Antihypertensive treatment and the risk for falls in multi-ill, hypertensive elderly requiring home care - a retrospective case control study

Version 2

Author: Johan Emanuelsson
Supervisor: Mikko Hellgren, MD PhD and Peter Engfeldt, Adj Professor
Abstract

Introduction: Hypertension increases with age, and is above all coupled to increased risk for cardiovascular disease and dementia. All antihypertensive drugs are nearly equally effective in lowering the blood pressure, but concurrently they also increase the risk for falls. Falls make up the most common cause of injury and hospital admissions in the elderly.

Aim: This study was made to assess the different classes of antihypertensives and the correlation with falls in a sample of 129 hypertensive, multi-ill patients with home care in Kumla municipality.

Method: Retrospective data, including chronic diseases, drug treatment and falls were collected from patients electronic journals in the Kumla Primary Health Care Center and the University hospital in Örebro (USÖ) during the time of April 2014 - April 2016.

Results: The studied group had a high incidence of reported falls (43%). Individuals using drugs that affect the renin-angiotensin system had the lowest frequency of falls. There was no difference in correlation between falls and what other type of antihypertensive drug groups that was used. Having 3 or 4 different kinds of antihypertensive drug groups increases the fall risk compared to having 0 to 2 different kinds of antihypertensive drug groups.

Conclusions: Individuals using drugs that affect the renin-angiotensin system have the lowest frequency of falls. There is no difference in correlation between falls and what other type of antihypertensive drug group that was used. Interventions to withdraw antihypertensive drugs in the group of fallers may relieve patients from possible side effects, and concurrently not increase the frequency of falls.
**Abbreviations**

eGFR - estimated Glomerular Filtration Rate

MDRD - Modification of Diet in Renal Disease (creatinine clearance)

MMSE - Mini Metal State Examination

ATC - Anatomical Therapeutic Chemical Classification System

FRID - Fall Risk Increasing Drug

ESRD - End Stage Renal Disease

NSAID - Non Steroidal Anti Inflammatory Drug

FAR - Physical Activity on Medical prescription
1. Introduction

1. Hypertension

Hypertension, a blood pressure above 140/90 mmHg, increases with age and men and women are equally affected. The prevalence of hypertension in European countries differs, but appears to be around 30-45% in the general population. Sweden lies somewhat lower, with a prevalence of 27% in the adult population older than 20 years. It is above all coupled to increased risk for cardiovascular disease, but also dementia [1-5]. According to the European society of hypertension, all blood pressures above 140/90 mmHg should be treated with antihypertensives regardless of whether other risk factors are present or not, given that non-pharmacological treatment has proven not successful [3].

The property of reducing risk for cardiovascular disease and stroke is similar in all blood pressure reducing drugs when the standard dose is given to a person no matter his/her age. The exceptions are beta-receptor inhibitors given shortly after a myocardial infarction that reduce the risk of recurring coronary heart disease significantly better than the rest - 31% vs 13% risk reduction, they are at the same time worse at reducing the risk for stroke. Calcium antagonists reduce the risk for stroke slightly more than the rest. There is also an indication that high doses of thiazides increase the risk of sudden cardiac death [4,5].

Hypertension in middle aged people is normally associated with cardiovascular disease and physical and cognitive decline later in life. Older people are on the contrary thought to benefit from a high blood pressure, because the higher blood pressure might compensate for the vascular disease many older physically disabled have. In that way the higher blood pressure may maintain organ perfusion, physical and cognitive ability [6].

One study showed that antihypertensives reduce the risk of having a stroke, cardiovascular diseases and all-cause mortality and morbidity for people older than 60, but the effect on all-cause mortality did not include people older than 80 years [7]. On the other hand did the Hypertension in the Very Elderly Trial (HYVET) study get contrarious results. Antihypertensives did there reduce the risk of death from any cause by 28% in people older than 80 years [8]. A systolic blood pressure less than 140 has been shown to be inversely associated with all-cause mortality in people older than 85 years [9].

