Effects of Depression, Dementia and Delirium on Activities of Daily Living in Elderly Patients after Discharge

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Abstract

Background The three geriatric conditions, depression, dementia and delirium (3D's), are common among hospitalized older patients and often lead to impairments of activities of daily living. The aim of this study is to explore the impact of depression, dementia and delirium on activities of daily living (ADLs) during and after hospitalization. Methods A prospective cohort study was conducted between 2012 and 2013 in a tertiary medical center in Taiwan. Patients aged 65 years and older admitted to the geriatric ward were invited to this study. Geriatric Depression Scale Short Form, Mini-Mental State and Confusion Assessment Method were used to identify patients with depression, dementia and delirium on admission, respectively. Barthel Index (BI) was used to evaluate patients' functional status on admission, at discharge, 30-day, 90-day and 180-day after discharge. Generalized Estimating Equation was used to calculate the associations between 3 D's and BI. Results One-hundred-and-forty-nine patients were included in this study. Twenty-seven patients (18.1%) had depression, 37 (24.8%) had dementia, and 85 (57.0%) had delirium. There were significant lower BI scores in patients with dementia and delirium compared with those without up to 180 days after discharge, but no difference was seen in the depression group. In general, patients had delirium or dementia had worsening functional status, even though significant magnitude of improvements on BI scores after discharge. Conclusions Depression does not affect patients' ADLs. On the other hand, dementia and delirium can persistently limit patients' physical function. Future care should focus more on dementia and delirium to restore function.

Background

Functional decline, defined as deterioration in self-care skills, is a common and devastating problem for hospitalized elderly patients [1,2]. It is associated with prolonged hospital stay, increased mortality, higher rates of institutionalization, and greater health care expenditure. Recent studies suggested that 34 to 50% of elderly patients experienced functional decline during hospitalization [3,4]. The reasons for decline are often irrelevant to the patients' admission diagnoses, but related to the underlying primary illness or iatrogenic complications during hospitalization [5,6].

Geriatric syndromes are prevalent among older people and have been known to be associated with poor outcomes, such as readmission, increased length of stay, functional decline, hospitalization and mortality [7-10]. The most common geriatric syndromes include malnutrition, incontinence and geriatric psychiatric problems, in particular, depression, dementia and delirium [11]. These geriatric psychiatric problems remain the most challenging diagnoses in the older populations [12]. Furthermore, these syndromes may co-exist, which could lead to diagnostic error and delayed management of adverse outcomes.

Understanding older patients who are at risk of functional decline during hospitalization is necessary before preventive strategies can be developed. In this study, we explore the impact of depression, dementia and delirium on functional trajectory in the hospitalized elder patients.

Materials And Methods

Study Design and Population

A prospective observational cohort study was conducted at National Taiwan University Hospital (NTUH) from March 2012 to October 2013. A total of 132 hospitalized patients were invited to this study. All the participants were evaluated using comprehensive geriatric assessment (CGA) [13,14] by the geriatric interdisciplinary team. Inclusion criteria were hospitalized patients aged 65 years or older, having a BI decline more than ten points within one month before the index hospitalization. Exclusion criteria were patients who were in comatose state, unstable vital signs, ventilator dependent and terminal illness (e.g. multiple organ failure, cancer with or without metastatic lesion). All the patients were provided oral informed consents or written consents by proxies. The research ethic committee at NTUH approved the study (No. 201108057RC).

Data Collection

Assessment of 3Ds

Depression was assessed according to Geriatric Depression Scale Short Form (GDS-SF). Patients who scores more than 5 points are considered depressed [15]. Dementia or cognitive impairment was assessed according to Mini–Mental State Examination (MMSE), a questionnaire to evaluate cognitive function with education adjusted cut-off points [16]. Delirium was evaluated according to Confusion Assessment Method (CAM) [17].

Assessment of Comorbidity and Other Geriatric Problems

Patients who reported having comorbid illnesses such as hypertension, diabetes mellitus, stroke, coronary artery disease, chronic obstructive pulmonary disease, heart failure, atrial fibrillation, hip fracture, and Parkinson's disease were recorded. Charlson Comorbidity Index (CCI) was also used to measure burden of disease [18].

Among other common geriatric problems, number of fall within one year prior to index admission was recorded. Hearing impairment is defined as having communication difficulties because of poor hearing with or without hearing aids. The visual impairment is conceptualized as poor eyesight despite using corrective lens.

