

Frequency of biochemical abnormality in elderly with fracture neck of femur

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Abstract

To assess the frequency of abnormal results of bone profile tests including serum calcium, phosphate, alkaline phosphatase and the results of parathyroid hormone in patients with fracture neck of femur. The study includes a group of 100 elderly patients ages 60 years and older with fracture neck of femur, and 100 healthy elderly persons without fracture neck of femur from the same age range, served as a control group. The subjects selected for the study were free from secondary risk of metabolic bone disease apart from age, genetic and menopause. Individual of both groups were referred to the laboratory of Department of Biochemistry/ College of Medicine/ University of Mosul. The study was conducted during the period from 17th February 2008 up to 22nd of December 2008. Measurements of serum parathyroid hormone was conducted by Enzyme-Linked ImmunoSorbent Assay, and serum calcium; phosphate, albumin, total alkaline phosphatase activity was conducted by colorimetric method. A high frequency of combined abnormal biochemical tests 79% among the fractured group was found, compared to 46% in non fractured, which is highly significant ($p < 0.001$). Combined abnormal biochemical tests (osteomalacia) in elderly person may contribute to risk of fracture.

Key words: parathyroid hormone, fracture neck femur, osteomalacia

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الخلاصة

إن هدف الدراسة هو تقييم التكرار في النتائج الشاذة لمجموعة فحوصات العظام الروتينية متضمنة فحوصات مصل الدم لكل من الكالسيوم، الفوسفات، الزلال، فعالية الفوسفاتيز القلوي ونتائج فحص هورمون الباراثايرويد في المرضى المسنين المصابين بكسر عنق عظم الفخذ. تتضمن الدراسة 100 مريض مسن بأعمار 60 سنة أو أكثر مصابين بكسر عنق عظم الفخذ، و 100 شخص مسن بدون كسر عنق عظم الفخذ من نفس مدى العمر وهي مجموعة الضبط. الأشخاص المختارين للدراسة لم تكن لديهم الأمراض الثانوية المؤدية إلى أمراض العظام الأيضية ما عدا العمر، الوراثة وسن يأس. المشاركون في كلتا المجموعتين أرسلوا إلى مختبر فرع الكيمياء الحياتية في كلية الطب في جامعة الموصل لفحص نماذج الدم و الدراسة أجريت في الفترة من السابع عشر من فبراير / شباط 2008 إلى الثاني والعشرون من ديسمبر / كانون الأول 2008. تم قياس هورمون الباراثايرويد في مصل الدم بجهاز (إليسا)، و تم استعمال مصل الدم أيضا لقياس الكالسيوم، الفوسفات، الزلال و فعالية الفوسفاتيز القلوي باستعمال جهاز المطياف. وجد تكرار عالي للنتائج الشاذة لمجموعة فحوصات العظام الروتينية ونتائج فحص هورمون الباراثايرويد 79% في المرضى المسنين المصابين بكسر عنق عظم الفخذ مقارنة ب 46% للأشخاص المسنين غير المصابين بكسر عنق عظم الفخذ وهي نسبة إحصائية عالية جدا ($p < 0.001$). النتائج الشاذة لمجموعة فحوصات العظام الروتينية ونتائج فحص هورمون الباراثايرويد (لين العظام) في الأشخاص المسنين قد يساهم في زيادة خطر الإصابة بكسر عنق عظم الفخذ.

