THE RESULTS

The present study was conducted at the Microbiology Laboratory, Clinical Pathology Department, Benha University Hospitals during the period from July 2007 to May 2009.

The study included 36 patients with central venous catheterization admitted to intensive care units (ICU) and dialysis department in Benha University Hospital and Benha Teaching hospital.

Table (1): **Relation between sex and catheter related blood stream infection.**

Parameter	N=(36)	Positive		Negative	
		NO	%	NO	%
Sex (M:F)	2:1				
-Male	24	22	91.6	2	8.4
-Female	12	11	91.6	1	8.4

X^2=0.41 p>0.05

There was no significant difference between sex of the patients and CRBSI.

Table (2): **Incidence of catheter related blood stream infection with different indications for applying CVC.**

parameter	NO	%	Positive		Negative	
			NO	%	NO	%
Monitoring fluid	2	5.5	1	50	1	50
No peripheral access	8	22.4	7	87.5	1	12.5
Monitoring CVP	2	5.5	2	100	0	0
Hemodialysis	24	66.6	23	95.8	1	4.2

Corrected X^2=5.46 p>0.05

There was no significant statistic difference between the incidence of CRBSI and the different indication for applying CVCs.

Fig. (1) Incidence of CRBSI with diff. indication for applying CVC

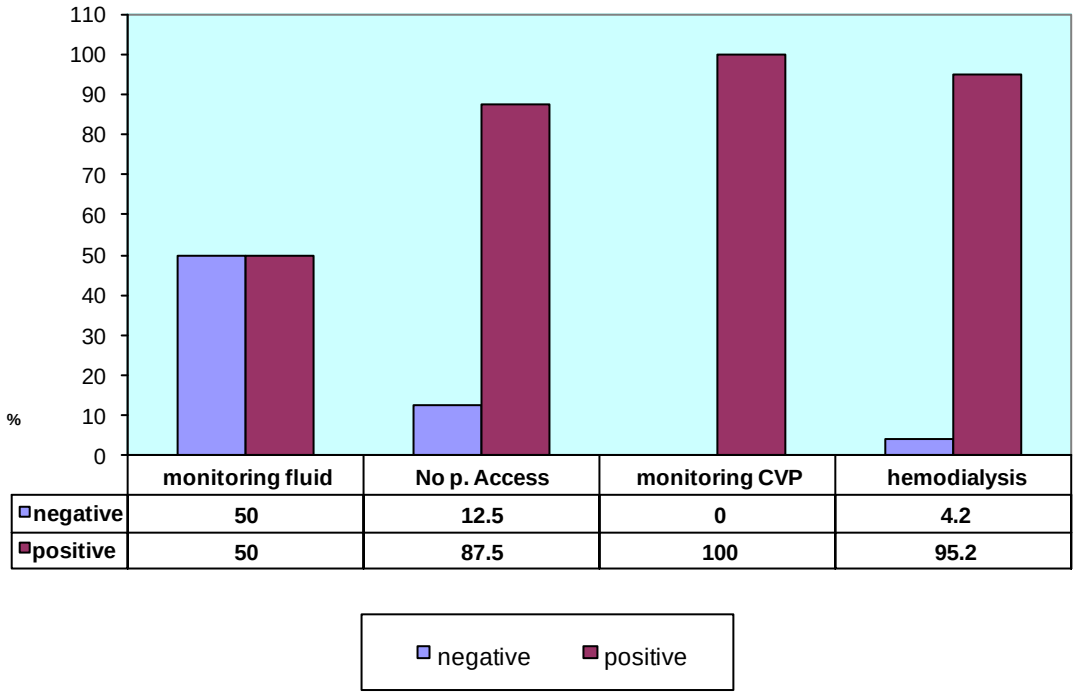

Table (3): **Catheter related blood stream infection incidence in relation to CVC insertion site.**

parameter	NO	%	Positive		Negative	
			NO	%	NO	%
- Internal jugular vein	6	16.6	6	100	0	0
- Subclavian vein	30	83.4	27	90	3	10

$X^2=5.04$ $p<0.05$

The incidence of CRBSI was higher when the catheter was inserted in the internal jugular vein than when inserted in the subclavian vein and this was of statistical significance.

