

Assessment of Risk of Fracture among obese elderly women attending primary health clinic at geriatric hospital in Ain Shams University Hospitals

Manar M.Abd EL kader, Manar MA.Maamoun, Nermeen N.Adly, Heba M.Shaloot.

Geriatrics and Gerontology Department, Faculty of Medicine Ain Shams University.

Abstract

Background: Elderly are more susceptible to develop fractures due to many risk factors such as osteoporosis and others risk factors as frequent falls, visual impairment, functional impairment and numerous comorbidities. Women have about twice as high a risk of any fracture than men. Because women live longer than men and are exposed, hence, for extended periods to reduced bone density and other risk factors for osteoporosis and fractures. Obesity is linked to a higher risk of some fragility fractures. A higher weight increases the risk of falling. On the other hand, the high values of body mass index (BMI), even though associated with good values of bone mineral density (BMD), are at high fracture risk based on an increased risk of fall, so obesity might not protect against all osteoporotic fractures as it was initially considered although BMD is the major element of the fracture risk. Fractures have major negative impacts on patient quality of life; increased risk of hospitalization. This is consequently a significant public health issue from the medical, social and economic perspectives.

Aim: To assess risk of fractures among community dwelling obese women attending the primary health clinic in the Geriatric Hospital in Ain Shams University.

Subjects and Methods: A cross sectional study done with 65 elderly females who were subjected to comprehensive geriatric assessment, assessment of BMI, fall risk by (Time up and go test)TUGT and fracture risk by both Garvan calculator and Q fracture 2016.

Results: Age has positive correlation with risk of fractures (P-value: <0.001). Body mass index (BMI) has negative correlation with fracture risk by both Garvan calculator and Q fracture 2016. (P-value: .008*), (p-value: <0.001*). Risk of fracture is higher among non-obese in comparison with obese. (P-value: .008*), (p-value: <0.001*). As regard correlation between fracture risk, Time up and go test there was no statically significant correlation. As regard comorbidities among studied population there is no statically significant association with risk of fractures.

Conclusion: Obese females has lower risk of fracture (as calculated by both Garvan calculator and Q fracture 2016) than non-obese elderly females.

Keywords: risk of fractures, elderly, obesity, age

Background

Elderly populations who aged more than 60 years old represent the majority of patients presenting with major fracture. Falls are the most common cause of fractures, accounting for approximately three-quarters of all fractures in these people.¹

Elderly are more liable to develop fractures due to numerous risk factors such as decreased bone mineral density (osteoporosis) and many other independent clinical risk factors as frequent falls, visual impairment, sluggish gait, functional impairment, many medical comorbidities and drugs.²

Bone fracture has major negative impacts on patient quality of life as it results in hospitalization in elderly patients. This is consequently a significant public health issue from the medical, social and economic perspectives.³ Overall, obesity was supposed to be protective against osteoporosis; however, several studies have challenged this belief. Although the most of the studies find that obesity has a favorable effect on bone density, it is unclear what the effect of obesity is on skeletal microarchitecture. Also, the effects of obesity on skeletal strength might be site-dependent as

obese individuals are at higher risk of definite fractures.⁴

Obesity in adults is defensive against some fractures, mainly hip fractures. Some fractures, such as ankle and humerus are more common in obesity, and the prevalence of low-trauma fractures is similar in obese and non-obese women. The fracture pattern in obesity need to consider other factors such as load-to-strength ratio, soft tissue padding, and muscle function and falls.

⁵Body mass index (BMI) is part of the fracture risk assessment tool (FRAX), and higher (BMI) leads to lower fracture risk. However, over the last few years, epidemiological and clinical studies have tested this belief. Some studies indicate that abdominal adiposity is associated with osteopenia and osteoporosis, whereas other studies indicate that this association is probably more complex and site-dependent, with a lower risk for certain types of fractures but higher risk for others.⁴

At least 50% of elderly people who were ambulatory before a hip fracture do not regain their previous level of function and mobility. The level of Function deteriorates extremely after a fracture.⁶ Disability determines outcome of fractures directly proportional to age, such as sustained bed rest, post-fall-Syndrome, increased risk of secondary and tertiary related events (pneumonia, bedsores, thromboembolic events etc.), greater recourse to the use of drugs.⁷

Aim

To assess fracture risk among obese elderly women attending primary health clinic at geriatric hospital in Ain Shams University Hospitals.

Methods

Sixty five females attending the Primary health clinic (PHC) then divided into obese group and non-obese group by body mass index (BMI).

A cross sectional study conducted to assess fracture risk among obese elderly.

