

ORIGINAL ARTICLE

Epidemiologic pattern of falls among inpatients in Ain Shams University Hospitals in Cairo, Egypt

I.M. BAKR, K.M. ABD ELAZIZ, M.M. ELGAAFARY, S.K. KANDIL, H.I. FAHIM

Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Key words

Falls • Inpatient • Epidemiology • Incidence density • Risk factors

Summary

Background. Patient falls and injuries during hospitalization is a good quality indicator of safety of inpatients. Data on inpatients falls are deficient in Egyptian hospitals. Ain Shams university hospitals do not have any recording system for falls.

Aim. This study aimed at estimating the incidence density of falls and describing pattern and risk factors contributing to falls in Ain shams university hospitals.

Subjects and methods. A prospective follow up study was conducted on inpatients admitted to Ain Shams university hospitals. Patients were followed up for a maximum of two weeks for the occurrence of fall. An interview questionnaire addressed to in-patients was designed to investigate the incident of fall. Type of fall, provisional cause, consequences, night or day timing of fall, walking condition in hospital and past history of fall were among the factors investigated in the

incident of fall. Questionnaire assessing the basic and instrumental daily activities for the elderly (≥ 60 years) was completed.

Results. 1779 patients were included in the study in eight different wards with a mean age of 41.8 years. The incidence density of falls was 9 per 1000 patient days. Logistic regression analysis identified male gender, walking difficulties in-hospital and history of falls before hospitalization as independent risk factors for falls among below 60 years patients.

Conclusion. Incidence of falls is relatively high among the studied university hospitals. Identified risk factors differed among adults compared to elderly.

Recommendations. Measuring, monitoring and assessing fall rates are strongly recommended using a valid and reliable tool to improve quality of health services.

Introduction

Falls are the most common reported safety incidents and a good quality indicators of hospital inpatients [1, 2]. A fall is often defined as “inadvertently coming to rest on the ground floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects” [3].

Falls among hospital inpatients are common, generally ranging from 3 to 14 per 1000 patient-days, resulting in 31.1% low harm, 3.6% moderate harm and 0.6% severe harm. They cause physical and psychological harm and are associated with impaired rehabilitation, increased length of stay and excess cost [1].

The majority of inpatient falls studied is retrospective and rely solely on data from medical records or incident reports. Information from risk management databases is often incomplete and may not identify potential causal factors for falls [4].

Despite the presence of strong evidence that falls are preventable, they still remain a major cause of morbidity in hospitalized elderly patients [5] with scarcity of evidence for successful preventive strategies [6].

Prospective and intensive examinations of patients who fall and circumstances surrounding falls are required to gain a full understanding of the epidemiology of hospital falls [4], specifically in Egyptian hospitals.

The aim of the following work is to estimate the incidence of falls during hospital stay in different wards in Ain Shams University Hospitals and to describe its pattern identifying the contributing risk factors.

Subjects and methods

A prospective follow up study design was conducted in Ain Shams University hospitals from January till March 2009.

A sample size of 1700 participants was sufficient to elucidate an incidence of 9 to 11 per 1000 person-days at 0.05 alpha error and 0.80 power of the test.

An interview questionnaire was developed and validated through a pilot study on 20 inpatients. It included socio-demographic data, clinical data about main reason of hospital admission, chronic illness, visual and hearing impairment, walking problems as articular disease, neurological diseases, nocturnal urination and use of walking aids and the presence of a companion during hospitalization, circumstances of the fall incident in terms site (in room, bathroom, corridor, on stairs) timing (night or day timing of fall), hospital stay day, type, provisional cause of fall from the patient point of view (drowsiness, slippery surfaces, darkness) consequences of fall (contusion, injury, fracture, loss of consciousness), walking

condition in hospital and past history of fall, basic [7] and instrumental daily activities [8] for the elderly (≥ 60 years). Different activities were asked whether done without assistance or with partial or complete assistance. A total score ≤ 9 is considered dependent in the basic activity scale (Total score = 12) while a score ≤ 12 is considered dependent in instrumental daily activities (Total score = 16).