Fig. (2) CRBSI incidence in relation to CVC insertion site

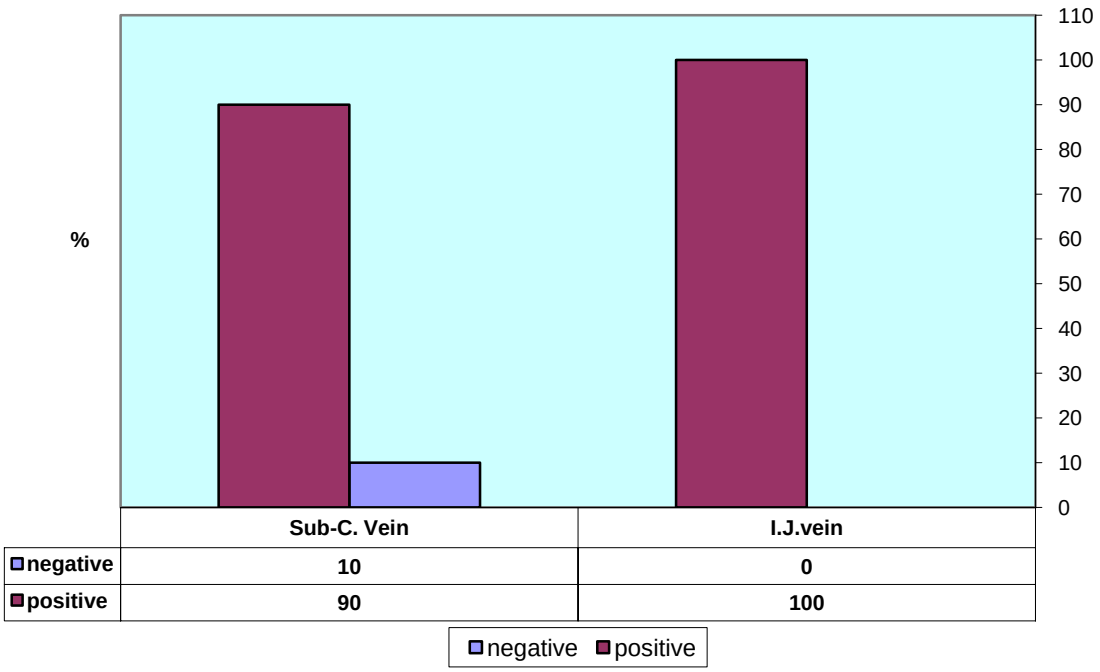

Table (4): **Duration of catheterization:**

Parameter	NO	%	Positive		Negative		X^2	P
			NO	%	NO	%		
Range (days) (4-7days)	3	8.4	1	33.3	2	66.7	0.58	>0.05
Range (days) (8-70 days)	33	91.6	32	96.9	1	3.1	5.4	<0.001
Mean±SEM	28.1±18.4							

X^2=7.44 p<0.001

There was high statistical significant difference between CRBSI and duration of catheter insertion as it was 96.6% in catheters which kept in place for more than one week (32 out of 33) but it was only 33.3% in catheters which kept in place for less than one week (1 out of 3).

Table (5): **Incidence of Catheter related blood stream infection with different underlying diseases of the patients.**

Parameter	NO	%	Positive		Negative	
			No	%	No	%
renal failure	24	66.6	23	95.8	1	4.2
cardiac disease	2	5.5	1	50	1	50
crebrovascular stroke	2	5.5	2	100	0	0
surgical	8	22.4	7	87.5	1	12.5

X^2=5.46 p >0.05

It was found no significant statistical difference between the incidence of CRBSI and the different underlying diseases of the patients.

