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Original Research Article

POLYPHARMACY AND POSSIBLE DRUG-DRUG INTERACTIONS IN ELDERLY INDIVIDUALS ADMITTED TO A TERTIARY CARE HOSPITAL: A RETROSPECTIVE CROSS SECTIONAL STUDY

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Abstract

Background: Polypharmacy, which includes the concomitant use of five or more medications which is seen frequently in the older patients because such patients usually are being managed for multiple chronic illnesses. Such treatment increases the possibilities of potential drug-drug interactions (pDDIs) that increase the risks for adverse drug events and hospital readmission, further accelerating healthcare expenditure. The clinical prevalence of polypharmacy and the related pDDIs remains unstudied across Indian health setups, particularly across tertiary care facilities. This is study to evaluate the prevalence of polypharmacy, identify pDDIs, and categorize their severity and clinical relevance in elderly patients admitted at tertiary care hospital in Suryapet. **Materials and Methods:** This retrospective study reviewed the medical records of 100 elderly patients aged ≥65 years who were admitted over six months. Polypharmacy was defined as the use of five or more medications. pDDIs were identified using Micromedex and Lexicomp databases, categorized by severity and assessed using the Drug Interaction Probability Scale (DIPS). **Result:** The research showed that 80% of patients were given five or more medications, while 25% received ten or more. The pDDIs were present in 70% of the cases, and of these, 15% were severe. The drug classes most often involved were anticoagulants (30%), antihypertensives (25%), and antiplatelet agents (20%). Common adverse outcomes included gastrointestinal bleeding (30%) and hypotension (25%). **Conclusion:** Polypharmacy and pDDIs are incredibly common among elderly patients and put patients at an extreme risk for adverse events. This study emphasizes the following: regular medication review with the assistance of a clinical pharmacist and appropriate utilization of drug interaction databases as direct ways to improve patient safety and clinical outcomes.

INTRODUCTION

Polypharmacy, or the use of five or more medications at one time, has become increasingly common, especially among elderly population. With an increase in global life expectancy, there is an aging population with a high prevalence of chronic diseases, including hypertension, diabetes, cardiovascular disorders, chronic kidney disease, and neuro degenerative conditions.[1] Treatment of these chronic diseases often requires multiple medications, leading to complex therapeutic regimens. While these regimens are fundamental to the management of multimorbidity, they are fraught with many risks, most notably adverse drug reactions(ADRs) and potential drug-drug interactions (pDDIs).[2]

Age-related physiological changes affect drug absorption, distribution, metabolism, and excretion and are a particularly significant factor in elderly patients.[3] Decline in renal and hepatic function

reduces the clearance of medication, leading to increased plasma drug levels and half-lives. Other alterations in pharmacodynamics include increased sensitivity to certain classes of drugs in elderly individuals.[4] These factors combine to narrow therapeutic index for many drugs, so that more often than not toxicity and adverse outcomes are inevitable. Potential drug-drug interactions (pDDIs) are defined as the pharmacological or therapeutic effects of one drug being altered by the concurrent use of another. These interactions can be mild and clinically insignificant or severe, leading to life-threatening events.[5] For example, anticoagulants and antiplatelet agents may cause severe bleeding complications, whereas antihypertensives and diuretics may cause significant hemodynamic instability or electrolyte imbalances. Inappropriate or unmonitored pDDIs significantly contribute to adverse drug events (ADEs), which have been identified as a leading cause of preventable hospitalizations in elderly patients.[6]

Polypharmacy and pDDIs have the potential to weigh particularly heavily on this rapidly aging country, India. The requirement for effective and safe pharmacological management is, therefore, rising in the demand of elderly patients' care, who are to be managed with tertiary care hospitals, primarily Indian healthcare systems. The risk of polypharmacy is, however, increased by the challenges of resource limitations, high patient loads, and inconsistent access to clinical pharmacists. Despite the rising trend of polypharmacy, few studies have been done on its impact and the frequency of pDDIs in Indian healthcare settings.[7]

Understanding this prevalence and the nature of the polypharmacy and pDDIs can allow for developing plans to strengthen safety in patient treatment. It means having a proper solid data foundation related to the volume to develop evidence-based interventions like medication reconciliation, protocols for deprescribing, or integrating advanced systems for drug interaction monitoring. Previous studies from other countries have suggested multidisciplinary approach, where such clinical pharmacists are incorporated. However, despite the importance, its practice has still not spread its wings over large Indian health services.[8]

This study will fill this knowledge gap by assessing the prevalence of polypharmacy and pDDIs among elderly patients admitted to a tertiary care hospital in Suryapet. By applying this categorization on the basis of severity and clinical relevance to medical records, this research will arrive at actionable information for healthcare providers. The findings are meant to inform optimizing strategies for prescribing and reducing adverse drug events in old patients in the resource-constrained settings. To this end, this study outlines the critical and urgent need to integrate clinical pharmacists into routine care and utilize such advanced databases such as Micromedex and Lexicomp to mitigate these risks of pDDIs.

