حالات بعض الأنواع البكتيرية الأكثر شيوعاً في مرضى التليف الكيسي في جدة، المملكة العربية السعودية

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مستخلص. يُعد فقدان التدريجي لوظائف الرئة بسبب الاستجابة الالتهابية للاستعمار البكتيري السبب الرئيسي لوفيات مرضى التليف الكيسي. هناك حاجة إلى فهم أكبر لهذه الالتهابات البكتيرية لتحسين إدارة أمراض الرئة. كان الهدف من هذا البحث عزل البكتيريا المرتبطة بمرضى التليف الكيسي وتعريفها كيميائياً. وتمت مقارنة ٢٥ عزلة بكتيرية من مرضى التليف الكيسي مع ٢٤ عزلة من مرضى غير التليف الكيسي. تم عزل أربعة أنواع مختلفة في هذه الدراسة. *A. baumannii*، *K. pneumoniae*، *S. aureus*، *P. aeruginosa*. في الختام، أظهرت هذه النتائج أن مرضى التليف الكيسي في جدة لديهم أنواع بكتيرية Bacterial Species غير شائعة لدى مرضى التليف الكيسي.

الكلمات المفتاحية: الإصابة، الشائعة، جنس البكتيريا، التليف الكيسي، المرضى.

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nosocomial infections [23]. *A. baumannii* isolates have a propensity to readily develop resistance to second and third generation antibiotics such as cefotaxime, ciprofloxacin, and giving rise to therapeutic problems [24] As next-generation antibiotics are being developed to overcome problem of resistance against available antibiotics, *A. baumannii* are developing mechanisms to resist newer antimicrobials. In this study, *A. baumannii* isolates showed resistance to both old and new generation antibiotics.

CONCLUSIONS

In Conclusion, in this investigation, our results show that CF patients in Jeddah had uncommon species i.e. *A. baumannii* and *K. pneumoniae*.

Conflict of interest

The authors declare no conflicts of interest.

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DISCUSSION

CF is the most common lethal inherited disease in white persons [10]. Chronic airway inflammation and infection are the greatest causes of morbidity and mortality in CF patients [11]. Lungs of CF patients are often colonized or infected in infancy and early childhood with organisms, such as *Staphylococcus aureus* and *Haemophilus influenza*, that may damage the epithelial surfaces, leading to increased attachment of, and eventual replacement by *P. aeruginosa* [12]. Approximately 30,000 Americans have CF, and there are an estimated 1,000 new cases diagnosed each year (Cystic Fibrosis Foundation) and there are more than 5,000 registered CF patients in the UK [13]. The incidence of CF in Saudi Arabia was reported to be 1 in 4243 children [6]. The Microbiological analysis of clinical specimens has relied traditionally on cultivation prior to identification, have gained widespread acceptance for the study of bacterial communities in samples [14]. The data obtained in this study found that *P. aeruginosa* is present in 56% (14 of 25) of CF samples and 37.5 % (9 of 24) in non CF samples, being the highest rate of colonization in agreement with Cystic Fibrosis Foundation Report, USA, in 2006 and Cystic Fibrosis Foundation Report, UK, in 2010. *S. aureus* was isolated from 16% of CF samples and 16.64 % of non CF samples. As reported in previous studies on the prevalence and antimicrobial susceptibility of bacterial isolates from CF patients in USA, Germany, and South America, we found that *S. aureus* and *P. aeruginosa* are the most frequent pathogens in this population [15]. In 2010, the prevalence of *S. aureus* was highest (70.7%) among children and in older age the prevalence of *S. aureus* isolates declined as the prevalence of *P. aeruginosa* increased. *A. baumannii* is an unusual organism in CF patients [16]. In this study *A. baumannii* was

