Adverse cardiovascular outcomes in patients with hand osteoarthritis

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Abstract

Objective: The study aimed to search for the suggested association of hand osteoarthritis (HOA) with the evidence of atherosclerotic vascular disease in population above 45 years old.

Patients and methods: This study was carried out at the Department of rheumatology and cardiology, Sohag University Hospital, during 2013-2016. It is a Cross-sectional study comprising the following groups: 30 patients with HOA above 45 years old, 30 patients with non-hand osteoarthritis (knee OA) above 45 years old and 30 healthy volunteers as control. The three groups were compared clinically and through ECG, trans thoracic echo TTE and carotid doppler. Coronary angiography was done for selected patients. Follow up and recording of adverse cardiovascular events was carried out for 18-24 months.

Results: The mean age of the study group was 56.41 ± 6.494 years. Knee OA patients was older than HOA and control subjects. The three groups were matched as regard sex, smoking and BMI. HOA patients showed the most frequent cardiac manifestations. (26.7%) of HOA patients had ECG findings suggestive of ischemia. TTE examination of the studied population showed that (LVH, SWMA and aortic sclerosis) was more prevalent among patients with hand OA followed by knee OA and least in the control group. There is a positive, weak, non-significant correlation between severity of atherosclerosis and severity of OA. Follow up for adverse cardiovascular events ACE for all groups at 18-24 months interval. 2 patients (6.6%) in hand osteoarthritis group developed stable angina with no admission in CCU but diagnosed on the basics of outpatient clinic, one of them had coronary angiography and revascularization, another patient developed myocardial infarction at 10 months follow up and revascularization at discharge of CCU. One patient (3.3%) in Knee OA group developed stroke with partial recovery. One patient in the control group lost during follow up time.

Introduction

Osteoarthritis (OA) is the leading cause of musculoskeletal morbidity in the elderly, the hands being one of the most frequent sites of osteoarthritis development. Disability directly related to hand osteoarthritis has largely been ignored, although several studies have shown a significant impact of osteoarthritis on hand strength and function [1].

The term atherosclerosis comes from the Greek Atheros, meaning gruel, and sclerosis, meaning hardening. Atherosclerosis begins at the at luminal surface, at the interface between blood and the arterial wall [2]. Atherosclerosis-related cardio-vascular events are the cause of death in almost 50% of cases in developed countries. The presence of atherosclerotic disease in more than one arterial system is associated with a higher risk of recurrent symptoms and complications [3]. Worldwide over 8.6 million women die from CVD each year; this is almost equal to the number of deaths seen in men [4]. Evidence exists that OA patients are at higher risk than the general population for developing several additional serious conditions and cardiovascular disease (CVD) in particular. In fact, a number of studies have demonstrated association of increased rates of cardiovascular morbidity in OA patients. Interestingly, recent study showed that the overall cardiovascular mortality to be directly proportional to the extent of radiographic evidence of OA by demonstrating diminished survival in women with an increased number of joint groups affected by OA [5].

Aim of the work

Our study aimed to search for the association of hand OA, with evidence of atherosclerotic vascular disease in population above 45 years old and to determine if there is a correlation between the severity of the hand osteoarthritis and atherosclerotic changes in the carotid arteries.

Patients and methods

This study was carried out at the department of (cardiology) and department of (rheumatology and rehabilitation) Sohag University Hospital, during 2013-2016. It is a Cross-sectional study comprising the following groups:

1.   Group 1) 30 patients with hand osteoarthritis above 45 years old, the patient diagnosed as having hand OA according to the American College of Rheumatology criteria for classification of HOA.

2.   Group 2) 30 patients with non-hand osteoarthritis (knee OA) above 45 years old,

3. Group 3) 30 healthy volunteers as control.

Exclusion criteria

1) Knee OA patients with manifest hand osteoarthritis.

2) Patients' known clinically and by laboratory analyses to have inflammatory arthritis (rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis and any other connective tissue disease).

