



Assessment of potentially inappropriate medicines used in geriatric patients according to 2012 AGS Beer's criteria in tertiary care teaching hospital

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ABSTRACT

This prospective observational study was conducted to assess the potentially inappropriate prescriptions in hospitalized geriatric patients in Medicine ward of Rajah Muthiah Medical College Hospital, Annamalai University, Tamil Nadu. The Ethical Committee approval was obtained from the relevant Institutional Human Ethics committee. We have collected 520 cases of hospitalized geriatric patients at the age of 60 and above with both genders. All the Prescriptions were assessed for the use of potentially inappropriate medications by using American Geriatric Society (AGS) Beer's criteria, 2012. Drug-disease interactions and drugs to be used with caution in geriatric patients were also assessed using Beer's criteria. In our total study population 342(65.76%) cases were males and 178(34.23%) were females. 294 patients (56.53%) were prescribed (6-7) drugs for their treatment. More than 12 drugs were used in a single prescription for 41 patients that may lead more number of drug interactions. Drugs acting on Gastrointestinal system (n=563, 16.59%) were the majority often prescribed drugs. The study concluded that the use of inappropriate medicines in the elderly patients is a problematic and challenged task. This study examined that all three sub-types of inappropriate prescribing outline in the 2012 AGS Beer criteria in the hospital setting. Regardless of different editions of Beers criteria used for evaluating the use of PIMs in the elderly, there is a high prevalence of PIM use in hospitalized elderly which must be brought to the attention of the Physicians and evaluate the medications they prescribe to geriatric patients using drug formularies.

INTRODUCTION

The world population is growing; what is new is the rapid pace of aging. As a result of the decline in birth rate and increased life expectancy, the older population in most countries is growing faster than the population as a whole. Lesser developed nations are aging faster than their developed counterparts [1]. India's population aged 60 years and above, is projected to increase over the next decade from 8.3 to 10.7% in 2021 according to the United Nations Population Division. This is due to increased life expectancy at birth which is 67.3 years for males and 69.6 years for females. This number may also rise by almost 3 years during the next decade. [2]

The elderly population is the highest consumer of drugs. The high degree of caution is required while prescribing in this vulnerable group. Due to age-related changes in the physiology of elderly, these people also experience altered pharmacokinetics and dynamics of drugs. They have multiple comorbidities and are hospitalized more often which increases the chances of Polypharmacy and inappropriate prescribing. The several studies have reported increased incidence of adverse drug reactions with PIMs. [3, 4] Identifying potentially inappropriate medications is, thus, important to minimize the pharmacotherapy related hazards in this vulnerable population.

Potentially inappropriate prescriptions (PIPs), defined as prescriptions in which risks outweigh benefits, have been

assessed in various settings using lists of precise criteria mainly frequently based on that developed by Beers. [5] Several criteria have been designed for identification of PIMs. These criteria can be drug based explicit criteria like Beers. [6]

The AGS 2012 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults (AGS 2012 Beers Criteria) has been developed to support healthcare providers in civilizing medication safety in elders. Our principle is to inform clinical decision-making regarding the prescribing of medications for the elder in order to progress safety and excellence of care. The goal of this clinical instrument is to improve the care of elder by falling their experience to Potentially Inappropriate Medications (PIMs).

This should be viewed as a guide for recognizing medicines for which the hazards of use in elder compensate the benefits. These criteria are not intended to be applied in a corrective manner. This list is not meant to succeed clinical decision or an individual patient's importance and wants. Prescribing and care for disease situation should be individualized and engage shared decision-making. These criteria also emphasize the significance of using a team approach to prescribing and utilize of non-pharmacological approaches and of include financial and managerial incentives for this kind of model. Verifiable criteria, for example, the STOPP/START criteria and Medication Appropriateness Index ought to be utilized as a part of a corresponding way with the 2012 AGS Beers Criteria to guide clinicians in settling on choices about safe pharmaceutical use in more established grown-ups.

- 34 medications and kinds of medications that are “potentially inappropriate” for elder people. Healthcare providers should think regarding stay away from drugs on this listing when prescribing for adults 65 or older. These medicines create an advanced threat of side effects, may not act as well in an aged person, and may be substituted with secure or additional capable medications or non-drug remedies.