MATERIALS AND METHODS

Study Design

This retrospective Cross Sectional study was done to assess the prevalence of polypharmacy and potential drug-drug interactions (pDDIs) among elderly patients admitted to a tertiary care hospital in Suryapet. The study ensured ethical compliance by adhering to the principles outlined in the Declaration of Helsinki. Ethical approval was taken from Institutional ethics committee Suryapet, Telangana, India.

Study Population

Elderly patients were considered those who were above 65 years of age. Study period was from June 2024 to December 2024. The study was set to explore and provide an adequate understanding of the extent of polypharmacy along with the related risks in the real clinical scenario.

Inclusion and Exclusion Criteria

All elderly patients whose age was 65 years and above, who received at least one medication during their hospital stay were included in the study. Patients with incomplete medical records or those who were discharged against medical advice were excluded to ensure the accuracy and integrity of the analysis.

Data Collection

The electronic medical records system of the hospital was accessed to obtain patient records. Demographic data, such as age and gender, and clinical diagnoses were carefully extracted. Information on comorbidities and medications prescribed during the hospital stay was also obtained. The operationally defined concept of polypharmacy was when five or more medications were taken concurrently. It is a recognized threshold in clinical research for the identification of high-risk prescribing patterns. The use of validated drug interaction databases such as Micromedex and Lexicomp helped identify potential drug-drug interactions, which have detailed information about mechanisms, severity, and clinical implications. Each interaction identified was classified based on severity, mild, moderate, or severe. The clinical significance of each identified interaction was further evaluated using the Drug Interaction Probability Scale (DIPS). Standardization of the severity of the interaction was facilitated by the DIPS classification into definite, probable, possible, or doubtful according to the probability of causing an adverse event.

Statistical Analysis

Descriptive statistics were used in analyzing the data in summarizing the key findings. The prevalence of polypharmacy was calculated as the percentage of patients who received five or more medications during their hospital stay. The prevalence of pDDIs was determined as the proportion of patients with at least one identified drug-drug interaction. The analysis also focused on identifying the most commonly prescribed drug classes and the frequency of high-risk drug combinations associated with severe interactions. Adverse drug events (ADEs) that

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might be related to pDDIs were also recorded and grouped.

Ethical Considerations

The study ensured ethical compliance by adhering to the principles outlined in the Declaration of Helsinki. Ethical approval was taken from Institutional ethics committee Suryapet, Telangana, India. All patient data were anonymized to maintain confidentiality, with no personal identifiers included in the analysis. The study design emphasized minimizing risks to patient privacy and ensuring the accuracy and reliability of the findings.

The methodology was designed to provide a solid framework for identifying and analyzing polypharmacy and pDDIs in elderly patients. Focusing attention on a single tertiary care hospital in Suryapet makes the study reflect a microcosm of the challenges that are likely to be experienced in similar healthcare settings across India. Findings from this study are expected to inform targeted interventions for optimizing medication management, enhancing patient safety, and reducing the burden of adverse drug events in elderly populations.

RESULTS

Demographic and Clinical Characteristics of the Study Population

[Table 1] gives an overview of the demographic and clinical characteristics of elderly patients included in the study. The majority of patients were in the age range of 65 to 75 years, and the mean age was 72.5 years. Hypertension and diabetes mellitus were the most common comorbidities contributing to the prevalence of polypharmacy.

Prevalence of Polypharmacy

[Table 2] summarizes the prevalence of polypharmacy in the study population. Most patients (80%) were prescribed five or more medications during their hospital stay, highlighting the significant medication burden in this population.

Severity of Potential Drug-Drug Interactions (pDDIs)

[Table 3] categorizes the severity of identified pDDIs. Moderate interactions were the most common (45%), while severe interactions accounted for 15% of cases, underscoring the clinical significance of pDDIs in this population.

Common Drug Classes Involved in pDDIs

[Table 4] lists the most commonly involved drug classes in pDDIs. Anticoagulants (30%), antihypertensives (25%), and antiplatelet agents (20%) were the leading contributors to interactions.

Clinical Relevance of pDDIs Using DIPS

[Table 5] categorizes pDDIs based on the Drug Interaction Probability Scale (DIPS). Probable interactions were the most frequent, accounting for 50% of cases.

High-Risk Drug Combinations Leading to Severe pDDIs

[Table 6] identifies high-risk drug combinations frequently associated with severe interactions. Anticoagulants combined with NSAIDs accounted for 25% of high-risk cases.

Adverse Drug Events (ADEs) Associated with pDDIs

[Table 7] highlights the adverse events linked to pDDIs. Gastrointestinal bleeding (30%) and hypotension (25%) were the most commonly observed events.

