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RESEARCH ARTICLE
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ASSESSMENT OF DRUG-DRUG INTERACTION IN GERIATRIC IN-PATIENTS OF A TERTIARY CARE TEACHING HOSPITAL: A CROSS -SECTIONAL STUDY.

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Abstract

Objective: This study evaluated the prevalence and characteristics of potential drug-drug interactions (pDDIs) among geriatric inpatients in a tertiary care hospital.

Methods: A cross-sectional study was conducted over six months including patients aged 65 years and above prescribed two or more medications. Medication records were reviewed using electronic interaction database Micromedex to identify pDDIs. Descriptive statistics summarized interactions in terms of frequencies and severity, while chi-square tests assessed associations between demographics and interaction occurrence.

Results: Among 220 patients, a total of 519 drug interactions were identified from 620 prescriptions, indicating a high prevalence of 85.91%. Moderate and major interactions comprised 38.05% and 31.14%, respectively. Age was significantly associated with interaction frequency, particularly in patients aged 60–79 years (p=0.002). Common interacting drugs included anticoagulants, cardiovascular agents, CNS depressants, and antidiabetics.

Conclusion: This study highlights a substantial burden of drug interactions in elderly patients, underscoring the need for vigilant monitoring, tailored pharmacotherapy, and interdisciplinary management. The use of electronic screening tools and pharmacist involvement may reduce adverse outcomes and improve therapeutic safety in this vulnerable population.

Keywords: drug-drug interactions, polypharmacy, geriatric patients, prevalence, risk factors

Introduction-

Pharmacological actions of the drugs can be altered by the food, nutritional supplement and also concomitant drug administration. Drugs have the potential to interfere with the pharmacodynamic and pharmacokinetic parameters of other drugs; in addition they can also alter the disease state, potentially worsening the symptoms leading to therapeutic failure or adverse drug events.[1,2,3] Ageing is a biological process beyond human control that involves the physiological changes capable of altering pharmacokinetics and pharmacodynamics of an individual which by itself can result in the adverse events when elderly are treated for their illness. It is estimated that India's geriatric population was around 104 million in 2011 and is continuously increasing and by 2050 it is projected to be around 319 million.[4, 5]

Majority of Geriatric population suffers from co-morbidities like hypertension, diabetes mellitus and osteoarthritis and when such patients develop a new illness, medical professionals tend to prescribe newer medicines in addition to treatment of already existing co-morbid conditions, which ultimately results in polypharmacy. According to Swedish Panel Study of living Conditions of the Oldest Old (SWEOLD) survey there has been 3-fold increase in the prevalence of polypharmacy from 1993(18%) to 2002(42%). [6] Polypharmacy is one of the major risk factors for drug-drug interaction especially among elderly, which often results in adverse drug event or reaction. Incidence of DDIs related adverse drug have increased significantly that ranges 4.5 to 6.5% and also increases the percentage hospitalization among the geriatric population.[7,8] Certain drugs should not be used concomitantly but due to lack of knowledge of drug-drug interactions, poses a deleterious effect among the elderly who have a compromised senile physiological change. As a result selecting the drugs to treat the illness, which is efficacious, with minimal toxicological profile and less drug interactions has become a challenge among the clinicians. [9.10,11] In order ease tackle these problem of drug interactions various measures have been taken one among them is the introduction of electronic mobile applications like American Society of Health-System Pharmacists, Cerner Multum, Micromedex, and Lexicomp, which helps clinicians to identify, manage and avoid drug combinations having deleterious drug – drug interactions which increases the burden of not only the patients but also the treating physicians especially while treating the geriatric population. [12] Hence the study was planned to assess the potential drug-drug interactions among the geriatric in-patients using the software Micromedex online drug database by Merative.

Materials and Methods

This cross-sectional study was conducted in the Department of General Medicine at a tertiary care teaching hospital over a six-month period from August 2022 to February 2023, after institutional ethics committee approval.

Study Population

Patients aged 65 years and above admitted during the study period and prescribed two or more medications were included. Patients from outpatient departments, intensive care units, emergency departments, and those solely on nutraceuticals were excluded.

Data Collection

Data were collected through a review of case sheets of all elderly patients admitted in Department of Medicine. Demographic data, clinical diagnosis, comorbidities, and detailed pharmacological information—including drug names, doses, routes, frequency, and duration—were retrieved through systematic review of medical records. One prescription per patient was evaluated to ensure uniformity.

Statistical Analysis

Data were entered into SPSS software version 28.0 for statistical analysis. Descriptive statistics including frequencies and percentages were used to summarize patient characteristics and interaction

profiles. Chi-square tests evaluated associations between categorical variables such as age group and gender with the presence of drug interactions. A p-value less than 0.05 was considered statistically significant.

