IJCRR
Vol 04 issue 21
Section: Healthcare
Category: Research
Received on: 01/09/12
Revised on: 14/09/12
Accepted on: 23/09/12

LOWER RESPIRATORY TRACT INFECTION- BACTERIOLOGICAL PROFILE AND ANTIBIOGRAM PATTERN

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ABSTRACT

Objective: A study was conducted to know bacteriological profile and antibiogram pattern of lower respiratory tract infection (LRTI) in a rural setup. **Methods:** Sputum samples from 95 patients with symptoms of LRTI and endotracheal aspirates from 5 patients admitted to intensive care unit (ICU) were processed for culture and antibiotic sensitivity test was done to commonly used antibiotics.

Results: Aetiological diagnosis was possible in 83 patients. Sixty five patients were culture positive for single pathogen and 18 patients were culture positive for two pathogens. Males (n=63) were found more at risk to LRTI than females (n=37).LRTI was found more prevalent in 51-60 year age group (n=24). *K.pneumoniae* (31.3%) was the commonest single pathogen isolated followed by Coagulase positive *Staphylococci (*26.5%), *Streptococcus pneumoniae* (15.6%) and *Pseudomonas aeruginosa*(3.6%*). Str. pneuminiae* strains were sensitive to ciprofloxacin (95%) and erythromycin (89%),but resistant to ampicillin(31.5%). *K.pneumoniae* and *Pseu.aeruginosa* strains were sensitive to ofloxacin (95-100%) ;and cefotaxime and ceftriaxone(67-100%). **Conclusion:** The present study reveals that *K.pneumoniae* is the emerging pathogen of LRTI in rural setup with a low prevalence of antibiotic resistance among the pathogens.

Key words: Lower respiratory tract infection, sputum culture.

INTRODUCTION

Infections of the Lower respiratory tract are responsible for 4.4% of all hospital admissions and 6% of all general practitioner consultations(1).They account for 3 to 5% of deaths in adults(2).The problem is much greater in developing countries where pneumonia is the most common cause of hospital attendance in adults(3).

Since the etiological agents of Lower respiratory tract infections(LRTI) can not be determined clinically , microbiological investigation is required for both treatment and management of individual case and epidemiological purposes(4).

But routine laboratories in the rural set up are not able to perform sputum culture for various reasons. Therefore, antimicrobial therapy is frequently empirical and presumptive, which is complicated by the increasing prevalence of resistance among bacteria causing LRTI(5).

AIM OF THE STUDY

The objective of the present study is to find out the bacteriological spectrum and antibiotic susceptibility pattern of Lower Respiratory Tract Infection among the patients attending MIMS General Hospital, Nellimarla, a village situated 8 kilometer away from Vizianagaram town.

MATERIALS AND METHODS

- STUDY GROUP: After taking the approval from institutional review committee, 100 consecutive patients between the age group of 21-90 years with productive cough and fever

for more than two weeks presented to outpatients department of Medicine and TB chest; and admitted to Medicine ward and intensive care unit(ICU) were included in the present study.

- STUDY PERIOD : For a period of 8 months from January 2011-August 2011.
- EXCLUSION CRITERIA

Patients with pulmonary tuberculosis, congestive heart failure, pulmonary infarction, AIDS and those receiving Immune suppressive therapy were excluded from the study.

LABORATORY INVESTIGATION

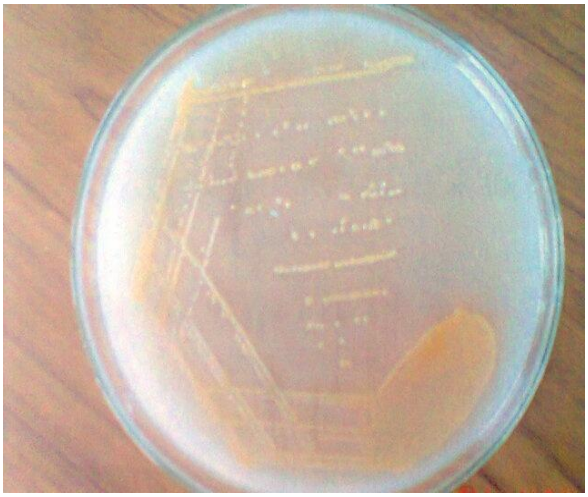
- Two sets of sputum samples from each patient and endotracheal aspirates from patients on ventilator were collected after taking informed consent from them and from close relatives for the unconscious patients and processed within 2 hours. The samples were subjected to the following investigations :-

1. Gram stained smears were examined to see the character of exudates, number and type of organisms. Specimens containing more than 25 polymorphonuclear leucocytes and less than 10 epithelial cells per low power field were included in the study (6).
2. Culture of sputum was done on Blood agar with a streak of *Staphylococcus aureus*, chocolate agar and Mac Conkey agar. Blood agar and chocolate agar were incubated in candle jar at 37 degree centigrade.

