

Original Article

EVALUATION OF APPROPRIATENESS OF PRESCRIPTION AND POLYPHARMACY IN THE GERIATRIC POPULATION: A CROSS-SECTIONAL STUDY AT A COMPREHENSIVE GERIATRIC CLINIC IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: To assess the prescription quality in a comprehensive geriatric clinic and to determine the frequency of inappropriate prescription and polypharmacy.

Methods: Both males and female patients above the age of 60 y attending a comprehensive geriatric clinic of a tertiary care hospital were included in the study. Medications taken by the patients, excluding vitamins, minerals and herbal medications were counted in each patient and analyzed by considering their medical history and using universally accepted tools like medication appropriateness index, START, STOPP & Beer's criteria. In this study, polypharmacy was considered as having 6 or more medications per prescription.

Results: A total of 120 patients were included in the study. Around 82 (68.33%) patients had less than 6 prescribed medications and 38 patients (31.66%) were on 6 or more than 6 medications. The number of medications used by the patients is 4.37 ± 2.33 . Around 21 (17.5%) were on medications that are not indicated, 25 patients (20.83%) were receiving medications which are to be avoided in elderly as per the Beer's and STOPP criteria. Medication was underused in 24 patients (20%) as per START criteria. When both overused drugs and drugs to be avoided were considered for assessment of inappropriateness, 39 patients (32.5%) were found to be receiving inappropriate medication. Among the drugs to be avoided in elderly, amitriptyline was the most common drug and was used in 15 (12.5%) patients. Antihypertensives were the most common potential prescribing omissions in geriatric patients.

Conclusion: Polypharmacy is seen in a significant proportion of geriatric patients. Inappropriate prescription and potential prescribing omissions were observed in a significant proportion of geriatric patients.

Keywords: Polypharmacy, Geriatrics, Beer's criteria, STOPP criteria

INTRODUCTION

Appropriate prescribing is the outcome of the process of decision-making that maximises net individual health gains within the society's available resources' [1]. The use of medication can be considered appropriate if it has potential benefits outweighing the potential risks. Failure to prescribe drugs when it is indicated (act of omission) or prescribing drugs that are contraindicated (act of commission) are the examples of inappropriate prescription [2]. The polypharmacy i. e, the use of more than six medications is a serious problem in the present health care system, especially in the geriatric population. There is no consensus on the definition of polypharmacy. The terms 'polypharmacy' and 'inappropriate drug use' were used interchangeably in the literature [3].

The prescriptions can be evaluated for their appropriateness using the process or outcome that may be implicit (judgment-based) or explicit (criterion-based) measures. Process measures assess whether the prescription is in line with the accepted standards. In the geriatric population, explicit indicators of appropriate prescribing were developed based on extensive literature reviews and expert opinions which are drug or disease-oriented. These require a little clinical judgment, are too rigid and do not sufficiently address the comorbidities. Whereas in implicit measures, the information from the patient as well as from the medical literature was used to make judgments regarding appropriateness. Here, the focus is usually on the patient rather than on a specific drug. These are most sensitive, consider patient preferences, but are time-consuming. It depends on the knowledge and attitudes of the user and likely to have low inter-rater variability [4].

Evaluation of the quality of health care, especially in geriatrics is gaining more importance in the recent years. Longer life expectancy, comorbidities and the use of evidence-based clinical practice

guidelines are responsible for increasing polypharmacy in the elderly population. Prescribing cascade i. e, medication resulting in an adverse drug reaction that is treated with another medication, could be one of the factors involved in polypharmacy [5]. With the increased number of prescription drugs, there are more chances of inappropriateness including medication errors like drug-drug interactions, drug-disease interactions, etc. Polypharmacy may be associated with increased risk of adverse drug reactions and a decrease in the efficacy of medication because of reduced compliance. Increased drug consumption by elderly patients may lead to increased prevalence of medication-associated morbidity and mortality. The increased cost of drugs with limited resources too necessitates the need to audit prescriptions, thereby draw the attention of health care providers towards this aspect of prescribing quality and appropriateness.

Most commonly used tool for assessing potential inappropriate prescribing in geriatric population is the Beers' criteria [6]. Previous Beers Criteria were updated in 2012 using a comprehensive, systematic review and grading of the evidence on drug-related problems and adverse drug reactions in older adults. The other tools used to assess inappropriate prescribing in geriatric population are STOPP (screening tool of older persons' prescriptions) for detection of potential prescribing commission and START (screening tool to alert to the right treatment) for detection of potential prescribing omission [7].

