Bacterial Etiology of Lower Respiratory Tract Infection that Isolated from Tripoli University Hospital (TUH) Units in 2019

Basma Doro [a*], Elloulo T. BenDarif [b], Esraa Franka [a], Hanan Aqeehal [c] and Hiba Tibi [a]

[a] *Department of Microbiology and Immunology, Faculty of Pharmacy, University of Tripoli, Libya.*
[b] *Department of Microbiology and Immunology, Faculty of Medicine, University of Tripoli, Libya.*
[c] *National Center for Diseases Control, Ministry of Health Libya, Libya.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Introduction: Lower respiratory tract infection (LRTI) is one of the common major health problems, causing morbidity and mortality.
Aims: The study was conducted to determine the current trends of bacterial etiology of LRTIs among patients who attended the University Teaching Hospital (UTH) and their antimicrobial susceptibility profile with special interest on drug resistance.
Study Design: The study was a Cross sectional study. All patients' files were selected as diagnosed with LRTIs and their demographic data, other illness, prescribed treatment /antibiotic used previously.

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Corresponding author: E-mail: b.doro@uot.edu.ly;

Place and Duration of Study: This study is designed to collect data from files of lower respiratory tract infection patients following in units of university hospital in Tripoli.

Methodology: The study was conducted between January to December 2019. at the unit in university hospital in Tripoli city in Libya. Sputum samples of 465 patients with suspected LRTIs were received, after obtaining patients' informed consent and ethical clearance from the UNTH. The samples were collected and processed according to standard laboratory procedures.

Results: Of the total 465 sputum samples, 366 (78.7%) were positive for micro-organisms. Four main types of bacteria have been identified: *acinetobacter spp.* 25.6%, *Klebsiellla pneumoniae* 25.6%, *P. saeroginosa (*1.39%), *Candida (*9.03%). The distribution of lower respiratory tract infections within the hospital department indicated that the isolated strains revealed a higher infection rate of Gram-negative bacteria in the Pediatric Intensive Care Unit (PICU) and General Surgical Intensive Care Unit (GSICU) compared to other departments, with statistical significance. Notably, there was a significant difference in the infection rates of *Pseudomonas* in the Special Care Baby Unit (SCBU) with 7 cases, and in the Medical Intensive Care Unit (MICU) with 6 cases, as well as in the Neonatal Intensive Care Unit (NICU) with 2 cases. The infection rates for Candida and Streptococcus pneumoniae in the NICU were recorded at 2, 1, and 2, respectively, which were significantly different from those observed in other departments. The prevalence of antimicrobial resistance among Gram-negative and Gram-positive bacterial isolates indicated a very high resistance rate (98–100%) among *Acinetobacter baumanni*i isolates to various antibiotics including AK, AMC, ATM, CAZ, CRO, CIP, GN, MEM, TOB, PRL, and CZ. However, for SXT, the isolate demonstrated the highest sensitivity, with a resistance rate of less than 53%.

Conclusion: Understanding the variety of pathogens that cause lower respiratory tract infections (LRTIs) and their patterns of susceptibility to antibiotics, in addition to monitoring antibiotic resistance, is crucial for the effective management of LRTIs. This includes timely clinical and laboratory diagnoses, as well as the implementation of the appropriate treatment strategies.

ABBREVIATIONS

LRTIs : Lower Respiratory Tract Infection
CAP : Community-Acquired Pneumonia
GSICU : General Surgery Intensive Care Unit.
PICU : pediatric Intensive Care Unit
NICU : Neonatal Intensive Care Unit
SCBU : Special Care Baby Unit
MICU : Medical Intensive Care Unit
AK : Amikacin
AMC : Amoxycillin+calvulanic acid
ATM : Aztreonam
CAZ : Ceftazidime
CRO : Ceftriaxone
CIP : Ciprofloxacin
GN : Gentamicin
MEM : Meropenem
TOB : Tobramycin
PRL : Piperacillin
CZ : Cefazolin
SXT : Trimethoprim+sulfamethoxazole
FEP : Cefepime
CXM : Cefuroxime
FOX : Cefoxitin
DA : Clindamycin
E : Erythromycin
LEV : Levofloxacin

