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Original Article

A Hospital Based Study on Empirical Use of Antibiotics in the Treatment of Lower Respiratory Tract Infections

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Abstract

Background: Improving the care of adult patients with lower respiratory tract infections (LRTI) especially community-acquired pneumonia (CAP) has been the focus of many different organizations, and several have developed guidelines for management of CAP. The guidelines are mainly for emergency medicine physicians, hospitalists, and primary care practitioners. Every hospital should conduct an audit of the treatment protocols followed by their physicians at regular intervals.

Aim of the Study: The aim of the study was to analyze the current trends in the selection of antibiotic empirically and their effectiveness in the treatment of LRTI in a tertiary teaching hospital.

Materials and Methods: A total of 86 patients with the diagnosis of LRTI were included in this study. The severity of LRTI was assessed using the confusion, oxygen saturation, respiratory rate, and blood pressure (CORB) score. A point was given for each parameter to compute the total score. A CORB score of 0, 1, and >2 indicates mild, moderate, and severe CAP, respectively. Investigations done were Chest "X" ray, antibiotics received: (1) Antibiotics prescribed on admission, (2) route of AB administration, and (3) duration of ABs given. (4) If there is a switch from parenteral to oral therapy. (5) If there is a change of ABs group or not. (6) If yes to which group? (7) Duration and cause of such change were noted.

Observations and Results: Among the 86 patients included in the study there were 51 (59.30%) males and 35 (40.69%) female patients. The mean age was 47.90 ± 9.48 years. The mean age among the males was 53.78 ± 6.45, and in females, the mean age was 49.85 ± 4.70 years. History of active smoking was present in 23/86 (26.74%), passive smoking in 14 (16.27%), and ex-smoker in 19 (22.09%) patients. The frequent antibiotic prescription used was broad-spectrum penicillins and cephalosporins (21) in all the LRTI patients amounting to 14/58 of CAP, 4/14 of chronic obstructive pulmonary disease, and 3/14 of bronchiectasis in this study.

Conclusions: Empirical antibiotic prescription practices need to be well evaluated in a hospital to formulate an acceptable rationale aiming at improving the antibiotic usage. Awareness among the physicians about different widely accepted guidelines is necessary. The pharmacological audit should include patient compliance, patient demand, combination antibiotic therapy, and cost of treatment.

Key words: Antibiotic, Bacteria, Infection, Lower respiratory tract infections, Pneumonia

INTRODUCTION

Lower respiratory tract infections (LRTI) are a broad terminology which includes different diseases including acute bronchitis, pneumonia, and acute exacerbation of chronic lung diseases such as chronic obstructive pulmonary disease (COPD) or bronchiectasis. Annual incidence of pneumonia, one of the most important LRTIs, is reported to be 24.8/10,000 adults. The rates differ based on the age, with higher incidence observed in patients between 65 and 79 years of age (63.0/10,000 adults) and >80 years of age (164.3/10,000 adults).[1] Pneumococcal pneumonia is the most common cause of mortality due to the lower respiratory infections. According to the global burden of disease 2015 study,[2] pneumococcal pneumonia is the most common cause of pneumonia responsible for

