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Cognitive impairment in older emergency department patients

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ENGLISH SUMMARY

Introduction

The number of older people in the population is rising and so is the number of older patients in the Emergency Department (ED)[1]. Older patients often have complex problems which leads to an increased chance of repeat ED visits, longer length of stay, higher chance of hospital admission and higher chance of negative health outcomes after a visit to the ED[2]. Cognitive impairment is a frequent problem in older ED patients, with an estimated prevalence of 20-40%[3-5]. Unfortunately cognitive impairment often remains unrecognized[3] and little is known about the association between cognitive impairment and adverse outcomes in older ED patients.

Aim of this thesis

The aim of this thesis is threefold. The primary aim of this thesis is to investigate whether cognitive impairment is associated with adverse outcomes in acutely presenting older patients. The second aim is to assess whether routinely collected parameters in addition to cognitive impairment can be used to screen for high risk of adverse outcome in older ED patients. The third aim is to investigate whether a proportion of older ED patients might have cognitive impairment due to impaired brain perfusion and oxygenation.

Summary of key findings

This thesis is divided in two parts. The first part discusses the association between cognitive impairment and adverse outcomes in acutely presenting older patients. In **chapter 2** we investigated older patients who were acutely hospitalised. During four month periods in three consecutive years we included patients aged 70-years or older and performed the Six-Item Cognitive Impairment Test (6-CIT) to measure cognitive function. One in six older patients suffered from cognitive impairment and these patients had a higher chance of 90-day functional decline and mortality. When corrected for age, sex, living situation and treating medical specialist this association was no longer statistically significant. Cognitive impairment was independently associated with prolonged hospital length of stay, admission to a nursing home and in-hospital mortality.

In **chapter 3** we investigated older patients in the Emergency Department of three different hospitals. We found that nearly 30% of older ED patients suffered from cognitive impairment. Three and twelve months after the ED visit we determined whether patients had endured functional decline or mortality. There is an association between cognitive impairment and adverse outcomes, irrespective of the cause of the cognitive impairment. This association was independent of age, disease severity and comorbid-

ties. In a sub-analysis we found that this association was similar for patients who were hospitalised and those who were sent home.

The second part of this thesis consists of multiple chapters which describe prediction models and screening instruments used to identify older ED patients with a high risk of adverse events.

In **chapter 4** we used a retrospective cohort of all patients aged 70-years and older who visited the ED of the Leiden University Medical Center during a 1-year period. We created a prediction model using routinely collected parameters, such as age, vital signs and the indication to perform laboratory testing. These routinely collected parameters can be used at arrival of older patients to the ED to predict 90-day mortality. The strongest predictors were indication to perform laboratory testing, hypothermia, referral from another hospital and low oxygen saturation levels. These data were used to determine the parameters which we investigated in the prospective APOP-study.

In **chapter 5** we also used a retrospective cohort study of all ED visits of the Leiden University Medical Center during a one year period. For this study both younger and older patients were included. We showed that hospital admission can be predicted at arrival to the ED using routinely collected parameters. Different prediction models were made for younger and older patients. The strongest predictors for hospital admission were age, sex, triage category, arrival via ambulance, indication to perform laboratory testing, main complaint, responsible medical specialist and all measured vital signs. The model for younger patients had better overall predictive capabilities with a higher area under the curve. The model for older patients was better suited to identify those patients with the highest risk, with a higher positive predictive value.

In **chapter 6** we describe the main results of the APOP-study. We performed a prospective cohort study in four hospitals in which we collected data of older people at arrival to the ED. After three and twelve months we determined whether they suffered adverse events (functional decline or mortality). In this chapter we show how the previously created APOP-screener[6] was updated. Amongst other things, cognitive impairment was added as predictor. The other parameters in the model are age, sex, arrival by ambulance, needing help on a regular basis, needing help with bathing and hospitalisation in the past six months. The calibration and discrimination of the model were good and a group of patients with a high positive predictive value could be successfully identified.

In **chapter 7** we used the prospective data of the APOP-study of two hospitals. We performed the CAM-ICU, a delirium screener, within one hour of arrival of older patients to the ED. Using this screener we found an unexpectedly low delirium incidence of 1%. This was compared to another method of diagnosing delirium, the 6-CIT with a cut-off point of ≥ 14 points, where we found a delirium incidence of 10%. This last prevalence is comparable to previously published literature. The CAM-ICU might not be suitable for early detection of delirium in the ED.

In **chapter 8** we used the prospective data of the APOP-study of four hospitals. At arrival to the ED cognitive function was assessed using the 6-CIT, after which we looked at the association between vital signs, as a measure of acute hemodynamic changes, and cognitive impairment. Vital signs that associate with decreased brain perfusion and oxygenation, such as a low systolic and diastolic blood pressure, as well as a low mean arterial pressure, high respiratory rate and low oxygen saturation were associated with cognitive impairment. An association between high levels of creatinine, high levels of urea, low levels of haemoglobin and cognitive impairment was also found. This might partially reflect the association of disease severity with delirium, but may also be caused by acute disturbance of brain perfusion. If a part of cognitive impairment in older ED patients is caused by acute disturbance of brain perfusion and oxygenation, this might mean it could be reversed by optimal resuscitation.

Discussion

As mentioned previously, cognitive impairment is frequently missed in the ED[3]. To prevent cognitive impairment to be underdiagnosed it is important to implement a standard evaluation of cognitive function, in all older patients and using a validated instrument, into daily practice[7]. Although we would like to emphasize that recognizing cognitive impairment in all older ED patients should have the priority, a next step would be to identify patients in whom cognitive impairment might be reversible. In patients with chronic hypoperfusion of the brain, for example in the case of chronic heart failure, it was proven that cognitive function improved when cardiac function did[8, 9]. It is possible this 'heart-brain association' might also be applicable to older patients in the acute setting. Measuring brain perfusion and oxygenation and the effects of optimal resuscitation on cognitive function is a subject which should be further investigated in the future. When cognitive impairment remains existing despite optimal resuscitation it is of great importance to start conservative measures in the ED to prevent or treat delirium. If patients are hospitalised well-trained specialists can make the diagnosis of delirium vs. dementia. An example of a workflow for optimal treatment of older patients with cognitive impairment in the ED can be found in the discussion of this thesis.

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