Assessment of Functional Status

ADLs (eating, transferring from bed to wheelchair, toileting, bathing, dressing, ambulation, and urination and defecation control) were assessed based on BI [19]. Ascertainment of functional decline is defined as BI decreases more than ten points in one month before admission. BI was also determined on discharge, 30-day, 90-day and 180-day after discharge.

Statistical analysis

Data were reported as number (percentage) for categorical variable and mean (standard deviation) for continuous variables. Group difference was assessed using chi-square or t-test when appropriate. The relationship between the development of ADL independence over time and the type of 3Ds was analyzed using generalized estimating equation (GEE).

The interaction terms of each geriatric condition by time points (using discharge as reference category) were added to the GEE model adjusted with other covariates. The changes in functional status are significantly different for a given subgroup (of a certain geriatric condition) when a significant interaction term appears.

Finally, to investigate the associated factors with functional status over time, GEE was adopted again in which all the patients' characteristics were adjusted. Correction for within-subject correlations were made by an exchangeable form. All the statistical analyses were conducted using SPSS software version 15 (SPSS Inc, Chicago, Illinois). Statistical significance was defined as $P < 0.05$.

Results

Subjects

Table 1 depicts the clinical characteristics of all participants. The mean age was 87.6 years. Among the participants, 80.5% were 81 years or older, 54.4% were female, 60.4% received less than 9 years of education, 46.3% were still married, 10.7% living alone, and 69.8% having their son or daughter as their primary contact person. The most common comorbidities were hypertension (78.5%), stroke (60.8%), diabetes mellitus (39.9%), coronary artery disease (26.4%), and chronic obstructive pulmonary disease (15.5%). On average, each subject had 4 comorbidities and the CCI revealed a score of 4.1.

More than half of the subjects (54.7%) experienced fall in the past years, and 11.5% and 29.1% of the participants had hearing and visual impairments, respectively. On average, each participant took 8.5 prescription drugs per day and the length of hospitalization was 13.8 days (Table 1).

Comparison of functional status among the 3D's patients

Of the 149 participants, 27 (18.1%) had depression, 37 (24.8%) had dementia, and 85 (57.0%) had delirium. The BI scores were similar among patients with or without depression in each time point (T1: 32.0 vs 36.3, P = 0.416; T2: 42.3 vs 50.5, P = 0.207; T3: 56.9 vs 61.1, P = 0.558; T4: 62.9 vs 60.8, p = 0.781) (Table 2). In contrast, patients with dementia or delirium demonstrated lower BI scores than those without the syndromes up to six months after discharge (P < 0.05) (Table 2). Patient in the dementia group has similar discrepancy at T2-T4, while the delirium group demonstrated a decreasing trend in functional gap 30 days after discharge (Table 2, Figure 1A-C). GEE was used to estimate the change in BI scores at various time points. Functional improvement was not obvious in the depression group (T2-T1: 4.8, P = 0.446; T3-T1: 2.12, P = 0.114; T4-T1: 4.24, P = 0.492) (Table 3), whilst a greater magnitude of improvement from 14.7 to 19.59 (T2-T1, T3-T1, T4-T1, all P < 0.05) in functional scores was noted in

dementia and delirium groups (Table 3, Figure 1A-C). One hundred and eighty days after discharge, the BI score in the depression group was similar to those without (62.9 vs 60.8, P = 0.781).

In general, patients with delirium or dementia had worsening functional status, even though greater improvements on BI scores after discharge. Irrespective of depression status, functional status can nearly the same up to six months after discharge.

Discussion

The present study demonstrated that all the geriatric inpatients with functional decline presented with gradual improvements of physical function up to 180 days after discharge. The patients with or without depression had similar BI scores at discharge to 180 days after discharge. However, patients with dementia and delirium had poorer functional status at discharge and the status persisted for at least six months. Elder people are thought to impede functional outcomes especially with more comorbidities, older age or more geriatric syndromes.

The term "geriatric syndromes" contains the features of various conditions in the elder people. The cause of geriatric syndromes is multifactorial, patient-specific and situation-specific, and often leading to subsequent sequela, morbidity and poor outcomes in hospitalized elderly [10,20]. Geriatric psychiatric problems—delirium, dementia, and depression denote the most common presentation and obscure diagnoses for older adults[12]. Each of these syndrome may overlap and exist simultaneously or emerge exclusively in one patient, and affect or confer to the other mutually, and eventually leading to functional decline, institutionalization and even death [12,21].

