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Research Article

Prescribing pattern, polypharmacy and potentially inappropriate prescribing in hospitalized elderly patients: a retrospective study in a teaching hospital in Nepal

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ABSTRACT

Background: Evaluate prescribing pattern, polypharmacy, and prescribing potentially inappropriate medicine (PIM) in elderly population to contribute in awareness towards rational use of drugs.
Methods: A retrospective cross-sectional and observational study was done in hospitalized geriatric patients in Nepal. The World Health Organization (WHO) "core prescribing indicators" and Beers' 2012 updated criteria were used to assess prescribing pattern and inappropriate prescribing respectively. The drug- drug interactions were checked using Medscape drug interaction checker. In addition, disease prevalence and the most commonly prescribed drugs were also assessed where diseases and drugs were classified according to International Classification of Diseases-10 (ICD-10) and the Anatomical Therapeutic Chemical (ATC) classification respectively.
Results: Out of 225 patients, 118 (52.4%) were males and most of the patients were in the age group 65-74 years (125, 55.6%). The diseases of circulatory system were more prevalent (135, 60%) and the average number of drugs was 8.19±3.50. Generic name prescribing was 8.51% and 77.33% of prescription contained antibiotic(s). Injection(s) prescribed were 80%, and drugs prescribed from national essential drug list and WHO essential drug list were 52.55% and 46.15% respectively. Medicines for alimentary tract and metabolism (215, 95.55%) and cardiovascular system (155, 68.89%) were most frequently prescribed. Polypharmacy (≥5 drugs) was found in 195 (86.66%) patients and was significant (P= 0.001). The potentially inappropriate medicines (PIMs) prescribed were 133 (7.21%) and at least one PIM was prescribed to 78 (34.67%) patients. Almost half numbers of patients (48.9%) were detected with at least one potential drug-drug interaction (DDI).
Conclusions: Majority of hospitalized elderly patients received polypharmacy with drugs which may have serious drug-drug interactions. Thus, less number of drugs per prescription with minimum potential of drug-drug interaction and inappropriate medicines for elderly can be reinforced by implementing proper system of recording and analysing the therapy.

Keywords: Elderly, Prescribing pattern, Inappropriate prescribing, Polypharmacy, Drug- interaction

INTRODUCTION

In Nepal, the older population accounts for about seven percent of the total population with majority in their sixties.[1] This population is frequent consumer of medications due to the high prevalence of chronic disease and are at particular risk for drug-related problems (DRP) due to physiologic changes that occur with aging and

multiple concomitant diseases.[2] Furthermore, physician prescribing habits and practices have resulted in the polypharmacy.[3] The most common adverse outcomes of polypharmacy are increased incidence of adverse effects, drug-drug -disease interactions, and an increase in medication costs.[4] Patients in a hospital setting with more than four drugs can suffer irreversible damage that may result in reduced functional and working ability.[5,6]

Prescribing patterns need to be evaluated periodically for providing feedback to the prescribers to create awareness towards rational use of drugs.[7,8] The World Health Organization (WHO) has formulated a set of "core prescribing indicators" for improvement in rational drug use.[9] Beer's Criteria describes medications or medication classes, which are potentially inappropriate and need to be avoided or to be used with caution for elderly.[10] Therefore, this study aimed to determine the current prescribing pattern and inappropriate prescribing in the hospitalized elderly population.

METHODS

Study design

A single-center retrospective cross-sectional and observational study was carried out on elderly patients, 65 years and above, admitted to a Teaching Hospital, Bharatpur, Nepal. Data of elderly patients admitted to all the wards of the hospital was obtained from Medical Records Section after receiving the ethical approval from Chitwan Medical College- Institutional Review Committee (CMC-IRC).

Sample size and data collection

The total of 1,686 records of patients, who were admitted in different wards during the period of January and February, 2014 were found, out of which 225 were geriatric patients whose records were studied. Data were collected in a structured Proforma, which included patient's demographic details (age, sex, length of hospital stay), diagnosis, and medicines prescribed. Diseases and drugs were classified according to International Classification of Diseases-10 (ICD-10) and the anatomical therapeutic chemical (ATC) classification respectively.[11, 12]

WHO prescribing indicators were assessed to evaluate the drug prescribing pattern.[13] WHO model list of essential medicines (2013) and National list of essential medicines, Nepal (2011) were used to find out the percentages of drugs prescribed from the lists. Following prescribing indicators were assessed: [14, 15]

- Average number of drugs per prescription.
- Percentage of drugs prescribed by generic name.
- Percentage of prescriptions with antimicrobial(s) prescribed.
- Percentage of prescriptions with injection(s) prescribed.
- Percentage of drugs prescribed from national essential drug list (Nepalese).
- Percentage of drugs prescribed from WHO essential drug list.

