Predictors of Hospital length of Stay among Egyptian Elderly

Sherine M.H. El Banouby, Sarah A. Hamza, Samia A. Abdul-Rahman and Ahmed K. Mortagy

[1]Department of Geriatrics and Gerontology, Faculty of Medicine, Ain Shams University.
sa1382001@hotmail.com

Abstract: Background: With the demographic changes, older people are admitted to hospitals. Longer hospital length of stay (LOS) has been described among this population resulting in adverse outcomes and increased health costs. To avoid such adverse outcomes, risk factors of prolonged LOS must be identified and managed. **Subjects and methods**: A prospective cohort study enrolling 205 elderly patients admitted to inpatient ward of Ain Shams University Hospitals. All patients were assessed both on admission and discharge using comprehensive geriatric assessment and laboratory investigations [total proteins, albumin, total cholesterol, Sodium (Na), Potassium (K), erythrocyte sedimentation rate (ESR)]. LOS was also calculated. **Results**: LOS was significantly higher in females ($p < 0.05$), age older than 67 years ($p < 0.01$), participates who experienced intensive care unit (ICU) admission ($p < 0.01$) and patients admitted due to neurological disease and multiple medical problems ($p < 0.01$). Significant negative correlation with serum total protein, albumin, cholesterol, sodium, and potassium ($p < 0.01$) were reported. There was a significant negative correlation between LOS and mental functions ($p < 0.01$). Patients who experienced deterioration in function had significant higher LOS than those had stationary functional capacity ($P < 0.01$). Deterioration in total proteins, albumin, cholesterol and sodium are significantly associated with LOS. **Conclusion**: Advanced age, female sex, number of previous hospitalizations, complications or ICU admission during hospitalization, patients admitted with neurological or multiple causes, patients admitted in geriatric department, patients with cognitive or functional impairment, and malnourished patients, all are at risk factors for prolonged LOS.

1.Introduction:

With the demographic and epidemiological changes, an increasing number of older subjects are admitted to hospital. These patients are at increased risk of adverse health outcomes, including functional decline, increased length of stay, institutionalization, geriatric syndromes, hospital readmissions and death [1]. Patients in geriatric wards generally have a long length of stay (LOS) and reducing that time is one way of reducing medical costs. In addition; long hospitalization may result in further medical and functional problems [2]. The patient's disease alone or, in conjunction with social segregation, psychological factors, economic status, lack of medical awareness are considered risk factors for the development of a prolonged hospital stay, malnutrition, morbidity, mortality, and increased hospital costs [3].

Unfortunately, few hospitalist groups have specific programs or protocols to address the special needs of older patients [4].

The role of comorbidities and complications in inpatient medicine has been an intense area of investigation, because of their impact on resource use, mortality, length of hospital stay, functional status, quality of life, and delivery of health care in elderly patients [5].

The aim of this study is to identify the factors that are associated with prolonged hospital stay in Egyptian elderly patients.

2.Subjects and methods:

A prospective cohort study was conducted in the different departments of Ain Shams University Hospitals in the period between March 2012 and March 2013 after approval by Ain Shams University Ethical committee. It included 205 elderly patients 60 years and above, both males and females who were admitted to Ain Shams University hospitals after obtaining their informed consent.

Participants were assessed within 48 hours of their admission and then reassessment before discharge was done.

All participants were subjected – at the 2 stages of assessment- to comprehensive geriatric assessment with special consideration to; nutrition assessment using Mini Nutritional Assessment (MNA) [6], functional assessment assessed by basic activities of daily living (ADL) [7] and Instrumental activities of daily living (IADL) [8]. Cognitive assessment was also performed using Arabic version [9] of the

original Mini Mental State Examination (MMSE) [10].

Laboratory tests for each participant including; total proteins, albumin, total cholesterol, Sodium (Na), Potassium (K), erythrocyte sedimentation rate (ESR), all measured in serum at both stages.

N.B. All laboratory measures were performed in the central laboratories of Ain Shams University hospitals.

At the end, length of hospital stay (LOS) was calculated from day of admission to day of discharge.

The data was collected, coded and entered to a personal and analyzed with the program (SPSS) statistical package for social science under windows version 15.0. Then the following tests were used; Student t test, Pearson Correlation coefficient (r) test, one way Analysis of variance (ANOVA) test and Linear Regression.

3.Results:

The study population comprises 109 males (53%) and 96 females (46.8%) with mean age 67.2 ± 4 years.

