

Original article

Inappropriate medication use in older adults according to Beers Criteria in a Tertiary Referral Hospital, in Bolu, Turkey

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Abstract: *Aims* — We aimed to study the medications used by older adults for any potentially inappropriate medications.

Material and Methods — A hundred and four consecutive subjects over 65 years of age who visited our clinic were enrolled in the study. Possible inappropriate medications were defined according to Beers Criteria.

Results — A total of 57 women and 49 men were enrolled in the study. Mean ages of the women and men were 78.6±6.1 years and 77.4±5.4 years, respectively ($p=0.30$). While 18 subjects (17%) had no increased risk due to inappropriate use of medications, 30 were on inappropriate medications that increased renal failure risk, 5 were on inappropriate medication that amplified neurological side effects, 12 were on inappropriate medications that augmented bleeding risk, 20 were on inappropriate medication that lack safety and efficacy data, and 30 were on inappropriate medication that amplified the risk of falls. The number of increased risks according to Beers Criteria was significantly and positively correlated with number of medications used ($r=0.366$, $p<0.001$) and the number of comorbidities ($r=0.312$, $p=0.001$).

Conclusion — The number of increased risks due to inappropriate use of medicines in older adults is positively correlated with the number of medicines used and the number of accompanied diseases. Therefore we suggest that the medicines used by older people should be reviewed in all settings, and unnecessary drugs should be avoided to be prescribed.

Keywords: inappropriate medicine, older adults, comorbidity, Beers criteria.

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Introduction

Human population of the world is increasing day by day due to several factors including prolonged life expectancy. In Europe, mean age at death is increased from 50 years in 1900s to over 80 years in 2000s. In United States, life is increased from 47 years in 1900s to 73 years in 1980s [1]. The ratio of population over 65 years of age to general population was 4.1% in 1900s in United States and increased to 12.4% by 2000s [2]. Chronic diseases are increased by the aging in most individuals. Coronary heart disease, hypertension, type 2 diabetes mellitus are some of the chronic conditions that are more frequent in older adults. Significant proportion of the older population has one or more of these chronic conditions [3]. An older patient uses over 5 drugs every day for accompanying diseases, but it has been reported to be as high as 11 per day [4]. The risk of inappropriate drug combinations and their hazard increase due to polypharmacy.

Inappropriate medication use in older adults is a common issue worldwide [5]. Studies in literature showed that older subjects who visit emergency rooms of the institutions have greater number of possible inappropriate medication use [6]. Therefore, it is important to develop methods for detecting

inappropriate medication use by older population. For this purpose, Beers Criteria list was developed and updated in 2019 by American Geriatrics Society to detect potentially inappropriate medications in older adults [7]. More than 90% of the older adults experience one or more unwanted events related to medicines used daily [8], therefore, medications used by individual older adults should be reviewed for possible drug interactions and possible harm *sensu* these criteria.

In present study, we aimed to observe inappropriate medication use in older adults who visited outpatient internal medicine clinics of our institution, according to Beers Criteria. We also aimed to compare increased risks due to inappropriate medication use in older women and men.

Material and Methods

Study design

After obtaining approval from local ethics committee (approval number: 2019/160) and informed consent from the participants, patients over 65 years of age were enrolled in the observational study. The study has been approved by the appropriate institutional and/or national research ethics committee and have

been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. A hundred and six consecutive subjects that given consent and visited our clinic were included.

Age, gender, medications used daily, accompanying diseases (such as; type 2 diabetes mellitus, hypertension, heart failure, chronic obstructive pulmonary disease, osteoporosis, chronic kidney disease, neurological disorders, etc.), and number of medications used daily were noted. Combined drugs were accounted for as separate entities. All medications used by the participants for over two weeks were taken into account. Recently used and ceased drugs such as antibiotics and pain killers were not considered. Any potentially inappropriate medication use was defined according to the Beers Criteria. A total of 106 older adult subjects (57 women and 49 men) were enrolled in the study.

