

RESULTS

A total of (500) clinical specimens recovered from the clinical microbiology lab at Benha University Hospitals from (august 2009 to july 2010), were cultured by the conventional methods. Of them Two hundred and sixty six cultures were positive, of which (172) were gram negative isolates and (94) were gram positive isolates. A total of (205) nosocomial specimens were cultured and showed (89) gram negative and (35) gram positive isolates .In our study we only included the nosocomial gram negative isolates resistant to 3rd generation cephalosporins (54) and the gram positive isolates which were resistant to vancomycin ± methicillin (20) to be tested by **Sensititer** for Identification and susceptibility testing.

Table (1): Frequency of pathogenic (community and hospital acquired) isolates from different units .

Organism	Adult ICU N (%)	Neonatal ICU N (%)	Dialysis unit N (%)	surgery unit N (%)	Internal medicine unit N (%)	Overall N (%)
Gram negative isolates						
<i>E .coli</i>	14 (16.3%)	12 (14.6%)	10(26.3%)	2 (9.1%)	12 (31.6%)	50 (29.1%)
<i>Klebsiellae species*</i>	25(29.1%)	37(45.2%)	5 (13.2%)	5 (22.7%)	5 (13.2%)	77 (44.8%)
<i>Proteus species</i>	3 (3.5%)	3 (3.6%)	2 (5.3%)	2 (9.1%)	2 (5.3%)	12 (6.9%)
<i>Enterobacter species</i>	3 (3.5%)	4 (4.9%)	2 (5.3%)	1 (4.5%)	1 (2.6%)	11 (6.4%)
<i>Pseudomonase species</i>	4(4.6%)	2 (2.5%)	2 (5.3%)	1 (4.5%)	1 (2.6%)	10 (5.8%)
<i>Acinetobacter species</i>	1 (1.2%)	0 (0%)	0 (0%)	1 (4.5%)	1 (2.6%)	3 (1.8%)
<i>Other enterobacteriace**</i>	2 (2.3%)	3 (3.7%)	1 (2.6%)	2 (9.1%)	1 (2.6%)	9 (5.2%)
Subtotal gram negative isolates	52 (60.5%)	61(74.5%)	22 (58%)	14(63.5%)	23(60.5%)	172(64.6%)
Gram positive isolates						
<i>Staphylococcus aureus</i>	18(20.9%)	11 (13.4%)	5 (13.2%)	3 (13.7%)	4 (10.5%)	41 (43.6%)
<i>Coagulase negative staph.</i>	11(12.8%)	8 (9.7%)	4 (10.5%)	2 (9.1%)	5 (13.2%)	30 (31.9%)
<i>Enterococcus species</i>	3 (3.5%)	0 (0%)	4 (10.5%)	2 (9.1%)	4 (10.5%)	13 (13.9%)
<i>Streptococcus species</i>	2 (2.3%)	2 (2.4%)	3 (7.8%)	1 (4.6%)	2 (5.3%)	10(10.6%)
Subtotal gram positive isolates	34(39.5%)	21(25.5%)	16(42%)	8 (36.5%)	15 (39.5%)	94(35.4%)
Total	86(32.3%)	82(30.8%)	38(14.3%)	22(8.3%)	38 (14.3%)	266(100%)

*Including *raoultella terrigena*

***Serretia*(4), *aeromonas*(1), *citrobacter*(2), *kluyvera species*(2).

This table shows the pathogens most frequently isolated from different units. *Klebsiellae species* and *S.aureus* were more frequent in adult ICU, neonatal ICU and surgery unit representing 29.1% and 20.9% in adult ICU, 45.2% and 13.4% in neonatal ICU , 22.7% and 13.7% in surgery unit respectively. *E.coli* and *S.aureus* were more frequent in dialysis unit representing 26.3% and 13.2% respectively. *E.coli* and *CONS* were more frequent in internal medicine unit representing 31.6% and 13.2% respectively.

Table (2): Frequency of pathogenic (community and hospital acquired) isolates from different clinical specimens.

Organism	Surgical wounds N(%)	Deep pus* N (%)	Blood N (%)	Others** N (%)	Overall N (%)
Gram negative isolates					
<i>E.coli</i>	11(31.4%)	17 (50%)	7(11.3%)	15(36.6%)	50 (29.1%)
<i>Klebsiellae species</i>	13(37.2%)	7 (20.6%)	43(69.4%)	14(34.2%)	77 (44.7%)
<i>Proteus species</i>	4 (11.4%)	5 (14.7%)	0 (0%)	3 (7.3%)	12 (6.9%)
<i>Enterobacter species</i>	3 (8.6%)	2 (5.9%)	5 (8.1%)	1 (2.4%)	11 (6.4%)
<i>Pseudomonase species</i>	2 (5.7%)	2 (5.9%)	4 (6.4%)	2 (4.9%)	10 (5.8%)
<i>Acinetobacter species</i>	0 (0%)	0 (0%)	1 (1.6%)	2 (4.9%)	3 (1.8%)
<i>Other Enterobacteriaceae***</i>	2 (5.7%)	1 (2.9%)	2 (3.2%)	4 (9.7%)	9 (5.3%)
Subtotal gram negative isolates	35(66.1%)	34(61.8%)	62(66.6%)	41 (63.1%)	172(64.6%)
Gram positive isolates					
<i>Staphylococcus aureus</i>	11(61.2%)	11(52.4%)	11 (35.5%)	8(33.4%)	41 (43.7%)
<i>Coagulase negative staph.</i>	2 (11.1%)	5 (23.8%)	12 (38.7%)	11(45.8%)	30 (31.9%)
<i>Enterococcus species</i>	3 (16.6%)	4 (19.1%)	3 (9.7%)	3 (12.5%)	13 (13.8%)
<i>Streptococcus species</i>	2(11.1%)	1(4.7%)	5(16.1%)	2(8.3%)	10(10.6%)
Subtotal gram positive isolates	18(33.9%)	21(38.2%)	31(33.4%)	24(36.9%)	94(35.4%)
Total	53(19.9%)	55(20.7%)	93(34.9%)	65 (24.5%)	266(100%)

* Except surgical wounds.

** Respiratory tract, urinary tract.

*** *Serretia*(4), *aeromonas*(1), *citrobacter* (2), *kluvera species*(2)

This table shows that *Klebsiellae species* and *S.aureus* were more frequent in surgical wounds, representing 37.2% and 61.2% respectively. *E.coli* and *S.aureus* were more frequent in deep pus representing 50 % and 52.4% respectively. *Klebsiellae species* and *CONS* were more frequent in blood representing 69.4% and 38.7% respectively. *E.coli* and *CONS* were more frequent in respiratory and urinary tract isolates representing 36.6% and 45.8% respectively.

