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Delirium is a risk factor for further cognitive decline in cognitively impaired hip fracture patients☆

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ABSTRACT

Background: Delirium is a risk factor for dementia in cognitively intact patients. Whether an episode of delirium accelerates cognitive decline in patients with known dementia, is less explored.
Methods: This is a prospective follow-up study of 287 hip fracture patients with pre-fracture cognitive impairment. During the hospitalization, the patients were screened daily for delirium using the Confusion Assessment Method. Pre-fracture cognitive impairment was defined as a score of 3.44 or higher on the pre-fracture Informant Questionnaire on Cognitive Decline in the Elderly Short Form (IQCODE-SF). At follow-up after 4–6 months, the caregivers rated cognitive changes emerging after the fracture using the IQCODE-SF, and the patients were tested with the Mini Mental State Examination (MMSE). A sub-group of the patients had a pre-fracture MMSE score which was used to calculate the yearly decline on the MMSE in patients with and without delirium.
Results: 201 of the 287 patients developed delirium in the acute phase. In linear regression analysis, delirium was a significant and independent predictor of a more prominent cognitive decline at follow-up measured by the IQCODE-SF questionnaire ($p = 0.002$). Among patients having a pre-fracture MMSE score, the patients developing delirium had a median (IQR) yearly decline of 2.4 points (1.1–3.9), compared to 1.0 points (0–1.9) in the group without delirium ($p = 0.001$, Mann–Whitney test).
Conclusions: Hip fracture patients with pre-fracture dementia run a higher risk of developing delirium. Delirium superimposed on dementia is a significant predictor of an accelerated further cognitive decline.

1. Introduction

Delirium is a syndrome of acute cognitive impairment, dominated by a fluctuating course, signs of inattention, and reduced orientation to the environment (American Psychiatric Association, 2013). By definition, delirium is a consequence of a general medical condition, and is said to be reversible. In general, the most potent predisposing factors are higher age and known dementia (Inouye, Westendorp, & Saczynski, 2014). Delirium is associated with poor prognosis, and may trigger a decline in cognition (Krogseth, Wyller, Engedal, & Juliebø, 2011; Witlox et al., 2010).

The syndrome of dementia comprises a group of symptoms involving intellectual and social abilities and a change of behaviour to a degree that affects daily functioning (World Health Organization, 2008). Due to an ageing society, the prevalence of dementia is expected to increase over the coming years, and it is estimated that in the year of 2020, 42 million persons worldwide will suffer from

☆ The results have been presented at the 9th Annual Meeting of the European Delirium Association in Cremona, Italy, November 2014.

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dementia (Ferri, Prince, & Brayne, 2005). Patients with dementia are prone to develop delirium and have an elevated risk of hospitalization (Fong, Jones, & Marcantonio, 2012). Despite the high number of patients affected by both delirium and dementia simultaneously, research on delirium superimposed on dementia is sparse.

Recent studies have indicated that delirium superimposed on dementia is associated with accelerated cognitive decline (Fong et al., 2012; Fong, Jones, & Shi, 2009; Davis, Muniz Terrera, & Keage, 2012; Gross, Jones, & Habtemariam, 2012). However, in these studies the diagnoses of delirium were based on chart review only, and structured bedside diagnostics of delirium were missing. The use of chart review alone to identify delirium has limited validity, the positive predictive value being estimated to 39% for the method with the highest sensitivity (Inouye, Leo-Summers, Zhang, Leslie, & Agostini, 2005). Moreover, co-morbid dementia is a major risk factor for misclassification of delirium when using a chart-based method (Inouye et al., 2005). The aim of the current paper was to assess whether an episode of delirium affects further cognitive decline in already cognitively impaired individuals, by using a validated tool for bedside delirium diagnostic.

2. Methods

2.1. Study design

We included hip fracture patients from two cohorts; both with a prospective design. The participants in Cohort 1 were admitted to Oslo University Hospital or to Diakonhjemmet Hospital, both in Oslo, Norway from January 2006 through December 2006. The participants in Cohort 2 were included in the Oslo Orthogeriatric Trial (Wyller, Watne, & Torbergsen, 2012; Watne, Torbergsen, & Conroy, 2014a), and were admitted to Oslo University Hospital between September 2009 and January 2012. The methods of these studies have previously been described (Krogseth et al., 2011; Wyller et al., 2012; Watne et al., 2014a; Juliebø et al., 2009; Krogseth, Wyller, Engedal, & Juliebø, 2014; Watne, Hall, & Molden, 2014b; Juliebo, Krogseth, Skovlund, Engedal, & Wyller, 2010a; Juliebo et al., 2010b).

