ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 14, Issue 8, 2021

Online - 2455-3891
Print - 0974-2441

Research Article

PATTERN OF MEDICATION USE AMONG ELDERLY INPATIENTS IN A TERTIARY CARE HOSPITAL OF NORTHEAST INDIA

BRAHMA DK[1], CHAYNA SARKAR[1], JOONMONI LAHON[2]*, JULIE WAHLANG[1], BHATTACHARYA PK[3], LYNRAH KG[3], BANYLLA SHISHA NONGKYNRIH[4], PYNJOP KUPAR NONGRUM[1]

[1]Department of Pharmacology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong, Meghalaya, India. [2]Department of Pharmacology, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India. [3]Department of General Medicine, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong, Meghalaya, India. [4]Department of Pasteur Institute, Shillong, Meghalaya, India. Email: joanlahon@yahoo.co.in

Received: 23 May 2021, Revised and Accepted: 30 June 2021

ABSTRACT

Objectives: The objective of the present study was to assess the pattern of medication use among elderly inpatients of internal Medicine Wards and to evaluate inappropriate prescribing with the help of Beers criteria 2019.

Methods: It was a retrospective hospital data-based study. Data were obtained from treatment charts of elderly inpatients stored in the Medical Records Department. Total 236 treatment record charts of patients ≥60 years of either sex was obtained from the period of July 2015 to December 2015 and the information were noted in predesigned pro forma.

Results: The mean±SD age of the patients was 69.07±7.72 years with male preponderance (58.5%). Maximum number of patients were having respiratory disorders (57.6%), followed by kidney diseases (20.8%), cardiovascular diseases (18.6%), and so on. A total of 2683 drugs were prescribed with average number of 10.68±4.74 drugs per prescription. Only 363 formulations were prescribed by their generic names and 29.1% drugs were prescribed as fixed dose combinations. Polypharmacy was seen in 91.5% and 39%, respectively, in hospital stay and during discharge. About 60.5% drugs were prescribed from the National list of essential medicine. Total 57 drugs were found to be potentially inappropriate. About 22% patients received at least one drug which was potentially inappropriate according to Beers criteria and around 14% drugs were prescribed inappropriately.

Conclusion: This study suggests that use of potentially inappropriate medications is common in elderly patients, some of them associated with high degree of risk in terms of worsening of the co-morbidity or drug-drug interactions. There is a need for nationwide assessment and strategies that may reduce or overcome such high prevalence.

Keywords: Beers criteria, Geriatric, Potentially inappropriate medication, Prescription pattern, Prescribing indicators.

 DOI: http://dx.doi.org/10.22159/ajpcr.2021v14i8.42152. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

The number of elderly people is increasing worldwide. There were 962 million people 60 years or over globally in 2017, which were more than twice as large as in 1980, when there were 382 million older people worldwide. The number of older people is expected to reach nearly 2.1 billion in 2050. In 2017, people 60 years or over in India were 9.4% of the total population, which accounted to 125.69 million [1]. This profound shift in the population of elderly people brings with it a variety of social, economic, and health-care policy challenges [2]. Moreover, a large number of elderly people suffer from chronic and degenerative pathology, leading in turn to a demand for more medication.

Medications play crucial role in geriatric healthcare as they treat chronic diseases, alleviate pain, and improve quality of life. About 55% of community prescriptions dispensed in 2001 in UK were meant for people ≥60 years of age [3]. Interindividual differences in age-related pharmacokinetic and pharmacodynamic changes as well as presence of comorbid conditions have to be considered while prescribing medicines in elderly population. Polypharmacy, for number of comorbid conditions, leads to higher incidence of side-effects and harmful drug-drug interactions and drug-disease interactions, with often atypical presentation. Polypharmacy is the concomitant administration and use of five or more medications and it is usually common among older adults [4,5]. Likewise, underuse of medication seems to have a negative effect on health outcomes for older people, which include functional disability, health services use, and death [6]. About 20–25% of hospital admissions in elderly population are attributed to adverse drug reactions and about half of these reactions are preventable. Moreover, there is limited evidence available to guide prescribing for elderly; the prescribers tend to depend on data available for younger subjects. Furthermore, these patients are often excluded from drug trials making it difficult for the clinician to weigh up the benefits versus risks [4,7].

