A Study on Prescribing Patterns of Drugs in Geriatric Patients Attending A Tertiary Care Hospital

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Abstract :
Background: *The population of geriatric patients is increasing as a result of increased life expectancy. India is ageing fast and currently the Geriatric population is about 7% of the total population. Geriatric medicine is the branch of gerontology which deals with clinical or medical aspect of gerontology.*
Objectives: *Primary objective: To evaluate the prescribing pattern in Geriatric Patients. Secondary objective: To determine the occurrence of Polypharmacy according to Beer's criteria. To check the Drug – Drug interaction of the common OTC Drugs.*
Methodology: *This study was conducted at Mallige hospital. Mallige hospital is a multispecialty tertiary care hospital with over 126 beds conveniently located in the heart of Bengaluru, the capital of Karnataka state of India. Mallige hospital consist of many departments like Nephrology, Cardiology, Radiology, General Medicine, Surgical, Paediatrics, Obstetrics & Gynaecology, etc. The study involves retrospective observational study. Study was conducted for 6 months in which data collection period for 3 months. Inclusion criteria: Patients above 65 years of either sex. Exclusion criteria: Patient who aren't willing to sign the consent form. Statistical analysis was performed using MS-excel and the result will be statistically analysed using appropriate statistical method.*
Results: *Out of 100 patients enrolled in the study from inpatient department, Majority of patients (42%) belonged to age group of 65-75 years. 52(52%) patients were males and 48 (48%) patients were females. Maximum number of prescriptions were having seven drugs (33%). Intravenous injections were the major formulations used for administration of drugs in geriatric patients (86.66%). The average number of days in the hospital was found to be between 6-10 days. It was observed that Diabetes mellitus in 22 (22%) followed by Systemic hypertension 16 (16%), and Ischemic heart disease in 12 (12%). Out of 557 drugs prescribed in the study, it was observed that Gastrointestinal drugs in 132 (23.69%).*
Conclusion: *The current study could assess the prescribing pattern of medicines in the geriatrics according to Beer's criteria 2015. The study report shows that the prevalence of PIMs is steadily increasing. In this study prescription pattern was not rational as there is polypharmacy, overuse and inappropriate use of drugs in geriatrics. The use of inappropriate medications can be avoided using the Beers criteria 2015, which is one of the important clinical tools which can be wisely used by physicians, pharmacists and health care providers. Polypharmacy and the prescription of PIMs constitute a major problem, especially when dealing with the elderly.*
Keywords: *Beer's criteria, geriatrics, Gastrointestinal drugs, Diabetes mellitus.*

I. INTRODUCTION

The population of geriatric patients is increasing as a result of increased life expectancy.[1] India is ageing fast and currently the Geriatric population is about 7% of the total population. Geriatric medicine is the branch of gerontology which deals with clinical or medical aspect of gerontology.[2] Polypharmacy and inappropriate prescriptions are prominent prescribing issues with elderly patients. Because of the following factors like; the physiologic changes of aging and potential drug–drug and drug–disease interaction; drug use in the elderly is fraught with many problems.[3] These factors have been shown to be responsible for a disproportionately high rate of adverse drug reactions among elderly patients and its associated increased healthcare costs.[4] Detecting adverse drug reactions among geriatric patients is challenging, as they often exhibit non-specific symptoms such as constipation, lethargy, light-headedness, confusion, falls and depression. Elderly patients commonly have multiple pathologies leading to polypharmacy, and altered pharmacokinetics and pharmacodynamics, are prone to adverse drug reactions from inappropriate medication.[8] The most common influential factors of inappropriate prescribing include lack of adequate information regarding the correct

treatment, poor patient–physician relationship, unavailability of appropriate alternative medicines, and improper prescribing supervision.[5]