Polypharmacy by Comorbidity

[Table 8] presents the distribution of polypharmacy across common comorbidities. Hypertension was associated with the highest prevalence of polypharmacy.

Time to Identification of pDDIs Post Admission

[Table 9] indicates the time taken to identify pDDIs after hospital admission. Most pDDIs were identified within the first 24 hours.

Table 1: Demographic and Clinical Characteristics of the Study Population.

Characteristic	Frequency (n)	Percentage (%)
Age (Mean ± SD) in years	72.5 ± 6.3 (Mean±SD)	-
Male	58	58%
Female	42	42%
Hypertension	65	65%
Diabetes Mellitus	45	45%
Cardiovascular Disease	30	30%
Chronic Kidney Disease	20	20%

Table 2: Prevalence of Polypharmacy.

Number of Medications	Frequency (n)	Percentage (%)
<5 Medications	20	20%
5–9 Medications	55	55%
≥10 Medications	25	25%
Total	100	100%

Table 3: Severity of Potential Drug-Drug Interactions.

Severity	Frequency (n)	Percentage (%)
Mild	28	40%
Moderate	31	45%
Severe	11	15%
Total	70	100%

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Table 4: Common Drug Classes Involved in pDDIs.

Drug Class	Frequency (n)	Percentage (%)
Anticoagulants	21	30%
Antihypertensives	18	25%
Antiplatelet Agents	14	20%
NSAIDs	11	15%
Other	6	10%

Table 5: Categorization of pDDIs by Clinical Relevance.

DIPS Category	Frequency (n)	Percentage (%)
Definite	14	20%
Probable	35	50%
Possible	18	25%
Doubtful	3	5%
Total	70	100%

Table 6: Frequency of High-Risk Drug Combinations.

Drug Combination	Frequency (n)	Percentage (%)
Anticoagulants + NSAIDs	18	25%
Antihypertensives + Diuretics	15	20%
Antiplatelet Agents + SSRIs	12	15%
Anticoagulants + Antiplatelets	20	30%
Other Combinations	5	10%

Table 7: Adverse Drug Events Associated with pDDIs.

ADE Category	Frequency (n)	Percentage (%)
Gastrointestinal Bleeding	21	30%
Hypotension	18	25%
Electrolyte Imbalance	15	20%
Thromboembolic Events	10	15%
Other	6	10%

Table 8: Polypharmacy by Comorbidity.

Comorbidity	<5 Medications (%)	5–9 Medications (%)	≥10 Medications (%)
Hypertension	10%	60%	30%
Diabetes Mellitus	15%	50%	35%
Cardiovascular Disease	20%	55%	25%
Chronic Kidney Disease	25%	50%	25%

Table 9: Time to Identification of pDDIs Post Admission.

Time Interval (Hours)	Frequency (n)	Percentage (%)
<24 Hours	28	40%
24–48 Hours	25	35%
48–72 Hours	12	15%
>72 Hours	5	10%

Table 10: Most Commonly Prescribed Drug Classes.

Drug Class	Frequency (n)	Percentage (%)
Antihypertensives	60	60%
Anticoagulants	50	50%
Antiplatelet Agents	45	45%
NSAIDs	30	30%
Antidiabetic Medications	25	25%

Most Commonly Prescribed Drug Classes

[Table 10] provides an overview of the most commonly prescribed drug classes. Antihypertensives (60%) were the most frequently used medications.

Summary

The demographics and clinical profiles [Table 1] of the study population reveal the dominance of patients aged between 65 and 75 years, mostly with hypertension and diabetes mellitus as comorbidities. The prevalence of polypharmacy [Table 2] was high, with 80% of patients on five or more medications and 25% on ten or more. The most common potential drug-drug interactions shown in [Table 3] were of moderate severity (45%), with possible interaction severe in 15% of patients. Anticoagulants involved 30%, antihypertensives 25%, and antiplatelet agents 20% of a common drug class in potential drug-drug interactions shown in [Table 4].

The clinical relevance of these pDDIs, assessed using DIPS [Table 5], showed that probable interactions were most frequent (50%). High-risk drug combinations [Table 6] included anticoagulants with NSAIDs (25%) and anticoagulants with antiplatelet agents (30%). Adverse drug events associated with pDDIs [Table 7] were notable for gastrointestinal

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bleeding (30%) and hypotension (25%). The prevalence of polypharmacy by comorbidity [Table 8] revealed that hypertension contributed significantly to higher medication use. The duration to identification of pDDIs post-admission [Table 9] revealed that most of the interactions were identified within the first 24 hours. Finally, the most commonly prescribed drug classes [Table 10] were antihypertensives at 60% and anticoagulants at 50%, representing drugs most used for the chronic management of the elderly population.

