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Original Article

Current Pattern of Respiratory Pathogens and Their Sensitivity in Low Socio-Economical Female Population of Tertiary Care Hospital

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ABSTRACT

Objective: To determine the current pattern and antimicrobial sensitivity of respiratory pathogens in low socio-economical female population reporting to tertiary care hospital.

Study Design: Cross-sectional study.

Place and Duration of Study: Microbiology department, Fauji Foundation Hospital, Rawalpindi Pakistan, from October 2021 to September 2022.

Methodology: The study was conducted on out-door and in-door female population presented with symptoms and signs of respiratory tract infections like fever, cough and dyspnea. The specimen included were nasal swab, throat swab, sputum, pleural fluid, tracheal tube culture and bronchial washings for culture and sensitivities.

Results: Among 290 above mentioned specimens that yielded the growth of bacteria, Pseudomonas aeruginosa was most frequently isolated i.e in 124(42.7%) followed by *Acinetobacter baumannii* in 63(21.7%), *Klebseilla* species in 28(9.6%), *Eschrechia coli* in 20(6.9%), *Methicillin resistant Staphylococcus aureus* (MRSA) in 18(6.2%), *Staphylococcus aureus* in 09(3.1%), and several other gram positive and gram negative organisms.

Being a part of developing country, it is one of the leading cause of frequent hospital visits and medications. Female population of low socio-economic ethnic group was most prevalent. Gram negative organisms were seen in highest percentages and were showing resistance to commonly used antibiotics like ampicillin, co-amoxiclav, cephalosporins, aminoglycosides, and quinolones.

Conclusion: To overcome the problem of multidrug resistance and for better treatment outcome, the results for culture and sensitivities should be consulted and relied upon. It gives us better insight towards the prevalent organisms in our set up and the effective treatment options for respiratory tract infections.

Keywords: Antimicrobial susceptibility test, Multidrug resistance (MDR), Respiratort tract infections.

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INTRODUCTION

Respiratory tract has an upper part comprising of nose, oral cavity, and larynx. Lower respiratory tract consists of trachea, bronchi and alveolus. There are several micro organisms that come in contact with the respiratory tract everyday with the process of inspiration and cause infections locally.[1] Pharyngitis, laryngitis, pneumonias and lung abcesses are some of its examples.

Respiratory tract diseases are one of the leading causes of illness and thus compromise the quality of life. They ranked at number 3 as a cause of fatality after cerebro-vascular and ischemic heart diseases.[2] It is among the top ten causes of death in Pakistan as well, according to the surveys conducted in different regions of Pakistan.[3,4]

There are so many factors involved in causing respiratory tract infections. They differ in different geographic distribution, seasons, weather conditions and with different co-morbidities like under-lying chronic obstructive diseases, diabetes, malignancies, inappropriate antibiotics and prolonged hospitalization.[5] There is a variation seen among different age groups as well, mostly ,because of difference in immune status and exposure to different environments and the difference goes on in their sensitivity patterns too.

Most commonly respiratory tract isolates are seen to be most resistant of all. It is because of the fact that these specimens are received from In patient ICU samples.[5,6] The bacterial isolates are already in antibiotic rich environment, and the patients are

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admitted for a longer periods of time.[6] All these factors contributes towards a cause of emergence of antibiotic resistant bacteria.[7]

More over the choices left for treating such infections are narrowed down with the passage of time.[8,9] Clinicians require culture and sensitivity of multi drug resistant bacteria to efficiently and promptly treat these infection.[10,11]

Empirical treatments are given to nearly all the patients . Most of the knowledge is based on the most common organisms prevalent locally.[12,13] Thus making the need to conduct studies, to collect local data about the organisms causing the diseases and their sensitivity patterns even more important.[14] Hand hygiene practices matters a lot in halting the inflation in disease incident, and to break the chain of transmission.

Added benefits are achieved rationalizing use of empirical broad spectrum antibiotics and that can be modified and adjusted according to the results of culture and sensitivity.[15-17] The study aimed to investigate the causative organisms causing respiratory tract infections among low socioeconomic female population and their sensitivity pattern.

