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Bacterial Etiology of Acquired Community Pneumonia Among Yemeni Patients Whose Diagnosed Clinically as A Pulmonary Tuberculosis Patients

Anas A. Al-Mahbashi[1], Abdullah Y. Al-Mahdi[1], Ahmed Y. Al-Jaufy[2] and Ahmed Y. Al-jamrah[3]

1 Department of Biology, Faculty of Science, Sana'a University, Yemen.
2 Department of Microbiology. Faculty of Medicine, Sana'a University, Yemen.
3 Modern Hospital, Sana'a, Yemen.

ABSTRACT

This study was conducted to determine the incidence of bacterial pneumonia among Yemeni patients whose diagnosed clinically as a pulmonary tuberculosis infection attending the National Tuberculosis Control Center in Sana'a city, Yemen.

All patients were out patients and sent to the laboratory for laboratory investigation. Patient's age ranged from 6 to 56 years and were from both sexes.

Three hundreds and eighty eight sputum samples were collected from the patients, stained and cultured on the appropriate media. Sociodemographic and health information were collected using questionnaire filled by the patients.

Results showed that the rate of infection by Mycobacterium tuberculosis was 13/388 (3.4%) whereas the infection by bacterial pneumonia other than tuberculosis was 166/388 (42.8%).

Isolated bacterial etiologies were; Staphylococcus aureus (17.5%), Streptococcus pneumonia (12.4%), Klebsiella pneumonia (9.8%), and Pseudomonas aeruginosa (3.1%).

Pneumonia was most predominant among the age group 46-55 years and occurred more commonly among females (44%) than males (41.4%). There was statistically significant correlation between family size and pneumonia infection but the correlation between pneumonia and other predisposing illness like diabetes mellitus, arthritis, Kidney and liver diseases were not significant.

Keywords: Pneumonia, Yemeni, Bacteria, Infection, Tuberculosis.

INTRODUCTION

Pneumonia is one of the most common causes of morbidity and mortality worldwide, particularly in developing countries where it kills more than 1.6 million people each year (UNICEF, 2006 and WHO, 2011).

Bacterial pneumonia is the most important complication of the lower respiratory tract and classified as either community acquired or nosocomial infection (El Sheikh, *et al*., 1998 and Garner, *et al*., 1988).

Although, children under five years and elderly patient are the most susceptible groups affected by the infection, there are some predisposing factors including uncontrolled diabetes mellitus, arthritis, urinary disease and liver disease (Gilbert, *et al.,* 2010; Joseph and Mazgred, 2008; and Masria, 2008).

Pneumonia currently accounts for 20% of annual deaths in low-income countries compared to only 4.3% in high-income countries (Black, *et al.,* 2010).

Yemen is considered one of the largest countries in southern Arabia both in area and in population (24,407,000). However, according to income, most of the population is below the poverty line.

Pneumonia has been studies poorly in Yemen. One study in Al-Sabe'en Hospital, Sana'a-Yemen, among children under 5 years suffering from acute respiratory tract infection, reported a mortality rate of 221/2554 (8.7%) and mostly among infants under 6 months of age (Banajeh, *et al.,* 1998) and (Abdo, *et al.,* 2006).

According to latest report by WHO, (2010) Yemen was classified in the countries where almost no observable decline in infectious diseases including respiratory tract infection.

This study was carried out to determine the prevalence of bacterial etiologies pneumonia among patients whose suffering from pneumonia disease and diagnosed clinically as a pulmonary tuberculosis infection. The effect of sociodemographic factors on the disease were investigated.

METHODS

Ethical consideration

This study approved by the university ethics committee. Consents was obtained from the each participants or their legal guardian before enrollment in the study.

It was carried out during a period of six months, starting in February - September 2011.

Samples collection

A total of 388 early morning sputum samples were collected from patients referring the National Tuberculosis Control Center in Sana'a city-Yemen.