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over 15 lakhs deaths across the world in 2015. Community-acquired pneumonia (CAP) and acute exacerbation of chronic bronchitis are the two commonly encountered acute LRTIs in outpatient setting. The annual incidence of CAP is about 5–11/1,000 population with higher rates reported in the elderly population.[3] LRTI account for large-scale morbidity and mortality in India. They are among the top six causes of death in low-income, middle-income, and high-income countries[4-6] and impose a huge economic burden on the health services of a country. LRTI can present in adults and children in a variety of community based and hospital settings with variable complex, clinical presentations from the minimally symptomatic to the rapidly fulminant. Current standard diagnostic tests for acute and chronic bacterial and viral infections are laborious and time consuming. Currently, all ill patients presenting with any form of respiratory tract infections community-acquired pneumonias (CAP), hospital-acquired pneumonias, ventilator-assisted pneumonia, or respiratory tract infections in the immunosuppressed are treated empirically without an accurate diagnosis of the causative microorganism and their antibiotic sensitivity patterns.[7] Correctly identifying the exact microorganism causing respiratory tract infections and treating with appropriate antibiotics they are susceptible to is essential, as morbidity and mortality rates are high.[8] Carroll,[9] in 2002, reported, LRTIs as the most frequently reported infectious diseases of human in worldwide. Panda *et al.* showed that LRTIs are responsible for 4.4% of all hospital admissions and 6% of all general practitioner consultations.[10] As bacterial etiology may vary in different geographical regions and even over time in the same location and population, Tripathi suggested routine surveillance of microbial etiology of LRTI in their management.[11] Gram-positive bacteria such as *Staphylococcus aureus* and *Streptococcus pneumonia* and Gram-negative bacteria, for example, *Pseudomonas* spp., *Escherichia coli*, and *Klebsiella* spp. were identified in the LRTI patients in the study conducted by Mishra *et al.*[12] and Kollef *et al.* opined that unnecessary and inappropriate initial antibiotic therapy is a potential risk factor that has been associated with increased mortality in patients with serious infections.[13] When the etiologic agents causing LRTI and their antibiotic susceptibility patterns are known, the choice of antimicrobial therapy for bacterial LRTIs is relatively straightforward; however, the clinical presentation is usually not specific enough to make a firm etiologic diagnosis whether in the community or hospital setting.[14] In almost all cases, eradication of causative agents requires initiation of antimicrobial therapy before obtaining culture report; however, during the past few years, the increase in antibiotic resistance has compromised the selection of empirical treatment[15] 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. The practices of using antibiotics empirically without culture reports, transmission of resistant bacteria from patient to patient and from health-care practitioners to patients and vice versa[13] are some of the factors for the development of resistance to the antibiotics. Therefore, the clinicians and microbiologists worldwide are focusing on knowledge and strategies to limit the development of antimicrobial resistance. The present study was conducted with the aim of analyzing the current trends in the selection of antibiotic empirically and their effectiveness in the treatment of LRTI in a tertiary teaching hospital.

Period of Study

This study was from February 2014 to January 2016.

Institution of Study

This study was conducted at Kannur Medical College, Anjarakandy, Kannur, Kerala.

Type of Study

This was a prospective, cross-sectional hospital-based study.

MATERIALS AND METHODS

The present study was a prospective cross-sectional one conducted in a tertiary teaching Hospital. Ethical Committee Clearance was obtained before the study was undertaken. 86 patients with the diagnosis of LRTI were included in this study using ICD 10 coding (codes 09–J18) from the medical records section of the hospital. Inclusion criteria: (1) Patients aged above 20 years were included in the study. (2) Patients with LRTI were defined by acute onset of respiratory symptoms (cough, fever, expectoration, chills, and sweating) with a latest chest X-ray infiltrate were included. (3) Patients with history of cough, expectoration, Pneumonias lasting for more than 48 h were included. Exclusion criteria: (1) Patients aged below 20 years were excluded. (2) Patients with pneumonias of hospital-acquired or aspiration pneumonia; patients with chronic lung disease such as interstitial lung disease, bronchiectasis or advanced COPD on home oxygen therapy or with known bacterial colonization were excluded. (3) Patients who were prescribed antibiotics before admission were excluded. (4) Patients diagnosed as having; patients receiving immunosuppressive treatments (defined as receiving a daily average Prednisolone dose ≥7.5 mg or other immunosuppressive medications); and patients who were considered for palliative treatment within 48 h of admission. The severity of pneumonia was assessed using the confusion, oxygen saturation, respiratory rate, and blood pressure (CORB) score. The CORB assessment parameters include the following: Confusion; oxygen saturation <90% on room air; respiratory rate

>30/min; and systolic blood pressure <90 mmHg. A point was given for each parameter to compute the total score. A CORB score of 0, 1, and >2 indicates mild, moderate, and severe CAP, respectively. All the patients were subjected to the following: (1) Full medical history and examination, (2) chest "X" ray, and (3) antibiotics received: (1) Antibiotics prescribed on admission, (2) route of AB administration, and (3) duration of ABs given. (4) If there is a switch from parenteral to oral therapy. (5) If there is a change of ABs group or not. (6) If yes to which group? (7) Duration and cause of such change. The relevant demographic, clinical, and laboratory and outcome data were extracted by the review of medical records. The following information was collected: Age, gender, usual residence (home vs. residential care), usual comorbidities, usual medications, history of allergy (particularly penicillin allergy), information on personal activities of daily living (PADL) (PADLs- transferring, walking, toileting, bathing, dressing, and feeding), antibiotics prescribed within 24 h of admission, the parameters required for computing the CORB score, relevant laboratory data, admission to high-dependency unit or intensive care unit (ICU), and admission outcomes such as length of stay and death. All the data were analyzed using standard statistical methods.