The prevalence of polypharmacy (5-9 medications) and high-level polypharmacy (>or=10 medications) were determined. Inappropriate medications for older adults were identified using Beers' 2012 updated criteria. The drug-drug interactions were checked using Medscape drug interaction checker.

Data analysis

Excel 2013, SPSS 20, and EpiInfo version 6 were used to analyse the data. A probability value of less than 0.05 was considered statistically significant. Data have been expressed as mean ± S.D. (standard deviation) wherever applicable.

RESULTS

Demographics

The total of 225 prescriptions was evaluated, out of which, 118 (52.4%) were male and 107 (47.6%) were female (table 1). Mean age was 73.93±6.94 years and 125 (55.6%) were younger elderly (65-74 years). Average length of hospital stay was 4.67 (±3.81) days. The most prevalent diseases were from circulatory system (135, 60%), in which hypertensive patients were 88 (39.1%) and those with ischemic heart disease, cardiovascular accident, and other forms of heart diseases (arrhythmia, cardiomyopathy, etc.) were 92 (40.8%), as shown in table 2.

Table 1: Demographic characteristics of hospitalized elderly patients.

Age group (years)	Gender		Number (%)	Average Number of drugs
	Female (N=107, 47.6%)	Male (118, 52.4%)		
65-74	63	62	125(55.6)	7.80
75-84	37	42	79(35.1)	8.35
>=85	7	14	21 (9.3)	9.10

Prescription pattern and polypharmacy

The total number of medicines prescribed to 225 patients was 1,844 (during the hospital stay), with average of 8.19±3.50 per person. The mean number of drugs prescribed within the age group of 65-74 years was 7.80, for those within the age group of 75-84 years were 8.35 and those within the age group of 85 years and above were 9.10. Based on WHO core drug use indicators, the prescribing pattern was evaluated as shown in table 3.

Table 2: Prevalence of chronic and acute diseases in the hospitalized geriatric patients.

Disease group	Specific condition	Number (%) (n=225)	Total (%)
Circulatory system	Hypertension IHD, CVA, and other forms of heart diseases (arrhythmia, cardiomyopathy, etc.)	88 (39.1) 92 (40.8)	135 (60.0)
Respiratory system	COPD Pneumonia Other	68 (30.2) 18 (8.0) 8 (3.5)	94 (41.7)
Endocrine, nutritional and metabolic diseases	Diabetes mellitus Disorders of thyroid gland	39 (17.3) 7 (3.1)	45 (20)
Genitourinary system	UTI Renal failure Other	15 (6.6) 22 (9.7) 4 (1.7)	37 (16.4)
Diseases of the blood and blood forming organs and certain disorders involving the immune mechanism	Nutrional anemia Other	17 (7.5) 5 (2.2)	22 (9.7)
Neoplasms		13 (5.7)	13(5.7)
Infectious and parasitic diseases	TB Leprosy	12 (5.3) 2 (0.8)	14 (6.2)
Digestive system	Peptic ulcer, gastritis and duodenitis Other	12 (5.3) 8 (3.5)	20 (8.8)

Generic name prescribing was 8.51%, and 77.33% of prescription contained antibiotic(s). Injection(s) prescribed were 80%, and drugs prescribed from national essential drug list and WHO essential drug list were 52.55% and 46.15% respectively. The most prescribed drugs were from ATC group A (alimentary tract and metabolism; drugs-422, 22.88%; patients-215, 95.55%) followed by group C (cardiovascular system; drugs-374, 20.28%; patients-155, 68.89%). Proton pump inhibitors (87.11% patients and 10.62% drugs) and beta-lactam antibacterial excluding penicillin's (51.55% patients and 6.29% drugs) were mostly prescribed (table 4). Polypharmacy was found in 195 (86.66%) patients with high significance (P=0.001), including 75 (33.3%) patients with high level polypharmacy (>or=10 medications).

Table 3: Pattern of WHO core drug use indicators.

