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Cognitive status following a hip fracture and its association with postoperative mortality and activities of daily living: A prospective comparative study of two prehospital emergency care procedures

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A B S T R A C T

Introduction: Early assessment of hip fracture patients' cognitive function is important for preventing pre- and postoperative complications. The aim of this study was twofold: (1) to assess prehospital cognitive function in hip fracture patients and establish whether cognitive status differs pre- and postoperatively between prehospital fast track care (PFTC) and the traditional emergency department (ED) pathway and (2) whether preoperative cognitive function is associated with postoperative mortality and activities of daily living (ADL) ability.

Methods: Three hundred and ninety one hip fracture patients were prospectively included. The Short Portable Mental Status Questionnaire (SPMSQ) was used prehospital, at the orthopaedic ward and three days postoperatively. ADL was followed up after four months.

Results: No difference in patients' cognitive function was observed between PFTC and ED. Four-month mortality was 37% for patients with dementia, 21% for those with cognitive impairment and 10% for patients without cognitive impariment. Only 26% of patients with dementia and 47% with cognitive impairment had full ADL ability, compared with 70% of patients with intact cognitive function ($p < 0.001$).

Conclusion: PFTC did not influence hip fracture patients' cognitive function. Patients with prehospital cognitive impairment had a poor outcome in terms of mortality and ADL, indicating the need for special care interventions.

Introduction

Patients suffering from hip fracture need early assessment and management of their cognitive function to prevent serious consequences (Han et al., 2010). Prehospital emergency care is the first important step in the clinical pathway of hip fracture patients and prepares patients for hospital care. Since 2005, there has been a registered nurse on the crew of every ambulance in Sweden to provide care at the scene and during transportation that includes various forms of assessment, pain treatment, stabilization of the patient's condition, sending the electrocardiogram (ECG) results to the hospital and providing information about the patient's condition to subsequent caregivers (Suserud and Lundberg, 2016).

Cognitive impairment, such as disturbance in organized thinking, attention, consciousness and memory, affects 13–52% of hospitalized hip fracture patients (Dolan et al., 2000; Soderqvist et al., 2006). Cognitive impairment occurs in both delirium and dementia and it is sometimes difficult to differentiate between these conditions in a physically ill and elderly group of patients (Gruber-Baldini et al., 2003; Yang et al., 2017).

Among hip fracture patients, cognitive impairment increases the risk of severe postoperative complications, longer hospital stay, poor functional recovery and mortality (Holmes and House, 2000; Martocchia et al., 2015; Morrison and Siu, 2000; Soderqvist et al., 2007). After hip fracture surgery, cognitive impairment is associated with an increased need for assistance with activities of daily living (ADL) (Brannstrom et al., 1991) and is also an important predictor of patients' inability to return to their own homes or regain walking and ADL ability (Samuelsson et al., 2009).

Upon arrival at the ED, patients often have to wait several hours for assessment and pain treatment (Hwang et al., 2006). They may be left in corridors and the care environment in the ED can be disorienting, mentally exhausting and stressful, which may influence the patients' cognitive function (Rosen et al., 2015). Patients' cognitive function is often overlooked in the ED because cognitive assessment is not routinely performed (Rosen et al., 2015).

Prehospital fast track care (PFTC) has led to improvements (Turesson et al., 2012; Eriksson et al., 2012; Larsson et al., 2016) as

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pain treatment, oxygen therapy and intravenous fluid substitution begin at the scene of the injury and patients are transported directly to the radiology department and orthopaedic ward instead of via the ED.

Previous studies have described the importance of early medical intervention and rapid admission to the orthopaedic ward for preventing cognitive impairment (Bjorkelund et al., 2010; Larsson and Holgers, 2011). However, knowledge of the association between prehospital emergency care assessment of hip fracture patients' cognitive function and association with functional recovery and mortality is lacking in the literature. It is also unclear whether cognitive status changes in the time between the injury scene and arrival at the orthopaedic department with prehospital fast track care.