OBSERVATIONS AND RESULTS

Among the 86 patients included in the study there were 51 (59.30%) males and 35 (40.69%) female patients. The mean age was 47.90 ± 9.48 years. The mean age among the males was 53.78 ± 6.45 and, in females, the mean age was 49.85 ± 4.70 years. History of active smoking was present in 23/86 (26.74%), passive smoking in 14 (16.27%), and ex-smoker in 19 (22.09%) patients. The positive clinical manifestations were tabulated in Table 1.

The trends of empirical antibiotic prescriptions to the patients with LRTI among the treating physicians of the hospital were tabulated in Table 2. The frequent antibiotic prescription used was broad-spectrum penicillins and cephalosporins 21/86 (24.41%) in all the LRTI patients amounting to 14/58 (24.13%) of CAP, 4/14 (28.57%) of COPD, and 3/14 (21.42%) of bronchiectasis in this study. This was followed by cephalosporins 11/58 in CAP, 4/14 (28.57%) in COPD, and 3/14 (21.42%) in bronchiectasis. Cephalosporins and macrolides were used in 9/58 (15.51%) of CAP patients, 2/14 (14.28%) of COPD, and 2/14 (14.28%) of bronchiectasis patients [Table 2].

The number of days these prescriptions were used by the patients was observed and found that 53/86 (61.62%) were for 5–7 days and the remaining 33/86 (38.37%) for 7–10days. The frequency of changing the antibiotics was observed and found that more than 3 times were found in 43% of the patients and <3 times were observed in 57% of the patients.

DISCUSSION

The present study was on prescribing pattern of antibiotics in LRTI, is a component of the medical audit, which seeks monitoring, evaluation, and necessary modification in the prescribing practice of prescribers to achieve rational and cost-effective medical care. It is necessary to define prescribing habits to drive a remedial message to the prescribers. Most people will develop an acute LRTI almost

Table 1: The incidence of clinical manifestations of LRTI (*n*-86)

Observations	Community-acquired pneumonia 58 (%)	COPD 14 (%)	Bronchiectasis 14 (%)
Fever	50 (86.20)	10 (71.42)	07 (50.0)
Cough/expectoration	43 (74.13)	09 (64.28)	13 (92.85)
Hemoptysis	31 (53.44)	06 (42.85)	12 (85.71)
Worsening of dyspnea	12 (20.68)	10 (71.42)	11 (78.57)
Comorbid diseases	00 (00)	00 (00)	00 (00)
Increased temperature	46 (79.31)	12 (85.71)	09 (64.28)
High respiratory rate	45 (77.58)	09 (64.28)	07 (50.0)
Antibiotics in the past 3 months	07 (12.06)	03 (21.42)	08 (57.14)
Consolidation	22 (37.93)	02 (14.28)	05 (35.71)
Sonorous rhonchi	37 (63.79)	08 (57.14)	13 (92.85)
Coarse crepitation	18 (31.03)	11 (78.57)	13 (92.85)
X-ray			
Patchy infiltration	20 (34.48)	03 (21.42)	02 (14.28)
Cavity	07 (12.06)	05 (35.71)	03 (21.42)
Emphysema	11 (18.96)	03 (21.42)	02 (14.28)
Leukocytosis	37 (63.79)	06 (42.85)	07 (50.0)
ESR	33 (56.89)	07 (50.0)	08 (57.14)
Sputum Gram stain	29 (50.0)	09 (64.28)	11 (78.57)
Sputum C and S	53 (91.37)	06 (42.85)	06 (42.85)

LRTI: Lower respiratory tract infections, COPD: Chronic obstructive pulmonary disease

Table 2: The antibiotics prescribed for admission (*n*-86)

Antibiotics used empirically total patients- 86	Community-acquired pneumonia 58 (%)	COPD 14 (%)	Bronchiectasis 14 (%)
Broad-spectrum penicillins and cephalosporins - 21	14 (%)	04 (28.57)	03 (21.42)
Cephalosporins - 18	11 (18.96)	04 (28.57)	03 (21.42)
Cephalosporins and macrolides - 13	09 (15.51)	02 (14.28)	02 (14.28)
Broad-spectrum penicillins and Aminoglycosides - 10	07 (12.06)	01 (07.14)	02 (14.28)
Broad-spectrum penicillins, aminoglycosides and metronidazole - 09	06 (10.34)	01 (07.14)	02 (14.28)
Cephalosporins and metronidazole - 08	06 (12.06)	01 (07.14)	01 (07.14)
Ciprofloxacin and metronidazole - 07	05 (08.62)	01 (07.14)	01 (07.14)

