JMSCR Vol||06||Issue||01||Page 32499-32514||January 2018

www.jmscr.igmpublication.org
Impact Factor 5.84
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v6i1.16

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Research Paper

An Analysis of the Pharmacological Management of Respiratory Tract Infections in-Patients at a Tertiary Care Teaching Hospital

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Abstract

Background: *Upper respiratory tract infection (URI) represents the most common acute illness evaluated in the outpatient setting. URIs range from the common cold—typically a mild, self-limited, catarrhal syndrome of the nasopharynx—to life-threatening illnesses such as epiglottitis. Antimicrobials are the mainstay in the management and irrational use of them may increase resistance to bacteria and the total cost of treatment.*

Objectives: *To evaluate the pattern of drug prescriptions for respiratory tract infections in Medicine and Pediatric outpatient departments of a rural teaching hospital.*

Methods & Patients: *Over a period of 18 months, 391 prescriptions of outpatients with respiratory tract infection were collected. The drugs prescribed, their dose and duration of treatment were recorded. DU 90% was calculated.*

Results: *Data from a total of 603 medical case records pertaining to respiratory tract infective disorders were assessed. The mean (±SEM) age of the patients was38.55±0.9 years and there were 204 (52.1%) men and 187 (42.1%) women. The most common disorder among the patients was acute rhinitis (61.1%) while the least common was acute bronchitis (1.3%). The prevalence of RTIs was slightly higher in males. The preferential AMAs employed were amoxicillin, amoxicillin-clavulinic acid combination, ceftriaxone, cefixime and azithromycin used individually. Of 12 different AMAs prescribed in this study, 6 drugs*

(penicillin, cephalosporin, aminoglycosodes, ATT, macrolides and fluroquinolones) falls within DU90% segment. Bronchodilators and expectorants, mucolytics, cough suppressant, decongestants combination is noteworthy. The concurrent use of different groups of bronchodilators along with inhalational corticosteroids is also highlighted. Ranitidine, omeprazole and pantoprazole were the foremost gastroprotective agents. A variety of heterogenous adjuvants other than those mentioned above were administered and their roles in conferring additional therapeutic benefits have been emphasized. Majority of drugs used are from NLEM 2011.

Conclusion: *Penicillins and cephalosporins were the commonly used antibiotics for respiratory tract infection in outpatients of a rural teaching hospital and two thirds of the prescribed drugs were essential medicines. The overall impression about the prescription trends noted herein is suggestive of modest and rational approach in prescribing practices.*

Keywords: *Respiratory tract infections, Drug utilization, Antimicrobial agents.*

Introduction

Respiratory tract infection (RTI) is defined as any infectious disease of the upper or lower respiratory tract. Upper respiratory tract infections (URTIs) include the common cold, laryngitis, pharyngitis/tonsillitis, acute rhinitis, acute rhinosinusitis and acute otitis media. Lower respiratory tract infections (LRTIs) include acute bronchitis, bronchiolitis, pneumonia and tracheitis. Antibiotics are commonly prescribed for RTIs in adults and children in primary care. General practice consultation rates in England and Wales show that a quarter of the population will visit their GP because of an RTI each year.[1] RTIs are the reason for 60% of all antibiotic prescribing in general practice, and this constitutes a significant cost to the NHS. Annual prescribing costs for acute cough alone exceed £15 million.[2]

Respiratory tract Infections (RTIs) are common clinical problems frequently seen in both children and adults and responsible for considerable morbidity, distress and mortality. Acute respiratory infections account for 20-40% of outpatient attendance in a general hospital.[3,4] Upper respiratory tract infections (URTIs) constitute the majority of respiratory tract infections and the presenting manifestations are coughs or colds (coryza). Drug therapy for the symptoms of upper respiratory infections is sought for the relief of discomfort and for the alleviation of the anxiety that the URTIs are potentially serious.[3] Symptom-based therapy represents the mainstay of URI treatment in immunocompetent adults. Antimicrobial or antiviral therapy is appropriate in selected patients.

Lower respiratory tract infections (LRTIs) can be applied to pneumonia and other types of infection including lung abscess and acute bronchitis.

Symptoms include shortness of breath, weakness, high fever, coughing and fatigue. The two most common LRTIs are bronchitis and pneumonia, pneumonia is the fourth leading cause of death.[4,5] LRTIs impose a considerable cost to the nation.[6]

Acute Respiratory Infections in pediatric age group is a major concern in developing countries like India.[5,6] Lower respiratory tract infections (LRTI) are basically leading cause of death among children under 5 years of age in such developing countries like India.[7,8] Child health is a matter of concern in developing countries like India. Predominantly, pneumonia and bronchiolitis comprising the lower respiratory tract infections along with upper respiratory tract infections have some severe implications on the health of pediatric population when they occur recurrently. Pneumonias can prove fatal at times especially in the rural areas where immediate health care facilities remain unavailable as compared to urban areas where immediate interventions are possible due to presence of tertiary health care centers.[9]

Antibiotics are often thought to be the first line treatment in lower respiratory tract infections; however, these are not indicated in viral infections where antiviral therapy is required. It is important to use appropriate antibiotic selection based on the infecting organism and to ensure this therapy changes with the evolving nature of these

infections and the emerging resistance to conventional therapies.[10]

A WHO study of antimicrobial use in 13 low-middle and high-income countries revealed that antimicrobials were wrongly prescribed for approximately 30% of cases of URTI.[11] The International Network for the Rational Use of Drugs (INRUD) was established in 1989 to promote the rational use of drugs in developing countries. Various indicators were developed by INRUD in collaboration with WHO that provided objective indices to allow for assessment of drug-use practices. Therefore, it is imperative to evaluate and monitor the drug utilization patterns from time to time, to enable suitable modifications in prescribing patterns to increase the therapeutic benefit and decrease the adverse effects to optimize the medical services for the patients.