TIG : Tigecycline
VA : Vancomycin
TEC : Teicoplanin
TE : Tetracycline
OX : Oxacillin
P : Pinicllin
FA : Fusidic acid
LIN : Lincomycin

1. INTRODUCTION

lower respiratory tract infection (LRTI) is one of the widespread and reports for significant antibiotic use and health-care costs. It is neither reasonable nor cost-efficient to identify microbial aetiology in most patients who present with LRTI because of sampling challenges, limited access diagnostics and the limited clinical utility of receiving a result after empirical treatment decision has been made (Woodhead et al., 2011). LRTI are any infections in the lungs or below the voice box. These include pneumonia, bronchitis, and tuberculosis (Mizgerd, 2008). They are among the most common infectious diseases. in such cases are bacteria, with potential life-threatening complications. It accounts for 20-30 % of all hospital-acquired

contagions. They are characterized by high mortality of hospitalized patients (Aslam et al., 2018). It is also important to differentiate pneumonia from other respiratory infections. Pneumonia is suspected based on one of the clinical features of the following: new localized chest sign, dyspnea, tachypnea, tachycardia (pulse rate more than 100/min), or fever for more than 4 days (Woodhead et al., 2011).

Identification of etiological agents is the most effective approach to avoiding inappropriate antibiotic use, and that others as; the large number of the etiological factors that cause these infections, the unfavourable symptoms caused by particular pathogen, the increasing number of antibiotic-resistant bacteria and limited microbiological diagnostic capabilities (Aslam et al., 2018).

It is estimated that 2.74 million deaths worldwide occur each year due to LRTIs (Santella, 2021). The commonest LRTIs are acute bronchitis, acute trachea bronchitis, chronic bronchitis, and pneumonia, which account for 4.4% of all hospital admissions and are associated with high morbidity, mortality, and excessive health costs (Santella, 2021).

The microbial etiology of LRTIs and their susceptibility profile to antibiotics varies in different geographic regions. The most common bacterial agents of LRTIs are Gram-positive bacteria such as *Staphylococcus aureus* and *Enterococcus spp.*, and Gram-negative bacteria such as *Pseudomonas spp., Acinetobacter spp., Klebsiella pneumoniae,* and *Haemophilus influenzae* (Duan et al., 2020).

The current knowledge of bacterial etiology and their antimicrobial susceptibility pattern would help to choose the antimicrobial therapy for bacterial LRTIs, to limit the development of antimicrobial resistance and reduce overall management costs (Edition et al., 2019). However, the clinical presentation is usually not specific enough to make a firm etiologic diagnosis whether in the community or hospital setting. In almost all cases, eradication of causative agents requires initiation of antimicrobial therapy before obtaining culture report; however, during the last few years, the increase in antibiotic resistance has compromised the selection of empirical treatment (Sartelli et al., 2023) and how to choose an effective antimicrobial agent is a new challenge to the clinicians, as the composition and the

resistance to antimicrobial agents of infection pathogens was changing frequently. This trend is presumably due to the empirical administration of antibacterial therapy even before the availability of the culture results (Nwobodo et al., 2022). Various other factors also contribute to the emergence of resistance such as irrational use of antibiotics, transmission of resistant bacteria from patient to patient and from healthcare practitioners to patients and vice versa (Muteeb et al., 2023).

Nowadays, antibiotic resistance exerted by microorganisms against antibiotics is considered as a serious issue by global medicinal and research community (WHO, 2023). Therefore, the clinicians and microbiologists worldwide are focusing on knowledge and strategies to limit the development of antimicrobial resistance. Current knowledge of bacterial etiology and microbial susceptibility would help reduce the indiscriminate antibiotic use and result in better therapeutic outcome and decrease in development of resistance. Evidence showed that bacteriological more effective antibiotics can reduce overall management costs, particularly with respect to consequential morbidity and hospital admission. Therefore, the aim of this study was to describe the prevalence and patterns of antimicrobial sensitivity of microorganisms isolated from respiratory samples of patients with LRTIs, admitted to the T.U.H Hospital (Tripoli, Libya), to improve treatment protocols. The present study was conducted to determine the causative bacteria of lower respiratory tract infections (LRTIs) and their antibiotic resistance patterns among various units at Tripoli University Hospital (TUH), Tripoli-Libya. This study is significant to avoid misuse and overuse of antimicrobials that are the main drivers in the development of drug-resistant pathogens. In addition, the study may aid drug selection for successful empirical antibiotic therapy to reduce morbidity and mortality outcomes in TUH units.

