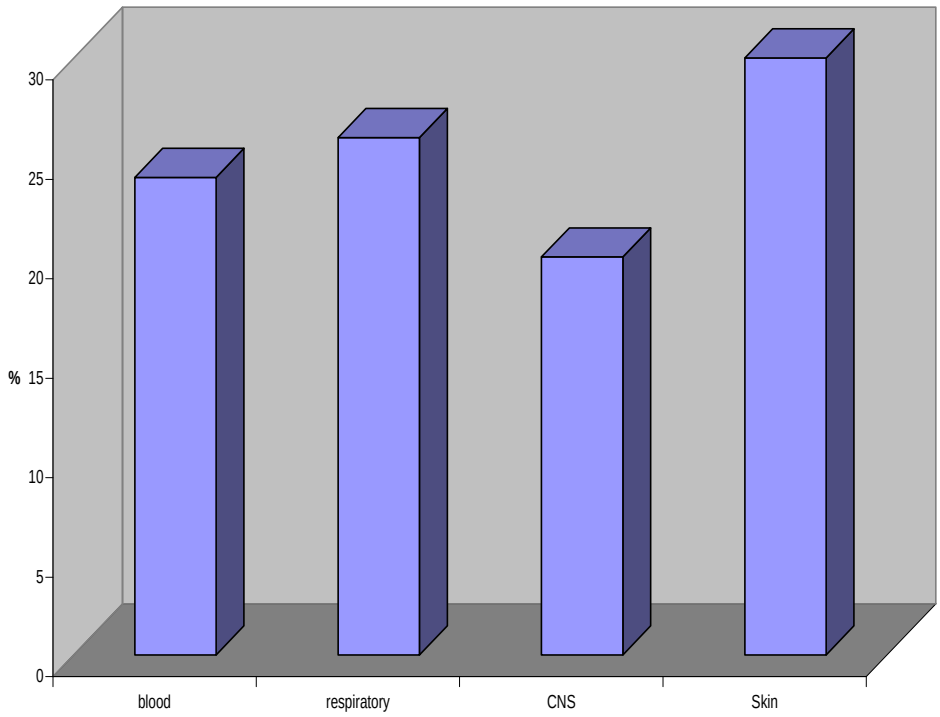

Table 8. Distribution of positive results per the swabbed personnel (Doctors, Nurses and Health care workers of P.I.C.U).

Item	Site of swabbing		
	Nose	Nail	Throat
Doctor 1	Streptococci		
Doctor 2		Staphylococci	
Doctor 3			Streptococci
Doctor 4			Streptococci
Doctor 5	Staphylococci		Streptococci
Nurse 1		Pseudomonas	
Nurse 2	Neisseria		
Nurse 3			Staphylococci
Nurse 4			
Nurse 5	Staphylococci		
Nurse 6		Streptococci	
Nurse 7	Diphteroid		
Nurse 8			Neisseria
Nurse 9	Staphylococci	Staphylococci	
Nurse 10		E. Coli	Neisseria
HCW 1	Staphylococci		
HCW 2		E. Coli	Neisseria
HCW 3	Pseudomonas		Streptococci
HCW 4	Staphylococci		
HCW 5		Pseudomonas	Neisseria

Table 9. Results of the performed cultures for screening of P.I.C.U equipments and environments.

Item	Results						Z	P
	Positive		Negative		Total			
	No.	%	No.	%	No.	%		
Suction traps.	3	60.0	2	40.0	5	100.0	0.45	>0.05
Ambu bag masks.	3	60.0	2	40.0	5	100.0	0.45	>0.05
Oxygen connections.	3	75.0	1	25.0	4	100.0	1.0	>0.05
Walls & floors.	3	60.0	2	40.0	5	100.0	0.45	>0.05
I.V. Cannulas.	12	85.7	2	14.3	14	100.0	2.67	<0.01
Endotracheal tubes.	5	71.4	2	28.6	7	100.0	1.13	>0.05
Total	29	72.5	11	27.5	40	100.0	2.85	<0.01