3) Patients' known to be hypertensive or diabetic will be excluded.

4) Patients younger than age of 45 years.

Patients were subjected to

1) Full history taking and complete general and musculoskeletal examination.

2) Plane X ray hand.

3) 2-D ultrasound and Color Doppler study of the carotid artery was done.

4) Electrocardiogram ECG was done searching for ECG changes suggestive of ischemia (ST segment (including elevation and depression) and T wave changes that may represent myocardial ischemia and may be followed by the formation of Q waves as well as the changes in the QRS complex associated with prior myocardial infarction.

5) Trans thoracic Echocardiography TTE was done by Toshiba echocardiography device model (NEMIO30) for each patient left ventricular hypertrophy, segmental wall motion abnormalities of ischemic heart disease, ejection fraction and aortic sclerosis.

6) Trans catheter coronary angiography was done by (INFINI CBI bi-plane catheterization LAB) (TOSHIBA corporation japan) for patients eligible for coronary angiography and revascularization (5 cases from hand OA group and 2 cases from knee OA group).

Statistical analysis: Statistical package for social sciences (IBM-SPSS), version 19 IBM- Chicago, USA was used for statistical data analysis. Data expressed as mean, standard deviation (SD), number and percentage. Mean and standard deviation were used as descriptive value for quantitative data. Student t test was used to compare the means between two groups, and one-way analysis of variance (ANOVA) test was used to compare means of more than two groups. P-value was considered significant if <0.05.

Results

The mean age of the study group was 56.41 ± 6.494 years. Knee OA patients was older than hand OA and control subjects, but there was no significant difference between the three groups (Table1). There was female predominance in the three groups, ranging from (73.3%) in the knee OA patients, to (86.7%) in the hand OA group. Again, there is no significant difference between the three groups regarding sex distribution. The majority of the study population were overweight to obese, with a mean BMI of 28.33 ± 3.54. The three groups were matched regarding BMI.

Comparing the three groups of our study together regarding cardiac manifestations, hand OA patients showed the most frequent cardiac manifestations, followed by knee OA and least frequent among control subjects. However, these differences were only significant in the prevalence of dyspnea (Table 2).

Musculoskeletal manifestations had the highest prevalence among hand OA patients, followed by knee OA. The results of K&L hand score seen by X-ray is summarised in the following figure (Figure 1). Radiological features of the modified Kellgren and Lawrence grading system of OA: Scoring each of the 30 joints (5 DIP, 4PIP, 5MCP, 1ST CMC joints of both hands) from 0 to 4 according to the presence of osteophytes and joint space narrowing (subsequent suggestions by Spector and Lane) (Spector and Cooper, 1993; Lane and Kremer, 1995) [6,7].

ECG examination of the study population showed that 8 cases out of the 30 hand OA patients (26.7%) had ECG findings suggestive of

Table 1. Demographic data of the study groups.

Group	Hand OA	Knee OA	Control	ANOVA*/Chi square**	P value
Age Mean ± SD Range	55.67 ± 5.188 47-65	58.27 ± 7.781 45-70	55.30 ± 6.047 45-70	1.898*	0.156 (NS)
Sex Male Female	4(13.3%) 26(86.7%)	8(26.7%) 22(73.3%)	7(23.3%) 23(76.7%)	1.735**	0.420 (NS)
Smoking	3(10%)	6(20%)	4(13.3%)	1.259**	0.533 (NS)
BMI Mean ± SD Range	28.47 ± 3.78 22.6-35	27.99 ± 3.83 21.9-34.1	28.53 ± 3.07 23.1-33.3	0.203*	0.817 (NS)

Table 2. Cardiac manifestations among the study groups.