An informed consent was obtained from the participants explaining the aim and the importance of the study. The study was approved by Ain Shams University Ethical Committee.

Newly admitted patients were followed for a maximum of 2 weeks, depending on previous studies identifying the median duration of hospital stay as 14 days. Different wards were visited on alternate days of the week to record incidence of falls. Patients admitted before collection of data were asked retrospectively about incidence of falls during their previous hospital stay days that were ranging between 1 to 2 weeks. Patients who refused to participate or are comatosed were excluded from the study.

Data was revised for completeness and consistency and analyzed using SPSS program version 16.0 and STATA 10.0. Univariate analysis (chi-square and Mann Whitney test of significance). Logistic regression analysis was performed on elder and adults groups to identify predictor of falls. All variables at 0.10 significance level were submitted for prediction model generation.

Results

The study included 1779 inpatients. Their mean age was 41.8 ± 17.1 . Most of the study group were married (78.2%) and have children (77.9%). Females constitutes 58% of the study group, and 34.6% were illiterate. Most of the study group lives in urban areas in Egypt (76.6%). 46.6% of the study group were housewives, 16.2% had skilled occupations and 16.2% do not work. The median length of stay of the observed inpatients was 8.0 days.

The incidence density of falls was 9 per thousand patient days being higher in elderly and in the ophthalmology department (Tab. I).

Most of fallers, fell once (73.5%) 37.3% and 24.7% of falls occurred inside their rooms and in the bathroom respectively, mostly in the form of sliding (27.1%) (Tab. II).

Males (11%) and elderly (≥ 60 years and above) (11.8%) fell at a higher rate than females (8.1%)

and younger age groups (8.8%). The difference was statistically significant for the gender only ($P = 0.04$). Also inpatients in the geriatric departments fell at a higher rate (20.4%) than inpatients in other departments and the difference was statistically significant ($P = 0.005$) (Tab. III).

Patients suffering from chronic diseases (11.2%) and report medical treatment as a cause of hospital admission (13.4%) and those with visual problems (11.6%) showed a higher rate of falling than non-chronically ill (8%) ($p < 0.05$).

Inpatients with walking problem (14%) due to neurological causes (21.8%) and using walking aids (14.4%) fell at a higher rate than those without no walking problems (6.8%), having other causes than neurological causes and not using walking aids (8.2%) ($p < 0.05$).

Patients suffering urine incontinence (14.7%) and nocturnal urination (11.5%) fell at a higher rate than those who did not suffer from either problem (8.1% and 6.7%, $P = 0.000$ and $P = 0.001$ respectively).

Inpatients recalling a history of falls before hospital admission (16%) experienced falling at a higher rate than those with negative history for falling (6.4%)

Tab. I. Incidence density of falls in the studied patients, those above and below 60 years and in the different departments of the hospital.

	Total hospital stay Days	Number of falls	Incidence density (per thousand)
All patients	24777	223	9.0
< 60 years	22276	194	8.7
≥ 60 years	2501	29	11.5
Departments			
Internal medicine	6001	66	10.9
Surgery	7878	50	6.3
Gyn and Obstetric	5740	47	8.1
ENT	1108	16	14.0
Ophthalmology	774	13	16.0
Geriatric	807	12	14.0
Neurology	1141	8	7.0
Neurosurgery	1328	11	8.0

Tab. II. Description of falls among the study group N = 166.