presented in 16% of CF samples (4 of 25) and 37.5% in non-CF samples (9 of 24). In comparing this result with study in the USA in 2010, *A. baumannii* was found in 5 patients out of 53 U.S patients, which indicated the infrequency of this species in these patients. There is a paucity of reports regarding colonization of *K. pneumoniae* in CF patients [17, 18]. Its present in 12% of CF samples (3 patients) and 8.32 % in non-CF samples (2 patients), it was the lowest prevalent microorganism isolated from our patients. In contrasts with this result, *K. pneumoniae* was the second most pathogen isolated from CF patients in Brazil [19]. Antibiotic therapy reduces the morbidity of CF lung disease. Although the treatment of lung infection in CF patients is based on the patient's age, the colonizing organisms, and the severity of the patient's pulmonary exacerbation, choosing antibiotic according to the resistance pattern of the strains is highly recommended [20]. The following antibiotic susceptibility results were observed in this study; *P. aeruginosa* isolates recorded a high resistance for Ampicillin 95% and Augmentin 95.6 then Ceftriaxone 69.44%, Aztreonam, 60%, and Cefotaxime 52%. The *P. aeruginosa* isolates were most susceptible to Meropenem 78%, Imipenem 78%, and Ceftazidime 60%. The susceptibility to Meropenem and Imipenem was higher in another study, Meropenem 82%, and Imipenem 84% [21]. The differences of susceptibility patterns between this and other studies may be related to variations in the isolated strain and the use of infection control practices. The *S. aureus* isolates showed 100% sensitivity to vancomycin, teicoplanin, and cefoxitin (a measure of methicillin resistance). The susceptibility test results showed ampicillin and Augmentin to be the least effective agents with 75% bacterial resistance, this has been widely reported for *S. aureus* from various sites of healthy subjects [22] and

CRO	8	4	2	8	1	0	4	0	0	8	1	0	2	1	0	0	2	0	0	0	0	0	0	0
TZP	2	9	3	7	2	0	4	0	0	8	1	0	2	1	0	1	1	0	0	0	0	0	0	0
CTX	5	7	2	7	1	1	4	0	0	8	0	1	2	0	1	0	1	1	0	0	0	0	0	0
FEB	3	10	1	7	1	1	4	0	0	8	1	0	2	1	0	0	2	0	0	0	0	0	0	0
MEM	1	12	1	3	6	0	4	0	0	8	1	0	0	3	0	0	2	0	0	0	0	0	0	0
KF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	2	1
TS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	0
PG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	2	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	3	1	0
CD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2	2	0
TEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0
OX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	0
VA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0

AP: Ampicillin AUG: Augmentin GM: Gentamicin
 FOX: Cefoxitin KF: Cephalothin TS: Cotrimoxazole
 AK: Amikacin CAZ: Ceftazidime ATM: Aztreonam.
 PRL: Piperacillin. IMI: Imipenem. CIP: Ciprofloxacin.
 CRO: Ceftriaxone. TZP: Piperacillin +Tazobactam.
 CTX: Cefotaxime.

FEB: Cefebime. MEM: Meropenem. AUG: Augmentin
 AP: Ampicillin GM: Gentamicin FOX: Cefoxitin
 KF: Cephalothin PG: Penicillin E: Erythromycin
 CD: Clindamycin OX: Oxacillin TEC: Teicoplanin
 V: Vancomycin S= Sensitive I= Intermediate
 R= Resistant

Table 3: MIC of bacterial isolates and its Sensitivity in CF.

	<i>P. aeruginosa</i>			<i>A. baumannii</i>			<i>K. pneumoniae</i>			<i>S. aureus</i>		
	R	S	I	R	S	I	R	S	I	R	S	I
AK	39.06	43.4	17.36	76.92	23.07	0	20	80	0			
IMI	4.34	95.6	0	76.92	23.07	0	0	100	0			
MEM	4.34	95.6	0	76.92	15.4	7.7	0	100	0			
CTX	43.4	34.7	8.68	76.92	23.07	0	0	60	40			
CAZ	39.06	30.38	0	76.92	23.07	0	0	100	0			
FEB	21.7	65.1	13.02	76.92	23.07	0	20	80	0			
TZP	52.08	30.38	17.36	76.92	23.07	0	20	80	0			
GM	0	100	0	100	0	0	0	100	0			
TEC										0	100	0
AUG										37.5	62.5	0
OX										0	100	0
CD										12.5	75	12.5
PG										0	100	0
FOX										0	100	0
GM										12.5	87.5	0