Figure (6) Types of culture for screening

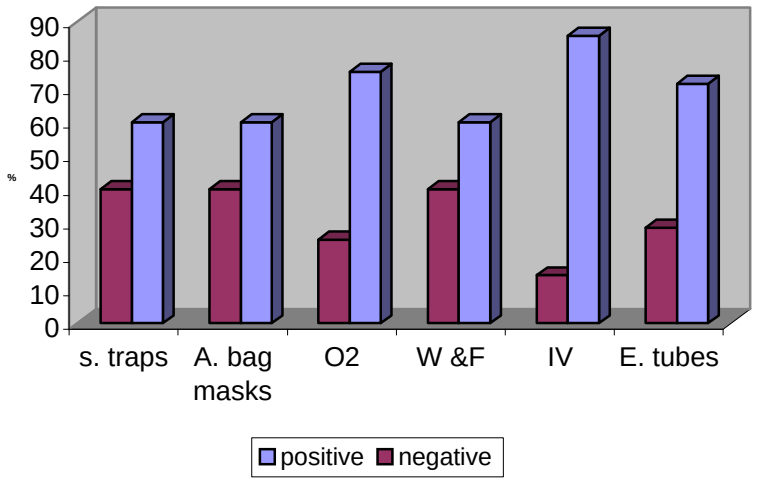

Table 11. Prevalence of Staphylococcal respiratory infection as regarding the presence of mechanical ventilation.

With ventilation		Without ventilation		Total	
No.	**%**	**No.**	**%**	**No.**	**%**
37	74.0	13	26.0	50	100.0

Z= 3.39 **P= <0.01 HS**

Table 12. Nosocomial Staphylococcal Blood Stream Infection as regarding the presence of central venous line.

With (CVL)		Without (CVL)		Total	
No.	**%**	**No.**	**%**	**No.**	**%**
10	83.3	2	16.7	12	100.0

Z= 2.31 **P= <0.05 S**

Table 13. Drugs sensitivity and resistance of S. aureus.

Drug	Sensitivity		Resistance		Z	P
	No.	%	No.	%		
Amoxicillin & clavulenic acid.	13	32.5	27	67.5	2.21	<0.05
Methicillin.	23	57.5	17	42.5	0.95	>0.05
Cefuroxime.	11	27.5	29	72.5	2.85	<0.01
Amoxicillin.	12	30.0	28	70.0	2.53	<0.05
Impenem.	27	67.5	13	32.5	2.21	<0.05
Lincomycin.	29	72.5	11	27.5	2.85	<0.01
Cefotaxime.	15	37.5	25	62.5	1.58	>0.05
Vancomycin.	40	100.0	0	0	-	-
Erythromycin.	28	70.0	12	30.0	2.53	<0.05
Amikin.	35	87.5	5	12.5	4.74	<0.001
Chloramphenicol.	30	75.0	10	25.0	3.16	<0.01

P>0.05 → Non-significant. P<0.05(Or 0.01) → Significant.
P<0.001 → Highly-significant.