Introduction

Vitamin D deficiency is common in elderly ⁽¹⁾ and is thought to be a contributing factor to fall risk via effects on neuromuscular function ⁽²⁾. In Asians, a raised PTH is a better determinant of histological osteomalacia than 25-hydroxyvitamin D and it is more predictive of osteomalacia ⁽³⁾, and is therefore a better initial test for Asian patients with musculoskeletal symptoms, a reasonable policy is to measure calcium and PTH ⁽⁴⁾. It was reported that patients with abnormal routine biochemistry (serum calcium, phosphate and ALP) had a greater increase in PTH than those with normal biochemistry, in other words, abnormal routine biochemistry may point to more advanced bone disease ⁽⁵⁾. It is well-established that serum PTH concentration varies inversely with absorbed calcium ⁽⁶⁾. A functional deficit of Vitamin D would, therefore, be expected to impair calcium absorptive efficiency, leading to a rise in PTH production ⁽⁷⁾. Secondary hyperparathyroidism is associated with increased bone resorption ⁽⁸⁾ and low bone mass ⁽⁹⁾. Bone loss results from an imbalance between the two processes of bone resorption and bone formation ⁽¹⁰⁾. Secondary hyperparathyroidism is one of the determinants of femoral bone loss ⁽¹¹⁾. It has been suggested that an elevation in PTH is a sensitive pointer to significant hypovitaminosis D ⁽¹²⁾. Parathormone is a recognized marker of bone remodeling ⁽¹³⁾, and is the principal regulator of calcium homeostasis ⁽¹⁴⁾. A raised PTH usually indicates secondary hyperparathyroidism (unless there is concomitant primary or tertiary hyperparathyroidism) ⁽¹⁵⁾.

Materials and Methods

This study represents a case control study. The study includes 100 elderly patients ages 60 years or older, The mean \pm SD for age (67.91 \pm 7.61) (served as a case group), presented with recent fractured neck of femur due to falling from standing height,

were selected from orthopedic ward in Al-Jumhoori teaching hospital in Mosul. A control group of 100 healthy elderly person without fracture neck of femur from the same age range, with a mean \pm SD for age(65.39 \pm 6.25) were selected from patients of the ENT and Ophthalmology departments in the same hospital. Before starting data collection, all participants were informed about the objectives of the study. The subjects selected for the study were free from secondary risk of metabolic bone disease apart from age, genetic and menopause. The subjects of both groups were interviewed and the general information were taken, including name, age, sex, medical history, surgical history, drug history, smoking habits, marital state, number of children (parity), and history of breast feeding. Both groups were referred to the laboratory of Department of Biochemistry/ College of Medicine/ University of Mosul, for measuring serum parathyroid hormone by Enzyme-Linked ImmunoSorbent Assay (ELISA) ⁽¹⁶⁾ by a kit supplied from "DGR". Serum calcium measured colorimetrically ⁽¹⁷⁾ by a kit supplied from "Biolabo". Corrected [calcium]= measured [calcium]+0.02 (40-[albumin]) ⁽¹⁸⁾. Serum phosphate was measured colorimetrically ⁽¹⁷⁾ by a kit supplied from "SPINREACT,Spain". Serum albumin was measured by colorimetric determination ⁽¹⁹⁾ using a kit from "Biolabo". Serum total alkaline phosphatase activity (ALP) was measured by colorimetric determination ⁽²⁰⁾ using a kit from "bioMerieux". The study was conducted during the period from 17th February 2008 up to 22nd of December 2008. Standard statistical methods were used to determine the mean, standard deviation (SD), standard error (SE), range (minimum-maximum), and median. Student t-test was used for the comparison between control group and case group. Chi-squared test was used for assessment of hyperparathyroidism and the increase in

ALP activity in controls and cases.

Results

Table 1 shows case and control groups that were divided according to their age and sex.

Table (1):- Basic data of study participants:

CHARACTERISTIC		(CONTROL) N=100		(CASE) N=100	
		No.	%	No.	%
Age (years)	60-70	78	78.0	69	69.0
	71-80	19	19.0	24	24.0
	81-90	3	3.0	7	7.0
sex	Male	37	37.0	36	36.0
	Female	63	63.0	64	64.0

Table 2 shows different parameters measured in the present study, there were significant differences between subjects in case and control groups concerning the

PTH, calcium, corrected calcium, phosphate, ALP and albumin ($P < 0.001$) each.

Table (2):- Mean, SD, median and range of parameters reported by the present study.