Category	No (%)	Category	No (%)
Number of Falls		Cause of falling	
Once	122 (73.5)	Don't know	25 (15.1)
Twice	24 (14.5)	Dizziness	88 (53.0)
Thrice or more	20 (12.0)	Slippery floors	18 (10.8)
		More than one cause	35 (21.1)
Site of fall		Results of falling	
Inside the room	62 (37.3)	Nothing	62 (37.3)
Outside the room	24 (14.5)	Contusion / haematoma	55 (33.1)
In the bathroom	41 (24.7)	Wound	13 (7.8)
On the stairs	14 (8.4)	Fracture	1 (0.6)
Others*	13 (7.8)	Loss of consciousness	32 (19.3)
More than one place	12 (7.2)	More than one result	3 (1.8)
Time of falling		How did he/she fall?	
Day	74 (44.6)	From the bed	28 (16.9)
Night	92 (55.4)	Sliding	45 (27.1)
		Slipping	53 (31.9)
		Syncope	40 (24.1)

Patients that have fallen during hospital stay were 166 (9.3%); * 7 patients fell in the examination room, 2 patients in delivery room and 4 patients in the X-Ray room.

($P < 0.001$). The highest odds ratio in the studied risk factors was having a walking problems and experiencing previous falls before hospital admission (Tab. IV).

Fallers reported a longer hospital stay than non fallers. Impaired basic and Instrumental daily activities score was reported by elderly fallers than non fallers and the difference was statistically significant. (Tab. V). Dependency in basic and instrumental daily activities in relation to falling among the elderly are shown in Figures 1 and 2.

History of previous falls before hospital admission and admission due to medical condition had the highest odds ratio among those less and above 60 years respectively in the backward logistic regression model (Tabs. VI-VII).

Factors entered in the model are gender, duration of hospital stay, presence of DM, presence of hypertension, presence of visual problems, incontinence, walking difficulties inside hospital, admission due to medical reasons, walking problems, falls before entry, hearing problems, basic and instrumental daily activities.

Tab. III. Socio-demographic factors in relation to falls among the study group.

Socio-demographic factors	Fall during hospital stay		OR (95% CI)	P value
	Yes No (%)	No No (%)		
Gender			1.39 (1.0-1.94)	0.04
Female	84 (8.1)	947 (91.9)		
Male	82 (11)	666 (89)		
Social status				0.48
Married	122 (8.8)	1266 (91.2)		
Separated/divorced	5 (15.2)	28 (84.8)		
Widowed	16 (11.7)	121 (88.3)		
Single	23 (10.4)	198 (89.6)		
Age			1.40 (0.9-2.08)	0.08
< 60	128 (8.8)	1330 (91.2)		
≥60	38 (11.8)	283 (88.2)		
Education				0.709
Illiterate	57 (9.3)	558 (90.7)		
Read & write	14 (7.9)	163 (92.1)		
School	73 (9.4)	703 (90.6)		
University	19 (9.7)	176 (90.3)		
Below age	3 (18.8)	13 (81.3)		
Residence				0.72
Rural	37 (8.9)	379 (91.1)		
Urban	129 (9.5)	1234 (90.5)		
Hospital departments				0.005
Internal medicine	48 (11.5)	371 (88.5)		
Surgery	35 (7.6)	427 (92.4)		
Gyn. & Obst.	34 (6.5)	488 (93.5)		
ENT	9 (11.4)	70 (88.6)		
Ophthalmology	13 (9.7)	121 (90.3)		
Geriatrics	10 (20.4)	39 (79.6)		
Neurology	8 (14.8)	46 (85.2)		
Neurosurgery	9 (15)	51 (85)		

Discussion

Monitoring falls incidence is an evaluating tool for the care given to inpatients during their hospital stay [9]. The current study revealed that the overall hospital rate of falls among inpatients in different departments was 9 falls per 1000 patient days. This rate is higher than other study [9] who found an incidence rate of 2.2 per 1000 patient days. Ain Shams university hospitals more than 2000 beds compared to the Swiss university hospital that comprises only 800 beds, that might have created the difference as larger number of beds deserve more care. The present study's results are comparable to Healey et al. [1], who found an incidence rate of fall ranging from 4.8/1000 patient days in acute and 8.4/1000 patient days in community hospitals in England. Ain Shams University hospitals provide both acute and community based services. Fallers defined in different ways in different studies [10] could create such differences. Prevalence of fall in this study was 9.3% compared to 1.3% in Nakai et al. [11]. Difference in study methodology; definition of fall, fall reporting tools might have created the difference. Nakai et al. source of data was falls register completed by nurses and other hospital employee witnessing the incident of falls. The interview questionnaire completed by the patient, used in this study, might be rather subjective. Also our calculated rate was higher than Schwendimann et al. [12], study

where falls was experienced by 7.2% in a 300 bed urban public hospital.