Though the risks of polypharmacy are very clear, it may be unavoidable as multiple medications may be needed to cure, slow the progression of the disease and prevent its complications. Medications may also be needed to reduce the symptoms of the disease, thereby improving the quality of life in elderly patients. Therefore, balancing the risks and benefits of multiple medications,

avoiding inappropriate medications in geriatrics is a major challenge for the healthcare providers. In this context, the present study was aimed at assessing the prescription quality in a comprehensive geriatric clinic and to determine the frequency of inappropriate prescription and polypharmacy.

MATERIALS AND METHODS

This cross-sectional study was conducted in the geriatric clinic of a tertiary care hospital in South India, during the period 2013-14. Both male and female patients above the age of 60 y attending a geriatric clinic of a tertiary care hospital were included in the study. The study protocol was approved by the institutional ethics committee. Data regarding patient's demographics, medical history and medication prescribed, were obtained from the patient records maintained in the geriatric clinic. The vitamins and minerals that are taken on a regular basis, herbal and other alternative medications were excluded, as it is difficult to analyse the appropriateness of these medications using the standard criteria. After excluding all these medications, remaining medications for each patient is counted separately. In this study, polypharmacy was considered as having 6 or more medications per prescription. Medication appropriateness for each patient is analysed separately based on their medical history and clinical findings by applying medication appropriateness index [8], STOPP [7] & Beer's criteria [6]. The potential prescribing omissions were assessed by START criteria [2].

Criteria to assess medication appropriateness

In this study, inappropriateness was evaluated in three categories: Overprescribing (Inappropriate prescription of more medications or duplication of medications): This is assessed using the Medication Appropriateness Index (MAI) which is a 10 item instrument. Three items from MAI was selected (Indication, effectiveness, duplication) to assess overprescribing. These three items found to have excellent Intra and inter-rater reliability, as

reported in the previous literature. Based on this assessment, medications that are not indicated or ineffective or duplicated are counted as overprescribed medications.

Drugs to be avoided based on Beer's criteria and STOPP criteria: These criteria help to identify drugs to be avoided and doses of drug that should not exceed in elderly. These criteria also provide information regarding drug-disease and drug-drug interactions that should be avoided in elderly.

Potential prescribing omissions (Under-prescribing): These are detected using START criteria. Drugs which are beneficial to the patients, but are not being used are identified and listed by reviewing the medical history and medication list.

Sample size: As this is a time-bound cross-sectional study, data were collected over a period of 1 y.

Statistical analysis

Analyses were done by using SPSS (Statistical Package for the Social Sciences) software programme, version 11. All tests were 2-tailed, with an α level of 0.05. Data were summarized using descriptive statistics. Continuous variables were analyzed using student's 't' tests and categorical variables were compared using chi-square test. Pearson correlation was used to correlate with different parameters.

RESULTS

A total of 120 patients were included in the study. Among them, 58 (48.3%) were males, and 62 (51.7%) were females. Mean age of the patients was 71.56 ± 6.61 y (60-94 y). Around 82 (68.33%) patients had less than 6 prescribed medications and 38 patients (31.66%) were on 6 or more than 6 medications. The mean number of medications used by the patients was 4.37 ± 2.33 (range 1-12). Table 1 shows the distribution of patients, according to the number of drugs prescribed to them.

Table 1: Distribution of patients based on the number of drugs prescribed

Number of drugs	All patients' frequency (%)	Male patient's frequency (%)	Female patient's frequency (%)
1	12 (10)	7 (12.1)	5 (8.1)
2	19 (15.8)	10 (17.2)	9 (14.5)
3	16 (13.3)	9 (15.5)	7 (11.3)
4	19 (15.8)	5 (8.6)	14 (22.6)
5	16 (13.3)	7 (12.1)	9 (14.5)
6	18 (15)	11 (19)	7 (11.3)
7	10 (8.3)	7 (12.1)	3 (4.8)
8	3 (2.5)	1 (1.7)	2 (3.2)
9	4 (3.3)	1 (1.7)	3 (4.8)
10	2 (1.7)	7 (12.1)	2 (3.2)
12	1 (0.8)	0	1 (1.6)

Among 120 patients, 21 (17.5%) were on medications that are not indicated, 25 patients (20.83%) were receiving medications which are to be avoided in elderly as per the Beer's and STOPP criteria. Medications were underused in 24 patients (20%) as per START criteria. When both overused drugs and drugs to be avoided were

considered for assessment of inappropriateness, 39 patients (32.5%) were found to be receiving inappropriate medications. Gender-wise comparison did not show statistical significance for the proportion of patients receiving an inappropriate prescription (table 2).

