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The prevalence of respiratory tract infections in the Ghaem Hospital of Mashhad

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Respiratory tract infection is a serious concern for public health worldwide, and imposes a lot of pressure on health facilities, specifically in developing countries along with economic restrictions. This study evaluated the prevalence of bacterial pathogens and their antibiotic sensitivity pattern among patients with respiratory tract infection in Ghaem Hospital, Mashhad, east of Iran during the 3 years period. All clinical isolates were identified by conventional biochemical tests. Antibacterial susceptibility testing was performed by disc diffusion method following clinical and laboratory standards institute (CLSI) guidelines. Among 4897 clinical respiratory samples, 3748 samples were positive. Out of 3748 culture positive, 42% were related to females and 58% to males. The prevalence of respiratory infections in our study reported 27.5%. Most isolates were obtained from the age group of 60-80 years old. The most common isolated were Acinetobacter spp. 37% and Klebsiella pneumonia 21%. Antimicrobial profile of Acinetobacter spp. and Klebsiella pneumonia showed maximum resistance to Amikacin 86.8 and 50.3% respectively. According to our study, the duration of hospitalization in the ICU, especially surgery ICU, is associated with an increased risk of respiratory infection. Therefore, infection control plays an important role in the ICUs.

Key words: Respiratory tract infections, Antibacterial susceptibility test, Intensive care unit.

INTRODUCTION

Respiratory tract infections (RTIs) are one of the common diseases which is the leading cause of mortality and account for more than 4 million fatalities annually (Khaltaev, 2017; Richter et al., 2016). Pneumonia accounted for 15% of the deaths in children aged under 5 years in 2015 (Khaltaev, 2017). also It is the second leading cause of untimely death and one of the most common reasons for hospitalization (Srinivasa and Shruthi, 2018).

Respiratory infections caused by a group of pathogens

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including viruses, bacteria and fungi (Srinivasa and Shruthi, 2018; Tang et al., 2019). The various types of bacteria which are involved in RTIs are *Acinetobacter spp.* , *Klebsiella pneumonia*, Pseudomonas aeruginosa and *Escherichia coli* (Wang et al., 2016). These infections are composed of upper respiratory tract infections (URTIs) and lower respiratory tract infections (LRTIs) (Khan et al., 2015). The causes of respiratory infections are influenced by the age, gender, season and pre-existing medical problems. Costs attributable to respiratory tract infection in patients settings are an important problem on national healthcare funds particularly in low income countries (Srinivasa and Shruthi, 2018; Ghanbari et al., 2018). Cases of RTIs reply to antibiotics treatment though antibiotics misuse since respiratory tract infection is prevalent particularly in developing countries and might lead to resistance (Khan et al., 2015). Therefore, the aim of this study was to consider bacterial pathogens of RTIs and their antibiotic resistance patterns among the patients in Ghaem Hospital settings over a period of 3 years.

This makes surveillance of antibiotic resistance very important for guiding experiential therapy, where health structures and patients must frequently rely on reasonable first-line antibiotics that may have lost their clinical effectiveness. Effective empirical therapy of bacterial diseases needs knowledge on local antimicrobial resistance patterns since respiratory tract infections are usually treated without identification of the causal pathogen or its antibiotics susceptibility profile (Camara et al., 2017).

MATERIALS AND METHODS

This study is a cross-sectional/descriptive study, which was designed during the 3 years period. It was conducted in all wards of the Ghaem Hospital, Mashhad. The Ghaem Hospital is one of the main hospitals in the East of Iran. Clinical tests were done by ward physicians, and during this time, examination for symptoms was conducted by the nurses.

A total of 4897 patients of heterogeneous population of a wide age range with suspected acute respiratory infection of community or hospital origin in Ghaem Hospital, Mashhad were attended in the present study between March 2017 and March 2020.

Specimen culture: The samples were collected from RTI patients. In the central Laboratory of Microbiology, samples were cultured on the enriched and selective media for example blood agar, chocolate agar, eosin methylene blue (EMB).

Identification of isolated organisms: After incubation for 24 hours, necessary examination including gram stain and morphological observation and use of biochemical tests as required to identify the organisms was performed (Khan et al., 2015).

Antibiotic susceptibility testing: Antibacterial susceptibility testing was done by the Kirby-Bauer disc diffusion method on Mueller Hinton agar plates using the following antimicrobial agents to determine resistance pattern for all of the isolated bacteria (Falahi et al., 2017).

