

Case Study

Incidence of nosocomial infections caused by *P. aeruginosa* among burn patients at Kurdistan province

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Objective: *Pseudomonas aeruginosa* is one of the most important opportunistic bacteria, causing a wide variety of infections especially in burn patients. In this study, we aimed to determine the etiology of burn, incidence of nosocomial infections caused by *P. aeruginosa* and their antimicrobial resistance pattern among burn patients in Sanandaj. **Methods:** Between April 2009 to April 2010, a total of 176 clinical specimens from the burn unit of Tohid Hospital, Sanandaj, were received to detect *Pseudomonas aeruginosa*. Antimicrobial susceptibility testing was done by Disc Diffusion method of Kirby Bauer method. Detection of ESBL producing *Pseudomonas aeruginosa* strains were performed according to CLSI guidelines. **Results:** During the study period 145 burn patients were admitted to burn unit at Tohid hospital. Their mean age and TBSA were 29 years and 37.7% respectively. Similarly, the mean length of hospital stay of the patients was 10 days. Kerosene was the commonest cause of burn (60%), followed by gas (30%). During our study, from 176 clinical specimens among burn patients, 100 *P. aeruginosa* were isolated and identified. The most resistant antibiotics to which the bacteria tested were Cefotaxime, Ceftriaxone and Ciprofloxacin. Of the 100 *P. aeruginosa* isolates, 28 (28%) were positive for ESBL production by the DDST. **Conclusion:** Of the burn injuries 87 (60%) patients were caused by Kerosene which is used mainly by people of low-income groups for lighting lamps. We strongly recommend that *P. aeruginosa* be seriously considered as the main source of infection in the referral burn centre at Tohid hospital - Sanandaj. *P. aeruginosa* producing β -lactamases are encountered frequently in this hospital, and their prevalence indicates a considerable potential for spread among patients.

Key words: Kerosene, *P. aeruginosa*, β -lactamases, Burn patients, Sanandaj.

Introduction

Burn is a tissue damage causes being due to thermal, electrical, chemical or scalds etc as indicated in studies conducted all over the world (Mago et . al, 2004, Askarian et. al., 2004, Mbagha and Mwafongo, 1998). It is among the most serious injuries man can come across with and remains a major health problem in the world. In the United States more than 1.25 million people sustain burns every year (Brigham and Mclonghlin, 1996). Worldwide, an estimated 6 million patients seek medical help for burns annually (Nele et. al, 2010).

Despite advances in the use of antimicrobial therapy, bacterial infection remains a major problem in the management of burn victims today. It is now estimated

that about 75% of the mortality following burn injuries is related to infections (Jefferson 2005). Therefore, knowledge of the responsible bacterial flora of burn wounds, its prevalence and bacterial resistance, is of crucial importance for fast and reliable therapeutic decisions. Over the years, *Pseudomonas aeruginosa* have become the most frequently isolated organisms in most burn units (Agnihotri et.al 2004, Farhat et. al. 2009, Weldhagen et.al 2003).

Pseudomonas aeruginosa develops antibiotic resistance very rapidly, which complicates medical treatment of infections.

The purpose of this study was to evaluate prevalence of Extended Spectrum Beta-Lactamases (ESBL) producing *Pseudomonas aeruginosa* strains

isolated from burn patients admitted at Tohid hospital which is a referral hospital in Kurdistan providence.

Materials and Methods

Between April 2009 to April 2010, a total of 176 clinical specimens from the burn unit of Tohid Hospital, Sanandaj, were received to detect *Pseudomonas aeruginosa*. The samples received to isolate and identify *Pseudomonas aeruginosa* isolates based on biochemical tests (Patrick et. al, 2007).

Antimicrobial susceptibility testing

Antimicrobial susceptibility testing was done by Disc Diffusion method of Kirby Bauer method on Muller-Hinton agar (Merck, Germany) (Bauer et. al 1966). The antibiotics used were: carbencilin (CB), ciprofloxacin (CIP), ceftazidime (CAZ), cefotaxime (CTX), ceftriaxone (CRO), gentamicin (GM) and Piperacillin (PIP).

Detection of Extended Spectrum Beta-Lactamases (ESBLs)

Detection of ESBL producing *Pseudomonas aeruginosa* strains were performed according to CLSI guidelines (CLSI 2006). Briefly, we used CPM and CPM/clavulanic acid, CAZ and CAZ/clavulanic acid and CTX and CTX/clavulanic acid disks (MAST). After inoculating isolates in Muller- Hinton Agar (Merck,

Germany) plates and 24 hours incubation, zones for compound disks larger than or equal to five mm compared with single disks, considered as producing ESBLs.

