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RESEARCH ARTICLE

Age- and gender-related differences in drug utilization patterns among patients in neurology ward of a tertiary care hospital

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ABSTRACT

Background: In most of Indian studies gender-specific prevalence rates for neurological disorders were found to be higher in men than women. Different studies revealed age-specific prevalence rates of various neurological disorders increases till fourth decade followed by decline to seventh decade. **Aims and Objectives:** The present study was taken to evaluate age- and gender-based inequalities in the clinical diagnosis, comorbidities, and drug utilization patterns of patients admitted to the neurology ward. **Materials and Methods**: The current study was a prospective cohort study. Case records of 200 patients over a period of January-December 2015 were reviewed. The demographic, clinical, and drug consumption data of the patients were evaluated based on age group (18-59 years vs. ≥60 years) and gender. **Results:** A total of 200 patients were admitted to neurology wards during the study. Of 200 patients, 60% were males, and 18% were ≥60-year-old. Consumption of antiepileptic drugs (AEDs), dopamine agonists, and antidepressants were found to be greater among patients aged >60 years ($P < 0.05$). Consumption of antiplatelets was significantly more among males, whereas utilization of vitamin was significantly among female ($P < 0.05$). The incidence of polypharmacy was noted significantly higher among elderly ($P < 0.05$). The duration of hospital stay was higher for elderly patients than patients aged between 18 and 59 years ($P < 0.05$). **Conclusion:** Age-related differences were observed in utilization of AEDs, dopamine agonists, and antidepressants. Gender-related differences were observed in drug utilization of anti-platelets and vitamins. Age- and gender-related differences were observed in the occurrence of polypharmacy.

KEY WORDS: Age and Gender Differences; Drug Utilization Pattern; Neurology; Polypharmacy

INTRODUCTION

The World Health Organization (WHO) report states that neurological disorders contribute for 6.29% of global burden of diseases which is predicted to increase to 6.77% by 2030.[1] In India, prevalence rates of neurological disorders vary from 967 to 4,070 with a mean of 2394/100000 population.[2]

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In India, age-specific prevalence rates of various neurological disorders have been shown to increase till the fourth decade followed by decline till the seventh decade. However, in Bengaluru, prevalence rates were reported to be high in the seventh decade indicating that the geriatric population suffers from the considerable burden of neurological disorders.[3] The prevalence rate for epilepsy in India was reported to be high in the second and third decades with no significant gender-based differences.[4] Another issue of concern in India is that 20-30% of strokes occur in people <45 years, as against sixth to the seventh decade in the western population. Hypertension (HTN) was observed to be the most important risk factor in the urban population of India along with diabetes mellitus (DM).[5-7] Many Indian studies indicate gender-specific prevalence rates of neurological disorders to be higher in men than women.[8]

The WHO definition of rational drug use suggests that age, gender, and comorbidities play a vital role in optimizing pharmacotherapy.[9] Age and gender inequalities exist in the pharmacotherapy of neurological disorders, particularly in the treatment of epilepsy as valproate and phenytoin are found to be prescribed more often in men than women.[10] "Treatment-risk" paradox noted, especially among elderly as they are less likely to receive appropriate treatment with the advance in age.[11] Gender differences in drug use have often been noted in various therapeutic areas.[12] Women were less frequently prescribed with antihypertensive, lipid-lowering drugs, and antidiabetic drugs compared to men. Antibiotics, antidepressants, and antipsychotics were found be prescribed commonly to women than men.[13] Risk versus benefit could be overestimated among women as compared to men that could contribute to gender differences in drug use. More research and greater awareness of the influence of age and gender in health and disease are required to ensure rational use.

This study aimed to ascertain the extent of age- and gender-related differences in the comorbid conditions and drug utilization pattern among the patients admitted in neurology ward since comprehensive overview on the same is lacking.