Table (1) describes the sample as regards education level, marital status, smoking, living arrangement and care-giver education. Causes of admission were either due to infection or medical problems concerning cardiac, respiratory, hepatic, renal or neurological systems with percentage of (9.3%, 18%, 14.1%, 12.2%, 8.3 & 12.2% respectively) but admission due multiple medical problems (22%) was the most prevalent.

Most patients (62%) were admitted from the outpatient clinic, while 32.2% were admitted from emergency department and 8% were transferred from intensive care unit (ICU).

26.3% develop complications during their hospital stay. As for previous hospitalization; 24.4% had no previous hospitalization, 21.5% had history of a single hospitalization, 26.3% gave history of hospitalization twice before that time and 27.8 % were hospitalized more than twice.

On admission, 50.7% of patients were independent as regards ADL, 44.9% were assisted and 4.4% were dependent. As for IADL, the percentages were 38%, 37.1% and 24.9% respectively. Nutritional assessment revealed that 26.8% were at risk to develop malnutrition while 5.4% were already suffering from malnutrition (diagnosed using MNA).

Table (2) presents the changes that occurred in the functional, nutritional and mental status during the current hospital stay (assessed in the 2nd stage). While, comparing the changes in laboratory parameters on admission and on discharge are demonstrated in (Table 3).

Among the study population, the mean hospital stay was 10.1 days with ranged between 6- 25 days.

Table (1): Distribution of education, marital status, living arrangement and education of care giver of studied patients

N=205	No.	%
Education		
Illiterate	90	**43.9**
Read write	64	31.2
Primary to secondary	50	24.4
University	1	0.5
Marital status		
Married	109	**53.2**
Widow	93	45.5
Single	3	1.5
Smoking		
Non smokers	95	46.3
Smokers	110	53.7
Living arrangement		
Spouse	99	**48.3**
Son or daughter	87	42.4
Brother or sister	9	4.4
Paid caregiver	2	1.0
Alone	8	3.9
Caregiver educ.		
Illiterate	75	**38.1**
Read write	37	18.8
School	71	36.0
University	14	7.1

LOS was significantly higher in females ($p < 0.05$), age older than 67 years ($p < 0.01$), smokers ($p < 0.05$), patients admitted from ICU ($p < 0.01$) and those living with offspring ($p < 0.05$).

LOS was also significantly higher among patients admitted to the Geriatric department ($p < 0.01$), Participates who experienced ICU admission ($p < 0.01$) and patients admitted due to neurological disease and multiple medical problems ($p < 0.01$).

Correlating LOS with laboratory parameters revealed significant negative correlation with serum total protein, albumin, cholesterol, sodium, ad potassium ($p < 0.01$). There was also a significant negative correlation between LOS and MMSE score ($p < 0.01$).

Again, LOS was significantly more among participants dependent in ADL and IADL on admission (mean LOS = 13.5 ± 4.3, 15.2 ± 6.6 days respectively) than those without dependency (8.5 ± 2.2, 8.3 ± 2.1) ($P < 0.01$ for both). Patients experienced deterioration in ADL had significant higher LOS (12.2 ± 4.6 days) versus 9 ± 2.6 days in those had stationary ADL ($P < 0.01$). Similarly those had deteriorated MMSE had significantly higher LOS (12 ± 3.9 days) versus 9.6 ± 3.7 in patients had stationary MMSE and 10.8 ± 3.3 days in those had improved MMSE ($p < 0.01$).

Deterioration in total proteins, albumin, cholesterol and sodium are significantly associated with LOS (*P* = 0.009, 0.04, 0.01, 0.00 respectively). Malnourished participants had mean LOS = 16.7±5.4 days while normal participants and those at risk of malnutrition had mean LOS 8.9± 2.3 & 11.9±4.2 days respectively (*P* <0.01)

Table (4) present the linear regression model between length of hospital stay and studied parameters and revealed that age, sex, education, IADL, MNA and cholesterol level are independent risk factors.

Table (2): Functional, nutritional and mental assessment on discharge

N=205	No.	%
ADL		
Stationary	136	66.3
Deteriorated	68	33.2
Improved	1	0.5
IADL		
Stationary	88	42.9
Deteriorated	117	57.1
Improved	0	0
MMSE		
Stationary	143	69.8
Deteriorated	21	10.2
improved	41	20.0
MNA is stationary in all patients		

Table (3): Descriptive statistics of the lab parameters on discharge

Lab parameters	No.	%
Total proteins		
Stationary	142	69.3
Deteriorated	54	26.3
Improved	9	4.4
Albumin		
Stationary	146	71.2
Deteriorated	47	22.9
Improved	12	5.9
Cholesterol		
Stationary	149	72.7
Deteriorated	16	7.8
Improved	40	19.5
Sodium		
Stationary	145	70.7
Deteriorated	27	13.2
Improved	33	16.1
Potassium		
Stationary	128	62.4
Deteriorated	23	11.2
Improved	54	26.3
ESR		
Stationary	184	89.8
Deteriorated	1	5
Improved	20	9.8