Incidence of falls in different departments, showed varied rates that could be attributed to differences in patients' characteristics. A higher rate of falling was found in different departments compared to Schwendimann et al. [13]. Generally, elderly (≥ 60 years), in all departments fell at a higher rate (11.8%) than the younger age groups (8.8%) (OR = 1.40, CI 0.9-2.08).

Fall has multifactorial etiology comprising both intrinsic and extrinsic causes [2]. Extrinsic causes of falling are mostly related to the hospital environment. Though extrinsic factors were not investigated in this study, but 16.9% of patients reported that they had fallen down from their beds. Diccini et al. [14] had attributed patient falling in 16.7% to lowered bed rails and in 50% to absent rails. In Ain Shams university hospital, most beds had absent bed rails. Another study showed that bedrails do not significantly reduce either falls or other serious injuries [10]. Tzeng and Yin [15] had found that the average height of patient beds among fallers was significantly higher than non fallers.

Longer hospital stay was associated with higher rate of falls ($P < 0.001$). This observation is supported by Nakai et al., 2006 [11] who conducted his study in hospital of Nippon Medical school.

Tab. IV. Factors affecting falls among the study group.

Factors	Falls during hospital stay		OR (95% CI)	P value
	Yes No (%)	No No (%)		
Chronic illness			1.46 (1.05-2.04)	0.019
Absent	83 (8.0)	958 (92)		
Present	83 (11.2)	655 (88.8)		
Cause of entry				0.001
Surgery	55 (7.7)	656 (92.3)		
Invasive investigation	8 (7.8)	95 (92.2)		
Non-invasive investigation	6 (8.1)	68 (91.9)		
Medical treatment	80 (13.4)	518 (86.6)		
Labor	9 (4.3)	200 (95.7)		
Others	8 (9.5)	76 (90.5)		
Visual problems			1.52 (1.09-2.14)	0.01
Absent	93 (8.1)	1055 (91.9)		
Present	73 (11.6)	558 (88.4)		
Walking problems			2.26 (1.61-3.17)	0.000
Absent	78 (6.8)	1072 (93.2)		
Present	88 (14.0)	541 (86)		
Cause of walking problems				0.002
Joint & Bone disease	20 (8.0)	231 (92.0)		
Imbalance	11 (16.4)	56 (83.6)		
Neurological	17 (21.8)	61 (78.2)		
Others	17 (13.4)	110 (86.6)		
More than one cause	23 (21.7)	83 (78.3)		
Using a walking aid			1.80 (1.2-2.9)	0.003
No	90 (8.2)	1004 (91.8)		
Yes	34 (14.4)	202 (85.6)		
Urine incontinence				0.3
No	59 (13.2)	389 (86.8)		
Yes	29 (16.0)	152 (84.0)		
Nocturnal urination			1.70 (1.26-2.56)	0.001
No	56 (6.8)	765 (93.2)		
Yes	110 (11.5)	848 (88.5)		
Falls before hospital entry			2.81 (1.87-3.9)	0.000
No	80 (6.4)	1161 (93.6)		
Yes	86 (16.0)	452 (84.0)		
Presence of companion			1.45 (1.04-2.03)	0.02
No	68 (7.8)	809 (92.2)		
Yes	98 (10.9)	804 (89.1)		

55.4% of patients in this study fell by night, this agrees with Kallstrand and Hildingh [16] who found that the majority of falls occurs between 12.00 and 6.00 a.m. Reduced number of nurses in night shift would give more chance for falls to occur.