FOX: Cefoxitin PG: Penicillin CD: Clindamycin OX: Oxacillin GM: Gentamicin AK: Amikacin CAZ: Ceftazidime
 IMI: Imipenem. TZP: Piperacillin +Tazobactam. CTX: Cefotaxime. EB: Cefebime. MEM: Meropenem. S= Sensitive
 I= Intermediate R= Resistance

P17	M	Sputum	<i>P. aeruginosa</i>	<i>A. baumannii</i>
P18	M	Sputum	<i>P. aeruginosa</i>	<i>K. pneumoniae</i>
P19	M	Sputum	<i>K. pneumoniae</i>	<i>A. baumannii</i>
P20	M	Sputum	<i>A. baumannii</i>	<i>P. aeruginosa</i>

P= Patient G= Gender M=Male F=Female * Patient has 2 isolates.

P. aeruginosa=*Pseudomonas aeruginosa* *S. aureus*=*Staph aureus* *K. pneumoniae*=*Klebsiella pneumoniae* *A. baumannii* = *Acinetobacter baumannii*

–Figure 1 Disk Diffusion Assay test

Table 2. Antibiotic Sensitivity in CF and Non-CF Isolates

Antibiotics	<i>P. aeruginosa</i>						<i>A. baumannii</i>						<i>K. pneumoniae</i>						<i>S. aureus</i>					
	No.CF Isolates			No. Non CF Isolates			No.CF Isolates			No. Non CF Isolates			No.CF Isolates			No. Non CF Isolates			No.CF Isolates			No. Non CF Isolates		
	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I	R	S	I
AP	13	1	0	9	0	0	4	0	0	8	1	0	3	0	0	2	0	0	3	1	0	4	0	0
AUG	13	1	0	9	0	0	4	0	0	8	1	0	1	1	1	1	1	0	3	1	0	2	0	2
GM	4	8	2	4	3	2	4	0	0	8	1	0	1	2	0	0	2	0	3	1	0	1	3	0
FOX	14	0	0	8	1	0	4	0	0	8	1	0	1	2	0	0	2	0	4	0	0	4	0	0
KF	14	0	0	9	0	0	4	0	0	8	1	0	1	2	0	0	2	0	2	2	0	1	2	1
TS	10	4	0	8	1	0	4	0	0	8	1	0	1	2	0	0	2	0	1	3	0	0	4	0
AK	10	2	2	2	5	2	4	0	0	8	1	0	1	1	1	0	2	0	4	0	2	2	0	0
CAZ	2	11	1	5	3	1	4	0	0	8	1	0	2	1	0	1	1	0	0	0	0	0	0	0
ATM	2	10	2	6	1	2	4	0	0	8	1	0	2	1	0	0	2	0	0	0	0	0	0	0
PRL	7	7	0	7	2	0	4	0	0	8	1	0	2	0	1	1	1	0	0	0	0	0	0	0
IMI	2	12	0	2	6	0	3	1	0	8	1	0	0	3	0	0	2	0	0	0	0	0	0	0
CIP	4	10	0	4	5	0	4	0	0	9	0	0	1	2	0	0	2	0	0	0	0	0	0	0

antibiotic resistance. Some samples of *Pseudomonas aeruginosa* could strongly resist some antibiotics such as KF, FOX, AP, AUG, TS, AK followed by other isolated strains from CF samples, Table (2) and Fig. (1). In the case of *Acinetobacter baumannii* samples, most isolates were resistant to all used antibiotic except one sample was sensitive to IMI as indicated in Table (2) and Fig. (1). The antibiotic resistance patterns of *Klebsiella pneumonia* also indicated that most of the strains are resistant to most of the used antibiotics. Strains also are intermediate resistant as indicated in Table (2). *S. aureus* Gram- positive samples were found to resist most of the used antibiotics except FOX, PG, TE and VA; some samples were sensitive to commonly used antibiotics as indicated in Table (2). Results also indicated that the bacterial isolates from non- CF patients are more sensitive than strains obtained from CF patients for most of the used antibiotics.