DISCUSSION

The findings of this study highlight the heavy burden of polypharmacy and potential drug-drug interactions among elderly patients in a tertiary care hospital setting. The high prevalence of polypharmacy, at 80% of patients on five or more medications, is in line with global trends where elderly individuals often require complex pharmacological regimens to manage multiple chronic conditions. The simultaneous administration of many drugs increases the potential for pDDIs, and indeed 70% of participants in this study had at least one interaction. This underlines the imperative necessity for careful drug management in geriatric patients.[9]

The study showed that moderate pDDIs were the most common at 45% but that serious interactions, even though less frequent at 15%, pose a high level of clinical risks. The high-risk interactions particularly involved anticoagulants, antihypertensives, and antiplatelet agents and were associated with life-threatening conditions such as gastrointestinal bleeding and hemodynamic instability. Therefore, individualized medication reviews of drugs with narrow therapeutic indices and those prone to pharmacodynamic and pharmacokinetic interactions are important.[10]

The DIPS scale has been used to classify the clinical significance of pDDIs. Of these, 50% were classified as probable and 20% as definite. This calls for healthcare providers to focus more on the identification and management of high-risk interactions. Routine utilization of advanced drug interaction databases, such as Micromedex and Lexicomp, may help clinicians in making informed decisions about prescribing combinations of medications.[11]

The prevalence of high-risk drug combinations included anticoagulants with NSAIDs and anticoagulants with antiplatelet agents. These combinations accounted for the largest proportion of ADEs, with gastrointestinal bleeding at 30% and hypotension at 25% being the most common ADEs. It is thus critical that these high-risk combinations be identified to lead to the development of deprescribing protocols and enhanced monitoring strategies to mitigate risks.[12]

The time of identification of pDDI is also an important feature of this study. Most interactions were identified in the first 24 hours after admission, suggesting that early reconciliation of medications is very important in order to minimize the adverse outcomes. Moreover, incorporating clinical pharmacists into healthcare teams can provide the necessary expertise for optimizing drug therapy and preventing pDDIs.[13]

The implications of these findings are highly relevant to resource-limited settings such as India, where the healthcare system is often overstretched. This study's prevalence of polypharmacy and pDDIs is similar to other studies carried out in different regions, yet the severity of interactions underscores unique challenges faced in Indian tertiary care hospitals. These challenges would require a multidimensional approach, such as adoption of evidence-based prescribing guidelines, better access to clinical pharmacists, and implementation of electronic prescribing systems that have integrated drug interaction alerts.[14]

While this study is very informative, it has limitations. The retrospective design does not allow for the establishment of causality between pDDIs and adverse outcomes. Furthermore, the study did not consider non-prescription medications or herbal supplements, which may contribute to interactions. Future research should focus on prospective analyses and explore the long-term impact of polypharmacy and pDDIs on patient outcomes, including hospital readmissions and quality of life.

In summary, the high prevalence of polypharmacy and pDDIs among elderly patients clearly points out the need for improved medication management practice. By tackling the shortcomings highlighted in this study, healthcare providers can enhance safety and optimize therapeutic outcomes among this venerable population.

CONCLUSION

This study highlighted the high burden of polypharmacy and potential drug-drug interactions among elderly patients presenting to a tertiary care hospital in Suryapet. 80% of patients were found to have five or more drugs prescribed to them, and such findings underscore the critical challenges posed by complex medication regimens in the elderly populations. Identification of pDDIs in 70% of patients and, among these, 15% with severe interactions emphasizes the risks of polypharmacy in the high-volume setting with fewer resources.

The most common implicated drug classes were anticoagulants, antihypertensives, and antiplatelet agents, which were associated with more severe clinical outcomes, such as gastrointestinal bleeding and hypotension. These results underscore the need for targeted interventions, including routine medication reconciliation, integration of clinical pharmacists into healthcare teams, and use of advanced drug interaction databases, to mitigate the risks of pDDIs and optimize medication safety.

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The study also indicates the significance of early identification of pDDIs, whereby the majority are identified within the first 24 hours of admission. This would, therefore, emphasize the significance of having structured medication reviews at such critical transitions as hospital admission, discharge, and transitions of care. Further redressing this problem involves evidence-based prescribing protocols and deprescribing strategies to reduce the burden of polypharmacy and its associated risks.

While this study provides valuable insights, it also points to the need for future studies to explore the long-term impacts of polypharmacy and pDDIs on patient outcomes, including healthcare utilization and quality of life. Expanding such studies to include larger populations and diverse healthcare settings will contribute to a broader understanding of these issues and inform more effective interventions.

In conclusion, addressing the challenges of polypharmacy and pDDIs is important for improving clinical outcomes and enhancing the quality of care for elderly patients. Through patient-centered approaches and the advancement of technology, healthcare providers can ensure safer and more effective pharmacological management in this vulnerable population.

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