COPD: Chronic obstructive pulmonary disease

every year. LRTI are the common problems encountered in the primary health-care centers. The treating physician starts an antibiotic empirically based on presumptive bacterial infections of the area and season. However, in the modern times, the rates of major complications are now low because of the higher rate of empirical prescription of antibiotics. In addition, there is no convincing evidence, either from international comparisons or evidence within countries, that lower rates of prescribing are associated with higher rates of complications. In this study based on the clinical diagnosis and laboratory diagnosis of LRTI was made (CAP, COPD, and bronchiectasis). Depending on the physicians started with broad-spectrum penicillins and cephalosporins in 21/86 (24.41%) of CAP patients. These patients had no complications, and during the course of treatment, no complications developed. Cephalosporins alone without combination were started in 18/86 patients (20.93%). Cephalosporins and macrolides were started in 3/86 (03.48%) of the patients. In the present study, 16 physicians were depended to collect the prescription pattern. All of them were using their textbook knowledge as the main source of information. Whereas in a study by Vancelik *et al*.[16] found that the 73.7% of the physicians got the information from pharmaceutical companies and 26.31% from medical textbooks. In the present study, there were no comorbid diseases associated with LRTI; hence, the change of prescriptions noted was <10%. Review of Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines[17] show that the presence of comorbid diseases should influence the choice of AB group. Furthermore, this result matched with the study done by Abbas *et al*.[18] who found that (97%) of physicians took into consideration the presence of comorbid diseases during AB prescription. Empirical antibiotics have to be started in LRTI especially in cases of CAP because earlier an antibiotic is started better would be the chances of recovery and lesser complications. In this study, all the patients were given antibiotics within 6 h after their clinical diagnosis. Time to first antibiotic dose for CAP has recently received significant attention from a quality of care perspective. This emphasis is based on 2 retrospective studies of Medicare beneficiaries that demonstrated statistically significantly lower mortality among patients who received early antibiotic therapy.[19,20] The initial study suggested a breakpoint of 8 h,[19] whereas the subsequent analysis found that 4 h was associated with lower mortality.[20] In the present study, all the patients received antibiotics by parenteral route initially later on changed to the oral route of administration. The switchover took place between 3rd and 7th day. With the use of a potent, highly bio-available antibiotic, the ability to eat and drink is the major consideration for switching from intravenous to oral antibiotic therapy for non-ICU patients. Initially, Ramirez *et al*.[21] defined a set of criteria for an early switch from intravenous to oral therapy. The duration of treatment in this study was for 3–10 days. IN case of macrolides it was 3–5 days. Most patients with CAP were treated for 7–10 days or long. Few well-controlled studies have evaluated the optimal duration of therapy for patients with CAP. Available data on short-course treatment do not suggest any difference in outcome with appropriate therapy in either inpatients or outpatients.[22] All the patients in this study responded to empirical antibiotic treatment in the hospital. Although difficult to define, non-response is not uncommon. Overall, 6–15% of hospitalized patients with CAP do not respond to the initial antibiotic treatment.[23-25] The incidence of treatment failure among patients with CAP.

CONCLUSIONS

Empirical antibiotic prescription practices need to be well evaluated in a hospital to formulate an acceptable rationale aiming at improving the antibiotic usage. Awareness among the physicians about different widely accepted guidelines is necessary. The pharmacological audit should include patient compliance, patient demand, combination antibiotic therapy, and cost of treatment.

REFERENCES

1. Jain S, Self WH, Wunderink RG, Fakhran S, Balk R, Bramley AM, *et al*. Community-acquired pneumonia requiring hospitalization among US adults. N Engl J Med 2015;373:415-27.

2. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: A systematic analysis for the global burden of disease study 2015. Lancet 2016;388:1459-544.
3. Brar NK, Niederman MS. Management of community-acquired pneumonia: A review and update. Ther Adv Respir Dis 2011;5:61-7.
4. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, *et al.* Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the global burden of disease study 2010. Lancet 2012;380:2095-128.
5. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, *et al.* A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the global burden of disease study 2010. Lancet 2012;380:2224-60.
6. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, *et al.* Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: A systematic analysis for the global burden of disease study 2010. Lancet 2012;380:2197-223.
7. Petersen I, Johnson A, Islam A, Duckworth G, Livermore D, Hayward A. Protective effect of antibiotics against serious complications of common respiratory tract infections: Retrospective cohort study with the UK general practice research database. BMJ 2007;335:982.
8. Gulliford M, Latinovic R, Charlton J, Little P, van Staa T, Ashworth M. Selective decrease in consultations and antibiotic prescribing for acute respiratory tract infections in UK primary care up to 2006. J Public Health (Oxf) 2009;31:512-20.
9. Carroll KC. Laboratory diagnosis of lower respiratory tract infections: Controversy and conundrums. J Clin Microbiol 2002;40:3115-20.
10. Panda S, Nandini PB, Ramani TV. Lower respiratory tract infection-bacteriological profile and antibiogram pattern. Int J Curr Res Rev 2012;4:149-55.
11. Tripathi PC, Dhote K. Lower respiratory tract infections: Current etiological trends and antibiogram. J Pharm Biomed Sci 2014;4:249-55.
12. Mishra SK, Kathel HP, Acharya J, Shah NP, Shah AS, Sherchand JB. Recent trends of bacterial etiology of LRTI in Nepal. Int J Infect Microbial 2012;1:3-8.
13. Kollef MH, Golan Y, Micek ST, Shorr AF, Restrepo MI. Appraising contemporary strategies to combat multidrug resistant gram-negative bacterial infections – proceedings and data from the gram-negative resistance summit. Clin Infect Dis 2011;53 Suppl 2:S33-55.
14. Shah BA, Singh G, Naik MA, Dhobi GN. Bacteriological and clinical profile of community acquired pneumonia in hospitalized patients. Lung India 2010;27:54-7.
15. Jonaidi Jafari N, Ranjbar R, Haghi-Ashtiani MT, Abedini M, Izadi M. The study of prevalence and antimicrobial susceptibility of tracheal bacterial strains isolated from pediatric patients. Pak J Biol Sci 2009;12:455-8.
16. Vancelik S, Beyhun NE, Acemoglu H, Calikoglu O. Impact of pharmaceutical promotion on prescribing decisions of general practitioners in Eastern Turkey. BMC Public Health 2007;7:122.
17. IDSA/ATS Guidelines for CAP in Adults; CID 2007:44 (Suppl 2):27-64.
18. Abbas AM, ELFaramawy MA, ELSharkawy SH. Evaluation of Prescription Practices of Antibiotics in Respiratory Tract Infections at Ain Shams University Hospital (Thesis Submitted for Partial Fulfillment of Master Degree in Chest Diseases and Tuberculosis), Ain Shams University; 2007.
19. Houck PM, Bratzler DW, Nsa W, Ma A, Bartlett JG. Timing of antibiotic administration and outcomes for Medicare patients hospitalized with community-acquired pneumonia. Arch Intern Med 2004;164:637-44.
20. Meehan TP, Fine MJ, Krumholz HM, Scinto JD, Galusha DH, Mockalis JT, *et al.* Quality of care, process, and outcomes in elderly patients with pneumonia. JAMA 1997;278:2080-4.
21. Ramirez JA, Srinath L, Ahkee S, Huang A, Raff MJ. Early switch from intravenous to oral cephalosporins in the treatment of hospitalized patients with community-acquired pneumonia. Arch Intern Med 1995;155:1273-6.
22. Dunbar LM, Wunderink RG, Habib MP, Smith LG, Tennenberg AM, Khashab MM, *et al.* High-dose, short-course levofloxacin for community-acquired pneumonia: A new treatment paradigm. Clin Infect Dis 2003;37:752-60.
23. Rosón B, Carratalà J, Fernández-Sabé N, Tubau F, Manresa F, Gudiol F, *et al.* Causes and factors associated with early failure in hospitalized patients with community-acquired pneumonia. Arch Intern Med 2004;164:502-8.
24. Menéndez R, Torres A, Zalacaín R, Aspa J, Martín Villasclaras JJ, Borderías L, *et al.* Risk factors of treatment failure in community acquired pneumonia: Implications for disease outcome. Thorax 2004;59:960-5.
25. Arancibia F, Ewig S, Martinez JA, Ruiz M, Bauer T, Marcos MA, *et al.* Antimicrobial treatment failures in patients with community-acquired pneumonia: Causes and prognostic implications. Am J Respir Crit Care Med 2000;162:154-60.

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