The main sites of falling were inside the room (37.3%) and bathroom (24.7%). 8.4% fell on stairs and 7.2% fell in more than one place. A study [17] conducted in the emergency department in Indiana University hospital School of Medicine found that 64.3% of fallers falling inside the emergency department and 10.7% fell in the restroom. Chen et al. [18] reported that falls among elderly inpatients falling in the bathroom was 18.9%. Masud et al. [10] argued that 10% of falls related deaths are stair-related, and 75% of falls on stairs occur during descent.

As regard the intrinsic factors of falling, like Chen et al. [19], a previous history of fall before hospital admission was a significant factor of falling but at a higher rate compared to our study this might be attributed to a

lower mean age in our study (41.8 vs. 68.2 years in Chen et al. study). Others [20] had found that history of falls, urination problems, transfer/mobility difficulty, walking dependency showed significant difference on adjusted-odds ratio for fall in their case control study conducted on ≥18 years old inpatients in five university hospitals and a general hospital in Korea. Tanaka et al. [21] in studying the independent risk factor related to falls during hospitalization had found a hazard ratio of history of falls was 1.2 compared to an odds ratio of 3.2 in our study.

In this study, independent factors of falls were identified as male gender, walking difficulties inside the hospital and history of fall before hospital admission among younger than 60 years patients. In elderly, diabetes was one of the independent risk factors for falling. This was consistent with Corsinovi et al. [22] who found that diabetes was the strongest independent risk factor for falling in their study conducted in an acute Geriatric ward in a university hospital in Italy.

“Being dependent” in instrumental daily activities, was one of the independent risk factors of falling among elder (OR = 2.1, 95%CI 0.56 to 5.48), this was supported by Heinze et al. [23], in Germany, who concluded that care dependency was a stable risk factor for falls in hospital elderly patients. Falls occur at a high rate among basic daily activities dependent patients (OR = 2.8, 95%CI 1.39 to 5.92) and in instrumental daily activities (OR = 2.54, 95%CI 1.08 to 6.00). Krauss et al. [24] found that two of the basic daily activities were associated with falling: getting up and urine or fecal incontinence.

In Terrell et al. study [17], 7.8% of falls resulted in lacerations and 3.6% resulted in haematomas compared to 8% and 33.1% respectively in our study. Minimizing harm after fall, would necessitate more environmental intervention. Injuries occurred in 40.9% of falls in Krause 2005 study [24], this was comparable to our study where 38.7% of falls suffered contusions and wounds. Oliver et al. [25] reported that between 1% to 3% of falls in hospitals result in fractures in the United States. This agrees to the finding in our study where 0.6% of fallers in our study had fractures as a result of their falls.

Tab. V. Falls in relation to mean age, mean duration of stay of the patients, mean basic & mean instrumental activities of the elderly patients. Data are non parametric.

	Median (IQR)	Z	significance
Age of the patients in years			
Falls	44.5 (27-59)	0.9	0.3
No Falls	41 (27-55)		
Duration of stay of the patients			
Falls	10 (5-17.5)	3.5	0.000**
No Falls	8 (4-15)		
Basic daily activities			
Falls	8 (5.7-10.2)	2.6	0.000**
No Falls	10 (7-12)		
Instrumental Daily activities*			
Falls	6 (3-10)	3.7	0.000**
No Falls	10 (6-15)		

* Calculated for elderly only (Mann Whitney test is used).

Tab. VI. Backward logistic regression model for risk factors of falls inside the hospital: (Cases below the age of 60 years).