METHODOLOGY

The present cross-sectional study was conducted in the department of Microbiology, Fauji Foundation Hospital, Rawalpindi Pakistan, over a period of one year from October 2021 to September 2022. Sample size was calculated using WHO sample size calculator taking confidence interval 95%, margin of error 5%, reported proportion of positive culture 33.5%.[1] The estimated sample size came out to be 290 isolates. Non-probability purposive sampling was employed.

Inclusion Criteria: All samples from indoor or out door patients presented with symptoms and signs of respiratory tract infections, like fever, cough, dyspnea and sputum production were included in this study.

Exclusion criteria: All duplicated samples were excluded as do patients already on antibiotic treatment. All male patients were also excluded.

After approval from Ethical Review Board of the Institution (No. 510/RC/FFH/RWP dated 16 August 2021), samples fulfilling study criteria were enrolled.

From the Microbiology laboratory, all the samples from respiratory tract which includes nasal swab, throat swab, sputum, pleural fluid, tracheal tube and bronchial washings were included in the study. Sputum and endotracheal specimens were checked for their quality. They were stained by Gram staining and were observed at low power field (10x) of microscope, for number of epithelial cells and number of neutrophils.[13] The specimens that showed less than 10 epithelial cells at low power field were taken as satisfactory and were proceeded further with all other samples.

These specimens were inoculated on culture medium using nichrome loop wire .Blood, MacConkey and Chocolate media were used for inoculation of specimens. Incubation conditions were 37 C in incubator for 18-24 hours. The growth thus yielded is further evaluated by colonial morphology, Gram staining and Biochemical tests like Catalase, Coagulase on Gram positive organisms and Oxidase, Indole, Urease, Carbohydrate fermentation, H2S production and Motility tests on Gram negative organisms in addition to API (Analytical Profile Index) BioMerieux Industry. For endotracheal secretion colonial count of $\geq 10^5$/ml is taken as significant count.

After identification of bacteria, their Antibiotic sensitivity was performed. The panel of antibiotics used for gram positive organisms was PEN(10µg), AMP(10µg), AMC(30µg), CLO(1µg), ERY(15µg), SXT(1.25/23.75µg), DOX(30µg), CIP(5µg), GEN(10µg), LZN(10µg), VAN(30µg) and CAP(10µg). (OxiodTM) and that for gram negative was AMP(10µg), AMC(30µg), CRO(30µg), CAZ(30µg), TZP(110µg), IMP(10µg), MER(10µg), CIP(5µg), SXT(1.25/23.75µg), GEN(10µg), AK(30µg), MIN(30µg), DOX(30µg), TGC(15µg), PB(50µg/300UI). (OxiodTM).

It was in accordance to the guidelines provided by CLSI 2022.[10,18] The antibiotic sensitivity was done by Modified Kirby-Bauer disc diffusion method on Muller-Hinton agar media and the plates were read for sensitivity or resistance next day after incubation at 37 C for 18-24 hours.[11]

Multidrug resistant organisms (MDR) are defined as the organisms which show resistance to more than one agents from three or more classes of antibiotics.

Data analysis was done by using software SPSS version 22 (SPSS Inc.,Chicargo, IL, USA) and Excel work sheets. Frequency of gram positive and gram negative organisms is described in a tabulated manner.

RESULTS

A total of 900 respiratory specimens were received, from October 2021 to Septembert 2022 at Microbiology laboratory, Fauji Foundation Hospital

Rawalpindi. Out of these 440(48.8%) yeilded growth and 460 sample showed no significant growth or normal upper respiratory tract flora. Total of 290(32.2%) samples were from the female patients.

The specimen included were nasal swab, throat swab, sputum, pleural fluid, tracheal tube and bronchial washing for culture and sensitivities. Table-I shows relative proportion of different types of positive samples in female population included in the study.

Table-I: Different types of Respiratory Specimens that Yielded Bacterial Growth and their Relative Proportion in the Study

Type of Specimen (culture)	Number (%)
Sputum	136(46.6%)
Tracheal tube	97(33.4%0
Bronchial wash	44(15.6%)
Throat swab	09(03%)
Pleural fluid	03(1.37%)
Nasal swab	01(0.03%)
Total	290(100%)