MATERIALS AND METHODS

This prospective cohort study was conducted in the Neurology ward of super-speciality hospital attached to Bangalore Medical College and Research Institute, Bengaluru, India. The study was Approved by the Institutional Ethics Committee. The case records of 200 consecutive patients admitted to the neurology ward from 1st January to 31st December 2015 were prospectively reviewed. Data collected included the patient's demographic data, the existence of co-morbid conditions, diagnosis at admission, medications prescribed and duration of stay in the hospital. Data were collected using predesigned case record proforma. The drugs were divided into neurological and non-neurological drugs based on anatomical-therapeutic-chemical classification and differences in the prescription of the same were analyzed.

Data were stratified according to age (18-59 years vs. ≥60 years) and gender (male vs. female) for analysis. Further stratification was performed according to age among males (18-59 years vs. ≥60 years) and females (18-59 years vs. ≥60 years). Polypharmacy (i.e., ≥5 drugs per prescription) and duration of hospital stay were analyzed based on age and gender.

Statistical Analysis

Descriptive data were presented as percentage and frequencies for categorical characteristics mean ± standard deviation for continuous parametric variables. Q-Q plot and Klomogirov-Smirnov test was used to check the normality of data. Chi-square test, Fisher's exact test, Student's *t*-tests and Mann-Whitney *U*-test were appropriately employed to compare the categorical, parametric, and non-parametric variables between male and female and between age groups of 18-59 years and ≥60 years. The Statistical software R version 3.2.0 was used for statistical analysis. A probability value of <0.05 was set as statistically significant.

RESULT

Gender-wise Data

Age- and gender-based distribution of clinical diagnosis and comorbidities are depicted in Tables 1 and 2, respectively.

A total of 200 patients with various neurological disorders were admitted to neurology wards during the study period of 1-year which comprised 120 (60%) males and 80 (40%) females. Among 120 males, 20 (16.6%) patients were aged above 60 years. Out of 80 female patients, 16 (20%) patients were aged above 60 years.

The incidence of cerebrovascular accident (CVA), epilepsy and Parkinson's (PD) diseases was significantly higher among males, whereas the incidence of cerebral venous thrombosis (CVT) and myasthenia gravis was significantly higher among females. Among comorbidities, incidence of HTN and dyslipidemia was significantly higher among male patients, whereas female patients had significantly higher incidence of depression.

Out of 1320 drugs dispensed, 825 drugs were prescribed to males and 495 to females. Male patients received 201 neurological drugs, whereas 110 neurological drugs were prescribed to females. Utilization of neurological (P = 0.04) drugs was significantly higher in male patients than in female patients (Table 3). 624 non-neurological drugs were prescribed to male, whereas females received 385 non-neurological drugs, but no gender-related differences were noted in the drug utilization pattern of them. Utilization of vitamin was significantly higher among females than males (P = 0.02). Consumption of anti-platelets was significantly higher among male patients (P = 0.045) (Table 4).

Age-wise Data

Among 200 patients, 164 (82%) patients were aged between 18 and 59 years and 36 (18%) were aged ≥60 years. The incidence of HTN, type-2 DM, ischemic heart diseases (IHD), PD and depression was significantly higher among elderly than patients aged 18-59 years (Tables 1 and 2). Elderly patients had significantly longer duration of hospital stay compared to patients age between 18 and 59 years (P = 0.03)

Table 1: Age and gender related differential distribution of neurologic disorders among patients admitted to neurology wards

Clinical diagnosis	Gender		Age (years)		Male (years)		Female (years)	
	Male 120 (60)	Female 80 (40)	18-59 164 (82)	>60 36 (18)	18-59 100 (50)	>60 20 (10)	18-59 64 (32)	>60 16 (08)
Significant variables*								
CVA	33 (28)‡	10 (13)	34 (21)	9 (25)	26 (26)	7 (35)	8 (13)	2 (13)
Epilepsy	31 (26)‡	10 (13)	33 (20)	8 (22)	26 (26)	5 (25)	7 (11)	3 (19)
Parkinson diseases	15 (13)‡	2 (3)	10 (6)	7 (19)‡	9 (9)	6 (30)‡	1 (02)	1 (6)
CVT	10 (8)	11 (14)‡	18 (11)	3 (8)	8 (8)	2 (10)	10 (16)‡	1 (6)
Myasthenia gravis	4 (3)	11 (14)‡	12 (8)	3 (5)	3 (3)	1 (5)	9 (14)	2 (13)
Non-significant variables								
Meningitis	18 (15)	09 (11)	22 (14)	5 (14)	15 (15)	3 (15)	7 (11)	2 (13)
Myopathy	11 (9)	04 (5)	12 (7)	3 (8)	9 (9)	2 (10)	3 (5)	1 (6)
Cervical myelopathy	8 (7)	05 (6)	09 (5)	4 (11)	6 (6)	2 (10)	3 (5)	2 (6)
GBS	7 (6)	04 (5)	08 (5)	3 (8)	5 (5)	2 (10)	3 (5)	1 (6)
Encephalitis	6 (5)	07 (9)	11 (7)	2 (5)	5 (5)	1 (5)	6 (9)	1 (6)

