Dedication

To

My mother Lool Mohammed, father Kaid Ahmed, my wife Ngeba Taher and my sons Mohammed and Omer

Abbreviation

AMC:	Amoxiclave (Augmentin)	LEV:	Levofloxacin
AML:	Amoxicillin	MET:	Methicillin
AMP:	Ampicillin	MH:	Minocycline
ATM:	Aztreonam	MW:	medical word
AZM:	Azithromycin	NOR:	Norfloxacin
C:	Chloramphenicol	OB:	cloxacillin
CAR:	Carbinicillin	OPD:	outpatient department
CAZ:	Ceftazidime	OX:	Oxacillin
CFC:	Cefaclor	PIP:	Piperacillin
CFR:	Cephadroxil	V:	Vancomycin
CIP:	Ciprofloxacin	TIC:	Ticarcillin
CL:	Cephalexin	T:	Tetracycline
CN:	Gentamicin	SXT:	Co-trimoxazole
CRO:	Ceftriaxone	S:	Sensitive
CTX:	Cefotaxime	R:	Resistance
E:	Erythromycin	M:	Moderate sensitive
FEP:	Cefepeme	UTI:	Urinary tract infection
ICU:	Intensive care unit	ESBL:	Extended spectrum β-lactamase
IMP:	Imipenem	SW:	Surgical word
OFX:	Ofloxacin	ICU	Intensive care unit

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Abstract

Antibiotics-resistant is becoming one of the major health problem all over the world. The emergence of antimicrobial resistance is not a new phenomenon and has become as a snowballed given rise to several serious health problems concern with economic, social and political implications**.** The study was designed to determine antibiotic resistance among common pathogenic bacteria in Yemen as well as genes responsible for Extended Spectrum β- Lactamase (ESBL) in these bacteria.

A total of 950 clinical specimens were collected from three major Cities in Yemen. Viz: 1. Sana'a, 2. Aden, 3. Taiz . These specimens were cultivated on bacteriological media for primary isolation. The isolates were identified according to standard methods. Antimicrobial susceptibility tests were assessed according to the Kirby–Bauer method. ESBL-producers were determined by using double disc synergy test and confirmed by cephalosporin/clavulanate combination disks. The ESBL genes were identified by Polymerase Chain Reaction.

Among investigated specimens, *Escherichia coli* was the most common pathogens 117 (30.8%), followed by *Klebsiella pneumoniae* 107 (28.2%), *Staphylococcus aureus* 95 (25.0%), *Pseudomonas aeruginosa* 40 (10.5%), and *Proteus* spp. 21(5.5%). Study on antibiotic sensitivity revealed that, 62.3%, 35.8% and 1.9% of the isolates were sensitive, resistant and moderate sensitive to all antibiotics used in this study respectively. On the other hand, it was found that the antibiotic resistance was statistically significant($p <$ 0.0001) among isolates of intensive care units and surgical ward.

The prevalence of ESBL producers was 35.4%. The difference between ESBL and non-ESBL producing pathogens was statistically significant ($p <$ 0. 007). *Klebsiella pneumoniae* was the most common organisms producing ESBL 51(47.9%), followed by *Escherichia coli* 45 (38.5%), *Proteus species* 2 (9.5%) and *Pseudomonas aeruginosa* 3(7.5%). The prevalence of ESBL production in Sana'a, Aden and Taiz was 43.9%, 24.6% and 27.9% respectively. Antibiotic resistance was seen significantly among ESBL producing isolates ($P <0.0001$). Moreover, antibiotic resistance of all ESBL- producing isolates were statistically significant to all tested antibiotic ($p < 0.0001$) except impenem.

The most frequent identified genes among (ESBL) isolates were *CTX-M* 73 (75.3%), followed by *TEM* 49 (50.5%) and *SHV* 15 (15.5%).

It was concluded that *Escherichia coli* were the most frequent pathogen in Yemen and the major causative agents of female urinary tract infections. *Staphylococcus aureus* was the most prevalence pathogen among outpatients with low resistance to antibiotics. *Klebsiella pneumoniae* was the predominant pathogens among inpatients with high resistance to antibiotics. The major source of ESBL-producers was intensive care units and surgical words. All isolates were susceptible to impenem (100%).

This study is considered as the first document on the prevalence of ESBLs and their epidemiological distribution in Yemen. More studies are needed to confirm and enrich the data obtained during this research.

