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Pattern of *Pseudomonas aeruginosa* Drug Resistance in Tabriz Children Hospital

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Abstract: Regarding the different reports about increasing drug resistance of *Pseudomonas*, this study was done in Tabriz Pediatric Medical Center. In a cross sectional study, during 3 years, 84 positive culture of pseudomonas were obtained from the records of microbiology laboratory. Information about the patients and pattern of drug resistance were analyzed statistically. 81.9% of patients were below 2 years of age and all of them had one or more medical intervention. Most of the positive cultures were isolated from bronchial and eye discharges. Eighty one percent of positive cultures were from intensive care unit and neonatal wards. Resistance to Ampicillin, Ceftizoxime, Cotrimoxasol and Cefotoxime has been more than 95%. Resistance to Ceftazidime was seen in 50% and lowest resistance was to Ciprofloxacin. At present time Ciprofloxacin is relatively effective antibiotic for *Pseudomonas* infection. Since, there is increasing resistance to this drug and limited use of this drug in children, newer antibiotic discs should be used in antibiogram.

Key words: *Pseudomonas aeruginosa*, antibiogram, intensive care unit, nosocomial infection, child

INTRODUCTION

Pseudomonas are widespread throughout nature, inhabiting soil, water, plants and animals including humans (Baltimore, 2007). These bacteria are usually gram negative, obligate aerobic, nonsporulating bacilli. *Pseudomonas* by producing numerous exotoxins, hemolysins and adhesion molecules primarily induce local infection which then extends (Baltimore, 2007; Pier and Ramphal, 2010; Begum *et al*., 2007; Trachoo, 2007). Most human infections due to these species are opportunistic and occur among Low Birth Weight (LBW) infants and in older infants and children with impaired host defenses, such as those with traumatic wounds, cystic fibrosis, malignancies, extensive burns, malnutrition, primary immunodeficiencies and people under immunosuppressive therapy (Baltimore, 2007; Mcintosh *et al*., 2003). *Pseudomonas* (P.) *aeruginosa* is the most clinically important species of the genus *Pseudomonas* (Brady, 2009). Most *P. aeruginosa* infections are acquired in the hospital, where Intensive Care Units (ICUs) account for higher rates of infection than other hospital units. According to the National Nosocomial Infections Surveillance (NNIS) system, between 1992 and 1999, *P. aeruginosa* was the second most common cause of pneumonia, the fourth most common cause of urinary tract infection and the sixth most common bloodstream isolate in ICUs (Reuben, 2008).

Unfortunately, *P. aeruginosa* is naturally resistant to many antibiotics and has a remarkable capacity for acquiring new resistance mechanisms under selective pressures from antibiotics, creating increased therapeutic problems (Livermore, 2002). Resistance of *P. aeruginosa* to various types of antibiotics is increasing particularly among people hospitalized in ICU wards and people with cystic fibrosis (Reuben, 2008). Present study aimed to evaluate *P. aeruginosa*'s drug resistance pattern in Tabriz Children's Hospital.

MATERIALS AND METHODS

Present cross-sectional study was conducted on 84 cases with positive *P. aeruginosa* culture in Tabriz Children's Hospital from A pril 2007 to February 2009. Consecutive isolates (non-duplicate) originating from bloodstream, urinary tract, respiratory tract (trachea/bronchi, chest tube), eye, skin and soft tissue which collected before or during hospitalization were collected. Demographic characteristics and laboratory data of patients with positive *P. aeruginosa* culture were extracted from documents. Demographic characteristics

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include body weight, age, diagnosis, medical interventions, previous hospitalization history, hospital acquired infection, white blood cells count, antibacterial sensitivity and resistance pattern of *P. aeruginosa*.

After sampling, specimen was transferred to transport media and cultured in blood agar (Himedia Laboratories PVT Ltd., India) during 30 min. Following culture and growth of bacteria, antibiotic sensitivity was determined by standard method kiyrby-bauer using disks (Himedia, India). Statistical analysis was performed using SPSS software package for windows version 13 (SPSS Ins., Chicago, IL, USA). The results are presented as Mean±standard deviation (SD). The p-value less than 0.05 was considered significant statistically.

RESULTS

The mean age of patients was 15.33±1.62 months, ranged from one day to 13 years. 50.60% of patients aged less than 1 month and 31.30% age between one month and two years. Out of patients with less than one month age, birth weight of 34 patients was more than 2500 g, seven patients between 1500-2500 g (low birth weight) and two patients had birth weight less than 1500 g (very low birth weight).

Figure 1 shows medical intervention carried out on study population. All patients had intravenous line. Sixty three patients had nasogastric tube, 31 tracheal tube and four bladder catheter. Sixteen and eight patients underwent various surgery procedures and bronchoscopy, respectively.