Demographic information was obtained from the patients through a questionnaire containing parameters including; presence of other diseases, family size and income. Patients' age ranged from 6-95 years and were from both sexes.

Sputum samples were collected in sterile, screw cap containers.

The expectorated sputum was obtained by asking the patient to cough deeply into the container.

Part of specimen was inoculated into Blood Agar with 10% human blood, Chocolate Agar with 10% human blood, and MacConkeys Agar (Oxiod, UK) and incubated at 37 ºC

aerobically and anaerobically for 24-48 hours for detection of pathogenic bacteria that cause pneumonia (MacFaddin, 2000).

Isolated bacteria were identified by colony morphology, hemolytic characteristics, lactose fermentation, Gram stain and biochemical reactions including catalase and coagulase tests for Gram-positive cocci and oxidase, citrate utilization test, urease, for Gram-negative bacteria (Cheesbrough, 2006).

The confirmation of identified isolated bacteria was accomplished using automated technique Vitek 2 compact biomriex, following the procedure described by the manufacturer (bioMerieux Inc. Hazelwood, MO, USA).

The other part of specimen was processed for diagnosis of *Mycobacterium tuberculosis.* Direct smears were prepared from the samples and stained by Ziehel-Nelseen stain for detection of acid fact bacilli (AFB), all samples that yield positive AFB were cultured on special egg based solid media (Ogawa) medium according to the National Tuberculosis Institute (NTI) program and Japan International Cooperative Agency (JICA) in Yemen.

Statistical analysis

The data were coded, tabulated and analyzed using SPSS program version (11.5). Relative risk (RR) was calculated to detect ratio of incidence among different groups $P < 0.05$ was used as the cut-off level of significance.

RESULTS

This cross sectional study was included 388 patients, whom 181 were males (46.6%) and 207 were females (53.4%). Their age ranged from 6 to >56 years with a mean age of 38.7 years and a standard deviation (SD) of ± 18.2 years (Table 1).

The rate of incidence by *M.tuberculosis* was 13/388 (3.4%) whereas infection by other bacterial pneumonia was 166/388 (42.8%) and the disease affecting all age groups with highest prevalence rate among age group 46– 56 years (56.6%) with significant in $p< 0.05$ as describe in (Table 1).

Table 1: Prevalence of pneumonia infection according to the age

Age/years	Total (n = 388)		Positive pneumonia (n= 166)		RR	χ^2	*P*
	NO	%	NO	%			
6 -15	27	7	12	44.4	1.04	0.03	0.98
16 -25	96	24.7	39	40.6	0.93	0.14	0.7
26 -35	68	17.5	28	41.2	0.95	0.09	0.87
36 – 45	61	15.7	25	41	0.95	0.86	0.45
46 – 55	53	13.7	30	56.6	1.4	4.8	0.02
≥56	83	21.4	32	38.6	0.88	0.77	0.37
Crude Total	**388**	**100**	**166**	**42.8**			

$\chi^2 \geq 3.84$, $P < 0.05$ (Significant), RR >1 (at risk).

Staphylococcus aureus was the most commonly isolated bacteria (17.5%), followed by *Streptococcus pneumonia* (12.4%), *Klebsiella pneumonia* (9.8%) and *Pseudomonas aeruginosa* (3.1%) which present in table (2).

Table 2: Distribution of bacterial species other than *Mycobacterium tuberculosis* causing pneumonia among patients.

Staphylococcus aureus		*Streptococcus pneumonia*		*Klebsiella pneumonia*		*Pseudomonas aeruginosa*		Total	
No	%	No	%	No	%	No	%	No	%
68	17.5	48	12.4	38	9.8	12	3.1	166	42.8

A strong relationship between pneumonia incidence and the rate of individual income rate compared with size of family, which clear present in table (3)

Table 3: Effect of family size and income rate risk factors on the incidence of pneumonia.