Laboratory parameters, such as blood urea, creatinine, fasting glucose, serum electrolytes (sodium (Na), potassium (K)), alanine and aspartate transaminases (ALT, AST), albumin, leukocyte count (WBC), blood hemoglobin level (Hb) and platelet count (Plt) were recorded. Possible inappropriate medications and interactions were defined *sensu* Beers Criteria [7]. Possible inappropriate medications were defined as either those with a lack of data on safety and efficacy, or those with increased risk of hypoglycemia, fall, renal failure, gastrointestinal side effects (e.g., gastroduodenal ulcer), bleeding, hyperkalemia, and neurological side effects.

Statistical analysis

Statistical analyses were conducted with SPSS software (SPSS 15.0 for Windows, IBM Co, Chicago, IL, USA). Kolmogorov Smirnov test was used to determine distribution of the variables in study groups. Comparison of the variables with or without normal distribution were conducted by independent samples Student's t-test and Mann Whitney U test, respectively. Variables with or without normal distribution were expressed, correspondingly, as either mean±standard deviation, or median (min-max) with interquartile range (IQR). Comparison of categorical variables was carried out via chi-square test and expressed as percentages. A p value lower than 0.05 was considered as statistically significant.

Results

Mean ages of women and men were 78.6±6.1 years and 77.4±5.4 years, respectively (p=0.296).

There were no significant differences between women and men according to WBC (p=0.163), AST (p=0.334), ALT (p=0.073), blood urea (p=0.193), creatinine (p=0.171), GFR (p=0.099), albumin (p=0.291), Na (p=0.317) and K (p=0.707) levels. On the other hand, blood Hb of women (11.8±1.6 g/dL) was significantly lower than the Hb level (13.5±2.2 g/dL) of men (p<0.001), and blood Plt level of women (286±87 k/mm³) was significantly higher than Plt value (247±79 k/mm³) in men (p=0.017).

Number of medications used by women and men were 7 (2-13) (IQR: 3.5) and 7 (1-11) (IQR: 2.5), respectively. There was no significant difference between older women and men according to number of medications used daily (p=0.613). Number of comorbidities in women and men were 3 (1-7) (IQR: 3) and 3 (1-8) (IQR: 2), correspondingly. There was no significant difference between older women and men according to the number of comorbidities (p=0.252). Number of increased risks due to inappropriate medications in women and men were 1 (0-3) (IQR:

1) and 1 (0-2) (IQR: 0.5), respectively. There was no significant difference between older women and men in terms of the number of increased risks due to inappropriate medications (p=0.193).

A total of 18 subjects (17%) – 8 women and 10 men – had no increased risk due to inappropriate use of medications in the study population. Increased risks in women and men are summarized in Table 1. Thirty subjects: 15 (26%) of women and 15 (31%) of men were on inappropriate medications that increase renal failure risk (p=0.624). Five subjects: 5 (9%) of women and 0 (0%) of men were on inappropriate medication that increase neurological side effects (p=0.034). Twelve subjects: 8 (14%) of women and 4 (11%) of men were on inappropriate medications that increase bleeding risk (p=0.341). One subject: 1 (2%) of women and 0 (0%) of men were on inappropriate medication that increase the risk of hyperkalemia (p=0.352). Twelve subjects: 10 (17.5%) of women and 10 (19%) of men were on inappropriate medication that lack safety and efficacy data (p=0.707). Thirty subjects: 19 (33%) of women and 11 (28%) of men were on inappropriate medication that increase the risk of fall (p=0.215). Twelve subjects: 8 (14%) of women and 4 (11%) of men were on inappropriate medication that increase gastrointestinal side effects (p=0.341). Thirteen subjects: 6 (10.5%) of women and 7 (12%) of men were on inappropriate medication that increase hypoglycemia risk (p=0.556) (Table 1).

In correlation analysis, number of increased risks according to Beers Criteria significantly and positively correlated with number of used medications (r=0.366, p<0.001) and the number of comorbidities (r=0.312, p=0.001). The number of used medications also correlated with the number of comorbid situations (r=0.530, p<0.001). Neither number of used medications (r=0.068, p=0.487) nor number of increased risks (r=0.017, p=0.865) correlated with age. Table 2 summarizes the correlation between study parameters.