Results

During the study period 145 burn patients were admitted to burn unit at Tohid hospital. Their mean age was 29 years (range: 4 –74 years). The age distribution and sex related to the injury and outcome are shown in Table 1. Mean of TBSA (Table 2) were 37/7% (range: 5% – 95%). Similarly, the mean length of hospital stay of the patients was 10 days (range: 4 to 18 days) (Table 3).

Table 4 shows that kerosene was the commonest cause of burn (60%), followed by gas (30%). During our study, from 176 clinical specimens among burn patients, 100 *P. aeruginosa* were isolated and identified. Table 5 shows the antibiotic resistance pattern of *P. aeruginosa* isolates. The most resistant antibiotics to which the bacteria tested were Cefotaxime, Ceftriaxone and Ciprofloxacin.

The next step in testing was designed to analyze the β -lactamase contents of the *P. aeruginosa* isolates. On the basis of CLSI-ESBL phenotypic confirmatory test, of the 100 *P. aeruginosa* isolates, 28 (28%) were positive for ESBL production by the DDST.

Table 1: Frequency of burn patients according to age and sex

Sex	Age group (year)					
	0 - 10	11- 20	21-30	31-40	41-50	51- >
Male	3	13	9	10	8	4
Female	3	13	16	10	8	4
Total	6	26	25	20	16	8

Table 2. Percentage of total body surface area (TBSA) of burn patients in Tohid hospital

TBSA (%)	Age group (year)					
	0 -10	11 -20	21 -30	31- 40	41 - 50	>51
> 10	2%	5%	1%	3%	1%	1%
10 -30	2%	8%	8%	7%	6%	5%
31 – 60	1%	5%	8%	5%	4%	1%
> 60	0	5%	5%	2%	3%	1%

Table 3: Length of hospital stay according to percentage of total body surface area (TBSA)

Hospital stay (day)	Sex			
	Male		Female	
	Number	Percent	Number	Percent
> 7	11	11%	13	13%
7 -14	31	31%	32	32%
15 -30	7	7%	7	7%
> 30	0	0	0	0
Total	49		52	

Table 4: Etiology of burn patients according to sex

Sex	Etiology of Burn				
	Petrol	Kerosene	Gas	Chemicals	Electricity
Male	4	24	18	1	3
Female	1	35	12	1	1
Total	5	59	30	2	4

Table 5: In Vitro antibiotic resistance pattern of Infection-Associated *P. aeruginosa*

Antibiotic	Resistance %	
	Number	Percent
Amikacin (AN)	0	0
Carbencillin (CB)	10	19.2
Ciprofloxacin(CIP)	23	43
Ceftazidime (CAZ)	15	28/8
Cefotaxime (CTX)	27	50
Ceftriaxone (CRO)	22	42/3
Piperacillin (PIP)	15	28/8
Gentamicin(GM)	13	25
Imipenem(IMI)	0.0	0.0
Meropenem(MEM)	0.0	0.0

Fig 1: Phenotypic detection of ESBL by DDST among *P. aeruginosa* isolates in burn patients at Tohid hospital - Sanandaj

method successfully detected 28 (28%) of the 100 *P. aeruginosa* isolates were positive for ESBL production.

Conclusion

Of the burn injuries 87 (60%) patients were caused by Kerosene which is used mainly by people of low-income groups for lighting lamps. We strongly recommend that *P. aeruginosa* be seriously considered as the main source of infection in the referral burn centre at Tohid hospital - Sanandaj. The results of the present study also shows that isolates of *P. aeruginosa* producing β -lactamases are encountered frequently in this hospital, and that their high prevalence indicate a considerable potential for spread among patients.

Acknowledgments

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Discussion

Burns are one of the most significant health problems throughout the world, leading to prolonged hospitalization and hence increased expense for the patients and society. In spite of the fact that all burned patients are routinely cleaned with an antiseptic solution, in this study 100 *Pseudomonas aeruginosa* were isolated and identified. This microorganism has been held responsible for the majority of invasive burn wound infections in many burn centers (Xiaofei et. al 2006, Pagani et. al, 2004). These bacteria have been of much concern because of a rapid increase of resistance to a variety of antibacterial drugs. In our study 50%, 42.3 % and 43% of these bacteria were resistant to Cefotaxime, Ceftriaxone and Ciprofloxacin respectively; this resistance rate is much lower than other reports from Iran (Rastegar et. al, 2005, Hamid et. al 2002). Actually, these antibiotics are used as OTC in Sanandaj and therefore, this resistance rate may increase.

The acquisition of ESBL in *P. aeruginosa* has been known of since long; however studies regarding ESBL are rudimentary in our region. With the occurrence of ESBLs in *P. aeruginosa* being increasingly reported worldwide (Livermore and Brown 2001, Mirsalehian et. al 2010), there is a need to detect ESBLs in clinical isolates of *P. aeruginosa*. In this study, a DDST

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