Pattern of Pseudomonas aeruginosa Drug Resistance in Tabriz Children Hospital

1Z. Ghorashi, 2N. Nezami, 3R. Ghotaslou and 5S. Ghorashi
1Department of Pediatrics, Tabriz Children Hospital, Tabriz University (Medical Sciences), Tabriz, Iran
2Young Researcher Club, Tabriz Islamic Azad University, Tabriz, Iran
3Drug Applied Research Center, Tabriz University (Medical Sciences), Tabriz, Iran
4Department of Microbiology, Tabriz University (Medical Sciences), Tabriz, Iran
5Faculty of Medicine, Tabriz Islamic Azad University, Tabriz, Iran

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, Cefixime, Cotrimoxoal 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 April 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
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 kijrby-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 pneumothorax, 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, cefuzoxime, cefotaxim and cotrimoxazole. Also, *P. aeruginosa* had lowest drug resistance to ciprofloxacin.
**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).
Infectors 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 medical 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; Panhota 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, cefotaxime, cefotaxim and ceftriaxone and gentamicin antibiotics. Drug resistance to cefazidim, 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, amikacim ranked as second effective antibiotic against P. aeruginosa. Antibiotic resistance to amikacin was near to 38% reported by Mohajeri (2003) (13%). P. aeruginosa was 94 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.

REFERENCES


