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Relationship between Coronary Risk Factors, C-Reactive Protein, Bone Mineral Density and Carotid Circulation Among Frail Elderly

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Abstract

Background: Frailty may now be regarded as a geriatric syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, causing vulnerability to adverse health outcomes including falls, hospitalisation, institutionalisation and mortality. The inflammatory mediators as C-reactive protein have been associated with the development of the geriatric frailty. Several studies have pointed out increased level of homocystiene in frail elderly Increasing frailty was associated with lower bone mineral density, as both bone mass and muscle strength decrease during ageing and this has also been associated with higher risk of osteoporotic fractures in frail elderly. Objective: To compare frail and non-frail elderly regarding Bone mineral density, carotid circulation and serum levels of Homocysteine, coronary risk factors and CRP.

Methods: 104 elderly patients, who were assigned to 2 groups. Group A (52 frail participants): diagnosed by Fried's criteria as applied by Avila-Funes et al., 2008. Group B (52 non-frail participants).All participants were subjected to the following: through history, physical examination, ADL, IADL assessment, MMSE ,GDS, laboratory investigations including; CRP, homocystiene and total lipid profile, measurement of bone mineral density by DEXA and carotid intima-media thickness by carotid duplex.

Results: There was no statistically significant difference in age, sex, among both groups.Frail participants had higher ADL and IADL dependence, higher incidence of depression, cognitive impairment and osteoprosis.They also had higher levels of homocystiene , CRP , CIMT and lower levels of HDL cholesterol.

Conclusion: Osteoporosis is more prevalent among frail elderly also frailty is associated with more ADL & IADL dependence, higher GDS scores & lower MMSE score in addition to higher mean level of homocystiene, CRP & triglycerides in addition to low serum HDL & higher CIMT.

Key words: Frailty, comprehensive geriatric assessment, coronary risk factors, osteoporosis.

Introduction:

Frailty is often conceptualized by health care providers as a state of late life decline and vulnerability characterized by weakness and decreased physiologic reserve. Frail older adults are less able to adapt to stressors such as acute illness or trauma. Their increased vulnerability leads to adverse outcomes including falls, institutionalization, disability, and death[1]

With aging, cardiovascular (CV) diseases become more frequent and complicated. There is an emerging body of literature linking CVD and frailty both at the mechanistic level and the epidemiologic level [2].Osteoporosis appears to be a good marker of frailty. It is a sign of vulnerability. Hip fracture is the major complication confronting elderly subjects and this too is a major public health problem. Frail subjects seem to be particularly exposed to this complication [3].

Aim of the study: To compare frail and non-frail elderly regarding bone mineral density, carotid circulation and serum levels of homocysteine, coronary risk factors and CRP.

Patients and Methods: The study is a Case-control study. 104 Elderly patients (60 years old and above), both males and females were recruited from Ain Shams University hospital from January 2011 till December 2012. One hundred and twenty participants were

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interviewed 16 were excluded 10 of them had renal impairment by labs (which lead to increased Hcy level) 8 were excluded due to technical difficulties . They were divided into two groups:

Cases Group: 52 frail elderly 60 years and older diagnosed by Fried's criteria[4] as applied by Avila-Funes et al[5] (Which are: shrinking, poor endurance and energy, slowness, weakness and low physical activity)

The participants were considered to be ''frail'' if they had three or more frailty components among the five criteria.

Controls Group: 52 elderly 60 years and older matched with caeses regarding age and gender. They are not frail or have 2 or less of frailty criteria.

Methods:

Every participant was subjected to the following:

1- Informed written or oral consent.

2- Comprehensive geriatric assessment including:

a) Complete medical history.

b) Physical examination.

c) Mini mental status examination (MMSE)[6].

d) Geriatric depression scale (GDS)[7].

e) Activities of daily living (ADL)[8].

f) Instrumental activities of daily living (IADL)[9]

The results of ADI and IADL assessment are as follows:

Independent; if they reported being able to carry out all activities without assistance

Dependent: if they needed assistance of any degree in all activities.

Assissted: if they are receiving assisstance of any degree in some but not all activities.

3- Laboratory investigations including; CRP, homocystiene and total lipid profile.

I-CRP: CRP level in normal healthy adults is usually low <10mg/dl[10].

II-Homocystiene: Hyperhomocysteinaemia was defined as levels greater than 12 mmol/l[11].

III-Lipid profile.

4- Measurement of bone mineral density by DEXA.

BMD was classified according to WHO (World Health Organization) definition based on T-score.

Normal: T-score between 0 and -1 .

Osteopenia: T-score between -1 and -2.5.

Osteoporosis: T score less than or equal to -2.5 [12].

5- Measurement of carotid intima-media thickness by carotid duplex.

Normal intima media thickness is usually less than 0.8mm [13].

Data Management:

Analysis of data was performed by using the 12th version of Statistical Package for Social Science (SPSS).Description of all data in the form of mean (M) and standard deviation (SD) for all quantitative variables was done. Frequency and percentage was done for all qualitative variables.Comparison between quantitative variables was done using t-test to compare two groups . Comparison of qualitative variables was done using the Chi-square test.Correlation coefficient also was used to find linear relation between different variables using r-test or Sperman correlation co-efficient.Significant level measured according to P value (probability), $P>0.05$ is insignificant, $P<0.05$ is significant and $p<0.01$ is highly significant.

