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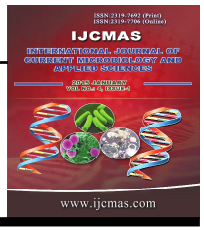

Original Research Article

Time related emergence of bacteria and their antibiogram of infected burns of patients during the hospital stay

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Keywords

Bacteria, burns, antibiotic sensitivity, Time dependent bacterial emergence, Multi drug resistance

A B S T R A C T

Infection with microbes in burns patients is a leading cause of morbidity and mortality. We investigated the bacteriology of infected burns wounds their antibiogram. This hospital based study was conducted during June 2011 to May 2013. Patients with greater than 25 - 30% burns of total body surface area (TBSA) and hospitalized in burns unit for a minimal duration of hospitalization of 7 days were included in the study. Specimens such as wound swabs, blood and intra vascular devices were collected at the end of 1st,2nd, 3rd and 4th week, processing, isolation, identification and antibiogram of the isolates were done as per standard procedures. 354 patients with 188 males and 166 females with a mean age of 24±18.6 years and the TBSA percentage was 15% (28–88%) were studied. *Pseudomonas aeruginosa* was the predominant isolate (23.91%) followed by *Staphylococcus aureus* (18.61%) in the study. *Staphylococcus aureus* dominated during the 1st week later surpassed by *Pseudomonas aeruginosa* throughout the study in all cases.51.13% of blood cultures and 48.64% of IVD's were positive for growth. Greater than 90% of isolates showed sensitivity to Carbapenems, moderate sensitivity to Piperaciilin/tazobactam, Cefoperazone/sulbactam, Amikacin and resistance to Cefuroxime, Amoxycillin/Clavulanic acid. Multidrug resistance was noted among the gram negative isolates. Gram positive cocci showed 100% sensitivity to Vancomycin & Linezolid .High degree of methicillin resistance was noted among *Staphylococcus aureus* and coagulase negative *staphylococci.* We highlighted the time dependent emergence of bacterial pathogens and their antibiotic sensitivity during the period of hospital stay. Most of the isolates demonstrated multidrug resistance. Inadequate initial antimicrobial therapy for these infected patients can result in higher morbidity and mortality. Continuous surveillance of microorganisms and their antibiotic resistance can improve the efficacy of infection control programs in a burn unit.

Introduction

Burn injury is a serious concern around the world (Revathi et al., 1998). In spite of recent advances in the health care practices related to burn wound management and infection control practices, still infection remain the main cause of mortality. Several

reports states that nearly 75% of all deaths based in burns patients are due to infection (Vindenes and Bjerknes, 1995). Further, these infected burn wounds causes delay in epidermal maturation and deep scar formation (Mayhall, 2002). Patients suffering with infected burn wounds tend to stay for a longer duration in the hospital and are always associated with morbidity and high rates of mortality due to sepsis when compared with non-infected patients (Mc Manus et al., 1994).

The surface area of burns is sterile on admission; however microbial colonization of the wound will take place in a time dependent manner. In first 48hrs microbes colonize from the skin, sweat glands and hair follicles, whereas the next 48–72hrs infection will arise due to pathogens from the respiratory tract, gastrointestinal tract and organisms from hospital environment, which further influence the incidence of invasive infection and the outcome of patient management (Barret and Herndon, 2003; Erol et al., 2004; Altoparlak et al., 2004).

Previous studies clearly mentioned that from the burn wounds numerous types of organisms have been isolated (Agnihotri et al., 2004; Karlowsky et al., 2004; Pruitt, 1984) such as gram positive or gram negative bacteria. Gram positive include *Staphylococcus aureus*, Coagulase negative *Staphylococci* and *Enterococcus* spp, whereas Gram negative include *Pseudomonas aeruginosa, Acinetobacter* spp, *Escherichia coli, Klebsiella pneumoniae, Enterobacter* spp, *Proteus* spp, and *Citrobacter* sp. (Karlowsky et al., 2004; Pruitt, 1984).

However the pathogens which cause infections in burns patients vary from place to place, time to time based upon the duration of hospital stay (Kumar et al., 2001). Various studies have clearly mentioned that gram positive organisms predominate during 1st week with replacement by gram negative bacteria in the course of hospital stay (Kumar et al., 2001).

Irrational and long duration administration of Oral and Intravenous antibiotics could lead to development of antimicrobial resistance among the pathogens and a burning concern causing limitation in starting the treatment of burn infection. The present study was aimed to evaluate the aerobic bacterial pathogens from infected burns patients periodically during their stay in the hospital from wound surface, blood and intravascular devices and to study their antibiotic sensitivity.