Data are presented as *N* (%). *Significant in any one parameter assessed, ‡statistically significant (P<0.05). CVT: Cerebral venous thrombosis, CVA: Cerebrovascular accident, GBS: Guillain-barré syndrome

Table 2: Age and gender related differential distribution of co-morbid illnesses among patients admitted to neurology wards

Co-morbidities	Gender		Age (years)		Male (years)		Female (years)	
	Male 120 (60)	Female 80 (40)	18-59 164 (82)	>60 36 (18)	18-59 100 (50)	>60 20 (10)	18-59 64 (32)	>60 16 (8)
Significant variables*								
Hypertension	50 (42)‡	19 (24)	47 (29)	22 (61)‡	35 (35)	15 (75)‡	12 (18)	7 (44)‡
Type-2 DM	32 (27)	22 (28)	38 (23)	16 (44)‡	24 (24)	8 (40)	14 (22)	8 (50)‡
Dyslipidemia	31 (26)‡	09 (11)	28 (17)	12 (33)	22 (22)	9 (45)	6 (9)	3 (19)
IHD	17 (14)	11 (14)	19 (12)	9 (25)‡	12 (12)	5 (25)‡	7 (11)	4 (25)‡
Depression	6 (5)	8 (10)‡	8 (5)	6 (16)‡	2 (2)	4 (20)‡	6 (9)	2 (13)
Non-significant variables								
URTI	9 (8)	8 (10)	13 (8)	4 (11)	7 (7)	2 (10)	6 (9)	2 (13)
LRTI	9 (8)	5 (6)	10 (6)	4 (11)	7 (7)	2 (10)	3 (5)	2 (13)
HAP	8 (7)	3 (3)	8 (4)	3 (8)	6 (6)	2 (10)	2 (3)	1 (6)
Hypothyroidism	5 (4)	5 (6)	8 (4)	2 (6)	4 (4)	1 (5)	4 (8)	1 (6)
CAP	4 (3)	6 (8)	7 (4)	3 (8)	3 (3)	1 (5)	4 (6)	2 (13)

Data are presented as *N* (%). *Significant in any one parameter assessed, ‡statistically significant (P<0.05). IHD: Ischemic heart disease, URTI: Upper respiratory tract infection, DM: Diabetes mellitus, LRTI: Lower respiratory tract infection, CAP: Community acquired pneumonia, HAP: Hospital acquired pneumonia

(Table 3). 55 neurological and 217 non-neurological drugs were dispensed to patients aged >60 years, whereas patients aged between 18 and 59 years received 181 neurological and 868 non-neurological drugs. Prescription of neurological (P = 0.04) and non-neurological (P = 0.01) drugs were significantly higher in elderly patients than in patients aged 18-59 years (Table 3). Encounters with polypharmacy were observed significantly higher among elderly patients than in those aged 18-59 years (P = 0.01) (Table 5). Conventional antiepileptic drug (AED) were prescribed significantly higher to patients aged between 18 and 59 years than elderly patients (P = 0.03). On the contrary, newer antiepileptics were prescribed more commonly to elderly (P = 0.041). Utilization of dopamine agonists were significantly higher among elderly compared to patients aged between 18 and 59 years (P = 0.01). Utilizations of antidepressants were higher among elderly (P = 0.01) (Table 6). Antiulcer drugs were prescribed significantly more to elderly (P = 0.02). Patients aged 18-59 years received hypolipidemic more compared to elderly patients (P = 0.04). Prescriptions of antihypertensives (P = 0.04) and anti-diabetics (P = 0.01) were significantly higher in elderly than patients aged 18-59 years (Table 4).