Sign	Hand OA		Knee OA		Control		Total		Chi square	P value
	No	%	No	%	No	%	No	%		
Normal pulse rate	27	90	28	93.3	29	96.7	84	93.3	1.071	0.585(NS)
Pulse irregularity	4	13.3	2	6.7	1	3.3	7	7.8	2.169	0.338(NS)
Raised JVP	3	10	1	3.3	1	3.3	5	5.6	1.694	0.429(NS)
Dyspnea	10	33.3	8	26.7	1	3.3	19	21.1	8.940	**0.011 (S)**
PND	3	10	1	3.3	1	3.3	5	5.6	1.496	0.429(NS)
Angina	6	20	5	16.7	1	3.3	12	13.3	4.038	0.133(NS)
CCU admission	1	3.3	2	6.7	0	0	3	3.3	2.069	0.355(NS)
Stroke	0	0	0	0	0	0	0	0	-	-
TIA	3	10	4	13.3	1	3.3	8	8.9	1.921	0.383(NS)

ischemia, compared to 5 cases in knee OA patients and one case in the control group (16.7% and 3.3%, respectively). The difference was statistically significant (Figure 2).

Echo cardiographic examination of the study population showed that (LVH, SWMA and aortic sclerosis) were more prevalent among patients with hand OA followed by knee OA and least in the control group. The difference was statistically significant regarding all
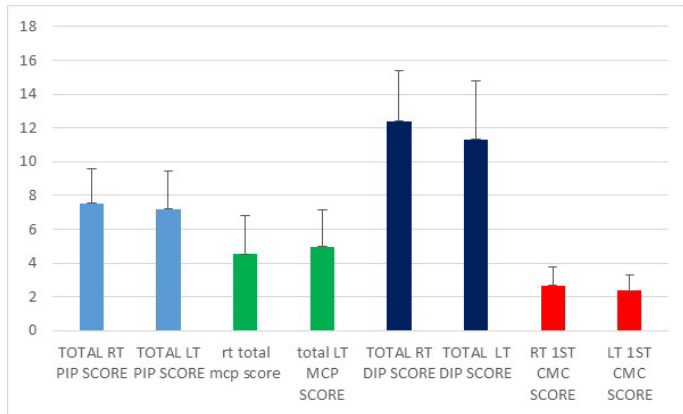

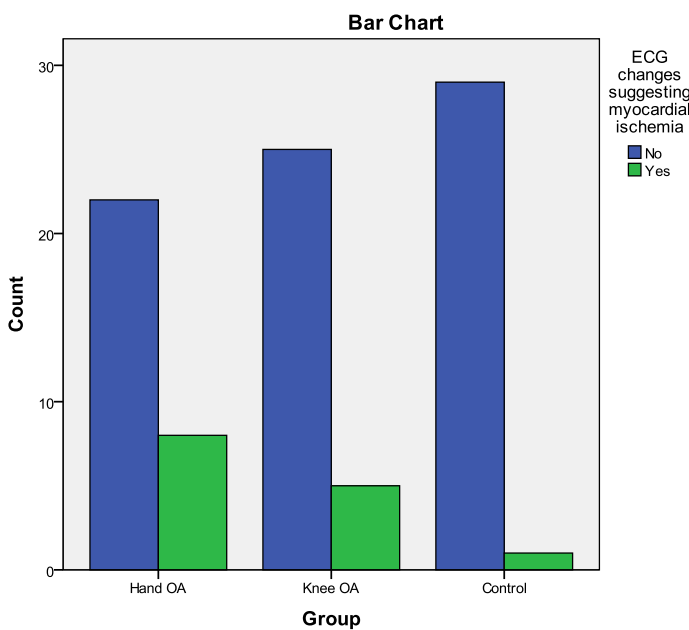**Figure 1.** X-ray hand of group 1 patients.

Figure 2. ECG findings of the study groups.

parameters except ejection fraction (Table 3 and Figure 3).

Carotid doppler examination of the study population showed that increase in (intimal medial thickness, plaque size and number, calcification and number of critical stenotic segments >59%) were more prevalent among patients with hand OA patients followed by knee OA patients and least in the control group. The difference was statistically significant regarding all parameters except ejection fraction (Table 4 and Figure 3).

