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The effect of comprehensive geriatric assessment on anticholinergic exposure assessed by four ranked anticholinergic lists

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ABSTRACT

Background: Older people often use multiple drugs, and some of them have anticholinergic activity. Anticholinergic drugs may cause adverse reactions, and therefore their use should be limited. To identify anticholinergic load, several ranked lists with different drugs and scoring systems have been developed and used widely in research. We investigated, if a comprehensive geriatric assessment (CGA) decreased the anticholinergic drug score in a 4-year period. We used four different anticholinergic ranked lists to determine the anticholinergic score and to describe how the results differ depending on the list used.
Methods: We analyzed data from population-based intervention study, in which a random sample of 1000 persons aged ≥75 years were randomized to either an intervention group or a control group. Those in the intervention group underwent CGA including medication assessment annually between 2004 and 2007. Current medication use was assessed annually. The anticholinergic load was calculated by using four ranked lists of anticholinergic drugs (Boustani's, Carnahan's, Chew's and Rudolph's) for each person and for each year.
Results: CGA had no statistically significant effect on anticholinergic exposure during the 4-year follow-up, but improvements towards more appropriate medication use were observed especially in the intervention group. However, age, gender and functional comorbidity index were associated to higher anticholinergic exposure, depending on the list used.
Conclusions: Repeated CGAs may result as more appropriate anticholinergic medication use. The selection of the list may affect the results and therefore the selection of the list is important.

1. Introduction

Older people use multiple drugs, and the proportion of those without any medication is only 2–3% (Barat, Andreasen, & Damsgaard, 2000,Jyrkkä, Vartiainen, Hartikainen, Sulkava, & Enlund, 2006). In addition, older people also are vulnerable to adverse drug reactions (Stegemann et al., 2010). Therefore, several criteria have been generated in an attempt to decrease the use of inappropriate drugs, such as explicit (criterion-based) Beers' criteria (American Geriatrics Society 2012 Beers Criteria Update Expert Panel, 2012), and implicit (judgement-based) Medication Appropriateness Index (Hamilton, Gallagher, & O'Mahony, 2009).

Anticholinergic drugs are commonly used among older people as reported in previous studies, and the prevalence ranges from 27% in community-dwelling to up to 80% in nursing-home residents with dementia (Ness, Hoth, Barnett, Shorr, & Kaboli, 2006; Kolanowski, Fick, Campbell, Litaker, & Boustani, 2009). Anticholinergic adverse effects include constipation, urinary retention, dry mouth, confusion and attention deficit (Lieberman, 2004), and anticholinergic drug use has been associated with e.g. falls (Rudolph, Salow, Angelini, & McGlinchey, 2008) and cognitive impairment (Fox et al., 2011). Therefore, unnecessary use of anticholinergics should be avoided. However, defining an anticholinergic drug has been challenging, and therefore several different ranked lists have been compiled (*e.g.* Boustani, Campbell, Munger, Maidment, & Fox, 2008; Rudolph et al., 2008; Carnahan, Lund, Perry, Pollock, & Culp, 2006; Chew et al., 2008). Generally, these lists score different drugs based on their anticholinergic activity, and they are based on *in vitro* results, published literature, and/or expert opinion. The anticholinergic lists have been found to associate with anticholinergic adverse effects (Rudolph et al., 2008) or serum anticholinergic activity (Carnahan et al., 2006). Previously published studies generally utilized only one anticholinergic list, and the selection of the list used varied depending on the author and study setting. However, as the lists differ from each

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other in terms of the drugs included, if the dose is taken into account and the scoring of anticholinergic potential, the results may also change depending on the list used (Lampela et al., 2013a; Mangoni, van Munster, Woodman, & de Rooij, 2013). Therefore, the selection of the anticholinergic list may affect the results on the reported prevalence of use as well as the associated outcomes.

Comprehensive geriatric assessment (CGA) is one of the cornerstones of modern geriatric care (Ellis, Whitehead, Robinson, O'Neill, & Langhorne, 2011). In this process, a multidisciplinary team aims to improve the health and quality of life of an older person focusing on physical health, functional status, psychological health and socioenvironmental parameters (Rubenstein & Joseph, 2004). It has been shown to be effective in helping older people to live safely and independently (Beswick et al., 2008).

Previous studies have focused on the effect of the intervention on anticholinergic exposure (i.e. before and shortly after the intervention) (Tay, Soiza, & Mangoni, 2014). In the present study, we studied the effect of CGA in real-life situation, where other health care professionals also may affect the result. We investigated if a comprehensive geriatric assessment has an impact on the anticholinergic load during 4-year follow-up. Instead of just selecting one list to be used, we chose to use four different lists of anticholinergic drugs to see, how the results may change depending on the list.

2. Methods

2.1. Population

We investigated data derived from the Geriatric Multidisciplinary Strategy for the Good Care of the Elderly (GeMS) Study, which took place in Kuopio, Finland, during 2004–2007. This study has been previously described in detail (Lampela, Hartikainen, Lavikainen, Sulkava, & Huupponen, 2010). In short, a random sample of 1000 persons aged $\geq$ 75 years was drawn from the inhabitants of the city of Kuopio, Finland. They were randomized using computer-generated numbers in control and intervention groups (each n = 500), and persons in both groups were annually interviewed and examined by trained nurses. They paid special attention to current drug use by not only asking the participants directly, but also by using medical records from the municipal health centre, home nursing service, local hospitals and Kuopio University Hospital. In addition, those in the intervention group underwent a CGA, which consisted of annual health status examinations including medication assessment by a physician (a trainee in geriatrics), as well as examinations by a dentist, physiotherapist and nutritionist, when necessary. Although the study physicians were trainees in geriatrics, they had been working as a general practitioner for at least 10 years with a lot of experience of older population. They had received training in adverse drug reactions, but they did not use any anticholinergic list when assessing medication. They also had weekly meetings with senior geriatrician (SH). Cognitive status was measured using the Mini-mental state examination. Those in the control group had access to regular health services. In this study, we used medication data from all persons that participated each year. Demographics of the study population are shown in Table 1, and flow chart of persons in the GeMS study in Fig. 1.