2. MATERIALS AND METHODS

2.1 Study Design

The study was a Cross sectional study. All patients' files were selected as diagnosed with LRTIs and their demographic data including date of sample collection, sex of the patient, registration code number of the sample, other illness, prescribed treatment /antibiotic used previously.

2.2 Study Area

This study is designed to collect data from files of lower respiratory tract infection patients follow in TUH unit in university hospital in Tripoli city in Libya Some of extra data were taken from medical staff when required.

2.3 Period of Study

465 samples were collected from January to December 2019.

2.4 Data Statistical Analysis

The data was tested by using the Excel sheet.

3. RESULTS AND DISCUSSION

Prevalence of each bacterial isolates in TUH units: The incidence of lower respiratory tract infections (LTRIs) among patients in the sample collected from January 1, 2019, to December 31, 2019, revealed that out of a total of 465 samples, 366 (78.7%) tested positive for cultures. Among these 366 positive cultures, 332 (91%) were identified as Gram-negative bacteria, while 34 (9%) were classified as Gram-positive bacteria. The analysis included 137 sputum samples, 7 from bronchoaspirate, 70 from tracheal aspiration, and 251 from endotracheal tubes (ETT), all processed following standard microbiological protocols. The prevalence of bacteria isolated from throat swabs of patients at Tripoli University Hospital, indicating that 56% of the analyzed samples yielded cultures. Four

predominant bacterial types were identified: Acinetobacter spp. at 25.6%, Klebsiella pneumoniae also at approximately 25.6%, Pseudomonas aeruginosa at 11.39%, and Candida at 9.03%, with 4.9% showing no growth (Fig. 1). Notably, 71.62% of the organisms were isolated from patients within the hospital, with no significant difference (P > 0.05) compared to other patients.

Prevalence of *Acientobacter spp* and Klebsiella *spp* isolates that isolated from LRTI samples among various TUH units: The analysis of pathogens and their distribution concerning lower respiratory tract infections revealed that the isolated strains from various departments indicated a higher infection rate of Acinetobacter bacteria in the Special Care Baby Unit (SCBU) and Neonatal Intensive Care Unit (NICU), recorded at 19.3% and 15.2%, respectively, with a statistically significant difference. Conversely, the infection rate of Klebsiella spp. was lower in these departments, at 5% and 6%, respectively, also demonstrating statistical significance.

In other departments, the isolated strains showed that the infection rates of Acinetobacter bacteria in the General Surgical Intensive Care Unit (GSICU) and Pediatric Intensive Care Unit (PICU) were lower, at 14.3% and 13.5%, respectively, with a statistically significant difference noted. In contrast, the infection rates of Klebsiella spp. were higher in these sections, at 23% and 18%, respectively, which were significantly different from those observed in other departments.
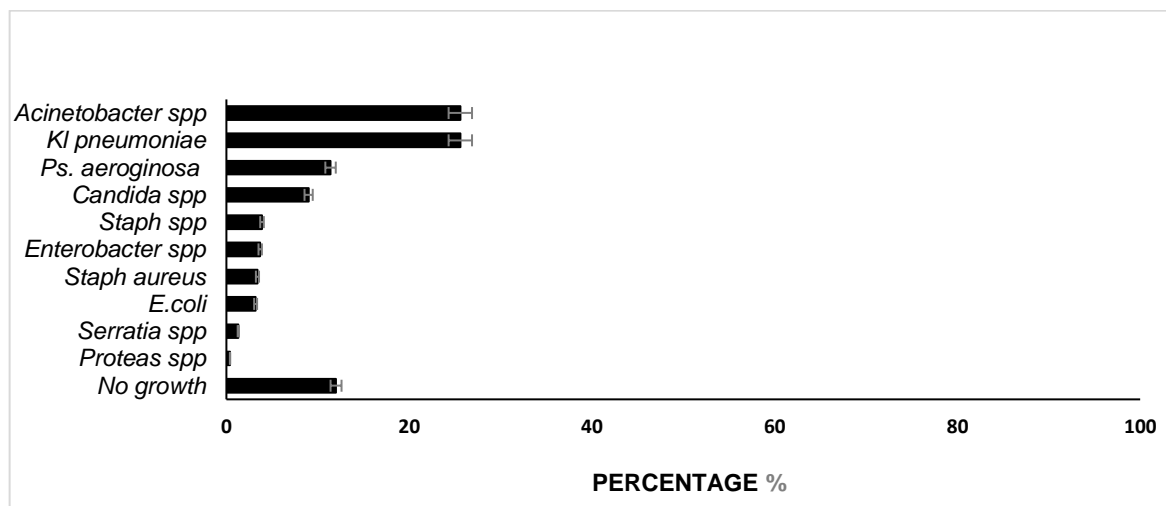