Table (3): Nosocomial gram negative and positive isolates tested by Sensititer.

Tested nosocomial isolates (N = 74)	
Nosocomial gram negative isolates (N = 54)	Species (N)
(1) <i>E.coli</i> (7)	
(2) <i>Klebsiellae species</i> (30)	• *<i>Klebsiella pneumoniae</i> ss <i>Pneumoniae</i> (21) • <i>Klebsiella oxytoca</i> (5) • <i>Klebsiella group 47</i> (3) • <i>Raoultella terrigena</i> (1)
(3) <i>Pseudomonas species</i> (5)	• <i>Pseudomonas aeruginosa</i> (3) • <i>Pseudomonas mendocina</i> (2)
(4) <i>Enterobacter species</i> (7)	• <i>Enterobacter aerogenes</i> (3) • <i>Enterobacter cloacae</i> (3) • <i>Enterobacter gergoviae</i> (1)
(5) <i>Aeromonas species</i> (1)	• ** <i>Aeromonas hydrophila</i> SS <i>hydrophila</i> (1)
(6) <i>Proteus species</i> (2)	<i>Proteus mirabilis</i> (2)
(7) <i>Acinetobacter species</i> (1)	<i>Acinetobacter baumannii</i> (1)
(8) <i>Kluyvera species</i> (1)	<i>Kluyvera cryocrescens</i> (1)
Nosocomial gram positive isolates (N = 20)	Species (N)
(1) MRSA (10)	
(2) MRCONS (7)	• <i>Staphylococcus epidermidis</i> (3) • ****<i>Staphylococcus saprophyticus</i> ss <i>saprophyticus</i> (3) • <i>Staphylococcus haemolyticus</i> (1)
(3) VRCONS*** (3)	• <i>Staphylococcus saprophyticus</i> SS <i>saprophyticus</i> (2) • <i>Staphylococcus haemolyticus</i> (1)
(4) VRE (3)	• <i>Enterococcus Faecium</i> (2) • <i>Enterococcus faecalis</i> (1)

* *Klebsiellae pneumoniae* sub species *pneumoniae*

***Aeromonas hydrophila* sub species *hydrophila*

***Also are methicillin resistant.

*****Staphylococcus saprophyticus* sub species *saprophyticus*.

Table (4): Frequency of resistant* nosocomial isolates from different units.

Organism	Adult ICU N (%)	Neonatal ICU N (%)	Dialysis unit N (%)	Surgery unit N (%)	Internal medicine unit N (%)	Overall N (%)
Gram negative isolates						
<i>E. coli</i>	2 (7.7%)	0 (0%)	2 (50%)	0 (0%)	3 (42.8%)	7 (12.9%)
<i>Klebsiellae species</i>	11(42.3%)	19(57.5%)	0 (0%)	0(0%)	0 (0%)	30 (55.5%)
<i>Proteus mirabilis</i>	1 (3.8%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	2 (3.7%)
<i>Enterobacter species</i>	2(7.7%)	5 (15.2%)	0 (0%)	0 (0%)	0 (0%)	7 (12.9%)
<i>Pseudomonase species</i>	3(11.5%)	2 (6.1%)	0 (0%)	0 (0%)	0 (0%)	5 (9.3%)
<i>Acinetobacter baumannii</i>	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (1.9%)
<i>Aeromonas hydrophila</i>	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (1.9%)
<i>Kluyvera cryocrescens</i>	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (1.9%)
Subtotal gram negative isolates	19 (73%)	26(78.8%)	3 (75%)	3 (75%)	3 (42.8%)	54(72.9%)
Gram positive isolates						
<i>Staphylococcus aureus</i>	3(11.6%)	3 (9.1%)	1 (25%)	1 (25%)	2 (28.6%)	10 (50%)
<i>Coagulase negative staph.</i>	1 (3.8%)	4 (12.1%)	0 (0%)	0 (0%)	2 (28.6%)	7 (35%)
<i>Enterococcus species</i>	3 (11.6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (15%)
Subtotal gram positive isolates	7(27%)	7 (21.2%)	1(25%)	1(25%)	4(57.2%)	20(27.1%)
Total	26(35.2%)	33(44.5%)	4(5.4%)	4(5.4%)	7 (9.5%)	74(100%)

*Resistant = common resistant phenotypes to (3rd generation cephalosporins, methicillin ± vancomycin)

This table shows the resistant nosocomial isolates most frequently isolated from different units. *Klebsiellae species* were more frequent in adult and neonatal ICU representing 42.3% and 57.5% respectively. *E.coli* were more frequent in dialysis and internal medicine unit representing 50% and 42.8% respectively. *Acinetobacter baumannii*, *Aeromonas hydrophila*, *Kluyvera cryocrescens*, and *Staphylococcus aureus* were the only isolates from surgery unit each representing 25%.

Table (5): Frequency of resistant* nosocomial isolates from different clinical specimens.

Organism	Surgical wounds N (%)	Deep pus** N (%)	Blood N (%)	Others*** N (%)	Overall N (%)
Gram negative isolates					
<i>E .coli</i>	1 (20%)	0 (0%)	2 (7.2%)	4 (21%)	7 (12.9%)
<i>Klebsiellae species</i>	1 (20%)	0 (0%)	18(64.2%)	11(57.8%)	30 (55.5%)
<i>Proteus mirabilis</i>	0 (0%)	1 (50%)	0 (0%)	1 (5.3%)	2 (3.7%)
<i>Enterobacter species</i>	0 (0%)	0 (0%)	6 (21.4%)	1 (5.3%)	7 (12.9%)
<i>Pseudomonase species</i>	1 (20%)	1 (50%)	2 (7.2%)	1 (5.3%)	5 (9.3%)
<i>Acinetobacter baumanii</i>	0 (0%)	0 (0%)	0 (0%)	1 (5.3%)	1 (1.9%)
<i>Aeromonas hydrophila</i>	1 (20%)	0 (0%)	0 (0%)	0 (0%)	1 (1.9%)
<i>Kluyvera cryocrescens</i>	1 (20%)	0 (0%)	0 (0%)	0 (0%)	1 (1.9%)
Subtotal gram negative isolates	5 (83.3%)	2 (50%)	28(68.3%)	19 (82.6%)	54(72.9%)
Gram positive isolates					
<i>Staphylococcus aureus</i>	1 (100%)	2 (100%)	4 (30.7%)	3(75%)	10 (50%)
<i>Coagulase negative staph.</i>	0 (0%)	0 (0%)	6 (46.2%)	1 (25%)	7 (35%)
<i>Enterococcus species.</i>	0 (0%)	0 (0%)	3 (23.1%)	0 (0%)	3 (15%)
Subtotal gram positive isolates	1 (16.7%)	2 (50%)	13(31.7%)	4 (17.4%)	20 (27.1%)
Total	6 (8.1%)	4 (5.4%)	41.(55.4%)	23 (31.1%)	74 (100%)