Fig. (3) Incidence of CRBSI with diff. underlying diseases of patients

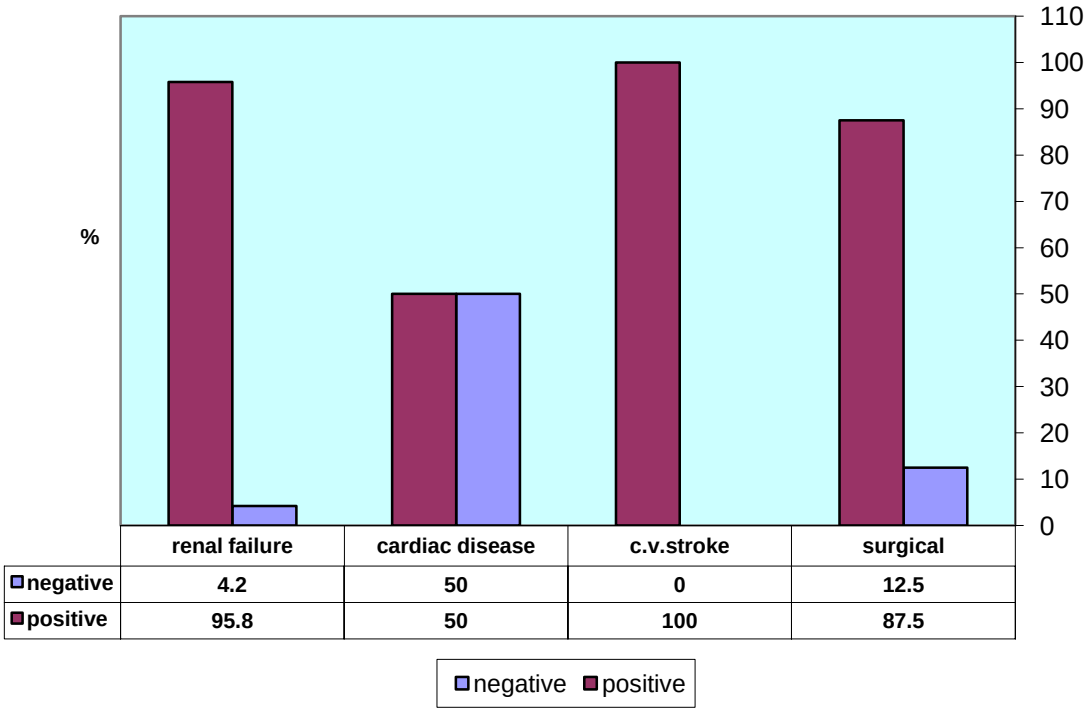

Table (6): **Incidence of Catheter related blood stream infection in different locations of insertion of CVC.**

Parameter	No	%	Positive		Negative	
			No	%	No	%
- ward(dialysis room)	27	75	27	100	0	0
- ICU	4	11	3	75	1	25
- operating room in dialysis unites	5	14	3	60	2	40

Corrected X^2 =10.47 P <0.001

It was found a highly significant statistical difference in the incidence of CRBSI with different location of insertion of CVCs as it was (100%), (27 out of 27) when the catheter was inserted in dialysis room and it was (75%), (3out of 4) when the catheter was inserted in ICU while when the catheter was inserted in the operating room (the most sterile) it was only (60%), (3 out of 5).

Fig. (4) Incidence of CRBSI in diff. location of CVC

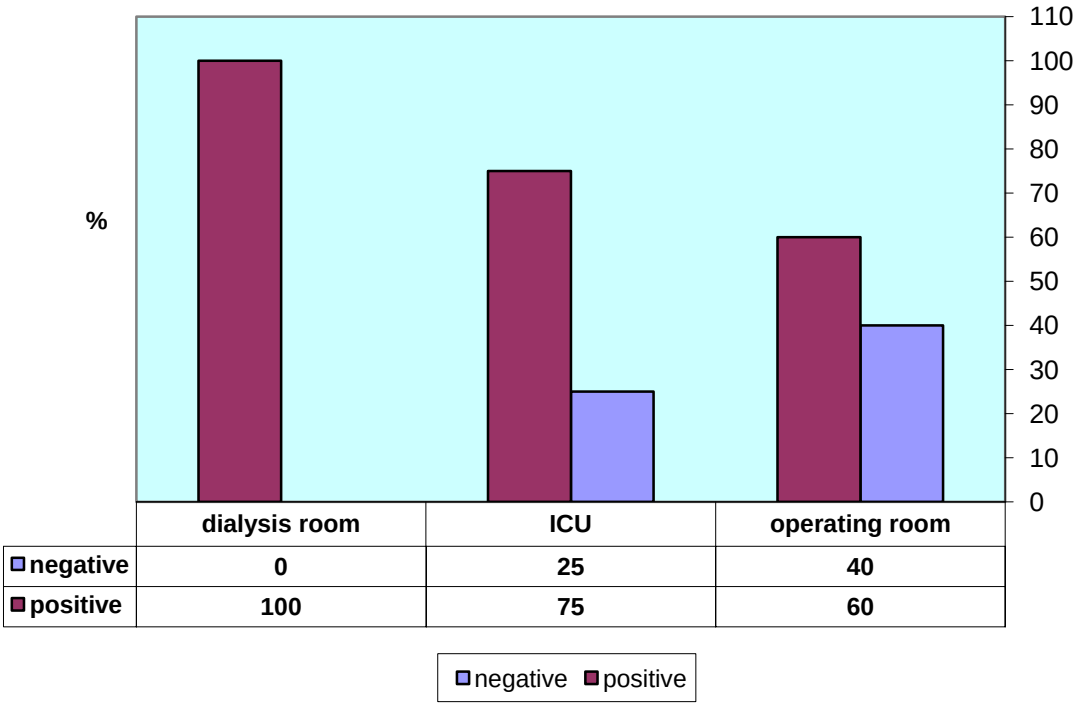

Table (7): **Different causes of removal of CVC in the studied patients:**

Causes of removal of CVC	No	%
Pus discharge from the catheter	14	38.8
Suspected CVC related systemic infection	12	33.4
The end of its need	8	22.3
Death	2	5.5
Total number	36	100

This table shows that during the period of the study 36 CVCs were removed. Local signs of CVC infection e.g. pus discharge from the catheter and hyperemia were the most common causes for catheter removal (38.8%), followed by suspected CVC related systemic infection e.g. fever, hypotension and tachycardia (33.4 %), then there were no more need for the catheter in (22.3%). Only 2 (5.5 %) catheter were removed due to patient death.