Table 3: Age and gender differences in duration of hospital stay and average number of neurological and non-neurological drugs

Parameter	*N* (%)	Hospital stay (days) (mean±SD)	*P* value*	Neurological drugs (mean±SD)	*P* value*	Non-neurological drugs (mean±SD)	*P* value*
Gender							
Male	120 (60)	7.06±2.89	0.29	1.67±1.00	0.04†	5.2±2.1	0.19
Female	80 (40)	6.5±1.36		1.37±0.87		4.81±1.9	
Age (years)							
18-59	164 (82)	6.4±1.57	0.03†	1.10±0.76	0.043†	5.29±1.44	0.01†
>60	36 (18)	7.13±1.71		1.53±1.00		6.02±1.81	
Male and age (years)							
18-59	100 (50)	6.6±1.39	0.07	1.12±1.02	0.024†	5.5±1.84	0.17
>60	20 (10)	7.35±1.25		1.95±1.19		6.15±2.14	
Female and age (years)							
18-59	64 (32)	5.8±1.24	0.01†	1.28±0.91	0.74	4.87±1.81	0.89
>60	16 (8)	7.1±1.61		1.38±0.86		4.93±1.13	

*Unpaired *t*-test for analysis. ±Wilcoxon rank sum test for analysis, †statistically significant ($P<0.05$). SD: Standard deviation

Table 4: Age- and gender-related differences in utilization patterns of non-neurological drugs

Drugs prescribed	Gender		Age (years)		Male (years)		Female (years)	
	Male 120 (60)	Female 80 (40)	18-59 164 (82)	>60 36 (18)	18-59 100 (50)	>60 20 (10)	18-59 64 (32)	>60 16 (8)
Significant variables*								
Vitamins	92 (77)	72 (90)‡	136 (83)	28 (78)	77 (77)	15 (75)	59 (92)	13 (81)
Antiulcer agents	69 (58)	33 (41)	77 (47)	25 (69)‡	54 (54)	15 (75)	23 (36)	10 (63)
Anti-platelets	45 (38)‡	14 (18)	49 (30)	10 (28)	39 (39)	6 (30)	10 (16)	4 (25)
Antihypertensives	41 (34)	27 (34)	50 (30)	18 (50)‡	32 (32)	9 (45)	18 (28)	9 (56)‡
Anti-diabetics	34 (28)	20 (25)	38 (23)	16 (44)‡	24 (24)	10 (50)‡	14 (22)	6 (38)
Hypolipidemics	27 (23)	16 (20)	40 (24)‡	3 (8)	25 (25)	2 (10)	15 (23)	1 (6)
Non-significant variables								
AMAs	59 (49)	44 (55)	85 (52)	18 (50)	48 (48)	11 (55)	37 (58)	7 (44)
Anti-emetics	42 (35)	30 (38)	52 (32)	20 (56)	29 (29)	13 (65)	23 (36)	7 (44)
Anticoagulants	23 (19)	13 (16)	26 (16)	10 (28)	17 (17)	6 (30)	9 (14)	4 (25)
Analgesics	19 (16)	12 (15)	23 (14)	8 (22)	14 (14)	5 (25)	9 (14)	3 (19)
Diuretics	18 (15)	9 (11)	23 (14)	4 (11)	16 (16)	2 (10)	7 (11)	2 (13)
Calcium supplements	15 (13)	7 (9)	17 (10)	5 (14)	12 (12)	3 (15)	5 (8)	2 (13)
Hormonal agents	11 (9)	7 (9)	13 (8)	5 (14)	9 (9)	2 (10)	4 (6)	3 (19)

Data are presented as *N* (%). *Significant in any one parameter assessed, ‡statistically significant ($P<0.05$). AMA: Anti-microbial agents