Table 2: Proportion of patients receiving inappropriate prescriptions

Groups	Drugs to avoid	Overprescribing	Under use of medications	Inappropriate use
All patients n(%)	25 (20.83)	21 (17.5)	24 (20)	39 (32.5)
Males n(%)	11 (19)	12 (20.7)	15 (25.9)	20 (34.5)
Females n(%)	14 (22.6)	9 (14.5)	9 (14.5)	19 (30.6)
p value	0.66	0.47	0.17	0.70

X² test

Table 3 shows the comparison of a mean number of medications among patients with or without an inappropriate prescription. There was a significant difference in the mean number of medications among patient with or without drugs to be avoided in

their prescription ($p < 0.001$). Patients who received drugs to be avoided had 5.84 ± 2.41 medications in comparison with those who did not have such medications in their prescription. Similar observations are seen with regard to the overprescribing and

inappropriate use of medications. As expected, patients with potential prescribing omissions had less number of medications

when compared with patients without potential prescribing omissions.

Table 3: Comparison of number medications among patients with or without inappropriate prescription

Groups		Number of medications (mean±SD)	t value	p value	Confidence interval
Drugs to avoid	Present (n=25)	5.84±2.41	3.74	<0.001*	0.88-2.85
	Absent (n=95)	3.98±2.16			
Overprescribing	Present (n=21)	6±2.47	3.72	<0.001*	0.03-3.03
	Absent (n=99)	4.02±2.16			
Potential prescribing omissions	Present (n=24)	4.17±2.22	-0.47	0.648*	-1.31-0.81
	Absent (n=96)	4.42±2.37			
Prescription inappropriateness	Present (n=39)	5.95±2.26	5.84	<0.001	1.55-3.14
	Absent (n=81)	4.02±2.16			

Student 't' test * significant

Table 4 shows the correlation of the number of medications with the number of patients receiving drugs to be avoided, overprescribed drugs, potential prescribing omissions and inappropriate prescription.

There was a significant positive correlation between the number of medications used and the number of patients receiving drugs to be avoided in all patients as well as in females. Over prescribing also showed statistically significant positive correlation between the number of medications used in all patients as well as in females. Potential prescribing omissions have shown a negative

correlation with the number of medications received, but it is statistically insignificant. The combination of drugs to be avoided and overprescription was considered as inappropriate use and it was showing statistically significant positive correlation with the number of medications used in all patients as well as in males and females separately.

Table 5 shows the list of drugs to be avoided (as per Beer's and STOPP criteria) received by patients in this study. Most commonly used drug was amitriptyline, which was used in 15 (12.5%) patients.

Table 4: Correlation of prescription quality with the number of medications used

Groups		Correlation coefficient (r)	p value
Drugs to avoid	All patients	0.326	<0.01*
	Males	0.212	0.11
	Females	0.409	<0.01*
Overprescribing	All patients	0.324	<0.01*
	Males	0.241	0.068
	Females	0.427	<0.01*
Potential prescribing omissions	All patients	-0.043	0.64
	Males	-0.116	0.38
	Females	0.054	0.68
Inappropriate use	All patients	0.473	<0.01*
	Males	0.422	<0.01*
	Females	0.530	<0.01*

Pearson correlation * significant

Table 5: Patients receiving drugs to be avoided

Drugs to be avoided	Frequency	Percentage
Amitriptyline	15	12.5
Quetiapine	2	1.67
Prothiaden	1	0.83
Prazosin	1	0.83
Benzodiazepines	3	2.5
Risperidone	1	0.83
Trihexyphenidil	2	1.67
Amiodarone	4	3.33
Digoxin	1	0.83

Table 6 shows the list of drugs overused (assessed by MAI). Two of the patients were receiving more than 2 diuretics.