A Potentially Inappropriate Medication (PIM) list is a useful tool for elderly in preventing adverse drug events occurring at prescription stage. Potentially Inappropriate Medication Highlights Potentially Inappropriate Prescribing (PIP), Potential Prescribing Omissions (PPO), potentially harmful drug-drug/drug-disease interactions i.e. using NSAIDs in patients with hypertension, β blocking agents in diabetic patients, Poly pharmacy, morbidity, contraindications based on patients genetic profile and those with age related contraindications.[6,7] It is well known that PIMs use among older patients is associated with negative health consequences and can impact patients' quality of life. PIMs use increases the risk of hospitalization, drug-related problems and other adverse health outcomes by two to three folds.[9] Several studies performed in order to investigate the association between PIMs use and developing unwanted Adverse Drug Reactions (ADRs) and Adverse Drug Events (ADEs) among elderly patients at different settings (hospitalized, outpatient and even nursing home residents) concluded that using PIMs is significantly associated with an increased risk of developing ADRs and ADEs.[21] Medications are often used in older people based on studies of younger persons without significant comorbidities. Applying clinical guidelines based on the studies to older adults with comorbidity and functional impairment is challenging.[10] Statins are effective when used as secondary prevention in older adults, but their efficacy when used as primary prevention of atherosclerotic cardiovascular disease in people age 75 and older is questionable. Nevertheless, they are widely used for this purpose.[11] Drugs with anticholinergic properties are commonly prescribed in the elderly for conditions such as muscle spasm, overactive bladder, psychiatric disorders, insomnia, extrapyramidal symptoms, vertigo, pruritus, peptic ulcer disease, seasonal allergies, and even the common cold, and many of the drugs often prescribed have strong anticholinergic properties.[12] Proton pump inhibitors are among the most commonly prescribed medications in the India, and their use has increased significantly over the decade. It has been estimated that between 25% and 70% of these prescriptions have no appropriate indication.[16] Although proton pump inhibitors are highly effective and have low toxicity, there are reports of an association with *Clostridium difficile* infection, community-acquired pneumonia, hip fracture, vitamin B12 deficiency, atrophic gastritis, kidney disease, and dementia.[17,18,19] The beers criteria are the most frequently used of those explicit methods of determining PIMs. The Beers criteria, developed in 1991 by a geriatrician as an approach to safer, more effective drug therapy in frail elderly nursing home patients, were updated by the American Geriatrics Society in 2015 for use in any clinical setting.[20] The Beers criteria offer evidence-based recommendations on drugs to avoid in the elderly, along with the rationale for use, the quality of evidence behind the recommendation, and the graded strength of the recommendation. According to beer criteria drugs which are prescribed inappropriately are classified into one of the following categories:

Category A: Drugs that generally should be avoided in old adults.
Category B: Drugs that exceed maximum recommended daily dose.
Category C: Drugs to be avoided in combination with specific co-morbidity.[22]

Geriatric People particularly those with multiple co-morbid condition may result in polypharmacy which can be associated with use of potentially inappropriate medication. This study aims to understand about prescription pattern and to find out inappropriate medication used in geriatric patients using Beer's criteria 2015.

II.   MATERIALS AND METHODS

DURATION OF STUDY
Study was conducted for 6 months in which data collection period for 3 months.

SITE OF STUDY
This study was conducted at Mallige hospital. Mallige hospital is a multispecialty tertiary care hospital with over 126 beds conveniently located in the heart of Bengaluru, the capital of Karnataka state of India. Mallige hospital consist of many departments like Nephrology, Cardiology, Radiology, General Medicine, Surgical, Paediatrics, Obstetrics & Gynaecology, etc.

STUDY DESIGN
The study involves retrospective observational study.

SOURCES OF DATA AND MATERIALS
* Prescription of patient / medication chart
* Investigational data
* Nursing notes and doctor notes
* Discharge summary

STUDY CRITERIA
INCLUSION CRITERIA
Patients above 65 years of either sex.
EXCLUSION CRITERIA

Patient who aren't willing to sign the consent form.

METHODOLOGY:

For this study data of patient was collected in the data collection form from case sheets from the Medical Records Department and the prescription were evaluated according to Beer's criteria to check polypharmacy.

STATISTICAL ANALYSIS

Statistical analysis was performed using MS-excel and the result will be statistically analysed using appropriate statistical method.

III. RESULTS

➢ **Age distribution of patients observed in this study**

Out of 100 patients enrolled in the study from inpatient department, Majority of patients 42(42%) belonged to age group of 65-75 years. (Fig. 1 and Table. 1)

AGE DISTRIBUTION	NO. OF PATIENTS	IN PERCENTAGE
65-75	42	42%
76-85	36	36%
86-95	18	18%
96>	4	4%
Total no. of patient	100	100%

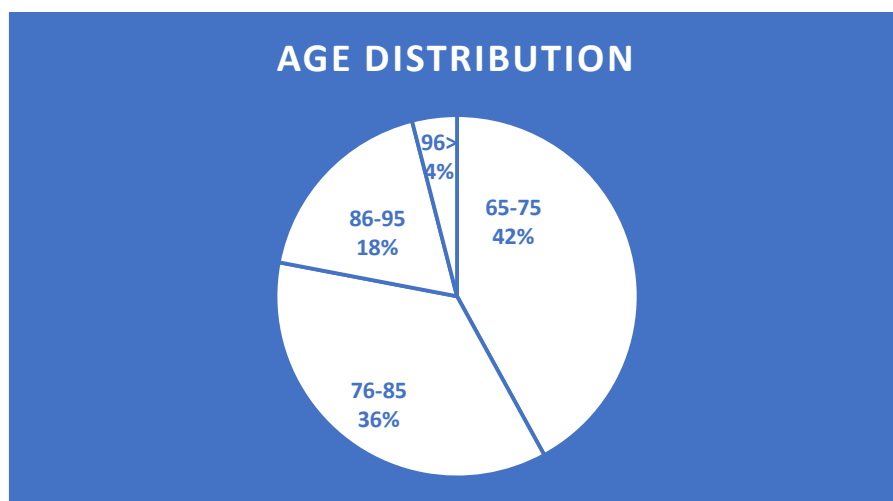**Table 1: Age distribution of patients observed (n=100)**