Age Wise Data among Male Patients

Among 120 males, 100 (84%) patients were aged between 18 and 59 years, whereas 20 patients (16%) were elderly. The incidence of HTN, PD, IHD, and depression was significantly higher among elderly male patients (Tables 1 and 2). Elderly male received 39 and 123 neurological and non-neurological drugs, respectively, whereas male patients aged between 18 and 59 years received 112 and 551 neurological and non-neurological drugs, respectively. Elderly males were prescribed with significantly more neurological drugs ($P = 0.024$) such as dopamine agonists ($P = 0.03$) and newer AEDs ($P = 0.01$) (Tables 4 and 6); however, no significant differences were observed for consumption of non-neurological drugs (Table 3) except anti-diabetics ($P = 0.03$) (Tables 4 and 6). Polypharmacy was observed significantly higher among male patients aged ≥60 years ($P = 0.032$) (Table 5).

Age-wise Data in Female

Among 80 female patients, 64 patients (80%) were aged between 18 and 59 years, whereas 16 patients (20%) aged above 60 years. Females aged between 18 and 59 years had significantly higher incidence of CVT. Incidence of

HTN, DM, and IHD was significantly higher among elderly females (Tables 1 and 2). Elderly females had significantly longer duration of hospital stay compared to female patients aged between 18 and 59 years (P = 0.01) (Table 3). 22 and 79 neurological and non-neurological drugs were prescribed to female patients aged above 60 years; whereas female patients aged 18-59 years received 82 and 312 neurological and non-neurological drugs, respectively. Utilization of antihypertensives were significantly higher in elderly females (P = 0.03) (Table 4).

DISCUSSION

The present study aimed at identifying age- and gender-related variations in drug use and neurologic disorders along with comorbid illness. Awareness as to how these factors influence drug utilization in neurological disorders may prompt rational drug use.

Table 5: Age- and gender-related differences in polypharmacy

Parameters	All	<5 drugs	>5 drugs	*P* value
Gender				0.099†
Male	120	37 (31)	83 (69)	
Female	80	34 (43)	46 (57)	
Age (years)				0.011‡≠
18-59	164	65 (40)	99 (60)	
>60	36	06 (25)	30 (75)	
Gender by age male (years)				0.032‡≠
18-59	100	35 (35)	65 (65)	
>60	20	2 (10)	18 (90)	
Gender by age female (years)				0.13≠
18-59	64	30 (47)	34 (53)	
>60	16	4 (25)	12 (75)	

Data are presented as *N* (%). †Chi-square test was used for analysis. ≠Fisher's exact test was used for analysis; ‡Statistically significant (P<0.05)

We found that the incidence of CVA, epilepsy and PD was significantly higher in male patients. Previous surveys also reported an increased likelihood of men having CVA, epilepsy, and PD.[5-7] Higher incidence of HTN, DM and smoking among men may contribute to higher rates of CVA in males.[14] Greater exposure of men to risk factors such as CVA, traumatic head injuries, alcohol withdrawal, metabolic disorders, and Alzheimer's disease may account for gender-related differences in seizure disorders.[15] Incidence of myasthenia gravis was found be significantly higher among females as the chance of autoimmune disorders increases among women.[16] Incidence of CVT, especially among young females was higher. Rajoor and Seema from Karnataka, India concluded that CVT was more common among women aged between 20 and 35 years. Pregnancy, puerperium, and oral contraceptive use contributed to higher incidence of CVT among young females.[17] Age-related difference was seen only in the incidence of PD disease as elderly patients were significantly affected. Age-related changes in the substantia nigra (SN) often leads to neuronal cell death. Accumulation of mitochondrial DNA defects, oxidative damage, and aggregation of neuromelanin increases the vulnerability of SN neurons which is amplified by a further insult from alpha-synuclein.[18] Among the comorbid illnesses, gender differences were noted in the incidence of HTN and dyslipidemia as it was significantly greater in males than females. Androgen-mediated chronic increase in renal angiotensinogen stimulates the renin activity. Androgens also affect the number and affinity of receptors for angiotensin II leading to sodium reabsorption and renal vasoconstriction which blunts pressure-natriuresis and increases blood pressure.[19] Gender-related differences in lipid abnormalities could be due to different levels of circulating sex hormones, specifically estrogens and androgens in women versus men.