* Resistant = common resistant phenotypes to (3rd generation cephalosporins, methicillin ± vancomycin)

** Except surgical wounds.

*** Respiratory tract, urinary tract.

Table (6): Percentage of resistant nosocomial gram negative isolates by testing MIC using sensititer (N=54)

Gram negative drugs %	<i>E. coli</i> (7) %	<i>Klebsiellae</i> species(30) %	<i>Pseudomonas</i> species (5) %	<i>Enterobacter</i> species (7) %	<i>Proteus mirabilis</i> (2) %	<i>Aeromonas hydrophila</i> (1) %	<i>Acinetobacter baumannii</i> (1) %	<i>Kluyvera cryocrescens</i> (1) %
1-Amikacin	14.3%	83.3%	60%	57.2%	50%	100%	100%	100%
2-Ampicillin	100%	100%	100%	100%	100%	100%	100%	100%
3-Ampicillin/sulbactam	100%	100%	100%	100%	100%	100%	100%	100%
4-Aztreonam	85.7%	100%	100%	100%	100%	100%	100%	100%
5- Cefazolin	100%	100%	100%	100%	100%	100%	100%	100%
6- Cefepime	85.7%	96.6%	100%	42.8%	100%	100%	100%	100%
7- Cefotetan	57.2%	63.3%	100%	57.2%	50%	100%	0%	100%
8-Cefoxitin	100%	96.6%	100%	100%	100%	100%	100%	100%
9-Cefpodoxime	100%	100%	100%	100%	100%	100%	100%	100%
10-Ceftazidime	85.7%	100%	100%	100%	100%	100%	100%	100%
11-Ceftriazone	100%	100%	100%	85.7%	100%	100%	100%	100%
12-Cefuroxime (sodium)	100%	100%	100%	100%	100%	100%	100%	100%
13- Ciprofloxacin	85.7%	70%	100%	14.3%	100%	100%	100%	100%
14-Gatifloxacin	85.7%	66.6%	60%	28.6%	100%	100%	100%	100%
15-Gentamicin	71.4%	96.6%	60%	71.4%	100%	100%	100%	100%
16-Imipenem	0%	33.3%	60%	14.3%	50%	100%	0%	0%
17-Meropenem	0%	56.6%	100%	14.3%	50%	100%	100%	100%
18-Nitrofurantoin	28.5%	80%	100%	57.2%	100%	100%	100%	100%
19-Pipracillin	100%	100%	100%	100%	100%	100%	100%	100%
20-Piperacillin/tazobactam	57.2%	90%	100%	71.4%	100%	100%	100%	100%
21- Ticarcillin/ clavulanic acid	100%	100%	100%	100%	100%	100%	100%	100%
22- Tobramycin	85.7%	100%	100%	71.4%	100%	100%	100%	100%
23- Trimethoprim/ Sulphamethoxazole	100%	90%	100%	57.2%	100%	100%	100%	100%

The isolates showing intermediate resistance were grouped together with resistant isolates for the purpose of data analysis. The resistance rate was calculated as the number of non-susceptible isolates divided by the total number of isolates tested by sensititer.

The resistant rate of nosocomial gram negative bacilli (resistant plus intermediate) were 98.2% (53/54) for third generation cephalosporins (Ceftazidime, Ceftriaxone and Aztreonam), 88.8% (48/54) for cefepime. 16 isolates out of 54 were resistant to imipenem 29.6%, while 26 out of 54 were resistant to meropenem 48.2%.

Table (7): Percentage of resistant nosocomial gram positive isolates by testing MIC using sensititer (N=20)

Gram positive (N) Drugs	<i>S.aureus</i> (10) %	CONS* (7) %	<i>Enterococci</i> (3) %
1-Ampicillin	100%	100%	66.6%
2-Ceftriaxone	100%	100%	100%
3-Ciprofloxacin	50%	57.1%	0%
4-Clindamycin	50%	85.7%	66.6%
5-Daptomycin	0%	28.5%	100%
6-Erythromycin	70%	85.7%	100%
7-Gatifloxacin	100%	100%	0%
8-Gentamicin	50%	57.1%	0%
9-Gentamicin 500 ug/ml	20%	0%	0%
10- Levofloxacin	30%	57.1%	0%
11- Linezolid	0%	28.5%	100%
12- Oxacillin + 2% NaCl	100%	100%	100%
13- Penicillin	100%	100%	100%
14- Quinupristin / dalfopristin	0%	42.8%	66.6%
15- Rifampin	50%	42.8%	100%
16-Streptomycin 1000 ug/ml	30%	0%	0%
17- Tetracyclin	100%	57.1%	66.6%
18- Trimethoprim/ sulphamethoxazole	50%	71.4%	100%
19- Vancomycin	0%	42.8%	100%

* *Coagulase negative staphylococci.*

All tested *S.aureus* isolates were 100% resistant to oxacillin, but susceptible to linezolid, quinupristin / dalfopristin, vancomycin and daptomycin. All CONS isolates were 100% resistant to oxacillin, two out of 7 (28.5%) were resistant to both linezolid and daptomycin, three out of 7 (42.8%) were resistant to both quinupristin / dalfopristin and vancomycin. All enterococcal isolates were linezolid, vancomycin and daptomycin resistant, while all were susceptible to ciprofloxacin, gatifloxacin, levofloxacin, gentamicin, gentamicin 500 ug/ml and streptomycin 1000 ug/ml.

Table (8): Antibiotic susceptibilities (MIC) of nosocomial *klebsiellae* species (N=30).