To improve the care of hip fracture patients, as well as early identification of conditions that lead to pre- and postoperative complications, more comprehensive assessment of cognitive function in prehospital emergency care are needed, as recommended by several authors (Carpenter and Platts-Mills, 2013; Shah et al., 2009; Shah et al., 2011; Wennberg et al., 2018).

The aim of this study was twofold: (1) to assess prehospital cognitive function in hip fracture patients and establish whether their cognitive status differs pre- and postoperatively between prehospital fast track care (PFTC) and the traditional acute emergency (ED) pathway and; (2) whether preoperative cognitive function is associated with postoperative mortality and ADL ability.

Methods

Study design and setting

This was a secondary analysis of data from a prospective study of hip fracture patients randomized to PFTC or ED conducted between July 2012 and May 2014 at the ambulance service in Region Halland, Sweden. Earlier reported outcomes were: time to radiographic examination and to surgery, postoperative complications, length of hospital stay and mortality (Larsson et al., 2016). At the time of recruitment, the cognitive function of a subgroup of the patients in the study was tested for specific inclusion criteria (see below).

Eligible patients cared for in the ambulance were consecutively invited to participate in the study by an ambulance nurse. All participants received written and oral information from the ambulance nurse, who explained the research project and the differences between the two pathways. Informed consent was obtained by means of a signature. If the participants were unable to give their consent because of dementia or cognitive deficit, a relative could provide consent. Randomization took place at the scene by the ambulance nurses using a closed, opaque envelope. The participants were allocated either to the PFTC (intervention group) or to traditional transport to the ED (control group).

Participants

All patients in the study were treated in accordance with the ambulance service guidelines including pain treatment, oxygen therapy and intravenous liquid substitution. The Rapid Emergency Triage and Treatment System (RETTS) (Widgren and Jourak, 2011) was used to assess each patient's condition and level of priority. Only patients without life-threating conditions were included. This study was approved by the Regional Ethical Review Board in Lund, Sweden (No. 2011/467).

PFTC group

In the PFTC group, the ambulance nurse administered and assessed a 12-Lead ECG and forwarded the results to the hospital database. Blood samples were taken to analyse the plasma glucose level. The ambulance nurse provided the patient with an ID-bracelet and instructed the ED to send a referral for an x-ray to the radiology department. If the ambulance nurse was unsure about the patient's condition (for example, ongoing arrhythmia, wound injury or abnormal plasma glucose level) and whether the patient was suitable for direct transport to radiology department, an orthopaedic surgeon was contacted. The ambulance nurse also informed the orthopaedic ward nurse by phone about the patient's current condition. The patient was transported directly to the radiology department instead of the ED. If the x-ray verified a hip fracture, the patient was immediately transported to the orthopaedic ward for preoperative care. If the x-ray did not verify a hip fracture, the patient was transported to the ED for further assessment and a decision about treatment.

ED group

Patients randomized to the ED group were transported to the ED and the ambulance nurse gave a report of the patient to the admissions nurse. A nurse at the ED gave the patient an ID-bracelet, performed blood tests and an ECG. The patient was placed in an examination room or a corridor, together with other orthopaedic patients, to await examination by the orthopaedic surgeon. After the examination, the patient was moved to the radiology department and then back to the ED to await the treatment decision. Thereafter the patient was admitted to the orthopaedic department.

Inclusion and exclusion

Patients assessed in prehospital care as having a hip fracture that was later verified by x-ray met the inclusion criteria. Patients who had a high level of pain, insufficient hearing or other difficulties that made it impossible for them to answer the questions in the questionnaire were excluded from the cognitive test. Patients suffering from dementia (judged by clinical appearance or a known diagnosis) were placed in a separate group and not screened with the Short Portable Mental Status Questionnaire (SPMSQ).