Table (4): Linear regression model between length of stay in days and studied parameters

Variable	B coefficient	T	*P*	95% CI
Age	**0.150**	**2.2**	**0.02***	**0.01-0.2**
Sex	**-0.139**	**2.1**	**0.03***	**-2.0- -0.1**
Marital status	0.10	1.5	0.1	
Education	**-0.2**	**3.4**	**0.001****	**-2.4- -0.6**
Number of previous hospitalization	0.03	0.5	0.5	
MMSE	0.7	1.1	0.2	
ADL	1.1	1.8	0.06	
IADL	**1.18**	**2.5**	**0.01***	**0.2-2.1**
MNA	**1.5**	**3.2**	**0.001****	**0.5-2.3**
Total proteins	0.3	1.5	0.1	
albumin	-0.8	1.9	0.05	
Cholesterol	**-0.2**	**2.7**	**0.007****	**0.02-0.004**
Na	-0.01	0.1	0.8	
K	0.25	0.8	0.3	
ESR	0.01	0.3	0.7	

* *P* <0.05=significant ***P* <0.01=highly significant

4.Discussion:

This study examined different predictors that might lead to prolonged hospital LOS and we found that advanced age, sex, marital status, education, number of previous hospitalizations, complications or ICU admission during hospitalization, patients admitted with neurological or multiple causes, patients admitted in geriatric department, patients with cognitive or functional impairment, and malnourished patients, all are at risk factors for prolonged LOS.

Most research on LOS addresses the problem in specific groups like those admitted with specific medical conditions [11], and post-operative patients [12] but very scarce research addressed it generally like [13]. But they mostly found similar risk factors for prolonged LOS including age, those admitted from nursing homes or admitted to ICU and those with functional dependency.

One interesting finding is the longer LOS in the Geriatric wards which was never seen in literature. This could be explained by the fact that Geriatric wards unlike other medical wards require a comprehensive geriatric assessment followed by a comprehensive plan for not only the improvement of the acute medical condition but also control of other problems on social, mental, and physical functions of these patients.

Several studies have described deterioration of patients' function during hospitalization. Lafont and

colleagues stated that between 30% and 60% of hospitalized elderly experience functional decline in ADL resulting in loss of independence [14]. Several observational longitudinal studies found that many hospitalized elderly develop new ADL disability that range from 6.7-30% [15-16]. In this study, 66.3% of patients had stationary ADL, 33.2% experienced deteriorated ADL and only 0.5% showed improvement. As regard IADL on discharge, 42.9% stayed stationary, 57.1% deteriorated and 0% improved.

There is not much research that considered whether baseline functional state has an influence on hospital LOS or not. Only one study that directly examined this relation, and found that baseline function is the most significant predictor of the LOS [17] and another that found baseline functional to have no influence on hospital LOS [2].

Our study found that LOS was significantly longer among those dependent in ADL and IADL at baseline (mean LOS = 13.5 ± 4.3, 15.2 ± 6.6 days respectively) than those without dependency (8.5 ± 2.2, 8.3 ± 2.1) ($p<0.01$ for both).

Unfortunately, the effect of cognitive impairment on LOS has not been addressed much in literature despite its importance. Of the few work addressing this issue is the study of Kato and colleagues who found that cognitive state on admission was the most important factor in determining LOS when compared to other factors such as socio-demograhic variables or clinical diagnosis [18]. On the contrary, Umegaki and colleagues in 2003 found no significant relation between total MMSE score or individual items with LOS [2].

In the current study we found that those with cognitive impairment have longer LOS and that relation was highly significant.

Most research on the relation between nutritional status and LOS describe an inverse relation in which poorer nutrition is associated with longer LOS [19-21]. The current study as well found a strong relation between poor nutritional state (assessed using MNA, total proteins, albumin and cholesterol) on admission and longer LOS.

Conclusion:

Patients admitted with neurological or multiple causes, patients admitted in geriatric department, patients with cognitive or functional impairment, and malnourished patients, all are at risk factors for prolonged LOS.

Corresponding author:
Samia A. Abdul-Rahman
Address: Ain Shams University Hospitals, Geriatrics and Gerontology department, Emtedad Ramsis st., Cairo, Egypt.
Email: sa1382001@hotmail.com

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