Parameters	Groups	Mean	SD	Median	Range	p-value*
PTH (pg/ml)	control	106.56	49.47	98	20-178	<0.001
	case	161.6	45.13	184	50-198	
Ca (mmol/L)	control	2.16	0.12	2.15	1.97-2.5	<0.001
	case	2.065	0.08	2.05	1.87-2.25	
Corrected Ca (mmol/L)	control	2.19	0.1	2.16	2.06-2.47	<0.001
	case	2.108	0.06	2.09	1.92-2.27	
Phosphate (mmol/L)	control	0.86	0.18	0.79	0.68-1.28	<0.001
	case	0.75	0.11	0.72	0.62-1.21	
ALP (U/L)	control	121.68	42.91	120	40-188	<0.001
	case	176.2	38.55	190	88-233	
Albumin (g/L)	control	38.64	1.33	38.5	35-43	<0.001
	case	37.76	1.26	38	33.5-39.8	

*Student t-test was used

Using Chi-square test, and depending on combined abnormal biochemical tests including: high PTH level (>55pg/ml), low corrected serum calcium (<2.2mmol/l), low phosphate (<0.74mmol/l for males and <0.9mmol/l in females), high ALP

(>92U/l), for the comparison as a state of osteomalacia (+ve) in the studied groups, it was found that subjects in case group having higher percentage (79.0%), than in control group (46%) and it was highly significant (P<0.001).

Table (3):- Frequency of the combined abnormal biochemical tests (osteomalacia).

Osteomalacia	Control		Case		p-value*
	No.	%	No.	%	
+ve	46	46.0	79	79.0	<0.001
-ve	54	54.0	21	21.0	
Total	100	100	100	100	

*Using Chi-square test

Depending on the above criteria 75.0% of males in case group compared with 35.1% of males in control group, which was a

significantly differ (P=0.001), were (+ve) according to the above criteria.

Table (4):- Frequency of the combined abnormal biochemical tests among male.

Osteomalacia	Control		Case		p-value*
	No.	%	No.	%	
+ve	13	35.1	27	75.0	0.001
-ve	24	64.9	9	25.0	
Total	37	100	36	100	

Using to Chi-square test *

By comparing females who were (+ve) for the above criteria on control group (52.4%) with those who were (+ve) for the

above criteria on case group (81.3%), this was a significantly differ (P=0.001).

Table (5):- Frequency of the combined abnormal biochemical tests among female.

Osteomalacia	Control		Case		p-value*
	No.	%	No.	%	
+ve	33	52.4	52	81.3	0.001
-ve	30	47.6	12	18.8	
Total	63	100	64	100	