Inclusion Criteria: 1. Informed consent from the patients to participate in the study

2. Females aged 60 and equal or less than 75 years old.

Exclusion Criteria:

- Refusal to enroll in the study.
- Peoples with any acute illness.
- Bed bound peoples.

1. **Study tools and procedures:** The following was done for each participant attending primary health care clinic at geriatric hospital.

A. Comprehensive Geriatric Assessment:

1. History taking including: age, gender, other co morbidities by (Charlson Comorbidity Index)⁸.
2. Assessment of independent function and daily Activities using : a. ADL (Activities of Daily living): Basic activities of daily living assess the ability of the patient to complete basic

self-care tasks (e.g. bathing- dressing- toileting- transfer -continence and feeding) .

⁹ The scoring category of patient is one of the following:

- 1) If an elderly is independent in the above six items so is able to function at home without assistance he is said to be independent.
- 2) If there is a disability in any one of these six items, this means the need of at least part-time care-giver, he is said to be assisted.
- 3) If he is completely unable to perform basic activities of daily living, he is said to be dependent and needs a 24 hours care-giver.

b. Instrumental Activities of Daily Living Scale (IADL):

It measures the patient ability to maintain an independent household, (e.g. shopping for groceries - using public transportation-using the Telephone-meal preparation – housework - taking medications-handling Finances).¹⁰ The scoring category of patient is one of the following:

3. If an elderly is independent in the above seven items so he is able to Function without assistance he is said to be independent.
4. If there is disability in any one of these items, this means the need of at Least part-time care-giver and said to be assisted.
5. If he is completely unable to perform instrumental activities of daily Living, he is said to be dependent and needs a 24 hours care-giver.

c . **Body mass index (BMI)** to obtain obese patients by measuring weight in kilograms, height in meters, BMI=weight in kg /height in meter², normal:(18.5-24.9) overweight:(25-29),obese:(30-39),morbid obese: (more than40)

D. Time up and go test : The Timed "Up & Go" Test (TUG) Evaluates Gait and Balance and risk of falls :

The patient gets up out of a standard armchair seat height of approximately 46 cm (18.4 inch), walks a distance of 3 m (10 ft.), turns, walks back to the chair and sits down again. The patient wears regular footwear and, if applicable, uses any customary walking aid (e.g., cane or walker). No physical assistance is given. The physician uses a stopwatch or a wristwatch with a second hand to time this activity. A score of 30 seconds or greater indicates that the patient has impaired mobility and requires assistance (i.e., has a high risk of falling). This test has been shown to be as valid as sophisticated gait testing.¹¹

If the time is less than 10 seconds the elderly is considered freely mobile, less than 20 seconds is considered mostly independent, 20 to 29 seconds is considered variable mobility, more than 30 seconds is considered impaired mobility , a score more than 14 seconds indicates high risk of falls .¹¹

E. Screening of Depression: by Patient health questionnaire (PHQ-2) if the score greater or equal 3

major depressive disorder is likely. ¹²

F. Assessment of cognitive function by the Mini Mental State Examination (MMSE):

The MMSE comprises of 30 questions of which 10 devoted to orientation, three items requiring registration of new information,

Five questions addressing attention and calculation, requiring patient to make five serial subtractions of 7 from 100 or spell word backward. Three recall items, eight items assessing language skills, and one construction question .The maximum MMSE score is 30 points. A score of 20 to 24 suggests mild dementia, 13 to20 suggests moderate dementia and less than 12 indicates severe dementia.¹³

G. Fracture risk assessment by :

1.Q Fracture 2016 algorithms have been developed by Julia Hippisley-Cox and Carol coupland in 2012 and the latest update was in 2016.the risk calculator includes numerous clinical risk factors but does not include BMD. It provides outputs of any osteoporotic fracture (hip,wrist,or spine) and hip fracture over a user selected follow up period from 1 year to 10 years.¹⁴

2.Garvan calculator : Scientists from The Garvan Institute of Medical Research (one of Australia's largest medical research institutions) developed this tool using data, accumulated over 17 years, from the internationally recognized Dubbo Osteoporosis Epidemiology Study, this tool has the potential to allow individuals to make informed judgments about their actual risk of having an osteoporotic fracture and what steps they may wish to take to reduce that risk. The Garvan Fracture Risk Calculator is valid and clinically useful in identifying individuals at high risk of fracture .¹⁵ As with FRAX, Garvan was calculated with BMI and not BMD. At this study we used it without BMD.

Ethical Considerations: An informed consent was obtained from each participant the study methodology was approved by the Research Review Board of the Geriatrics and Gerontology Department, Faculty of Medicine, Ain Shams University. The Hospital administration consent to review the needed data records was obtained. Confidentiality and privacy of data was ensured.

