

Assessment of potentially inappropriate medication use and polypharmacy in geriatric diabetic patients

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Abstract: Background: In countries like India and other developing nations, the elderly population is rapidly increasing, leading to concerns about inappropriate prescribing and the use of Potentially Inappropriate Medications (PIMs). This can result in adverse effects and worsen health conditions. With diabetes cases rising significantly in India, personalized treatment plans tailored to each individual's medical history are crucial.

Methods: For our study, we conducted a prospective observational study at a tertiary care hospital in the general medicine department. We selected 183 patients based on specific criteria, collecting demographics, laboratory details, comorbidities, and pharmacological therapy data.

Results: Among the patients, 51% experienced polypharmacy, and 30% experienced hyper polypharmacy. The most commonly used oral hypoglycaemic agents were Metformin, Gliclazide, and Vildagliptin. Long-acting Insulin glargine was the predominant insulin prescribed. The top Potentially Inappropriate Medications (PIMs) included Gliclazide, proton pump inhibitors (PPIs), Amitriptyline, and Prazosin.

Diuretics, Aspirin, and Amitriptyline were among the major drugs used without caution. Our findings suggest the need for consensus on a tool for detecting PIM use in hospitalized elderly Indian patients. Hypertension, dyslipidaemia, bone disorders, and cardiovascular diseases were prevalent among geriatric diabetic patients. Metformin was the most commonly prescribed medication, with newer oral hypoglycaemic agents less frequently used. Dual or triple therapy was commonly prescribed, while insulin use was less frequent due to daily usage challenges.

Conclusions: Our study supports the use of the Beers criteria as a medication review tool to improve elderly care and also emphasises the importance of personalized treatment strategies in managing diabetes in this population.

Keywords: Beer's Criteria, Potentially Inappropriate Medications, Diabetes, Elderly, Polypharmacy

INTRODUCTION

Ageing is a complex biological process marked by numerous physiological changes, particularly after reproductive years. These changes include alterations in tissue biochemistry, declining physiological capacity, increased susceptibility to disease, and higher mortality rates. Chronic conditions like hypertension, dyslipidaemia, depression, and diabetes often necessitate multiple medications, leading to polypharmacy, defined as the use of more drugs than clinically indicated. In adults aged 65 and older, over 40% use five or more medications, with 12% using ten or more. However, the extent of this issue remains largely unknown in many countries¹.

The global rise in the elderly population, now comprising over 60% of the world's population, has resulted in increased hospital visits and medication use. By 2050, nearly 8 out of 10 older individuals worldwide will reside in less developed regions. This demographic shift has led to a surge in chronic diseases, hospital admissions, and associated adverse drug reactions (ADRs), highlighting the public health challenge of inappropriate medication use².

India and other developing countries are experiencing a rapid increase in the elderly population, estimated to quadruple by 2050. With this demographic shift comes a greater prevalence of chronic diseases, necessitating complex treatments and impacting healthcare planning^{3,4}.

Polypharmacy, defined as the concurrent use of five or more prescription medications, poses significant risks, including drug interactions, potentially inappropriate medications (PIMs), ADRs, drug omissions, and heightened morbidity and mortality. Age-related changes in pharmacokinetics and pharmacodynamics further exacerbate these risks^{5,6}.

Diabetes, a prevalent health challenge in India, is associated with multiple comorbid conditions, often necessitating multiple medications. However, while beneficial, multiple medications increase the risk of drug interactions and ADRs, underscoring the need for patient adherence and careful medication management^{7,8}.

The management of diabetes in older patients presents unique challenges, given the increased risk of geriatric syndromes and complications. Achieving optimal glycaemic control requires individualized treatment approaches and consideration of medical history and comorbidities. Antihyperglycemic agents with a low risk of hypoglycaemia are preferred, with metformin being the first-line agent^{9,10}.