A significant reduced cognitive decline could not be presented for the treatment group in the Hypertension in the Very Elderly Trial cognitive function assessment (HYVET-COG) study,
where patients were randomly assigned antihypertensive medications or placebo. When this study was included in a meta-analysis of other placebo-controlled, double-blinded, trials of antihypertensive treatment there was however a significant reduction of incident dementia among the ones treated with antihypertensives [10].

Another study found that the cognitive decline is shown to be related to the level of hypertension, with the exception of the verbal fluency domain in cognition among the elderly participants. The cognitive domains are Mini Mental State Examination (MMSE), Memory, Concentration, Visual retention and Verbal fluency (which is not affected by hypertension) The normotensives in the study, with the lowest blood pressure, performed poorest (there was also an indication that normalized hypertensives performed better than normotensives, but it was non-significant). The ones treated but uncontrolled, with the highest blood pressure, performed a lot better compared to the other groups (normotensives, normalized hypertensives and untreated hypertensives) in 4 of the 5 cognitive domains. [11].

Another study has gotten similar results. People older than 75 with a low systolic blood pressure, <130 mmHg, is associated with an increased risk for cognitive impairment and a high systolic blood pressure is accordingly associated with a decreased risk for cognitive impairment. A systolic blood pressure above 180 mmHg was associated with a higher risk for cognitive impairment, but that result was not statistically significant. There is however no doubt whether or not antihypertensive treatment is good for people in their mid-life - it is [12].

A Cochrane report shows that antihypertensive medications neither decrease morbidity or mortality in the case of mild hypertension, 159-140/99-90 mmHg, for people older than 18 years (excluding pregnant women) with no previous cardiovascular disease [13]. The effects on elderly’s health after pharmaceutical treatment of hypertension are therefore less convincing than for the rest of the population, as they have an increased risk for falls, hip fractures and death following a hip fracture [14]……… En till källa!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

2. Risk of falls

Antihypertensives have for a long time been a well-known potential cause for falls in older people, through the effect of orthostatic hypotension [15]. Prescribing antihypertensive medications immediately increases the risk for falls, hip fractures and the risk of death following a hip fracture [1,14,16]. Falls are coupled to increased risk of having fractures. Another cause for fractures is osteoporosis, but it is secondary to falls in risk for fractures [16]. Hip fractures are
regardless of cause coupled to increased mortality [1]. It is important to define what a fall is. If that is not properly done, many different types of fall and loss-of-balance will be recorded [17]. The definition of a fall as it is in the literature was only given by one care giver and no senior when seniors and care givers were asked to define and describe a fall [18]. A common definition of fall is “inadvertently coming to rest on the ground, floor, or other lower level, excluding intentional change in position to rest in furniture, wall or other objects” [17].

There are several factors that affect the risk for falls. They can be divided into two groups:

1. Intrinsic factors, such as old age, being female, high and low BMI, Caucasian ethnicity, postmenopausal status, tallness, cognitive impairment, hearing impairment, not best corrected vision impairment, decreased walking ability, balance disorders, postural hypotension, End Stage Renal Disease (ESRD) with hemodialysis, medicative use of antipsychotics, sedatives, antidepressants, antihypertensives, antiarrhythmics, digoxin, hypnotics, opioids, thyroid hormones, constipation drugs and Non Steroidal Anti Inflammatory Drugs (NSAIDs).

2. Extrinsic factors, such as living in nursing homes, malnutrition, uneven surfaces, poor lighting and absence of helping equipment such as handrails.

The intrinsic risk group plays a greater role for elderly falling because the illnesses they catch get more important.

A fracture occurs in 3-12% of all falls, hits women more often than men. Out of all falls, less than 1% involves the hips [19-25]. The number of falls is increasing with age and increased number of Fall Risk Increasing Drugs (FRIDs) [17,26]. The number of medications a person uses is associated with falls, functional decline and hospitalization [27]. Falls make up the most common cause of injuries and hospital admissions in the elderly, 75+ [26].