Antibiotic Name	% (No)		
	R	I	S
1.Amikacin	76.6% (23)	6.7% (2)	16.7% (5)
2.Ampicillin	100% (30)	0% (0)	0% (0)
3.Ampicillin/sulbactam	100% (30)	0% (0)	0% (0)
4.Aztreonam	100% (30)	0% (0)	0% (0)
5.Cefazolin	100% (30)	0 % (0)	0% (0)
6.Cefepime	90% (27)	6.7% (2)	3.3% (1)
7.Cefotetan	50% (15)	13.3% (4)	36.7%(11)
8.Cefoxitin	93.4% (28)	3.3% (1)	3.3% (1)
9.Cefpodoxime	100% (30)	0% (0)	0% (0)
10.Ceftazidime	100% (30)	0% (0)	0% (0)
11.Ceftriazone	100% (30)	0% (0)	0% (0)
12.Cefuroxime (sodium)	100%(30)	0%(0)	0% (0)
13.Ciprofloxacin	70% (21)	0% (0)	30%(9)
14.Gatifloxacin	50%(15)	16.7% (5)	33.3%(10)
15.Gentamicin	90%(27)	6.7% (2)	3.3%(1)
16.Imipenem	16.7% (5)	16.7% (5)	66.6%(20)
17.Meropenem	43.35%(13)	13.3% (4)	43.35%(13)
18.Nitrofurantoin	63.3%(19)	16.7% (5)	20% (6)
19.Pipracillin	100%(30)	0% (0)	0% (0)
20.Piperacilin/tazobactam	76.7%(23)	13.3% (4)	10% (3)
21.Ticarcillin/clavulanic acid	86.7%(26)	13.3% (4)	0% (0)
22.Tobramycin	80% (24)	20% (6)	0% (0)
23.Trimethoprim/sulphamethoxazole	90% (27)	0% (0)	10% (3)

R: resistant

I: Intermediately sensitive

S: Sensitive

All tested *klebsiellae* species are 100% resistant to extended spectrum cephalosporins (Aztreonam, cefpodoxime, ceftazidime, ceftriazone, cefepime). The resistance rate of nosocomial *klebsiellae* species (resistant plus intermediate) were 33.3% for imipenem (10/30), 56.6% for meropenem (17/30). *Klebsiella Pneumoniae* represents 70% (n=21) of *klebsiellae* species isolates, *Klebsiella Oxytoca* represents 16.6% (n=5), *Klebsiella group 47* represents 10% (n=3) and *Raoultella terrigena* represents 3.4% (n=1).

Table (9): Antibiotic susceptibilities (MIC) of nosocomial *Escherichia coli* strains (N=7).

Antibiotic Name	% (No)		
	R	I	S
1.Amikacin	0% (0)	14.3% (1)	85.7% (6)
2.Ampicillin	100% (7)	0% (0)	0% (0)
3.Ampicillin/sulbactam	85.7% (6)	14.3% (1)	0% (0)
4.Aztreonam	71.4% (5)	14.3% (1)	14.3% (1)
5. Cefazolin	100% (7)	0 % (0)	0% (0)
6. Cefepime	85.7% (6)	0% (0)	14.3% (1)
7.Cefotetan	42.85% (3)	14.3% (1)	42.85%(3)
8.Cefoxitin	57.2% (4)	42.8% (3)	0% (0)
9.Cefpodoxime	100% (7)	0% (0)	0% (0)
10.Ceftazidime	71.4% (5)	14.3% (1)	14.3% (1)
11.Ceftriazone	85.7% (6)	14.3% (1)	0% (0)
12.Cefuroxime (sodium)	100%(7)	0%(0)	0% (0)
13. Ciprofloxacin	85.7% (6)	0% (0)	14.3%(1)
14.Gatifloxacin	85.7%(6)	0% (0)	14.3%(1)
15.Gentamicin	71.4%(5)	0% (0)	28.6%(2)
16.Imipenem	0% (0)	0% (0)	100%(7)
17.Meropenem	0%(0)	0% (0)	100%(7)
18.Nitrofurantoin	14.3%(1)	14.3% (1)	71.4% (5)
19.Pipracillin	100%(7)	0% (0)	0% (0)
20.Piperacilin/tazobactam	42.85%(3)	14.3% (1)	42.85%(3)
21. Ticarcillin/ Clavulanic acid	71.4%(5)	28.6% (2)	0% (0)
22. Tobramycin	71.4% (5)	14.3% (1)	14.3% (1)
23.Trimethoprim/ Sulphamethoxazole	100% (7)	0% (0)	0% (0)

The tested *E.coli* strains were susceptible to imipenem and meropenem. The resistance rate of nosocomial *E.coli* strains (resistant plus intermediate) were 85.7% (6/7) for aztreonam, 100% (7/7) for cefpodoxime, 85.7% (6/7) for ceftazidime, 100% (7/7) for ceftriazone and 85.7% (6/7) for cefepime.

Table (10): Antibiotic susceptibilities (MIC) of nosocomial *Enterobacter* species (N=7).

Antibiotic Name	% (No)		
	R	I	S
1.Amikacin	57.2% (4)	0% (0)	42.8% (3)
2.Ampicillin	100% (7)	0% (0)	0% (0)
3.Ampicillin/sulbactam	85.7% (6)	14.3% (1)	0% (0)
4.Aztreonam	100% (7)	0% (0)	0% (0)
5. Cefazolin	100% (7)	0 % (0)	0% (0)
6. Cefepime	42.8% (3)	0% (0)	57.2% (4)
7. Cefotetan	28.6% (2)	28.6% (2)	42.8%(3)
8.Cefoxitin	100% (7)	0% (0)	0% (0)
9.Cefpodoxime	100% (7)	0% (0)	0% (0)
10.Ceftazidime	85.7% (6)	14.3% (1)	0% (0)
11.Ceftriazone	71.4% (5)	14.3% (1)	14.3% (1)
12.Cefuroxime (sodium)	85.7%(6)	14.3%(1)	0% (0)
13. Ciprofloxacin	14.3% (1)	0% (0)	85.7%(6)
14.Gatifloxacin	14.3%(1)	14.3% (1)	71.4%(5)
15.Gentamicin	57.1%(4)	14.3% (1)	28.6%(2)
16.Imipenem	14.3% (1)	0% (0)	85.7%(6)
17.Meropenem	14.3%(1)	0% (0)	85.7%(6)
18.Nitrofurantoin	14.3%(1)	42.85% (3)	42.85%(3)
19.Pipracillin	100%(7)	0% (0)	0% (0)
20.Piperacilin/tazobactam	42.8%(3)	28.6% (2)	28.6% (2)
21. Ticarcillin/clavulanic acid	85.7%(6)	14.3% (1)	0% (0)
22. Tobramycin	42.8% (3)	28.6% (2)	28.6% (2)
23. Trimethoprim/ Sulphamethoxazole	57.2% (4)	0% (0)	42.8% (3)

This table shows that the resistance rate of nosocomial *Enterobacter* species (resistant plus intermediate) were 100% (7/7) for aztreonam and cefpodoxime, 85.7% (6/7) for ceftazidime, 71.4% (5/7) for ceftriazone, 42.8% (3/7) for cefepime, and 14.3% (1/7) for both imipenem and meropenem. *Enterobacter cloacae* represents 42.8% (3/7), *Enterobacter aerogenes* represents 42.8% (3/7), and *Enterobacter gergoviae* represents 14.3% (1/7) of *Enterobacter* isolates.