Among 290 above mentioned specimens that yielded the growth of microorganisms, *Pseudomonas aeruginosa* was most frequently isolated i.e in 124(42.7%) followed by *Acinetobacter baumannii* in 63(21.7%), *Klebseilla* species in 28(9.6%), *Eschrechia coli* in 20(6.9%), *Methicillin resistant Staphylococcus aureus* (MRSA) in 18(6.2%), *Staphylococcus aureus* in 09(3.1%). Table-II details different types of isolated organisms and their frequencies. Tables III and IV shows antibiotic sensitivity of gram positive and gram negative bacteria, respectively. All sensitivity results are according to Clinical and Laboratory Standards Institute (CLSI) 2022, 32nd Edition Supp. M 100 except Tigecycline, Fusidic acid and Polymixin B/ Colistin (EUCAST 2020).

to grow pathogens on ordinary culture media is always there as also predicted Jain *et al*.[12] In our study female predominance of 32% was observed ,in contrary to be seen in American, African and Lebanese regions.[1-12] Female of middle age group shows preponderance, mainly because the institution is the beneficiary one and mostly the families of retired Armed personnel are entertained.

Low socio economic ethnic group is popular one among all patients. As Pakistan is a third world country, financial problems are among the vital ones. Population presents late as health issues are their least priority because of more trivial issues like starvation and shelter.[20]

Table-II: Table Showing Different types of Microbial Isolated and their Percentages

Isolates	Number (%)
Pseudomonas spp.	124(42.7%)
Acinetobacter spp	63(21.7%)
Klebsiella spp	28(9.6%)
E.coli	20(6.9%)
MRSA	18(6.2%)
Staphylococcus aureus	09(3.1%)
Moraxella spp.	07(2.4%)
Enterococcus spp	04(1.3%)
S.pneumoniae	03(1.2%)
Corynebacterium spp	03(1.2%)
H.influenzae	03(1.2%)
Serratia spp.	01(0.3%)
VRE	02(0.6%)
Candida spp	02(0.6%)
Others	03(01%)
Total	290(100%)

Age group most commonly at risk for developing clinical respiratory illnesses were middle age group 32-47 years , and this observation is in

Table-III: Gram–Positive Organism Sensitivity Pattern to Different Antibiotics

		% Resistant											
Gram-positive Organisms	**n**	**PEN**	**AMP**	**AMC**	**CLO**	**ERY**	**SXT**	**DOX**	**CIP**	**GEN**	**LNZ**	**VAN**	**CAP**
Staphylococcs aureus	09	07	01	01	00	01	02	01	08	01	00	00	01
MRSA	18	23	22	10	23	00	02	05	20	18	00	00	02
Enterococcus species	04	00	06	03	NT	04	IR	00	06	IR	02	04	00
VRE	01	NT	NT	NT	NT	NT	NT	NT	NT	NT	01	01	NT
Streptococcus pneumoniae	03	NT	01	NT	NT	NT	05	01	03	NT	NT	NT	NT
Corynebactem species	03	01	04	01	NT	04	03	02	04	02	02	02	02

KEY TABLE: PEN: Penicillin, AMP: Ampicillin, AMC: Amoxicillin, CLO:Cloxacillin, ERY:Erythromycin, CLI:Clindamycin, SXT: Co-trimoxazole, DOX:Doxycycline, FD: Fusidic Acid, CIP:Ciprofloxacin, GEN:Gentamicin,AK:Amikacin, LZN:Linezolid, VAN:Vancomycin, RIF:Rifampicin, TEC:Tecoplanin, NT = Not tested.

DISCUSSION

In our study, 32.2% of the clinical isolates showed in- significant growth or normal upper respiratory tract flora, the possibility of wrong sampling technique, temperature sensitive isolates and difficult

accordance with the studies conducted in North America, Ethopia,[1,14] and in contrary to the ones showing elder age group as the most prevalent age group in studies conducted among East Mediterereriaean coast.[15-17] Mostly leisure lifestyle,