Fig. (5) Different causes of removal of CVC in patients

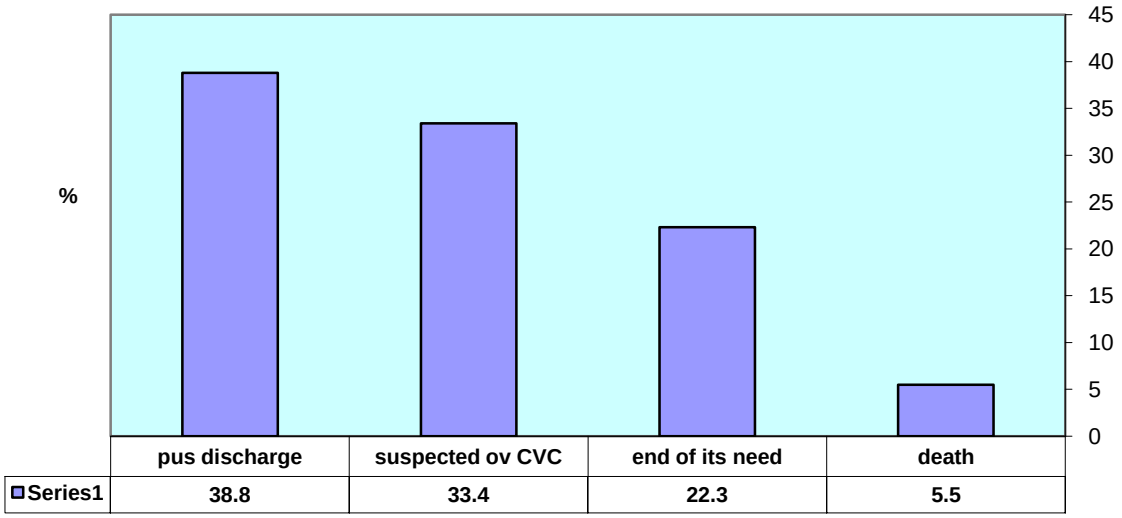

Table (8): **Frequency of CVC colonization in relation to patient administration of antimicrobial therapy.**

Administration of antimicrobial therapy	significant colonization			
	Yes		No	
	No	%	No	%
Yes (NO=30)	27	90	3	10
No (NO=6)	6	100	0	0

Corrected X^2=5.04 p<0. 05

There was a significant statistical difference between the incidence of CRBSI and the administration of antimicrobial therapy as the CRBSI was 100% in patients who didn't receive antimicrobial therapy and it was only (90%) in patients who received antimicrobial therapy.

Table (9): **Frequency of CVC colonization in relation to number of lumens of CVC.**

Number of lumens of CVC	significant colonization			
	Yes		No	
	No	%	No	%
One (NO=12)	11	91.6	1	8.4
Two (NO=21)	19	90.4	2	9.6
Three (NO=3)	3	100	0	0
Total (No=36)	33	91.6	3	8.4

Corrected X^2=0.312 p>0.05

There was no significant statistical difference between the incidence of CRBSI and the number of catheter lumens. Yet higher frequencies of significant colonization occurred in those catheters with 3 lumens (100%), (3 out of 3) and in catheters with 2 lumens (90.4%), (19 out of 21).

Fig. (6) Frequency of CVC colonization in relation to number of lumens of CVC

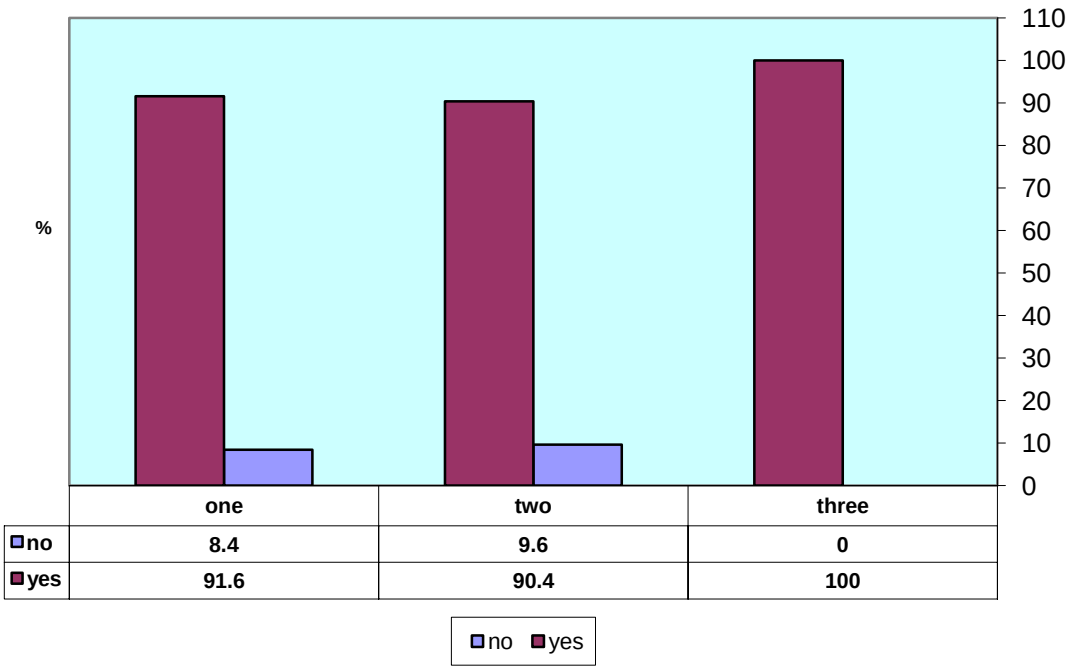

Table (10): **Frequency of CVC colonization in relation to applying maximal sterile barriers during their insertion in patients.**