Frequency of positive *P. aeruginosa* samples is shown in Fig 2. Twenty one (25%) patients have hospitalized at least for once time (had previous history of hospitalization). Fifty three (65.4%) patients had hospital acquired infection and 28 (33.34%) had *P. aeruginosa* before hospitalization. In case of three patients, source of infection is unknown.

Diagnosis of patients was shown in Fig. 3. As it's evident, most of positive samples were from patients with pneumonia and lowest frequency of patients had pnemothorax, catheter induced infection, hypovolumic shock and congenital heart disease ($p = 0.013$). Eighty one percent of patients were hospitalized in intensive care unite and neonatal ward. The WBC was lower than 5000 mm^{-3} in four patients, between 5000 and 15000 mm^{-3} in 61 patients and more than 15000 mm^{-3} in 19 patients. Resistance of *P. aeruginosa* against antibacterial agents is shown in Fig. 4. As it is evident, *P. aeruginosa* showed highest resistance against ampicillin, ceftizoxime, cefotaxim and cotrimoxazole. Also, *P. aeruginosa* had lowest drug resistance to ciprofloxacin.

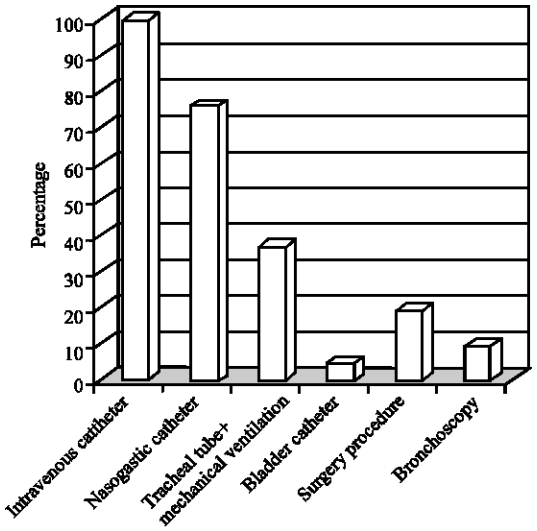

Fig. 1: Frequency of intervention in studied population

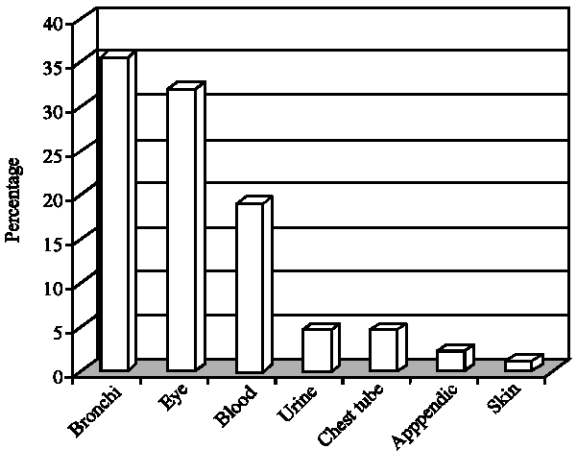

Fig. 2: Origin of positive *P. aeruginosa* samples

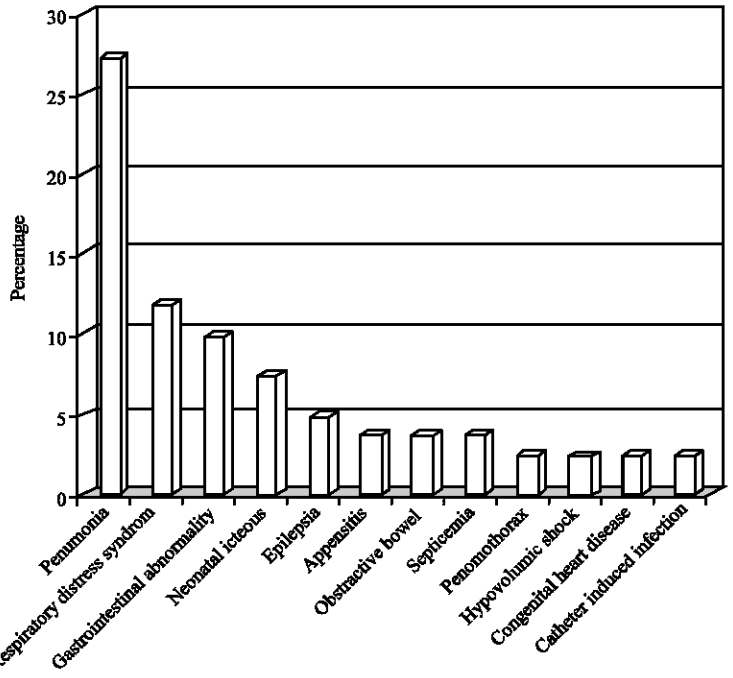

Fig. 3: Primary diagnosis of studied population.