Questionnaires

The study was conducted using the SPMSQ (Pfeiffer, 1975) and the ADL taxonomy(Sonn et al., 1999). The SPMSQ is a validated instrument for screening cognitive function in different patient populations and consists of 10 questions that take 1–5 min to complete. In the present study the questions were posed verbally. A score of 8–10 correct answers indicates intact cognitive function, 3–7 mild to moderate cognitive dysfunction and 0–2 severe cognitive dysfunction. Intact cognitive function was defined as ≥ 8 correct answers and impaired cognitive function as < 8 correct answers, in accordance with the SPMSQ. The ADL taxonomy was used to examine ADL ability and comprises 12 defined activities: eating and drinking, mobility, going to the toilet, dressing, personal hygiene, grooming, communication, transportation, cooking, shopping, cleaning and washing. The number of actions within each activity varies from 2 to 6 (organized in a logical order from the easiest to the most demanding). The instrument describes the level of full ability to no ability on individual and group levels (Sonn et al., 1999). The focus of the ADL follow-up was mobility, as ability to walk independently is a major goal of care and impaired mobility is associated with increased need for assistance. Mobility is also a simple function that is not dependent on instrumental skills. The ADL taxonomy is defined as targeted mobility of the body from one place to another. The activity comprises: 1) Transfer in bed (i.e., changing position, turning over and sitting up), 2) Transferring the body from bed to chair or between two chairs, 3) Walking or moving from one room to another (on the same floor), 4) Walking or moving from one floor to another, 5) Walking or moving in and out of the house. and 6) Walking or moving in the neighbourhood.