Figure1: Age distribution of patients observed

Distribution of gender in patients observed in this study

Out of 100 patients, 52(52%) patients were males and 48 (48%) patients were females. the number of male patients were slightly high by 4%. (Fig. 2 and Table. 2)

GENDER	NO. OF PATIENTS	IN PERCENTAGE
Male	52	52%
Female	48	48%

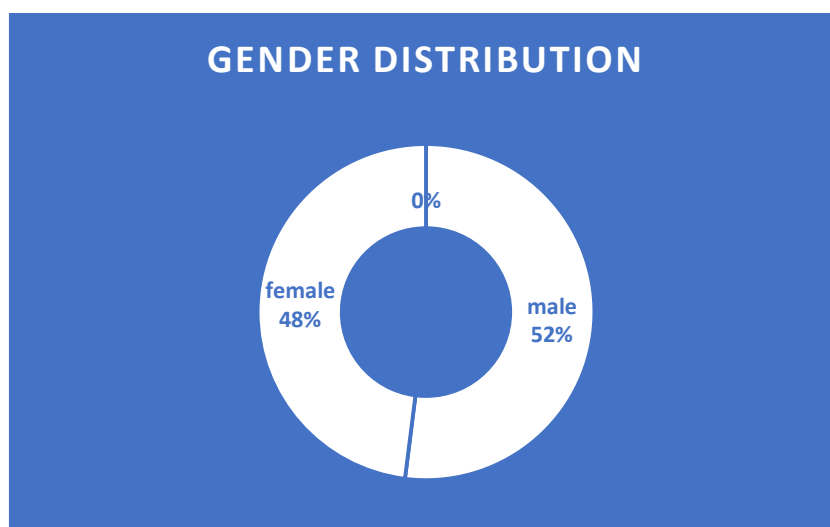**Table 2: Gender Distribution of Patients observed (n=100)**

Figure 2: Gender Distribution of Patients observed

➢ **Distribution of Total number of drugs prescribed per patient**

This result showed tendency of polypharmacy with maximum number of prescriptions were having seven drugs (33%). (Fig. 3 and Table. 3)

THERAPY PATTERN	NO. OF PATIENTS	IN PERCENTAGE
One drug	3	3%
Two drugs	7	7%
Three drugs	5	5%
Four drugs	11	11%
Five drugs	8	8%
Six drugs	27	27%
Seven drugs	33	33%
Eight drugs	6	6%

Table 3: Total number of drugs prescribed per patient (n=100)
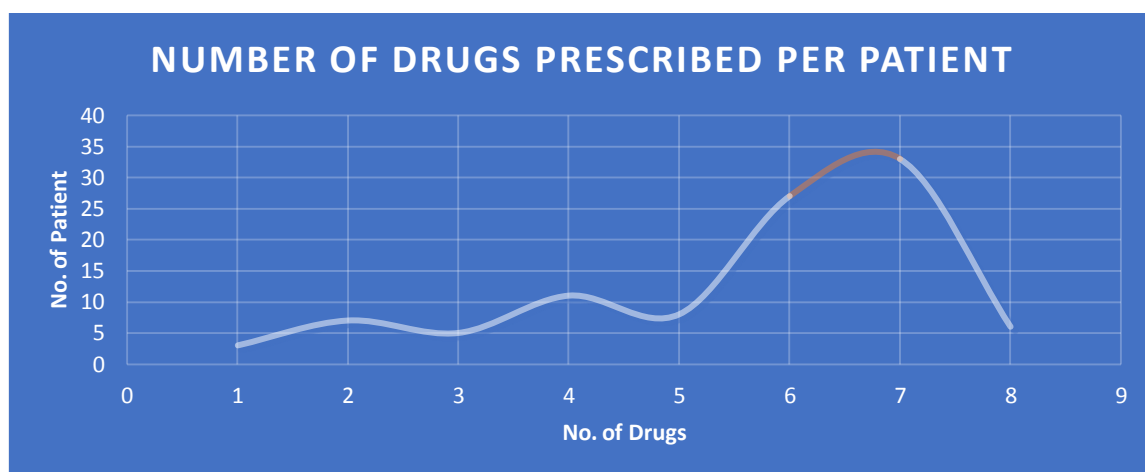