This study would enable to set up a separate burn management protocol in the hospital which helps to start empirical systemic antibiotic before the results of microbial culture become available and limit the septic episodes in the burn patients.

Materials and Methods

This retrospective hospital based study was conducted at Narayana medical college and Hospital Nellore, Andhra Pradesh, India during June 2011 to May 2013. Patients with greater than 25–30% burns of total body surface area (TBSA) and hospitalized in burns unit for a minimal duration of hospitalization of 7 days were included in the study. Patients with partial skin thickness burns <25% of TBSA, Full skin thickness burns <5% and admitted after 72hrs of burn injury were excluded.

A total of three hundred and fifty four patients were enrolled, there were 188 males and 166 females. Institutional ethics committee approved the study protocol. On

admission routine investigations has been performed and documented as requested by treating physician. The specimens like swab, blood and intravascular devices (IVD) from the patients underwent routine culture tests at regular intervals.

For isolation of pathogens, sterile cotton tipped swabs from the surface and deeper parts of wound were collected from admission till date of discharge or death. Few of the swabs were collected during surgical debridement and prior to grafting. These swabs were placed on 5% SBA (Sheep blood agar), MacConkey agar, and Chocolate agar, incubated at 37^{o}C aerobically for 24–48 hrs.

The blood samples were collected at the end of 1st, 2nd, 3rd and 4th week, irrespective of presence or absence of signs and symptoms of sepsis. The samples were processed by automated BACTEC 3D blood culture system. The tips of the removed IVD's were processed on 5%SBA, Macconkey agar, and Chocolate agar incubated at 37^{o}C aerobically for 24–48 hrs. All isolates were identified using standard biochemical tests as per CLSI guidelines (CLSI, 2008).

A suspension of each isolate was placed with standard antibiotic discs. (Himedia Ltd, Mumbai).and susceptibility of the isolates was determined by Kirby-Bauer disc diffusion method and results were interpreted as per CLSI guidelines (CLSI, 2008).

Gram positive isolates were tested against Oxacillin (1µg), Cephalothin (30µg) Gentamicin (10µg), Amikacin (30µg), Ofloxacin (5µg), Clindamicin (2µg), Vancomycin (30µg), Amoxycillin/ clavulanicacid (20/10µg), Imipenem (10µg), Doripenem (10µg), Mupirocin (5µg) and Linezolid (30µg). Gram negative isolates by Cephalexin (30µg), Cefuroxime (30µg), Cefixime (5µg), Ceftriaxone (30µg), Cefoperazone (75µg), Amikacin (30µg), Polymyxin B (300U) Amoxycillin/ clavualnicacid (20/10µg), Cefoperazone/ sulbactam (75/30µg), Meropenem (10µg), Doripenem (10µg),) and Piperacillin/tazobactam(100/10µg).

Escherichia coli ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853 and *Staphylococcus aureus* ATCC 25923 were used as control strains.

Statistical analysis

The data was entered in excel spread sheet and then the statistical analysis was performed by using SPSS Version-11. The continuous data was presented as mean and standard deviation. The categorical data was presented as actual numbers and percentages.

Results and Discussion

In the present study, we demonstrated the antibiotic sensitivity pattern of the organism's isolated during hospital stay among the burn injury patients. 354 patients were studied among them there were 188 (53.2%) males and 166 (46.8%) females. The mean age of the patients was 24± 18.6years (range 1-82years). The data clearly indicates that the patients were gender matched with male to female ratio 1:0.9.

The TBSA percentage was 15% (28-88%). The most common cause of burn injury was flame burns 262 (74%) followed by scalds 58 (16.4%), electrical 24(6.8%) and other types 10 (2.8%). 1062 swabs were assessed, 964(90.77%) were culture positive, 98 (9.23%) sterile and 753 (78%) produced single isolate, 174(18%) produced twin

isolates and 37(4%) produced triple isolates.