maximal sterile barriers	Significant Colonization			
	Yes		No	
	No	%	No	%
Applied (No= 10)	7	70	3	30
Not applied (No=26)	26	100	0	0

$X^2=5.04$ $p<0.05$

There was a significant statistical difference between the incidence of CRBSI and the application of maximal sterile barriers precautions during the catheter insertion in patients**.**

Table (11):**frequency of CVC colonization in relation to applying daily care of the catheter.**

Daily care of the catheter	significant colonization			
	Yes		No	
	No	%	No	%
Applied (No= 9)	6	66.7	3	33.3
Not applied (No=27)	27	100	0	0

Corrected $X^2=5.94$ $p<0.05$

There was a significant statistical difference between the incidence of CRBSI and the application of daily care of the catheter as it was (100%) in patients not applying daily care of catheter while it was only (66.7%) in patients applying daily care of the catheter.

Table (12): **Frequency of CVC colonization in relation to type of infusate.**

Type of infusate	Significant Colonization			
	Yes		No	
	No	%	No	%
Parentral fluid (No= 7)	5	71.4	2	28.6
Blood and parentral fluid (No=23)	23	100	0	0
Other (No=6)	5	83.3	1	16.7

Corrected X^2=6.39 p<0.05

This table shows statistical significant difference in the rate of incidence of CRBSI and the type of infusated fluids through the catheter lumen as it was (71.4%) when the parentral fluid is the only infusate and it was (100%) when blood is added to the parentral fluid.

Fig. (7) Frequency of CVC colonization in relation to type of infusate

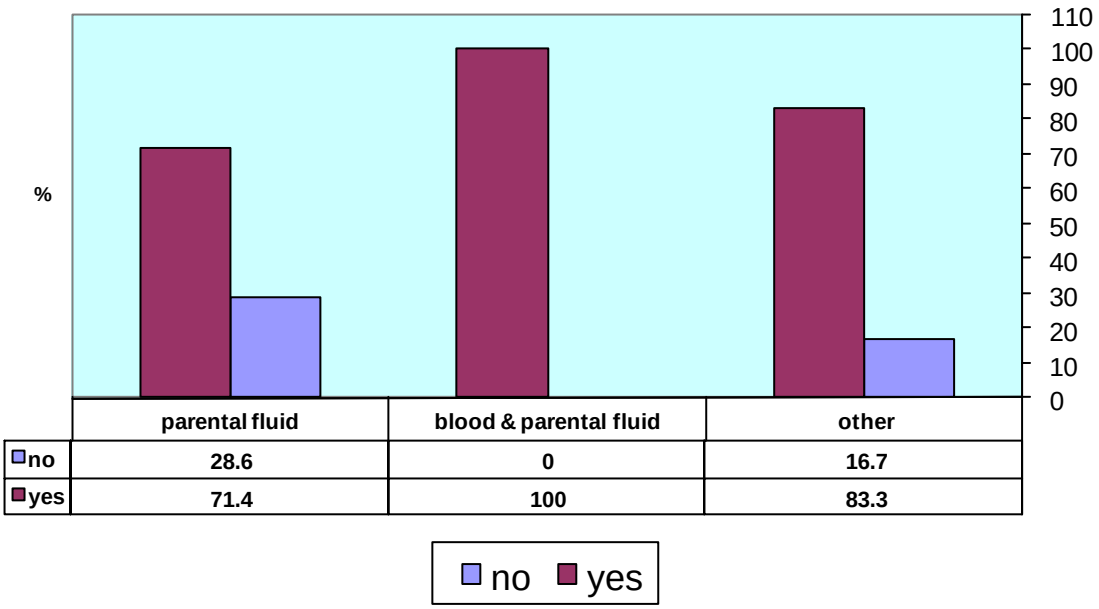

Table (13): **The result of different methods used in detection of Catheter related blood stream infection:**

METHOD	CRBSI			
	POSITIVE		NEGATIVE	
	No	%	No	%
Roll –plate method	33	91.6	3	8.4
Tip flush	27	75	9	25
Pour plate	21	58.3	15	41.7
Paired quantitative blood culture method	27	75	9	25
AOLC/G test	26	72.2	10	37.8