Figure 3: Total number of drugs prescribed per patient

➢ **Distribution of formulation of drugs**

Intravenous injections were the major formulations used for administration of drugs in geriatric patients (86.66%) followed by tablet (9.16%) and syrup (4.16%). (Fig. 4 and Table. 4)

FORMULATIONS	NO. OF PATIENTS	IN PERCENTAGE
INTRAVENOUS	257	46.14%
INTRAMUSCULAR	78	14%
TABLETS & CAPSULES	160	28.72%

SYRUP	62	11.13%

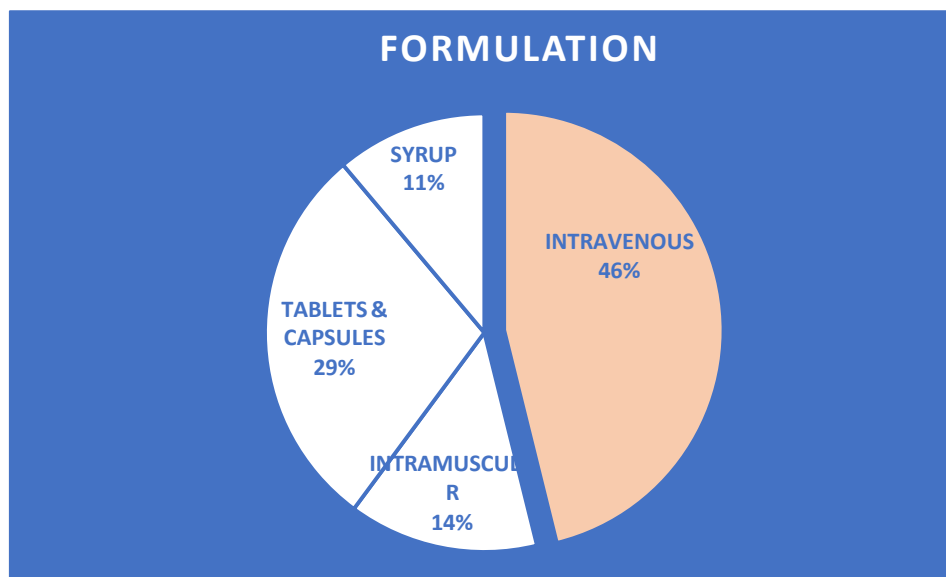**Table 4: Formulation of drugs prescribed (n=557)**

Figure 4: Formulation of drugs prescribe

➢ **Distribution of length of stay in hospital**

The average number of days patients stayed in the hospital was found to be between 6-10 days. (Fig. 5 and Table. 5)

NUMBER OF DAYS	NO. OF PATIENTS	IN PERCENTAGE
1-5	15	15%
6-10	68	68%
11-15	14	14%
16-20	3	3%

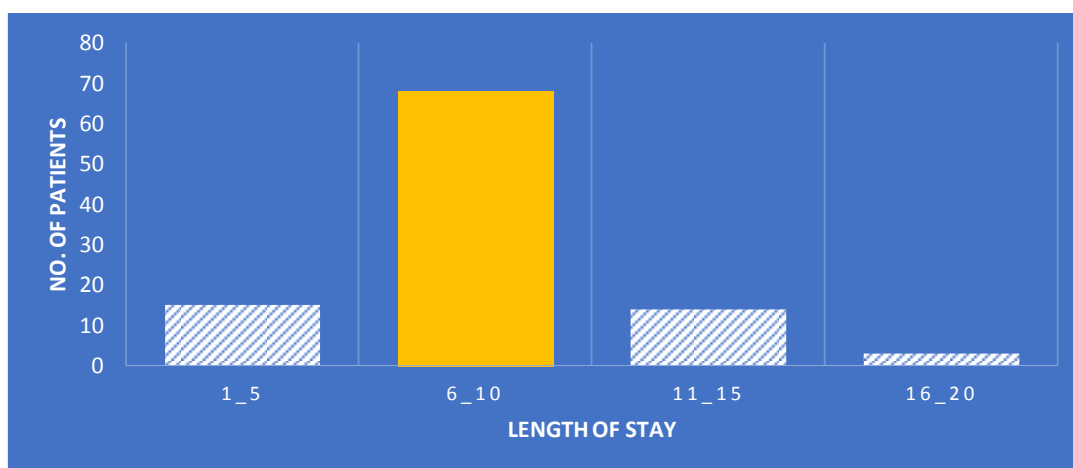**Table 5: Number of days in hospital (n=100)**

Figure 5: Number of days in hospital

➢ **Diagnosis pattern in different age groups**

Out of 100 patients enrolled in the study, it was observed that Diabetes mellitus in 22 (22%) followed by Systemic hypertension 16 (16%), and Ischemic heart disease in 12 (12%). (Fig. 6.1 & 6.2 and Table. 6)