Overall analysis of 2654 specimens (wound swabs, Blood and IVD's) revealed that 1757 specimens were positive for culture and remaining 897 were sterile. Gram negative organisms were more common 578 (60%) than gram positive organisms 386 (40%). Maximum percentage of clinical isolates were observed between 3rd and 4th week, particularly Gram positive organisms were predominant during the 1st week and gram negative organisms in between 2nd and 4th week. *Pseudomonas aeruginosa* 23.91%was the most predominant isolate identified throughout the study, followed by *Staphylococcus aureus* 18.61%, and coagulase negative *Staphylococci* 18.3%. (Table-1&2)

Among gram positive, *Staphylococcus aureus* was the most common organism 206(21.35%) followed by coagulase negative *Staphylococci* 177 (18.34%) and *Enterococci* 03 (0.3%) *Pseudomonas aeruginosa* was most common among gram negative 207(21.45%) followed by *Klebsiella pneumoniae* 133 (13.78%), *Acinetobacter baumanii* 116 (12.02%), *Escherichia coli* 55(5.67%), *Enterobacter* sp 38 (3.94%) and *Proteus mirabilis* 29 (3%).

Further analysis of the culture data from wound swabs revealed that *Staphylococcus aureus* was the common organism isolated during 1st week (39.8%), *Pseudomonas aeruginosa* became more common from 2nd to 4th week (35.3%) and *Staphylococcus aureus* became only 6.1% by end of the 4th week

We analyzed 708 blood samples and found that 362(51.13%) samples were positive for culture and remaining 346(48.87%) were sterile. The maximum growth was observed during the 4th week of hospital stay (82%) and minimum during the 1st week (13.1%). (Table 1). *Pseudomonas aeruginosa* 26.8% was the most common organism followed by *Klebsiella pneumoniae* 20.1%, *Acinetobacter baumanii* 15.2%, *Escherichia coli* 12.4%, *Staphylococcus aureus* 12.4% and coagulase negative *Staphylococci* 12.3%. (Table-3& 4)

Cultures from from the tips of 884 IVD revealed that 48.64% were positive and 51.36% were sterile. Maximum positivity 68% was seen during the 4th week and minimal 27% during 1st week (Table-1). *Pseudomonas aeruginosa* 26.7% was the most common organism followed by coagulase negative *Staphylococci* 23.26%, *Klebsiella pneumoniae* 18.84%, *Staphylococcus aureus* 17.67%, *Acinetobacter baumanii* 8.6% and least by *Escherichia coli* 4.65 %. The striking observation was that *Acinetobacter baumanii* isolates were found in significant numbers (11.83%) (Table 3and 4).

We also found that a range of sensitivity towards various antibiotics varied drastically among the same isolate from various specimens. For instance, *Pseudomonas aeruginosa* demonstrated maximum sensitivity towards carbapenems, where as the range of sensitivity varied drastically with Doripenem in the range of 95–99%, Meropenem in the range of 91–98%, Cefoperazone/sulbactam in the range of 88–92%.

Moderate sensitivity was observed towards PolymixinB (89–92%), Amikacin (87–91%) and Piperaciilin /tazobactam (82–88%) and less sensitivity towards Amoxycillin/ Clavulanicacid (55–57%), Ofloxacin (76–80%), Cefixime (64–72%), Ceoperazone (81–97%), Ceftriaxone (76–81%). Similarly, the same pattern was observed in the isolates like *Klebsiella pneumoniae, Acinetobacter*

baumanii, Escherichia coli, Enterobacter sp and Proteus mirabilis which exhibited maximum sensitivity towards Dorepenem (96–99%), Meropene (92–98%), Cefoperazone/ sulbactam (88–92%), Amikacin (87–92%) and Pipercillin/tazobactam (83–91%) and less sensitivity towards Cephalosporins, Amoxycillin/clavulanicacid (61–78%) (Table 4).

Staphylococcus aureus, Coagulase negative *Staphylococci* and *Enterococci* demonstrated 100% sensitivity towards Vancomycin and Linezolid. 90–99% was shown towards Imipenem, Doripenem, Mupirocin, and Amikacin. *Staphylococcus aureus* and coagulase negative *Staphylococci* isolated from wound swabs demonstrated 25% resistance towards Oxacillin but the same from Blood and IVD's demonstrated 30–35% resistance. No resistance to Vancomycin was noted among *Enterococci* (Table 5)

Infections remain the primary reason for increased morbidity and mortality in hospitalized burn victims. In spite of early surgical debridement, skin grafting, prophylactic antibiotic administration; the mortality associated with burn wound infections remains high (Salah et al., 2003).