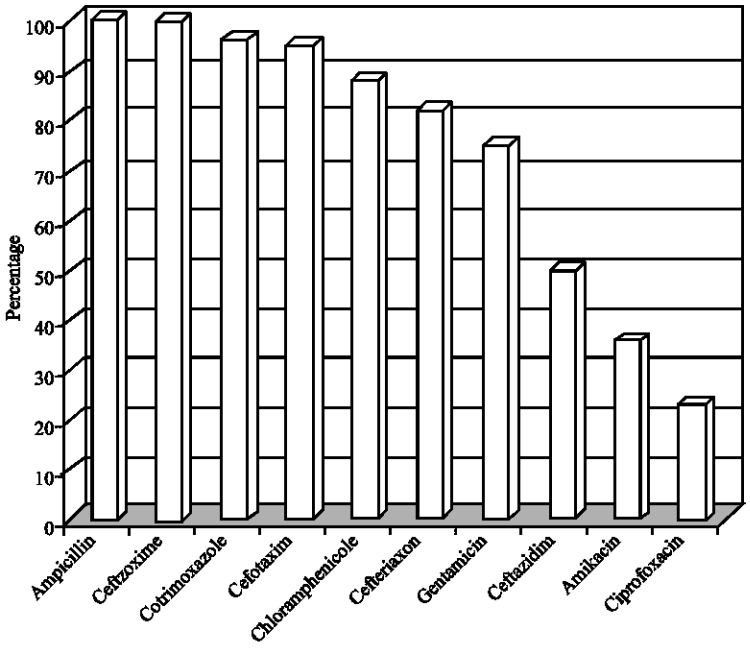

Fig. 4: Frequency of antibiotic resistance against ten current agents

DISCUSSION

In the present study, more than half of patients with positive *P. aeruginosa* culture aged less than one month and 81.9% aged less than two years. This fact shows the higher incidence of *P. aeruginosa* in lower ages especially in low birth weight hospitalized neonates. Positive samples for *P. aeruginosa* were bronchial and ophthalmic discharges which were consistent with results of previous studies (Reuben, 2008; Streit *et al*., 2004).

Infections with *P. aeruginosa* are commonly a hospital acquired infection and medical procedures predispose people to infection with this agent (Pier and Ramphal, 2010; Reuben, 2008; Defez *et al*., 2004; Cao *et al*., 2004). Consistent to previous reports, results of our study showed that 65.4% of patients have hospital acquired *P. aeruginosa* infection and all of these patients had positive history of one or more medial interventions.

In present study, more than 80% of positive *P. aeruginosa* samples were collected from ICU and neonatal ward, which was consistent with other researchers' reports (Cabrera *et al*., 1997; Panhotra *et al*., 2005).

Present study results like study of Shah *et al*. (2005) showed that leukocytosis was not useful in diagnosing life threatening infections with *P. aeruginosa*.

Out of ten antibiotic disks, *P. aeruginosa* showed more than 95% resistance against ampicillin, ceftizoxime, cefotaxim and cotrimoxazole. Also, 75-88% resistance was seen against chloramphenicol, ceftriaxone and gentamicin antibiotics. Drug resistance to ceftazidim, amikacin and ciprofloxacin was 50, 36 and 23%, respectively. In contrast to 22% resistance to ciprofloxacin in present study, resistance to this antibiotic was higher in Kermanshah Hospitals (Mohajeri, 2003). In studies in Canada (Blondeau *et al*., 1998) and Turkey (Gonlugur *et al*., 2003), level of resistance to ciprofloxacin was lower (12 and 16%, respectively) than reported in present study. Babay (2007) reported increasing level of resistance against ciprofloxacin from 2002 to 2005 in Saudi Arabia about 7-8%. Resistance to ciprofloxacin in present study was higher than what occurred in Babay's study. The increasing resistance against multi drugs by *P. aeruginosa* occurs by transferring and loading of broadly-specific multidrug efflux systems (Abdi-Ali *et al*., 2007).

Considering 36% antibacterial resistance, amikacin ranked as second effective antibiotic against *P. aeruginosa*. Antibiotic resistance to amikacin was near to 38% reported by Mohajeri (2003) (13%). *P. aeruginosa* was 96 and 79% sensitive to amikacin in United state of America (Streit *et al*., 2004) and Italy (Blandino *et al*., 2004), respectively. Resistance of *P. aeruginosa* to ceftazidim was 50% in present study and studies carried out in Kermanshah and Turkey, but resistance of *P. aeruginosa* against this antibiotic was reported 75 and 90% in Italy (Blandino *et al*., 2004) and Canada (Blondeau *et al*., 1998), respectively. Today, *P. aeruginosa* is resistant to the most of antibiotics (Rastegar-Lari *et al*., 2005).

In conclusion, ciprofloxacin is a relatively effective antibiotic against *P. aeruginosa* infections. Unfortunately, resistance to this antibacterial agent is growing and considering the limited use of this antibiotic in pediatrics, it is better to new generations of antibiotic disks tested against *P. aeruginosa* including carbapenem like study of Rahbar *et al*. (2008), imipenem, meropenem and ticarcillin.

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