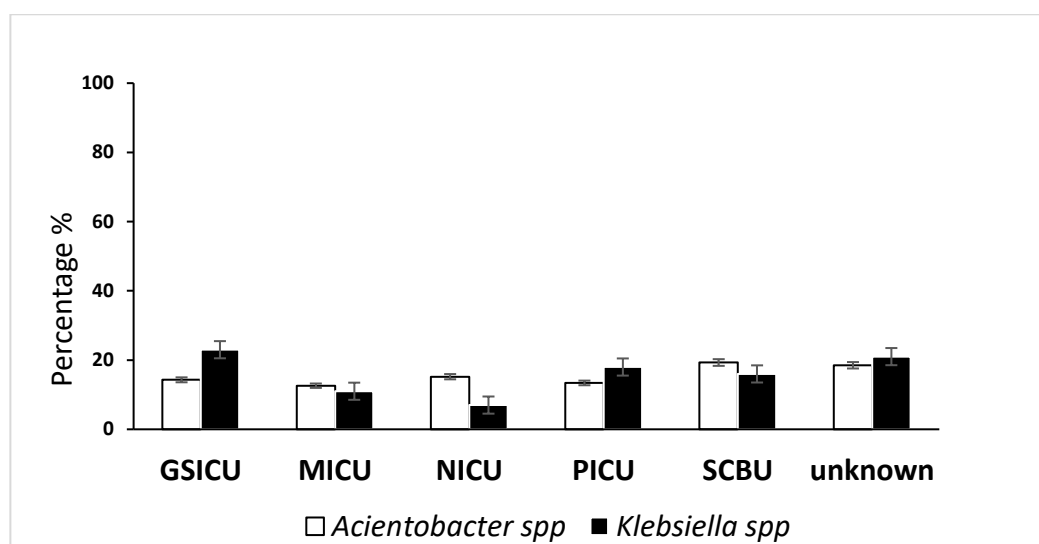**Fig. 1. Prevalence of isolated bacteria from LTRIs collected sample**

Fig. 2. The percentage of *Acientobacter* Spp and *Klebsiella pneumoniae*
LRTIs=Lower Respiratory Tract Infection, CAP=Community-acquired pneumonia, GSICU=General Surgery Intensive Care Unit., PICU=pediatric intensive care unit, NICU=Neonatal intensive care unit SCBU=Special Care Baby Unit, MICU=Medical Intensive Care Unit

Frequency of different bacterial isolates that isolated from LRTI samples among various TUH units: The analysis of Pathogens and Department Distribution concerning Lower Respiratory Tract Infection revealed that the isolated strains from each department, as illustrated in Fig. 3, indicated a higher infection rate of Gram-negative bacteria in the Pediatric Intensive Care Unit (PICU) and General Surgical Intensive Care Unit (GSICU), with rates of 34 and 24, respectively, demonstrating statistical significance. Conversely, the infection rates of Gram-positive bacteria were lower in these departments, recorded at 5 and 6, respectively, also showing statistical significance. Regarding opportunistic infection-related pathogens, the infection rates for Pseudomonas, Candida, Enterobacter spp., and Staphylococcus aureus in the PICU were 13, 9, 5, and 3, respectively, which were significantly different from those in other departments. In the GSICU, the infection rates for these pathogens were 7, 6, 4, and 4, respectively, again showing significant differences compared to other departments. Additionally, significant differences were noted in the infection rates of Pseudomonas in the Special Care Baby Unit (SCBU) at 7 and the Medical Intensive Care Unit (MICU) at 6, as well as in the Neonatal Intensive Care Unit (NICU) at 2. The infection rates for Candida and Streptococcus pneumoniae in the NICU were recorded at 2, 1, and 2, respectively, which were significantly different from those observed in other departments.

