Research Article

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Medication Appropriateness in Elderly Patients Diagnosed with Pneumonia

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Abstract: Ageing is a natural process accompanied with compromised good health**.** Pneumonia is associated with several independent risk factors, including the severity of clinical presentation, age, comorbidities, and specific pathogens which increase the burden of morbidity, mortality in aged patients. This study was carried out to assess the appropriateness of therapy for pneumonia in elderly patients. A prospective, observational study was conducted from July 2018 to June 2021 in the department of pulmonary medicine of a tertiary care teaching hospital in Bangalore, India. A total of 90 elderly patients aged >65 years, diagnosed with pneumonia who fulfilled study criteria and consented to take part in the study were enrolled. A well designed and internally validated case report form was used to document the findings after a due approval from the Institutional Ethics Committee. Socio-demographic characteristics, prescribed medications and clinical characteristics were documented and analyzed. Out of the 90 elderly patients, 25.6% were male while 75.4% were female. The mean age of the participants was 70.03±5.26 (SD) years. Applying tools like START/STOPP criteria, Beers criteria and MAI index, it was found that, 16.7% were received incorrect dose, 12.22% received drug duplication, 3.3% received drug which was not indicated, 2.2% received drug which was not effective for that condition and in 1.1% patients did not receive drugs for required duration. The findings from this study provide the feedback to the healthcare team to ensure rational management of pneumonia in elderly patients and enable this vulnerable population with improved health related quality of life.

Keywords: Pneumonia, Comorbidities, Pharmacotherapeutic Management, Medication Appropriateness Tools, Polypharmacy

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1. INTRODUCTION

Aging is natural and often associated with the cost of quality of health. A great percentage of elderly people aged 65 years or above suffer from two or more chronic conditions that is associated with increased risk of mortality.[1,2] With advancing age, the efficiency of adaptive and inherent immune systems reduce which make the elderly susceptible to infectious diseases such as pneumonia along with COPD, asthma,etc.[3] Globally, Community-acquired pneumonia is ranked as the fifth leading cause of death.[4,5] As per one study, the incidence of CAP in elderly patients is between 76 and 140 cases per 10,000 adults/year in Europe while in the US, the incidence of CAP in adults between 65 and 79 years is 63 cases per 10,000 and rises to 164.3 cases per 10,000 adults in the over-80 age group.[3] India also, share 23% of the global burden of CAP.[6] CAP is a critical issue for community wellbeing associated with several independent risk factors, including the severity of clinical presentation, age, the presence of comorbidities, and specific pathogens which increase the burden of morbidity, mortality in very old (aged $\geqslant$ 80 years) patients.[4,7-9] The incidence of pneumonia in the elderly is four-times higher than that of younger populations.[2] Community-acquired pneumonia frequently affects very old adults and as per a study, quality of life is reduced to 16% among elderly patients who survive hospitalization for CAP, compared to non-diseased persons. However, no specific guidelines are available for the management of community-acquired pneumonia in elderly patients. Pneumonia may also be associated with an exacerbation of previous chronic comorbidities such as diabetes mellitus, cardiac disease, chronic pulmonary disease. CAP is associated with many risk factors such as age >65 years, smoking, alcoholism, immunosuppressive conditions, and conditions such as COPD, cardiovascular disease, cerebrovascular disease, chronic liver or renal disease, diabetes mellitus and dementia. Cough, fever, chest pain, fatigue, lethargy, anorexia, tachypnoea and tachycardia are the most frequent symptoms associated with pneumonia in very old patients. The insufficient inflammatory response to an infection due to immunosenescence reduces the ability of very old patients to respond to an infection which in turn leads to an underestimation of pneumonia severity[10,11]. Appropriate prescribing in elderly patients is a huge challenge for healthcare professionals which include an increase in polypharmacy as incidence of multiple chronic diseases and degenerative conditions increases, and age-related physiological changes affect the pharmacodynamics and pharmacokinetics profiles of medicines. Polypharmacy and inappropriate prescribing (including potential prescribing omissions) are risk factors for adverse drug reactions, which commonly cause adverse clinical outcomes in elderly people.[12] The concern regarding the impact of inappropriate prescribing among the elderly population is the detection of potentially inappropriate medications (PIMs).[13] Different tools to assess appropriateness of prescription in geriatrics include Beers criteria, screening tool of older person's prescriptions (STOPP) criteria, screening tool to alert to right treatment (START) criteria, and medication appropriate index (MAI).[14] The MAI measures appropriateness of prescribing for elderly patients, using 10 criteria for each medication prescribed. For each criterion, the evaluator rates whether the medication is appropriate, marginally appropriate, or inappropriate.[15] Therefore, this study was aimed to evaluate medication appropriateness of elderly patients with pneumonia.