Potentially inappropriate medication (PIM) use remains a significant concern in older adults, leading to adverse outcomes and increased mortality rates. The American Geriatrics Society (AGS) Beers Criteria provides guidance on medications to avoid in older adults, serving as a vital tool for enhancing medication safety in this population^{11,12}.

The ageing population and the prevalence of chronic diseases necessitate a careful balance between medication benefits and risks. Polypharmacy, though common, requires vigilant management to mitigate adverse outcomes and improve patient well-being.

METHODS

A prospective observational study was conducted at a tertiary care hospital within the Department of General Medicine, focusing on patients diagnosed with Type 2 Diabetes Mellitus and aged 65 years or older. The study drew its data primarily from outpatient prescriptions, diagnosis charts, and the Beer's criteria.

The study population encompassed patients meeting specific inclusion criteria: individuals aged 65 years and above, diagnosed with Type 2 Diabetes Mellitus. Exclusion criteria were set to omit patients under palliative care, those diagnosed with Type 1 Diabetes Mellitus, and inpatient geriatric patients.

Methodologically, patients were selected based on the defined criteria, with only those consenting to participate included in the study. Data collection comprised demographic information (such as gender, age, and weight), laboratory details (including GRBS, HbA1c, and Creatinine clearance), and comorbidities alongside pharmacological therapy.

Prescription patterns of antidiabetic agents and the potential use of inappropriate medications were thoroughly analyzed, with prescriptions from outpatient sheets scrutinized daily. Each prescription was examined to assess medications prescribed, the number of comorbidities, and the quantity of drugs prescribed. Additionally, prescriptions were cross-referenced against the Beer's criteria to detect any potentially inappropriate medication (PIM) usage.

Data collection forms facilitated the gathering of essential information, including details on oral hypoglycaemic agents (OHAs), insulin, comorbidities, the number of drugs prescribed, and patient demographics. To enhance the evaluation of prescription patterns, polypharmacy, and comorbidities, reference project books and various research articles were consulted.

All data were compiled using accepted statistical procedures into an Excel file, ensuring accurate analysis and interpretation. Throughout the study, the privacy and confidentiality of research participants were diligently safeguarded, adhering to ethical standards and regulations.

RESULTS

Characteristics of the study population, consisting of 183 patients, revealed a nearly equal distribution between males (53.82%) and females (49.18%). The age range spanned from 65 to 92 years, with patients categorized into three age groups: The Youngest Old (65-74 years), Middle Old (75-84 years), and Oldest Old (≥ 85 years). Notably, the majority fell into the Youngest Old category (60.7%), followed by the Middle Old (32.8%) and the Oldest Old (6.5%). The prevalence of comorbidities among diabetic geriatrics was striking, with a staggering 97.7% presenting with one or more comorbidity. Hypertension (73.8%), cardiovascular disease (32.2%), bone disorders (29.5%), dyslipidaemia (25.1%), and hypothyroidism (22.9%) were among the most commonly encountered comorbidities (Table 1).

Polypharmacy, a significant concern in geriatric care, was observed in the study cohort. Among the 183 patients, polypharmacy (defined as the use of 5 or more drugs) was evident in 94 patients (51%), while hyper polypharmacy (the use of 10 or more drugs) was observed in 55 patients (30%). Interestingly, the prevalence of polypharmacy and hyper polypharmacy varied across age groups, with the Oldest Old group exhibiting the highest rates. Additionally, there was a direct correlation between the number of comorbidities and the extent of polypharmacy, with higher comorbidity burdens associated with increased polypharmacy.

Regarding antidiabetic drug prescription patterns, oral hypoglycaemic drugs (OHAs) were more commonly utilized compared to insulin, with metformin, glimepiride, and vildagliptin being the most prescribed OHAs. Biguanides, sulfonylureas, and DPP4 inhibitors constituted the major drug classes within the OHAs category (Table 2). Insulin therapy, predominantly in the form of long-acting insulin glargine, was less prevalent compared to OHAs (Table 3).

