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Original Article

Bacteriological Profile and Antibiogram of Lower Respiratory Tract Infection (LRTI) in a Tertiary Teaching Hospital of Bangladesh.

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Abstract:

Introduction: Lower respiratory tract infection (LRTI) is one of the common infectious diseases in the world especially in the developing countries. This causes a large financial burden to healthcare system too.

Methodology: This was a cross-sectional descriptive study to find out the infection patter and antibiogram of sputum of LRTI patients. Study place was Sylhet Women's Medical College Hospital. Study period was 6 months. Sample size 684.

Results: This positive samples were 60.4% of all the samples. Male and female percentage were 61.1% and 38.9% respectively. The age of the nearly half (49.56%) of the participants were 60 years or above. Commonest isolated Gram-positive bacteria was Staphylococcus aureus (37.87%) and commonest Gram-negative bacteria was Klbsiellaspp (23.39%). Commonest sensitive antibiotics were Piperacillin & Tazobactam (93.86%), Imipenem (93.71%) and Meropenem (90.64%).

Conclusion: Use of proper antibiotic is essential to prevent antibiotic resistance. Institutional and regional antibiogram can help in decision making for selecting empirical antibiotic.

Key words: Lower Respiratory Tract Infection (LRTI), Antibiogram, Bacteriological Profile.

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Introduction:

When infection affects lungs, primary bronchi and trachea then it is termed as lower respiratory tract infection (LRTI).[1] The commonest clinical features of LRTI is coughing but most frequently fever, shortness of breath, fatigue and generalized weakness may coexist.[2] In several developing countries this condition leads to a huge health issues and this is one of the major cause of mortality and morbidity. Globally more than 5 million people died of this infection in both hospital and community set up.[3]

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There are different kinds of pathogens are responsible for this infection including bacteria, virus, fungi, atypical pathogens and parasites.[4] The average in patient mortality of LRTI is nearly 11.7% though in the critical care set up it goes up to 45%. If not treated timely then this infection may lead to systemic infection and eventually may cause multi organ involvement to increase mortality.[5] Antibiotic abuse is one of the key cause of antibiotic resistance, so using proper antibiotic is very important. Antibiotic can be selected by either empirical selection or by etiological diagnosis. An empirical selection of antibiotic is usually made by experience of non-effective treatment, clinical data and clinical experiences. Etiological selection is done by the microbial culture and sensitivity test.[6] Common non M. tuberculosis isolated bacteria responsible for are Streptococcus pneumoniae, Haemophilusinfluenzae, Klebsiella pneumonia and Pseudomonas aeruginosa.[7]

The aim of this study was to find out the bacteriological profile and antibiotic sensitivity of sputum of LRTI patients by the culture and sensitivity (C&S) test in a tertiary medical college hospital of Bangladesh.

Methodology:
This was a cross-sectional descriptive study to find out the bacteriological profile and antibiogram of sputum samples of Sylhet Women's Medical College Hospital (SWMCH) of Bangladesh. Data were collected the Infection Prevention and Control (IPC) committee of SWMCH as a part of internal audit with the guidance of hospital Director. The study period was from October 2022 to March 2023. The study place was Sylhet Women's Medical College Hospital. Sputum culture reports of 6 months (October 2022 to March 2023) was retrieved from medical information system (MIS) of hospital. All the sputum sample culture and sensitivity tests were done by standard protocol in a same laboratory of SWMCH by the same technician under the guidance of the same microbiologist. Positive reports were sorted. The name, gender, age, referring department, isolated bacteria and sensitivity reports of antibiotics were documented in an Excel data collection master sheet. Chi-square test was done for qualitative variables and descriptive mathematical calculation was done to find out the percentages.

Results:
A-total 1133 samples were analyzed. Out of these 684 culture sensitivity results were positive for isolating bacteria. This positive samples were 60.4% of all the samples.

Table-1: According to gender (N=684)

Gender	Number	Percentage	p-value (chi-square test)
Male Female	418 266	61.1% 38.9%	< 0.001

Table-1 shows male predominance with significant difference ($p<0.001$)

Table-2: According to age frequency (N=684).