DIAGNOSIS	65-75 YEARS	76-85 YEARS	86-95 YEARS	90> YEARS	TOTAL	IN PERCENTAGE
Diabetes mellitus	11	7	3	1	22	22%
Systemic hypertension	7	6	3	---	16	16%
Ischemic heart disease	6	4	2	---	12	12%

Coronary Artery Disease	5	3	1	---	9	9%
LRT	2	4	2	---	8	8%
Bronchial asthma	2	3	1	---	6	6%
COPD	1	2	1	---	4	4%
UTI	----	2	1	1	3	3%
Anemia	----	1	1	---	2	2%
Chronic renal failure	2	---	---	---	2	2%
Parkinson's disease	1	1	---	---	2	2%
CKD	2	---		---	2	2%
Others*	1	1	2	---	4	4%
Combination**	2	2	1	2	7	7%
TOTAL	42	36	18	4		
IN PERCENTAGE	42%	36%	18%	4%		

Table 6: Diagnosis pattern in different age groups (n=100)

Others*: Poisoning, Skin Infection, ADEM, Viral hepatitis.
Combination**: CKD and Anemia and UTI, COPD and Ischemic heart disease, COPD and HTN, CKD and HTN, DM and HTN, Parkinson's disease and HTN, D.M and Ischemic heart disease.
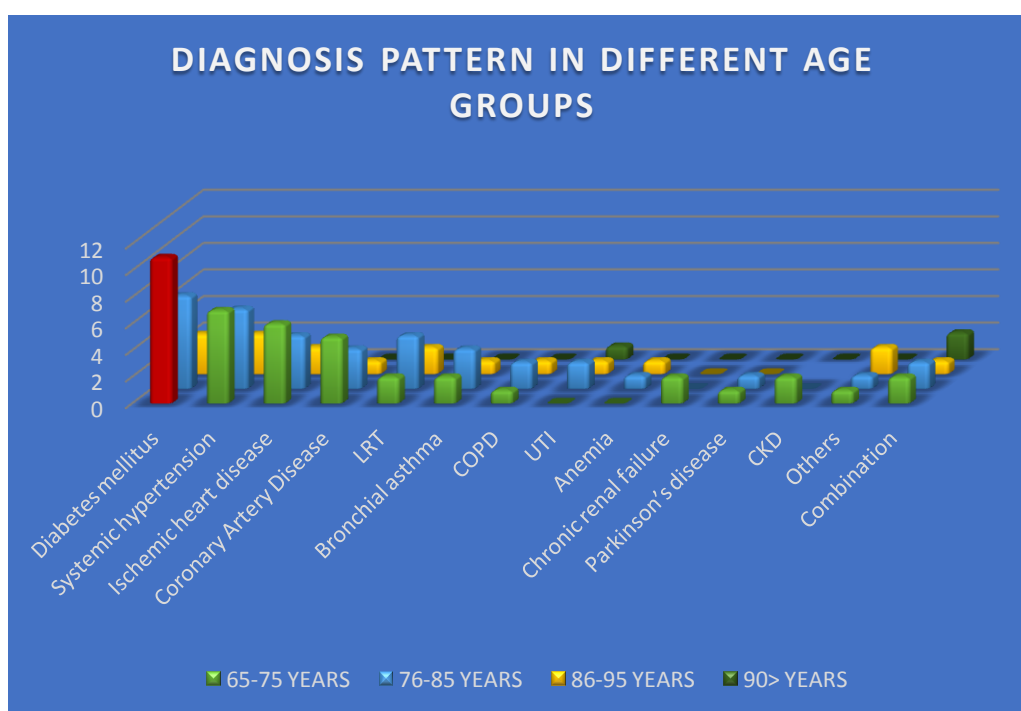