Figure (7) Drugs sensitivity and resistance of S. aureus

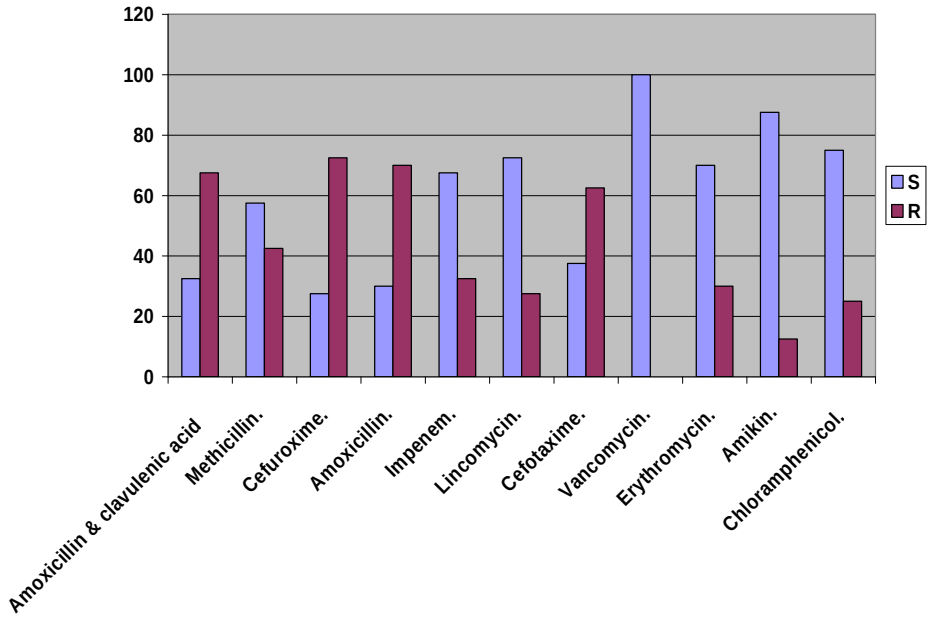

Table 14. Antibiotics resistance of methicillin resistant S.aureus isolates (No. of samples = 17).

Drug	No.	%	Z
Gentamycin.	8	47.0	0.75
Chloramphenicol.	3	17.6	2.49
Erythromycin.	13	76.5	1.8
Lincomycin.	11	64.7	0.52
Cefotaxime.	17	100.0	3.3
Ampicillin.	17	100.0	3.84

Table 15. Antibiotics resistance of methicillin sensitive S.aureus isolates (No. of samples = 23).

Drug	No.	%
Gentamycin.	15	65.2
Chloramphenicol.	17	73.9
Erythromycin.	8	34.8
Lincomycin.	12	52.2
Cefotaxime.	5	21.7
Ampicillin.	3	13

Table 16. Antibiotic resistance to MRSA and MSSA.

Isolate	MRSA (n=17)		MSSA (n=23)		Z	P
Antibiotic	No.	%	No.	%		
Gentamycin.	8	47.0	15	65.2	0.75	>0.05
Chloramphenicol.	3	17.6	17	73.9	2.49	<0.05
Erythromycin.	13	76.5	8	34.8	1.8	<0.05
Lincomycin.	11	64.7	12	52.2	0.52	>0.05
Cefotaxime.	17	100.0	5	21.7	3.3	<0.01
Ampicillin.	17	100.0	3	13	3.84	<0.001

P<0.05 (Or 0.01) → Significant. P>0.05 → Non-significant.

P<0.001 → Highly-significant.

Figure (8) Antibiotic resistance to MRSA and MSSA

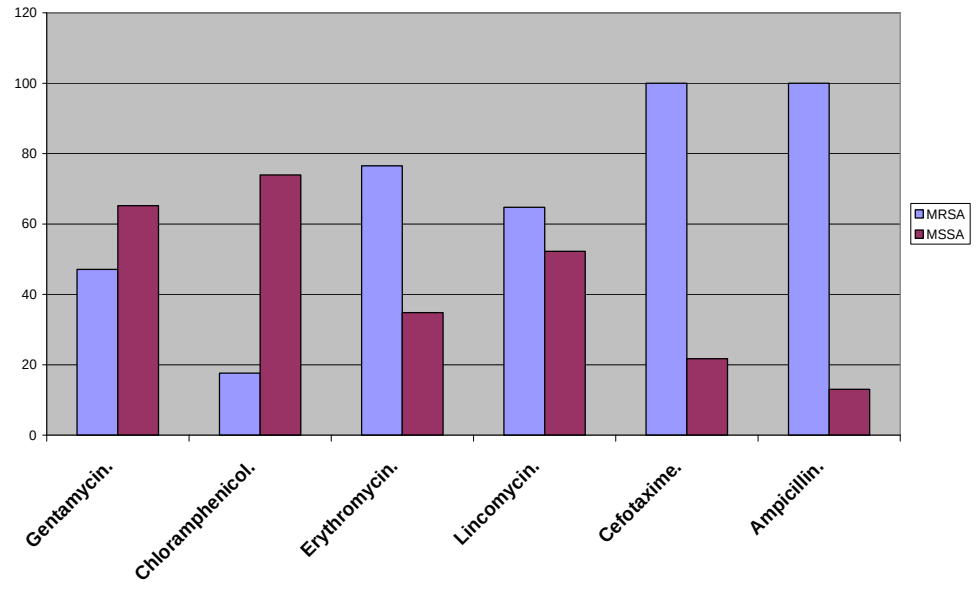

Table 17. Methicillin resistance to staphylococci.