Drug use evaluation is ongoing, authorized and a systematic quality improvement process, which is designed to review the drugs which are prescribed to the patients, provide a right feedback to the clinician and other relevant groups, develop criteria and standards that describe optimal drug use, promote appropriate drug use through education.[12]

There are more effective drugs (medicines) today on the market than ever before. Patients are better educated, have greater expectations from health care, and they use multiple sources of health care. Still, drugs are not frequently used to their full potential or according to the generally accepted criteria. All prescriptions may not necessarily be based on patient needs and all patient needs are not necessarily met with drug therapy.[13]

Consequently, there is as much concern about inappropriate and expensive prescribing, as about under-prescribing. The development of drug utilization (DU) as a research area made it possible to study drug prescribing and drug usage in a scientific and formal manner.[14]

Developing countries have limited funds available for health care and drugs and it becomes very important to prescribe drugs rationally so that the available funds can be utilized optimally.[13]

Accordingly, in view of the aforementioned observations, this prospective study envisages compilation, analysis of pattern, trend, rationality, and frequency of the use of drugs in the treatment of respiratory tract infections, with emphasis on available treatment regimens inclusive of primary and adjuvant therapy.

Methodology

Place of the Study

This study was undertaken in collaboration with the Department of General Medicine and the Department of Pediatrics at the KVG Medical College Hospital, Sullia, Dakshin Kannada District, Karnataka, India.

Sample size

WHO states that for any drug utilization study at least 600 samples are required for proper analysis, hence in accordance with WHO guidelines.[15] A total sample size of 603 was taken for this study.

Design and duration of study

A prospective, non-interventional, observational and medical audit-study was carried out during the period of January 2013 to June 2014.

Inclusion Criteria

1. Out-patients attending the department of General Medicine and Pediatrics as well as in-patients admitted in both Medicine and Pediatric wards with respiratory tract infections in particular.
2. Patients above five years of age of either gender suffering from respiratory tract infections

Exclusion Criteria

1. Patients below five years.
2. Pregnant mothers with RTIs.

Pilot Study

For the purpose of becoming familiar with the topic chosen and collection of data, a pilot study was undertaken.

Accordingly, a proforma was planned and designed for the collection and compilation of the relevant data for this study. However, certain minor modifications were considered in the said proforma and the initial pilot study was carried

out over a period of 2 months to begin with, in the department of Medicine and Pediatrics at KVGMCH, Sullia.

The main objectives of the pilot study were to know and confirm

- The feasibility of conducting such a study.
- The availability of adequate number of patients suffering from the various respiratory tract infective disorders (viz. URTI and LRTI) at the KVGMCH, Sullia.
- The need, if any, for modification of the proforma wherever required to facilitate the comprehensive collection of the appropriate data.

During the pilot Study, the observations made and recorded were as follows.

- All the patients attending the hospital were being examined and treated appropriately.
- Most patients were able to provide information regarding their health status.
- The patients received treatment as out-patients and in-patients
- Over a period of 18 months, 603 patients with respiratory tract infections received treatment as out-patients as well in-patients and this sample/number was considered adequate for proceeding with this study.

Data Collection

The relevant data available from the medical case records of the department of Medicine and Pediatrics, KVGMCH, Sullia, was collected by the investigator in person, and a special proforma was designed for collection of data such as:

1) Demographic data: Comprising of name, age, gender and OP/IP number of the patients and date of prescription
2) Disease data: Type and duration of respiratory tract infections.
3) Data pertaining to drug therapy: Drug / drugs prescribed; dose, strength, frequency, route and duration of administration.
4) Data pertaining to investigation : sputum for culture and sensitivity report
5) Data pertaining to adverse effects of drugs, if any

Ethical committee clearance was obtained for the conduct of the study. Personal details of the patients were kept confidential.

Analysis of the Data

Demographic data and clinical condition for which the drugs were prescribed were captured. Details of the drugs prescribed including drugs name, class, dosage, route of administration, likely duration of treatment was also documented. The data collected in a specially designed proforma were processed and subjected to relevant statistical analysis. Descriptive statistical procedure and evaluation were done to analyze the results using SPSS for windows (version19). Descriptive statistical analysis of the data was done in the form of pie-chart and bar diagrams.

Results

A total number of 800 prescriptions were screened over a study period of 18 months from January 2013 to June 2014 in two departments (Medicine and Pediatrics) and out of which 391 prescriptions were collected, scrutinized and analyzed for epidemiologic profile, disease incidence and drug prescription. Accordingly, the results of this observational, prospective and medical audit study are as follows:

Epidemiologic profile

In this study patients of either gender and above 5years of age have been selected for the scrutiny of the prescription patterns. The respective tables 1-15 indicate the overall details regarding the respiratory tract infections.

Table 1 illustrates that the total number of male patients affected with respiratory tract infections (57.87%) was more than the female patients (42.12%). Also incidence of URTI in men (35.98%) and women (30.84%) were more compared to LRTI (male-21.84%, female-11.29%).