About 28-35% of the general population above 65 years old fall annually, increasing to 32-42% for those older than 70 years of age. Falls are more common for those living in nursing homes than those living in the community. The locations where older people living in retirement homes and long term care fall are: bedroom (65%), dining rooms, hallways, lounges (21%). Activities being performed prior to falling are walking (40%), transferring (12% and turning or standing (12%), with slight differences between the two groups [25].

40% of injury deaths are generally accounted for by falls, but differing between countries and populations. In USA there is a somewhat higher incidence for men than women to die after a fall,
46.2 versus 31.1 per 100,000 population. That can be compared to men’s lower frequency of falling. The reason they die more often is that they normally have more co-morbidities than women of the same age. The same tendency can be observed when it comes to mortality after a hip fracture. Women get more hip fractures, but men die more often following them [17].

The cost of falls is divided into two groups: Direct cost for health care, including medications and consultations. The other one is indirect costs which include loss of income and activities that the patient and family care givers would have involved if the fall had not happened.

Fall related injury requiring hospitalization averages a cost ranging from 6646 US dollars in Ireland to 17483 US dollars in USA [17].

3. Interventions to reduce the number of falls

When people at risk of falling are identified and assessed, interventions can be implemented. Interventions that have been proven to decrease the number of falls, consists of:

- Exercise, as Tai Chi, significantly reduces the number of falls in older people living in the community. It is thought to depend on its combination of strength and balance training [19].

- Education about fall-prevention to family physicians, feedback on the prescriptions and self-assessment of medication combined with financial rewards, followed by a review of the medications and a modification of the prescriptions decreases the risk of falling with 39% [19].

- Surgical intervention, where a pacemaker is inserted reduces the number of falls with 58%. Surgery for cataract reduces the number of falls with 34%, but the fall rate reduction was only seen for the first eye [19].

- Anti-slip shoe devices reduces the number of falls with 58% under icy conditions [19].

- Vitamin D, with or without calcium supplementation, does not decrease the number of falls or the number of fallers in community dwelling elderly. It does however decrease the number of falls but not the number of fallers in instutionalized elderly people. The number of fallers and falls does also decrease in subgroups with low vitamin D levels at baseline [19].

- Drug-targeted interventions, withdrawing antihypertensive and psychotropic drugs, decrease the number of falls but not the number of fallers [19,27].
4. Aim

How does the correlation between the different antihypertensive drug groups and fall frequency look like?

5. Objectives

The purpose of this study is to see how the different antihypertensive drug groups correlate with the frequency of falls. The outcome is important because it may show that some antihypertensive drug groups are better than others regarding the fall risk and therefore should be used more often.

2. Method

1. Subjects

The study population included all groups but the Hällabrottsgruppen in the Kumla Home Care. The inclusion criteria were: patients with home care in Kumla municipality, that are multi-ill with at least two chronic diseases, and hypertension has to be one of them. The exclusion criteria were: palliative patients and those about to die without a set palliative diagnosis.

Some patients fell out of the study because it was not possible to access their journals, others had already died or were dying at time of data collection.

2. Data collection

A retrospective analysis over the last 24 months, reaching back to 2014-04-14, was made to see the participants chronic diseases, medications and number of falls. In order to do that, patient lists from the Kumla Home Care teams were assessed. The participants electronic journals from both the Primary Health Care Center in Kumla and the University hospital in Örebro (USÖ) were reviewed. The data given in this study is the latest recorded in their journals, with the exception of the patients psychiatric journals, which were not included.

3. Way of handling uncertain information

When a diagnosis that was not set as chronic, or not set at all (the journal might not have been updated) was encountered, it was accounted for anyway if the patient’s data given in the journal clearly showed that he/she should have had the diagnosis listed as chronic. One way the journals clearly could show that the patients had a chronic disease, but not yet listed, was if the patient for
example had antihypertensive treatment and a history of high blood pressure and no other indication for having the medication.