RESULTS

In this study, from 4897 suspected patients in different wards of hospital, 3748 cases (76%) were reported of respiratory tract infection. Most of the patients were between 60 and 80 years old; with 58% males and 42% females (male/ female ratio 1.37). The age frequency is shown in Figure 1. Among the total 3748 bacterial isolates, the most frequency isolated Gram-negative organisms causing RTIs were including *Acinetobacter spp.* (1370; 37%), *Klebsiella pneumonia* (774; 21%), *Pseudomonas aeruginosa* (312; 8%), *Escherichia coli* (298; 8%), respectively. In addition, among the isolated Gram-positive organisms, Staphylococcus aureus (138; 4%) was the main pathogen (Table 1). The resistance pattern of bacteria isolated is shown in Table 2. The highly resistant in *Acinetobacter spp.* was observed to Amikacin (R=86.8%), Meropenem (R=88.1%), Cefepime (R=93.5%). Also, *Klebsiella pneumonia* showed high resistance to Amikacin (R=50.3%) and Ceftazidime (R=85.1%).

DISCUSSION

Respiratory infections are considered as one of the main causes of annual mortality in over 4 million people worldwide and as well as the main death factor in developing countries. The infections caused by these infections are responsible for 15 % of the deaths in children under age 5. Respiratory infections are also the second major cause of the deaths during the last years of life (Khaltaev, 2017). Studies of Asian countries showed that a total of 12 million deaths was a quarter of it related to the respiratory causes, which the respiratory infections accounted for about a third of it (Jamrozik and Musk, 2011).

According to the results of the present study, respiratory infections accounted for 27.5% of the Ghaem Hospital infections, which are considered the second most common infection after the urinary infection. The prevalence of respiratory infections in the study of Zahraei et al., in Tehran showed 24.6% (Zahraei et al., 2012). Another study done by Malhotra et al. (2014) showed the prevalence of respiratory infections by 23.3%. The results of these studies are in agreement with the present study. While in other studies including the study of Ho et al. (2018) in Vietnam, Ghafouri et al. (2015), Hasanzade et al. (2009), Falahi et al. (2017), Farzanpour et al. (2013) in Iran, the prevalence of infection was reported 67.6, 65.2, 47.7, and 44%, respectively (9, 13-16). Furthermore, the study of Akhtar N in Pakistan reported an incidence of respiratory infections of 47.9% (Akhtar, 2010). The study of Rachid Razine et al., in Morocco showed a lower prevalence of respiratory infections (10.6%) in the region (Razine et al., 2012). In the present study, the total of 3748 positive samples was 1580 samples (42%) related to females and 2168 samples (58%) related to males, that are similar to the results of Salman Khan et al. (2015).

The prevalence of respiratory infections was higher in people over 50 years of age, which emphasizes the direct

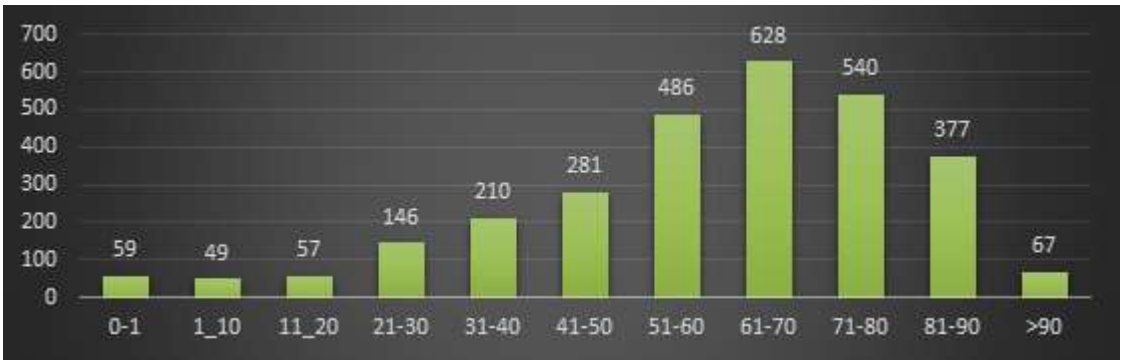

Figure 1. Age distribution analysis of patients with respiratory tract infections at Ghaem Hospital.
Source: Authors.

Table 1. Gender-based prevalence of respiratory tract infection pathogens at Ghaem Hospital.

Bacterial species	Number of isolates	Percentage	Number of patients	Female	Male
Acinetobacter sp.	1370	37	1119	520	599
Klebsiella pneumoniae	774	21	695	263	432
Pseudomonas aeruginosa	312	8	284	126	158
Escherichia coli	298	8	279	100	179
Staphylococcus aureus	138	4	137	51	86
Enterobacter sp.	113	3	124	53	71
Pseudomonas sp.	127	3	110	38	72
Staphylococcus epidermidis	106	3	104	51	53

Source: Authors.

Table 2. Antibiotic resistance patterns of bacterial species isolated at Ghaem Hospital.