Statistical analysis: Data were tabulated and statistically analyzed using SPSS, version 16. Quantitative data were described as mean and standard deviation. Independent t test was used for comparing quantitative variables between groups. Qualitative data were expressed as frequencies (n) and percentage (%). Fisher exact test was used to test the association between qualitative variables. Pearson correlation coefficient was used to correlate between quantitative variables. Linear regression analysis was done for detection of variables affecting the risk of fractures. P-

value ≤ 0.05 was considered significant.

Results

The study enrolled sixty-five females the mean age of all subjects was 64.5, it was found that 87.7% of the study population were housewives, 61.5% of the study population were illiterate, 83.1% of the study populations lived with their families. As seen in (Table 1).

The study populations were neither smokers nor alcoholic and 67.7 % of them had adequate pension. Among the studied sample 47.7 % of them were obese, 12.3% of them were morbidly obese as seen in table 2, all studied sample were functionally independent as regard ADL , As regard (IADL) 4.6% of them were assisted as seen in table 3. By mini mental examination 98.5% of them was normal, 1.5% of them had mild cognitive impairment (table 3).

It was found that 3.1% of the studied population had a history of fracture within 6months or 12 months. There was no history of hip fracture or osteoporosis among the studied population as seen in table 5. As regard age in current study had strong positive correlation with risk of fractures (P-value: $<0.001^*$) as seen in table 6. As regard correlation between fracture risk, Time up and go test there was no statically significant correlation as seen in table 6.As regard comorbidities among studied population there is no statically significant association with risk of fractures as seen in table 4.

According to fracture risk assessment by Garvan calculator:

Mean hip 5 yr fracture risk was $0.2 \pm 0.4\%$, mean 10 yrs fracture risk was $0.4 \pm 1.0\%$, osteoporotic fracture 5 yr risk was $6.2 \pm 4.7\%$, osteoporotic fracture 10 yrs risk was $12.6 \pm 8.2\%$ as seen in table 5. **According to Q fracture 2016**

Mean hip fracture 10 yrs risk was $2.5 \pm 2.3\%$. Mean hip, wrist, shoulder or spine fracture 10 yrs risk was $6.6 \pm 3.9\%$ as seen in table 5.

As regard risk of fractures in relation to obesity:

There was highly significant negative correlation between weight, BMI score , and risk of fractures. As regard fracture risk assessment by garvan calculator and Q fracture 2016: risk of fracture was higher among non-obese in comparison with obese. Although we found that fracture risk is lower in elderly females with normal BMI, However the only two ladies that had history of fracture in the last 6 months had high BMI as seen in table 7.

Table 1. Sociodemographic characteristics in the studied populations:

	N	%
Age (mean + SD)	64.5 + 4.8	(60.0 - 74.0)
Occupation	Retired	5 7.7%
	manual labor	0 0.0%
	office job	3 4.6%
	house wife	57 87.7%
Education	illiterate	40 61.5%
	educated less than 5 yrs	2 3.1%
	educated more than 5 yrs	23 35.5%

Table 2. Distribution of body measurements in the studied sample:

	N	(Minnum-maxiam)
Weight (mean + SD) in kg	84.2 + 18.3	(52.0 - 133.0)
HEIGHT (mean + SD)in cm	160.6 + 5.3	(149.0 - 175.0)
BMI score (mean + SD)	32.1 + 6.7	(19.7 - 51.0)
BMI	Normal	10 15.4%
	Overweight	16 24.6%
	Obese	31 47.7%
	Morbid obese	8 12.3%

Body mass index (BMI): normal:(18.5-24.9)overweight:(25-29),obese:(30-39),morbid obese: (more than40)

Table3. Functional and cognitive assessment description in the studied sample:

	N	%
ADL	independent (6)	65 100.0%
	assisted (1-5)	0 0.0%
	dependent (0)	0 0.0%
IADL	independent (8)	62 95.4%
	assisted (1-7)	3 4.6%
	dependent (0)	0 0.0%
Mini mental examination	normal (24 or higher)	64 98.5%
	mild dementia (19-23)	1 1.5%
	moderate dementia (10-18)	0 0.0%
	sever dementia (9 and lower)	0 0.0%
PHQ2	1.9 + .3	(1.0 - 3.0)

Activities of daily life (ADL), Instrumental activities of daily life(IADL),Patient health Questionnaire 2 :(PHQ2)

Table 4. . Description of comorbidities and Charlson comorbidity index in the studied sample:

	N	%
Hypertension	42	64.6%
Diabetes Mellitus	42	40.0%
Osteoarthritis	23	35.4%
Liver diseases	9	13.8%
ISHD	8	12.3%
Thyroid disease	7	10.8%
Visual impairment	7	10.8%
Bronchial asthma	4	6.2%
Stroke	3	4.6%
Hearing impairment	2	3.1%
AF	1	1.5%
Epilepsy	1	1.5%
CKD	1	1.5%
Mean + SD (min – max)		
Charlson comorbidity index	3.0 + .6 (2.0 – 4.0)	

Chronic kidney disease (CKD), Atrial fibrillation (AF) There is no statically significant correlation between comorbidities and fracture risk assessed by Garvan calculator and Q fracture 2016.

Table 5. history and risk of fracture in the studied sample:

	N	%
History of osteoporosis or hip fracture	0	0.0%
Fracture within last 6 months or 12months	63	96.9%
Garvan calculator	2	3.1%
hip_5y fracture risk (mean + SD)	.2 + .4 (.0 - 3.0)	
hip_10y fracture risk (mean + SD)	.4 + 1.0 (.0 - 6.0)	
Osteoporotic _fracture _5y risk (mean + SD)	6.2 + 4.7 (3.0 - 35.0)	
Osteoporotic _fracture _10y risk (mean + SD)	12.6 + 8.2 (6.0 - 60.0)	
Qfracture2016		
hip fracture _10yrs risk (mean + SD)	2.5 + 2.3 (.4 - 10.0)	
hip wrist _shoulder _or spine fracture _10yrs risk (mean + SD)	6.6 + 3.9 (1.9 - 18.7)	

Table 6.correlation between risk of fracture ,Age , weight ,height ,BMI score ,TUGT .

		hip_5y	hip_10y	Osteoporotic fracture 5y	Osteoporotic fracture 10y	Hip fracture 10yrs	Hip wrist shoulder spine 10yrs
Age	r	.502	.477	.615	.656	.807	.782
	P	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Weight	r	-.318	-.296	-.339	-.380	-.443	-.454
	P	.010*	.017*	.006*	.002*	<0.001*	<0.001*
Height	r	.030	.039	-.013	-.025	-.024	-.082
	P	.811	.757	.921	.841	.852	.517
BMI score	r	-.329	-.307	-.328	-.368	-.444	-.438
	P	.008*	.013*	.008*	.003*	<0.001*	<0.001*
Time up and go test	r	0.052	-0.009	0.055	0.069	0.145	0.163
	P	0.682	0.945	0.661	0.583	0.251	0.196

Body mass index :BMI , Time up and Go test :TUGT

Table 7. risk of fracture in relation to obesity:

	Non-obese Mean + SD (min – max)	Obese Mean + SD (min – max)	Test	P
Garvan calculator				
Hip 5y fracture risk	.5 + .6 (.1- 2.0)	.1 + .4 (.0 - 3.0)	2.450	.017*
Hip10y fracture risk	1.1 + 1.4 (.3 - 5.0)	.3 + .8 (.0 - 6.0)	2.450	.017*
Osteoporotic fracture 5y risk	9.4 + 5.3 (5.0 - 23.0)	5.6 + 4.4 (3.0 - 35.0)	2.430	.018*
Osteoporotic fracture 10y risk	18.8 + 9.5 (11.0 - 43.0)	11.4 + 7.5 (6.0 - 60.0)	2.741	.008*
Q fracture 2016				
Hip fracture 10yrs risk	5.3 + 3.1 (1.2 - 10.0)	2.0 + 1.8 (.4 - 7.9)	3.180	.010*
Hip wrist shoulder spine 10yrs risk	10.9 + 4.5 (3.9 - 18.7)	5.8 + 3.3 (1.9 - 17.0)	4.216	<0.001*

Discussion:

The current study done to assess fracture risk among community dwelling females attending the primary health clinic in the geriatric hospital in Ain Shams University .

The study enrolled 65 patients females the mean age of all subjects was 64.5, among study population 87.7% were housewives, 61.5% of the study population were illiterate, 83.1% of the study populations lived with their families. The study

populations were neither smokers nor alcoholic. And 67.7 % of them had adequate pension. Among the studied sample 47.7 % of the studied sample were obese, 12.3% of them were morbid obese. As regard age in current study had strong positive correlation with risk of fractures. (P-value: <0.001*) Studies that examined the relation between fractures and age are numerous and are consistent with the current study. One example is the study of Barlow et

al.¹⁶ which confirmed that fractures rise exponentially with advancing age, also Albrand et al.¹⁷ in a cohort study of 672 healthy postmenopausal women established that age 65 or more is an independent risk factor for developing fractures. (Independent of bone mineral density).