Table 6: Age and gender related differences in utilization patterns of neurological drugs

Drugs prescribed	Gender		Age (years)		Male (years)		Female (years)	
	Male 120 (60)	Female 80 (40)	18-59 164 (82)	>60 36 (18)	18-59 100 (50)	>60 20 (10)	18-59 64 (32)	>60 16 (08)
Significant variables*								
Conventional AEDs	28 (28)	22 (24)	46 (28)‡	4 (14)	34 (34)	2 (10)	12 (19)	2 (13)
Newer AEDs	21 (16)	16 (20)	24 (15)	13 (31)‡	13 (13)	8 (40)‡	11 (17)	5 (31)
Dopamine agonist	16 (13)	10 (13)	17 (10)	9 (25)‡	10 (10)	6 (30)‡	7 (11)	3 (19)
Antidepressants (SSRI+SNRI+TCA)	11 (10)	9 (11)	12 (7)	8 (22)‡	6 (6)	5 (25)	6 (9)	3 (19)
Non-significant variables								
Nootropic	24 (20)	13 (16)	27 (16)	10 (28)	17 (17)	7 (35)	10 (16)	3 (19)
Benzodiazepine	29 (24)	16 (20)	36 (22)	9 (25)	23 (23)	6 (30)	13 (20)	3 (19)
Reversible Anticholinesterase	12 (10)	11 (14)	17 (10)	6 (17)	8 (8)	4 (20)	9 (14)	2 (13)
$GABA_B$ agonist	10 (8)	7 (9)	13 (8)	4 (11)	7 (7)	3 (15)	6 (9)	1 (6)

Data are presented as *N* (%). *Significant in any one parameter assessed, ‡Statistically significant (P<0.05). SSRI: Serotonin reuptake inhibitors, SNRI: Serotonin noradrenaline reuptake inhibitors, TCA: Tricyclic antidepressants, AED: Antiepileptic drugs, GABA: Gamma amino butyric acid

It has been found that apoA-I production rates are higher among women leading to higher amount of HDL than men.[20] Females had significantly higher incidence of depression as compared to males. Twin Swedish study indicated that liability to major depression among female is largely genetic in origin.[21] Age-related difference was noted in the incidence of HTN, type 2 DM, IHD and depression as it was significantly higher among elderly as compared to those aged between 18 and 59 years. Age-specific decrease in arterial compliance and increase in arterial stiffness contributes for the steep increase in blood pressure at old age. The incidence of heart failure and IHD were significantly more at old age. Higher incidence of DM and HTN at old age accounts for left ventricular hypertrophy, loss of control of endothelial dilation and changes in the caliber of stenosed coronary artery due to physiologic vasomotion.[22] Higher incidence of HTN, DM and ischemic heart disease in old age interact to augment the risk of heart failure.