المستخلص

إن مقاومة البكتريا للمضادات الحيوية أصبحت واحدة من المشكلات الصحية الرئيسة فيا كل بلدان العالم. وظهورها ليست ظاهرة جديدة إذ أنها ستبقى معنا وهي ذات خطر متزايد. وترتبط بالوضع الاقتصادي والاجتماعي والسياسي.

صممت هذه الدراسة بغرض تحديد نسبة مقاومة البكتيريا للمضادات الحيوية وتحديد جينات إنزيمات البيتالاكتام الممتدة الطيف المسئولة عن هذه المقاومة.

خلال فترة الدراسة تم جمع 950 عينة سريرية من ثلاث مدن رئيسية في اليمن وهي 1.صنعاء 2. عدن 3. تعز. استزرعت هذه العينات وتم عزل البكتيريا والتعرف عليها باستخدام الطرق المعيارية ومن ثم إجراء اختبارات حساسيات العزلات للمضادات الحيوية باستخدام طريقة كيربي-باير. تم الكشف عن البكتريا المنتجة لإنزيمات البيتالاكتام الممتدة الطيف بالطرق المعيارية باستخدام اختبار أقراص التآزر المزدوج والطرق التأكيدية باستخدام طريقة اختبار القرص المتمازج للسيفالوسبورين مع حامض الكلفيولينك ينما تم تحديد عن جينات إنزيمات ألبيتالاكتام الممتدة الطيف باستخدام تفاعل البلمرة المتسلسل.

من العينات التي شخصت كانت الاشريكية القولونية هي أكثر العزلات انتشاراً 117 (30.8%) يليها الكلبسيلة الرئوية 107 (28.2%) والمكورات العنقودية الذهبية 95 (25.0%) والزائفة الزنجارية 40 (10.5%) و المتقلبة 22 (5.5%).

أظهرت نتائج الدراسة أن نسبة 62.3% و 35.8% و 1.9% من العزلات كانت حساسة ومقاومة ومتوسطة التحسس على التوالي لكل المضادات الحيوية التي اشتملت عليها هذه الدراسة . من جهة أخرى فقد كانت المقاومة للمضادات الحيوية ذات دلالة إحصائية ($p < 0.0001$) في العزلات من قسم العناية المركزة والجراحة .

كانت نسبة انتشار البكتيريا المنتجة لإنزيمات البيتالاكتام الممتد الطيف 35.4% وكان الفرق بين البكتيريا المنتجة وغير المنتجة لإنزيمات البيتالاكتام الممتد الطيف له دلالة اصحصائية ($p < 0.0001$). كانت الكلبسيلة الرئوية أكثر العزلات منتجة لإنزيم اليتالاكتام 51 (47.7%) يليها الاشريكية القولونية 45 (38.5%) و المتقلبات 2 (9.5%) والزائفة الزنجارية 3 (7.5%). كما وجد نسبة انتشار البيتالاكتام في كل من مدينة صنعاء وعدن وتعز 43.9% و 24.6% و 27.9% على التوالي.

مقاومة المضادات الحيوية كان له ارتباط ذو دلالة إحصائية في العزلات المنتجة لإنزيم البيتالاكتام الممتد الطيف ($P<0.0001$) . نتائج هذه الدراسة أظهرت أن كل البكتيريا المنتجة لإنزيم البيتالاكتام الممتد الطيف كانت لها دلالة إحصائية في مقاومة المضادات الحيوية ($p < 0.0001$) باستثناء للامبينيم.

كان جينات *CTX-M* أكثر الجينات إنتشاراً بين العزلات 73 (75.3%) يليه *TEM* 49 (50.5%) وأخيرا *SHV* 15 (15.5%).

يستنتج من هذه الدراسة أن الإشريكية القولونية أكثر العزلات إنتشاراً في اليمن وأهم العوامل الممرضة لالتهابات المجاري البولية. كما أن المكورات العنقودية المذهبة أكثر إنتشاراً في أوساط الحالات المرضية من خارج المستشفيات وأقلها مقاومة للمضادات الحيوية. بينما الكلبسيلة الرئوية كانت أكثر إنتشاراً داخل

المستشفيات والمسببة للالتهابات الرئوية وأكثر العزلات مقاومة للمضادات الحيوية مقارنة بالأنواع الأخرى .
كل العزلات البكتيرية أعطت حساسية عالي للامبينيم (100%).
تعتبر هذه الدراسة أول توثيق لمعدل إنتشاراً أنزيم وجينات البيتالاكتام ولانتشار الوبائي له ففي اليمن. وان دراسات أخرى مطلوبة لتأكيد وإثراء المعلومات التي تم الحصول عليها في هذا البحث.

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