Table-IV: Gram Negative Organism Sensitivity Pattern to Different Antibiotics

		% Resistant														
Gram-Negative Organisms	**n**	**AMP**	**AMC**	**CRO**	**CAZ**	**TZP**	**IMP**	**MER**	**CIP**	**SXT**	**GEN**	**AK**	**MIN**	**DOX**	**TGC**	**PB**
Pseudomonas spp.	124	IR	IR	IR	42	13	53	49	57	IR	61	51	IR	IR	IR	01
Acinetobacter spp	63	IR	IR	53	40	06	47	46	46	43	43	45	09	39	12	08
Klebsiella spp	28	IR	22	21	17	02	22	22	27	19	23	21	13	24	07	02
E.coli	20	34	30	26	10	02	20	20	30	27	21	20	11	24	02	02
H.influenzae	03	01	NT	NT	NT	NT	NT	NT	02	02	NT	01	NT	NT	NT	NT
Serratia spp.	01	IR	IR	IR	IR	NT	02	02	02	02	02	02	NT	NT	NT	IR
FUNGAL ORGANISM		**FLU**														
Candida species	02	01	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

The figures in the boxes represent the % resistant isolates against particular antibiotic.
KEY TABLE: AMP:Ampicillin, AMC: Amoxicillin, CFM:Cefipime, CRO: Ceftriaxone, CAZ:Ceftazidime,TZP:Piperacillin-Tazobactam, IMP:Imipenem,MEM:Meropenem, CIP:Ciprofloxacin, SXT: Co-trimoxazole,GEN: Gentamicin,AK: Amikacin, MIN: Minocycline, DOX:Doxycycline,TGC: Tigecycline,PB: Colistin , FLU = Fluconazone, NT= Not tested.

smoking and other bad hygiene practices fuels up to cause respiratory illnesses in this age group.

The current study showed most prevalent organisms to be *Pseudomonas aeruginosa* (42.7%) followed by, *Acinetobacter baumannii* (21.7%), *Klebseilla species* (9.6%), *Eschrechia coli* (6.9%), *Staphylococcus aureus* (3.1%), *MRSA* (6.2%), *Moraxella spp.* (2.4%), *Enterococcus fecalis* (1.3%), *Streptococcus pneumoniae* (1.2%), *Corynebacterium species* (1.2%), *Haemophilus influenza* (1.2%), *Serratia spp*. (0.3%) and *Candida species* (0.6%). This is in contrast to the North America.[14] Bushra *et al.*, showing data of Pakistan and indicating *Streptococcus pneumonia* and *Haemophilus* species to be prevalent.[5] similar finding is observed in Ethopia such as in Jimma *et al.*, and Felege Hiwo *et al.*, and in accordance with studies of Egypt, Nepal, South India.[1-19]

Staphylococcus aureus in this study showed 3.1% prevalance, showing lower values as seen in the studies conducted in Felege Hiwot 14.4%,[12] Jimma 10.5%[13] and Arba minch 8.8%.[21] Central India shows similar results.[13]

In this study *Pseudomonas aeruginosa* showed highest rate of susceptibility to Colistin, Sulzone, and Amikacin. It showed resistance to Gentamicin, Ciprofloxacin and Imipenem. These findings are in contrast to Alemitu *et al.*,[12] and the similar order of prevalence is seen by Thomas *et al*., Jafari *et al*., Shestha *et al*., and Mishra *et al*.[12-14]

On further evaluation it was observed that 47% of the isolates showed multi drug resistance i.e they were resistant to at least three classes of antibiotics that are Penicillins, Cephalosporins and Carbapenems. Majority of the strains were gram negative and were isolates from critical care units. Similar finding is observed by Gebre *et al*.[1]

LIMITATION OF STUDY

Male group could not be commented upon,so review about general population could not be given.

Time constrants,larger number of specimens could not be dealth with

RECOMMENDATION

Empirical treatments for the respiratory tract infections should be in accordance to culture and sensitivity results of respective Hospital.

CONCLUSION

Multi drug resistant bacteria are the threat to the mankind .They are not only increasing the mortality rates but are also a cause of decreased quality of life, increased hospital stays and financial burden .Most of these strains are isolated from admitted patients from critical care units.

It is the Need Of The Hour to keep strict check and balance on the use of the antibiotics. and for respiratory tract infections it is important that it is to be ascertain that the illness is of bacterial origin and appropriate empirical treatment is to be started which can be modified afterwards according to culture and sensitivity results. Infection control practices play a vital role in limiting the spread of infections, thus hospitals must have infection control SOPs and Committees.

Culture and sensitivity reports will help in the decision of choosing right antibiotic treatment and will help in reducing the incidence of mis-use and over-use of antibiotics.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SI & FK: Data acquisition, data analysis, critical review, approval of the final version to be published.

ZAA & SS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

HA & UF: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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