Table 2 and figure 1 indicates the incidence of the various infective conditions of respiratory tract in

different age groups. Most of the URTIs recorded in this study have shown a predilection for the age group 5 to 25 years (28.85%) followed by the age group 26 to 50 years (28.19%) with a slight variation, whereas, most of the LRTIs which have been studied show predilection for the age group 51 to 75 years (18.90%).

Data Pertaining To Respiratory Tract Infections

Table 3 highlights the distribution of various types of respiratory tract infections in terms of numbers and percentage as per the medical case records of this study. Accordingly, acute rhinitis (42.78%) appears to be the most prevalent respiratory tract infective condition followed by acute bronchitis with acute exacerbation of COPD (13.59%), acute rhinopharyngitis (12.10%), acute bronchitis (9.9%), acute pharyngitis (9.45%), pneumonia (6.13%), acute bronchitis with pulmonary Koch's (3.15%), pulmonary Koch's (2.65%), chronic bronchitis (2.15%), chronic pharyngitis (1.32%), acute sinusitis (1.16%), atypical pneumonia (0.49%) in that decreasing order.

Furthermore, regarding the laboratory investigations, in 195 out of 603 case records, relevant materials were sent for culture and sensitivity tests. The need for the culture and sensitivity tests in the remainder of the cases (408) may not have arisen.

Out of 195 cases sent for culture and sensitivity tests, pathogenic organisms were found in 45 cases, while no bacterial isolates were observed in the remaining 150 cases (Table 4). Among the 43 cases where bacterial isolates were found *Klebsiella pneumoniae* (9.74%), *Acinetobacter spp*. (5.12%), *Pseudomonas aeruginosa* (2.56%), *Escherichia coli* (2.05%), *Streptococcus pneumoniae* (1.02%) and *Enterococcus spp*. (1.02%) were the common pathogens noted. AFB was found in 20 cases out of 35 cases sent for investigations under RNTCP. In this context, the culture and sensitivity reports have revealed the sensitivity and the resistance pattern of the isolates to the various AMAs employed for the laboratory testing listed in table 5. Among the sensitive isolates the highest sensitivity has been recorded in case of imipenem, followed by amoxicillin-clavulinic acid and amikacin with slight variation and the least sensitivity in case of ciprofloxacin. The resistance of the bacterial isolates has been the most to cefotaxime when compared with other AMAs used for performing the culture and sensitivity tests.

Drug Utilization Data in RTIs

On scrutiny, the prescription patterns reveal the use of antimicrobial agents, bronchodilators, H_1 antihistamines, expectorants, mucolytics, cough suppressants, decongestants, gastroprotective agents (H_2 antihistamines and proton pump inhibitors), and leukotriene antagonists as important therapeutic remedies in the respective respiratory tract infective disorders. Table 6 illustrates the various combinations in regard to monotherapy (41.95%) and polytherapy (27.36%) regimens in various conditions of respiratory tract infections.

Table 7 shows the mean number of AMAs prescribed in different condition of RTIs. In total 738 antimicrobials have been prescribed in 603 patients treated for respiratory tract infection. Average number of AMAs per prescription was 1.22±0.05, whereas average number of AMAs per prescription was 5.2±0.39 when patients of pulmonary Koch's have been taken into consideration.

Table 8 enlightens the extent and pattern of overall group wise AMAs prescriptions in total sample of 603 patients. Specific antimicrobials used include the antibacterials viz. penicillins (35.71%) (amoxicillin, amoxicillin-clavulinic acid combination), cephalosporins (28.31%) (cefixime, ceftriaxone), aminoglycosides (4.20%) (amikacin), macrolides (8.53%) (azithromycin, clarithromycin), fluoroquinolones (4.06%) (levofloxacin, ciprofloxacin), antitubercular drugs (12.46%) (RIM, PZN, INH, ETH), anthelmintics (2.84%) viz. albendazole, tinidazole and antifungals (1.16%) viz. fluconazole.

Commonly used cephalosporins for the treatment of respiratory tract infections were ceftriaxone

(56.93%), cefixime (17.22%), ceftriaxone + sulbactam (11%) (Table 9) and commonly used penicillins for the treatment of respiratory tract infections were amoxicillin (52.65%), amoxicillin + clavulinic acid combination (13.25%), crystalline penicillin (3.40%) (Table 10). Table 11 highlights the important categories of adjuvants co-prescribed with AMAs in relevant clinical situations such as bronchodilators (25.63%), expectorants, mucolytics, cough suppressants, decongestants (26.21%), H_1 antihistamines (6.87%), gastroprotective agents (10.95%), antipyretics (8.26%), corticosteroids (4.41%) and few other drugs.

The chosen bronchodilators used as adjuvants concurrently or separately are salbutamol, salmeterol, albuterol, terbutaline, aminophylline, theophylline, ipratropium bromide. Adjuvant drugs used systematically were chlorpheniramine, cetirizine, levocetirizine, loratadine (H_1 antihistamine), ranitidine (H_2 antihistamine), omeprazole, pantoprazole, rabeprazole (proton pump inhibitor). Corticosteroids employed as the adjuvants were budesonide, dexamethasone, hydrocortisone, beclomethasone and prednisolone. Expectorants, mucolytics, cough suppressants and decongestants commonly included were bromhexine, guaiphenesin, ambroxol, noscapine, dextromethorphan, phenylephrine. Xylometa-zoline was the most common decongestant used topically. The chosen NSAIDs used as concurrently or separately are diclofenac, ibuprofen and paracetamol. Table 12 illustrates the different groups of bronchodilators that have been used for different conditions of respiratory tract infections in following order; β_2 agonists (59.97%), methyl xanthines (29.53%) and anticholinergics (10.47%).