This is a secondary analysis of data from the two prospective studies, supplied with retrospective data from previous cognitive test-results.

2.2. Participants

Patients acutely admitted for a hip fracture, resulting from a low energy trauma (fall from a height less than 1 m), were eligible for inclusion. Cohort 1 included patients aged 65 and older, while Cohort 2 did not hold any criteria related to age. Terminal illness was an exclusion criterion in both cohorts.

In the acute phase, pre-fracture cognitive impairment was estimated using the Informant Questionnaire on Cognitive Decline in the Elderly, Short Form (IQCODE-SF) (Jorm, 1994), a validated tool developed to acquire proxy information on cognitive changes during the last 10 years and up to 14 days before admission. The time of 14 days before the fracture was chosen to rule out any cognitive changes associated with potential acute illness or exacerbation of chronic illness that in turn led to the fracture. An average score of 3.44 or greater on IQCODE-SF was set as an indicator of pre-fracture cognitive impairment (Jorm, 2004), and hence an inclusion criterion for the current paper.

2.3. Procedures and measurements

In Cohort 1, all assessments during the hospital stay and collection of data were conducted by three research nurses and two researchers. In Cohort 2, the same information was obtained by a third researcher and two research nurses. During the hospital stay, demographic data including age, gender, place of living, and marital status, was collected. In both cohorts, the patients were screened for delirium daily (not weekends) using the Confusion Assessment Method (CAM) (Inouye et al., 1990). CAM is based on the core features of delirium (acute onset, fluctuating course, inattention, disorganized thinking, and altered level of consciousness), and is a recommended tool for bedside detection of delirium (Wong, Holroyd-Leduc, Simel, & Straus, 2010), also in patients with known dementia (Morandi, McCurley, & Vasilevskis, 2012). The delirium screening was accomplished until the fifth postoperative day or until discharge. In patients fulfilling the CAM-criteria for delirium, more than 90% performed the full Memorial Delirium Assessment Scale (MDAS) questionnaire (Breitbart et al., 1997) at least once. The MDAS instrument includes three cognitive tests; a test of orientation, a test of short term memory, and a Digit Span task. On the third post-operative day all patients in Cohort 1 were assessed with the Mini Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) and the clock drawing test (Shulman, 2000).

Based on the patients' medical records, diagnoses on admission and regular use of drugs were registered. We calculated the Charlson Cormorbidity Index (Charlson, Pompei, Ales, & MacKenzie, 1987), a weighted index that takes into account the number and the seriousness of comorbidities. Whether the fracture was acquired indoors was also registered. The caregivers gave information on function in activities of daily living (ADL), using the Barthel ADL Index (Mahoney & Barthel, 1965), based on the patients' level of function 14 days before the fracture. The score of this index range from 0 (completely dependent) to 20 (independent).

2.4. Follow-up

The mean time from the fracture to follow-up was 5.2 months (standard deviation: 1.6). The schedules for the assessments differed slightly between the two cohorts, with time to follow-up being six months in Cohort 1, and four months in Cohort 2. Deceased patients were identified in the National Population Register. All follow-up assessments were performed as home-visits. In Cohort 1, home-visits were done by one researcher. In Cohort 2, the visits were conducted by one of two research nurses.

2.5. Outcomes

To measure any further cognitive decline after the fracture, we used the IQCODE-SF questionnaire. We modified the administration from the original instruction as the caregivers were instructed to compare the cognitive status at follow-up with that of two weeks before the fracture, not by the cognitive status 10 years ago as in the original IQCODE-SF. We have named this questionnaire *the modified IQCODE-SF* throughout the manuscript. At follow-up, a comprehensive cognitive assessment was performed. In both cohorts the MMSE was included among the cognitive tests at follow-up. To further explore the impact of delirium upon cognition in patients with dementia, each patient's medical record was examined regarding any pre-fracture MMSE results. The setting of which the MMSE was performed was registered, and a geriatrician, blinded regarding the delirium status in the acute phase, evaluated whether the tests were valid (MMSE results in which the patient was described as cognitively affected by an acute insult, were considered as not valid). Patients having a valid pre-fracture MMSE score were included in the analysis exploring the effect of delirium upon progression in the MMSE scores.