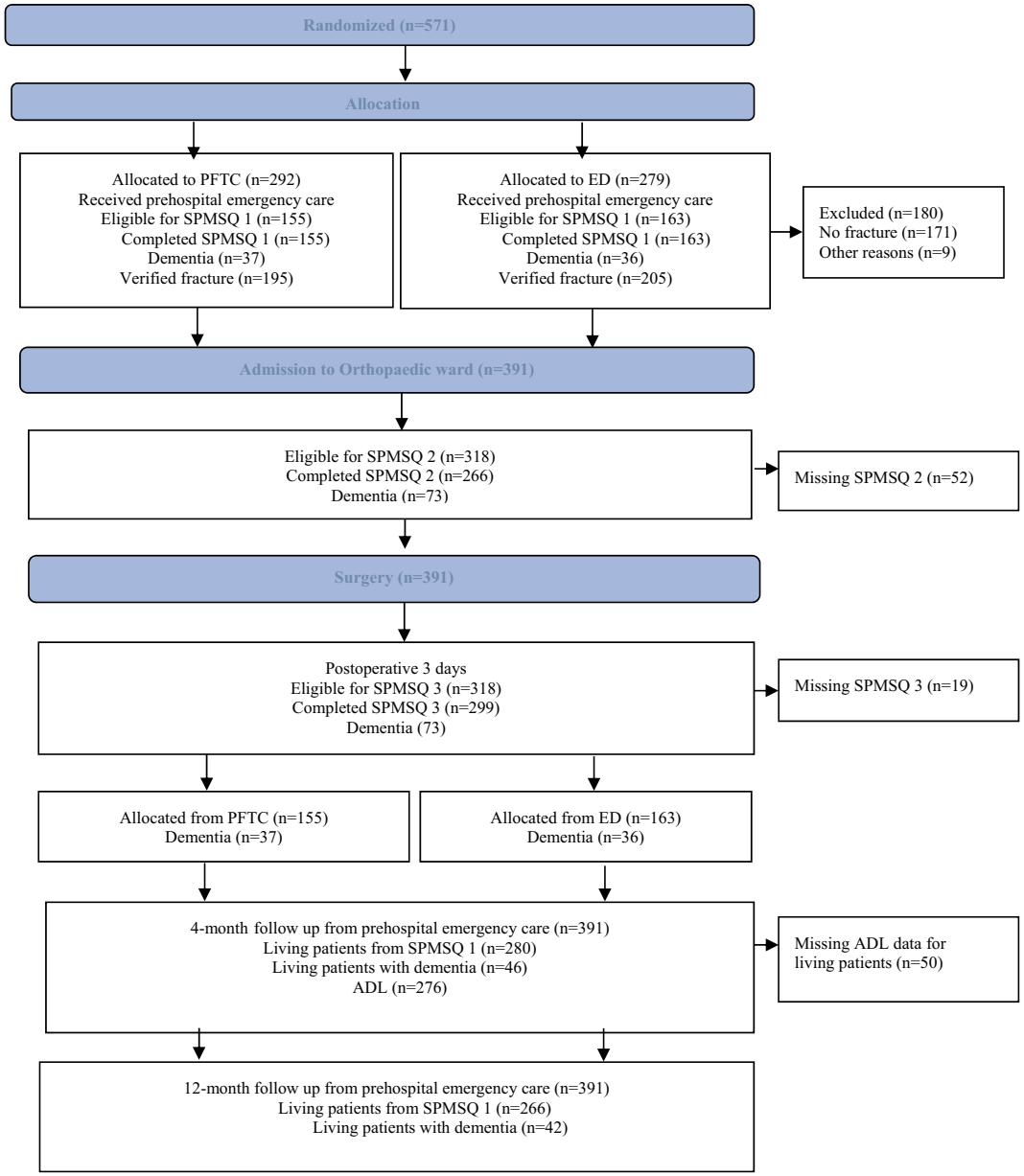

Fig. 1. Flow chart of patients in the study

Data collection

The SPMSQ test was first carried out by the ambulance nurses at the scene, then by nurses at the orthopaedic ward when the patients arrived with a verified fracture and, finally, three days after surgery. The total score of correct answers was documented on a form marked with each patient's ambulance journal number (specific case number) (Fig. 1). Four months after surgery, a designated nurse from the orthopaedic ward interviewed the patients or their relatives by phone and registered each patient's ability in accordance with the ADL taxonomy on a form marked with the patient's ambulance journal number. Data on age, gender, PFTC or transport to ED were collected from the ambulance patient care record. The hospital medical record system provided data on the presence of dementia. Information on mortality after four and 12 months was collected from the Swedish population registry. Data on the patients' ASA (American Society of Anesthesiologists) classification (Owens et al., 1978) and type of residence (“own home” or “other”) were retrieved from The Swedish National Registry of hip fracture patient care (2015).

Statistical analyses

For comparison of outcome data between PFTC and ED, Fisher's exact test was used for binary outcomes (intact or impaired cognitive function) and the chi-square test was employed for comparing individual cognitive function changes over time (unchanged, from intact to impaired and vice versa). The chi-square test was applied when comparing the binary outcomes (mortality) of the prehospital cognitive function assessment (cf+ = cognitively intact; cf- = cognitively impaired; d = dementia) in sub-groups of patients.The Kruskal-Wallis test was employed for ordinal outcomes (ADL). P-values of less than 0.05 were considered significant. IBM SPSS 24.0.0 was used for the statistical analyses.

Results

Prehospital assessment of cognitive function

During the study period, 571 hip fracture patients were randomized

Questionnaire	1. Prehospital emergency care	2. Arrival at Orthopaedic ward	3. Three days postoperatively
1. What day is it today?	Right/Wrong	Right/Wrong	Right/Wrong
2. What day of the week is it?	Right/Wrong	Right/Wrong	Right/Wrong
3. Where are you now?	Right/Wrong	Right/Wrong	Right/Wrong
4. What is your address?	Right/Wrong	Right/Wrong	Right/Wrong
5. How old are you?	Right/Wrong	Right/Wrong	Right/Wrong
6. When were you born?	Right/Wrong	Right/Wrong	Right/Wrong
7. Who is the prime minister now?	Right/Wrong	Right/Wrong	Right/Wrong
8. Who was prime minister before him?	Right/Wrong	Right/Wrong	Right/Wrong
9. What was your mother's maiden name?	Right/Wrong	Right/Wrong	Right/Wrong
10. Subtract 3 from 20 and keep subtracting 3 from each new number, all the way down.	Right/Wrong	Right/Wrong	Right/Wrong
Number of right answers			