Fig. (8) Results of different methods used in detction of CRBSI

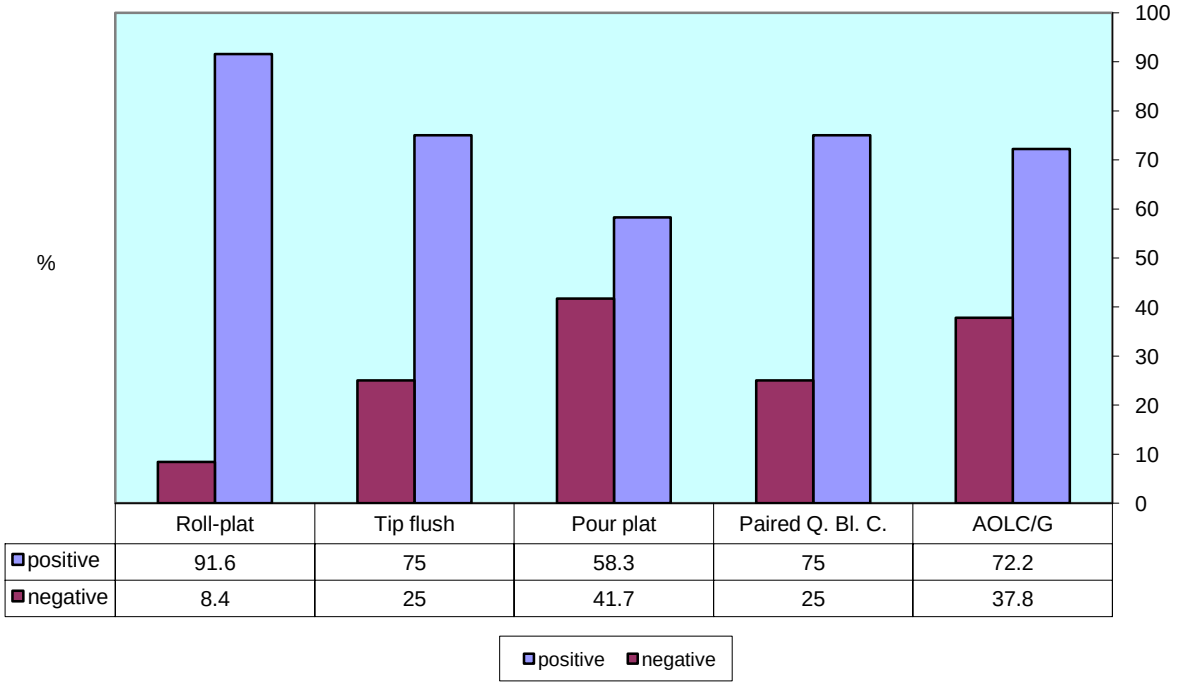

Table (14): **Comparison between the result of roll plate technique and pour plate technique.**

		Roll Plate		
		Positive	**Negative**	**Total**
Pour Plate	**Positive**	21	0	21
	Negative	12	3	15
	Total	33	3	36
agreement		66.7		
Kappa		0.226		
P		Fair		
X^2		2.34 p (>0.05)		

It was noted from this table that in the diagnosis of CRBSI there was fair agreement (66.7%) between the results of pour plate technique and roll plate techniques (kappa=0.226).

Value of K	**Strength of agreement**
0.2	Poor
0.21-0.4	Fair
0.41-0.6	Moderate
0.61-0.8	Good
0.81-1.00	Very good

Table (15): **Sensitivity, specificity of pour plate technique for diagnosis of CRBSI taking roll plate as a reference method:**

Test	sensitivity	specificity	PPV	NPV	false positive	false negative
Pour plate	63.6	100	100	20	0	12

The above table shows the diagnostic validity test done for pour plate technique for diagnosis of CRBSI taking roll plate as a reference method. As shown in the table the specificity of pour plate technique was 100% and the sensitivity was 63.6 as it failed to diagnose 12 cases detected positive by roll plate technique.