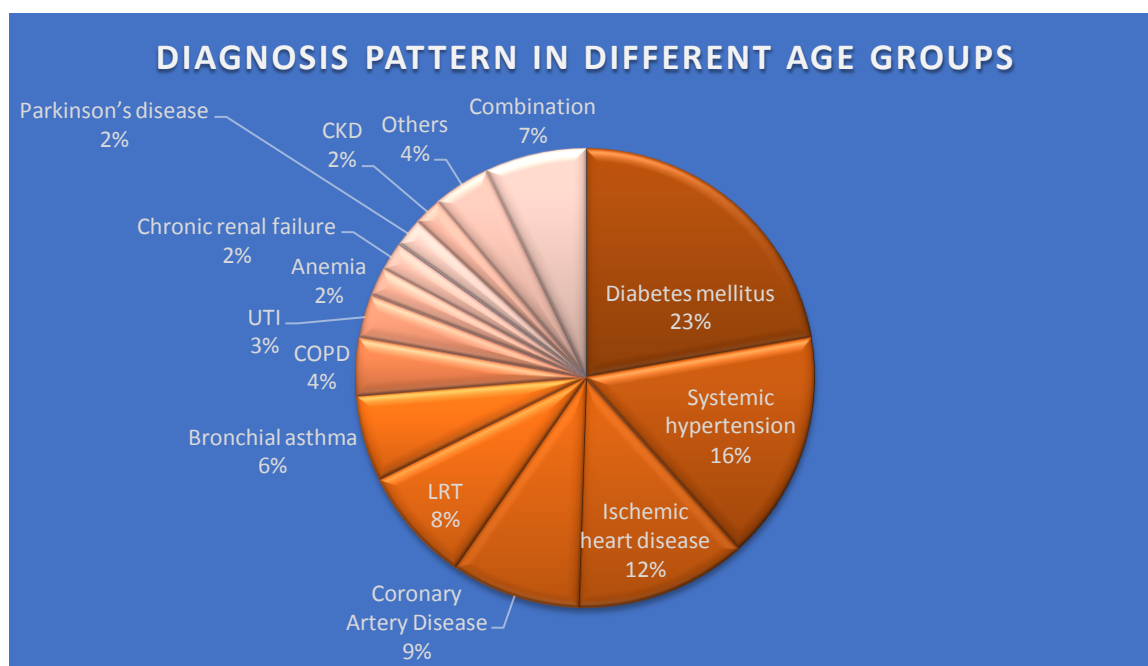**Figure 6.1: Diagnosis pattern in different age groups**

Figure 6.2: Diagnosis pattern in different age groups in percentage

➤ **Distribution of categories of drugs prescribed**

Out of 557 drugs prescribed in the study, it was observed that Gastrointestinal drugs in 132 (23.69%) followed by Antidiabetic drugs 112 (20.1%), and Antimicrobial drugs in 77 (13.82%). (Fig. 7 and Table. 7)

DRUG CATEGORY	NO. OF DRUGS	IN PERCENTAGE
Gastrointestinal drugs	132	23.69%
Antimicrobial drugs	77	13.82%
Cardiovascular drugs	64	11.49%
Antidiabetic drugs	112	20.1%
Analgesics	52	9.33%
Anti-gout drugs	6	1.07%
Drug acting on central nervous system	33	5.92%
Anti-hyperlipidaemic drugs	12	2.15%
Anti-epileptics	8	1.43%
Drugs acting on blood and blood forming agents	34	6.1%
Other dugs	27	4.84%

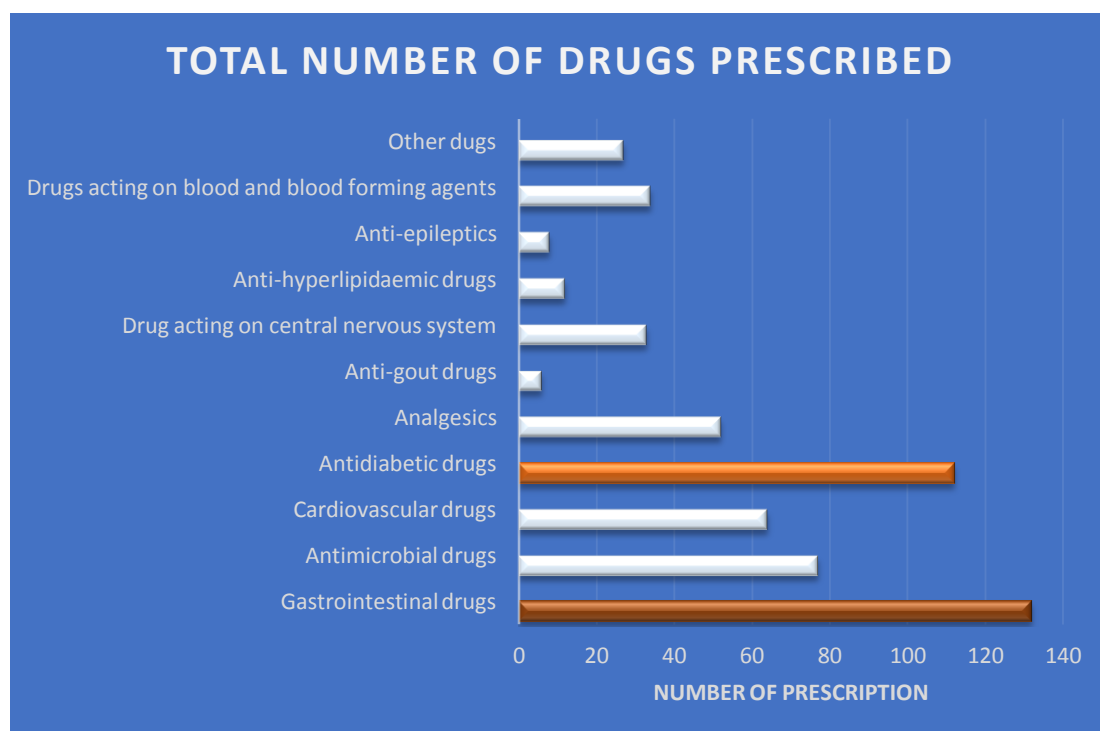**Table 7: Distribution of total number of drugs prescribed (n=557)**