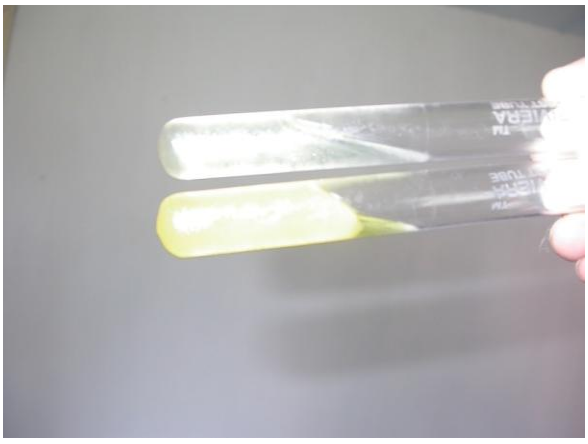
** Any bacteria showing heavy growth on culture or a moderate or light growth along with Gram stain report compatible with the culture results were considered to be the causative agents(4).

3. Identification of bacterial isolates were done by the relevant biochemical tests.
4. Antibiotic sensitivity test was done by modified Kirby Bauer's method for Gram positive organisms to Ampicillin+Sulbactam-10mcg,Amoxyclav-10mcg,Vancomycin-30mcg,Ceftazidime-30mcg, Ampicillin-10mcg, Netilmicin-30mcg, Ciprofloxacin-5mcg and Cefazolin-30mcg ; and for Gram negative organisms to Ampicillin + Sulbactam- 10mcg, Amoxyclav- 10mcg, Cefotaxime-30mcg, Tetracycline-30mcg, Amikacin-30mcg, Gentamycin-10mcg, Ofloxacin-5mcg, Ceftriaxone-30 mcg and Chloramphenicol-30mcg.

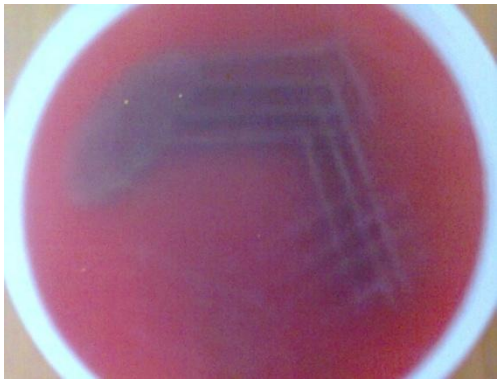
Colonies of *Staph.aureus* on milk agar



Tube coagulase test



Alpha haemolytic colonies of *Str.pneumoniae* on blood agar



Bile solubility test for *Streptococcus pneumoniae*

Tube method

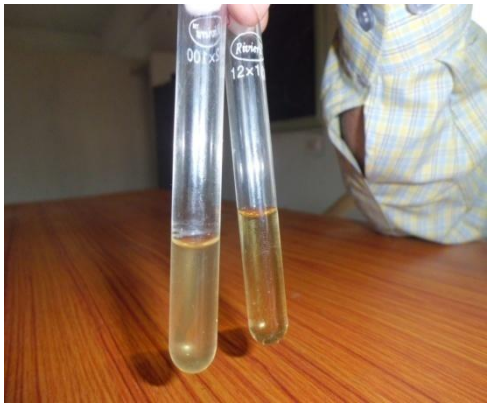
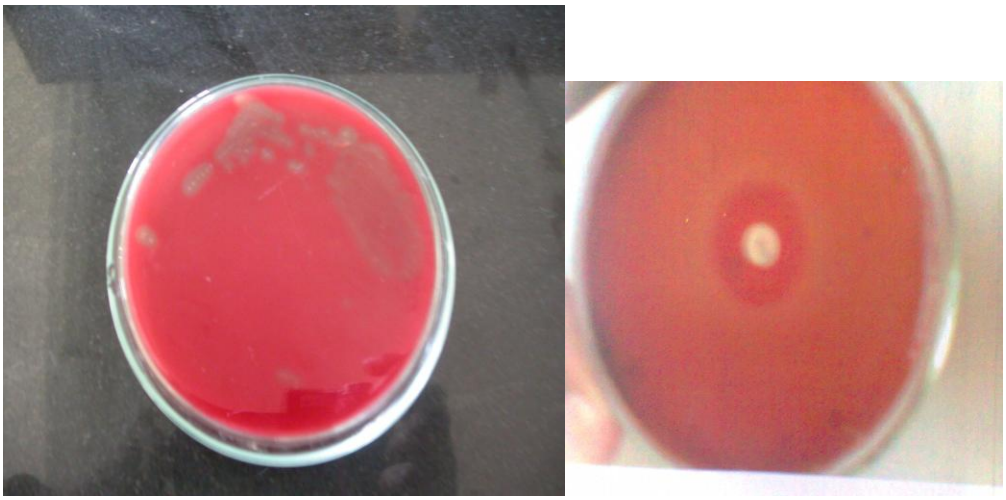