Prescribing indicators	Findings
Average number of drugs per prescription	8.19
Percentage of drugs prescribed by generic name	8.51%
Percentage of prescriptions with antimicrobial(s) prescribed	77.33%
Percentage of prescriptions with injection(s) prescribed	80%
Percentage of drugs prescribed from national essential drug list	52.55%
Percentage of drugs prescribed from WHO essential drug list	46.15%

Potentially inappropriate medication

In the total of 1,844 medicines prescribed, 133 (7.21%) were potentially inappropriate as determined by Beer's criteria. At least one potentially inappropriate medicine was prescribed to 78 (34.67%) patients. Benzodiazepines and NSAIDs were most frequently prescribed (Table 5).

Potential drug-drug interaction

A computerized drug-interaction program (Medscape drug interaction checker) was used and almost half numbers of patients (48.9%) were detected with at least one potential drug-drug interaction (DDI). Potentially relevant clinical consequences appeared to be relatively low, whereas 26 serious drug interactions were observed (Table 6). Pantoprazole and digoxin were the more frequently prescribed drugs (9 patients, 4%) with potential serious interaction.

DISCUSSION

Like in other countries, disease pattern is changing also in Nepal like other developing countries from infectious to chronic; however, burden of infectious diseases is still high.[16] In this study, most of the patients were suffering from non-communicable diseases, with diseases of circulatory system being the most prevalent followed by respiratory system diseases. Most prescribed drugs were from ATC group A (alimentary tract and metabolism) and C (cardiovascular system). Proton pump inhibitors and beta-lactam antibacterial excluding penicillin's were the most commonly prescribed medicines. In the hospitalized elderly patients, pantoprazole was administered very commonly as a gastro-protective agent who seems considerable in this population. However, maximum use of antibiotics (77.33%) in the condition where majority of the patients had non-communicable diseases may reflect the irrational use of antibiotics. A study by Ghosh et al also had similar result (72.05%).[17]

Average number of drugs prescribed was relatively higher (8.19) than that found in similar study (4.34) by

Ghosh et al.[17] Furthermore, it was found that the average number of drugs was increasing with the increasing age group of the patients. In present study, polypharmacy is observed to be very significant, which is in concordant with the similar study in the literature.[18] However, it is not a clinically useful independent marker of the quality use of medicines as comorbid condition of a patient and severity of diseases may necessitate combination therapy in hospitalized patients.

Table 4: Medicines mainly prescribed in elderly.

ATC system main groups	Medicines mainly used		Number & percentage of patients who used the medicine (n=225)	Number & percentage of drugs used (n=1844)	Total number & percentage of drugs used (n=1844)
Alimentary tract and metabolism	A02 BC	Proton pump inhibitors	196 (87.11)	196 (10.62)	422 (22.88)
	A06A	Laxatives	50 (22.22)	50 (2.71)	
	A11	Vitamins	45 (20.0)	50 (2.71)	
		Others		126 (6.83)	
Blood & blood forming organs excluding heparin	B01AC	Platelet aggregation inhibitors	48 (21.33)	71 (3.85)	115 (6.23)
		Other		44 (2.38)	
Cardiovascular system	C01DA	Organic nitrates	20 (8.89)	20 (1.08)	374 (20.28)
	C03	Diuretics	98 (43.55)	114 (7.80)	
	C08CA	Dihydropyridine derivatives	61 (27.11)	61 (3.30)	
	C09	Agents acting on the renin-angiotensin system	84 (37.33)	84 (4.55)	
	C10AA	HMG CoA reductase inhibitors	60 (26.66)	60 (3.25)	
		Other		35 (1.90)	
Systemic hormonal preparations excluding sex hormones, insulin	H02	Corticosteroids for systemic use	51 (22.66)	51 (2.76)	51 (2.76)
Antiinfectives for systemic use	J01C	Beta-lactam antibacterials, penicillins	40 (17.77)	45 (2.44)	269 (14.58)
	J01D	Other beta-lactam antibacterial	116 (51.55)	116 (6.29)	
	J01F	Macrolides, lincosamides & Streptogramins	53 (23.55)	53 (2.87)	
	J01MA	Fluoroquinolones	24 (10.66)	24 (1.30)	
	J01XD	Imidazole derivatives	24 (10.66)	24 (1.30)	
		Other		7 (0.38)	
Musculo-skeletal system	M01A	Anti-inflammatory and antirheumatic Products, non-steroid	20 (8.89)	20 (1.08)	25 (1.35)
		Other		5 (0.27)	
Nervous system	N02	Analgesics	68 (30.22)	73 (3.95)	129 (7.00)
	N05CD	Benzodiazepine derivatives	34 (15.11)	34 (1.84)	
		Other		22 (1.20)	
Respiratory system	R03AK	Adrenergics and other drugs fo obstructive airway diseases	55 (24.44)	55 (2.98)	138 (7.48)
	R03DA	Xanthine	50 (22.22)	50 (2.71)	
		Other		33 (1.79)	

Table 5: Potentially inappropriate medication use for elderly based on Beer's criteria.