Table 13 shows various AMAs constituting DU90% segment. Here DU90% segment was mainly constituted by penicillins, cephalosporins, aminoglycosides, macrolides, antitubercular treatment and fluoroquinolones. Out of 12 different AMAs prescribed in this study, 6 drugs were part of DU90% segment.

Chi-square test shows no significant difference in the use of AMAs in various infective conditions in out-patient department (Table 14). Most of the outpatients reported were suffering from acute rhinitis and acute rhinosinusitis which are viral in origin and were treated symptomatically without any antimicrobial agents. AMAs were prescribed for patients complaining of symptoms of pharyngitis or other severe symptoms.

Table 15 shows different prescribing parameters obtained from this medical-audit study. This table illustrates that average number of drugs prescribed per prescription was 5.53 and the percentage of drugs prescribed by generic name was negligible (0.56%). The table also demonstrates that the percentage of prescriptions with antibiotics was 69% which accounts for the fact that most of the RTIs had been treated with antimicrobials. Percentage of prescriptions with injection prescribed was 28.35% whereas the percentage of drugs prescribed from Essential Drug List 2011(NLEM 2011) was 67.56%. It shows that moderate numbers of drugs were prescribed from the essential list and there is still scope for prescribing more drugs from the Essential Drug List (NLEM 2011).

In general, the routes of drug administration in the respiratory tract infections have been oral with a few exceptions wherein, certain antimicrobial agents have also been administered parenterally. Adjuvants have been administered through oral, parenteral and inhalational route.

Table 1: Gender distribution of study samples in RTIs [Total number of cases = six hundred three (603)]

	MALE		FEMALE		TOTAL	
Disease	Number	%	Number	%	Number	%
URTI	217	35.98%	186	30.84%	403	66.83%
LRTI	132	21.84%	68	11.27%	200	33.16%
TOTAL	349	57.87%	254	42.12%	603	100%

Table 2: Age prevalence of patients in RTIs (n = 603)

Age in years	URTI	%	LRTI	%
5-25	174	28.85%	17	2.81%
26-50	170	28.19%	47	7.79%
51-75	57	9.45%	114	18.90%
>75	2	0.33%	22	3.64%

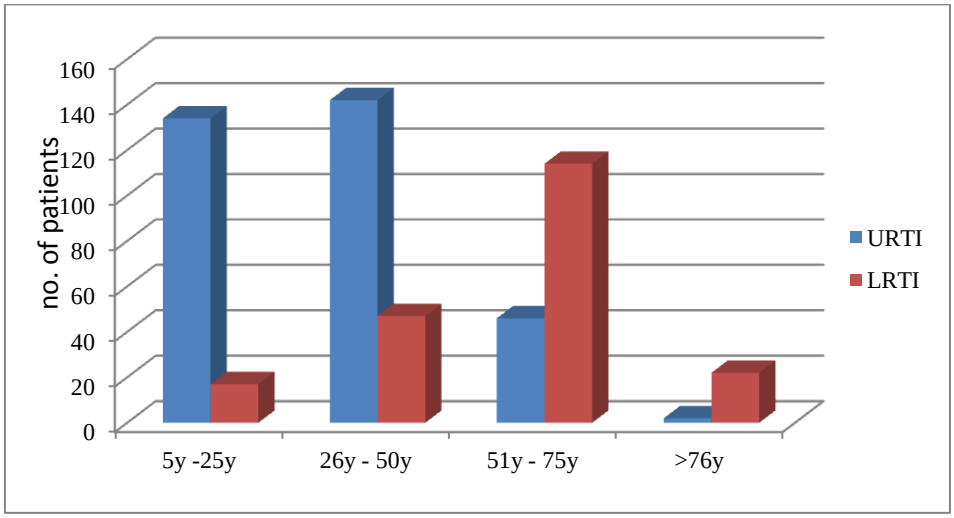

Figure 1: Age prevalence of patients of RTIs

[Note: F=Female, LRTI= Lower Respiratory Tract Infection, M=Male, URTI=Upper Respiratory Tract Infection]

Table 3: Distribution of RTIs (n = 603)

Disease	Number	%
URTI	403	66.83%
Acute Pharyngitis	57	9.45%
Acute Rhinitis	258	42.78%
Acute Rhinopharyngitis	73	12.10%
Acute Sinusitis	7	1.16%
Chronic Pharyngitis	8	1.32%
LRTI	200	33.16%
Acute Bronchitis	30	9.9%
Acute Bronchitis + Acute COPD	82	13.59%
Acute Bronchitis + Pulmonary Koch's	19	3.15%
Atypical Pneumonia	3	0.49%
Pneumonia	37	6.13%
Pulmonary Koch's	16	2.65%
Chronic Bronchitis	13	2.15%

Table 4: Distribution of organisms isolated from sputum/throat swab

Organisms	Numbers	%
No Organisms	150	76.92%
Klebsiella pneumoniae	19	9.74%
Acinetobacter sp.	10	5.12%
Pseudomonas aeruginosa	5	2.56%
Escherichia coli	4	2.05%
Streptococcus pneumoniae	2	1.02%
Enterococcus	2	1.02%
Others	3	1.53%
Total	195	100%