2. MATERIALS AND METHODS

Study design and duration: Prospective, observational study was conducted for a period of three-year period (July 2018 to June 2021) Study site: In the department of pulmonary medicine of a tertiary care hospital located in Bangalore, India. Patients: Elderly patients (age group 65-80 years) diagnosed with pneumonia and admitted to the department of pulmonary medicine were enrolled in the study. Study criteria: The inclusion and exclusion criteria of the study are shown below.

Inclusion Criteria	Exclusion Criteria
Elderly inpatients of age 65-80 years admitted to pulmonary medicine ward at the study centre	Elderly patients data with mortality within 24 hours of hospitalization or shifted to a higher intensive care unit
Elderly inpatients shifted to Pulmonary medicine ward from Emergency medicine department	Non consenting patients

The study received the approval from the Institutional Ethics Committee (Ref. No. – VIPS/IEC/2018-01, dt.11/12/2018) and informed consent was taken from the enrolled patients to ensure their acceptance into the study. Patient details regarding demographics, all relevant clinical data including past medical and medication history, medication usage, pulmonary function test report, were documented in a well-designed and internally validated case report form based on data obtained from medical records of patients, self-reporting by patient or by the caregiver and laboratory reports. The enrolled patients' cases were followed up from the day of admission until discharge by the researcher. Medication appropriateness tools START/STOPP criteria, Beers criteria and Medication appropriateness index were applied to assess the therapy.[16-18]

3. STATISTICAL ANALYSIS

The documented data was entered in MS Excel version 2019 and descriptive statistics in terms of frequency, percentage, mean ± standard deviation were calculated. Quantitative variables like age are expressed as mean values ± standard deviation (SD) whereas the qualitative variables like comorbidities are expressed as absolute and relative frequencies.

4.   RESULTS

Table 1: Demographics and clinical characteristics of study patients		
Socio-demographic details		
Gender	**N/%**	**Age (years)- Mean±SD**
Male	23(25.6%)	69.9±5.03
Female	67(74.4%)	70.03±5.26
Total	90	70.03±5.26
Comorbidities		
	N/%	
HTN	19/21.1%	
HTN, T2DM	16/17.8%	
T2DM	06/6.7%	
Hypothyroid	03/3.3%	
Physical examination		
Respiratory rate	22.76±4.4	
Pulse rate	105.23±19.8	
Systolic blood pressure	133±24.4	
Diastolic blood pressure	82.8±12.3	
Laboratory examination		
Haematocrit	40.59±4.9	
Serum Creatinine	0.82±0.5	
Na	131.2±5.6	

Table 1 includes the demographics and other related parameters of the participants where more than 50% were female patients. The mean age of male was 69.9±5.03 years, for female was 70.03±5.26 years while the mean age of total study participants was found to be 70.03±5.26 years. 77.8% were in the age group of 65-70 years; followed by 11.1% aged 71-75 years, 4.4% aged 76-80 years while 6.7% were above 80 years of age.