Plate method

Optochin sensitivity of *Str. pneumoniae*



Beta haemolytic Streptococcus and its Bacitracin sensitivity

RESULTS

Out of 100 patients presented clinically as LRTI, aetiological diagnosis could be possible in 83 cases(65 for single pathogen and 18 for mixed infections)in the present study(table no.2). Maximum number of cases were males (n=63) and from 51-60 years (n=24)of age group(table no 1&3).A total of 101 isolates of pathogenic bacteria were isolated from these 83 culture positive cases.Commonest organism isolated was *K.pneumoniae* both as single pathogen and in mixed infection.(table no 4 &5). Out of 40 isolates of *K.pneumoniae*, 29 isolates were from inpatients and 19 isolates were from 51-70 year of age group(table no 4&6).Fourteen isolates of *K.pneumoniae*(n=40)and 3 isolates of *Pseu.aeruginosa*(n=3) were resistant to ampicillin +sulbactam combination,30 isolates of *coagulase positive Staphylococcus*(n=34) and 6 isolates of *Str.pnuminiae*(n=19) were resistant to ampicillin.(table7-10)

Table 1: Total No. of patients

	No. of cases	male	female
Inpatients	55	40	15
Outpatients	45	23	22
Total	100	63	37

Table 2 : culture for pathogens (n=100)

	Culture positive			culture negative
	male	female	total	
for single pathogen	42	23	65	
for mixed infection	11	07	18	
total	53	30	83	17

Table 3: distribution of cases age wise

Age in years	No. of cases
21-30	12
31-40	22
41-50	19
51-60	24
61-70	19
71-80	2
81-90	2
total	100

Table 4 : Number of organisms isolated

Organism	total no. isolated	IP	OP	male	female
K.pneumoniae	40	29	11	27	13
Coag.+ve Staph.	34	18	16	21	13
Str.pneumoniae	19	06	13	11	08
Pseu.aeruginosa	03	03	0	03	0
Group A beta Strept.	03	01	02	01	02
Prot.mirabilis	02	02	0	01	01
Total	101	59	42	64	37

Table 5 : culture positive for mixed infections

Mixture of organisms	Male	Female	Total
Coag.+ve Staph+K.pneumoniae	6	2	8
Coag.+ve staph. +Str. pneumoniae	1	3	4
Str.pneumoniae+ K.pneumoniae	2	0	2
K.pneumoniae +beta haem strept.	1	1	2
K.pneumoniae + Prot. mirabilis	1	1	2
total	11	7	18

Table 6: Age distribution of K.pneumoniae isolates

Age	No. of isolates	
21-30 yrs	5	
31-40 yrs	9	
41-50 yrs	5	
51-60 yrs	9	47.5%
61-70 yrs	10	
71-80 yrs	1	
81-90 yrs	1	
total	40	

Table 7: Antibiotic sensitivity pattern.

	K.pneumoniae (n=40)		*Coag.+ve staph.* (n=34)		*Str.pneumoniae* (n=19)		*Ps.aeruginosa* (n=03)		*Pr.mirabils* (n=02)	
	S	R	S	R	S	R	S	R	S	R
Ampicillin	NA		04	30	13	06	NA		NA	
Ampicillin+sulbactam	26	14	28	06	18	01	0	03	02	0
Amoxyclav	06	34	28	06	15	04	01	02	02	0
Amikacin	40	0	NA		NA		03	0	02	0
Cefazolin	NA		26	08	17	02	NA		NA	
Cefotaxime	34	06	NA		NA		02	01	02	0
Ceftazidime	NA		31	03	18	01	NA		NA	
Ceftriaxone	36	04	NA		NA		02	01	02	0
Ciprofloxacin	NA		27	07	18	01	NA		NA	
Chloramphenicol	30	10	NA		NA		01	02	02	0
Erythromycin	NA		31	03	17	02	NA		NA	
Gentamycin	37	03	NA		NA		03	0	02	0
Netilmycin	NA		34	0	19	0	NA		NA	
Ofloxacin	37	03	NA		NA		03	0	02	0
Tetracycline	26	14	NA		NA		02	01	0	02
Vancomycin	NA		34	0	19	0	NA		NA	