Results

Among the 220 patients included, a total of 519 drug interactions were identified from 539, indicating a high interaction prevalence of 96.28%. This reflects the widespread occurrence of potential drug-drug interactions in the study population, consistent with the complex medication regimens often encountered in clinical settings involving polypharmacy.

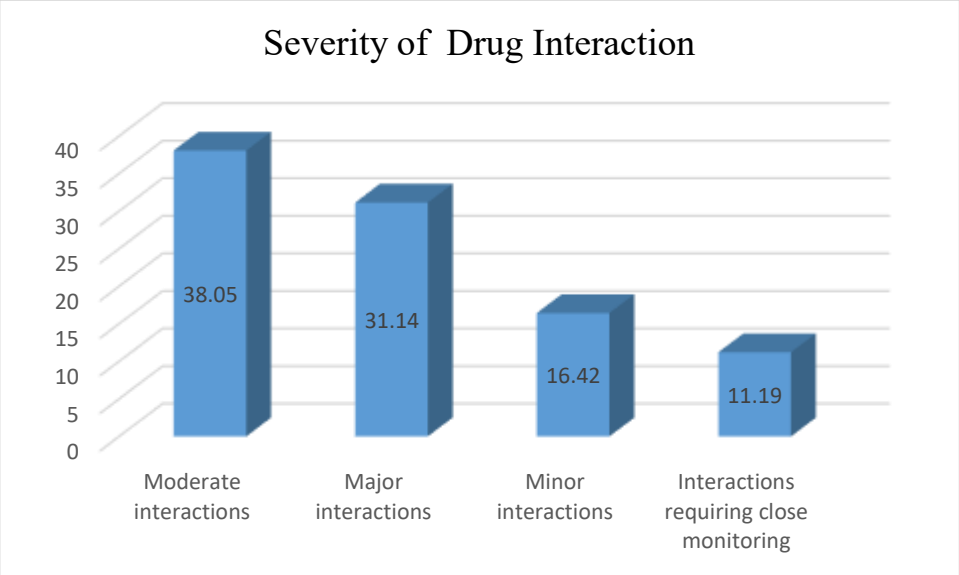

Fig 1- The severity of these interactions was distributed as follows: 38.05% were moderate, requiring adjustments or monitoring; 31.14% major, which may necessitate immediate clinical intervention; 16.42% minor, likely with minimal clinical consequences; and 11.19% needed close monitoring to avoid adverse outcomes. Only 3.17% of prescriptions showed no interactions, highlighting the rarity of interaction-free polypharmacy.

Table 1- Evidence level – Drug interaction

Evidence Level	Number of Interactions	Percentage (%)
Excellent Evidence	190	36.61
Good Evidence	165	31.78
Fair Evidence	164	31.61

- **Excellent:** Controlled clinical studies have definitively established the existence of the interaction.
- **Good:** Documentation provides strong support for the interaction, but well-controlled studies may be lacking.
- **Fair:** Documentation is limited or poor, but pharmacological evidence suggests the interaction is likely to occur. This rating can also be used if there is strong evidence for an interaction with a pharmacologically similar drug.

Table 1-Out of 519 potential drug-drug interactions detected using Micromedex, 36.61% were supported by excellent evidence, reflecting strong clinical data from randomized controlled trials and systematic reviews. Good evidence accounted for 31.78%, based on high-quality observational studies. A significant 31.61% of interactions were supported by fair evidence, stemming from case reports and expert consensus, indicating the need for further investigation. This distribution

demonstrates the clinical significance of the interactions identified and emphasizes the necessity for careful monitoring in elderly inpatient.

Table 2: Correlation of Age, Gender with drug interaction

	With interaction (%)	Without interaction (%)	Total (n, %)	P value
Age (years)				
60–69	88 (40.0)	8 (3.6)	96 (40.0)	
70–79	69(31.4)	5 (2.3)	74 (33.6)	
80–89	33 (15.0)	2 (0.9)	35 (15.9)	
≥90	10 (4.5)	5 (2.3)	15 (4.5)	0.008*
Gender				
Male	103 (46.8)	12(5.5)	115(52.3)	
Female	97 (44.1)	8 (3.6)	105 (47.7)	0.62

Table 2-Age was identified as a significant factor influencing the occurrence of drug interactions (p=0.008). Patients aged 60–69 years accounted for the highest proportion of interactions (40%) followed by those aged 70–79 years (31.4%), reinforcing the vulnerability of elderly patients to drug interactions due to age-related physiological changes and multiple comorbidities. Gender, however, did not significantly affect interaction rates (p=0.62), indicating similar risks among males and females.