- Medications utilized for 14 common health trouble that

are potentially inappropriate for elder patients. The elder frequently have multiple diseases or disorders in adding to these 14 health crisis that the medications may make of poorer excellence.

- 14 kinds of drugs that are potentially inappropriate and must be making use of merely with care in the elder. This list of drugs on may origin medication-related problems and may not be entirely efficient. However, they may be the superlative alternative available for definite elder patients. Healthcare providers should to carefully observe how these are functioning and stay an eye out for consequences. And the elder who receives these medications or their caregivers necessitate letting their healthcare professionals be recognizable with if these drugs don't appear to be functioning, or come into view to be producing side effects.

MATERIALS AND METHODS

The study was conducted in the Medicine ward of Rajah Muthiah Medical College Hospital (RMMCH), Annamalai University, Annamalai Nagar, Tamil Nadu and 1425 bedded multispecialty tertiary care teaching hospital. The Prospective and Observational study was conducted for a period of 3 years. The study method involved selection of patient based on the inclusion criteria that the In-Patients with age of 60 years and above of both gender of Geriatric patients who were admitted in the Medicine Units and Patients with multiple diseases and the exclusion criteria was the Patients who discontinued the treatment and Patients who were not willing to participate.

The research protocol was approved by Institutional Human Ethical Committee. The study included 520 hospitalized patients of geriatric age group (≥ 60 years) of both sexes. Demographic data, medical and medication history were collected from the patient's case sheet after getting consent from the patients. Then collected information was analyzed according to their age, gender, and therapeutic category. 520 geriatric patient's Prescriptions were assessed for the use of potentially inappropriate medications by using American Geriatric Society

Table 1. : Characteristics of hospitalized geriatric patients

Characters	Number of Patients	Percentage (%)
Gender		
Male	342	65.76
Female	178	34.23
Age Groups		
60 - 64	202	38.84
65 - 69	152	29.23
70 - 74	103	19.80
≥ 75	63	12.11
Therapeutic Category		
Cardiovascular System	147	28.26
Respiratory System	103	19.80
Hepatic System	97	18.65
Endocrine system	73	14.03
Nervous System	41	7.85
Gastrointestinal System	36	6.92
Others	23	4.42
Number of drugs Prescribed		
≤ 5	61	11.73
6 - 8	294	56.53
9 - 12	124	23.84
> 12	41	7.88

(AGS) Beer's criteria, 2012. Drug disease interactions and drugs to be used with caution in geriatric patients were also assessed using Beer's criteria. All collected data were scrutinized with the SPSS version 20 for data management and analyzes in the study. The socio-demographic data were calculated and expressed as percentages. The summarized results were arranged and put into a table form with the use of Microsoft word 2010.

RESULTS

A total of 520 geriatric cases were collected from Medicine wards of the Rajah Muthiah Medical College and Hospital. In our total study population 342 (65.76%) cases were males and 178(34.23%) were females. The total geriatric populations were classified into four age groups and patient in each group were recorded. The data from our study represent that; 60-64 years 38.84% (n=202), 65-69 years 29.23% (n=152), 70-74 years 19.80% (n=103), 75 and above years 12.11% (n=63). Tabulated data of age distribution in the study population is given in Table-1.

The collected geriatric prescriptions were classified to various therapeutic categories according with disease associated system. Out of the total prescriptions Cardiovascular (n=147), Respiratory (n=103) and Hepatic system (n=97) accounted for major geriatric cases. 294 patients (56.53%) were prescribed (6-7) drugs for their treatment. More than 12 drugs were used in a single prescription for 41 patients that may lead more number of drug interactions.

A whole of 3392 drug formulations were given to an entire 520 patients for diverse diseases in the study. The category wise drugs prescribed is revealed (Table-2). Drugs acting on Gastrointestinal system (n=563, 16.59%) were the majority often prescribed drugs, followed by cardiovascular drugs (n=412, 12.14%), Antimicrobial drugs (n=386, 11.37%), Vitamins, minerals & dietary supplements (n=375, 11.05%), drugs acting on Hematological system (n=369, 10.87%), Analgesics & anti-inflammatory drugs (n=338, 9.96%), Drugs acting on Respiratory System (n=328, 9.66%), Drugs acting on Endocrine system 8.69%, other drugs 6.10%, Drugs acting on Central Nervous System 3.50%.