Character		**Positive pneumonia**		**Negative pneumonia**		**Total**		**X^2**	**OR**	**P**
Family Size	1-3	NO	%	NO	%	NO	%			
		19	40.4	28	59.6	47	12.1	0.12	0.9	0.727
	4-7	57	39.6	87	60.4	144	37.1	0.96	0.8	0.328
	>8	90	45.7	107	54.3	197	50.8	1.4	1.3	0.241
Income	Medium	96	38.6	153	61.4	249	64.2	5.1	0.6	0.024
	Low	70	50.4	69	49.6	139	35.8	5.1	1.6	0.024

Statistically no significance correlation between the occurrence of bacterial pneumonia among predisposing illness listed diseases and patients not suffering from those underlying diseases which shown in table (4).

Table 4: Effect of co factors on the incidence of pneumonia.

Character	**Positive pneumonia**		**Negative pneumonia**		**Total**		**X^2**	**OR**	**95% CI**	**P**
	No	%	No	%	No	%				
Diabetes mellitus	9	2.3	12	3.1	21	5.4	0.000	1.5	0.499-4.521	0.470
Arthritis	4	1.0	5	1.3	9	2.3	0.010	0.181	0.017-1.882	0.152
liver disease	1	0.3	8	2.1	9	2.3	3.776	0.162	0.020-1.309	0.050
Renal insufficiency	4	1.0	6	1.6	10	2.6	0.038	0.581	0.125-2.710	0.490
Chi-square , OR =Odds ratio ,95%CI =confidence intervals ,P = P Vale = X^2										

*$\chi^2 \geq 3.84$, $p < 0.05$ (Significant), OR >1 (at risk).

DISCUSSION

Pneumonia is the sixth leading infectious cause of death in young and older age particularly in developing countries worldwide (Black, *et al.,* 2010). In Yemen, there has been inadequate information on the prevalence of bacterial causing pneumonia among Yemeni patient.

Although all patients were suffering from acute respiratory tract infection and diagnosed clinically as a pulmonary tuberculosis out patients and sent to the National Tuberculosis Control Center which followed to the Ministry of Health in Sana'a city the Capital city-Yemen for confirmatory the diagnosis. But the results yielded that only 13/388 (3.4) was infected by *M.tuberculosis* .

The rate of prevalence of bacteria causing pneumonia other than *tuberculosis* was (42.8%). This prevalence rate was high and nearly similar to that reported from India in 2004 (Shailaja, *et al*., 2004), Southern Estonia in 2006 (Leesik, *et al.,* 2006) and Iran in 2010 (Hashemi, *et al.,* 2010).

In Yemen the low health services, absence of medical health insurance, and high rate of population poverty increasing the size of infection.

We found that the higher prevalence of pneumonia were noted in the age group 46-55 years and this result was highly statistically significant with value of $p< 0.029$.

This result was different from that observed by Alghamdi in the Western region of Saudi Arabia which they found that most affected age group was 26-45 years (Alghamdi, *et al*., 2009) and results reported from Finland and UK in which the peak of bacterial pneumonia occurred in very old patients over age of 60 years (Hashemi, *et al.,* 2010 and Leesik, *et al.,* 2006).

Staphylococcus aureus was the most commonly isolated bacteria (17.5%), followed by *Streptococcus pneumonia* (12.4%), *Klebsiella pneumonia* (9.8%), *Pseudomonas aeruginosa* (3.1%). This result was nearly similar to a previous study reported in Yemen (Abdo, *et al.,* 2006).

Regarding to the income rate highest percentage of infection was found in the medium and low-income rate with a percentage of 50.4% and 38.6% respectively. This result can be explained the medium income individuals had better chance to the health services than low-income individuals, which might be reflected in our result.

In addition, this result insured us that the low rate incidence by tuberculosis among the medium income patients because tuberculosis is considered the disease of the poor.