Table 2: Medication inappropriateness of study patients			
MAI criteria	**% inappropriateness of prescribed drugs (n = 1084)**	**% patients with inappropriate prescribed drugs (n = 90)**	**P value**
Incorrect dose	1.6	16.7	P < 0.0001
Drug duplication	0.9	12.2	P < 0.0001
Indication of the drug	0.3	3.3	P = 0.0002
Effectiveness of drug	0.2	2.2	P = 0.0021
Duration of the drug	0.2	1.1	P = 0.1133
No. of Medicines		**N/%**	
Polypharmacy			
>6-<10		31/ 34.4%	
>11-<15		46/ 51.1%	
>15		10/ 11.1%	
Drug – drug interaction			
Major		21/ 13%	
Moderate		83/ 51.2%	
Minor		58/ 35.8%	

Level of significance at 5% (P<0.001)

Table 2 includes the parameters related to medication appropriateness index. Amongst a total of 90 pneumonia patients recruited during the study, 16.7% were given incorrect dose, 12.2% received drug duplication, 3.3% received drug which was not indicated, 2.2% received drug which was not effective for that condition and in 1.1% patients did not receive drugs for required duration.
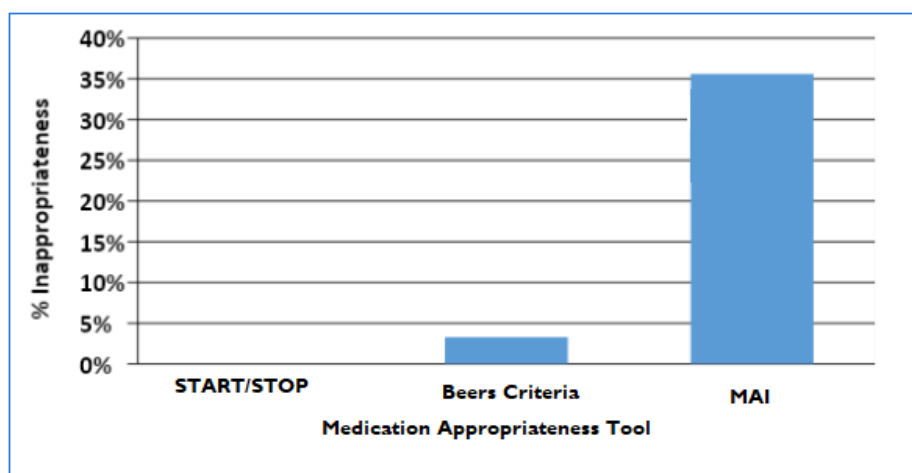
Figure I depicts the comparison of % inappropriateness with respect to the 3 criteria used in the study

Fig 1: Comparison of criteria for medication inappropriateness

5. DISCUSSION

Pneumonia is a relatively common infection accounting for more than 30% to 40% of the hospitalizations. Aging is associated with overall weakening of organ function which makes the elderly prone to pneumonia due to resistant organisms including Gram negative bacilli. Managing elderly patients with pneumonia is a major task. Recent guidelines, would address best way to manage pneumonia in elderly.[8] In the present study, the female study population is higher compared to males in this study. In another study, female patients were more.[19] In the present study, 48.9% were having one or other comorbidities while 51.1% were not having any comorbidity. Out of which, 21.1% were having Hypertension, 17.8% were having hypertension and diabetes mellitus, 6.7% were having only Diabetes mellitus while 3.3% were having hypothyroidism. In a study done by Luna CM, mortality was higher for those with more than one comorbidity such as COPD, congestive heart failure, cerebrovascular accident, chronic liver or renal disease, diabetes mellitus, and malignant disease and reported that all the comorbidities except COPD and liver disease were significantly associated with higher mortality.[4] In the present study, physical examination such as pulse rate, respiratory rate, blood pressure and laboratory examination was also documented similar to another study done by Gleason PP et al.,.[20] In the present study, A total of 1084 medications were prescribed to all patients. Almost 70% of these medicines were considered to be appropriate. However, 30% of medications had one or more inappropriate ratings in the 9 criteria of the MAI. On assessing polypharmacy, more than 34.4% of patients were prescribed 6-10 drugs, 51.1% received 11-15 drugs and 11.1% received more than 15 drugs. The similar findings were also reported by Rakesh KB.[14] When we compared polypharmacy to age, we found, 30% of 65-70 years patients got 6-10 drugs, 34.4% received 11-15 drugs, 10% received more than 15 drugs. 10% of 71-75 years patients received 11-15 drugs, 1.1% received more than 15 drugs. 4.4% of 76-80 years patients received 6-10 drugs while 6.6% of patients aged more than 80 years received 11-15 drugs respectively. These findings are similar to the other studies. Polypharmacy is common among elderly patients due to the presence of comorbidities, however, care needs to be exercised to monitor the therapy for any drug-related problems like drug-drug interactions, adverse reactions, etc. which can occur as a result of polypharmacy.[21] The prevalence