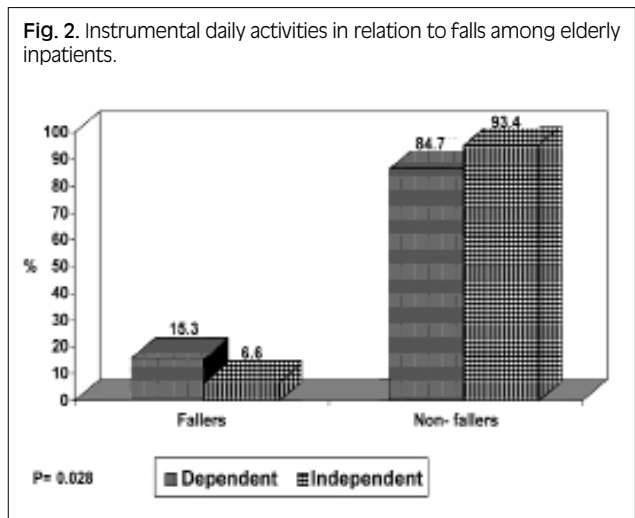
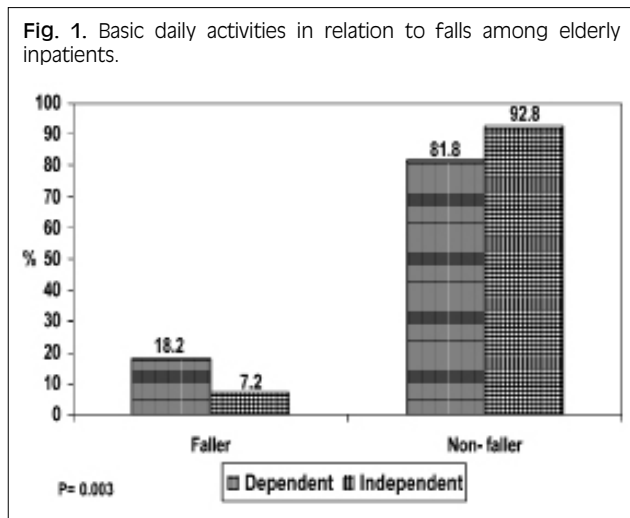
	P	OR	95% CI
Sex (males)	0.1	1.4	0.87-2.55
Walking difficulties inside hospital	0.01	2.1	1.13-3.97
Falls before hospital admission	0.000	3.2	1.90-5.67

Chi-square = 25.9; P=0.000; Hosmer and Lemeshow test P = 0.620.

Tab. VII. Backward logistic regression model for risk factors of falls inside the hospital (Cases above the age of 60 years).

	P	OR	95% CI
Diabetes	0.14	2.0	0.7-5.4
Walking difficulty inside hospital	0.12	2.1	0.8-5.8
Admission due to medical condition	0.01	4.2	1.2-13.7
Instrumental daily activity	0.09	2.1	0.86-5.48

Chi-square = 20.7; P = 0.000; Hosmer and Lemeshow test P = 0.93.



Recommendations

Calculated rates can be used for evaluation of the care given. Measuring, monitoring and assessing fall rates are strongly recommended using a valid and reliable tool.

More assistance should be provided to males below 60 with walking difficulties with history of previous falls. While for elderly more care should be directed to diabetics, with walking difficulties and patients with impaired ADL assessment.