Prevalence of Antimicrobial Resistance in gram-negative bacteria associated with lower respiratory tract infections: The incidence of antimicrobial resistance in gram- negative bacteria associated with lower respiratory tract infections (LRTIs) is concerning. A strikingly high resistance rate, ranging from 98% to 100%, was noted among Acinetobacter baumannii isolates against various antibiotics, including AK, AMC, ATM, CAZ, CRO, CIP, GN, MEM, TOB, PRL, and CZ. In contrast, the isolate exhibited the highest sensitivity to SXT, with a resistance rate of less than 53% (refer to Table 1). Similarly, Acinetobacter species demonstrated a significant resistance rate between 86% and 100% against antibiotics such as AMC, ATM, CAZ, CRO, CIP, GN, MEM, TOB, and PRL, as well as CZ. However, for SXT and AK, the isolates showed notable sensitivity, with resistance rates below 32% and 41%, respectively (Table 1).

A significantly elevated resistance rate (66–100%) was noted among isolates of Klebsiella pneumoniae against the following antibiotics: AMC, ATM, CAZ, CRO, CIP, GN, SXT, TOB, PRL, and CZ. In contrast, the isolates exhibited the highest sensitivity to MEM and AK, with resistance rates recorded at less than 55% and 45%, respectively (Table 1). A similarly high resistance rate (67–100%) was identified in Klebsiella species isolates against AMC, ATM, MEM, CAZ, CRO, CIP, GN, SXT, TOB, PRL, and CZ, while AK demonstrated the greatest sensitivity, with a resistance rate below 37% (Table 1).

Table 1. Number of isolated and antibacterial sensitivity for gram negative bacteria

Bacterial species	(Number of isolates) Antibacterial drugs													
	AK	AMC	ATM	FEP	CAZ	CRO	CXM	CIP	GN	MEM	TOB	SXT	PRL	CZ
Acinetobacter baumannii	(55)76%	(47)100%	(37)100%	(50)100%	(63)97%	(67)100%	(34)100%	(62)90%	(63)81%	(54)93%	(62)86%	(40)53%	(63)98%	(16)100%
Acinetobacter species	(34)41%	(33)97%	(12)92%	(30)87%	(45)96%	(45)98%	(19)100%	(42)91%	(43)86%	(38)90%	(40)90%	(37)32%	(44)100%	(22)100%
Klebsiella pneumoniae	(29)45%	(14)86%	(9)56%	(25)76%	(26)73%	(28)71%	(8)88%	(27)67%	(27)63%	(29)55%	(26)77%	(22)66%	(27)85%	(11)91%
Klebsiella species	(83)37%	(56)95%	(47)100%	(67)97%	(81)96%	(81)98%	(48)96%	(71)77%	(77)78%	(81)67%	(79)87%	(46)67%	(74)97%	(22)96%
Pseudomonas aeruginosa	(51)18%	(22)100%	(25)24%	(40)70%	(52)77%	(47)100%	-	(51)30%	(47)28%	(49)33%	(50)38%	(25)96%	(40)60%	(0)100%
Pseudomonas species	(2)0%	(1)100%	(2)100%	(2)100%	(2)100%	(2)100%	(2)100%	(2)50%	(2)50%	(2)100%	(2)50%	-	(2)100%	-
Enterobacter aerogenes	(4)25%	-	(3)67%	(4)75%	(3)100%	(4)75%	(1)100%	(4)25%	(4)50%	(3)33%	(4)50%	(2)0%	(3)100%	(2)100%
Enterobacter cloacae	(7)29%	-	(1)100%	(6)100%	(6)100%	(5)100%	-	(6)50%	(7)86%	(7)29%	(7)71%	(4)100%	(6)100%	(4)100%
Enterobacter species	(4)25%	(2)100%	(2)50%	(3)33%	(4)50%	(5)80%	(3)67%	(6)50%	(6)67%	(4)25%	(6)67%	-	(6)67%	-
E.coli	(13)31%	(9)89%	(5)100%	(11)82%	(16)88%	(14)86%	(7)86%	(11)73%	(12)75%	(15)53%	(11)73%	(8)75%	(13)92%	(5)80%
Citrobacter frenndii	(1)100%	(1)100%	-	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	-
Proteus mirahills	(1)100%	-	-	(1)100%	(1)100%	(1)100%	-	(1)0%	(1)100%	(1)100%	(1)100%	(1)0%	(1)100%	(1)100%
Proteus Species	(1)0%	(1)0%	-	-	(1)0%	-	(1)0%	(1)0%	(1)0%	(1)0%	(1)0%	(1)0%	(1)0%	-
Serratia dcriferia	(1)0%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)100%	(1)0%	-	-
Serratia marcescens	(1)0%	(1)100%	-	(2)50%	(1)0%	(1)0%	-	(2)0%	(2)0%	(2)0%	(1)0%	(2)0%	(1)0%	-
Serratia Species	(2)50%	(1)100%	(2)50%	-	(2)100%	(3)67%	(1)100%	-	(2)50%	(3)67%	(1)100%	(2)100%	(3)100%	-