To achieve the maximum therapeutic outcome with minimum adverse reactions, it is important to identify the pattern of inappropriate use of medicines in this population. Today, several tools are used to evaluate the prescription of potentially inappropriate medication (PIM) in older people. PIM is a drug, use of which outweighs the risk of an adverse event than its clinical benefit, particularly when there is a safer or more effective alternate therapy for the same condition [6]. Explicit criteria to identify certain drugs as PIMs are developed for elderly patients. The most common among them are the American Geriatrics Society (AGS) Beers criteria, Screening Tool of Older Person's Prescriptions/Screening Tool to Alert doctors to the Right Treatment tools, Improved prescribing in the elderly tool, and PRISCUS (Latin for "old and venerable") list [8,9]. The Beers criteria were initially developed by an expert consensus panel in 1991, which are comprehensive set of explicit criteria for potentially inappropriate drug use in elderly aged 65 years and above. Medications are grouped into five categories: (i) Those potentially inappropriate in most older adults, (ii) those that should typically be avoided in older adults with certain conditions, (iii) drugs to use with caution, (iv) drug-drug interactions, and (v) drug dose adjustment based on kidney

function. The criteria have been repeatedly updated, most recently in 2019, and are available on the AGS website [10].

The literature related to the prescription pattern analysis in geriatric population and the use of PIMs from India is meager. Hence, this study was undertaken at a tertiary care teaching hospital of Northeast India with the objectives of assessing the pattern of medication use among elderly inpatients of internal Medicine Wards and to evaluate the level of inappropriate prescribing with the help of Beers criteria 2019.

METHODS

It was a retrospective hospital data-based study carried out after obtaining due approval from the Institutional Ethics Committee. Data were obtained from treatment charts of elderly inpatients stored in the Medical Records Department (MRD). Total 236 treatment record charts of patients ≥60 years of either sex were obtained from the period of July 2015 to December 2015 and the information were noted in pre designed pro forma which included patient's demographic details, CR number, diagnosis, duration of hospitalization, and prescription characteristics such as name of the drug, strength and dosage form, whether prescribed in generic name or not. All drugs were coded as per the WHO Anatomical Therapeutic and Chemical Classification coding system. Prescriptions were also analyzed using the WHO prescribing indicators:

- Average number of drugs per prescription (encounter)
- Percentage of drugs prescribed by generic name
- Percentage of encounters resulting in prescription of an antibiotic
- Percentage of encounters resulting in prescription of an injection
- Percentage of drugs prescribed from the National list of essential medicine (NLEM).

Other parameters assessed were as follows:

- Percentage of Fixed Dose Combinations (FDC) in elderly patients
- % of prescription with ≥5 drugs (Polypharmacy)
- % of patients prescribed drugs which are to be avoided in elderly as per Beers criteria 2019
- % of prescribed drugs which are PIMs as per Beers criteria 2019.

NLEMs 2015 of India were used for assessing the number of drugs prescribed from the essential list [11]. The drugs which were prescribed by their brand names were identified by their generic names and were evaluated. In this study we included elderly patients 60 years and above, but for evaluation of the PIMs with the help of Beers criteria 2019, we evaluated only those treatment charts of patients >65 years, which accounted for 164 prescriptions.

Statistical analysis

Collected data were entered and analyzed in Microsoft Office Excel 2007. Data were expressed as mean±SD, numbers, and percentages.