Utilization of neurological drugs was significantly higher among males ($P = 0.04$) which could be due to significantly higher incidence of epilepsy, CVA and PD among male patients. Age-related differences were seen in the prescription of newer AEDs, dopamine agonists and antidepressants, as they were used more commonly among elderly. Newer AEDs have proved their efficacy in neuropathic pain including diabetic neuropathy which significantly increased their use among elderly. Even American Association of Neurology recommends uses of newer AEDs in elderly with new onset seizure because of better safety, tolerability, and less chances of drug-drug interaction. Greater incidence of PD at older age and proven efficacy and safety of dopamine agonists in PD could have led to higher utilization of this drug. This pattern correlates well with standard treatment guideline for PD.[23] Consumption of anti-depressants was found to be higher among elderly in the current study as depressive episodes are generally higher among elderly due to the negative impact of multiple co-morbid illnesses on mental health.[21] Antidepressants are also used for the management of neuropathic pain, migraine, etc., which could have increased their utilization among elderly. Conventional AEDs were used among patients aged 18-59 years more commonly than elderly, As the incidence of symptomatic seizure disorders are common among young adults because of greater exposure to risk factors such as stroke, and traumatic brain injury might be responsible for higher utilization of conventional AEDs. Absorption kinetics of conventional AEDs is affected by gastrointestinal change related to aging. The protein binding rate, distribution, elimination and clearance of conventional AEDs change due to progressive deterioration of liver and renal function leading to the poor tolerability of conventional AEDs among elderly.[24] Keeping these facts in view use of conventional AEDs in young adults is substantiated. Among the utilization of non-neurological drugs, gender-related difference was seen in the utilization of vitamins as its use was significantly higher among females. The morbidity pattern which led to this could not be identified. A study conducted by Loikas et al. from Sweden on differences in drug utilization between men and women found greater consumption of vitamins by females.[13] This trend is could be justified considering that our hospital caters predominantly to rural and poor socioeconomic population where women often suffer from various nutritional deficiencies because of poor dietary practices. Utilization of anti-platelets was significantly higher among males than females. Higher incidence of CVA among men could have contributed to this result. It has been documented that women are more prone to bleeding complications induced by antiplatelets than men because of lower body weight, lower glomerular filtration and thus reduced the net clinical benefit of antiplatelet agents in women is noted than age-matched men.[25] Age-related differences were seen in the prescription of anti-ulcer agents, antihypertensives, and anti-diabetics which were significantly more among elderly. Pottegård et al. from Denmark found 14% of proton pump inhibitor (PPI) users were aged over 60 years and most common reason for starting PPI therapy is gastro-oesophageal reflux disease whose incidence proportionately increases with advancement of age.[26] Higher incidence of HTN noted among elderly could be responsible for the greater consumption of antihypertensives. Moreover, in India due to lack of health awareness, HTN is often diagnosed at a later age. Utilization of anti-diabetics followed the same trend as antihypertensives. Age-related difference was noted in the prescription of hypolipidemics as it was significantly higher in patients aged 18-59 years. This did not follow the morbidity pattern as dyslipidemia was noted more among elderly. Under-utilization of hypolipidemics among elderly could be due to statin intolerance as a result of low lean body mass, cardiac cachexia and sarcopenia. Lower physical activity among elderly statin users often lead to muscle pain or muscular fatigue. Physiologic changes of ageing lead to reduced liver mass, hepatic blood flow and hepatic metabolic capacity aggravating the hepatotoxic potential of statins.[27] Encountering polypharmacy showed significant age related differences as it was seen commonly among elderly. Age-related polypathology often accounts for higher drug utilization. The duration of hospital stay was significantly longer for elderly patients. This can be attributed to greater number of comorbidities and higher incidence of polypharmacy in elderly. It has been hypothesized that the risk of encountering an adverse drug reactions (ADRs) increase exponentially as the number of medicines taken by the patient increases which could be associated with a significantly prolonged hospital stay.[28] Unlike males, we did not observe age-related differences among women in encountering polypharmacy. This may be because of greater use of medications in younger women, as well as a lower use of medications in older women. The greater use of medications in younger women could be because of their awareness about their health. They also tend to recognize and experience health problems early and therefore consult physicians more often.[29]

This study has its strengths and limitations. One of the strengths of the present study is that it is one of the few studies conducted to examine age and gender differences in neurological disorders, including the use of drugs. The findings of the present study clearly highlight the need for considering patient's age and gender while initiating pharmacotherapy for neurological disorders. One of the strength of our study is its prospective cohort design. A prospective study with larger sample sizes and adequate data on ADR monitoring is recommended to accurately estimate the age and gender-related differences in drug use in neurological disorders at a tertiary care setting. The result of this study cannot be generalized since the study was conducted in a super-speciality set up of a tertiary care hospital among homogenous population.

CONCLUSION

Age-related differences were observed in utilization of AEDs, dopamine agonists and antidepressants. The trend of prescribing newer AEDs among elderly is encouraging. Under-utilization of statins among elderly could be related to its tolerability issues. Gender-related differences were observed in drug utilization of anti-platelets and vitamins. Age and gender related differences were observed in the occurrence of polypharmacy. This study is an attempt to evaluate the age- and gender-related difference that could not be explained by the prevalence of the disease or biologic changes as a step toward reducing unequal treatment.

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