2.2. Anticholinergic lists

We used four previously published lists about anticholinergic drugs (Boustani et al., 2008; Carnahan et al., 2006; Chew et al., 2008; Rudolph et al., 2008) to determine the anticholinergic load (i.e. the sum of scores of each anticholinergic drug in use for each person) of regularly used drugs. Rudolph's Anticholinergic Risk Scale (ARS) includes 49 anticholinergic drugs and it is based on the 500 most prescribed medications within the veterans (Rudolph et al., 2008). It ranks drugs from 1 to 3 based on their anticholinergic activity. Chew's list was based on anticholinergic activities (score from 0 to +++; score of 0/+ was classified as 0.5) of 107 drugs determined *in vitro* (Chew et al., 2008). Carnahan's Anticholinergic Drug Scale (ADS) is the broadest (score from 0 to 3), including 536 drugs (117 of them having anticholinergic activity)

Table 1
Demographics of the study population.

Baseline year 2004	Intervention group			Control group			
	all	men	women	All	men	women	p-value[a]
N	404	116	288	377	117	260	
Age, mean (SD)	81.5 (4.9)	80.7 (4.5)	81.8 (5.0)	82.0 (5.0)	81.1 (4.8)	82.4 (5.1)	0.112
Regular medicines, mean (SD)	5.1 (5.0)	4.7 (2.8)	5.3 (3.4)	5.1 (5.0)	4.3 (2.8)	5.5 (3.4)	0.992
As-needed medicines, mean (SD)	1.6 (1.6)	1.1 (1.4)	1.7 (1.6)	1.3 (1.4)	1.0 (1.3)	1.5 (1.5)	0.127
FCI, mean (SD)	2.4 (1.7)	2.5 (1.5)	2.4 (1.7)	2.6 (1.7)	2.4 (1.6)	2.7 (1.7)	0.217
Dementia (DSM-IV), n (%)	90 (22.2)	24 (20.7)	66 (22.9)	77 (20.4)	19 (16.2)	58 (22.3)	0.528
ADS score, mean (SD)	1.3 (1.8)	1.2 (1.4)	1.4 (1.9)	1.3 (1.7)	1.1 (1.3)	1.4 (1.9)	0.760
Chew score, mean (SD)	0.6 (1.0)	0.4 (0.8)	0.7 (1.1)	0.5 (0.9)	0.4 (0.7)	0.6 (1.0)	0.187
ARS score, mean (SD)	0.3 (0.8)	0.2 (0.7)	0.4 (1.0)	0.4 (0.9)	0.2 (0.6)	0.5 (1.1)	0.495
ACB score, mean (SD)	1.3 (1.6)	1.2 (1.4)	1.4 (1.7)	1.3 (1.5)	1.2 (1.4)	1.4 (1.5)	0.748
Year 2007	**Intervention group**			**Control group**			
	all	men	women	all	men	women	p-value[a]
N	315	88	227	294	91	203	
Regular medicines, mean (SD)	5.8 (3.1)	5.2 (2.9)	6.0 (3.2)	5.8 (3.3)	5.3 (3.1)	6.1 (3.3)	0.966
As-needed medicines, mean (SD)	1.7 (1.4)	1.2 (1.2)	1.8 (1.5)	1.4 (1.3)	1.0 (1.2)	1.5 (1.4)	0.006
FCI, mean (SD)	3.0 (1.7)	3.1 (1.7)	3.0 (1.6)	2.6 (1.8)	2.4 (1.7)	2.7 (1.8)	0.003
Dementia (DSM-IV), n (%)	76 (24.1)	18 (20.5)	58 (25.6)	66 (22.4)	18 (19.8)	48 (23.6)	0.625
ADS score, mean (SD)	1.2 (1.3)	1.2 (1.2)	1.2 (1.4)	1.3 (1.5)	1.0 (1.1)	1.4 (1.6)	0.692
Chew score, mean (SD)	0.6 (0.9)	0.5 (0.7)	0.6 (0.9)	0.6 (1.0)	0.5 (0.8)	0.7 (1.1)	0.912
ARS score, mean (SD)	0.3 (0.8)	0.3 (0.7)	0.4 (0.9)	0.4 (0.8)	0.2 (0.5)	0.4 (0.9)	0.692
ACB score, mean (SD)	1.4 (1.6)	1.4 (1.5)	1.5 (1.6)	1.6 (1.7)	1.4 (1.5)	1.7 (1.7)	0.300

Abbreviations: ACB, Anticholinergic Cognitive Burden Scale; ADS, Anticholinergic Drug Scale; ARS, Anticholinergic Risk Scale; COPD, Chronic Obstructive Pulmonary Disease; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; FCI, Functional Comorbidity Index; SD, Standard Deviation.

[a] Between intervention and control groups. p-values were produced using Mann-Whitney U test for continuous variables, and Pearson Chi-Square test for categorical variables.