Improved functional outcome after hip fracture is associated with duration of rehabilitation, but not with waiting time for rehabilitation

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Improved functional outcome after hip fracture is associated with duration of rehabilitation, but not with waiting time for rehabilitation

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ABSTRACT

INTRODUCTION: The aim of this study was to explore the relationship between "waiting time to onset of municipal rehabilitation", "length of municipal rehabilitation" and the attained level of function four months after the hip fracture.

METHODS: Among a consecutive series of 156 patients, the 116 patients who were recommended a municipal rehabilitation sequence after discharge were included. The exposures were waiting time in days and duration in hours of the municipal rehabilitation. The outcome was lower-extremity functional level as measured with the Short Physical Performance Battery. Effects were assessed with non-parametric gamma coefficients.

RESULTS: The median waiting time to initiation of rehabilitation was ten days. A weak and insignificant correlation was observed between waiting time and outcome at four months, and a statistically significant correlation was recorded between duration of municipal rehabilitation and outcome, also at four months. No marked differences in these results were found when subgrouped by pre-fracture level of function as assessed with the Barthel-20 index.

CONCLUSIONS: Waiting times from hospital discharge to initiation of municipal rehabilitation seems not to correlate with functional level four months after the hip fracture. In contrast, the amount of municipal rehabilitation time does correlate with a better functional level four months after the hip fracture. Furthermore, large-sample studies are warranted to clarify this relationship.

FUNDING: none.

TRIAL REGISTRATION: not relevant.

In Denmark, older people incur approximately 6,700 hip fractures a year [1]. Although the incidence is decreasing [2], the growing population and longer life expectancy lead to the expectation that a growing number of older people will be exposed to hip fracture in the future.

Physical inactivity, e.g. in relation to hospitalisation, increases the risk of functional decline [3]. This underpins the rationale for initiation of post-operative training as early as possible [4].

Functional level is important for older hip fracture patients because limited functioning at discharge is associated with an increased risk of death [5], a lower quality of life [6] and fear of falling, which increases the risk of another fall [7].

In Denmark, responsibility for rehabilitation is divided between Health Regions that hold responsibility for the short, inpatient period (a mean eight-day period, according to Statistics Denmark, 2014), and the municipalities are responsible for the period following discharge. The length and type of municipal rehabilitation depend on an individual assessment and may typically last 2-3 months with rehabilitation sessions twice a week, often administered as a combination of individual and group training sessions [8]. The literature has shown no consistency in terms of the optimal type of rehabilitation or optimal duration of rehabilitation [9-11].

On the basis of the above, it is hypothesised that a shorter waiting time from hospital discharge to initiation of municipal rehabilitation and an extended rehabilitation time in the municipalities correlate with a higher functional level four months after the hip fracture.

Therefore, the aim of this study was to study the relationship in elderly patients between "waiting time to onset of municipal rehabilitation" and "length of municipal rehabilitation" on the one hand, and the attained level of function four months after the hip fracture on the other.

METHODS

Study design, settings and participants

We consecutively included All patients aged 65 years or older, who were acutely admitted and treated for a hip fracture at Odense University Hospital, Svendborg, Denmark, between 1 August 2012 and 30 April 2013 and discharged to one of four local municipalities.

Patients were identified from hospital inpatient records based on their primary International Classification of Diseases (ICD)-10 diagnosis, coded as femoral neck (S72.0), intertrochanteric (S72.1) or subtrochanteric fracture (S72.2), and the surgical procedure coded as either hemi-arthroplastic (KNFB.0-99) or nail fixation (KNFJ.4-9). An extensive quality assurance programme ensured the completeness of this consecutive patient series. Municipal allocation was ensured through direct

ORIGINAL ARTICLE

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FIGURE 1

Flow chart of included participants.