Table 5: Antibiotic Sensitivity of Organisms in culture/sensitivity test

Organisms	Sensitive	Resistant
Klebsiella pneumoniae	imipenem, amoxicillin - clavulinic acid, amikacin	gentamicin, sparfloxacin, cotrimoxazole, cefotaxime
Acinetobacter spp.	imipenem, amoxicillin-clavulinic acid, amikacin	ciprofloxacin, amikacin, cotrimoxazole, cefotaxime
Pseudomonas aeruginosa	Piperacillin-tazobactam, imipenem, meropenem, amikacin	ciprofloxacin, gentamicin, ceftriaxone, cotrimoxazole, sperfloxacin
Escherichia coli	amikacin	gentamicin, ceftriaxone, sparfloxacin
Streptococcus pneumoniae	Amoxicillin-clavulinic acid, imipenem	ampicillin, amikacin, ciprofloxacin
Enterococcus	amikacin, gentamicin, cotrimoxazole	ceftriaxone, ciprofloxacin

Table 6: Illustrations of monotherapy and polytherapy in RTIs (n=603)

Conditions	Monotherapy	%	Polytherapy	%
URTIs	184	30.51%	34	5.63%
Acute pharyngitis	27	4.47%	7	1.16%
Acute rhinitis	121	20.06%	5	0.82%
Acute rhinopharyngitis	32	5.30%	12	1.99%
Acute sinusitis	3	0.49%	4	0.66%
Chronic pharyngitis	1	0.16%	6	0.99%
LRTIs	69	11.44%	131	21.72%
Acute bronchitis	13	2.15%	17	2.81%
Acute bronchitis, Acute COPD	42	6.96%	40	6.63%
Acute bronchitis, Pulmonary Koch's	3	0.49%	16	2.65%
Atypical pneumonia	0	0	3	0.49%
Pneumonia	3	0.49%	34	5.63%
Pulmonary Koch's	0	0	16	2.65%
Chronic Bronchitis	8	1.32%	5	0.83%
Total	253	41.95%	165	27.36%

Table 7: Illustration of mean number of AMAs used in RTIs

RTIs	No. of cases	No. of AMAs	Mean±SE
Acute pharyngitis	57	43	0.71±0.09
Acute rhinitis	258	132	0.51±0.03
Acute rhinopharyngitis	73	56	0.77±0.08
Acute sinusitis	7	13	1.83±0.47
Chronic pharyngitis	8	14	1.71±0.35
Acute bronchitis	30	53	1.75±0.15
Acute bronchitis, Acute COPD	82	145	1.76±0.11
Acute bronchitis, Pulmonary Koch's	19	66	3.27±0.49
Atypical pneumonia	3	8	2.66±0
Pneumonia	37	103	2.08±0.19
Pulmonary Koch's	16	85	5.2±0.39
Chronic Bronchitis	13	20	1.58±0.22
Total	603	738	1.22±0.05

Table 8: Prescription pattern of AMAs used in various RTIs

Conditions	Peni	Ceph	AG	Macr	ATT	FQ	Other	Total
URTIs								
Acute pharyngitis	31	7	0	3	0	0	2	43
Acute rhinitis	107	10	0	4	0	0	11	132
Acute rhinopharyngitis	26	22	0	2	0	2	4	56
Acute sinusitis	9	2	0	0	0	1	1	13
Chronic pharyngitis	2	6	3	1	0	0	2	14
LRTIs								
Acute bronchitis	9	26	2	8	0	5	3	53
Acute bronchitis, Acute COPD	31	66	8	22	0	10	8	145
Acute bronchitis, Pulmonary Koch's	3	17	2	2	32	3	7	66
Atypical pneumonia	1	3	1	2	0	1	0	8
Pneumonia	28	34	10	15	0	7	9	103
Pulmonary Koch's	9	7	4	3	60	1	1	85
Chronic Bronchitis	8	9	1	1	0	0	1	20
Total	264	209	31	63	92	30	49	738
percentage	35.71%	28.31%	4.20%	8.53%	12.46%	4.06%	6.64%	100%

Note: AG=Aminoglycoside, ATT=Anti Tubercular Treatment, Ceph=Cephalosporin, FQ=Fluoroquinolone, Macr=Macrolide, Peni=Penicillin.

Table 9: Prescribing pattern of Cephalosporins in RTIs

Conditions	ceph	cefadr	cefpo	cefix	ceftri	Ceftri+sul
URTIs						
Acute pharyngitis	1	0	0	4	2	0
Acute rhinitis	2	1	1	6	0	0
Acute rhinopharyngitis	2	1	1	18	0	0
Acute sinusitis	0	0	0	0	2	0
Chronic pharyngitis	0	1	0	0	5	0
LRTIs						
Acute bronchitis	0	0	0	4	22	4
Acute bronchitis, Acute COPD	0	0	0	1	49	16
Acute bronchitis, Pulmonary Koch's	0	0	1	1	15	0
Atypical pneumonia	0	0	0	0	2	1
Pneumonia	0	0	2	1	16	0
Pulmonary Koch's	0	0	0	0	5	2
Chronic Bronchitis	0	0	1	1	6	0
Total	5(2.39%)	3(1.43%)	5(2.39%)	36(17.22%)	119(56.93%)	23(11%)

Note: ceph=cephalexin, cefadr=cefadroxil, cefpo=cefpodoxime, cefix=cefixime, ceftri=ceftriaxone, ceftri+sul=ceftriaxone+ sulbactam