Table (11): Antibiotic susceptibilities (MIC) of nosocomial *Pseudomonas species* (N=5).

Antibiotic Name	% (No)		
	R	I	S
1.Amikacin	60% (3)	0% (0)	40% (2)
2.Ampicillin	100% (5)	0% (0)	0% (0)
3.Ampicillin/sulbactam	100% (5)	0% (0)	0% (0)
4.Aztreonam	60% (3)	40% (2)	0% (0)
5. Cefazolin	100% (5)	0 % (0)	0% (0)
6. Cefepime	100% (5)	0% (0)	0% (0)
7. Cefotetan	60% (3)	40% (2)	0% (0)
8.Cefoxitin	100% (5)	0% (0)	0% (0)
9.Cefpodoxime	100% (5)	0% (0)	0% (0)
10.Ceftazidime	100% (5)	0% (0)	0% (0)
11.Ceftriazone	100% (5)	0% (0)	0% (0)
12.Cefuroxime (sodium)	100%(5)	0%(0)	0% (0)
13.Ciprofloxacin	60% (3)	40% (2)	0%(0)
14.Gatifloxacin	60%(3)	0% (0)	40%(2)
15.Gentamicin	60%(3)	0% (0)	40%(2)
16.Imipenem	60% (3)	0% (0)	40%(2)
17.Meropenem	60%(3)	40% (2)	0% (0)
18.Nitrofurantoin	100%(5)	0% (0)	0% (0)
19.Pipracillin	100%(5)	0% (0)	0% (0)
20.Piperacilin/tazobactam	100%(5)	0% (0)	0% (0)
21. Ticarcillin/clavulanic acid	100%(5)	0% (0)	0% (0)
22. Tobramycin	20% (1)	80% (4)	0% (0)
23.Trimethoprim/ Sulphamethoxazole	100% (5)	0% (0)	0% (0)

Pseudomonas aeruginosa represents 60% (3/5) of *Pseudomonas species* isolates in which one strain was pan drug resistant to the whole panel of sensitizer antibiotics, and the other two strains were sensitive only to amikacin and imipenem. *Pseudomonas mendocina* represents 40% (2/5) of *Pseudomonas species* isolates in which both were sensitive to gatifloxacin and gentamicin and resistant to other panel of antibiotics.

Table (12): Antibiotic susceptibilities (MIC) of other nosocomial gram negative strains (N=5).

Organism	No.		Antibiotic panel	
			Sensitive	Resistance
1. <i>Proteus mirabilis</i>	2	1	Imipenem, meropenem, amikacin	All other panel
		1	Cefotetan	All other panel
2. <i>Acinetobacter baumannii</i>		1	Imipenem, cefotetan	All other panel
3. <i>Kluyvera cryoenescens</i>		1	Impienem	All other panel
4. <i>Aeromonas hydrophila</i> subspecies <i>hydrophila</i>		1	-	All panel

Table (13): Antibiotic susceptibilities (MIC) of nosocomial MRSA strains (N= 10).

Antibiotic Name	% (No)		
	R	I	S
1-Ampicillin	100% (10)	0% (0)	0% (0)
2-Ceftriaxone	100% (10)	0% (0)	0% (0)
3-Ciprofloxacin	50% (5)	0% (0)	50% (5)
4-Clindamycin	50% (5)	0% (0)	50% (5)
5-Daptomycin	0% (0)	0 % (0)	100% (10)
6-Erythromycin	70% (7)	0% (0)	30% (3)
7-Gatifloxacin	70% (7)	30% (3)	0%(0)
8-Gentamicin	50% (5)	0% (0)	50% (5)
9-Gentamicin 500 ug/ml	20% (2)	0% (0)	80% (8)
10- Levofloxacin	0% (0)	30% (3)	70% (7)
11- Linezolid	0% (0)	0% (0)	100%(10)
12- Oxacillin + 2% NaCl	100%(10)	0%(0)	0% (0)
13- Penicillin	100% (10)	0% (0)	0% (0)
14- Quinupristin / dalfopristin	0% (0)	0% (0)	100%(10)
15- Rifampin	50%(5)	0% (0)	50%(5)
16-Streptomycin 1000 ug/ml	30% (3)	0% (0)	70%(7)
17- Tetracyclin	100%(10)	0% (0)	0%(0)
18- Trimethoprim/ sulphamethoxazole	50%(5)	0% (0)	50% (5)
19- Vancomycin	0%(0)	0% (0)	100%(10)

This table shows that all MRSA strains were susceptible to vancomycin, quinupristin / dalfopristin, linezolid and daptomycin.

Table (14): Antibiotic susceptibilities (MIC) of nosocomial MRCONS strains (N=7).

Antibiotic Name	% (No)		
	R	I	S
1-Ampicillin	100% (7)	0% (0)	0% (0)
2-Ceftriaxone	57.2% (4)	42.8% (3)	0% (0)
3-Ciprofloxacin	57.2% (4)	0% (0)	42.8% (3)
4-Clindamycin	57.2% (4)	28.5% (2)	14.3% (1)
5-Daptomycin	28.6% (2)	0 % (0)	71.4% (5)
6-Erythromycin	57.2% (4)	28.5% (2)	14.3% (1)
7-Gatifloxacin	57.2% (4)	42.8% (3)	0%(0)
8-Gentamicin	57.2% (4)	0% (0)	42.8% (3)
9-Gentamicin 500 ug/ml	0% (0)	0% (0)	100% (7)
10- Levofloxacin	57.2% (4)	0% (0)	42.8% (3)
11- Linezolid	28.6% (2)	0% (0)	71.4% (5)
12- Oxacillin + 2% NaCl	100%(7)	0%(0)	0% (0)
13- Penicillin	100% (7)	0% (0)	0% (0)
14- Quinupristin / dalfopristin	28.5%(2)	14.3% (1)	57.2%(4)
15- Rifampin	42.8%(3)	0% (0)	57.2%(4)
16-Streptomycin 1000 ug/ml	0% (0)	0% (0)	100%(7)
17- Tetracyclin	57.2%(4)	0% (0)	42.8%(3)
18Trimethoprim/ Sulphamethoxazole	71.4%(5)	0% (0)	28.6% (2)
19- Vancomycin	42.8%(3)	0% (0)	57.2% (4)