RESULTS

A total of 236 treatment charts were reviewed during the study period. The mean±SD age of the patients was 69.07±7.72 years (range: 60–92 years). About 55.9% patients were in the age group of 60–69 years, followed by 31.4% and 11.4% in the age groups 70–79 years and 80–89 years, respectively. Lowest number of patients (1.3%) was in the age group >90 years. There was total 138 (58.5%) males and 98 (41.5%) females. Maximum number of patients was having respiratory disorders (57.6%), followed by kidney diseases (20.8%), cardiovascular diseases (18.6%), diabetes mellitus (16%), and so on (Fig. 1). The average duration of hospital stay was 6.4 days (range 1–27 days).

A total of 2683 drug formulations were prescribed. The mean±SD of the number of drugs prescribed per prescription was 10.68±4.74. (range: 2–30). Drugs acting on gastrointestinal (GIT) system followed by antimicrobial agents, respiratory system drugs and cardiovascular drugs were the most common class of drugs prescribed to the patients (Table 1). The percentage of prescriptions with ≥5 drugs during hospital stay and during discharge was 91.5% and 39%, respectively. Total 781 (20%) FDC were prescribed. 1624 (60.5%) drugs were prescribed from the NLEM. 2320 (86.5%) drugs were prescribed by their brand names. The drug prescriptions were analyzed for the WHO prescribing indicators (Table 2).

Use of PIMs (Beers criteria)

Out of 164 patients (>65 years), 36 patients (22%) received at least one drug which was potentially inappropriate according to Beers criteria and 358 out of 2683 (13.3%) drugs were prescribed inappropriately. Furosemide was the most prescribed PIM for patients (16.2%, n=58). Hydrocortisone was the second most commonly prescribed PIM (7.3%, n=26). Fluoxetine was the third most commonly prescribed PIM (7%, n=25) (Table 3).

Out of 57 drugs which were found to be PIM according to Beers Criteria 2019, 52.6% (n=30) medications were potentially inappropriate in most elder adults, 43.9% (n=25) medications were typically to be avoided in older adults with certain conditions such as heart failure and syncope, 28.1% (n=16) drugs were to be used with caution in older adults, 28.1% (n=16) drugs were to be avoided due to their potential for clinically significant drug-drug interactions, and 15.8% (n=9) drugs were to be avoided or use with reduced dose in older adults with renal impairment.

DISCUSSION

Drug therapy is most common and important treatment in elderly people. Most geriatric patients take medications for chronic conditions such as diabetes, hypertension, and heart failure which accounted for long durations of therapy apart from drugs used for shorter periods for symptomatic relief. Moreover, geriatric patients have many comorbidities which lead to prescription of many drugs making them susceptible to drug-disease and drug-drug interactions.

The age group of 60–69 years had the highest number of patients (55.9%); whereas only 1.3% patients were above 90 years. The average number of drugs per patient was 10.68±4.74 which was higher than 7.37±2.22 and 7.24±2.28 as per a study by Bhaveshaikh *et al.* and Lalwani *et al.*, respectively [12,13]. The difference could be because our study was done only in medicine ward where comparatively higher number of drugs is used where as these studies included all other departments as well. In spite of the encouragement from policy-makers and various benefits like low cost of drug therapy, increase patient's adherence and equivalent therapeutic benefits as brand name alternatives generic prescribing is not a common practice in India [14]. In our study, more than 86.5% prescriptions were by brand names which was comparable to other studies, where