Figure 7: Distribution of total number of drugs prescribed

➢ **Distribution of possible ADRs and interactions discovered in the study**

Out of 100 patients enrolled in the study, it was observed two moderate drug interactions. It was also found that six patients were shown adverse drug reactions which, patients had most of the reactions with Amlodipine. (Fig. 8 and Table. 8.1 & 8.2)

INTERACTIONS	SEVERITY OF INTERACTION	EFFECT
Nifedipine <> Multivitamin with Minerals	Moderate	Decreased the effects of nifedipine.
Amlodipine <> Aspirin	Moderate	Combination caused blood pressure to increase.

Table 8.1: Distribution of drug/food/lifestyle Interactions

SUSPECTED DRUGS	NO. OF PATIENTS	INTERACTION
Amlodipine	3	Edema
Aspirin	2	Fatigue
Nifedipine	1	Dizziness

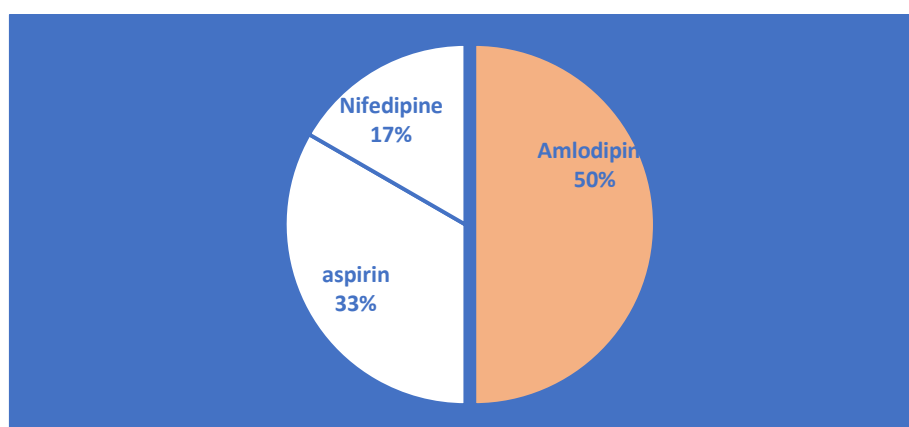**Table 8.2: Distribution of suspected ADRs**

Figure 8: Distribution of suspected ADRs

➢ **Distribution of medications prescribed in study population**

Out of 100 prescriptions, the total number of drugs prescribed were 557. Average number of drugs per prescription were 5.57. Number of appropriate prescriptions were 92 (92%) and Number of inappropriate prescriptions were 8 (8%). (Fig. 9 and Table. 9)

Total no of prescriptions	**100**
Total no of drugs prescribed	557
Average no of drugs per prescription	5.57
No of appropriate prescriptions	92 (92%)
No of inappropriate prescriptions	8 (8%)

Table 9: Number of medications prescribed in study population
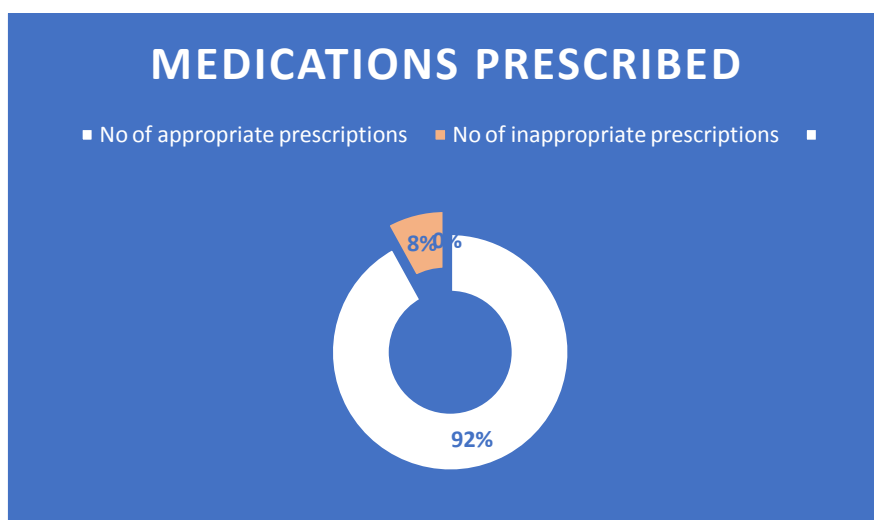