AK=Amikacin, AMC=Amoxycillin+calvulanic acid, ATM=Aztreonam, CAZ=Ceftazidime, CRO=Ceftriaxone, CIP=Ciprofloxacin, GN=Gentamicin, MEM=Meropenem, TOB=Tobramycin, PRL=Piperacillin, CZ=Cefazolin, SXT=Trimethoprim+sulfamethoxazole, FEP=Cefepime, CXM=Cefuroxime, FOX=Cefoxitin, DA=Clindamycin, E=Erythromycin, LEV=Levofloxacin, TIG=Tigecycline, VA=Vancomycin, TEC=Teicoplanin, TE=Tetracycline, OX=Oxacillin, P=Pinicllin, FA=Fusidic acid, LIN=Lincomycin

Table 2. Number of isolated and antibacterial sensitivity for gram positive bacteria

Bacterial species	(Number of isolates) Antibacterial drugs																	
	AMC	FOX	CRO	CIP	DA	E	CN_GN	LEV	TIG	TOB	SXT	VA	TEC	TE	OX	P	FA	LIN
Staphylococcus aureus	(9)100%	(13)23%	(5)80%	(12)58%	(8)25%	(6)33%	(13)38%	(5)40%	0%	(11)36%	(8)13%	0%	(13)23%	0%	(6)83%	(9)100%	(8)50%	0%
Staphylococcus haeolyticus	(3)100%	(2)100%	(3)100%	(4)75%	(7)43%	(5)80%	(7)100%	(4)100%	0%	(6)100%	(7)57%	0%	0%	(5)20%	(4)100%	(3)100%	(3)67%	0%
Staphylococcus warneri	-	(2)50%	-	-	(3)67%	(4)50%	(4)25%	(3)33%	0%	(4)25%	0%	(4)25%	(3)33%	(3)33%	(3)67%	(2)50%	0%	-
Staphylococcus epidermidis	(5)80%	(5)80%	(3)67%	(4)75%	0%	-	(5)40%	(1)100%	-	(4)100%	(3)67%	0%	0%	-	(2)100%	(5)80%	(1)100%	-
Streptococcus species	-	-	0%	(1)100%	0%	0%	0%	-	-	(1)100%	-	0%	0%	-	-	0%	-	-