Old people suffering from one of the geriatric psychiatric problems often have poor ADL outcomes and increasing risk of death. Several studies have developed strategies to predict the outcomes of functional decline or mortality in the elderly [22,23]. Barnes et al proposed a new strategy for prognosis, which can predict the risk of outcomes including functional recovery, dependence and death [24]. McCusker et al investigated the co-occurrence of the delirium, depression and dementia, and found that those without co-occurrence had better outcome [25]. In our study, we stratified functional decline of the hospitalized elder patients on admission and assessed the association between geriatric psychiatric problems and functional change after discharge. The BI scores are inversely related to days after discharge in patients with dementia or delirium, the finding is consistent with previous study [4]. The patients with delirium were too confused to maintain self-care, thus a low BI score were expected. Dementia is a strong risk factor for delirium, and once delirium develops, it can accelerate and worsen physical functions [26,27]. Similar to other studies, our finding also showed that the presence of delirium and dementia was associated with poorer functional recovery after hospitalization [28-30]. Parallel improvements in functional trajectories after discharge among those with or without delirium or dementia were seen (Fig 1A-C).

To overcome the functional gap, patients may need to consider other interventions such as rehabilitations, or as in this study, CGA. CGA is a useful tool that involves interdisciplinary diagnostic

process to identify functional, medical, mental, and socio-environmental complex problems of frail elderly in order to coordinate a proper program to treat and manage for optimal outcome [13,14,20]. CGA is both diagnostic and a therapeutic process. A meta-analysis of randomized controlled trial had shown significant improvement in outcome in older patients who received CGA intervention during hospitalization due to acute illness. The effect is much more prominent in specialized geriatric wards than general ward with geriatric teams [13]. Furthermore, direct communication, highly trained staff and effective interdisciplinary team will implicate the treatment outcome in subspecialized geriatric ward and inpatient stroke care unit [31]. The patient group selected in our study was at high risk because of the old ages (mean age 81.8 years old) and their underlying geriatric problems (more than half had fall incidence in the past years). CGA during hospitalization has effect on decreasing mortality, improvement function, and decreasing placement in nursing homes. The prolong effect after acute illness also reveal good impact, especially in at-risk elderly in the community [32]. Our results disclose that patients' functional status improved regardless of their psychiatric problems, suggesting the effectiveness of CGA.

On the other hand, all depressed patients improved functional outcome post-discharge, suggesting depression is a reversible disease and early intervention is crucial in reversing the functional outcome. Previous researches have highlighted the under diagnosis of depression among the elderly [33]. Although diagnosis is challenging, it is nevertheless potentially treatable morbidity in older people [34-36], clinical practitioner should put efforts on access to appropriate treatment. In our study, the magnitude of ADL improvement in depression or not can reach similar functional status after 180 days discharge. The explanations are first, the awareness of depression by caregiver that helps in coping with depression either in daily activity or taking antidepressant agents. Second, delirium and dementia have greater impact impeding functional status, whilst depression mainly influences mental function but not physical function.

This study has several limitations. First, the sample size was relatively small, thus the confounding variables could not draw a distinct effect on each of the 3D's in terms of functional outcomes. Second, the patients were not evaluated by the same staff every time during CGA, thus differences in reporting data and inconsistency may occur. Reassessed using rigorous research methods with well-trained same staff can provide much more promising results. Third, the definition of each of the 3D's might also be underestimated of the true prevalence in this study. Forth, the population had a substantial loss of follow-up for certain reasons such as rehospitalization may diminish the statistic power in this study.

Whether patients recovering from or maintain ADLs at an optimal state depend largely on careful assessments and plans. It is imperative that elderly patients with geriatric psychiatric condition, especially delirium and dementia should undergo rehabilitation in order to improve physical functioning. CGA should be emphasized during admission in elder people, and the application is suggested effective and crucial during the whole course after discharge. The recovery of functional improvement in delirium or dementia is relatively irreversible when comparing with depression, the magnitude of functional improvement is greater, nevertheless. Hence the intensive work and strategies on modifying delirium or dementia should be put more effort, not only by medical stuff but primary caregiver. Further research is

needed to determine whether intervening on depression in post-hospitalization care can improve functional outcomes. And, if so, whether pharmacologic or non-pharmacologic plan lead to functional recovery. The reinforcement of education of staff and clinical caregiver in management depression is necessary.

CONCLUSION

In conclusion, we highlighted notion on depression for those old hospitalized patients, with adequate management as soon as possible is beneficial on functional recovering after discharge.

Abbreviations

3D's: three geriatric conditions, including depression, dementia and delirium;

ADLs: activities of daily living;

BI: Barthel Index;

CGA: comprehensive geriatric assessment.