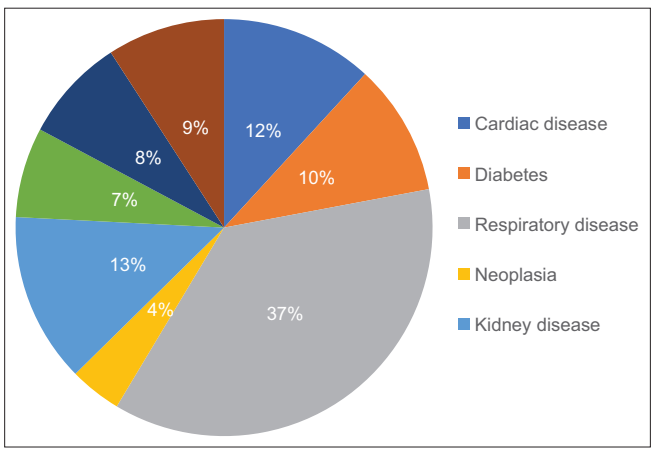

Fig. 1: Distribution of diseases in the geriatric patients

Table 1: Various classes of drugs prescribed

Drug class	Number	%
GIT system drugs	592	22.1
PPI	312	11.6
Antiemetic	54	2.0
Laxative purgative	53	2.0
Electrolyte	31	1.2
Antidiarrheal	26	1.0
Probiotic	21	0.8
PPI with prokinetic	14	0.5
Antacids	11	0.4
Others	70	2.6
Anti-microbial Agents (AMA)	494	18.4
Cephalosporins	191	7.1
Beta lactams	105	3.9
Macrolides	57	2.1
Fluoroquinolones	29	1.1
Antiprotozoal-Anthelminthic	21	0.8
Antifungal	13	0.5
Tetracyclines	6	0.2
Aminoglycosides	2	0.1
Others	70	2.6
Respiratory System Drugs	395	14.7
Bronchodilators	287	10.7
Antitussive-expectorant	101	3.8
Others	7	0.3
Cardio Vascular System (CVS) Drugs	262	9.8
Diuretics	119	4.4
Calcium channel blockers (CCB)	70	2.6
Angiotensin converting enzyme inhibitor (ACEI)	17	0.6
Beta-blockers	17	0.6
Angiotensin receptor blocker (ARB)	10	0.4
Antianginal	9	0.3
Alpha-blockers	6	0.2
Others	14	0.5
Blood	225	8.4
Hematinics	71	2.6
Antiplatelets	38	1.4
Hypolipidemics	33	1.2
Antifibrinolytics	14	0.5
Hematopoietic factors	13	0.5
Coagulants	12	0.4
Anticoagulants	10	0.4
Others	34	1.3
Anti-inflammatory incl. Antirheumatoid and Anti-gout drugs	177	6.6
NSAIDS	140	5.2
Antigout	19	0.7
Disease modifying antirheumatoid drugs (DMARDS)	6	0.2
Others	12	0.4
Hormones	142	5.3
Corticosteroids	53	2.0
Oral hypoglycemic agents (OHA)	41	1.5
Insulin	36	1.3
Thyroxine	12	0.4
Central Nervous System (CNS) Drugs	109	4.1
Antidepressants	43	1.6
Opioids	21	0.8
Anti-anxiety	17	0.6
Antiepileptics	11	0.4
Antipsychotic	10	0.4
Sedative-hypnotics	3	0.1
Others	4	0.1
Bone Metabolism incl. Vitamin D and drugs for osteoporosis	89	3.3
Calcium	54	2.0
Bisphosphonates	12	0.4
Vitamin D	10	0.4
Calcitonin	5	0.2
Parathormone	2	0.1
Others	6	0.2
Vitamins and Minerals excl. Vitamin D and calcium	68	2.5
Genitourinary System	39	1.5
Urinary alkalinizer	13	0.5
Urinary spasmolytics	11	0.4
α_1 blocker + 5-α reductase	8	0.3
α blocker	5	0.2
PDE inhibitor	2	0.1
Nutritional supplements	8	0.3
Others incl. Anticancer, Immunosuppressants, Antihistaminics, Vaccine and Sera, Drugs acting on skin and mucosa	83	3.1

GIT: Gastrointestinal.