of poly-pharmacy substantially increases with age. A higher exposure to poly-pharmacy was observed in the age group 60 to 79 years (56%), as compared to 34% in age group of 60 to 69 years and 23% in 70 to 79 years respectively.[22] Polypharmacy is considered inappropriate, if the prescribed medications were not indicated, not effective, or constitute a therapeutic duplication.[23] Moreover, polypharmacy comes with the risk of "overtreatment," or a situation that arises where the risk of adverse reactions far outweighs the expected clinical outcome. However, prescription of multiple drugs is considered clinically acceptable and not necessarily inappropriate in several clinical situations[24]. Drug interactions are also associated with polypharmacy. Advancing age increases the risk and burden of comorbidities which further increases risk of drug-drug interactions. Drug interactions are not easily predictable. It is important to optimize outcomes and to avoid harm from potentially dangerous interactions by implementing guiding principles in older adults.[25] In this study, more than 50% were moderate drug interactions followed by 13% major and 35.8% minor. In the elderly population, the impact of pneumonia is more than in other age groups. The most recent clinical practice guidelines stress the importance of appropriate treatment of elderly patients with pneumonia which is a challenging and complex process due to several characteristics associated with ageing.[1,12] In this study, for assessing medication appropriateness, three criteria have been used i.e START/ STOPP criteria, Beers criteria and medication appropriateness index, which is widely used by researchers, regulators, and policy- makers.[12,14] It was observed that, 16.7% received incorrect dose, eg. oseltamivir which was supposed to be given 75mg once in a day prophylactically was given 75mg twice in day, 12.2% received drug duplication, eg diclofenac was given along with acetaminophen, 3.3% received drug which was not indicated, in few cases furosemide or ondansetron was given which was not indicated 2.2% received drug which was not efficacious for that condition as antibiotic which was given to the patients and in 1.1% patients did not receive drugs for required duration. In the present study, 35.60% respondents had one or more inappropriate ratings among their prescribed medications as per MAI criteria. Similar findings have been reported earlier.[26] There is no error as per START/STOPP criteria in this study due to physicians' good knowledge and practice. Around 3.30% of patients were receiving inappropriate drugs to be avoided based on Beers criteria such as chlorpheniramine, dicyclomine, and

alprazolam. Similar finding was also reported in another study.[14]

6. CONCLUSION

Healthcare of elderly has always been a challenge to the care providers. The therapy appropriateness and monitoring has been guided by several approved criteria, the implementation of which aids in improved health related quality of life in the vulnerable elderly population.

7. AUTHORS CONTRIBUTION STATEMENT

Dr. Meenu Pandey conceptualized, gathered and analyzed the data with regard to this work. Dr. N.K Meera designed the study and provided the required clinical inputs for the conduct of the study. All the authors equally contributed in preparing the manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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