AK=Amikacin, AMC=Amoxycillin+calvulanic acid, ATM=Aztreonam, CAZ=Ceftazidime, CRO=Ceftriaxone, CIP=Ciprofloxacin, GN=Gentamicin, MEM=Meropenem, TOB=Tobramycin, PRL=Piperacillin, CZ=Cefazolin, SXT=Trimethoprim+sulfamethoxazole, FEP=Cefepime, CXM=Cefuroxime, FOX=Cefoxitin, DA=Clindamycin, E=Erythromycin, LEV=Levofloxacin, TIG=Tigecycline, VA=Vancomycin, TEC=Teicoplanin, TE=Tetracycline, OX=Oxacillin, P=Pinicllin, FA=Fusidic acid, LIN=Lincomycin
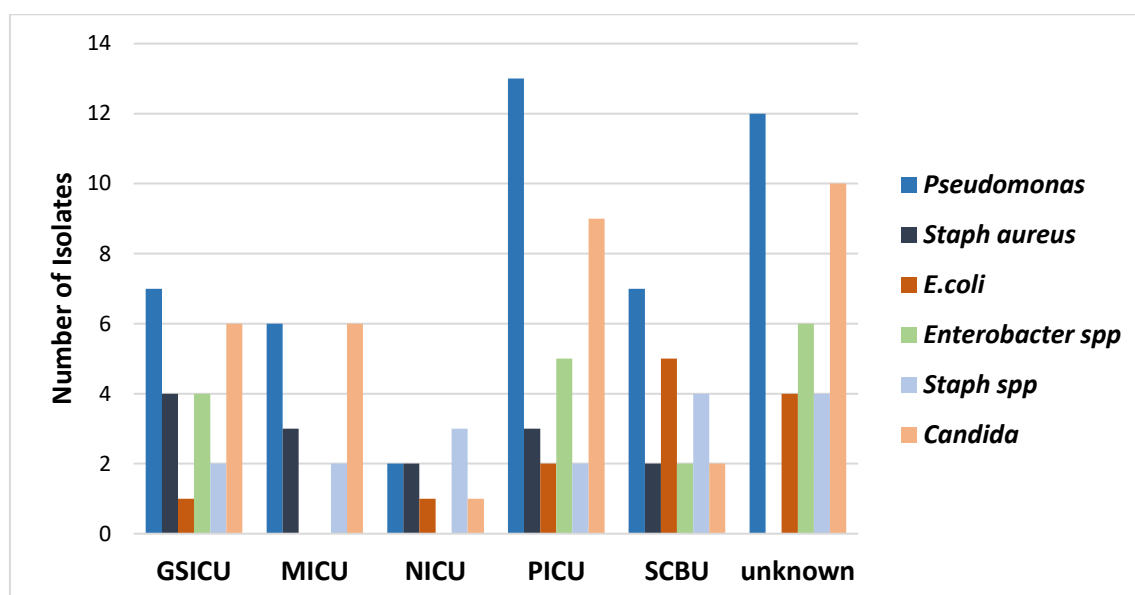
Fig. 3. The number of isolated bacteria
LRTIs=Lower Respiratory Tract Infection, CAP=Community-acquired pneumonia, GSICU=General Surgery Intensive Care Unit., PICU=pediatric intensive care unit, NICU=Neonatal intensive care unit SCBU=Special Care Baby Unit, MICU=Medical Intensive Care Unit

A notably high resistance rate (67–100%) was detected among isolates of Pseudomonas aeruginosa towards the antibiotics AMC, CAZ, CRO, SXT, and CZ. Conversely, the isolates displayed maximum sensitivity to AK, ATM, CIP, GN, MEM, TOB, and PRL, with resistance rates of less than 18%, 24%, 30%, 28%, 33%, 38%, and 60%, respectively (Table 1).

Prevalence of Antimicrobial Resistance in gram-positive bacteria associated with lower respiratory tract infections.

The data presented in Table 2 reveal a concerning pattern of antimicrobial resistance among gram-positive bacteria. Staphylococcus aureus exhibited high sensitivity to many antibiotics ((AMC,FOX,CRO,CIP,DA,E,CN_GN, LEV,TIG,TOB,SXT,VA,TEC,TE,P,FA,LIN)), but resistance to oxacillin (OX) suggests the potential presence of methicillin-resistant Staphylococcus aureus (MRSA). Staphylococcus haemolyticus and Staphylococcus epidermidis demonstrated high overall sensitivity, while Staphylococcus warneri showed moderate resistance to some antibiotics. Streptococcus species displayed limited data, but high resistance to all tested antibiotics was observed. These findings highlight the need for appropriate antibiotic stewardship and continuous monitoring of resistance trends to ensure effective treatment options for infections caused by these bacteria.