DISCUSSION

In the present study, LRTI is more common in males than females which is consistent with other studies from India (7). This is due to more prevalent associated risk factors (eg. Smoking, chronic alcoholism, COPD) of pneumonia in Indian males than females (8). Maximum number of patients(24%) were from older age group (51-60years).This is in accordance with a study from Finland, the rate of pneumonia increased for each year of age over 50 years.(9).Microbiological diagnosis was possible in 83% of cases. Studies from different areas reported an aetiological diagnosis between 45% to more than 80%.(8)

The major single pathogen causing LRTI are *Klebsiella pneumoniae*(31.3%),*Coagulase positive staphylococci*(26.5%),*Streptococcus pneumo*niae(15.6%) and *Pseudomonas aeruginosa*(3.6%) in this study.This is comparable with a report from Nigeria(10) where commonest organism isolated was *K.pneumoniae* accounting for 38% of the isolates. A higher prevalence of *Klebsiella pneumonia* has also been reported from India in last two decades. (11,12,13)

K.pneumoniae is the commonest organism causing LRTI in inpatients whereas among outpatients ,*S.aureus* is the commonest organism causing LRTI in the present study. All the 3 isolates of *Pseudomonas aeruginosa* were from ICU patients with ventilator and isolated as single pathogen. Nidhi Goel et al also reported this organism as the commonest cause of ventilator associated pneumonia (14). All 2 isolates of *Proteus mirabilis* were also from ICU patients with ventilator, but as mixed infection along with *Klebsiella pneumoniae*.

Isolation rate of *K.pneumoniae* both as single pathogen & in mixed infection is 48.2% in our study; and 72.5% of these isolates were from inpatients and 47.5% were from age group 51-70 yrs. Patients in the older age group are more susceptible to gram negative pneumonia because of waning immunity and pulmonary defense mechanisms, underlying chronic diseases and silent aspiration. Institutional care also makes the patients more susceptible to gram negative pneumonia(4). In the present study, incidence of mixed infections was 21.7% which is consistent with the fact that incidence of mixed infections does not usually exceed 30%(15).Identification of polymicrobial infection is very important for treatment strategies.

We got 3 isolates of *Beta hemolytic Group-A Streptococcus* in the age group 61-70 years. It can cause pneumonia by the spread of infection from the pharyngeal mucosa(16).There are reports regarding increasing prevalence of drug resistance among the strains of *Streptococcus pneumoniae* from India (17).Among our strains of *Str. pneumoniae* ,although 31.5% resistance was noted for ampicilin, they have shown high degree of sensitivity to ciprofloxacin(95%) and erythromycin(89%).

There are also reports from India regarding increase prevalence of drug resistance among gram negative bacilli strains from LRTI (14,18). But in the present study,*K.pneumoniae* and *Pseud. aeruginosa* strains have shown 95 to 100 % sensitivity to ofloxacin and 67 to 100 % sensitivity to cefotaxime and ceftriaxone.

All the strains of Gram positive cocci and Gram negative bacilli were senisitive to netilmycin and amikacin respectively although *Staph. aureus* strains have shown 88% resistance to ampicillin .

Resistance to Beta lactamase resistant antibiotics were 100 % for *Pseudomonas aeruginosa*, 85 % for *Klebsiella pneumoniae*,21% for *Streptococcus pneumoniae* and18% for *Coagulase positive Staphylococi*.

CONCLUSION

In the present study commonest organism isolated from patients with LRTI was *Klebsiella pneumoniae*(48.2%) both as single pathogen & in mixed infection. Incidence of drug resistance among the strains was less. The most effective antibiotics for Gram negative bacilli causing LRTI was Amikacin and for Gram positive cocci was Netilmicin in the present study. Cephalosporins may be started before culture report can be generated. However resistance to Beta lactamase antibiotics require further evaluation by more standardized method.

ACKNOELEDGEMENT

We acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/ editors/ publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

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