DISCUSSION

The present study was aimed at evaluating the quality of prescription and proportion of geriatric patients receiving polypharmacy at a comprehensive geriatric clinic. Though there is no generally accepted consensus on the definition of polypharmacy, most studies consider polypharmacy as the use of multiple drugs by a single person [9]. In this study, polypharmacy was considered if the patient receives >or = 6 concurrent medications.

Our study has shown polypharmacy in 31.66% of patients. Harugeri et al., reported prevalence of polypharmacy (5-9 medications) and high-level polypharmacy (more than 10 medications) as 45.0% and 45.5%, respectively [10]. The lower percentage of polypharmacy in the present study could be explained by the fact that we have taken criteria for defining polypharmacy as prescription having 6 or more medications. The mean number of medications used by our patients was 4.37±2.33. The mean number of drugs used by elderly people has varied from 3.5 to 6.9 [11-14].

Overprescribing was observed in 17.5% of patients and another 20.83% of patients were receiving medications which are to be avoided in elderly as per the Beer's and STOPP criteria. Inappropriate use was seen in 32.5%, which was assessed by taking account of both over-prescription and use of drugs to be avoided. In contrast to our findings, Harugeru A *et al.*, reported the prevalence of potentially inappropriate prescription use as 23.5% among the elderly inpatients in tertiary care hospitals [15]. The present study was based on the data collected from outpatients of a geriatric clinic in contrast to the above-mentioned inpatient data based study. Hence, comparison with this study may not be appropriate. As

expected, there was a very highly significant difference in the mean number of medications among patients having an inappropriate prescription and those without the evidence of inappropriateness. Correlation analysis also showed significant positive correlation between the number of medications used and the number of patients receiving an inappropriate prescription. Thus, there is a higher chance of inappropriate prescription as the number of medications in the prescription increases. Our findings are consistent with the previous reports of showing a significant association between a number of medications and inappropriateness in elderly patients [16, 17].

Table 6: List of drugs overused (overprescribing)

Drugs to be avoided	Frequency	Percentage
Valproate	2	1.67
Bethanechol	1	0.83
Amiodarone	1	0.83
Digoxin	1	0.83
Furosemide	1	0.83
Isosorbide mononitrate	1	0.83
Quetiapine	2	1.67
Cinnarizine+betahistine	3	2.5
Cremaffin+Isphagula	1	0.83
Ramipril+Rampril hydrochlorothiazide+furosemide+spironolactone	1	0.83
Hydrochlorothiazide+Clonidine-Hydrochlorothiazide+atenolol	1	0.83
Indapamide	1	0.83
Pantaprazole	1	0.83

Table 7 shows the list of potential prescribing omissions in geriatric patients (as per START criteria). Antihypertensives were the most common potential prescribing omissions.

Table 7: Potential prescribing omissions

Drugs	Frequency	Percentage
Hypolipidaemic agents (statins)	2	1.67
Antiparkinsonian agents	1	0.83
Antiplatelets	4	3.33
Antihypertensives	10	8.33
Antianginal agents	1	0.83
Drug for GERD	1	0.83

La Hy *et al.*, reported that 62.5% of elderly patients were receiving inappropriate medications [18]. They have observed that female gender was associated with an increased chance of receiving potentially inappropriate medications. In contrast to this study, we have observed lower levels of inappropriate prescription in our patients and also we did not find gender differences in the inappropriate prescription.

Chung *et al.*, reported inappropriate drug prescriptions using Beers' criteria, in 27.8% of elderly inpatients [19]. This is higher than the percentage observed in our study. This could be due to the fact that only hospitalized pneumonia patients are considered by Chung *et al.*

Potential prescribing omissions reviewed using the START criteria and were found to be 20%, which was lesser than that seen in a study by Lee S-J *et al.* (26.5%) [20] and in the Ireland study (22.7%) [21]. Patients with potential prescribing omissions had less number of medications when compared with patients without having potential prescribing omissions. Potential prescribing omissions have shown a negative correlation with the number of medications received, but it is statistically insignificant. Steinman *et al.*, did find any differences in potential prescribing omissions in patients taking less than five versus five or more medications [22].