Table 3- List of common drug interaction

Drug Interaction	Frequency	Percentage (%)
Warfarin + Aspirin	30	5.6
Digoxin + Furosemide	25	4.7
Metformin + ACE Inhibitors	20	3.7
ACE Inhibitors + Diuretics	18	3.4
Benzodiazepines + Opioids	22	4.1
NSAIDs + Antihypertensives	15	2.8
Statins + Macrolides	17	3.2
SSRIs + NSAIDs	10	1.9
Calcium Channel Blockers + Beta Blockers	12	2.2
Antidepressants + Antipsychotics	11	2.1
Lithium + Loop Diuretics	14	2.6
Phenytoin + Sulfamethoxazole/Trimethoprim	13	2.4
Digoxin + Antibiotics (e.g., erythromycin)	16	3
Warfarin + Fluconazole	9	1.7
Benzodiazepines + Gabapentin	8	1.5
Anticholinergic Drugs (multiple)	19	3.5
CNS Depressants (multiple combined)	21	3.9

SSRIs + St. John's Wort	7	1.3
Warfarin + NSAIDs	14	2.6
ACE Inhibitors + NSAIDs	10	1.9

The most frequent drug interaction pair was Warfarin and Aspirin (5.6%), a combination known to increase bleeding risk through synergistic anticoagulant effects. Other commonly observed interactions included Digoxin and Furosemide (4.7%), which can enhance digoxin toxicity by causing electrolyte imbalance, and Benzodiazepines with Opioids (4.1%), raising concerns for central nervous system depression. Additionally, combinations involving ACE inhibitors, diuretics, metformin, statins, and SSRIs were prevalent, reflecting typical therapeutic overlaps in chronic diseases such as hypertension, diabetes, hyperlipidemia, and depression.

Discussion

The study reveals a notably high prevalence of drug interactions, with 96.28% of patients experiencing at least one interaction, reflecting the widespread challenge posed by polypharmacy in clinical practice. This finding aligns with marunowska et al. that highlights the increased risk of drug interactions in patients receiving multiple medications, especially in hospital and outpatient settings. [13]

The predominance of moderate (38.05%) and major (31.14%) interactions underscores the clinical importance of vigilant monitoring and management, as these interactions have the potential to cause significant adverse effects or therapeutic failures. This is comparable to earlier studies that found a similar rate.[14]

The majority of identified interactions backed by excellent and good evidence are consistent with earlier studies, underscoring the reliability of Micromedex for clinical decision-making in geriatric populations. However, the substantial proportion of fair evidence interactions highlights areas where data remain incomplete, necessitating prospective research to confirm these findings. Considering the complexities of polypharmacy and altered pharmacokinetics in the elderly, incorporating such interaction data into clinical practice can reduce adverse drug events and improve therapeutic outcomes.[15]

Older adults, particularly those between 60 and 69 years, showed a higher frequency of interactions, confirming that aging is a crucial determinant in drug interaction risk due to physiological changes affecting drug metabolism and elimination, as well as the higher likelihood of multiple comorbidities requiring complex treatment regimens. This suggests that geriatric patients necessitate individualized medication reviews and closer supervision to mitigate harmful interactions. Gender did not significantly influence interaction rates, indicating that risk is comparable across males and females in this cohort.[16]

Common interaction pairs such as Warfarin with Aspirin, Digoxin with Furosemide, and benzodiazepines with opioids are particularly concerning, given their potential to cause serious complications like bleeding, toxicity, and respiratory depression. These combinations highlight the critical need for careful therapeutic decision-making and patient education to prevent avoidable adverse events. The frequent involvement of cardiovascular, antidiabetic, and central nervous system agents reflects typical prescribing patterns in chronic disease management, suggesting potential areas for focused intervention.

The findings reinforce the essential role of multidisciplinary collaboration, especially involving clinical pharmacists, in detecting and preventing harmful drug interactions. Incorporation of electronic prescribing systems with interaction alerts, routine medication reconciliation, and patient counseling are pivotal strategies that healthcare systems should prioritize to enhance medication safety.

Conclusion:

This study demonstrates a high prevalence of clinically significant drug interactions, particularly among elderly patients, necessitating increased awareness and proactive management in healthcare

settings. The substantial proportion of moderate and major interactions indicates a critical need for continuous monitoring, individualized therapy adjustment, and integration of decision-support tools to minimize adverse outcomes. Healthcare professionals should adopt a multidisciplinary approach, involving pharmacists and utilizing technology-based solutions to optimize pharmacotherapy and enhance patient safety. Addressing these challenges is vital to improving therapeutic efficacy and reducing the burden of drug-related complications in clinical practice

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