A patient was recorded as using a walker, crutch or wheelchair if that was recorded in the journals.

The medications were recorded as antihypertensives when a patient had medications that could be used for both heart failure and hypertension, regardless of if the patient had both diagnosis. It was recorded as antihypertensive medication although it primarily was meant for heart failure or a similar disease, because it affects the blood pressure. The medications were listed under heart failure medications in the case of patients having heart failure but not hypertension. The antihypertensive medications were in some cases used for edema, but they have been accounted for anyway, since they have an antihypertensive effect.

The blood pressures recorded in the patients journals were normally not specified to if it had been taken in an upright position, sitting or laying down. They were therefore all just accounted for as blood pressure. A mean blood pressure was recorded in the collected data when differing blood pressures between the arms were encountered on the last day in the journal.

4. Falls

A fall was defined as inadvertently coming to rest on the ground, floor, or other lower level, excluding intentional change in position to rest in furniture, wall or other objects. Falls caused by faintings and drinking alcohol have been recorded, but by stroke has not been recorded. Some faintings were not specified as to falling to the ground, but they were accounted for anyway. The falls had to be recorded in the electronical journals in the Kumla Primary Health Care Center or the University Hospital of Örebro (USÖ) to be part of this study. The falls were recorded as they appear in the journal, from the top of the notes within each clinic or the first one encountered in the Primary Health Care Center journal (from the top). The antihypertensive medications the patients had in their journals at the end of the 24 months period were recorded. Only the first fall that the patient went to the hospital for were accounted for regarding number of days hospitalized, changes in the patients drugs, number of drugs that the patient had at time of the fall and the number of antihypertensive drugs taken at that time. The following falls were only recorded as a number.
A patient was sometimes recorded to be found on the floor, but nothing was said about how he/she got there. It could have been a consequence of falling, but that assumption has not been made in this study.

5. Calculation of missing information

A calculation of patients missing estimated Glomerular Filtration Rate (eGFR) was made by using the Modification of Diet in Renal Disease (MDRD) eGFR equation, if a creatinine level was present and enabled this.

6. Recorded parameters

The following parameters were recorded for the patients (missing data were recorded with a blank space or a zero):

Name, eGFR, BMI, creatinine, chronic diseases related to hypertension, other chronic diseases, blood pressure, occurrence of falls, vertigo right before time of falling, antihypertensive treatment (coded with Anatomical Therapeutic Chemical Classification number - ATC number), number of fractures, occurrence of impaired vision, occurrence of impaired hearing, occurrence of paresis or decreased muscle strength in the legs, walking ability (coded for walker, wheel chair/permobil and crutch), total number of drugs, drugs that may affect the risk of falling, FRIDs (coded: obstipation, opioids, sedatives, parkinsonistic, sleeping pills, antipsychotic, antidepressants), other medications and number of drugs and drug changes at time of hospitalization. Occurrence of impaired cognition, sometimes recorded as a MMSE score was also recorded [2]. Kidney failure was defined as GFR <60 ml/min.

The reason that NSAID and alpha-1-receptor inhibitors were not included in the FRIDs is that I decided to go by a FRID list, in which they were not included, when making my parameters in Excel. I then subsequently discovered that these drugs also affect the risk of falling. I had by that time already put them under the group of other medications.

The reason for having fewer patients with the different types of antihypertensive drugs in table 2 compared with table 1 and figure 1 is that not all patients have blood pressures recorded in their journals.
7. Calculation of data

SPSS was used for calculating the data, a mean and standard deviation, to make crosstabs of the different data that needed to be checked upon together. An interpretation made upon those data was thereby possible to make. The data was not calculated to see whether they were significant or not.