Figure 9: Number of medications prescribed appropriate/ inappropriate

IV. DISCUSSION

Drug therapy is most common and important treatment in geriatric patients. Most elderly people take medications for long durations to control chronic conditions such as hypertension, diabetes, heart failure etc. Drugs are also used for shorter periods for symptomatic relief from conditions such as pain, to treat in Inappropriate prescribing is a major concern in the health care service, particularly in developing countries where the health system and health monitoring are often not well established. This study evaluated the prescribing patterns of drugs in geriatric patients attending a tertiary care hospital. The results of this study can serve as baseline information for health care professionals and policymakers to further improve drug therapy. The data was collected from 100 patients using specially designed data collection form. Out of which 52 (52%) were males and 48 (48%) were female patients. the number of male patients were slightly high by 4%. Hence the majority of drug utilization was by males. The study revealed that majority of the patients who got admitted in the hospital were in the age group between 65-75 years (42%) followed by patients who were in the age group 76-85 years (36%) and 86-95 years (18%) and the least comes under the range of 96> years of age (4%) which was similar to the study conducted by Manhal Izzy et al.,(2016) where majority of the patients age group are between 65-76.[23] This can be attributed to the fact that more patients who visited the hospital during study period were in the range between 60-80 years of age. In this study results showed tendency of polypharmacy with maximum number of prescriptions were having seven drugs (33%). Average number of drugs per person is an important index of prescription audit. The WHO recommends that the average number of drugs per prescription should be less than two. Mean number of drugs per prescription should be kept as low as possible. Higher figures (polypharmacy) always lead to increased risk of drug interaction, adverse effects, development of bacterial resistance, increased hospital cost. Intravenous injections were the major formulations used for administration of geriatric patients (46.14%). The main reason is it may be because of urgent control of infections and to minimize morbidity as compared to oral route. WHO recommends lesser use of injection as it helpful in reducing the cost of treatment and its disadvantages. In oral dosage forms the most commonly used dosage form was tablet. Similar findings were seen in other studies done by Seema anjum M et al., (2017).[24] Elderly people are comfortable with the dosage form like syrup and drops compared to tablets and capsules. It was observed that the average length of stay of patients in the hospital was found to be between 6-10 days. In B chitra et al., (2015) study shows that that the average length of stay of patients in the hospital was 5-9 days.[25]

Most common prevalence of disease among the study was Diabetes mellitus (22%) followed by Systemic hypertension (16%), and Ischemic heart disease in (12%) which was similar to the study conducted by B chitra et al., (2015) where they observed that where they observed that was Diabetes mellitus. Older adults are at high risk for the development of type 2 diabetes due to the combined effects of increasing insulin resistance and impaired pancreatic islet function with aging. Gastrointestinal drugs (23.69%) and Antidiabetic drugs (20.1%) were most commonly prescribed categories of drugs between geriatric patients. In one of the studies conducted in tertiary care hospital have found that the Antibiotics and Analgesics and Anti-inflammatory drugs were the most commonly prescribed categories of drugs in elderly people. (Prakash Goudanava et al.,2015)[26], Whereas, in another tertiary care hospital Drug acting on central nervous system was found to be widely prescribed. (Nachiket Bhaveshaikh et al.,2017) Out of 100 patients enrolled in the study, it was observed two moderate drug-drug interactions. It was also found that six patients were shown adverse drug reactions which patients had most of the reactions with Amlodipine. Out of 100 prescriptions, the total number of drugs prescribed were 557. Average number of drugs per prescription were 5.57. The risk of drug interaction may increase with increase in number of drugs per prescription which ultimately lead to prescribing errors and in hazardous to the health of patient.

V.   CONCLUSION

The current study could assess the prescribing pattern of medicines in the geriatrics according to Beer's criteria 2015. The study report shows that the prevalence of PIMs is steadily increasing. In this study prescription pattern was not rational as there is polypharmacy, overuse and inappropriate use of drugs in geriatrics. The use of inappropriate medications can be avoided using the Beers criteria 2015, which is one of the important clinical tools which can be wisely used by physicians, pharmacists and health care providers. Polypharmacy and the prescription of PIMs constitute a major problem, especially when dealing with the elderly. Particular attention needs to be paid to the training of prescribers regarding geriatric patients. Whereas, Regular medication review and promoting the use of the essential drug list among health care professionals are encouraged in primary care settings. This study emphasizes the need for creating more awareness among the general practitioners and clinicians on this important public health issue by conducting more Continued Medical Education programmes on drug therapy in elderly.

VI.   LIMITATION

Less number of samples and single study site.
It was conducted only among the inpatients.
The study enrolled the patients only from one hospital and hence cannot be generalized to the geriatric patient's population of India.

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