520 geriatric patient's Prescriptions were assessed for the use

of potentially inappropriate medications by using American Geriatric Society (AGS) Beer's criteria, 2012. Drug disease interactions and drugs to be used with caution in geriatric patients were also assessed using Beer's criteria.

A sum of 20 potentially inappropriate medications exposed in the Beer's criteria 2012 had been used in this study.

A total of 14 medications that can aggravate the disease owed to drug disease interaction were detected in the records of 80 (15.38%) patients. Use of Non steroidal Anti-Inflammatory Drugs (NSAIDs) in heart and renal failure patients was the generally recognized drug-disease interaction (Table-4).

Totally 6 drugs, which are to be used with care in elderly patients, were used. Isosorbide dinitrate (4.42%) and Aspirin (2.69%) prescribed inpatients above 80 years of age were the frequently prescribed drugs necessitate cautious use in geriatric patients as per the Beer's criteria (Table-5).

DISCUSSION

A total of 520 geriatric cases were collected from Medicine wards of the Rajah Muthiah Medical College and Hospital. In our total study population male cases were more compare with females. The total geriatric populations the age group 60-64 years geriatric patients were more. The collected geriatric prescriptions were classified to various therapeutic categories according with disease associated system. Out of the total prescriptions the cardiovascular system accounted for major geriatric cases. A report from more and Romsdal Prescription Study (MRPS) in Norwegian county mentioned the cardiovascular diagnoses were the highest incidence in their study [7]. This indicates life style of geriatric patients in the particular area.

(56.53%) patients were prescribed (6-7) drugs for their treatment. These results were compared with other studies it was less and some study has similar values. More than 12 drugs were used in a single prescription for 41 patients that may lead more number of drug interactions. In order to predict the possible consequences of the administration of two or more drugs it is essential that the health professional has a practical knowledge of the pharmacological mechanism involved in drug interactions, an awareness of the drugs associated with great risk, and the most

Table 2. : Category of drugs prescribed in geriatric patients

Category of drugs	Number of drugs (n= 3392)	Percentage (%)
Drugs acting on Respiratory System	328	9.66
Antimicrobial drugs	386	11.37
Drugs acting on Hematological system	369	10.87
Drugs acting on Central Nervous System	119	3.50
Drugs acting on Gastrointestinal System	563	16.59
Vitamins, minerals & dietary supplements	375	11.05
Cardiovascular drugs	412	12.14
Drugs acting on Endocrine system	295	8.69
Analgesics & anti-inflammatory drugs	338	9.96
Others*	207	6.10

* Antihistamines, Skeletal muscle relaxants etc.

Table 3. : Potentially inappropriate medicines used in geriatric patients according to 2012 AGS Beer's criteria.

Therapeutic category	Drugs	Number of patients	Percentages (%)
Anticholinergic	Chlorpheniramine	19	3.65
First-generation antihistamines	Promethazine	11	2.11
Antispasmodic	Dicyclomine	5	0.96
Cardiovascular System			
Alpha agonist	Methyldopa	4	0.76
Digitalis glycoside	Digoxin>0.125 mg/day	21	4.03
Dihydropyridines	Nifedipine immediate release	14	2.69
Potassium-sparing agent- diuretic	Spironolactone>25 mg/day	6	1.15
Central nervous system			
Tertiary TCA	Amitriptyline	4	0.76
Antipsychotic	Haloperidol	9	1.73
Benzodiazepines	Chlorpromazine	4	0.76
Short- acting	Alprazolam	15	2.88
Benzodiazepines			
Long- acting	Diazepam	14	2.69
Gastrointestinal tract system			
Propulsive	Metoclopramide	45	8.65
	Mineral oil	6	1.15
Pain medication	Aspirin>325mg/day	21	4.03
Non-COX selective NSAIDs	Diclofenac	23	4.42
	Ibuprofen	11	2.11
	Mefenamic acid	3	0.57
Opioid analgesic	Pentazocine	5	0.96
Skeletal muscle relaxants	Methocarbamol	2	0.38

A sum of 20 potentially inappropriate medications exposed in the Beer's criteria 2012 had been used in this study.