Ambulance case number:

Fig. 2. The short portable mental status questionnaire

Table 1
Characteristics and cognitive function (cf) or dementia in prehospital emergency care for patients in the study (n = 391), divided into Prehospital fast track care (PFTC) and Emergency department (ED). (cf+ = intact cognitive function, cf- = impaired cognitive function, d = dementia).

	cf+	cf-	d
PFTC (n)	125	30	37
ED	125	38	36
Men (n)	88	17	24
Women	162	51	49
Age			
mean (year)	82.67	85.45	87.01
Median	84	87	88
Min-Max	51–103	60–103	76–100
ASA (n)			
1–2	159	38	27
3–4	91	30	46
Residence (n)			
Own home	234	47	13
Other	16	21	60

by the ambulance personnel to PFTC or ED. Of these 571 patients, 180 were excluded; 171 because they did not have a hip fracture and 9 for other reasons such as agitation due to pain and impaired hearing that made them unable to complete the SPMSQ (Fig. 2). The patient characteristics are presented in Table 1. Of the included patients, 73 (19%) had apparent dementia and thus did not complete the SPMSQ. Hence 318 patients were assessed by the SPMSQ in prehospital emergency care (155 from PFTC and 163 from ED).

PFTC compared with ED

The two randomized groups of patients did not differ noticeably with respect to cognitive function at the prehospital assessment. In total, 68 patients (21%) were assessed as cognitively impaired and 250 patients (79%) as cognitively intact (Table 1).

Table 2
Cognitive function (cf) outcome using the Short portable mental status questionnaire, (SPMSQ) in prehospital emergency care, after arrival at the Orthopaedic ward, three days post-operatively; and comparison between Prehospital fast track care (PFTC) and the traditional Emergency department (ED) pathway.

	Orthopaedic ward n = 266 (%)		*P* value	3 days post op. n = 291 (%)		*P* value
	Cf+	cf-		Cf+	cf-	
PFTC	105 (77)	31 (23)	1.00[a]	109 (76)	34 (24)	0.25[a]
ED	100 (77)	30 (23)		121 (82)	27 (18)	

[a] Fisher's exact test was used for comparison of cognitive function.

The PFTC and ED groups had similar proportions of cognitively impaired patients (among those assessed with the SPMSQ) on arrival at the orthopaedic ward (23% in the PFTC group and 23% in the ED group, (p = 1.00) (Table 2) as well as three days postoperatively (24% in the PFTC group and 18% in the ED group (p = 0.25) (Table 2).

Changes in individual cognitive function from prehospital emergency care to arrival at the orthopaedic ward were based on SPMSQ data from 255/318 patients (80%). No differences between the groups were observed. In the PFTC group, 2% of patients changed from being cognitively impaired to intact compared with 5% in the ED group, while 7% in the PFTC group shifted from being cognitively intact to impaired compared with 5% in the ED group (p = 0.53). A similar pattern was observed postoperatively, where 5% of the patients in the PFTC group changed from being assessed as cognitively impaired to intact compared with 9% in the ED group, whereas 12% in the PFTC group compared with 6% in the ED group shifted from being cognitively intact to impaired (p = 0.14) (Table 3). The individual cognitive function changes in all patients on the three occasions are summarized in Fig. 3.

Table 3
Changes in individual cognitive status over time (unchanged, from intact to impaired and vice versa) from prehospital emergency care, after arrival at the Orthopaedic ward to three days postoperatively and comparison between Prehospital fast track care (PFTC) and the traditional Emergency department pathway (ED). Complete data from 255 patients who answered the SPMSQ.

	Orthopaedic ward n = 255 (%)			*P* value[a]	3 days post op, n = 255 (%)			*P* value[a]
	intact	impaired	unchanged		intact	impaired	unchanged	
PFTC	3 (2)	9 (7)	117 (91)	0.53	7 (5)	16 (12)	106 (82)	0.14
ED	6 (5)	7 (5)	113 (90)		12 (9)	8 (6)	106 (84)	

[a] Pearson's Chi-Square test was used for comparison of cognitive status.