Age frequency	Number	Percentage
0 – 19	27	3.95
20 – 29	79	11.55
30 – 39	58	8.48
40 – 49	61	8.92
50 – 59	120	17.54
60 – 69	164	23.98
70 and above	175	25.58

Table-2 describes distribution according to age frequency. Nearly half of the participants were more than 60-year age group with a predominance in the above 70-year age group. Lowest number of participants age were less than 20 years.

Table-3: According to referral departments:

Department	Number	Percentage
ICU	37	5.41
Medicine	636	92.98
Nephrology	6	0.88
Surgery	4	0.58
OBG	1	0.15

Table-3 displays the number and percentage of the referral departments of the participants. Nearly 93% participants were referred from the Medicine department.

Table-4: According to isolated organisms (N=684)

Name of bacteria	Number	Percentage
Staphylococcus aureus	259	37.87
Streptococcus pneumonia	215	31.43
Klebsiellaspp	160	23.39
Pseudomonusspp	37	5.41
Acinettobacter	10	1.46
Coagulase neg Staphylococcus	02	0.29
Salmonella spp	01	0.15

Table-4 shows the number and percentage of the isolated bacteria. Staphylococcus aureus (37.87) was the highest isolated bacteria followed by streptococcus pneumonia (31.43%) and Klebsiella species (23.39%).

Table-5: According to sensitive antibiotics (N=684).

Antibiotics	Number	Percentage
Piperacillin &Tazobactam	642	93.86
Imipenem	641	93.71
Meropenem	620	90.64
Amikacin	511	74.71
Doxycycline	494	72.22
Gentamicin	463	67.69
Levofloxacin	417	60.96
Ceftriaxone	411	60.09
Cefuroxime	399	58.33
Vancomycin	369	53.95
Ciprofloxacin	367	53.65
Amoxicillin &Clav Acid	346	50.58
Cefaclor	335	48.98
Colistin	333	48.68
Ceftazidime	285	41.67
Linezolid	248	36.26
Azithromycin	204	29.82
Cefixime	152	22.22

Table-5 illustrates that Piperacillin &Tazobactam, Imipenemand Meropenem had more than 90% sensitivity. Next sensitive antibiotics were Amikacin, Doxycycline and Gentamicin. Among the other antibiotics Levofloxacin, Ceftriaxone, Cefuroxime, Vancomycin and Ciprofloxacin showed more than 50% sensitivity.

Table-6: According to resistant antibiotics.

Antibiotics	Number	Percentage
Cefixime	532	77.78
Azithromycin	480	70.18
Linezolid	436	63.74
Ceftazidime	399	58.33
Colistin	351	51.32
Cefaclor	349	51.02
Amoxicillin &Clav Acid	338	49.42
Ciprofloxacin	317	46.35
Vancomycin	315	46.05
Cefuroxime	285	41.67
Ceftriaxone	273	39.91
Levofloxacin	267	39.04
Gentamicin	221	32.31
Doxycycline	190	27.78
Amikacin	173	25.29
Meropenem	64	9.36
Imipenem Piperacillin &Tazobactam	43	6.29
	42	6.14

Table-6 states that Cefixime, Azithromycin and Linezolid were the top three resistant antibiotics. Other antibiotics had more than 50% resistant were Ceftazidime, Colistin and Cefaclor.

Table-7: Top 5 sensitive antibiotics for most frequent bacteria.

Bacteria	Sensitive antibiotic	Percentage
Staphylococcus aureus	Piperacillin &Tazobactam	97.30
	Imipenem	95.75
	Meropenem	91.89
	Amikacin	82.24
	Doxycycline	79.15
Streptococcus pneumonia	Imipenem	97.21
	Meropenem	94.42
	Piperacillin &Tazobactam	94.42
	Doxycycline	79.53
	Ceftriaxone	73.49
Klebsiellaspp	Imipenem	90.00
	Piperacillin &Tazobactam	89.38
	Meropenem	88.75
	Amikacin	83.75
	Colistin	72.50
Pseudomonusspp	Colistin	94.59
	Piperacillin &Tazobactam	89.19
	Amikacin	78.38
	Ciprofloxacin	78.38
	Levofloxacin	78.38

Table-7 illustrates that in the both gram positive bacteria Piperacillin &Tazobactam, Imipenem and Meropenem showed more than 90% sensitivity. In the both gram negative bacteria Piperacillin &Tazobactam had nearly 90% sensitivity. Colistin was sensitive in nearly 95% of Pseudomonusspp isolated cases.