Declarations

Ethics Approval and Consent to Participate

The Ethics Committee of National Taiwan University Hospital, Taipei, Taiwan, approved this study (No. 201108057RC). The analysis was performed in accordance with the ethical standards of the hospital. The patient reported in this study provided oral informed consents or written informed consent.

Consent for Publication

Not applicable.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

Competing Interests

The authors have no conflicts of interest to declare.

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Author Contributions

CF Weng and KP Lin: acquisition of subject and data, preparation and analysis of data, preparation of manuscript. AH Tseng: edited the manuscript. FP Lu, JH Chen, CJ Wen, and JH Peng: acquisition of subject and analysis of data. DC Chan: experimental design, analysis of data, final approval of manuscript.

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Tables

Table 1. Characteristics of study sample (N= 149)

Characteristics	N (%)
Sociodemographic	
Age, years, Mean ± SD)	81.8 ± 7.8
< 80	29 (19.5)
81-90	64 (43.0)
> 90	56 (37.5)
Gender	
Male	62 (41.6)
Female	87 (54.4)
Education < 9 years	90 (60.4)
Marital status	
Married	68 (46.3)
Widowed	77 (51.7)
Others	3 (2.0)
Living	
Living alone	16 (10.7)
Living with family	131(87.9)
Others	2 (4.7)
Primary contact person	
self	24 (16.1)
Spouse	21 (14.1)
Children	104 (69.8)
Comorbidity	
Hypertension	117 (78.5)
Diabetes mellitus	59 (39.9)
Stroke	90 (60.8)
CAD	39 (26.4)
COPD	23 (15.5)
Heart failure	22 (14.9)
Atrial fibrillation	21 (14.2)
Malignancy	9 (6.2)
Hip fracture	20 (13.5)
Parkinson's disease	29 (20.0)
No. of comorbidities (Mean ± SD)	4.08 ± 1.78
CCI score (Mean ± SD)	4.10 ± 2.47
Geriatric problems	
Fall incidence in the past year	81 (54.7)
Hearing impairment	17 (11.5)
Visual impairment	43 (29.1)

Geriatric condition	
No. of medications (Mean ± SD)	8.5 ± 4.1
Length of stay, days (Mean ± SD)	13.8 ± 10.2

CAD, coronary artery disease; CCI, Charlson comorbidity index; COPD, chronic obstructive pulmonary disease; LOS, length of stay.

Table 2. Description of Barthel Index score between patients with and without depression, dementia, and delirium (N=149)

Variable	Maximum range	Actual Range	T1 (n = 148)	T2 (n = 137)	T3 (n = 131)	T4 (n = 113)
Depression						
Yes	0–100	0-90	32.0 ± 27.7 (N=27)	42.3 ± 28.6 (N=26)	56.9 ± 32.1 (N=24)	62.9 ± 33.0 (N=22)
No	0–100	0-85	36.3 ± 23.6	50.5 ± 29.6	61.1 ± 31.9	60.8 ± 32.9
P-value			0.416	0.207	0.558	0.781
Dementia						
Yes	0–100	0-70	24.1 ± 18.0 (N=37)	33.3 ± 22.8 (N=37)	44.6 ± 27.6 (N=34)	45.5 ± 29.5 (N=30)
No	0–100	0-90	38.4 ± 25.4	53.4 ± 30.3	64.0 ± 32.9	65.5 ± 32.6
P-value			<0.001	<0.001	0.003	0.004
Delirium						
Yes	0–100	0-80	23.8 ± 19.2 (N=85)	37.9 ± 27.1 (N=80)	50.5 ± 31.4 (N=71)	51.6 ± 32.5 (N=65)
No	0–100	5-90	49.2 ± 22.9	60.5 ± 28.1	68.4 ± 30.1	70.4 ± 31.6
P-value			<0.001	<0.001	0.001	0.002

T1: at discharge. T2: 30 days. T3: 90 days. T4: 180 days.

Table 3. Multivariate GEE model for the Barthel Index score measures at discharge, and 30, 90, and 180 days follow-up (n=149)

Variables	Model for Depression			Model for Dementia			Model for Delirium		
	Beta	SE	*P-value*	Beta	SE	*P*-value	Beta	SE	*P*-value
Constant	4.61	7.38	*0.532*	17.84	6.72	*0.008*	28.77	6.24	*<0.000*
Time (T2-T1)	4.80	6.29	*0.446*	14.70	4.76	*0.002*	18.32	4.40	*<0.000*
Time (T3-T1)	2.12	6.26	*0.114*	15.37	4.87	*0.002*	19.59	4.41	*<0.000*
Time (T4-T1)	4.24	6.18	*0.492*	15.00	4.80	*0.002*	19.48	4.26	*<0.000*

All models had random intercepts.