Association between prehospital cognitive function and mortality

The mortality rate for all patients including those assessed as cognitively intact, impaired and suffering from dementia was 17% after four months and 21% after 12 months. In the group assessed as being cognitively intact in prehospital emergency care, 10% died after four months compared with 21% for cognitively impaired patients and 37% for patients with dementia (p = 0.001; Table 3). The mortality rate after 12 months was 14% for intact patients, 26% for cognitively impaired patients and 42% for patients with dementia (p = 0.001; Table 3).

Association between prehospital cognitive function and ADL

In the group of patients assessed as having intact cognitive function in prehospital emergency care, 70% had full walking ability (category A) when evaluated by means of the ADL taxonomy, compared with 47% of cognitively impaired patients and 26% of patients with dementia (p = 0.001) (Table 4). In general, individuals suffering from dementia had lower ADL ability in all activities compared with other patients. The outcome of all activities using the ADL taxonomy is shown in the supplementary table.

Discussion

The present study shows that PFTC seems to have a minor influence on patients' cognitive changes during the pre- and postoperative phases compared with the ED pathway. The study also reveals that hip fracture patients with cognitive impairment or dementia have a poor outcome in terms of mortality and ADL ability.

Cognitive changes in the PFTC group compared with the ED group

Prehospital fast track care did not influence the patients' cognitive changes during the early pre- and postsurgical phases, compared to traditional ED treatment. To the best of our knowledge, this comparison has not been made before. It could be assumed that receiving pain relief, oxygen and intravenous fluids in the prehospital setting in addition to avoiding a mentally strenuous care environment at the ED would decrease the risk of impaired cognition. However, several mechanisms cause cognitive impairment and different care strategies to prevent and treat cognitive impairment have previously been reported (Martocchia et al., 2015). It is important to observe and treat ongoing infections, constipation, sensory impairment and sleep disturbances (Meehan et al., 2019). Moreover, a review of medications and nutritional status is necessary (Butler Maher, Meehan, Hertz et al., 2012).

Previous non-randomized studies have shown the benefits of rapid admission to an orthopaedic ward for reducing postoperative cognitive impairment (Bjorkelund et al., 2010; Larsson and Holgers, 2011). However, these findings are not supported by our study. More reliable data could be obtained using a randomized design based on a prehospital assessment of cognitive function by means of the SPMSQ.

Occurrence of cognitive impairment

In the SPMSQ assessment in prehospital emergency care, a considerable number of hip fracture patients with cognitive impairment was identified. When adding the patients suffering from dementia, more