Seven nosocomial MRCONS were isolated. Three were *S. epidermidis*, three were *S. saprophyticus ss saprophyticus*, and one was *S. haemolyticus*. Three vancomycin resistant strains (VRCONS) were isolated, in which one was *S. epidermidis* and was resistant also to quinupristin / dalfopristin, linezolid and daptomycin and two isolates were *S. saprophyticus ss saprophyticus* in which one was resistant also to quinupristin/dalfopristin, linezolid and daptomycin, and the other was resistant to quinupristin/dalfopristin but sensitive to linezolid and daptomycin. The other four strains were susceptible to vancomycin, quinupristin/dalfopristin, linezolid and daptomycin, and they were three *S. epidermidis*, and one *S. saprophyticus ss saprophyticus*.

Table (15): Antibiotic susceptibilities (MIC) of nosocomial VRE strains (No =3).

Organism	No.		Antibiotic panel	
			Sensitive	Resistance
1. <i>Enterococcus Faecium</i>	2	1	• Ciprofloxacin • Gatifloxacin • Levofloxacin • Gentamicin • Gentamicin 500 ug/ml • Streptomycin 1000 ug/ml • Tetracyclin	• Vancomycin • Daptomycin • Ampicillin • Erythromycin • Clindamycin • Quinupristin/dalfopristin • Linezolid • Oxacillin +2%NaCL • Penicillin • Trimethoprim/Sulphamethoxazole • Ceftriaxone* • Rifampin*
		1	• Ampicillin • Ciprofloxacin • Gatifloxacin • Levofloxacin • Gentamicin • Gentamicin 500 ug/ml • Streptomycin 1000 ug/ml • Quinupristin /dalfopristin • Clindamycin	• Vancomycin • Daptomycin • Erythromycin • Linezolid • Tetracycline • Oxacillin +2%NaCL • Penicillin • Trimethoprim/Sulphamethoxazole • Ceftriaxone* • Rifampin*
2. <i>Enterococcus faecalis</i>		1	• Ciprofloxacin • Gatifloxacin • Levofloxacin • Gentamicin • Gentamicin 500 ug/ml • Streptomycin 1000ug/ml	• Vancomycin • Daptomycin • Ampicillin • Erythromycin • Clindamycin • Ceftriaxone • Linezolid • Quinupristin/dalfopristin • Oxacillin +2%NaCL • Penicillin • Trimethoprim/Sulphamethoxazole • Rifampin • Tetracyclin*

*Intermediately sensitive

Results of phenotypic confirmatory combined disc tests includes:

(A) Results of D68C AmpC & ESBL Detection Set :Table (16)

(B) Results of (IMP) imipenem – EDTA combined disc test: Table (17)

Table (16): Results of D68C AmpC & ESBL Detection Set.

Type of organism (Total number = 54)	(a)	(b)	(c)	(d)
	N/T(%) of positive ESBL only	N/T(%) of positive AmpC Only	N/T(%) of positive ESBL +AmpC combined	N/T(%) of positive ESBL or AmpC + impermeability or carbapenemase production
1. <i>E.coli</i> (7)	6/7 (85.7%)	1/7(14.3%)	0/7 (0%)	0/7(0%)
2. <i>Klebsiellae species</i> (30)	16/30(53.4%)	0/30(0%)	5/30(16.6%)	9/30(30%)
3. <i>Pseudomonas species</i> (5)	0/5(0%)	0/5(0%)	2/5(40%)	3/5(60%)
4. <i>Enterobacter species</i> (7)	4/7(57.2%)	0/7(0%)	3/7(42.8%)	0/7(0%)
5. <i>Proteus mirabilis</i> (2)	0/2(0%)	2/2(100%)	0/2(0%)	0/2(0%)
6. <i>Aeromonas hydrophila</i> (1)	1/1(100%)	0/1(0%)	0/1(0%)	0/1(0%)
7. <i>Acinetobacter baumannii</i> (1)	0/1(0%)	1/1(100%)	0/1(0%)	0/1(0%)
8. <i>Kluyvera cryocrescens</i> (1)	1/1(100%)	0/1(0%)	0/1(0%)	0/1(0%)

N/ T : number / total.

(a)Twenty eight isolates had positive ESBL only.

(b)Four isolates had positive AmpC Only.

(c) Ten isolates had positive ESBL +AmpC combined

(d) Twelve isolates of both *klebsiellae* and *pseudomonas species* remaining resistant to cefpodoxime irrespective of clavulanate and cloxacillin which denote that organisms may have ESBL or AmpC plus impermeability or may have a carbapenemase. These isolates deserve reference investigation.

Table (17): Results of (IMP) imipenem – EDTA combined disc test.

Type of organism (Total number = 54)	N/T (%) of positive test (Comparative zone* $\geq$ 7 mm)
1- <i>E. coli</i> (7)	0/7 (0%)
2- <i>Klebsiellae species</i> (30)	7/30 (23.3%)
3- <i>Pseudomonas species</i> (5)	3 /5 (60%)
4- <i>Enterobacter species</i> (7)	0/7 (0%)
5- <i>Proteus mirabilis</i> (2)	1/2 (50%)
6- <i>Aeromonas hydrophila</i> (1)	0/1 (0%)
7- <i>Acinetobacter baumannii</i> (1)	0/1 (0%)
8- <i>Kluyvera cryocrescens</i> (1)	0/1 (0%)

***Comparative zone: difference in inhibition zone diameters around imipenem+EDTA discs and imipenem discs alone.**

Eleven isolates showed an inhibition zone diameters around the discs containing imipenem+EDTA that were 7mm or more greater than the inhibition zone diameters around the discs containing imipenem alone which denote that they produce metallo -beta-lactamases (MBL).

Table (18): Results of carbapenem susceptibility (MIC) using sensititer versus phenotypes according to type of organisms (gram negative).