Table 2: WHO prescribing indicators

WHO Prescribing Indicators	%
Average number of drugs per prescription (encounter)	10.68
Percentage of drugs prescribed by generic name	13.5
Percentage of encounters resulting in prescription of an antibiotic	54.2
Percentage of encounters resulting in prescription of an injection	76.3
Percentage of drugs prescribed from the NLEM	60.5%

NLEM: National list of essential medicine

percentage of drugs by generic names were much lower [12,15]. About 20% of the formulations used in our study were FDCs which was more as compared to 4.9% and 10.82% [12,13]. In elderly with renal and hepatic dysfunction, FDCs may lead to unnecessary and prolonged exposure to drugs and increase risk of drug toxicity [12]. Drugs acting on alimentary tract (22.1%), followed by anti-microbial agents (18.4%), respiratory system (14.7%), and cardiovascular system (9.8%) were the most were commonly prescribed class of drugs, which was comparable to a study done by Nataraj and Bharathi in South India [16]. Overall, 60.5% of the total drugs prescribed were from the NLEMs 2015. Adherence to the list was most commonly seen with hormones (94.4%) and least with respiratory system drugs (31.1%). The understanding of concept of essential medicines and their availability to different sections of society needs to be tested. Around 76.3% of prescriptions had a drug prescribed as an injection. The high percentage of injectables was quite explainable since this was an inpatient study with patients mostly having serious and acute illnesses.

Based on AGS Beers criteria 2019, 369 out of 2683 (13.8%) drugs prescribed in our study were classified as PIM, which was lower than that reported (37.76%) in studies by Bhaveshaikh *et al*., which used Beers criteria 2012 for assessment [12]. Another study carried out in North Cyprus reported a prevalence of 16.9% PIM as determined by Beers Criteria 2015 [6]. Total 22%, elderly patients received potentially inappropriate prescription of at least one drug which was comparable (23.59%) to a study done by Zaveri *et al*. [7]. Our value was much lower as compared (76.6%) to a study done by Khamis *et al.* using Beers Criteria 2015 [6].

Studies to identify the factors for high prevalence of PIM have reported many factors which include multiple diseases, polypharmacy, easy access to medications, both over-the counter drug (OTC) and non-OTC drugs, multiple different hospitalizations with lack of geriatric specialty clinics and possibly the lack of medication review services by pharmacists, or other qualified health-care providers [6].