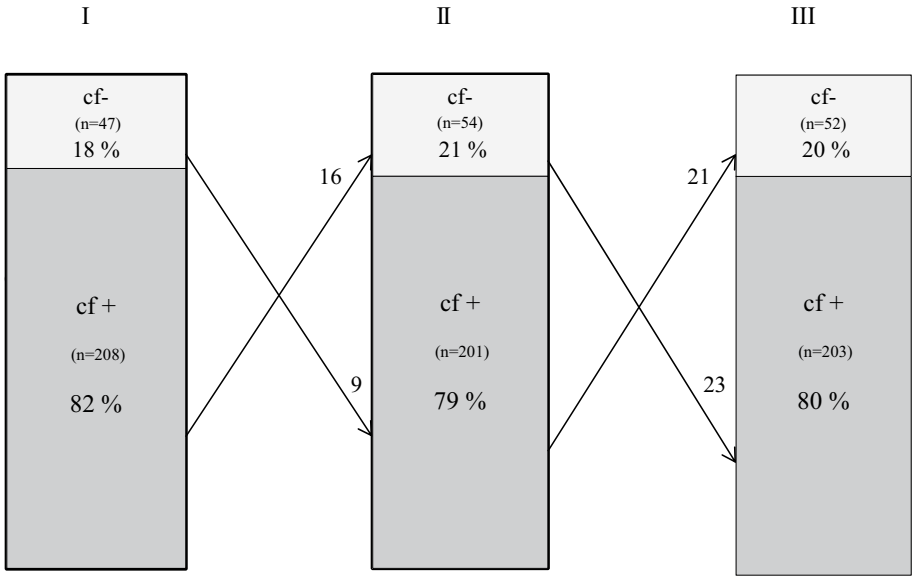

Fig. 3. Changes in cognitive function (cf- = cognitively impaired and cf+ = cognitively intact) of 255 patients who completed SPMSQ on all three occasions, I = prehospital emergency care, II = arrival at orthopaedic ward and III = day three post-surgery.

Table 4
Cognitive function (cf) assessed by the SPMSQ and patients with diagnosed dementia (d) in Prehospital emergency care as well as mortality outcome after 4 and 12 months. Relative frequency distribution of ordered mobility categories based on the ADL taxonomy 4 months postoperatively and compared with cf+, cf- and d.

	Mortality 4 months n = 391 (%)		Mortality 12 months n = 391 (%)		ADL								
						Category (%)							
		P value		*P* value	N	A	B	C	D	E	F	G	Missing[c] (%)	*P* value
cf+	24/250 (9.6)	0.001[a]	34/250 (13.6)	0.001[a]	199	70.3	1.5	7.0	14.5	2.0	2.0	2.5	20.1[c]	0.001[b]
cf-	14/68 (20.6)		18/68 (26.5)		46	47.4	4.0	6.7	19.5	13.1	4.4	6.7	30.4	
d	27/73 (34.2)		31/73 (42.5)		31	25.8	6.5	18.8	6.9	6.7	0.0	35.8	59.1	

[a] Pearson's Chi-Square test was used for comparison of mortality after 4 and 12 months.
[b] The Kruskal Wallis test was applied to compare mobility.
[c] No available patient information.

than one third of the participants were identified at the prehospital stage with a condition that increases the risk of pre- and postoperative complications.

In the subsequent assessments during the early phase of care, half of the patients normalized their cognitive function, but every tenth patient deteriorated. Cognitive fluctuations during hospitalisation between cognitively intact and moderate to mild cognitive impairment have previously been described when using the SPMSQ with non-dementia hip fracture patients (Stromberg et al., 1997). This result is confirmed and strengthened by our findings.

Cognitive function and associations with mortality and ADL

Mortality after four and 12 months was significantly higher for patients with cognitive impairment or dementia compared with cognitively intact patients. An SPMSQ score <8 on admission to an orthopaedic ward is a strong predictor of 4-month mortality (Bjorkelund et al., 2009; Soderqvist et al., 2009) and patients with cognitive impairment have a higher risk of death within 12 months compared with lucid patients on admission after hip fracture (Smith et al., 2014). Consequently, multifactorial care interventions are required to improve outcomes in mortality and ADL for hip fracture patients (Arshi et al., 2018; Chehade et al., 2015; Parker et al., 2018; Prestmo et al., 2015).

Cognitive assessment with a validated instrument in prehospital emergency care can facilitate immediate allocation of cognitively impaired patients to a designated ward. Care provided in a geriatric ward with a multifactorial intervention programme ca improve postoperative cognitive impairment (Lundstrom et al., 2007).

Several authors have described the usefulness of assessment by means of the SPMSQ before surgery for predicting mortality and recovery of ADL ability (Prodovic et al., 2016; Samuelsson et al., 2009). As mobility reflects general function after hip surgery, it is relevant to evaluate this ADL variable (Dyer et al., 2016). Even if the ability to move is reduced before the fracture, it is possible to achieve autonomy after surgery. A previous study outlines the importance of an appropriate rehabilitation process for patients with cognitive impairment (Morghen et al., 2011).