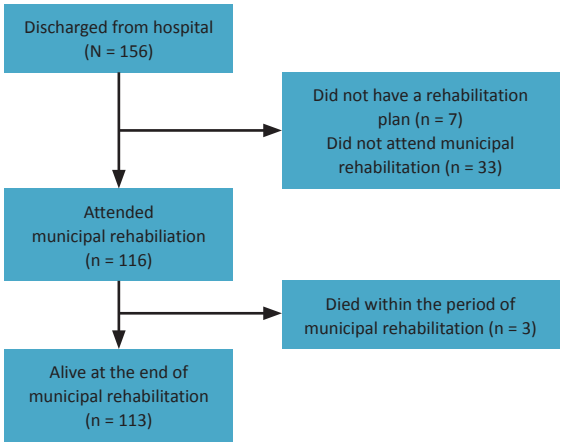
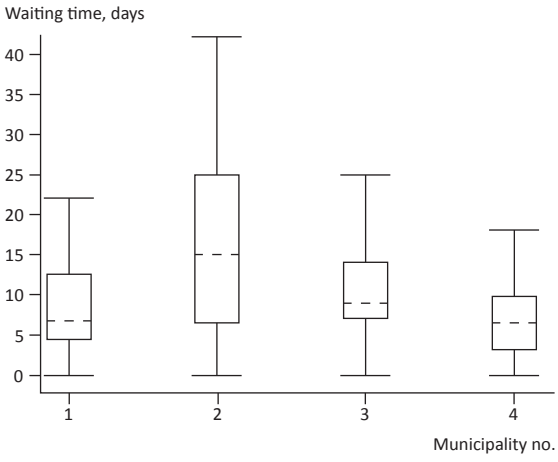


FIGURE 2

Variation in waiting time to initiation of rehabilitation among municipalities shown with box plots[a] (n = 116).



a) Displaying median, interquartile range and max.-min.

collaboration with a responsible contact therapist in each municipality.

All patients received standard treatment and follow-up in addition to the assessments carried out as part of the project, and were informed about the project as recommended by the local ethics committee.

The study was approved by the Danish Data Protection Agency (2008-58-0035).

Definition of exposures

The exposures of this study were the waiting time in days, measured from hospital discharge to initialisation of municipal rehabilitation, and length of municipal rehabilitation measured as hours of therapist-led rehabilitation, regardless of the characteristics of the rehabilitation.

Definition of the outcome

The primary outcome measure was lower-extremity functional level assessed by the Short Physical Performance Battery (SPPB) [12]. The SPPB consists of three different performance-based tests:

1) A balance test. Firstly, the patient stands with his or her feet side-by-side; if this position is held for 10 sec, the score is one point. Secondly, the patient stands with the side of the heel of one foot touching the big toe of the other foot (semi-tandem position); if held for 10 sec, the score is two points. Thirdly, the patient stands with the heel of one foot in front of and touching the toes of the other foot (tandem position); if held for 3 sec, the score is three points, and if held for 10 sec the score is four points.
2) A gait speed test, walking 4 m at usual speed. If time > 8.70 sec: one point. If time is 6.21-8.70 sec: two points. If time is 4.82-6.20 sec: three points. Finally, if time < 4.82 sec: four points.
3) A chair stand test, standing up as quickly as possible five times, without stopping in between. The arms folded across the chest. If the patient is unable to complete five chair stands or completes stands in > 60 sec: zero points. If the chair stand time is ≥ 16.70 sec: one point. If the chair stand time is 13.70-16.69 sec: two points. If the chair stand time is 11.20-13.69 sec: three points. If the chair stand time is ≤ 11.19 sec: four points.

As described, the patient's performance of the tasks is transformed into an ordinal scale ranging 0-4 points for each test, so that higher values represent higher levels of functioning [13].

Data collection

Data regarding date of discharge, length of hospital stay, discharge municipality, age, sex and in-hospital rehabilitation were recorded from the medical records. Dates for the start and end of municipal rehabilitation and its weekly duration (in hours) were reported to the first author (TJP) by the treating therapists. Unfortunately, the reports could not be validated.

TJP assessed the pre-fracture functional level immediately following surgery and assessed the functional level immediately before discharge using the Barthel index (20-point version). If a patient had difficulty giving relevant responses, close relatives or caregivers were contacted to collect sufficient information. SPPB tests four months after the fracture were done in the patients' own homes by TJP and documented in a standard form. All project-specific assessments were conducted separately from the routine recording of patient information in the hospitals or municipalities.

The SPPB scores were missing at four months in six patients because they did not wish to participate.