Table 3: PIM in elderly*

Name of the Drug	Total Number (%)	Rationale	Recommendations
Furosemide	58 (16.2)	May exacerbate or cause SIADH or hyponatremia	Use with caution
Hydrocortisone	26 (7.3)	1. Potential of inducing or worsening dementia 2. Increase risk of PUD or GI bleed with NSAIDS	1. Avoid (with exceptions) 2. Give GI protection
Fluoxetin	25 (7)	1. Highly anticholinergic, sedating cause orthostatic hypotension 2. May cause ataxia and increase the risk of falls and fractures	Avoid
Aspirin	22 (6.1)	1. Increased risk of GI bleed or Peptic ulcer in high-risk groups 2. Increase BP 3. Kidney injury (if > 325 mg/d)	1. Avoid chronic use (avoided with exception) 2. Use with caution in ≥70 years
Tramadol	21 (5.9)	1. May exacerbate or cause SIADH or hyponatremia 2. CNS adverse effect	1. Use with caution 2. Reduce dose of immediate release 3. Avoid Extended release if Cr Cl < 30 ml/min
Torasemide	21 (5.9)	May exacerbate or cause SIADH or hyponatremia	Use with caution
Regular Insulin	19 (5.3)	Regimen with only short acting or rapid acting insulin has higher risk of hypoglycemia	Avoid using alone
Nitrofurantoin	17 (4.7)	Potential for pulmonary toxicity, hepatotoxicity, and peripheral neuropathy, especially with long-term use; safer alternatives available	Avoid if Cr Cl <30 mL/min or for long-term suppression
Ramipril	14 (3.9)	Increased risk of hyperkalemia	Avoid routine use in those with CKD stage 3a or higher
Opioid Derivative Combinations	13 (3.6)	1. May cause ataxia and increase the risk of falls and fractures 2. Increase risk of overdose with BZD and Gabapentin and Pregabalin	Avoid (with exceptions)
Diclofenac	10 (2.8)	1. Increased risk of GI bleed or Peptic ulcer in high-risk groups 2. Increase BP 3. Kidney injury	Avoid chronic use (avoided with exception)
Furosemide + Spironolactone	9 (2.5)	1. May exacerbate or cause SIADH or hyponatremia 2. Hyperkalemia	Use with caution. Avoid if Cr Cl< 30 ml/min.
Glimepiride	9 (2.5)	Higher risk of severe prolonged hypoglycemia	Avoid
Ciprofloxacin	7 (2)	Increased risk of CNS effects (e.g., seizures and confusion) and tendon rupture	Dose Reduction if Cr Cl <30 mL/min
Telmisartan	7 (2)	Increased risk of hyperkalemia	Avoid routine use in those with CKD stage 3a or higher
Haloperidol	5 (1.4)	1. Increased risk of CVA, Cognitive decline and mortality in Dementia 2. May cause ataxia and increase the risk of falls and fractures 3. May exacerbate or cause SIADH or hyponatremia	1. Avoid in Delirium, dementia, h/o falls and fractures, Parkinson's disease (with exceptions) 2. Use with caution
Lorazepam	5 (1.4)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid (with exceptions)
Prazosin	5 (1.4)	High risk of orthostatic hypotension. Aggravation of Urinary incontinence in Urinary incontinence in women	Avoid
Hyoscine	5 (1.4)	Anticholinergic side effects, uncertain effectiveness	Avoid
Ranitidine	5 (1.4)	Potential to Induce or worsen delirium. Mental status change	Avoid in delirium. Reduce dose if Cr Cl < 50 ml/min.
Sulfamethoxazole+ Trimethoprim	4 (1.1)	Increased risk of hyperkalemia when used concurrently with an ACEI or ARB in presence of decreased creatinine clearance < 30 ml/min	1. Used with caution by patients with reduced kidney function and taking an angiotensin-converting enzyme inhibitor (ACEI) or angiotensin receptor blocker (ARB) 2. Reduce Dose/Avoid if Cr Cl 15-29 ml/min
Alprazolam	4 (1.1)	Increase the risk of cognitive impairment, delirium, falls, fractures and accidents	Avoid (with exceptions)
Diltiazem	4 (1.1)	Potential to promote fluid retention and exacerbate heart failure	Avoid
Enoxaparin	3 (0.8)	Increase risk of bleeding	Reduce dose if Cr Cl <30 ml/min
Telmisartan + Diuretic	3 (0.8)	May exacerbate or cause SIADH or hyponatremia	Use with caution

(Contd...)