Antihypertensives were the most common potential prescribing omissions followed by antiplatelets and hypolipidaemic agents. The START criterion recommends statins for patients with coronary artery, cerebrovascular, peripheral vascular disease and diabetics with a major risk factor for coronary artery disease, provided that they are able to do normal activities of daily life and have a life expectancy of more than five years [2]. Steinman *et al.*, also has seen

that cardiovascular drugs are the most common potential prescribing omissions [22]. These drugs proved to be having a major effect on morbidity and mortality. Hence, the omission of potentially useful medication too needs to be addressed with equal priority to that of inappropriate/over prescribing. We need to develop country-specific clinical practice guidelines for geriatric drug therapy to prioritize and balance the use of medications when the patient has multiple comorbidities, thereby avoiding the omission of potentially useful medications.

Among the drugs to be avoided, amitriptyline was the most commonly used drug in elderly. As per the STOPP & Beer's criteria, tricyclic antidepressants like amitriptyline should be avoided in elderly patients. They are highly anticholinergic, sedating and cause orthostatic hypotension. Being the cheapest option for painful neuropathy, amitriptyline is commonly prescribed for the same even in the elderly age group. According to our clinical experience, amitriptyline at low dose of 10 mg per day is safe and well tolerated in elderly patients. Benzodiazepines also need to be avoided in elderly except for some limited situations like ethanol withdrawal, severe generalized anxiety, periprocedural anaesthesia, seizure disorders, rapid eye movement sleep disorders, end of life care, etc. Any type of benzodiazepines should be avoided for treatment of insomnia, agitation or delirium. Elderly patients are more sensitive to benzodiazepines and have decreased metabolism of long-acting benzodiazepines. They increase the risk of cognitive impairment, delirium, falls, fractures, etc. Selective α_1 blockers like prazosin should be avoided for the routine treatment of hypertension as it is associated with high risk of orthostatic hypotension. Prazosin was given as 4th or 5th antihypertensive agent for resistant hypertension.

Amiodarone is associated with multiple toxicities. Antiarrhythmic drugs are avoided as first-line treatment for atrial fibrillation. Evidence suggests that in the elderly population, rate control yields the better balance of benefits and harms than rhythm control. Amiodarone was used in our patients for control of intermittent atrial fibrillation with each episode leading to pulmonary edema. Digoxin was used for rate control in cases of atrial fibrillation with mitral valve disease. Conventional and atypical antipsychotics increase the risk of stroke and mortality in the presence of dementia and hence should be avoided for behavioural problems of dementia unless non-pharmacological options have failed and the patient is a threat to self or others. Quetiapine and risperidone were used in our patients for psychosis. Anticholinergics like trihexyphenidyl are not recommended for Parkinson's disease in elderly as the most effective agents are available for the same[6].

Prescribing for elderly patients is more complex as they usually have multiple comorbidities. Age-related changes in pharmacokinetics, risk of drug-drug/disease interactions adds to the complexity for a quality prescription. Prescribing decisions are not always clear cut, and clinicians must consider multiple factors. Balancing all these issues requires up to date information on standard criteria for prescribing in elderly. In this context, the findings of our study may provide some insight to improve the quality of prescription for elderly patients.

The strength of our study could be the fact that both the explicit criterion (independent of diagnosis) and the implicit criterion (considering diagnosis) were applied to assess the appropriateness of prescription by using the STOPP/Beers criteria. In addition, in this study potential prescription omissions were also identified using the START criteria.

Some of the limitations of our study need to be considered. Data for the analysis collected from a comprehensive geriatric clinic. Hence, it may be difficult to extrapolate/generalise the findings to all elderly patients, especially those residing in rural settings. The Beer's criteria, as well as STOPP criteria, were developed in western countries. The medications listed in these criteria may not have the same adverse consequences in different populations of diverse ethnicity. In addition, these criteria may have some inherent limitations. Assessment of overprescribing was based on some of the relevant questions from the Medication Appropriate Index. Though these questions were not validated independently as the measure of over-prescribing, many authors have used the same in the previous literature. We have checked the patient's medical history and medications only through the medical records maintained in the geriatric clinic. As there was no direct interaction with the patients, there could be the possibility of data being incompletely captured in the medical records.

CONCLUSION

Polypharmacy is seen in a significant proportion of geriatric patients. The inappropriate prescription is directly proportional to the number of medications prescribed. Potential prescribing omissions were also observed in a significant proportion of geriatric patients, which too needs to be addressed to improve the quality of prescription in elderly.

CONFLICT OF INTERESTS

Declare none

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