



Original article

Impact of different drug classes on clinical severity of falls in an elderly population: Epidemiological survey in a trauma center



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ABSTRACT

Purpose: Certain classes of drugs have been associated with the risk of falls in elderly individuals. The aim of this study was to evaluate the impact of several classes of drugs on fall-related injuries in individuals aged 65 years or older.

Methods: Data on all the emergency department (ED) visits for trivial falls during the year 2013 were retrieved from the database of the Academic Hospital of Parma. The individual reports of the visits were analyzed to evaluate where and how the patient fell, the drugs currently taken, the type, and severity of injury.

Results: A total of 2533 visits for trivial falls in patients aged 65 years or older were analyzed. We found a significant positive correlation between age and total number of drugs ($r = 0.063$; $p < 0.03$), but no correlation between the number of ED visits for trivial falls and the number of drugs ($r = 0.001$; $p < 0.984$). Anticoagulants [odds ratio (OR), 1.59; 95% confidence interval (CI), 1.22–2.07], antiplatelets (OR, 1.41; 95% CI, 1.12–1.79), and narcotic analgesics (OR, 2.38; 95% CI, 1.23–4.62) were predictors of hospital admission. Antiplatelets (OR, 2.02; 95% CI, 1.56–2.62), anticoagulants (OR, 1.89; 95% CI, 1.141–2.55), antihypertensive (OR, 1.44; 95% CI, 1.08–1.93), and psychotropic drugs (OR, 1.93; 95% CI, 1.09–3.44) were predictors of traumatic brain injury. Other classes of drugs were not related to any of the considered outcomes.

Conclusions: To reduce the risk of falling in elderly patients, a major focus should be placed on optimization of antihypertensives, narcotic analgesics, and psychotropic drugs administration. The risk-to-benefit ratio of anticoagulants and antiplatelet drugs should be individually tailored, to minimize the risk of adverse outcome of falls.

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1. Introduction

Falls are a major public health concern. It has been estimated that more than 400,000 fatal falls occur each year worldwide, which makes them the second leading cause of death due to accidental injury, only preceded by road traffic collisions.¹ Even when nonlethal, falls are associated with negative health outcomes,

leading to 20–30% of mild to severe injuries, from soft-tissue injuries to fractures.^{2,3} Each fall also carries several negative psychosocial consequences such as reduced physical activity,⁴ at least partially due to the fear of falling,^{2,3} thus resulting in a global impairment of the quality of life.⁵ As such, even when nonfatal in the short term, falls are often followed by functional limitations, high health-care costs, along with high mortality on the medium term.^{6,7}

Many people have an increased risk of fall with aging, and this is attributable to a variety of reasons, including impaired vision, dizziness, musculoskeletal diseases, malnutrition, gait problems, parkinsonism, and cognitive impairment.^{8–11} Environmental

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barriers are also responsible for a considerable burden of falls, often interacting with increased individual susceptibility.⁸ Notably, the underlying mechanisms leading to fall remain largely unrecognized.¹² Moreover, there is a large overlap between syncope and falls, which makes an etiological diagnosis even more difficult.¹³

Despite a number of methodological difficulties in establishing these relationships, certain classes of drugs have been associated with the risk of falls,^{14,15} especially narcotic analgesics,^{16,17} psychotropic drugs,^{18–22} antihypertensives,²³ antidiabetics,²⁴ and polypharmacy (i.e., more than four medications).^{25,26} Falls in patients taking anticoagulant drugs have also been associated with a greater mortality,²⁷ especially when associated with other fall-risk medications.²⁸

Based on the aforementioned data, the Swedish National Board of Health and Welfare has produced a “fall-risk-increasing drugs” list, as well as a list of drugs causing or worsening orthostatic blood pressure. The two lists of drugs, obviously, partially overlap.²⁹ This tool can help in decision making when prescribing drugs in frail elderly individuals.

The purpose of this study was to evaluate the impact of several classes of drugs on the type and severity of falls injuries in patients aged 65 years or older admitted to a large emergency department (ED) of a level 2 trauma center in northern Italy.

2. Materials and methods

Data on all the ED visits during the year 2013 for domestic or trivial falls were retrieved from the database of the ED of the Academic Hospital of Parma, with exclusion of injuries related to sports, car accidents, and all high-energy trauma. We considered the falls as “trivial” if they were not associated with high-energy features, such as accidents, hit pedestrians, and fall from 1.5 m or more.

Furthermore, we identified all falls that occurred in hospitalized patients using the incident-reporting database, and selected data regarding patients admitted for a previous fall in the same year.