Fig. (9) Sensitivity,specificity,PPV & NPP of pour plate technique

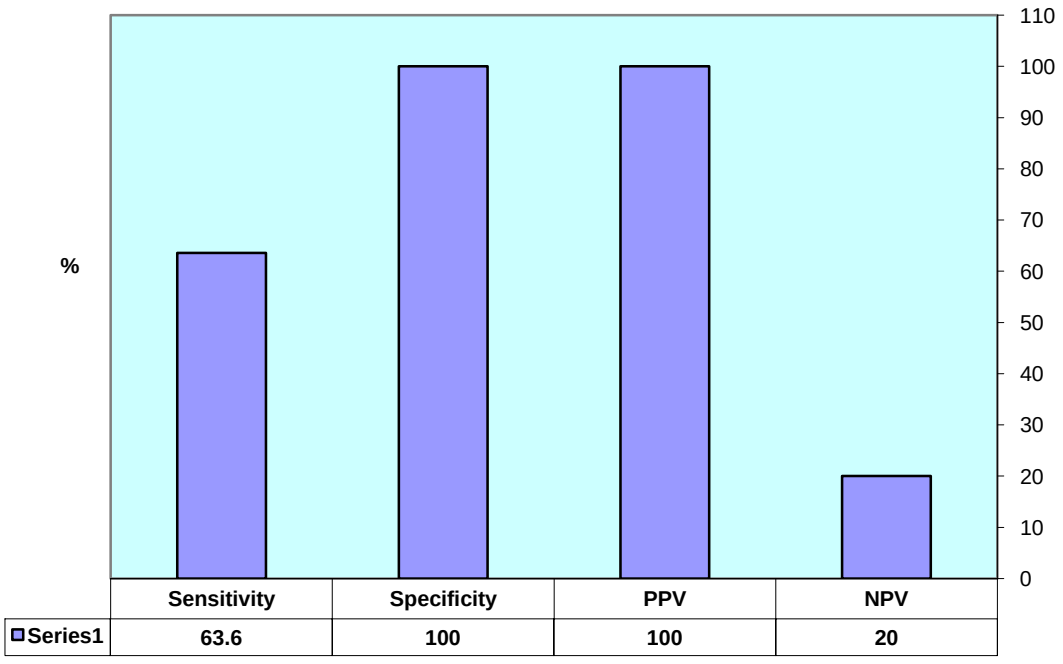

Table (16): Comparison between the results of roll plate technique and paired quantitative blood culture method.

		Roll Plate		
		Positive	Negative	Total
paired quantitative blood culture	Positive	27	0	27
	Negative	6	3	9
	Total	33	3	36
agreement		83.3		
Kappa		0.429		
P		Moderate		
X^2		5.94 p (<0.01)		

It was noted from this table that in the diagnosis of CRBSI there was moderate agreement (83.3%) between the results of paired quantitative blood culture and roll plate techniques (kappa=0.429).

Value of K	**Strength of agreement**
0.2	**Poor**
0.21-0.4	**Fair**
0.41-0.6	**Moderate**
0.61-0.8	**Good**
0.81-1.00	**Very good**

Table (17): **Sensitivity, specificity of paired quantitative blood culture for diagnosis of CRBSI taking roll plate as a reference method:**

Test	Sensitivity	Specificity	PPV	NPV)	False positive	False negative
Paired quantitative blood culture	81.8	100	100	33.3	0	6

The above table shows the diagnostic validity tests done for paired quantitative blood culture method for diagnosis of CRBSI taking roll plate as a reference method. As shown in the table the specificity of paired quantitative blood culture was 100% and the sensitivity was 81.8% as it failed to diagnose 6 cases detected positive by roll plate technique.

Fig. (10) Sensitivity,specificity,PPV & NPP of paired quanti. blood culture

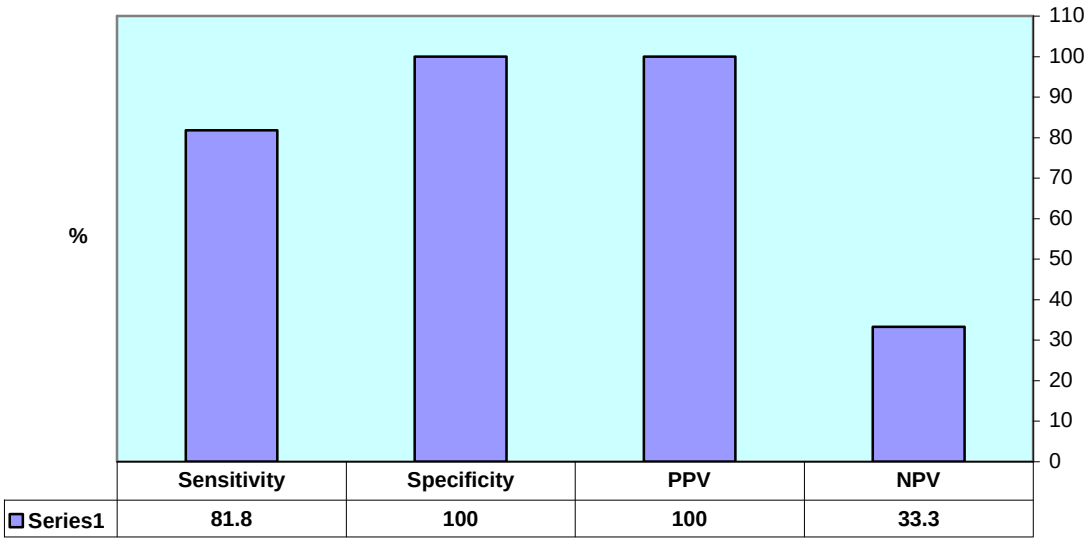

Table (18): **Comparison between the results of roll plate technique and tip flush method.**

		Roll Plate		
		Positive	Negative	Total
Tip flush method	Positive	27	0	27
	Negative	6	3	9
	Total	33	3	36
agreement		83.3		
Kappa		0.429		
P		Moderate		
X^2		5.94 p(<0.01)		

It was noted from this table that in the diagnosis of CRBSI there was moderate agreement (83.3%) between the results of tip flush and roll plate technique (kappa=0.429).