In current study, there was significant negative correlation between weight, BMI score, risk of fractures, It agrees with the study of Sacha song et al.,¹⁸ which is a prospective cohort study conducted to predict the participant's ten-year probability of osteoporotic and hip fracture using the Fracture Risk Assessment Tool (FRAX) and established a negative relationship between BMI and FRAX is expected as a higher BMI would be likely to reduce fracture risk as the individual would have more soft tissue.

The risk of fracture is higher among non-obese in comparison with obese. This is the same with Johansson, H. et al.,¹⁹ showed a low BMI was a significant risk factor for all osteoporotic fractures, including hip and forearm fractures also suggested that the association between BMI and risk of future fracture is site-specific. Whereas low BMI was a risk factor for all osteoporotic fractures, a low BMI was a protective factor for lower leg fracture. Also this finding is very consistent with De Laet et al.,²⁰ which is a meta-analysis showed that a high BMI was a protective risk factor for osteoporotic fracture, including hip fracture, but a high BMI was weaker as a protective factor than low BMI was as a risk factor. A meta-analysis conducted by Tang, X. et al.,²¹ Fifteen prospective cohort studies involving a total 3,126,313 participants were finally included into this meta-analysis. Overall, adults with obesity compared with the normal weight group had a significantly decreased risk of hip fracture (RR: 0.66, 95% CI 0.57 to 0.77, P<0.001). Meta-analyses by the adjusted status of RRs also suggested adults with obesity compared with the reference group had a significantly decreased risk of hip fracture (adjusted RR: 0.48, 95% CI 0.39 to 0.58, P<0.001; unadjusted RR: 0.66, 95% CI 0.56 to 0.78, P<0.001). Subgroup analyses by gender suggested individuals with obesity had a significantly decreased risk for developing hip fracture compared with the reference group in both men (RR 0.54, 95% CI 0.48 to 0.60, P<0.001) and women (RR 0.70, 95% CI 0.58 to 0.84, P<0.001). It was found that obesity (increased BMI) significantly decreases the risk of hip fracture in adults, and obesity is probably a protective factor of hip fracture in adults which is consistent with the current study. Against current study Khatib et al.²² in a Meta-analysis revealed that there may be little to no effect of BMI on fracture risk. Nielson et al.²³ and Ong et al.²⁴ as well established that higher BMD in obesity is not defensive against fractures which

may be due to body habitus, mechanism of injury and the effect of adiposity on bone.

There was no statically significant correlation between TUGT fracture risk. that was inconsistent with other studies. A study done by Shereen M. Mousa²⁵ assessed the relationship between mobility status using TUG test, bone mineral density (BMD), and different fracture risks predicted by different tools. Participants were assessed for falls, fracture history, and BMD using dual energy X-ray absorptiometry; the estimated 10-year fracture risk was also calculated using both the World Health Organization fracture risk assessment tool and Garvan fracture risk calculator, established that Poor TUG test results are associated with lower BMD and higher estimated 10 year fracture risk. Another one by Su-Min Jeong²⁶ who evaluated the association between the TUG test and future fractures, which are a common clinical complication of falling, established that the slow TUG performance was concomitant with an increased risk of fracture independent of bone mineral density. TUG test can provide information on future fracture risk above that provided by BMD. Another study Larsson, B. et al.,²⁷ was a prospective population-based study established that the timed up and go (TUG) test measures physical performance and predicts falls in the elderly. In older women, TUG time predicts the risk of major osteoporotic fracture and hip fracture independently of clinical risk factors and bone mineral density, and has a substantial impact on fracture probabilities. Having a slow TUG time (> 12 s) had a substantial impact, on the probability of Major osteoporotic fracture (MOF) and hip fracture, indicating that evaluation of TUG could be useful in determining fracture risk in older women which is against current study. In another recent study, a slow TUG time (≥ 10 s) was found to be associated with a modest 21% increased risk of hip fracture and a 7% increased risk in vertebral fracture, compared to those with a faster TUG time which is against our study.²⁶ Against current study Khazzani, H et al.,²⁸ It established that in the group of postmenopausal patients, the scores of (TUGT) were significantly higher in fractured patients compared with patients without. After logistic regression, a score of 'TUGT' > 14.2 sec increased the probability of anterior peripheral fracture by 2.7.

Conclusions

Obese females has lower risk of fracture (as calculated by both Garvan calculator and Q fracture 2016) than non-obese elderly females.

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