Table 10: Prescribing pattern of Penicillins in RTIs

Conditions	crys pen	Clox	amox	amox+clav	piper+tazo
URTIs					
Acute pharyngitis	1	0	20	5	0
Acute rhinitis	0	0	101	3	0
Acute rhinopharyngitis	0	0	10	8	0
Acute sinusitis	1	0	4	2	0
Chronic pharyngitis	1	0	1	0	0
LRTIs					
Acute bronchitis	1	0	0	2	0
Acute bronchitis, Acute COPD	0	0	3	6	0
Acute bronchitis, Pulmonary Koch's	0	1	0	1	0
Atypical pneumonia	0	0	0	0	0
Pneumonia	2	1	0	3	2
Pulmonary Koch's	3	0	0	1	1
Chronic Bronchitis	0	0	0	4	0
Total	9(3.40%)	2(0.75%)	139(52.65%)	35(13.25%)	3(1.13%)

Note: crys pen=crystalline penicillin, clox=cloxacillin, amox=amoxicillin, amox+clav=amoxicillin+clavulinic acid, piper+tazo= piperacillin+tazobactam

Table 11: Details of adjuvants in RTIs

Conditions	Bron dil	steroids	Anti hist	Anti pyr	E,M,S,D	Anti acid
URTIs						
Acute pharyngitis	41	0	9	11	80	25
Acute rhinitis	132	1	52	57	326	18
Acute rhinopharyngitis	36	1	17	37	22	14
Acute sinusitis	3	1	3	4	6	7
Chronic pharyngitis	3	0	3	6	5	3
LRTIs						
Acute bronchitis	52	15	16	12	38	28
Acute bronchitis, Acute COPD	238	64	46	36	106	94
Acute bronchitis, Pulmonary Koch's	35	7	5	11	20	22
Atypical pneumonia	7	4	0	3	4	6
Pneumonia	65	12	10	25	40	35
Pulmonary Koch's	29	7	4	10	22	24
Chronic Bronchitis	26	3	4	3	13	9
Total	667(31.12%)	115(5.36%)	179(8.35%)	215(10.03%)	682(31.82%)	285(13.29%)

Note: Anti hist=Anti histamines, Anti pyr=Antipyretics, Bron dil=Bronchodilators, E= Expectorants, D=Decongestants, M=Mucolytic, S=Cough suppressants, Leu anta=leukotriene antagonists.

Table 12: Distribution of Bronchodilators in RTIs [Total number of bronchodilators used = six hundred and sixty seven (667)]

Conditions	β_2 Agonists	Methyl Xanthines	Anticholinergics
URTIs			
Acute pharyngitis	40	1	0
Acute rhinitis	124	8	0
Acute rhinopharyngitis	14	22	0
Acute sinusitis	2	1	0
Chronic pharyngitis	2	1	0
LRTIs			
Acute bronchitis	28	20	5
Acute bronchitis, Acute COPD	114	76	48
Acute bronchitis, Pulmonary Koch's	16	14	5
Atypical pneumonia	3	3	1
Pneumonia	29	29	7
Pulmonary Koch's	15	11	3
Chronic Bronchitis	13	11	2
Total	400 (59.97%)	197 (29.53%)	70 (10.47%)

Table No 13: AMAs constituting DU90%

AMAs	No. of prescriptions	Percentage
Penicillins	264	35.77%
Cephalosporins	209	28.31%
Antitubercular treatment	92	12.46%
Macrolides	63	8.53%
Aminoglycosides	31	4.20%
Fluoroquinolones	30	4.06%
DU90% constituted by 1 to 6 drugs	689(93.36%)	
Anthelmintic	21	2.84%
Antiamoebic	14	1.89%
Antifungal	7	1.16%
Cotrimoxazole	3	0.40%
Nitrofurantoin	2	0.27%
Tetracycline	1	0.13%
Chloramphenicol	1	0.13%

Table14: AMAs used and symptomatic treatment in outpatient department

Condition	Treatment		Total
	AMAs prescribed	Symptomatic treatment	
Acute Rhinitis	118	132	250
Acute Pharyngitis	32	23	55
Acute Rhinopharyngitis	30	29	59
Total	180	184	364

Pearson $\chi 2 = 2.32$ $p > 0.05$

Table 15: Prescription Parameters in study sample (n=603)

Average number of drugs per prescription	5.53
% of drugs prescribed by generic name	0.56%
% of prescription with antibiotics prescribed	69%
% of prescription with injection prescribed	28.35%
% of drugs from essential drug list (NLEM 2011)	58.13%

Note: NLEM=National List of Essential Medicine 2011

Discussion

The study was conducted in two major departments (Medicine and Pediatrics) of K.V.G. Medical College and Hospital, Sullia, over a period of 18 months (from Jan 2013 to Jun 2014) including 2 months of pilot study. Among the 4032 prescriptions screened, 391 medical case records of patients affected with RTIs were analyzed for prescription pattern. The mean age of presentation was observed to be 38.55±0.9 years. The percentage of male patients suffering from RTIs in this study was more (57.87%) compared to females (42.12%) whereas demographic characteristics in similar studies have shown that percentage of females suffering from RTIs was more than males.[16, 17]