Table 3: ***(Continued)***

Name of the Drug	Total Number (%)	Rationale	Recommendations
Methylprednisolone	3 (0.8)	1. Potential of inducing or worsening dementia 2. Increase risk of PUD or GI bleed with NSAIDS	1. Avoid (with exceptions) 2. Give GI protection
Prednisolone	3 (0.8)	1. Potential of inducing or worsening dementia 2. Increase risk of PUD or GI bleed with NSAIDS	1. Avoid (with exceptions) 2. Give GI protection
Clonazepam	2 (0.6)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid (with exceptions)
Escitalopram combination with Psycholeptics	2 (0.6)	1. Highly anticholinergic, sedating cause orthostatic hypotension 2. May cause ataxia and increase the risk of falls and fractures	Avoid (with exceptions)
Zolpidem	2 (0.6)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid
Dexamethasone	2 (0.5)	1. Potential of inducing or worsening dementia 2. Increase risk of PUD or GI bleed with NSAIDS	1. Avoid (with exceptions) 2. Give GI protection
Ibuprofen	1 (0.3)	1. Increased risk of GI bleed or Peptic ulcer in high-risk groups 2. Increase BP 3. Kidney injury	Avoid chronic use, unless other alternatives are not effective and patient can take PPI or Misoprostol
Rabeprazole sodium	1 (0.3)	Risk of *Clostridium difficile* infection and bone loss and fracture	Avoid scheduled use for >8 weeks (avoided with exception)
Levetiracetam	1 (0.3)	CNS Adverse Effect	Dose Reduction if Cr Cl ≤80 mL/min
Pregabalin	1 (0.3)	CNS Adverse Effect	Dose Reduction if Cr Cl <60 mL/min
Quetiapine	1 (0.3)	1. Increased risk of CVA, Cognitive decline and mortality in Dementia 2. May cause ataxia and increase the risk of falls and fractures 3. May exacerbate or cause SIADH or hyponatremia	1. Avoid in Delirium, dementia, h/o falls and fractures (with exceptions) 2. Use with caution
Aripiprazole	1 (0.3)	1. Increased risk of CVA, Cognitive decline and mortality in Dementia 2. May cause ataxia and increase the risk of falls and fractures 3. May exacerbate or cause SIADH or hyponatremia	1. Avoid in Delirium, dementia, h/o falls and fractures, Parkinson's disease (with exceptions) 2. Use with caution
Levosulpiride	1 (0.3)	1. Increased risk of CVA, Cognitive decline and mortality in Dementia 2. May cause ataxia and increase the risk of falls and fractures. 3. May exacerbate or cause SIADH or hyponatremia	1. Avoid in Delirium, dementia, h/o falls and fractures, Parkinson's disease (with exceptions) 2. Use with caution
Olanzapine	1 (0.3)	1. Increased risk of CVA, Cognitive decline and mortality in Dementia 2. May cause ataxia and increase the risk of falls and fractures 3. May exacerbate or cause SIADH or hyponatremia 4. Increase the risk of orthostatic hypotension 5. Increase risk of fall and fractures	1. Avoid in Delirium, dementia, h/o falls and fractures, Parkinson's disease (with exceptions) 2. Use with caution
Oxazepam	1 (0.3)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid (with exceptions)
Etizolam	1 (0.3)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid (with exceptions)
Venlafaxine	1 (0.3)	1. Highly anticholinergic, sedating cause orthostatic hypotension 2. May cause ataxia and increase the risk of falls and fractures	1. Avoid (with exceptions)
Theophylline	1 (0.3)	Increase risk of toxicity if used with Ciprofloxacin and Cimetidine	Avoid
Promethazine	1 (0.3)	1. Risk of Anticholinergic side effects; clearance reduced with advanced age, and tolerance develops when used as hypnotic 2. Worsen Parkinsonian symptoms	Avoid (with exceptions)
Amiodarone	1 (0.3)	1. Has greater toxicities than other antiarrhythmics used in atrial fibrillation	Avoid as 1st line therapy for atrial fibrillation (with exceptions)
Losartan	1 (0.3)	Increased risk of hyperkalemia	Avoid routine use in those with CKD stage 3a or higher
Digoxin	1 (0.3)	Should not be used as 1st line drug in AF and HF. Decreased renal excretion may increase the risk of toxicity	Avoid as 1st line drug
Chlorthalidone	1 (0.3)	May exacerbate or cause SIADH or hyponatremia	Use with caution
Mannitol	1 (0.3)	May exacerbate or cause SIADH or hyponatremia	Use with caution

(Contd...)

Table 3: ***(Continued)***

Name of the Drug	Total Number (%)	Rationale	Recommendations
Eplerenone	1 (0.3)	May exacerbate or cause SIADH or hyponatremia	Use with caution
Spironolactone	1 (0.3)	May exacerbate or cause SIADH or hyponatremia. Hyperkalemia	Use with caution. Avoid if Cr Cl< 30 ml/min
Clonidine	1 (0.3)	High risk of CNS adverse effect. May cause bradycardia and orthostatic hypotension	Avoid as 1st line anti-hypertensive
Chlordiazepoxide + Clidinium bromide	1 (0.3)	Increase the risk of cognitive impairment, Delirium, falls, fractures and accidents	Avoid (with exceptions)
Prochlorperazine	1 (0.3)	Worsen Parkinsonian symptoms	Avoid

PIMs: Potentially inappropriate medicines, CNS: Central nervous system, GI: Gastrointestinal, BP: Blood pressure.