Table 4. : AGS Beers criteria (2012) for potentially inappropriate medication use in older adults due to drug-disease or drug-syndrome interactions that may exacerbate the disease or syndrome

Diseases	Therapeutic category	Drugs	Number of patients	Percentages (%)
Cardiovascular system	NSAIDs and COX2 inhibitor	Aspirin	34	6.53
Heart failure	Non-dihydropyridine CCBs	Diclofenac	4	0.76
		Verapamil	3	0.57
Central nervous system	Anticholinergic	Dicyclomine	2	0.38
Delirium	Benzodiazepines	Alprazolam	2	0.38
	Corticosteroid	Hydrocortisone	1	0.19
	H2 receptor antagonist	Famotidine	1	0.19
Insomnia	Benzodiazepines	Ranitidine	5	0.96
		Diazepam	1	0.19
	Oral decongestants	Theophylline	3	0.57
		Caffeine	7	1.34
Gastrointestinal system				
History of gastric/duodenal ulcer	NSAIDs	Aspirin>325mg/day	3	0.57
Kidney/urinary tract system				
CRF/ARF	NSAIDs	Aspirin	13	2.50
		Diclofenac	2	0.38

Table 5. : Utilization of potentially inappropriate medication to be used with caution in geriatric patients according to 2012 AGS Beer's criteria

Therapeutic Category	Drugs	Number of patients	Percentages (%)
NSAIDs	Aspirin in patients >80 years of age	14	2.69
Antipsychotics	Carbamazepine	4	0.76
Vasodilators	Nitroglycerine	7	1.34
	Isosorbide dinitrate	23	4.42
	Nifedipine (SR)	7	1.34
	Verapamil	4	0.76

susceptible patient group. [8] Elderly patients are the population at the highest risk of potential DDIs.[9] Drugs acting on Gastrointestinal system were the majority often prescribed drugs, followed by cardiovascular drugs, Antimicrobial drugs, Vitamins, minerals & dietary supplements. The comparable study was conducted in Bangalore hospital [10], a whole of 2924 drug formulations include 3254 active ingredients were prescribed to that study. The Drugs performing on the cardiovascular system (667; 22.81%) were the majority regularly prescribed drugs, which is followed by antimicrobials (494; 16.89%), drugs acting on the gastrointestinal system (398; 13.61%), and vitamins and minerals (317; 10.84%). Collectively these drugs accounted for almost two-thirds (64.15%) of the entire drugs.

Use of one inappropriate medicine was somewhat high (92.5% vs. 24%) in dissimilarity to the results of other studies from India. [11, 12] According to Beer's criteria, as a least one potentially inappropriate medication was given in 242 (46.53%) patients, Metoclopramide (8.65%), Diclofenac (4.42%), Digoxin >0.125 mg/day (4.03%), Aspirin (4.03%), Chlorpheniramine (3.65%), Alprazolam (2.88%), and Diazepam (2.69%) were the frequently used inappropriate medications. Antihistamines, Benzodiazepines, Cardiac glycosides and Anticholinergic drugs, were the potentially inappropriate medicines reported by additional Indian studies.

Benzodiazepines are used for the cure of insomnia and anxiety in the aged. They can change the cognitive functions and their tranquilizing effect is a threat factor for fall and fracture. Digoxin is mostly used for heart failure and atrial fibrillation. Altered pharmacokinetics develops digoxin toxicity in the elderly patients.[13-15] Use of inappropriate medications is related with increased hazard of adverse drug reaction (ADR), morbidity, mortality, and financial trouble to the older patients.[16]

The common statement inappropriate medicine metoclopramide (8.65%) does not point out in the earlier list of Beer's criteria (2002). It is primarily used for gastro paresis and as an antiemetic for the reason that of its low price. Though it is endorsed for the cure of gastroparesis, its utilize is mostly considered inappropriate for the reason that of the risk of extra pyramidal adverse reactions. The lengthened treatment with metoclopramide can origin of serious adverse reactions similar to determined tardive dyskinesia. US Food and Drug Administration (FDA) have laid a black box warning for the reason that of the hazard of tardive dyskinesia. Other risk factors for tardive dyskinesia, intended advantage, and time of use should be deemed while prescribing metoclopramide.