MICs method (Revise highlighted text, Where's MIC values in the text or table 3)

The use of instrumentation for (MIC) can standardize the reading of end points and often produce susceptibility test results in a shorter

period than manual readings because sensitive optical detection systems allow detection of subtle changes in bacterial growth. The Micro Scan Walk Away (Siemens Healthcare Diagnostics) is a large self-contained incubator/reader device that can incubate and analyze 40–96 microdilution trays and it was used in this study. The Gram-positive isolates were tested for **susceptibility** against seven different antibiotics and data is shown in Table (3). All Gram-negative isolates were exposed to different antibiotic and data is shown in Table (3). Results indicated that *S. aureus* samples resisted GM with 87% then CD and 62% but it was sensitive to PG and TEC 100%. *P. aeruginosa* was sensitive to Gm with 100% and sensitive to IMI and MEM with 95%, but it was resistant to TZP with 52% and CTX with 43%. *A. baumannii* was the most resistant strain for all used antibiotics with 76% and it was resistant to GM with 100%. *K. pneumoniae* was sensitive to GM, CAZ, IMI, and MEM with 100% then AK, FEB and TZP with 80% (Table 3, Where's the MIC value).

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Table 1 Bacterial Species in Cystic Fibrosis and Non-Cystic Fibrosis Patients

NO.	Gender	Specimen	Cystic Fibrosis	Non-Cystic Fibrosis
			Bacterial species	Bacterial species
P1	F	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P2	F	Sputum	<i>S. aureus</i>	<i>S. aureus</i>
P3	F	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P3*	F	Sputum	<i>S. aureus</i>	<i>P. aeruginosa</i>
P4	F	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P5	F	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P5*	F	Sputum	<i>K. pneumoniae</i>	<i>P. aeruginosa</i>
P6	M	Sputum	<i>P. aeruginosa</i>	<i>A. baumannii</i>
P7	M	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P7*	M	Sputum	<i>A. baumannii</i>	<i>A. baumannii</i>
P8	M	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P9	M	Sputum	<i>P. aeruginosa</i>	<i>S. aureus</i>
P10	M	sputum	<i>S. aureus</i>	<i>A. baumannii</i>
P11	M	Sputum	<i>P. aeruginosa</i>	<i>P. aeruginosa</i>
P11*	M	Sputum	<i>K. pneumoniae</i>	<i>K. pneumoniae</i>
P12	M	Sputum	<i>A. baumannii</i>	<i>A. baumannii</i>
P12*	M	Sputum	<i>P. aeruginosa</i>	<i>S. aureus</i>
P13	M	Sputum	<i>S. aureus</i>	<i>S. aureus</i>
P14	M	Sputum	<i>P. aeruginosa</i>	<i>A. baumannii</i>
P15	M	Sputum	<i>A. baumannii</i>	<i>A. baumannii</i>
P16	M	Sputum	<i>P. aeruginosa</i>	<i>A. baumannii</i>

Center and King Abdul Aziz Hospital & Oncology Center from October 2011 until October 2012.

Culturing of patient samples:

All samples were cultured on the blood sheep agar, MacConkey agar, and Chocolate agar. Muller Hinton agar (Merck, Darmstadt, Germany) was used as a medium for the disk diffusion method.

Bacterial identification:

Gram staining was used to identify the pathogens in specimens and cultures. Biochemical reactions as catalase test oxidase test, API-20E test kit (Put company and catalog, and coagulase test by using rabbit plasma was performed.

Antibiotic susceptibility tests

The disk diffusion method was used as susceptibility pattern test. The test medium was Muller-Hinton agar (Merck, Darmstadt, Germany). For each isolate, one disk of each antibiotic was placed on a suitable distance on the surface of Mueller-Hinton agar plates inoculated with a bacterial suspension equivalent to 0.5 McFarland Standard and incubated for 24 h at 37°C. Disk testing was performed as recommended by CLSI (Clinical and Laboratory Standards Institute, 2005). The Antibiotics used were Amikacin 30 Mg, Ceftazidime 30 Mg, Aztreonam 30 Mg, Piperacillin 100 Mg, Imipenem 10 Mg, Ciprofloxacin 5 Mg, Ampicillin 10 Mg, Ceftriaxone 30 Mg, Piperacillin + Tazobactam 30Mg , Cefepime 30 Mg, Augmentin 30 Mg, Gentamicin 30 Mg, Cefoxitin 10Mg, Cephalothin 20 Mg, Cotrimoxazole 30 Mg, Cefotaxime 30 Mg, Colistin 10 Mg, Meropenem 30 Mg, Vancomycin 10 Mg , Teicoplanin 10 Mg, Erythromycin 30 Mg, Clindamycin 10 Mg, Oxacillin 10 Mg , Penicillin 30 Mg.