CONCLUSION

This study suggests that use of PIMs is common in elderly patients, some of them associated with high degree of risk in terms of worsening of the co-morbidity or drug-drug interactions. High prevalence of inappropriate prescribing of medicines in elderly people is associated with various health outcomes such as increased morbidity and mortality, increased cost of treatment, and decreased quality of life. The limitation of our study is that we have considered patients admitted to only Internal medicine ward. More studies in other specialties are necessary to know the prevalence of inappropriate prescribing of medicines in elderly people so as to sensitize the practitioners to this important public health issue and to develop rational prescribing in elderly.

ACKNOWLEDGMENT

The authors extend their acknowledgement to the staff of the MRD who helped to retrieve the data.

AUTHORS' CONTRIBUTIONS

Concept and design of the study were done by the first, second, and the corresponding authors, data collection, deciding the analysis tool and statistical analysis were done by all the authors and manuscript writing was done by the first and the corresponding authors.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S FUNDING

The study is non-funded.

REFERENCES

1. United Nations. Department of Economic and Social Affairs, Population Division (2017). World Population Ageing-Highlights (ST/ESA/SER.A/397); 2017.
2. Ingle GK, Nath A. Geriatric health in India: Concerns and solutions. Indian J Community Med 2008;33:214-8.
3. Shah RR. Drug development and use in the elderly: Search for the right dose and dosing regimen. Br J Clin Pharmacol 2004;58:452-69.
4. Sarangi SC, Medhi B. Drugs uses in geriatrics. In: Medhi B, Prakash A editors. Advanced Pharmacology. Hyderabad: PharmaMed Press; 2015. p. 291-306.
5. Morin L, Johnell K, Laroche ML, Fastbom J, Wastesson JW. The epidemiology of polypharmacy in older adults: Register-based prospective cohort study. Clin Epidemiol 2018;10:289-98.
6. Khamis S, Abdi AM, Uzan A, Basgut B. Applying beers criteria for elderly patients to assess rational drug use at a university hospital in Northern Cyprus. J Pharm Bioallied Sci 2019;11:133-41.
7. Zaveri HG, Mansuri SM, Patel VJ. Use of potentially inappropriate medicines in elderly: A prospective study in medicine out-patient department of a tertiary care teaching hospital. Indian J Pharmacol 2010;42:95-8.
8. Lavan AH, Grady J, Gallagher PF. Appropriate prescribing in the elderly: Current perspectives. World J Pharmacol 2015;4:193-209.
9. Primejdie DP, Bojita MT, Popa A. Potentially inappropriate medications in elderly ambulatory and institutionalized patients: An observational study. BMC Pharmacol Toxicol 2016;17:38.
10. American Geriatrics Society Update, New York. American geriatrics society 2019 updated AGS beers criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc 2019;67:674-94.
11. National List of Essential Medicines; 2015. p. 1-117. Available from: https://www.mohfw.gov.in/sites/default/files/NLEM%2C%202015.pdf.
12. Bhaveshaikh N, Sukumaran S, Vyas U. Drug prescribing patterns in elderly patients in a tertiary level hospital. Int J Basic Clin Pharmacol 2017;6:759-64.
13. Lalwani US, Pillai A, Piparva KG. Drug utilization pattern among geriatric patients in a tertiary care teaching hospital. Int J Pharm Sci Res 2017;8:1249-54.
14. Das M, Choudhury S, Maity S, Hazra A, Pradhan T, Pal A, *et al*. Generic versus branded medicines: An observational study among patients with chronic diseases attending a public hospital outpatient department. J Nat Sci Biol Med. 2017;8(1):26–31.
15. Jadhav RR, Jadhav AD, Padwal SL, Kale AS, Pise HN. Drug utilization pattern in geriatric out patient in tertiary care hospital. Int J Basic Clin Pharmacol 2017;6:2078-81.
16. Nataraj GR, Bharathi DR. A study on prescribing pattern in geriatric patients. Asian J Pharm Clin Res 2019;12:120-3.