Drugs	Number of medicines
Benzodiazepines (clonazepam, alprazolam, lorazepam)	34
NSAIDs (diclofenac, ibuprofen, ketorolac, naproxen)	22
Mineral oil, oral	18
Hyoscine	14
Aspirin (patients aged ≥80)	13
Other	32
Total	133 (7.21%)

Table 6: Most frequently prescribed drugs with potential drug-drug interaction.

Interaction	drugs	Number of drugs	Comment
Serious	Pantoprazole oral + Digoxin oral	9	Increasing gastric pH, pantoprazole increases digoxin absorption and toxicity Avoid concomitant use
	Others	17	
Significant	Spironolactone oral + Furosemide oral	26	Monitor serum potassium level
	Aspirin oral + Losartan oral	23	Monitor serum potassium level and renal function
	Aspirin oral + Clopidogrel oral	23	Caution for risk of bleeding
	Pantoprazole oral + Iron oral	23	Interferes iron absorption, monitor hemoglobin level
	Aspirin oral + Furosemide oral	21	Monitor serum potassium level
	Others	328	

It was found that only 8.5% of drugs were prescribed in generic name. There is a great variation in extent of generic name prescribing shown by other studies in different hospitals. In a study in Allahabad, India, it was as low as 2% and it was much higher as 53.6% in another study done in Nepal.[18,19] Though there are some disadvantages of generic name prescribing, such as uncertainty of bioavailability of drugs other than drugs of repute, use of generic names in prescription eliminate the chance of duplication of drug products and also reduce the cost of the medication.[17,20]

Percentage of drugs from essential drug lists of WHO and Nepal were lower than a study done by Sujata et al (55% and 75% respectively) but higher than other study done by Ghosh et al (41.76% & 38.20% respectively).[17,18] Use of drugs from the essential drug list should be promoted for optimal use of limited financial resources, to have acceptable safety and to satisfy the health needs of the majority of the population.[21] In this study, the percentage of prescriptions containing injections were 80%, which was higher than the data from College of Medical Sciences (CMS), Bharatpur (66.6%).[17] High cost and other disadvantages of parenteral therapy must be taken into consideration while prescribing injections. However, we cannot also deny the fact that hospitalized patients in a tertiary care hospital are critically ill and most of the time requires parenteral therapy.

One third of the patients were prescribed with potentially inappropriate medicines (PIM) from Beer's criteria, lower than the study in Dhulikhel Hospital-Kathmandu University Teaching Hospital (53%).[18] Benzodiazepines and NSAIDs were commonly prescribed inappropriate medicines for geriatrics. Benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults, while NSAIDs increase risk of GI bleeding and peptic ulcer disease.[10] Use of proton pump inhibitors may reduce the risk of ulcer, thus pantoprazole was prescribed to high number of patients. Present findings showed that pantoprazole and digoxin were more commonly prescribed medicines with potential serious drug-drug interaction. Pantoprazole may increase the level or effect of digoxin by increasing gastric ph. However, in a study conducted by Hartman et al, no adverse events or clinically relevant alterations in vital signs or clinical laboratory parameters were observed.[22] All other drug-drug interactions listed in table 6 have possibility of significant interaction requiring caution and close monitoring.

CONCLUSION

Present findings provide an insight to the current prescribing pattern in geriatric patients in a hospital setting. Since polypharmacy, inappropriate prescribing and prescribing drugs with potential drug-drug interaction in geriatrics are prevalent, current prescribing pattern seems to be improved which can contribute to increase the therapeutic efficacy and minimize the drug related problems by practicing the rational use of drugs.

Recommendations

This study was done in retrospective data of two months period, thus seasonal variation could not be determined. Since it was single centred study, it might not be able to reflect accurately the prescribing pattern of the entire community of Nepal. Therefore, multi-centred hospital based studies with larger sample size are necessary to substantiate findings of present study.

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