*Using to Chi-square test

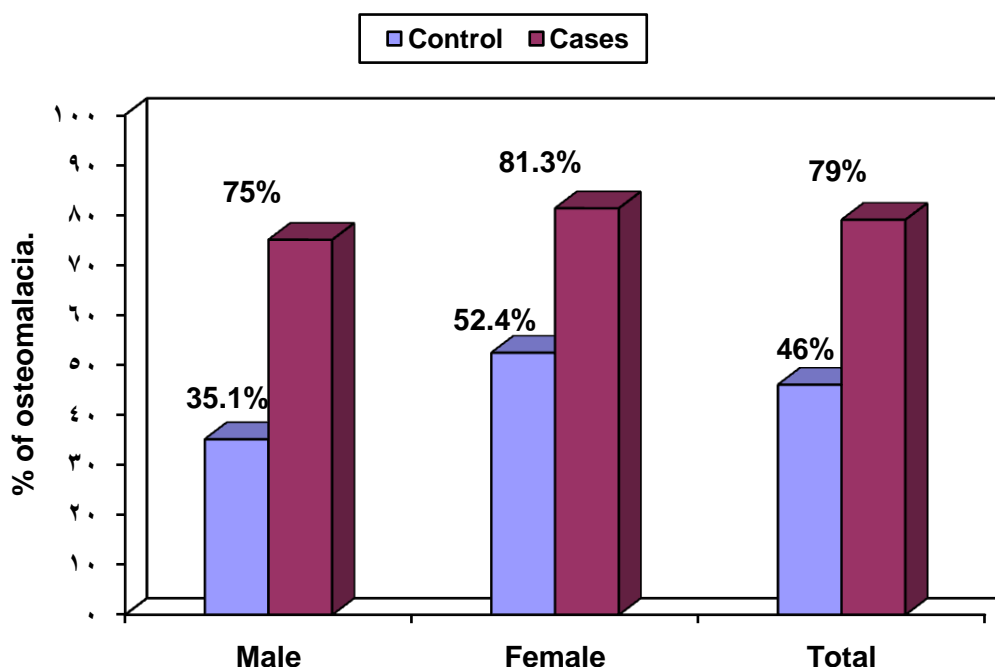


Fig. (1) The percentage of the osteomalacia among study groups.

Discussion

Falls are a major health care concern in the frail elderly⁽²¹⁾. The greatest increase in the incidence of fractures in elderly was due mainly to the installation of the osteomalacia and malnutrition as well as to the largest incidence of fall in elderly⁽²²⁾. The biochemical changes in osteomalacia show increased levels of ALP with normal or decreased serum calcium and phosphate, increased PTH (secondary hyperparathyroidism) and low vitamin D⁽¹⁸⁾. The results in the current study have been obtained by investigating 200 elderly whose age's ≥ 60 years. The results in this

study showed a highly significant increase ($P < 0.001$) in PTH level in elderly in cases group. This was in agreement with the results obtained by Compston *et al.*,⁽²³⁾ who showed that PTH level was significantly higher in patients with hip fracture and it contributes to bone loss and the high incidence of hip fractures in the elderly population. The results in this study disagree with the result reported by Falch *et al.*⁽²⁴⁾ who found that patients with hip fracture had no difference in serum levels of PTH from that of the control. The present study showed a highly significant decrease ($P < 0.001$), in serum calcium and

corrected serum calcium concentration in case group, This was in agreement with Benhamou *et al.*,⁽²⁵⁾ study who found that hypocalcaemia is common in elderly with fracture proximal femur. Moreover, the results obtained by Sitta *et al.*,⁽²⁶⁾ showed decreased serum calcium in elderly with fracture which may be due to vitamin D deficiency, which is a major risk factor for bone loss and fracture⁽²⁷⁾. The present study were not correspond with the results reported by Pun *et al.*,⁽²⁸⁾ who found that there is no statistically significant difference in serum calcium concentration between femoral neck fracture patients and the control. The results in our study showed a highly significant decrease ($P<0.001$), in serum phosphate concentration in case group, This was in agreement with Riaz *et al.*,⁽²⁹⁾. On the contrary, the result in our study was in contrast with the result obtained by Pun *et al.*,⁽²⁸⁾ who showed that there was no significant difference in serum phosphate concentration between femoral neck fracture patients and the control. The results in this study showed a highly significant increase ($P<0.001$), in ALP activity in cases group, This was in agreement with Sitta *et al.*,⁽²⁶⁾ who found that serum ALP activity was elevated in elderly with fracture. This result was disagreed with Pun *et al.*,⁽²⁸⁾ study who found that there was no significant difference in serum ALP activity between femoral neck fracture patients and the control. In this study, the abnormalities in serum PTH, corrected calcium, phosphate and ALP activity, was done to determine the percentage of osteomalacia in case and control groups. There was a significant higher percentage of combined abnormal biochemical tests (osteomalacia) in cases group (79%), and a higher percentage in males (75%) and females (81.3%) of the same group, and the percentage was higher in females of cases and controls groups. This was in agreement with Sitta *et al.*,⁽²⁶⁾ who reported that osteomalacia may predispose to fracture in

elderly. In contrast, Riaz *et al.*,⁽²⁹⁾ showed that frequency of osteomalacia in cases of hip fractures was found with no association with known risk factors, and about one fourth of the patients showed abnormal values of serum calcium, phosphorus and ALP.

Conclusion

Osteomalacia was common among patients with fracture neck of femur.

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