Upper respiratory tract infections (URTIs) are the illnesses caused by an acute infection which involves the upper respiratory tract: nose, sinuses, pharynx or larynx. The prototype is the illness known as the common cold and other infections are tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media and tracheobronchitis.[18] It encompasses sinus, pharyngeal and lower airway symptoms, where none of the symptoms are dominant and the exact site of infection cannot be clearly established.[19] URTI is primarily viral in etiology [20, 21, 22] and in most cases, will resolve spontaneously within one to two weeks.[19] URTIs do not require antimicrobial agents unless they are complicated by acute otitis media (AOM) with effusion, tonsillitis, sinusitis and lower respiratory tract infection. The main bacterial pathogen in URTI is the group A β-hemolytic streptococcus, which was found to be present in only 2.4 to 17% of adults who presented with URTI symptoms. [20, 21, 22]

The increasing resistance of these antimicrobials in upper respiratory tract pathogens is of great concern. Selection of an anti-infective agent regimen for the treatment of upper respiratory tract pathogens should be based on the drug spectrum of activity as well as the regimen's bacteriologic and clinical efficacy, potential adverse effects, ease of administration, patient compliance and cost.[23]

Common URTI terms are defined as follows:

- Rhinitis - Inflammation of the nasal mucosa.
- Rhinosinusitis or sinusitis - Inflammation of the nares and paranasal sinuses, including frontal, ethmoid, maxillary, and sphenoid.
- Nasopharyngitis (rhinopharyngitis) - Inflammation of the nares, pharynx, hypopharynx, uvula, and tonsils.
- Pharyngitis - Inflammation of the pharynx, hypopharynx, uvula, and tonsils.
- Epiglottitis (supraglottitis) - Inflammation of the superior portion of the larynx and supraglottic area.
- Laryngitis - Inflammation of the larynx.
- Laryngotracheitis - Inflammation of the larynx, trachea, and subglottic area.
- Tracheitis - Inflammation of the trachea and subglottic area.

Lower respiratory tract infections (LRTIs) are generally more serious than upper respiratory infections and are the leading cause of death among all infectious diseases.[24] The two most common LRTIs are bronchitis and pneumonia, pneumonia is the fourth leading cause of death.[25]

Use of antibiotic prescription in LRTI remains controversial. On the one hand, it is usually of bacterial origin, is associated with a high morbidity and mortality, and needs to be rapidly treated with an antibiotic. On the other hand, in a case of LRTI, it is difficult to exclude the diagnosis of community acquired pneumonia (CAP) in out-patients, and most of the times self-limiting illnesses, and prescription of antimicrobials may cause increased antimicrobial resistance.[26]

According to a study by Mandell LA the preferred treatment for CAP for hospitalized patients is azithromycin or a fluoroquinolone (moxifloxacin, gatifloxacin, and levofloxacin; gemifloxacin is only available as an oral formulations)[27] or the combination of macrolide (clarithromycin or azithromycin) plus a β lactam antibiotic (cefotaxime, ceftriaxone or ampicillin).[28]

During the study period a total of 4032 prescriptions were screened for RTIs, out of which 603 prescriptions met the inclusion criteria and were chosen for the study. The mean age of presentation was observed to be 38.55±0.9 years. The percentage of male patients suffering from RTIs in this study was more (57.87%) compared to females (42.12%) whereas demographic characteristics in similar studies have shown that percentage of females suffering from RTIs was more than males.[26, 29]

The occurrences of different URTIs among the patients were as follows; acute rhinitis 42.78%, acute rhinopharyngitis 12.10%, acute pharyngitis 9.45%, acute sinusitis 1.16% and chronic pharyngitis 1.32%. In a similar study the diagnosis of URTI (Non Specific URTI) accounted for 56.5%, sinusitis 28%, pharyngitis 12% and CSOM 3.5%.[29]

The percentage of patients suffering from LRTIs was 33.16% with differentiation as acute bronchitis with acute COPD 13.59%, acute bronchitis 9.9%, pneumonia 6.13%, acute bronchitis with associated pulmonary Koch's 3.15%, followed by pulmonary Koch's 2.65% and chronic bronchitis 2.15%. A study by Naik HG et al. showed that LRTIs (Non Specific LRTI and Acute Bronchitis) accounted for 46.87% and pneumonia accounted for 53.13% of the total cases analyzed.[26]

Culture and antibiotic sensitivity (C/S) was done in 195 cases out of 603 recorded cases and pathogenic organisms were found only in 45 cases (23.08%). The decrease in the percentage of samples sent for culture might be based on the clinical presentation at the time of admission so that the need for C/S tests in the remainder of cases might not have arisen or patient might have consumed the antibiotic prior to admission. Large percentage of sterile culture might be attributed to this and also to the viral cause of illness and, or proper specimen might not have been collected. Among 45 microbial isolates, *Klebsiella pneumoniae* was the commonest (9.74%) and *Enterococcus spp.* (1.02%) was the least common causative organism.

When prescriptions were screened thoroughly for all RTIs, the number of prescriptions containing mono-antibiotic therapy (single antibiotic per prescription) was 253 (41.95%) whereas prescriptions containing poly-antibiotic therapy were 165 (27.36%). Further, it was noted that mono-antibiotic therapy was preferred to poly-antibiotic therapy for the treatment of URTIs. However, in the treatment of LRTIs poly-antibiotic therapy was preferred than the mono-antibiotic therapy. The overall percentage of patients receiving various AMAs was 69.32% and the average number of AMAs per prescription was 1.22±0.05.