Results:

The study included 104 elderly participants (60 years old and above), both males and females were recruited from in-patient geriatric ward and Out-patient clinics at Ain Shams University hospital January 2011 till december 2012.One hundred twenty participants were interviewd 16 were excluded 10 of them had renal impairment by labs (which lead to increased Hcy level), 8 were execluded due to technichal difficulties.The participants were divided into a case (52 frail elderly patients) and control (52 non frail elderly) group.

As regards demographic criteria of the study population , there was no significant differences between cases and controls as regads:age , gender,living arrangment and smoking habits but there was a higher percentage of illiteracy among frail cases 73.1% compared to 34.6% among controls.

There was a higher mean number of associated chronic disease.Table (1) shows the

distribution of chronic disease among frail and non frail participants there was higher percentage of diabetes mellitus, IHD, hypertension, stroke, visual and hearing impiarment among cases . The three most prevalent chronic illnesses among cases were visual impairment, DM, and IHD (the least common were hearing impairment, stroke and chronic liver disease). As for controls the three most prevalent chronic illnesses were COPD, Visual impairment and arthritis.

Table(1): Comparison between the two studied groups as regards chronic diseases

	Cases		Controls		T	P-value
	No.	%	No.	%		
Diabetes mellitus	24	**46.2**	14	26.9	4.1	**0.04***
IHD	28	**53.8**	9	17.3	15.1	**0.000****
Hypertension	26	**50.0**	14	26.9	5.8	**0.01***
Stroke	10	**19.2**	2	3.8	6.0	**0.01***
COPD	18	34.6	19	36.5	0.4	0.8
Arthritis	20	38.5	18	34.6	0.1	0.6
Visual impairment	40	**76.9**	18	34.6	18.8	**0.000****
Hearing impairment	8	**15.4**	0	0	8.6	**0.003****
Chronic liver disease	10	19.2	5	9.6	1.9	0.1
Thyroid disease	6	**11.5**	0	0	6.3	**0.01***
Anemia	4	7.7	0	0	4.1	0.06

P<0.05 significant P<0.01 highly significant.

Frail cases had more assistance and dependendence in ADL and IADL than controls and also had higher percentage of depression & cognitive impairment than cases (The odds ratio were 4.8 for GDS score & 20.6 for MMES score).

There was a higher percentage of spinal and femoral neck osteopenia & osteoporosis among cases compared to controls,and also higher CIMT among cases was observed.Finally frail cases had higher levels of CRP, homocystiene & lower HDL levels (There was also Higher area under the curve in homocystiene compared to CRP which means better detection for frailty among elderly).

There was a significant positive linear correlation between serum homocystiene level & GDS.There was also positive correlation between CRP & T.cholesterol & LDL.Finally CIMT was positivly correlated to age and to the number of chronic diseases.as showen in tables (2,3)

Table(2): Correlation between age, homocystiene,CRP & studied parameters

	Age	Homocysteine	CRP
GDS	R=-0.088 P=0.5	**R=0.383** **P=0.005****	R=0.049 P=0.7
T.cholesterol	R=0.002 P=0.9	R=-0.081 P=0.5	**R=-0.319** **P=0.02***
Triglycerides	R=-0.016 P=0.9	R=-0.206 P=0.5	R=0.066 P=0.6
LDL	R=-0.075 P=0.5	R=-0.038 P=0.7	**R=-0.296** **P=0.03***
HDL	R=-0.030 P=0.8	R=-0.199 P=0.1	R=-0.155 P=0.2
CIMT	**R=420** **P=0.002**	R=-0.110 P=0.4	R=0.14 P=0.4

P<0.05 significant P<0.01 highly significant

Table(3): Correlation between CIMT,number of chronic diseases & osteoprosis

	Chronic diseases	Osteoprosis (femur)	Osteoprosis (spine)
CIMT	**R=0.389** **P=0.004**	R=-0.10 P=0.4	R=0.104 P=0.4

P<0.05 significant P<0.01 highly significant

Discussion:

The study also showed that frail cases had more ADL & IADL depedance , increased prevelance of depression & cognitive impairment. Which agreed with **Bandeen-Roche et al, Chen et al and Ensrud et al** respectively [14-16].

The three most prevalent chronic illnesses among cases were visual impairment, DM, and IHD (Frail participants had a higher atherosclerotic load than non-frail ones;as Clinical IHD was more prevalent than in non-frail, also clinical syndromes associated with atherosclerosis are more prevalent in frail participants; DM and IHD).The number of chronic diseases was also a predictor of frailty, independent of the number of physiological systems at abnormal levels which was found by **Fried et al** using data from Woman Health Initiative (WHS) I&II [17].The number of chronic diseases was positively correlated to CIMT , the latter was found in our study to be higher in frail elderly which agreed with **Newman et al** [18]. Our study also found that frail patients had higher prevalence of lumbar spine & femoral neck osteopenia & osteoporosis, these results perfectly matches those of **Frisoli et al** [19].

We found that Homocystiene & CRP were higher in frail elderly as proved before by **Wong et al, Walston et al** [20-21]also

By comparing the sensitivity & specificity of CRP & homocystiene in the detection of frailty the latter was found to be better predictor of frailty (higher area under the cure than CRP), contrary to **Houwelingen et al** [22] who stated that CRP & homocystiene are equally related to mortality in elderly (85 years & older).

Conclusion:

Frail cases had more ADL & IADL dependence, higher GDS scores & lower MMSE score. Frailty has been also associated with

higher number of chronic diseases, higher CIMT and higher incidence of osteoporosis.

Homocystiene and CRP are higher among frail elderly and the former is more sensitive than the later.

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