In contrast, many of the patients in the study by Samuelsson et al. (2009) were discharged early and received less instruction about and training in walking from specialists at the hospital compared to patients hospitalized for a longer period. Another study describes poor recovery of ADL and walking ability based on a low SPMSQ score (Corcoles-Jimenez et al., 2015).

Intact cognitive function is a strong predictor of regaining ADL ability after hip fracture surgery (Samuelsson et al., 2009). Our findings indicate poor post-fracture ADL ability in patients with cognitive impairment, but a limitation is the lack of baseline data on walking ability before the fracture.

SPMSQ in prehospital emergency care

Early assessment and documentation in prehospital emergency care and forwarding the information to the next caregiver (i.e. the relevant hospital department) can improve awareness of the individual needs of patients with cognitive impairment and facilitate subsequent care planning (Wennberg et al., 2018).

Several authors (Juliebo et al., 2009; Lap Fung Tsang et al., 2015; Soderqvist et al., 2006; Soderqvist et al., 2007; Stromberg et al., 1999) have recommended the use of a validated instrument. The SPMSQ is a quick, easy, tried-and-tested screening instrument suitable for prehospital emergency care. Ambulance nurses are in a key position, with early close contact with the patient, and could play a crucial role in detecting cognitive impairment. Furthermore, prehospital assessment of patients' cognitive function makes it possible to follow their cognitive status in a coherent care process from the time at which the ambulance arrives until discharge from hospital. Previous studies have reported potential strategies for preventing cognitive dysfunction as well as poor outcomes after surgery in hip fracture patients by means of early nurse-led identification of cognitive impairment (Givens et al., 2008; Milisen et al., 2001).

In addition to other challenges involved in improving patient care following hip fracture, prehospital emergency care is in a transition from transporting patients from one place to another to performing qualified assessments and medical procedures. Assessment of cognitive function contributes to progress in this area by not only focusing on primary injury, but also paying attention to a serious condition that could impede recovery. The present study demonstrates the feasibility of a coherent care process that starts before patients arrive at the hospital and includes a multifactorial care programme based on patients' individual care needs.

Strengths and limitations

To the best of our knowledge, this is the first prehospital emergency care study to assess hip fracture patients' cognitive function using a validated instrument in order to compare PFTC with the traditional ED pathway. It has a randomized and controlled design with cognitive function related to outcome in terms of mortality and ADL. The number of patients included is relatively large, evenly distributed and the patients were prospectively followed. Our results can be transferred to similar ambulance care organizations with direct transport from home to hospital care.

Some limitations should be taken into account. Hip fracture patients are in pain and receive opioids in accordance with prehospital guidelines, which might influence the SPMSQ score, so some patients may have been falsely assessed as cognitively impaired. On the other hand, undertreated pain and inadequate analgesia appear to be a risk factor for cognitive impairment (Morrison et al., 2003). We did not assess cognitive status in patients with known dementia for ethical reasons,

i.e., it seemed inappropriate to ask questions contained in the SPMSQ when it was clear that the patients were disoriented due to dementia. However, SPMSQ assessment of patients with dementia has previously been suggested as a means of identifying and preventing postoperative delirium (Martocchia et al., 2015).

Conclusion

We were unable to find evidence of the influence of PFTC on cognitive function in hip fracture patients. However, the hip fracture patients identified as suffering from cognitive impairment or dementia in prehospital emergency care had poor outcomes in terms of mortality and ADL ability. In order to reduce the risk of mortality and poor ADL ability it is vital to identify patients in need of special care as early as possible on arrival at the hospital. This study highlights the usefulness of including assessment of cognitive function in prehospital emergency care guidelines.

Clinical implications

Patients' cognitive function should be assessed in prehospital emergency care and followed up during the hospital stay.

The SPMSQ is a suitable screening instrument for prehospital emergency care.

Cognitively impaired patients need special care interventions upon arrival at the hospital.

Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest.

Ethics in publishing

The study design and procedures were approved by the Regional Ethical Review Board in Lund, Sweden (Dnr, 2011/467).

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijotn.2019.07.001.

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