All time-dependent covariates had a fixed slope.

T1: at discharge; T2: 30 days; T3: 90 days; T4: 180 days.

Beta: non-standardized regression coefficient in multilevel analyses; SE: standard error.

Figures

(A)

(B)

(C)
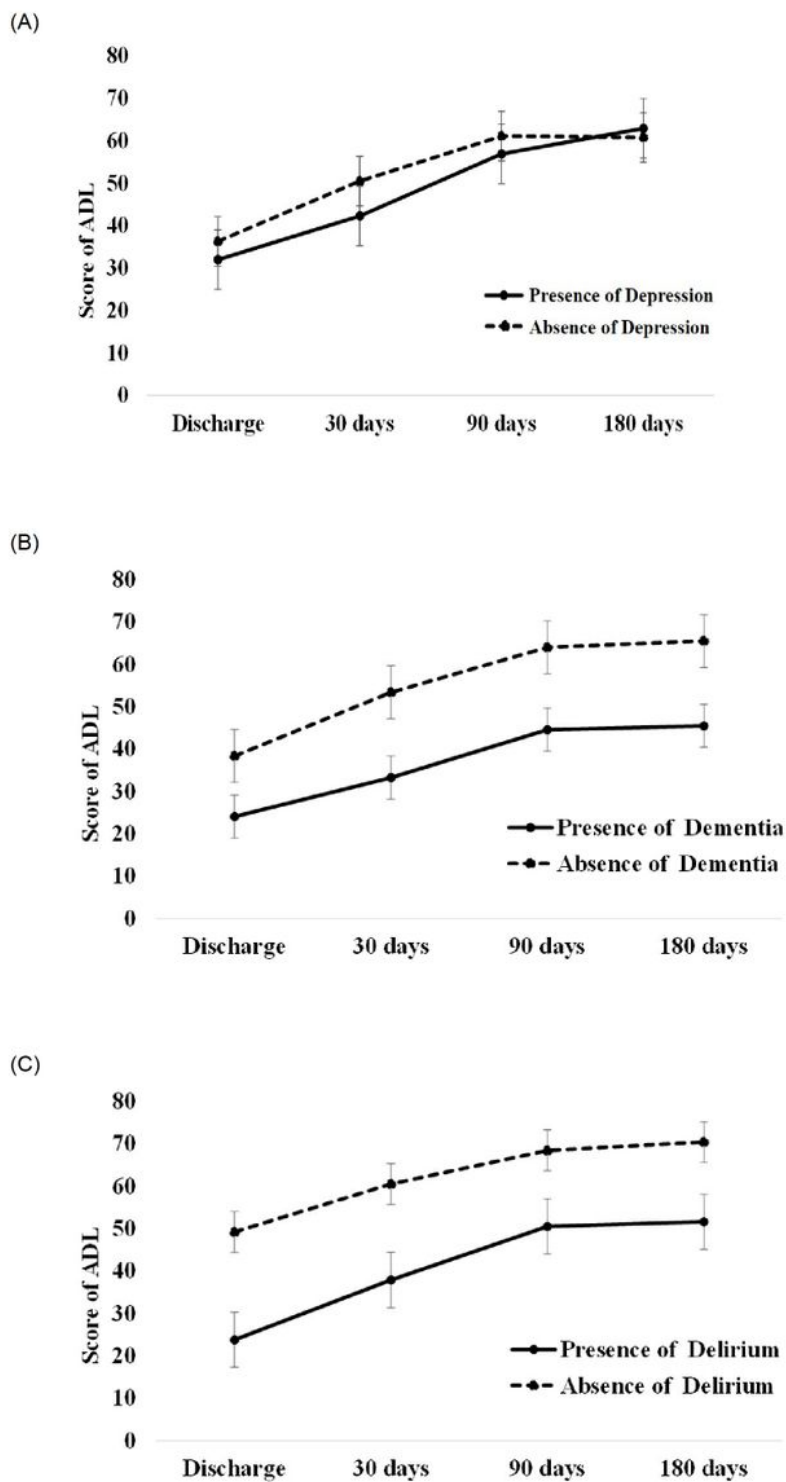
Figure 1

Mean score of ADL over time in the patients with or without (A) depression, (B) dementia, and (C) delirium