Most of the patients with URTIs were treated as outpatients unless they were associated with co-morbid conditions when they were admitted whereas most of the patients with LRTIs

presented with signs and symptoms that required emergency treatments or immediate hospital admission. Brand names were used while prescribing most of the drugs. Prescribing by generic name should be encouraged as it helps the hospital pharmacy to have better inventory control. These will also aid the pharmacy to purchase the drugs on contract basis. As the number of brand is less, it reduces the confusion among the pharmacists while dispensing. Generic drugs are often more economic than the branded ones.

When prescriptions were screened thoroughly, out of 603 prescriptions, antibiotics were not prescribed in 185 cases and were treated symptomatically. The patients were commonly prescribed with beta lactam antibiotics e.g. penicillins (35.17%) and cephalosporins (28.31%) followed by macrolide antibiotics (8.53%). Amoxicillin, amoxicillin+clavulinic acid combination, ceftriaxone, cefixime and azithromycin were the preferred antibiotics. ATT was prescribed for those suffering from pulmonary Koch's (12.46%).

In one case of pneumonia associated with hemorrhagic pleural disease and two non responding cases of acute bronchitis with acute exacerbation of chronic obstructive pulmonary diseases, piperacillin and tazobactam combination was used. In cases associated with diabetes, metronidazole was used; the reason might be increased risk of anaerobic infection which is seen most commonly with diabetes. In pediatric patients above 5 years of age anthelmintic was used, the reason might be anticipated risk of Loeffler's syndrome in lung.

The patients suffering from CAP have been treated according to the Guidelines for the management of pneumonia given by PGIMER Chandigarh guidelines.[30] Inpatients were switched to oral drugs after an initial course of intravenous antimicrobials for 5-7 days in accordance to severity and nature of disease. A variety of expectorants, mucolytics have been used in a combination with antitussives or antihistamines though evidence of efficacy of these is non-conclusive.

None of the prescriptions showed the simultaneous use of drugs which could possibly result in drug-drug interactions. Theophylline enhances the effect of sympathomimetics, hence these two groups of bronchodilators were often used simultaneously.[31]

Aminophylline was always used by a separate IV route. Combined ipratropium and β_2 agonist used in this study produced more marked and long lasting bronchodilatation as their effects are additive[31] especially in asthmatic bronchitis. Inhaled steroids were used in cases of frequent attacks of acute exacerbation of COPD, in advanced cases, though it is not known whether it will slow the disease progression.[32]

Chi-square test was applied to check the association between the disease conditions (for out-patients) and choice of treatment. Though no significant difference was found in the use of AMAs in various RTIs, it may be due to the fact that most of the outpatients reported were suffering from acute rhinitis and acute sinusitis, which are mostly viral in etiology and hence were treated symptomatically. Only when the patients complained of symptoms of pharyngitis, they were treated with AMAs.

Prescribing parameters obtained from this medical-audit study of RTIs illustrated that average number of drugs prescribed per prescription was 5.53. In a similar study conducted on URTIs in patients from ENT department the average number of drugs per prescription was 03.[33] Similarly a study on pediatric patients showed the average drug per prescription to be 4.88 ±1.57.[34]

Percentage of drugs prescribed in the form of injections was 28.35%. Drugs constituting DU90% comprised of penicillins, cephalosporins, ATT, macrolides, aminoglycosides and fluroquinolones. Out of 74 different drugs prescribed, 67.56% (50 drugs) were prescribed from the Essential Drug List 2011 which means moderate number of drugs from the essential list

was prescribed, and there is still scope for prescribing more drugs from the Essential Drug List. Percentage of prescriptions with antibiotics was 69%. A study by Lalit Patil et al showed that the percentage of prescriptions with an antibiotic prescribed was 91.5% and the percentage of drug prescribed from essential drug list was 56.75%.[33]
An attempt was made to record the adverse drug reactions. However, the incidence of adverse effects of drugs could not be ascertained or monitored because of the irregularity and poor compliance of patients in reporting for follow up measures. The prescription pattern followed in our hospital is in consensus with the standard guidelines. There is still scope for improvement with regard to use of drugs from Essential Drugs List.

Conclusion

Over a study period of 18 months, 603 medical case records of patients affected with RTIs (collected from two departments Medicine and Pediatrics of KVGMCH) were analyzed for prescription pattern. The incidence of URTIs was higher both in male and female patients compared to LRTIs. Highest incidence URTIs was noted in the age group of 5-25years, whereas most of LRTIs which have been studied show a predilection for the age group 51-75 years.
The various treatment regimens prescribed enlighten the use of several antimicrobial drugs viz. penicillins, cephalosporins, aminoglycosides, macrolides, fluoroquinolones and antitubercular drugs. Of the 12 different antimicrobials prescribed, 6 antimicrobials constituted DU90% segment. Among penicillins; amoxicillin, amoxicillin-clavulinic acid combination and among cephalosporins; ceftriaxones, cefixime were the preferred drugs. Azithromycin had also been used in high quantity.
Different adjuvants advocated for the treatment of RTIs are bronchodilators, expectorants, mucolytics, cough suppressants, decongestants, corticosteroids, antihistamines, antipyretics, gastroprotective agents. It has been noted that bronchodilators from different groups (β_2 agonist, methyl xanthines and anticholinergics) had been used concurrently probably for additive action. The combination of β_2 agonist with expectorants, mucolytics, cough suppressants and decongestants had also been noted.
In conclusion, modest prescribing practices are evident in the hospital where this study was undertaken and the prescription patterns are in consensus with the general trends, with a few changes, probably in the choice of established primary and supplementary therapeutic agents.

Conflict of Interest: None
Ethics Permission: Taken

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