Value of K	**Strength of agreement**
0.2	**Poor**
0.21-0.4	**Fair**
0.41-0.6	**Moderate**
0.61-0.8	**Good**
0.81-1.00	**Very good**

Table (19): **Sensitivity, specificity of tip flush method for diagnosis of CRBSI taking roll plate as a reference method**:

Test	sensitivity	specificity	PPV	NPV	false positive	false negative
Tip flush	81.8	100	100	33.3	0	6

The above table shows the diagnostic validity tests done for tip flush method for diagnosis of CRBSI taking roll plate as a reference method. As shown in the table the specificity of tip flush was 100% and the sensitivity was 81.8% as it failed to diagnose 6 cases detected positive by roll plate technique.

Fig. (11) Sensitivity,specificity,PPV & NPP of tip flush method

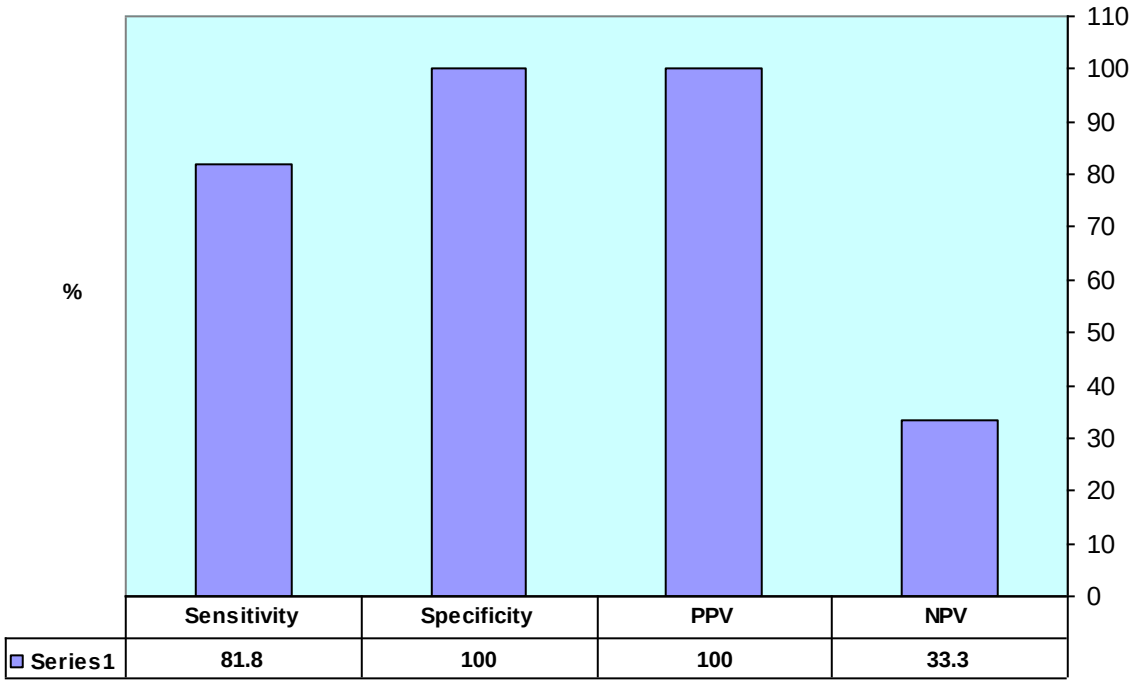

Table (20): **Comparison between the result of roll plate technique and AOLC/G test.**

		Roll Plate		
		Positive	Negative	Total
AOLC/G	Positive	26	0	26
	Negative	7	3	10
	Total	33	3	36
agreement		80.6		
Kappa		0.382		
P		Fair		
X^2		5.04 p(<0.05)		

It is noted from this table that in the diagnosis of CRBSI there was moderate agreement (80.6%) between the results of AOLC/G and roll plate technique (kappa=0.382).

Value of K	**Strength of agreement**
0.2	**Poor**
0.21-0.4	**Fair**
0.41-0.6	**Moderate**
0.61-0.8	**Good**
0.81-1.00	**Very good**

Table (21): **Sensitivity, specificity of AOLC for diagnosis of CRBSI taking roll plate as a reference method:**

Test	sensitivity	specificity	PPV	NPV)	false positive	false negative
AOLC	78.8	100	100	30	0	7

The above table shows the diagnostic validity tests done AOLC for diagnosis of CRBSI taking roll plate as a reference method. As shown in the table the specificity of AOLC was 100% and the sensitivity was 78.8 as it failed to diagnose 7 cases detected positive by roll plate technique only.

Fig. (12) Sensitivity,specificity,PPV & NPP of AOLC test