The Academic Hospital of Parma is a 1250-bed teaching general hospital, located in the Province of Parma (approximately 447,000 inhabitants). The hospital is a Level 2 trauma center, and a referral center for stroke and myocardial infarction. According to our study design, only patients aged 65 years or older were included in this analysis. The individual reports of the visits were analyzed separately to evaluate where and how the patient fell, the drugs currently taken, the type of injury, the need for hospitalization, and the ward of admission (i.e., medicine/geriatrics, orthopedics, neurosurgery).

In a first step, with the aim of searching for the impact of polypharmacy on falls, we have classified the patients according to the number of drugs currently taken. The second step was to separately analyze the influence of different classes of drugs commonly believed to be a potential concurrent cause of falls, that is, diuretics and antihypertensives, psychotropic drugs, antidiabetic agents, anticonvulsants, antiarrhythmics, and narcotic analgesics. Anticoagulants and antiplatelet agents were separately considered, due to their correlation with the clinical outcomes rather than the falls themselves. All drugs not belonging to the aforementioned classes were classified as “miscellaneous agents.”

2.1. Statistical analysis

The characteristics of the patients including age, sex, number of visits to ED for fall during the study period, type of injury, and number of drugs identified in patient's history were descriptively expressed as frequencies, percentages, and mean $\pm$ standard deviation (SD). The statistical analysis included Mann–Whitney test,

χ^2 test, and Pearson correlation coefficient. The distribution of the falls rate was analyzed with Pearson χ^2 statistic. In particular, the associations between sex (dichotomous variable), severity of injury, and number of drugs taken (continuous variables) have been compared through the Mann–Whitney test. The associations between the continuous variables such as age, severity of injury, and number of drugs taken have been verified through the Pearson correlation test.

Besides, the associations between dichotomous variables (consumption of four or more drugs) and the presence/absence of severe outcome (hospital admission, brain injury, and hip fracture) have been verified through the χ^2 test.

For the purposes of this study, the injuries were classified into a simplified model as follows: (1) hip fractures; (2) traumatic brain injury; (3) others, including minor fractures, contusions, and skin abrasions and lacerations. To determine whether the assumption of certain drugs was significantly associated with the risk of hip fractures, brain injuries, major trauma, and hospital admission, a logistic regression analysis was performed to calculate the adjusted odds ratios (ORs) and the 95% confidence intervals (CIs). For each of the considered outcomes (i.e., hospital admission, traumatic brain injury, and hip fracture), a multiple logistic regression analysis was performed, including all drugs categories [antihypertensive, diuretics, psychotropic drugs, antiplatelets, anticoagulants, antiarrhythmic drugs, proton-pump inhibitors (PPIs), statins, antidiabetic agents, thyroid drugs, nitro derivatives, osteoporosis medications, narcotic analgesics, anticonvulsants, and miscellaneous agents]. Subsequently, the ORs were adjusted for age and sex.

All statistical analyses were performed with SPSS software (version 17.0; SPSS Inc., Chicago, IL, USA) and Analyse-it (Analyse-it Software Ltd, Leeds, UK). A *p* value less than 0.05 was considered statistically significant.

3. Results

A total of 93,029 ED visits were recorded during the year 2013. During the study period, 2533 visits were related to trivial falls in 2377 patients aged 65 years or older (i.e., 2.7% of the total visits), occurring at home or in nursing home. During the same period, 2229 patients (87.4%) visited the ED for a fall only once, whereas 139 patients visited two times (5.5%), eight patients three times (0.3%), and one patient four times. Accordingly, the ED recorded 2533 visits for the 2377 patients. For 1280 cases, a thorough drug therapy history was available. The mean age of the eligible patients was 81.2 ± 8.02 years. Overall, female patients accounted for 1843 visits (72.8%) and male patients accounted for 690 visits (27.2%), respectively. In both patient groups, the absolute number of visits for falls increased with the age, peaking in the 80–84-year age group and then progressively decreasing in older ages. Nevertheless, when the number of falls was related to the actual number of residents by age groups, female patients displayed a continuous increase [Pearson χ^2 statistic 825; degrees of freedom (DF) = 8; *p* < 0.001 for trend], peaking at age over 100 years; male patients also displayed a continuous increase, but the peak was reached between 95 and 99 years (Pearson χ^2 statistic 716; DF = 8; *p* < 0.001 for trend).

A total number of 756 (i.e., 28.1%) patients needed hospitalization, 463 of whom were admitted to the orthopedic ward due to fractures, and 277 to the medical wards (including geriatrics, cardiology, and neurology) due to nonsurgical brain injury, abdominal or chest trauma, or comorbidity. Ten patients were admitted to the neurosurgical unit for acute subdural hematoma; two patients to the maxillofacial surgery unit for severe facial injuries, two patients to the thoracic surgery unit for severe chest trauma, two to the

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