Beer's criteria list has recognized those inappropriate medications mostly from drugs acting on the central nervous

system (CNS) and the cardiovascular system (CVS). Additional drugs monitored by the Beer's criteria were drugs with anticholinergic property (Promethazine, Benzhexol, Dicyclomine), Pain Medications (NSAIDs, Pentazocine, Methocarbamol), Metoclopramide, And Mineral oil. Though, many inappropriate medicines stated in the Beer's criteria are not exercised in India. (e.g. guanabenz, guanfacine, trimethobenzamide, brompheniramine, carbinoxamine, meprobamate, etc.). These drugs are not reported in this study. Make use of amiodarone in the nonexistence of other antiarrhythmic drugs and low-dose amitriptyline for neuropathic pain may be appropriate in a meticulous case. [17]

There is a require to make a separate listing of potentially inappropriate medicines for India as for USA, Canada, Ireland, Norway and France,, taking into account the prescribing pattern, endorsed drug listing for Indian people, local accessibility, necessitate for laboratory monitoring, and costbenefit ratio of substitute drugs.[18-20] Beer's criteria also Need to be match up with other tools to recognize inappropriate medications, such as START (Screening Tool to Alert doctors to the Right Treatment) and STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions) criteria, in an Indian system. Use of NSAIDs should be constrained in the patients at risk for congestive heart failure. It exacerbates the heart failure by salt and water retention and by rising peripheral vascular resistance. It can depreciate the renal function by disturbing the prostaglandin synthesis.

The results disclose that prescription of inappropriate medications is very much prevailing. Using tools for inappropriate medications should be characteristically experienced to stay away from potential inappropriate medications in elderly patients. Use of inappropriate medications was significantly diminished by distributed the listing of drugs always to stays away from along with other drugs, assessing the prescriptions, and through educating sessions in the Italian study, Clinicians should remember all times the risk of adverse reactions while treating an aged patient. Any new symptom should be measured drug related until confirmed otherwise. The Geronto Net ADR risk score study statements that the risk of adverse reactions augments by fourfold with the in excess of 8 medications. Other hazard factors contain a record of adverse reactions, liver disease, heart failure, a presence of four or more conditions, and renal failure. "The Medication Appropriateness Index" is available to estimate the inappropriate medications stand on the subsequent: indications for the drug; effectiveness of drug for the circumstance; right dosage and duration; accurate and practical directions; risk of clinically significant drug-drug interactions, drug-disease or drug-condition interactions;

unwanted duplication with other drugs; and being the low expensive substitute evaluate with others of the same utility. Clinicians should be made conscientious of potential inappropriate medications used in elderly patients by interrupted estimate. Prescribing guiding principle can be prepared for the meticulous hospital for elderly patients.

The limitation of the study was no individualized evaluation of risk and benefit for each patient. Inappropriate medicines could have been prescribed because of poor tolerance of alternative drugs or possibility of drug interaction with them. Because of the lack of documentation of adverse events in indoor case sheets, we could not estimate the direct risk of adverse events due to potentially inappropriate medications in the elderly. The study has identified the potentially inappropriate medicines according to Beer's criteria list based on American and German populations, respectively. The possibility of adverse drug events may be differing in Indian population because of prescribing, environmental, and genetic differences.

CONCLUSION

This study concluded that the cardiovascular system associated diseases geriatric patients were more and drugs acting on gastrointestinal system were the majority often prescribed drugs. A sum of 20 potentially inappropriate medications exposed in the Beer's criteria 2012 had been used in this study. Use of Non steroidal Anti-Inflammatory Drugs (NSAIDs) in heart and renal failure patients was the generally recognized drug-disease interaction. Isosorbide dinitrate and Aspirin prescribed inpatients above 80 years of age were the frequently prescribed drugs necessitate cautious use in geriatric patients as per the Beer's criteria. The lengthened treatments with Metoclopramide can origin of serious adverse reactions similar to determined tardive dyskinesia. Beer's criteria list has recognized those inappropriate medications mostly from drugs acting on the central nervous system (CNS) and the cardiovascular system (CVS). Metoclopramide, Diclofenac, Digoxin >0.125 mg/day Aspirin, Chlorpheniramine, Alprazolam, and Diazepam were the frequently used inappropriate medications. This study examined that all three sub-types of inappropriate prescribing outline in the 2012 AGS Beer criteria in the hospital setting. The Beers criteria used for evaluating the use of PIMs in the elderly, there is a high prevalence of PIM use in hospitalized elderly which must be brought to the attention of the Physicians.

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