The high rate of bacterial pneumonia infection in association with Co factors was found in Diabetes mellitus with percentage 2.3% followed by renal insufficiency with percentage 1% and arthritis with percentage 1%. All these results were not statistically significant with value $p<0.47$, $p<0.152$, respectively except for renal insufficiency $p<0.052$.

This result was nearly similar to that reported in Finland in 2001, with Diabetes mellitus 8% and liver disease 0.7% (Jokinen, *et al.,* 2001).

Our results were different from the result reported from Finland and Spain in which arthritis, diabetes mellitus (DM), liver disease or renal insufficiency found to be significant risk factors of contracting bacterial pneumonia (Lim, *et al*., 2001; Nagalingam, *at al*., 2005; and Arancibia, *et al*., 2002).

CONCLUSION

The prevalence rate of bacterial pneumonia infection among suspected TB patients was high and is roughly similar in both sexes. The most commonly isolated bacteria were *Staphyllococcus aureus* and *Streptococcus pneumoniae.*

Family size rate is important factor contributed to the occurrence of the disease significantly.

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البكتيرية المسببة لالتهاب الرئة بين المرضى اليمنيين واللذين تم تشخيصهم سريرياً كمرضى مصابين بمرض السل الرئوي

أنس المحبشي[1] ، عبدالله المهدي[1] ، أحمد الجوفي[2] ، أحمد الجمرة[3]

1- قسم علوم الحياة ، كلية العلوم ، جامعة صنعاء ، اليمن
2- قسم الاحياء الدقيقة، كلية الطب ، جامعة صنعاء ، اليمن
3- المستشفى الحديث ، صنعاء ، اليمن

ملخص

تم اجراء هذه الدراسة بغرض تحديد معدل انتشار البكتيريا المسببة لالتهاب ذات الرئة بين المرضى المترددين على المركز الوطني لمكافحة الدرن في العاصمة صنعاء-اليمن. جميع المرضى هم غير مقيمين في المستشفيات وقد تم تشخيصهم سريريا كمرضى مصابين بالسل الرئوي وارسالهم الي المختبر التابع للمركز الوطني لمكافحه الدرن بغرض التأكد من اصابتهم بالبكتيريا المسببة لمرض السل. تم جمع 388 عينة بصاق من المرضى من الجنسين حيث كانت أعمارهم تتراوح ما بين ست الي ستة وخمسون عاما من مختلف المناطق في اليمن. المعلومات الشخصية والحالة الاقتصادية والمعيشية والتاريخ المرضي للمرضى تم جمعها من خلال تعبئه الاستبيان الخاص بالبحث بواسطة المرضى. تم زراعة جميع عينات البصاق على الأوساط الزراعية المختلفة واستخدام الصبغات التفريقية للتعرف على انواع البكتيريا المسببة لالتهاب ذات الرئة باستخدام تقنية معيارية. اظهرت النتائج إن معدل انتشار البكتيريا المسببة للسل الرئوي كانت 388/13 (3.4%) بينما الإصابة بالبكتيريا المسببة لالتهاب ذات الرئة كانت 166/388 (42.8%). وان أكثر البكتيريا حدوثا هي*Staphylococcus aureus* (17.5%). *Klebsiella* pneumonia (12.4%), *Streptococcus pneumonia* (9.8%) and *Pseudomonas aeruginosa* (3.1%)

كان معدل الإصابة بين الاناث (44%) أعلى من الذكور (41%) واعلى نسبه للإصابة كانت في الفئة العمرية ما بين (46 -55) سنه. كما أظهرت النتائج ان هناك علاقة بين معدل الإصابة بالتهاب ذات الرئة ومعدل عدد افراد الاسرة كانت علاقة ذات دلاله إحصائية بينما العلاقة بين معدل الإصابة ووجود أمراض أخرى مثل مرض السكري وامراض الكلى والكبد والتهابات المفاصل لم تكن ذات دلاله إحصائية.