Moreover in invasive burn wound infection, Colonization of the pathogens to intra vascular devices act as sources for the pathogens to enter the blood stream occurs in a time dependent manner. The studies which describe the sources for sepsis in burn patients and the time related changes in these pathogens are limited (Salah et al., 2003; Song et al., 2001). In the present study, we assessed bacterial profile, their antibiotic sensitivity and time dependent changes of these pathogens during the hospital stay .We found that the risk of burn wound infection is correlates with the extent of the burn and is related to impaired resistance which may results from disruption of the skin's mechanical integrity and generalized immune suppression. The results of the study, confirms that contamination of burn wound by a pathogen occurs in almost all major burns victims. Even application of chlorhexidine and 1% silver sulphadiazine during the stay may not prevent contamination showing that 81.8% patients reported isolation of microorganisms from wound by the end of 1st week which coincides with the previous reports (Dash et al., 2013).

Multiple factors including the presence of coagulated proteins, absence of blood borne immune factors and the avascularity of burn wound might promote to opportunistic colonization by bacteria and fungi (Manson et al., 1992).

We noticed that, Gram positive cocci are more common during the early wound infection(1st week) followed later by colonization of wounds with Gram negative organisms starting by the 2nd week to 4th week demonstrates time dependent appearance of pathogens during the hospital stay. Our study findings are of the in line with the study of Agnihotri et al., 2004.

One of the possible explanation suggests that gram positive organisms which are present in the sweat glands, deep parts of hair follicles migrate to the burn wound during the early period, whereas Gram negative bacteria which slowly dominate the gram positive in the latter periods may be either exogenous or endogenous or both. The exogenous sources include contamination from the environment of the burn unit and health care workers while the endogenous sources include the gastrointestinal tract and respiratory tract.

The percentage of swab culture positivity gradually increased from 71.6% by day-3 and reached 100% by day 14th after that it remained same on 21st and 28th day. The overall culture positivity was 90.1%, these results correlates with the studies of Ekrami and Kalantar, 2007 and Bagdonas et al., 2004. However in these studies time dependent appearance was not noticed.

Twin isolates and Triple isolates were commonly observed during the 3rd and 4th week. *Staphylococcus aureus* and *Pseudomonas aeruginosa* were the common twin isolate combination followed by coagulase negative *Staphylococci* and *Klebsiella pneumonia,* which was also reported in many other studies (Kumar et al., 2011).

The minimum percentage of culture positivity from blood culture was during 1st week of hospital stay 13% which reached maximum during 4th week 82% with overall positivity of 51.13%, which was the similar earlier (Karlowsky et al., 2004).

Gram negative organisms are more predominant in causing sepsis because of their high propensity to invade and more virulent. In our present study cultural positivity from the tips of IVD's was minimum during 1st week 27% and maximum during 4th week 68% and overall positivity was 48.6%, which may be sources of sepsis. *Staphylococcus aureus* (18.6%) was the most common organism from all specimens during the 1st week of stay in hospital following burn injury.

Pseudomonas aeruginosa became more common than *Staphylococcus aureus* in the next all weeks. This finding of our study is strongly in accordance with many studies in and outside India (Atoyebi et al., 1992; Revathi et al., 1998; Agnihotri et al., 2004) but is in contrast to other studies which report *Staphylococcus aureus* as the predominant organism (Vindenes and Bjerknes, 1995).

The striking observation throughout the study was high isolation rate of coagulase negative *Staphylococci* throughout the hospital stay. Several studies have urged that coagulase negative *Staphylococci* should be considered as significant pathogen in both burn patients and critically ill patients (Vindenes and Bjerknes, 1995). In our study coagulase negative *Staphylococci* were isolated from blood culture (12.4%), IVD's (23.3%) and showed high resistance to oxacillin. Isolation of *β-hemolytic streptococci* has become rare. In addition the nosocomial pathogen *Acinetobacter baumanii* was demonstrated in 11.8 % of all isolates.

In our study >90% showed sensitivity to Carbapenems, moderate sensitivity to Piperaciilin/tazobactam, Cefoperazone/ sulbactam, Amikacin and resistance to Cefuroxime, Amoxycillin/Clavulanic acid which is correlating with other studies.

Demonstration of 100% sensitivity of *Staphylococcus aureus* to Vancomycin & Linezolid is observed in the study which is strongly supported by other studies. [18,19] 30% of *Staphylococcus aureus* showed methicillin resistance which is a significantly alarming condition Few studies in India have demonstrated almost 50-70% resistant to methicillin (Karlowsky et al., 2004; Rajput et al., 2008). Significant sensitivity was noted to Mupirocin, Imipenem, Dorepenem, Clindamycin, Amikacin & Ofloxacin. Less degree of sensitivity was noted to Amoxyclav, Oxacillin & Cephalothin.