Type of organism	Carbapenem susceptibility(MIC)		Phenotype	
	Imipenem	Mero penem	Comparative zone*	AmpC & ESBL detection test
1-Klebsiella pneumoniae SS pneumonia	S	I	Negative**	ESBL alone
2- Klebsiella pneumoniae SS pneumonia	S	I	Negative	ESBL alone
3-Klebsiella pneumoniae SS pneumonia	S	I	Negative	ESBL alone
4-Klebsiella pneumoniae SS pneumonia	I	R	Negative	ESBL and AmpC combined
5-Klebsiella pneumoniae SS pneumonia	S	I	Negative	ESBL and AmpC combined
6-Klebsiella pneumoniae ss pneumonia	R	R	Positive***	(1)ESBL or AmpC + impermeability or (2)may have carbapenemase.
7-Klebsiella pneumoniae ss pneumonia	I	R	Positive	(1)ESBL or AmpC+ impermeability or (2)may have carbapenemase.
8- Klebsiella pneumoniae SS pneumonia	I	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
9- Klebsiella pneumoniae SS pneumonia	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
10- Klebsiella Pneumoniae SS pneumonia	I	R	Negative	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
11- Klebsiella Pneumoniae SS pneumonia	R	R	Negative	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
12- Klebsiella Pneumoniae SS pneumonia	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase

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Type of organism	Carbapenem susceptibility(MIC)		Phenotype	
	Imipenem	Mero - penem	Comparative zone*	AmpC & ESBL detection test
13- <i>Klebsiella Oxytoca</i>	S	R	Negative	ESBL alone
14- <i>Klebsiella group 47</i>	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
15- <i>Klebsiella group 47</i>	I	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
16- <i>Raoultella Terrigena</i>	S	R	Negative	ESBL alone
17- <i>Enterobacter Gergoviae</i>	R	R	Negative	ESBL alone
18- <i>Pseudomonas Mendocina</i>	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
19- <i>Pseudomonas Mendocina</i>	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
20- <i>Pseudomonas Aeurginosa</i>	S	I	Negative	ESBL + AmpC combined
21- <i>Pseudomonas Aeurginosa</i>	S	I	Negative	ESBL + AmpC combined
22- <i>Pseudomonas Aeurginosa</i>	R	R	Positive	(1)ESBL or AmpC+ Impermeability or (2)may have Carbapnemase
23- <i>Proteus mirabilis</i>	R	R	Positive	AmpC alone
24- <i>Acinetobacter baumanii</i>	S	R	Negative	AmpC alone
25- <i>Aeromonas hydrophila SS hydrophila</i>	I	R	Negative	ESBL alone
26- <i>Kluyvera cryocrescens</i>	S	R	Negative	ESBL alone

*Comparative zone: difference in inhibition zone diameters around imipenem+EDTA discs and imipenem discs alone.

**Negative: The difference in inhibition zone diameters around imipenem+EDTA discs were < 7mm than around imipenem discs alone.

***Positive: The difference in inhibition zone diameters around imipenem+EDTA discs were $\geq$ 7mm than around imipenem discs alone

Table (19): Results of all tests of nosocomial gram negative phenotypes.

Organism	Phenotype	Carbapenem susceptibility (MIC)		Comparative zone
	AmpC & ESBL detection test	Imipenem	Meropenem	
(1) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	I	Negative
(2) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(3) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(4) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(5) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	I	Negative
(6) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(7) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(8) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	S	
(9) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL alone	S	I	Negative
(10) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL & AmpC combined	S	S	
(11) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL & AmpC combined	S	S	
(12) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL & AmpC combined	S	S	
(13) <i>Klebsiella pneumoniae</i> ss pneumonia	ESBL & AmpC combined	I	R	Negative
(14) <i>Klebsiella pneumoniae</i> SS pneumoniae	ESBL and AmpC combined	S	I	Negative
(15) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	R	R	Positive
				MBL producer
(16) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	I	R	Positive
				MBL producer
(17) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	I	R	Positive
				MBL producer
(18) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	R	R	Positive.
				MBL producer
(19) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	I	R	Negative
(20) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	R	R	Negative
(21) <i>Klebsiella pneumoniae</i> SS pneumoniae	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	R	R	Positive.
				MBL producer
(22) <i>Klebsiella oxytoca</i>	ESBL alone	S	S	
(23) <i>Klebsiella oxytoca</i>	ESBL alone	S	S	
(24) <i>Klebsiella oxytoca</i>	ESBL alone	S	S	
(25) <i>Klebsiella oxytoca</i>	ESBL alone	S	S	

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Organism	Phenotype	Carbapenem susceptibility (MIC)		Comparative zone
	AmpC & ESBL detection test	Imipenem	Meropenem	
(26) <i>Klebsiella oxytoca</i>	ESBL alone	S	R	Negative
(27) <i>Klebsiella group 47</i>	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	R	R	Positive. MBL producer
(28) <i>Klebsiella group 47</i>	ESBL alone	S	S	
(29) <i>Klebsiella group 47</i>	(1) ESBL or Ampc +impermeability or (2) may have carbapenemase	I	R	Positive. MBL producer
(30) <i>Raoultella terrigena</i>	ESBL alone	S	R	Negative
(31) <i>Escherichia coli</i>	ESBL alone	S	S	
(32) <i>Escherichia coli</i>	ESBL alone	S	S	
(33) <i>Escherichia coli</i>	ESBL alone	S	S	
(34) <i>Escherichia coli</i>	ESBL alone	S	S	
(35) <i>Escherichia coli</i>	ESBL alone	S	S	
(36) <i>Escherichia coli</i>	ESBL alone	S	S	
(37) <i>Escherichia coli</i>	AmpC alone	S	S	
(38) <i>Enterobacter cloacae</i>	ESBL alone	S	S	
(39) <i>Enterobacter cloacae</i>	ESBL alone	S	S	
(40) <i>Enterobacter cloacae</i>	ESBL alone	S	S	
(41) <i>Enterobacter aerogenes</i>	ESBL + AmpC combined	S	S	
(42) <i>Enterobacter aerogenes</i>	ESBL + AmpC combined	S	S	
(43) <i>Enterobacter aerogenes</i>	ESBL + AmpC combined	S	S	
(44) <i>Enterobacter gergoviae</i>	ESBL alone	R	R	Negative
(45) <i>Pseudomonas mendocina</i>	(1) ESBL or AmpC +impermeability or (2) may have carbapenemase	R	R	Positive. MBL producer
(46) <i>Pseudomonas mendocina</i>	(1) ESBL or AmpC +impermeability or (2) may have carbapenemase	R	R	Positive. MBL producer
(47) <i>Pseudomonas aeruginosa</i>	ESBL + AmpC combined	S	I	Negative
(48) <i>Pseudomonas aeruginosa</i>	ESBL + Ampc combined	S	I	Negative
(49) <i>Pseudomonas aeruginosa</i>	(1) ESBL or AmpC +impermeability or (2) may have carbapenemase	R	R	Positive. MBL producer
(50) <i>Proteus mirabilis</i>	AmpC alone	S	S	
				Positive.
(51) <i>Proteus mirabilis</i>	AmpC alone	R	R	MBL producer
(52) <i>Acinetobacter baumannii</i>	AmpC alone	S	R	Negative
(53) <i>Aeromonas hydrophila</i> SS <i>hydrophila</i>	ESBL alone	I	R	Negative
(54) <i>Kluyvera cryocrescens</i>	ESBL alone	S	R	Negative