8. Table and figure numbers

The numbers in the tables and figures, where multi-ill, hypertensive home care patients that fall and do not fall were compared, were rounded off to nearest whole number. The same goes for the two charts where falls were correlated to how many different antihypertensive drug groups the patients used and what antihypertensive drug they used.

9. Ethics

All participants were coded for, so no one could be identified. The issue of patients possibly being recognized was thereby minimized. The patients integrity was also cared for as their psychiatric journals were excluded in the study.

This study was a thorough retrospective case control study to screen patients for an interventions study to withdraw antihypertensive drugs, which had an ethical approval by the Uppsala Regional Ethical Review Board (dnr 2014/438).

3. Results

1. Fallers and non-fallers

One hundred twenty nine out of the 208 patients reviewed for this study had hypertension and at least one other chronic disease, fulfilled the inclusion criterias. Out of the 129, 88 were women and 41 were men. Fifty six participants, 43% of the ones included, had at least one recorded fall in the electronical journals within the last 24 months. There were only small differences between the fallers and non-fallers regarding age, BMI, eGFR, total number of diseases, total number of drugs and blood pressure. There was however a difference in the relative number of walking impairment, where the fallers more often used a walker or wheel chair, as seen in table 1. Relatively more women reported falls in the last 24 months. Men had relatively more
antihypertensives and FRIDs in the group of non-fallers, but less in the group of fallers. No hypertensive patient in the study had FAR prescribed as a non-pharmacological treatment for hypertension. The number of patients in the tables and figures varies because of lacking documentation in the journals.

2. Antihypertensive drug groups and falls

The drugs that affect the renin-angiotensin system had the lowest risk for falls. The relatively most common antihypertensive drug group to be associated with falls was the combined drugs. It was tightly followed by calcium antagonists, diuretics and beta-receptor inhibitors, as seen in figure 1.

Taking 3 or 4 different kinds of antihypertensive drug groups increases the fall risk, compared to taking 0-2 different kinds of antihypertensive drug groups, as seen in figure 2.

3. Fall in relation to the systolic blood pressure

More patients fell with a systolic blood pressure lower than 140 mmHg, compared to a systolic blood pressure equal to or above 140 mmHg, as seen in figure 3. A greater number of patients fell with an extremely low systolic blood pressure compared to those with an extremely high systolic blood pressure, as seen in figure 4.
Vertigo was the cause of falling in 5% of the cases. The drugs that affect the renin-angiotensin system were relatively more common among those not falling, compared to the other antihypertensive drug groups.

<table>
<thead>
<tr>
<th>Characteristics of the study sample</th>
<th>Non-fallers</th>
<th>Fallers</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Of hypertensive patients, N (%)</td>
<td>73</td>
<td>56</td>
</tr>
<tr>
<td>Sex, N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Male</td>
<td>26 (36)</td>
<td>15 (27)</td>
</tr>
<tr>
<td>-Female</td>
<td>47 (64)</td>
<td>41 (73)</td>
</tr>
<tr>
<td>Age (years), mean (SD)</td>
<td>84 (8)</td>
<td>85 (7)</td>
</tr>
<tr>
<td>BMI, mean (SD)</td>
<td>28 (6)</td>
<td>27 (6)</td>
</tr>
<tr>
<td>Vertigo leading to a fall, N (SD)</td>
<td>3 (5)</td>
<td></td>
</tr>
<tr>
<td>No. of Chronic diseases, mean (SD)</td>
<td>4 (1)</td>
<td>5 (2)</td>
</tr>
<tr>
<td>No. of Other diseases, mean (SD)</td>
<td>2 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Dementia, N (%)</td>
<td>7 (10)</td>
<td>8 (14)</td>
</tr>
<tr>
<td>Osteoporosis, N (%)</td>
<td>6 (8)</td>
<td>7 (13)</td>
</tr>
<tr>
<td>Kidney failure, N (%)</td>
<td>2 (3)</td>
<td>5 (9)</td>
</tr>
<tr>
<td>Diabetes Mellitus, N (%)</td>
<td>17 (23)</td>
<td>21 (38)</td>
</tr>
<tr>
<td>eGFR, mean (SD)</td>
<td>57 (20)</td>
<td>63 (29)</td>
</tr>
<tr>
<td>No. of total drugs, mean (SD)</td>
<td>9 (5)</td>
<td>11 (5)</td>
</tr>
<tr>
<td>No. of FRIDs, mean (SD)</td>
<td>2 (2)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>No. of antihypertensive treatment, mean (SD)</td>
<td>2 (1)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>No. of Diuretics (%)</td>
<td>38 (52)</td>
<td>34 (61)</td>
</tr>
<tr>
<td>No. of Beta-receptor inhibitors (%)</td>
<td>37 (51)</td>
<td>33 (59)</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>No. of Calcium antagonists (%)</td>
<td>21 (29)</td>
<td>20 (36)</td>
</tr>
<tr>
<td>No. of drugs affecting the renin-angiotensin system, N (%)</td>
<td>36 (49)</td>
<td>20 (36)</td>
</tr>
<tr>
<td>No. of Combinated antihypertensive drugs (%)</td>
<td>3 (4)</td>
<td>3 (5)</td>
</tr>
</tbody>
</table>