Utilizing the Beer's criteria, a notable proportion (18.07%) of medications prescribed to older adults with diabetes were identified as potentially inappropriate. Glimepiride, proton pump inhibitors (PPIs), amitriptyline, and prazosin emerged as the top four potentially inappropriate medications (PIMs) (Table 4). Additionally, drug-disease interactions were observed, with certain medications such as alprazolam, amitriptyline, clonazepam, and etodolac implicated (Table 5). Noteworthy drugs requiring cautious use included diuretics, aspirin, and amitriptyline (Table 6). Moreover, significant drug-drug interactions were identified, including potential interactions between Nortriptyline and Hydroxyzine, Sertraline and Quetiapine, Clonazepam and Mirtazapine, as well as Torsemide and Prazosin (Table 7).

DISCUSSION

Addressing inappropriate medication use and potential adverse drug reactions (ADRs) in the geriatric population is a multifaceted challenge. Utilizing medication screening tools like the BEERS criteria can aid in reducing potentially inappropriate medications (PIMs) and associated ADRs in geriatric patients. However, despite such efforts, the prevalence of PIM use remains notably high, with approximately one-third of listed drugs in this study deemed inappropriate¹³.

Given the advanced age and multiple chronic conditions prevalent in the sample, a substantial portion of patients exhibited polypharmacy, with 81% taking five or more medications. This heightened polypharmacy increases the risk of PIMs and subsequent ADRs, underscoring the importance of vigilant medication management in this population¹⁴.

The study highlighted the common occurrence of hypertension, dyslipidaemia, bone disorders, and cardiovascular disease among geriatric diabetic patients. Prescription patterns primarily favoured metformin (biguanide), with limited use of newer classes of oral hypoglycaemic agents (OHAs) observed. Dual or triple therapy was prevalent, while insulin usage was comparatively lower, likely due to practical challenges associated with daily administration¹⁵.

Navigating the complexities of prescribing for older individuals necessitates a delicate balance between safety and efficacy. Involving geriatricians and pharmacists in medication review processes can enhance the appropriateness of drug regimens. The findings underscore the utility of BEERS criteria in mitigating PIMs and ADRs, emphasizing the need for ongoing education and regular medication evaluations for geriatric patients¹⁶.

The study advocates for the adoption of BEERS criteria as a valuable tool for improving elderly care, especially in light of differences observed between various screening tools. However, it also acknowledges the need for consensus on the use of such tools in detecting PIMs among hospitalized Indian elderly patients.

Despite its contributions, the study has several limitations. It was conducted in an urban setting, potentially limiting the generalizability of findings to rural populations. The exclusion of non-prescription over-the-counter medications may have overlooked some ADRs, and the study's short duration may not fully capture seasonal variations in disease and prescribing patterns.

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Table 1: Comorbidities in a geriatric patient

Comorbidities in geriatric diabetic patients	Male n=93	Female n=90	Total n=183
Hypertension	68(73.1%)	67(74.4%)	135(73.8%)
Cardio vascular disease	38(40.9%)	21(23.3%)	59(32.2%)
Bone disorder	14(15.0%)	40(44.4%)	54(29.5%)
Dyslipidaemia	17(18.3%)	29(32.2%)	46(25.1%)
hypothyroidism	18(19.4%)	24(26.7%)	42(22.9%)
Kidney disease	24(25.8%)	4(4.4%)	28(15.3%)
Liver disease	6(6.4%)	20(22.2%)	26(14.2%)
Anaemia	12(12.9%)	12(13.3%)	24(13.1%)
Mental disorder	10(110.7%)	8(8.9%)	18(9.8%)
Benign prostate hyperplasia (Only men)	17(18.3%)	-	*17(18.3%)
Urinary tract infection	5(5.4%)	12(13.3%)	17(9.3%)
Cancer	8(8.6%)	2(2.2%)	10(5.5%)
GERD	4(4.3%)	5(5.5%)	9(4.9%)
Hernia	3(3.2%)	5(5.5%)	8(4.4%)
Spondylosis	2(2.1%)	6(6.7%)	8(4.4%)
Bronchial asthma	2(2.1%)	5(5.5%)	7(3.8%)
CVA	3(3.2%)	4(4.4%)	7(3.8%)