Table (20): Incidence of different nosocomial gram negative phenotypes among nosocomial gram negative isolates (N = 89), and total nosocomial specimens (N = 205) in the period of study.

Nosocomial gm -ve phenotypes	Number	%	
		Nosocomial gm -ve isolates (n=89)	Total nosocomial specimens (n = 205)
(1) Positive ESBL only	28	31.5%	13.6%
(2) Positive AmpC only	4	4.5%	1.9%
(3) Positive ESBL + AmpC combined	10	11.3%	4.9%
(4) Positive MBL	11	12.4%	5.4%
(5) Positive ESBL or AmpC + impermeability or carbapenemase production	12	13.5%	5.9%



Fig . (1): ESBL screening test: A case of *Klebsiella pneumoniae* SS *pneumoniae* having ESBL only. The inhibition zone diameters around CCAZ, CCTX & CFEP are $> 5\text{mm}$ compared to the inhibition zone diameters around CAZ, CTX & FEP alone respectively.



Fig . (2): AmpC & ESBL Detection Set: The same case of *Klebsiella pneumoniae* SS *pneumoniae* having ESBL only. ZB - ZA and ZD - ZC $\geq 5\text{mm}$ and ZD - ZB and ZC - ZA $< 5\text{mm}$.



Fig . (3): AmpC & ESBL Detection Set: A case of *E.Coli* having AmpC only. ZB - ZA and ZD - ZC < 5mm and ZD - ZB and ZC - ZA $\geq$ 5mm.



Fig . (4): ESBL screening test: The same case of *E.Coli* having AmpC only. CCTX =27 mm ,CTX =24mm , with no difference in the inhibition zone diameters around CCAZ & CFEP compared to the inhibition zone diameters around CAZ & FEP alone respectively.



Fig.(5): AmpC & ESBL Detection Set: A case of *Proteus mirabilis* having AmpC only. ZB - ZA and ZD - ZC < 5mm and ZD - ZB and ZC - ZA $\geq$ 5mm. Swarming is noticed in the zone around C & D discs.



Fig.(6): AmpC & ESBL Detection Set: A case of *Enterobacter aerogenes* having ESBL and AmpC combined. ZD - ZC $\geq$ 5mm and ZB - ZA < 5mm. The inhibition zone diameter around D disc is 13mm.



Fig. (7): ESBL screening test: The same case of *Enterobacter aerogenes* having ESBL and AmpC combined. CFEP=23mm ,FEP =12mm ,with < 5mm difference in the inhibition zone diameters around CCAZ & CCTX compared to the inhibition zone diameters around CAZ & CTX alone respectively. Notice that FEP & CFEP is not hydrolyzed by AmpC enzyme.



Fig . (8): ESBL screening test: A case of *Enterobacter aerogenes* having ESBL and AmpC combined. CFEP=15 mm ,FEP =10 mm ,with no difference in the inhibition zone diameters around CCAZ & CCTX compared to the inhibition zone diameters around CAZ & CTX alone respectively. Notice that FEP & CFEP is not hydrolyzed by AmpC enzyme.



Fig. (9): AmpC & ESBL Detection Set: A case of *Pseudomonas mendocina* resistant to cefpodoxime irrespective of clavulanate and cloxacillin. It may have an ESBL or AmpC plus impermeability or may have a carbapenemase.



Fig . (10): ESBL screening test: The same case of *Pseudomonas mendocina* resistant to the whole antibiotic discs in the plate. Notice the Carotenoid pigment of the strain.



Fig . (11): IMP-EDTA combined disc test: The same case of *Pseudomonas mendocina* having MBL. No zone of inhibition around IMP disc to the right of the figure with 17 mm zone of inhibition around IMP + EDTA disc to the left of the figure.



Fig . (12): AmpC & ESBL Detection Set: A case of *Klebsiella group 47* resistant to cefpodoxime irrespective of clavulanate and cloxacillin . It may have an ESBL or AmpC plus impermeability or may have a carbapenemase.



Fig . (13): ESBL screening test: The same case of *Klebsiella group 47* resistant to the whole antibiotic discs in the plate.

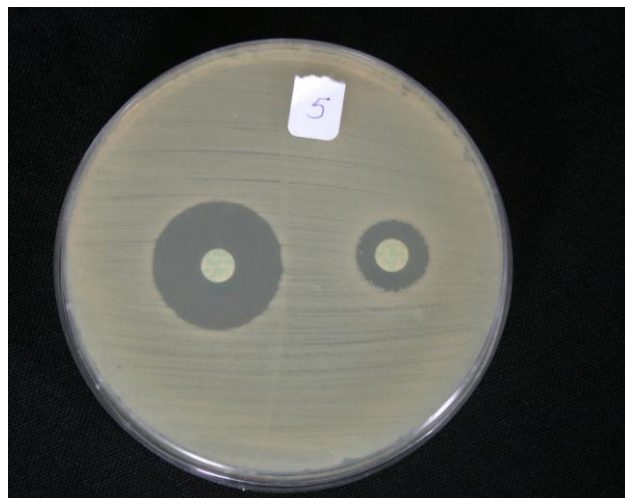


Fig. (14): IMP-EDTA combined disc test: A case of *Klebsiella pneumoniae* SS *pneumoniae* having MBL . The zone of inhibition around IMP disc to the right of the figure is 13 mm and the zone of inhibition around IMP + EDTA disc to the left of the figure is 24 mm with a difference of 11 mm between them.



Fig . (15): IMP-EDTA combined disc test: A case of *Klebsiella pneumoniae* SS *pneumoniae* having other carbapenemase than MBL. No difference in the zone of inhibition around IMP disc to the right of the figure and IMP + EDTA disc to the left of the figure.