**Blood pressure (mmHg), mean (SD)**

| -Systolic | 138 (18) | 136 (16) |
| -Diastolic | 75 (12) | 75 (11) |

**Locomotion, N (%)**

| -Use walker | 28 (38) | 26 (46) |
| -Use wheel chair | 6 (8) | 6 (11) |
Table 2. Antihypertensive drug groups and their achieved systolic blood pressure.
Diuretics had a relatively larger part of patients reaching a systolic blood pressure of 100-119, than the other antihypertensive drug groups.

<table>
<thead>
<tr>
<th>Antihypertensive treatment</th>
<th>Systolic blood pressure</th>
<th>&lt;100</th>
<th>100-119</th>
<th>120-139</th>
<th>140-159</th>
<th>160-179</th>
<th>180-199</th>
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</thead>
<tbody>
<tr>
<td>C03- Diuretics</td>
<td></td>
<td>11</td>
<td>26</td>
<td>20</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C07- Beta-receptor inhibitors</td>
<td></td>
<td>7</td>
<td>29</td>
<td>18</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C08- Calcium antagonists</td>
<td></td>
<td>2</td>
<td>18</td>
<td>11</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C09- Drugs that affect the renin-angiotensin system</td>
<td></td>
<td>6</td>
<td>19</td>
<td>15</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Combinated antihypertensive drugs</td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Antihypertensive drug groups and their correlation with falling.
The drugs that affect the renin-angiotensin system had the lowest frequency of falls. There was no correlation between the other different antihypertensive drug groups and their impact on fall risk.
Figure 2. The total number of antihypertensive drug groups the patients take and its correlation with falling.
Most patients used 2 different types of antihypertensive drug groups to lower their blood pressure. There was a smaller correlation between how many antihypertensive drug groups a patient take and how often he/she is falling. One or 2 different antihypertensive drug groups did not increase the risk for falls, but 3 or 4 different antihypertensive drug groups did increase the risk.
Figure 3. Fall in relation to whether they are hypertensive or not.
The Number of patients falling and not falling with a systolic blood pressure threshold limit above and under 140 mmHg.
Figure 4. Fall in relation to the extreme systolic blood pressure values. The number of patients falling and not falling with extreme systolic blood pressures.
4. Discussion

Patients were less likely to fall if they were using drugs that affect the renin-angiotensin system. The risk of falling was about the same among the other antihypertensive drug groups. Data in figure 2 indicates that having 1 or 2 different antihypertensive drug groups does not increase the risk for falls, but having 3 or 4 different antihypertensive drug groups does increase the risk of falling. There were only 6 patients reported using combined antihypertensive drugs. It is hard to draw any conclusions from that few cases, but it seems like they fall about as often as the other patients using other drugs. To see that patients without antihypertensive treatment fall about as much as the ones treated could be of great interest, even though there was only 10 patients in that group. That may indicate that more patients could benefit from withdrawing their medication. They could be relieved from possible side effects, from the medication itself but also through interactions with other medications. The medicative cost could also be cut [17,28,29]. More women than men were falling, as has been shown earlier [17].