COPD	5(5.4%)	2(2.2%)	7(3.8%)
PDR/NPDR	2(2.1%)	4(4.4%)	6(3.3%)
Seizure disorder	2(2.1%)	4(4.4%)	6(3.3%)
Neuropathy	5(5.4%)	1(1.1%)	6(3.3%)
Cholelithiasis	2(2.1%)	2(2.2%)	4(2.9%)
Other	33(35.5%)	25(27.8%)	58(31.7%)

*Only for men (n=93)

Table 2: Class of oral hypoglycaemic drugs used

Class of drugs	Number of patients n=292	Percentage %
Biguanides	111	38.01
Sulfonylureas	74	25.34
DPP4	72	24.66
Alpha Glucosidase Inhibitor	17	5.82
SGLT-2	15	5.14
Thiazolidinediones	2	0.68
PPAR agonist	1	0.34

Table 3: Prescribing pattern of different insulin.

Insulin	Number of patients n=183	Percentage %
Insulin glargine	28	15.3
Insulin aspart	10	5.46
Biphasic isophane insulin	10	5.46

Regular insulin	8	4.37
Insulin lispro	3	1.64

Table 4: PIM Use in Older Adults.

Medications	Number of patients n=183	Percentage %
Glimepiride	67	36.61
PPI	19	10.38
Amitriptyline	8	4.37
Prazosin	8	4.37
Alprazolam	3	1.64
Clonazepam	3	1.64
Trihexyphenidyl	3	1.64
Clonidine	2	1.09
Quetiapine	2	1.09
Zolpidem	2	1.09
Aripiprazole	1	0.55
Lorazepam	1	0.55
Risperidone	1	0.55
Hydroxyzine	1	0.55
Nortriptyline	1	0.55

Total= 122

Table 5: PIM Use in Older Adult Due to Drug - Disease Interaction.

Drug	Disease	Number of patients
Alprazolam	Fall	1
Amitriptyline	BPH	2
Amitriptyline	History of Fracture	1
Clonazepam	Delirium	1
Clonazepam	Cognitive Impairment	1
Etodolac	CVD	1

Table 6: Drugs to be Used with Caution.

Drugs Not used with caution	Number of patients	Percentage %	Comments
Diuretics	54	29.51	Monitor sodium level closely
Aspirin	25	13.66	For primary prevention of CVD - use with caution in adults \geq 70 years
Amitriptyline	9	4.92	Monitor sodium level closely
Escitalopram	4	2.19	Monitor sodium level closely
Quetiapine	4	2.19	Monitor sodium level closely
Mirtazapine	3	1.64	Monitor sodium level closely
Sertraline	3	1.64	Monitor sodium level closely
Nortriptyline	3	1.64	Monitor sodium level closely
Risperidone	2	1.09	Monitor sodium level closely
Aripiprazole	1	0.55	Monitor sodium level closely
Pimozide	1	0.55	Monitor sodium level closely
Dabigatran	1	0.55	Use with caution for treatment of VTE or Atrial fibrillation in adults \geq 75 years
Duloxetine	1	0.55	Monitor sodium level closely
Prasugrel	1	0.55	Increased risk of bleeding
Rivaroxaban	1	0.55	Use with caution for treatment of VTE or Atrial fibrillation in adults \geq 75 years
Tramadol	1	0.55	Monitor sodium level closely

Table 7: Potentially Clinically Important Drug-Drug Interactions.

Drug	Interacting Drug	Comment
Nortriptyline	Hydroxyzine	Increased risk of cognitive decline
Sertraline	Quetiapine, clonazepam, mirtazapine	Any combination 3 or more cns active drug-increased risk of falls and fractures:
Torseamide	Prazosin	Increased risk of urinary incontinence in older woman-avoid