Pseudomonas aeruginosa has demonstrated

high sensitivity to carbapenems and Piperacillin/tazobactam. Among Carbapenems, Doripenem showed more sensitivity when compared to Meropenem which is supported by many studies (Mushtaq et al., 2004). Demonstration of multidrug resistance among other gram negative isolates like *Klebsiella pneumoniae*, *Acinetobacter baumanii*, *Escherichia coli* & *Enterobacter* was also noticed in our study.

In conclusion we highlighted the time dependent emergence of bacterial pathogens and their antibiotic sensitivity during the period of hospital stay. Most of the isolates demonstrated multidrug resistance. Inadequate initial antimicrobial therapy for these infected patients can result in higher morbidity and mortality. Continuous surveillance of microorganisms and their antibiotic resistance can improve the efficacy of infection control programs in a burn unit.

Table.1 Time dependent emergence of pathogens from infected burn wounds

S.No	Time interval(Day)	No of cases(n)	Bacteria Growth	
			Negative(%)	Positive(%)
1	3	188	54 (28.7%)	134 (71.3 %)
2	7	165	30 (18.2 %)	135 (81.8 %)
3	10	194	14 (7.2 %)	180 (92.8%)
4	14	192	0	192(100%)
5	21	144	0	144(100%)
6	28	179	0	179(100%)
TOTAL		**1062**	**98(9.23%)**	**964(90.77%)**
Microbial pattern in Blood culture				
6	7	145	126(87%)	19(13%)
7	14	184	118(64%)	66(36%)
8	21	224	74(33%)	150 (67%)
9	28	155	28(18%)	127 (82%)
TOTAL		**708**	**346(48.87%)**	**362(51.13%)**
Microbial pattern in intra vascular device				
10	7	188	137 (73 %)	51 (27 %)
11	14	194	130 (67%)	64 (33 %)
12	21	215	95 (44%)	120 (56 %)
13	28	287	92 (32%)	195 (68 %)
TOTAL		**884**	**454(51.36%)**	**430(48.64%)**

Table.2 Time Dependent emergence of Gram positive isolates in various specimens

T.I (D-W)	Staphylococcus aureus n(%)			Coagulase negative Staphylococci n(%)			Enterococci n (%)		
	WS	BS	IVD	WS	BS	IVD	WS	BS	IVD
3rd	65 (48.7)	ND	ND	51 (38.4)	ND	ND	2 (1.2)	NI	NI
7^{TH}	54 (39.8)	09 (47.3)	18 (35.3)	47 (35.10	6 (31.6)	28 (54.9)	1 (0.3)	NI	NI
10^{TH}	38 (21.4)	ND	ND	22 (12.4)	ND	ND	0	NI	NI
14^{TH}	26 (13.3)	11 (16.7)	18 (28.2)	27 (14.4)	14 (21.20	22 (34.4)	0	NI	NI
21^{ST}	12 (8.2)	15 (10)	16 (13.30)	16 (11.2)	16 (10.7)	28 (23.4)	0	NI	NI
28^{TH}	11 (6.1)	10 (7.9)	24 (12.3)	14 (7.9)	8 (6.3)	22 (11.3)	0	NI	NI
TOTAL	327			321			03		
WB- Wound Swab, BS- Blood Specimen, IVD- Intra Vascular Device, ND- Not Done, NI- No Isolate									