Drugs that affect the renin-angiotensin system seems to lower the risk of falling, in comparison to the other antihypertensive drug groups, as can be seen in table 1 and 3. The fallers had an average total of 7 diseases and 11 drugs, compared to the non-fallers that had an average total of 6 diseases and 9 drugs. That is not a big difference, but their hyper polypharmacy might be a contributing factor for falls [29].

To see that vertigo only accounts for 5 % of all falls was quite surprising. It does not go along with the idea of orthostatic blood pressure leading to vertigo, and causing a fall. There is however very likely that more patients fall because of vertigo, but this had not been recorded in their journals for some reason.

Diuretics had a relatively larger part of patients reaching a systolic blood pressure of 100-119, than the other antihypertensive drug groups. That could indicate that those patients using diuretics would fall more often than patients using other antihypertensive drug groups, but that is not the case, as seen in table 3. The use of diuretics in another study has been shown to increase the risk for falls though [15].

Physical activity on medical prescription (FAR) was not used once in the study sample to lower the blood pressure. That indicates that there is much room for improvement, since exercise is a well-known way of reducing falls [19].
The many patients with low blood pressure indicate that there is a substantial number of patient that would benefit from either lowering their antihypertensive dose or withdrawing it, as has been successfully made in two other studies [28,30]. The greater number of fallers with low systolic blood pressure compared to those with high systolic blood pressure, as seen in table 6, may indicate that it is better for older people to have a higher systolic blood pressure.

The different results in the studies by Musini and Beckett, regarding all-cause mortality when treated with antihypertensives, could be explained by the included participants. The prior study included a broader range of older people and the later study included relatively healthy older people, especially since they excluded patients needing nursing care [7,8].

Alpha-1-receptor inhibitors are nowadays primarily used for prostate diseases, even though they are effective antihypertensives.

5. Limitations

A major limitation of the study is that it is not made certain that the patients list of drugs is up to date, or that the patient in fact take the prescribed drugs.

The number of falls may very well be a lot higher than reported, owing to the difficulties in recording them. The patient may not report a fall, or even remember falling when asked about it. Staff asked to record falls might also forget to ask the patient.

Another limitation is that many patients use several different drugs, polypharmacy. The large number of drugs taken by the patients may interact with one another, giving side effects as falls.

It is also quite likely that some patients have other chronic diseases/states than the ones in their journal, but they have not yet been investigated for it.

6. Future research

It would be interesting to further investigate the relationship between systolic blood pressure and fall tendency. This study gives the indication that a lower systolic blood pressure is not beneficial regarding the risk of falling. It could be done through an intervention study where antihypertensive treatment is withdrawn. Another aspect that would be interesting to do research
on is how big impact a fall risk education talk with the patient and his/her family and acquaintances, and an exercise program would have. It could then be compared to a control group to see if there are any benefits by doing a greater job in preventing falls.

7. Conclusions

Drugs that affect the renin-angiotensin system have the lowest frequency of falls. There is no difference in the risk of falling among the other antihypertensive drug groups. Having 1 or 2 different antihypertensive drug groups does not increase the risk of falling, but having 3 or 4 different antihypertensive drug groups increases the risk of falling. The greater number of fallers with low systolic blood pressure indicates that older people might benefit from a higher blood pressure. Interventions to withdraw antihypertensive drugs in the group of fallers may relieve patients from possible side effects, and at the same time not increase the frequency of falls.

8. Acknowledgements

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9. References