MIC determination for the isolates

MicroScan® Automated Microbiology System, type TN dried panel, Pos ID 2

(Siemens, Tarrytown, NY) was used for detecting the Minimal Inhibitory Concentration (MIC). The interpretation standards for MICs of Clinical and Laboratory Standards Institute (CLSI, 2013) were used to determine antibiotic susceptibility of bacterial isolates. The antimicrobials tested for Gram-negative bacteria were Cefepime, Ceftazidime, Cefotaxime, Gentamicin, Imipenem, Meropenem, Amikacin, and Piperacillin/Tazobactam. The antimicrobials tested for Gram-positive bacteria were Teicoplanin, Clindamycin, Gentamicin, Augmentin, Oxacillin, Fox and Penicillin.

RESULTS

Purification of bacteria isolated from CF and non-CF patients was carried out using the streaking method where 49 pure isolates (25 isolates from CF and 24 isolates from non-CF patients) were obtained. Identification of the pure isolates from patients was carried out using cell and colony morphology, Gram staining and biochemical profiling. (Table1). Results indicated that the most predominant strain in CF patients was *P. aeruginosa* (56%) followed by *S. aureus* and *A. baumannii* (16%) and *K. pneumoniae* (12%). Our data also indicated that the most common strains, identified in non-CF patients were *P. aeruginosa* and *A. baumannii* (37.5%) followed by *S. aureus* (16.64%) and *K. pneumoniae* (8.32%)

Antibiotic Resistance Patterns

Disk diffusion method:

Table 2 shows the antibiotic susceptibility of isolated and identified bacterial isolates against all used antibiotics for Gram-negative bacteria; *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Klebsiella pneumonia* and for Gram-positive *S. aureus* strain. Table 2 also revealed the number of Gram-negative CF *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, and *Klebsiella pneumonia* samples in their ability to develop

The Incidence of Some Most Common Bacterial Genus in Cystic Fibrosis Patients in Jeddah, Saudi Arabia

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Abstract. Progressive loss of lung function due to the inflammatory response to bacterial colonization is the leading cause of mortality in cystic fibrosis (CF) patients. A greater understanding of these bacterial infections is needed to improve lung disease management. This research was aimed to isolate and identify biochemically the bacteria associated with CF patients. 25 bacterial isolates from CF patients were compared with 24 isolates from non-CF patients. Four different species were isolated in this study; *P. aeruginosa*, *S. aureus*, *K. pneumoniae*, and *A. baumannii*. In conclusion, these results showed that CF patients in Jeddah had uncommon species in CF patients.

Keyword: Incidence, Common, Bacterial Genus, Cystic Fibrosis, Patients

INTRODUCTION

CF is a common recessive genetic disease, which affects the entire body, causing progressive disability and often-early death [1]. Over 1,500 mutations have been identified [2]. The primary organ system involved in CF is the lungs [3]. There are no clinical trials of chronic non-antibiotic maintenance pulmonary therapies in infants and preschool-aged children with CF, even though this is the population with the greatest potential for long-term benefit [4]. CF is most common in Ireland [5], Australia, New Zealand, the Middle East, Iran, Pakistan, India and Latin America. In Saudi Arabia, CF cases were reported to be 1 in 4243 children [6, 7]. It

affects persons without distinction of age or sex but can be asymptomatic in a great number of cases [8]. The ability of *P. aeruginosa* to persist and multiply in moist environments is of importance in cross-infection [9]. The aim of the present investigation was to determine the incidence of some most common bacterial genus in cystic fibrosis patients in Jeddah, Saudi Arabia.

MATERIALS AND METHODS

Collection of patients' samples:

The (CF) patients' samples were collected from King Faisal Specialist Hospital & Research Center (Pediatric Clinic) and the (non-CF) Patients' samples were collected from King Faisal Specialist Hospital research