3.1 Discussion

The findings from our study highlight significant insights into the prevalence of bacterial pathogens associated with lower respiratory tract infections (LRTIs) at Tripoli University Hospital (TUH). Out of 465 samples collected, 78.7% demonstrated positive cultures, predominantly comprising Gram-negative bacteria (91%). This observation is consistent with global trends where Gram-negative organisms are commonly implicated in LRTIs, particularly in hospital settings. The results are similar to studies of Goel *et al.*, Veena *et al.*, Barsanti *et al.*, Santella et al., who found that the incidences of Gram-negative bacteria isolates were 92.2%, 93.0%, 97.4% and 72.5%, respectively (Goel et al. 2009; Veena et al., 2007; Barsanti and Woeltje, 2009; Santella 2021).

The data indicate that Acinetobacter spp. and Klebsiella pneumoniae were the most frequently isolated bacteria in our study, each constituting approximately 25.6% of the cultures. This finding aligns with other research that has shown these pathogens are often associated with healthcare-associated infections, particularly in intensive care settings (Shehabia et al., 2000; Mobarak-Qamsari, 2023). The predominance of Acinetobacter in the Special Care Baby Unit (SCBU) and Neonatal Intensive Care Unit (NICU) underscores the vulnerability of these patient

populations to severe infections, highlighting the need for stringent infection control measures in these critical care areas (Nayeri et al., 2023). Conversely, the lower prevalence of Klebsiella spp. in the SCBU and NICU suggests that while it remains a significant pathogen, its impact may be more pronounced in other departments, such as the General Surgical Intensive Care Unit (GSICU) and Pediatric Intensive Care Unit (PICU), where it exhibited higher infection rates of 23% and 18%, respectively. This variability in pathogen distribution across departments underscores the necessity for tailored approaches to infection prevention and management in different clinical settings (Banda et al., 2001; Ali et al., 2023). The study also reveals alarming rates of antimicrobial resistance among Gram-negative bacteria, with Acinetobacter baumannii isolates exhibiting resistance rates ranging from 98% to 100% against multiple antibiotics. This raises significant concerns regarding the management of infections caused by this organism, as noted in similar studies that highlight the rising resistance patterns (Sannathimmappa et al., 2021; Tarafdar et al., 2020). Notably, the high sensitivity to SXT (Trimethoprim-sulfamethoxazole) provides a potential treatment option, although the resistance patterns necessitate careful antibiotic stewardship (Falagas et al., 2015). Similarly, Klebsiella pneumoniae demonstrated significant resistance rates of 66–100% against commonly used antibiotics, further complicating treatment strategies. The high sensitivity to MEM (Meropenem) and AK (Amikacin) suggests these may be the preferred options in resistant cases, yet the emergence of resistance to these drugs remains a growing concern (Ayatollahi 2020). Regarding Gram-positive bacteria, Staphylococcus aureus showed high sensitivity to various antibiotics; however, the presence of methicillin-resistant strains (MRSA), indicated by significant resistance to oxacillin (OX), poses considerable challenges in treatment, similarly to a study by (Asghar, 2011, Khalid 2023). The resistance patterns observed in *Staphylococcus haemolyticus* and *Staphylococcus epidermidis* are also concerning, particularly in immunocompromised patients, emphasizing the need for ongoing surveillance and appropriate antibiotic use the results were line with Nicolosi et al., (2020).

4. CONCLUSION

This study reveals that a variety of pathogens are responsible for LRTI and antibiotics resistance has become a great public health issue. Gram-negative organisms showed increased resistance to routinely used antibiotics. Gram-positive organisms showed 100% susceptibility to vancomycin, linezolid, and clindamycin. Proper identification of the probable pathogens and their antibiotic susceptibility pattern can help our health professionals to choose the right antibiotic therapy and improve the outcome. Do not report everything that grows, knowledge of colonizers and contaminants in different clinical conditions is important.

CONSENT

The respondents' written consent has been collected and preserved by the author (s).

ETHICAL CONSIDERATION

The Study was approved and confirmed under the rules and regulations of research in the university hospital Tripoli-Libya. Therefore, at commencing the research point, ethical approval and authorization were issued while referring to the hospital.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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