Statistical analysis

The values for each variable were entered into EpiData version 3.1 and the statistical analyses were performed using EpiData Analysis version 2.2.178. The association between exposures and outcome at four months post fracture is expressed as Goodmann & Kruskals gamma coefficient, with confidence interval (CI) and two-sided p-value. Partial gamma tests (Goodmann & Kruskals gamma) were performed controlling for pre-fracture Barthel-20 level and difference in Barthel-20 pre-fracture to hospital discharge. Variation by municipality is shown with box-plots.

Trial registration: not relevant.

RESULTS

A total of 156 patients were included during the study period (see **Figure 1**). The median inpatient length of stay was ten days (p25: seven days, p75: 12 days and p90: 15 days), and the median duration of inpatient occupational therapist- or physiotherapist-led rehabilitation was 3 h (p25: 1.3 h, p75: 3.5 h and p90: 4.5 h).

Seven patients did not receive a general rehabilitation plan, which means that a rehabilitation plan was sent from the hospital to the municipality for 149 patients. Of these, 33 choose not to participate in municipal rehabilitation, often after meeting with municipal staff. The characteristics relating to participation are shown in **Table 1**. Among the 116 patients who attended municipal rehabilitation, three died before ending planned rehabilitation.

There is a notable disparity between participants and non-participants in relation to mortality, pre-fracture residential status and need for walking aids. The non-participants are a frailer group.

Waiting time to initiation of municipal rehabilitation ranged 0-64 days, median eight days (p25: five days and p75%: 13 days), but with a varied composition between the four municipalities as presented in **Figure 2**.

For those who were alive at four months (n = 113), the duration (in hours) of municipal rehabilitation ranged 0.5-51 h, median 15.0 h, (p25: 7.25 h and p75: 28 h). The rehabilitation sessions were given over a median period of 89 days.

Main results

There was a weak and statistically insignificant correlation between waiting time from hospital discharge to initiation of municipal rehabilitation and lower-extremity functional level at four months measured with all three parts of the SPPB. There was no difference in waiting time in relation to pre-fracture functional level assessed with a Barthel-20 index score (gamma coefficient = –0.14 (95% CI: –0.44-0.15); p = 0.172). There was a strong and statistically significant correlation between the duration of municipal rehabilitation and lower-extremity function at four months for all three SPPB tests. No difference was seen when controlling for pre-fracture Barthel-20 levels. See **Table 2** for details.

Further subgroup analysis controlling for pre-fracture level, functional level at discharge as such and individual difference in functional level at discharge compared with pre-fracture functional level showed only weak association with lower-extremity function four

TABLE 1

Characteristics[a] of the 149 participants who had a rehabilitation plan.

	Municipal rehabilitation	
	attended (N = 116)	did not attend (N = 33)
Sex, n (%)		
Female	88 (76)	23 (70)
Male	28 (24)	10 (30)
Age, yrs, mean (95% confidence interval)	83.2 (81.8-84.5)	84.4 (81.6-87.2)
Dwelling before, n (%)		
Own home	79 (68)	16 (48)
Sheltered home	18 (16)	1 (3)
Nursing home	19 (16)	16 (49)
Walking aids before, n (%)		
Not used	47 (41)	11 (33)
Used	68 (58)	17 (52)
Wheelchair	1 (1)	5 (15)
Mortality, n (%)		
Died within 4 mo.s	3 (3)	13 (39)

a) Data were complete for all parameters.

TABLE 2

Association of waiting time and length of municipal rehabilitation with functional level measured with the Short Physical Performance Battery at four months (n = 107[a]).

	Gamma coefficient (95% CI)	p-value
Waiting time		
Tandem stands	0.09 (–0.06-0.25)	0.121
Gait speed test	0.10 (–0.08-0.27)	0.136
Chair-stand test	0.08 (–0.09-0.25)	0.172
SPPB, combined	0.10 (–0.05-0.24)	0.094
Length of rehabilitation		
Tandem stands	0.31 (0.16-0.47)	0.000
Gait speed test	0.36 (0.21-0.51))	0.000
Chair-stand test	0.39 (0.25-0.53)	0.000
SPPB, combined	0.34 (0.21-0.47)	0.000

CI = confidence interval; SPPB = Short Physical Performance Battery.
a) 6 patients had missing data on SPPB at 4 mo.s as they opted out of the visit.

months after the fracture (gamma coefficient = 0.10 (95% CI: –0.05-0.24); p = 0.094).