Meth. Res	No.	%	Z	P
S. Aureus. (Total n=40) Coagulase +	17	42.5	0.65	>0.05 **NS**
S. Aureus (Total n=10) Coagulase -	3	30.0		

Table 18. methicillin resistant S.aureus isolated from different sites.

Source of infection	No.	Percentage
Blood Stream.	3	17.6
Respiratory.	5	29.4
CNS.	2	11.8
Skin & Postoperative.	7	41.2
Total	17	100.0

Table 19. Outcome in relation to methicillin resistant S.aureus.

Outcome	No.	%	Z	P
Cured.	10	58.8	0.73	>0.05 **NS**
Died.	7	41.2		
Total	17	100.0		

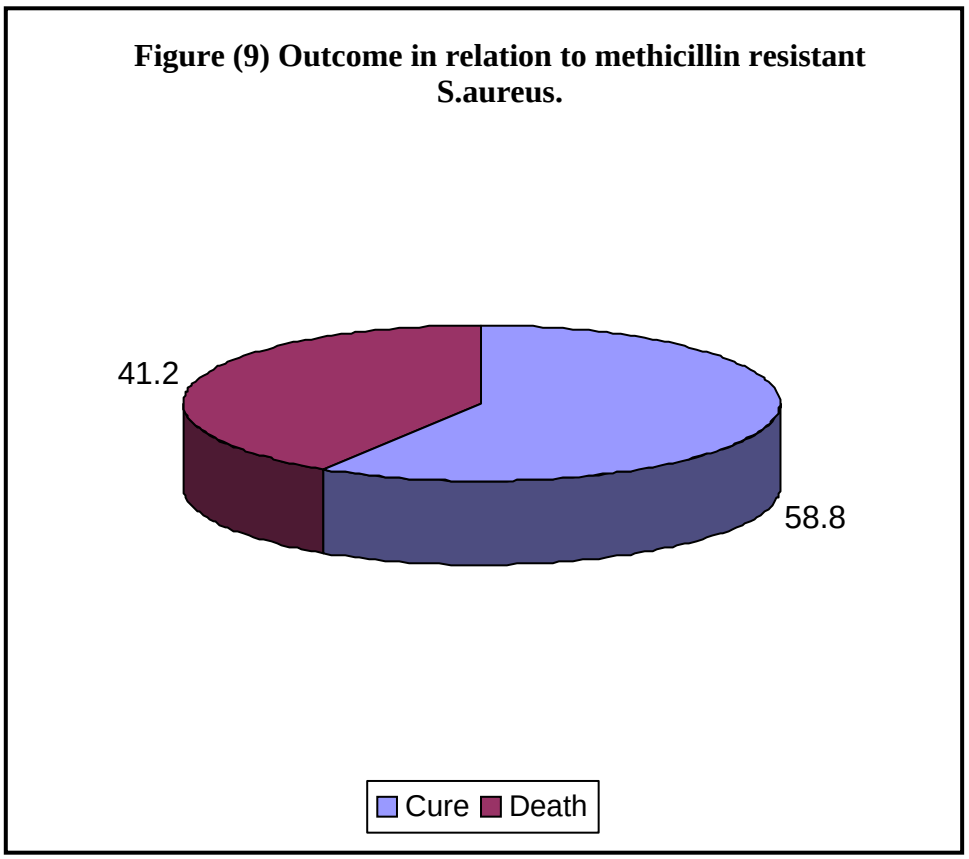

Figure (9) Outcome in relation to methicillin resistant S.aureus.

Figure (10) S.aureus growth on blood agar

Figure (11) Antimicrobial susceptibility testing by routine disc diffusion (Kirby-Baur)

Figure (12) Antimicrobial susceptibility testing by routine disc diffusion (Kirby-Baur)

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