Discussion:

According to the study of Sharma et al streptococcus pneumonia was sensitive to the commonly prescribed medicines like quinolones, cephalosporins and macrolides.[8] In their study E. coli was the commonest gram negative bacteria which was significantly resistant to cephalosporins, quinolones and aminoglycosides but was significantly sensitive to carbapenems and colistin.

This organism was resistant to piperacillin-tazobactam by 37.6%. In this study Staphylococcus aureus was the commonest isolated bacteria and streptococcus was the second common. Streptococcus were highly sensitive to Imipenem, Meropenem and Piperacillin &Tazobactam. In contrast to the study of Sharma et al in this study Klebsiella was the commonest Gram-negative bacteria.

Agmy G et al published their study on 360 cases. They found S. pneumonia (36%) commonest isolated bacteria.[9] Higher percentage of sensitivity was detected in levofloxacin, macrolids and cefepime. On the other hand, doxycycline and cephalosporins were mostly resistant. Other common isolated bacteria were methicillin-resistant staphylococcus aureus (23%), Klebsiella pneumonia (14%) and polymicrobials in 12%. Among the other sensitive antibiotics vancomycin, ciprofloxacin and moxifloxacin were in higher percentage. In this study common sensitive antibiotics were Imipenem,Meropenem and Piperacillin &Tazobactam and common resistant antibiotics were Cefixime, Azithromycin and Linezolid.

Manjhi R et al revealed imipenem (50%) and piperacillin-tazobactam (44.12%) as most effective antibiotics against Gram-negative bacteria.[10] Isolated bacteria were mostly resistant to ceftriaxone (27.94%), cefuroxime (27.94%) and cefotaxime (26.47%). Irrational use of these antibiotics in rural areas were thought to be most likely cause of resistance. Among the Gram-positive bacteria Staphylococcus were mostly effective against vancomycin and linezolid. In this study the sensitivity of imipenem and piperacillin-tazobactam were 93.86% and 93.71% respectiviely. Staphylococcus of this study had highest sensitivity for imipenem and piperacillin-tazobactam.

In the study of GebreA B et al, 136 participants (33.5%) of southern Ethopia turned positive for sputum infection out of 406 cases.[11]They found Gram-positive were sensitive to clindamycin 26(76.5%) and erythromycin 19(55.9%). *Staphylococcus aureus* was effectively sensitive to cefoxitin (90.6%), gentamycin (76.2%) and ciprofloxacin (71.4%). *Streptococcus pneumoniae* were mostly sensitive to clindamycin (88.9%), penicillin (77.8%) and erythromycin (66.7%). On the other hand, these bacteria were resistant to tetracycline (66.7%). On the contrary, isolated Gram-negative bacteria were mostly sensitive to cefepime (86.0%), ciprofloxacin (77.8%) and ceftazidime 49(45.4%). *Klebsiellapneumoniae* was sensitive to ciprofloxacin (91.7%) and cefepime (83.3%). *These bacteria were resistant* to augmentin (56.6%), ceftazidime (52.8%) and ampicillin (52.8%). *Pseudomonas* spp. *Was predominantly sensitive* to cefepime (92.0%), ciprofloxacin (68.0%), gentamycin (68.0%) and imipenem (64.0%). It was detected that *Pseudomonas* spp. *was* resistant to ceftazidime (68.0%). In this study, 1133 samples were analyzed. Out of these 684 culture sensitivity results were positive for isolating bacteria. This positive samples were 60.4% of all the samples.

RituVaish performed her study in Telangana, India on 120 cases where male was double in number in comparison to female.[12] Among the Klebsiellapneumonae (45.8%) were the commonest Gram negative bacteria followed by Pseudomonas aeruginosa (28.3%). Klebsiella were sensitive to Ceftazidime&Clavulanate in 90% of cases. Nearly 90% of Streptococcus pneumonae were sensitive to Ceftriaxone. Staphylococcus aureus were sensitive to Ceftazidime&Clavulanate in 92% of cases. In this study, male (61.1%) was higher than female (38.9%) too. The sensitivity pattern of Klebsiella was different in this study. Sensitivity of Ceftazidime was not very high in this series.

Conclusion:

Use of proper antibiotic is essential to prevent antibiotic resistance. Institutional and regional antibiogram can help in decision making for selecting empirical antibiotic.

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