DISCUSSION

The surprising result of this study is that there is no significant correlation between waiting times from hospital discharge to initiation of municipal rehabilitation and functional level four months after the hip fracture. The other main result is that the amount of rehabilitation time in municipalities correlates with a better functional level four months after the hip fracture.

The strength of this study is that a consecutive series of patients was followed to the end of the cross-sectorial efforts in the four municipalities. As a consequence of this, the composition of the patient group varies widely in terms of functional level. The large variation could be seen as a weakness, but since few studies cover the complete period, we found it reasonable to accept this weakness since for the main study we looked at mortality [14] and – based on the present study – other studies can be sized appropriately. Lower-extremity function measured with the SPPB was chosen as the sole outcome. We considered including the Barthel index as an activity-oriented outcome as well, but decided to focus on lower-extremity function because hip fracture evidently impacts physical functioning improvements [10]. Furthermore, the SPPB predicts mobility-related disability [13] and has been used as the primary outcome in other studies on the effects of rehabilitation [15, 16].

A few limitations should be considered. Firstly, the final sample size for analysis was rather small which did not allow for detailed confounder control or adjustment by, e.g., cognitive comorbidity. Secondly, it may be a bias that the exposure variables, the waiting time and the length of municipal rehabilitation were based on reports from the treating therapists in the municipalities. There could be an undisclosed trend towards adhering to agreements between the Regional Health Service and the municipalities in terms of lengths of rehabilitation and reported points of time rather than reporting the actual rehabilitation periods.

To avoid bias, we attempted to control for confounding on pre-fracture functional level [17], functional level at discharge and loss of functional ability from pre fracture to discharge, but could not carry this through due to sample size limitations.

The analysis indicates that some municipalities have a longer waiting time and/or a shorter length of rehabilitation. Studies should be initiated focusing on the exposures and outcomes in municipal rehabilitation, or, as mentioned in a cross-sectional questionnaire study [8], national initiatives may be introduced relating to evidence-based cross sectional rehabilitation programmes.

It could be hypothesised that the municipal rehabilitation participants were more physically active during the waiting period than those who did not attend municipal rehabilitation and that their functional level would therefore not have declined markedly. Another possibility is that the variation in actual waiting time was too small to actually show a given effect of waiting with 50% already starting after 8.5 days and only 25% after two weeks. But there is no doubt that the policy of each municipality in relation to the service level provided is a major factor in the area. We did not study such differences, which would have required a completely different design, but these differences need to be studied if we are to fully understand the mechanisms in play.

Even though the frailest citizens may not attend municipal rehabilitation, the results of this study show that the rehabilitation staff in the municipalities can use knowledge about the association between the lower-extremity function at four months and the amount of rehabilitation in the municipality.

Although the initial hypothesis – that waiting time correlates with improvement in functional level after discharge – was not confirmed, further studies aiming to inform municipal rehabilitation planning are needed. It has been shown that a mobility score, a score for a few activities, the diagnosis of dementia plus age categorisation may form homogeneous subgroups according to rehabilitation needs [17]; and in our study, the pre-fracture functional level was shown to correlate significantly with status at four months for all patients regardless of rehabilitation [14]. The same has been shown in other studies [17, 18]. Other possible confounding factors like functional level at discharge [5], pre fracture use of outdoor walking aids [19] and cognitive comorbidity [6, 17] should be considered.

The learning perspective of the complete study [14] combined with the present findings is that a few systematically performed functional assessments may potentially support decisions on rehabilitation needs by categorising the hip fracture patients according to associations with potentially better outcomes. But the study also points out that larger studies are needed to allow evaluation of the consequence of waiting time for rehabilitation. Based on the present findings, waiting time does not seem to be as important as expected. Settlement of this question attracts much political interest at the local and national level in relation to patient expectations and municipal-level establishment of service expectations.

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CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk

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