References

- [1] Healey F, Scobie S, Oliver D, et al. *Falls in English and Welsh hospitals: a national observational study based on retrospective analysis of 12 months of patient safety incident reports*. Qual Saf Health Care 2008;17:424-30.
- [2] Milutinovic D, Martinov-Cvejin M, Simic C. *Patients' falls and injuries during hospitalization as quality indicator of work in hospitals*. Med Pregl 2009;62:249-57.
- [3] Zecevic AA, Salmoni AW, Speechley M, et al. *Defining a fall and reasons for falling: comparisons among the views of seniors, health care providers, and the research literature*. Gerontologist 2006;46:367-76.
- [4] Hitcho BE, Krauss MJ, Birge S, et al. *Characteristics and circumstances of falls in a hospital setting: a prospective analysis*. J Gen Intern Med 2004;19:732-9.
- [5] Marschollek M, Nemitz G, Gietzelt M, et al. *Predicting inpatient falls in a geriatric clinic: a clinical study combining assessment data and simple sensory gait measurements*. Z Gerontology Geriatr 2009;42:317-21.
- [6] Frels C, Williams P, Narayanan S, et al. *Iatrogenic causes of falls in hospitalised elderly patients: a case-control study*. Postgrad Med J 2002;78:487-9.
- [7] Katz S, Ford AB, Moskowitz RW, et al. *Studies of the illness in the aged. The index of ADL: A standard measure of biological and psychological function*. JAMA 1963;185:914-9.
- [8] Lawton MP, Brody EM. *Assessment of older people: self-maintaining and instrumental activities of daily living*. Gerontologist 1969;9:179-86.
- [9] Halfon P, Egli Y, Van Melle G, et al. *Risk of falls for hospitalized patients: a predictive model based on routinely available data*. J Clin Epidemiol 2001;54:1258-66.
- [10] Masud T, Morris RO. *Epidemiology of falls*. Age Aging 2001;30(Suppl 4):3-7.
- [11] Nakai A, Akeda M., Kawabata I. *Incidence and risk factors for inpatient falls in an academic acute care hospital*. J Nippon Med Sch 2006;73:265-70.
- [12] Schwendimann R, Buhler H, De Geest S, et al. *Falls and consequent injuries in hospitalized patients: effects of an interdisciplinary falls prevention program*. BMC Health Serv Res 2006;6:69.
- [13] Schwendimann R, Buhler H, De Geest S, et al. *Characteristics of hospital inpatient falls across clinical departments*. Gerontology 2008;54:342-8.
- [14] Diccini S, De Pinho PG, Da Silva FO. *Assessment of risk and incidence of falls in neurosurgical inpatients*. Rev Lat Am Enfermagem 2008;16:752-7.
- [15] Tzeng HM, Yin CY. *Inpatient falls: the impact of family and personal caregivers*. Appl Nurs Res 2009;22:159-65.
- [16] Kallstrand-Ercison J, Hildingh C. *Visual impairment and falls: a register study*. J Clin Nurs 2009;18:366-72.
- [17] Terrel KM, Weaver CS, Giles BK, et al. *ED patient falls and resulting injuries*. J Emerg Nurs 2009;35:89-92.
- [18] Chen XL, Liu YH, Chan DK, et al. *Characteristics associated with falls among the elderly within aged care wards in a tertiary hospital: a retrospective*. Chin Med J (Engl) 2010;123:1668-72.
- [19] Chen YC, Chien SF, Chen LK. *Risk factors associated with falls among Chinese hospital inpatients in Taiwan*. Arch Gerontol Geriatr 2009;48:132-6.
- [20] Kim EK, Lee JC, Eom MR. *Falls risk factors of inpatients*. J Korean Acad Nurs 2008;38:676-84.
- [21] Tanaka B, Sakuma M, Ohtani M, et al. *Incidence and risk factors of hospital falls on long-term care wards in Japan*. J Eval Clin Pract 2011 Jan 6 [Epub ahead of print].
- [22] Corsinovi L, Bo M, Ricauda Aimonino N, et al. *Predictors of falls and hospitalization outcomes in elderly patients admitted to an acute geriatric unit*. Arch Gerontol Geriatr 2009;49:142-5.
- [23] Heinze C, Halfens RJ, Dassen T. *Falls in German in-patients and residents over 65 years of age*. J Clin Nurs 2007;16:495-501.
- [24] Krause T. *Geriatric in-hospital patients: falls and their consequences*. Pflege 2005;18:39-42.
- [25] Oliver D, Healey F, Haines TP. *Preventing Falls and Fall-Related Injuries in Hospitals*. Clin Geriatr Med 2010;26:645-92.

■ Received on February 1, 2011. Accepted on February 26, 2011.

■ Correspondence: Khaled Mahmoud Abd Elaziz, Department of Community, Environmental and Occupational Medicine, Faculty of Medicine, Abbassia square, Cairo, Egypt - Tel. +202 26350488 - Fax +202-24837888 - E-mail: khaledabdu@yahoo.com