Antibiotics	Bacterial species			
	Acinetobacter sp.	Klebsiella pneumonia	Pseudomonas aeruginosa	Escherichia coli
Amikacin	86.8	50.3	55.5	19.2
Meropenem	88.1	64.3	64.5	14.2
Cefepime	93.5	82.9	73.3	72.9
Imipenem	86.4	54.7	58.9	33
Gentamicin	86.2	67	53.4	41.1
Ceftazidime	96.2	85.1	53.5	64.5
cefazolin	98.7	92	96	89.1
Ciprofloxacin	93	69.4	61.1	71.8
Ceftriaxone	96.1	91.2	77.2	77.6
Cefotaxime	97.1	88.8	80.9	75.4

Source: Authors.

relevance between the incidence of respiratory infections with increasing age and repelling the immune system. In the study of Ghafouri et al. (2015) in Imam Reza Hospital in Bojnourd, the average age of these patients (54.3)was almost identical to the average age of study patients.

There are definite risk factors related with respiratory tract infection like length of stay in the hospital, underlying immunocompromised illnesses, age of over 50 years the patient (Malhotra et al., 2014). The study of Nadi et al. in Hamedan Educational hospitals showed 28% of those infected with pneumonia in the age range over 65 (Nadi et al., 2011). In addition, Ismaili et al. (2007) studies at the Baqiyatallah Hospital, Jafari et al. (2006) in Tehran, Larypoor and Frsad (2011) in the Ghom

are aligned with the results of the Nadi and present study (Esmaeili et al., 2007; Jafari et al., 2006; Larypoor and Frsad, 2011); whereas in some other studies, younger age groups were affected. The study of Salman Khan et al. (2015) in Nepal, included about 33% of the patients with respiratory infections in the age group of 1-10 years (Khan et al., 2015). In the study Li - min, Wang et al. have also been identified as 51% bacterial isolate related to the age group of 5-25 (age of school and university) (Wang et al., 2016). Also in the study of Srinivasa S was done in India for one month to five years, 48% of the cases were 6 months to 2 years (Srinivasa and Shruthi, 2018).

According to the results of this study, *Acinetobacter spp*. (35%) and second *klebsiella pneumonia* (20%) are the most common bacterial pathogens isolated from respiratory samples of Ghaem Hospital. Also, in a study conducted in the same center in the 83 and 84 years (Ghazvini et al., 2006), the same bacterial frequency was reported.

The result of Pradhan et al. (2014) study in India reported *Acinetobacter* as the most common pathogens isolated in respiratory infection. While in the studies of Sadeghi et al., in Yahyanejad hospital (Sadeghi et al., 2009) and Nadi et al. (2011) in Hamedan (Nadi et al., 2011) *Enterobacter* is the most common bacterial pathogens isolated from respiratory samples. It is also the most common pathogens in the study of Li– min wang et al. in china Haemophilus influenzae and Staphylococcus aureus (Wang et al., 2016) and in the study of Salman Khan et al. (2015), which were consistent with the results of our study.

The results obtained from the pattern of antibiotic resistance in this study indicate that Acinetobacter spp. have the highest resistance to Amikacin, Meropenem and Cefepime. Also, *Klebsiella pneumonia* showed maximum resistance to Amikacin and Ceftazidime. In other studies, different patterns of antibiotic resistance have been reported. In a study conducted by Ghafouri et al. (2015) in Imam Reza hospital at Bojnurd, the highest resistance rate was observed in Acinetobacter, which 100% of the cases were resistant to Amikacin, Ciprofloxacin, Gentamicin.

In the study Imani et al. (2015) at the Baqiyatallah hospital, 100% of isolated *klebsiella* species, showed resistance to the Amikacin and Amoxicillin. Whereas, according to the results of Golam Sarower Bhuyan, 100% of *klebsiella pneumonia* species had resistance to the Azithromycin (Bhuyan et al., 2017). According to the studies, antibiotic resistance in different regions of Iran and the world is different due to the genetic variation of pathogens and the difference in antibiotic use.

To prevent the rise of bacterial resistance, the determination of the resistance pattern and sensitivity by antibiogram method for bacterial pathogens is necessary and should be taken from the experimental or unnecessary prescription of antibiotics and treat the patient at the right time. This research has the highest prevalence of infection in the intensive care unit, especially the surgical ICU and stroke ICU. The intensive care unit (ICU) is one of the high - risk areas for respiratory infections because of the severity of the disease and increased hospitalization (Kayaaslan, 2016). So, it is very important to identify the underlying factors of infection in the ICU and control and prevent them, and Ventilation.

Conclusion

We found that RTIs accounted for 27.5% of total hospital infection. Due to the high prevalence of respiratory infections, especially in the special care unit and the importance of control, prevention and treatment of appropriate antibiotics in order to reduce the costs of hospital and death in these infections is essential in this study.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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