Table.3 Representation of Gram negative isolates in various specimens

T.I (D-W)	*E. coli*			*K.pneumoniae*			*P.aeruginosa*			*Acinetobacter*			*Enterobacter*			*P.mirabilis*		
	WS n(%)	**BS**	**IVD**	**WS**	**BS**	**IVD**	**WS**	**BS**	**IVD**	**WS**	**BS**	**IVD**	**WS**	**BS**	**IVD**	**WS**	**BS**	**IVD**
3	4 (3.1)	ND	ND	3 (2.4)	ND	ND	6 (4.8)	ND	ND	0	ND	ND	3 (1.4)	ND	ND	0	ND	ND
7	6 (4.1)	1 (5.3)	1 (1.3)	06 (4.6)	1 (5.3)	1 (1.3)	09 (6.3)	2 (10.5)	3 (6.2)	3 (2.3)	0	0	7 (5.2)	NIL	NIL	2 (1.8)	NIL	NIL
10	12 (6.1)	ND	ND	26 (14.6)	ND	ND	34 (19.1)	ND	ND	25 (13.6)	ND	ND	12 (6.4)	ND	ND	12 (6.4)	ND	ND
14	12 (6.1)	3 (4.5)	2 (3.1)	33 (17.1)	12 (18.2)	6 (9.4)	52 (26.9)	21 (31.5)	12 (18.7)	31 (16.2)	05 (7.6)	4 (6.2)	6 (3.0)	NIL	NIL	6 (3.0)	NIL	NIL
21	9 (7.1)	24 (16.0)	6 (5.0)	29 (20.4)	31 (20.7)	21 (17.5)	43 (30.1)	38 (25.3)	34 (28.3)	25 (17.1)	26 (17.3)	15 (12.5)	6 (3.1)	NIL	NIL	4 (2.8)	NIL	NIL
28	13 (7.1)	17 (13.4)	11 (5.6)	36 (20.4)	32 (25.2)	53 (27.2)	65 (35.3)	36 (28.3)	67 (34.4)	32 (18.1)	24 (18.9)	18 (9.2)	4 (2.5)	NIL	NIL	5 (2.6)	NIL	NIL
TOTAL	**120**			**290**			**420**			**208**			**38**			**29**		
T.I (D-W) time interval(day-week); ws: wound swab; bs :blood specimen;ivd :intra vascular device.nd:not done																		

Table.4 Antibiogram of gram positive isolates (%)

ANTIBIOTIC	*Staphylococcus aureus*			*CONS*			*Enterococci* sp.		
	SWAB	**BLOOD**	**IVD**	**SWAB**	**BLOOD**	**IVD**	**SWAB**	**BLOOD**	**IVD**
OXN	74.2	64.6	64.3	72.5	67.3	63.5	66.6	NI	NI
CTN	81.2	74.3	67.6	76.1	71.2	74.2	66.6	NI	NI
GM	91.2	85.6	86	90.2	89.3	88.2	100	NI	NI
AK	94.3	92.4	93.4	93.4	93	88.4	100	NI	NI
OF	91.2	89.4	88.7	91	88.3	88.3	66.6	NI	NI
AMV	85.6	82.1	83	81.4	81	82.9	100	NI	NI
VM	100	100	100	100	100	100	100	NI	NI
CD	87.2	89.7	93.5	89.2	87.4	89.2	100	NI	NI
AZM	94.2	96	93.4	97.3	97	94	100	NI	NI
DPM	93.6	99.1	99.1	98.2	98.6	98	ND	NI	NI
MPN	94.3	90.4	93.5	92.8	94.3	95.5	ND	NI	NI
LZ	100	100	100	100	100	100	100	NI	NI
OXN : Oxacillin, CTN : Cephalothin, GM :Gentamicin,AK : Amikacin, OF : Ofloxacin, AMV : Amoxyclav, VM : vancomycin, CD : Clindamycin, AZM : Aztreonem, DPM : Dorepenam MPN : Mupirocin, LZ: Linezolid. *NI : not isolated*									

Table.5 Antibiogram of gram negative isolates of the study (%)

ABC	***P.aeruginosa***			***K.pneumoniae***			***A.baumanii***	
	WS	**BC**	**IVD**	**WS**	**BC**	**IVD**	**WS**	**BC**
CPX	ND	ND	ND	51.7	68.1	68.1	ND	ND
CFR	30.1	48.2	50.3	57.2	67.1	68.8	27.2	38.3
CFX	64.2	72.2	64.3	73.2	73.2	73	65.6	77.3
CTX	76.9	81.1	80.3	86.3	89.3	88.5	67.8	72.1
CFP	82.2	87.1	81.3	84.2	87.2	88.7	80.6	86.4
OF	76.4	77.2	79.4	81.2	83.4	82.9	78.8	80
AMV	56.9	58.3	55.2	74.2	78.2	77.8	61.2	68.2
PTZ	82.2	84.5	88.4	87.2	87.2	88.7	83.4	87.3
CSM	91.2	93	91.2	87.3	90.2	89.5	88.3	88.3
AK	87.2	90.3	90	89.5	89.5	87.6	89.2	92.1
PB	89.5	92.1	91	ND	ND	ND	ND	ND
MPM	91	92	91.4	93.2	93.2	93	92.5	93
DPM	93.4	94	93	95.5	94	91.3	94.5	94.5

ABC: antibiotic; WS: wound swab; BC: Blood culture; IVD: Intra vascular device;.CPX: Cephalexin; CFR: Cefuroxime; CFX: Cefixime; CTX:Ceftriaxone; CFP: Cefoperazone; O

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