Discussion

Present study showed that only 17% of the older adult population was not subjected to increased risk due to used medicines according to the Beers Criteria, which means remaining 83% of the older adults were at increased risk due to medications they were taking. Second important result of the study is that the number of increased risks due to inappropriate use of medicines in older adults positively correlated with the number of used medicines and the number of accompanying diseases. The third outcome of our project is that increased risks due to inappropriate use of medicines were similar both in men and women, except increased neurological side effect risk, which was more common in women.

Table 1. Increased risks due to inappropriate medication use in study population

	Women (n)	Men (n)	p
Increased renal failure risk	15	15	0.624
Increased neurological side effects	5	0	0.034
Increased bleeding risk	8	4	0.341
Increased risk of hyperkalemia	1	0	0.352
Medication without safety and efficacy data	10	10	0.707
Increased risk of fall	19	11	0.215
Increased gastrointestinal side effects	8	4	0.341
Increased hypoglycemia risk	6	7	0.556

Table 2. Correlation between study parameters

	Age	Number of medicines used	Number of comorbidities	Number of increased risks due to inappropriate medicines
Age	–	r=0.068 p=0.487	r=0.157 p=0.109	r=0.017 p=0.865
Number of medicines used	r=0.068 p=0.487	–	r=0.531 p<0.001	r=0.366 p<0.001
Number of comorbidities	r=0.157 p=0.109	r=0.531 p<0.001	–	r=0.312 p=0.001
Number of increased risks due to inappropriate medicines	r=0.017 p=0.865	r=0.366 p<0.001	r=0.312 p=0.001	–

Comorbidities among older adult population increased since the ratio of older people over 60 years of age to general population increased dramatically [9]. The number of diseases also increases with age [10]. About 80% of older adults had one comorbidity, while the proportion of older patients with two or more comorbidities was 50% [11]. The median number of accompanying diseases in present study was 3 in both women and men.

Using more medications is common among older population [10]. About 30% of prescription drugs were prescribed to older adults, although they constitute only 12% of the general population [12]. The median number of medicines used in present study was 7 in both women and men.

Polypharmacy in older adults is very important because an association between potentially harmful drugs and increased number of continuously used drugs [13-16]. Exponential [17] and linear [15, 16] associations between number of used drugs and increased drug-related harm have been reported. Significant positive correlation between number of used drugs and number of increased risks caused by inappropriate medicines has been shown in the present study.

Published sources reported no differences between men and women in terms of the number of risks caused by inappropriate medications [14]. However, some studies reported fewer risks in women compared with men [18]. Similarly, except increased risk of neurological side effects, which were more common in women, there was no significant difference between men and women in terms of increased risks caused by inappropriate medicines in our study.

Older subjects with inappropriate medication use are more likely to develop unwanted diseases. In a study by Wong et al., the authors reported that older patients with inappropriate medication use visit emergency departments of health institutions more often than the older patients without inappropriate medication use [6].

A study from Sweden reported that review of the medications taken by older adults in primary care setting reduced the use of inappropriate medications [4]. That study has also showed that the most common problem of the older adults with multiple comorbidities was unnecessary medication use [4]. In our study, we also reported that number of risks, caused by inappropriate medications in older adults, correlated with comorbidities and the number of used medications. We think that these risks could be deterred by careful review and withdrawal of unnecessary drugs.

Two important limitations of our study are relatively small sample size and lack of data on drug interactions after review of the drugs at our clinic. However, the results of our study that showed significant correlation between the number of daily used medicines and the number of increased risks caused by these medications are very important for consideration in various healthcare settings.

Conclusion

The number of increased risks due to inappropriate use of medicines in older adults positively correlates with the number of used medicines and the number of accompanying diseases. Therefore, we propose that the medicines used by older people should be reviewed in all settings, and unnecessary drug taking should be stopped for the sake of decreasing the risks, associated with inappropriate medicines in older adult population.

Conflict of Interest

None to declare

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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