LDL cholesterol level was significantly higher among hand OA patients in comparison with other groups (Table 5).

ANOVA = 3.994, P value = 0.022 (S)

Post-HOC test (individual p values)

There is a positive, weak, non-significant correlation between severity of atherosclerosis and severity of OA. A score of atherosclerosis
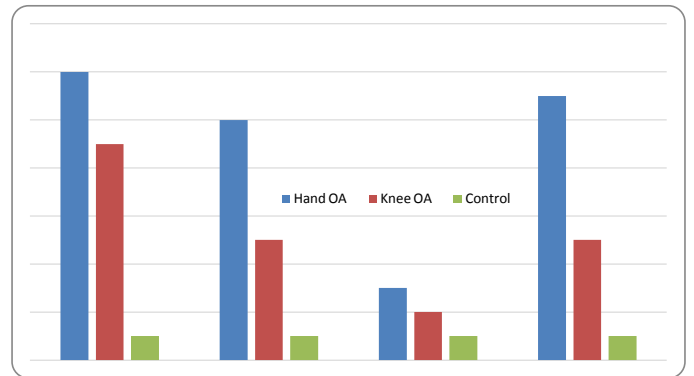

Figure 3. Echocardiography findings of the three groups.
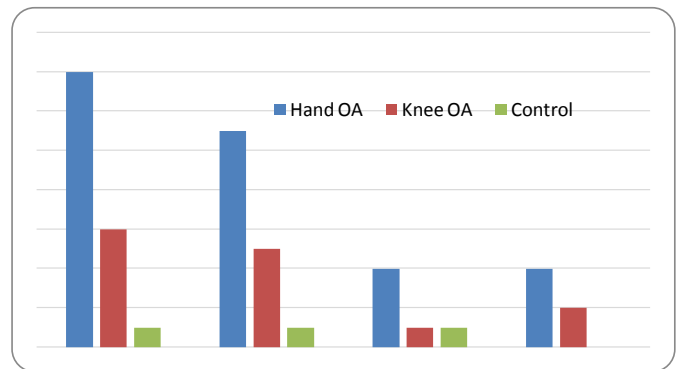
Figure 4. Power Doppler parameters of carotid arteries of the three groups.

Table 3. Echocardiography findings of the three groups.

Sign		Hand OA		Knee OA		Control		Chi square	P value
		No	%	No	%	No	%		
Left ventricular hypertrophy	Yes	12	40	9	30	0	0	11.671	**0.003 (S)**
	No	18	60	21	70	30	100		
Segmental wall motion abnormalities	Yes	10	33.3	5	16.7	0	0	9.274	**0.010 (S)**
	No	20	66.7	25	83.3	30	100		
Ejection fraction <55%	Yes	3	10	2	6.7	0	30	1.071	0.585 (NS)
	No	27	90	28	93.3	30	100		
Aortic sclerosis	Yes	11	36.7	5	16.7	0	0	11.023	**0.004 (S)**
	No	19	63.3	25	83.3	30	100		

Table 4. Power Doppler parameters of carotid arteries of the three groups.

Sign		Hand OA		Knee OA		Control		Chi square	P value
		No	%	No	%	No	%		
Intimal thickness	Yes	14	46.7	6	20	0	0	16.025	**<0.0001 (HS)**
	No	16	53.3	24	80	30	100		
Plaques	Yes	11	36.7	5	16.7	0	0	11.023	**0.004 (S)**
	No	19	63.3	25	83.3	30	100		
Stenotic segments	Yes	4	13.3	1	3.3	0	0	3.214	0.200 (NS)
	No	26	86.7	29	96.7	30	100		
Calcification	Yes	4	13.3	2	6.7	0	0	4.286	**0.040 (S)**
	No	26	86.7	28	93.3	30	100		

Table 5. LDL Cholesterol.

Group		LDL cholesterol
Hand OA	Mean	133.27
	Std. Deviation	45.078
Knee OA	Mean	113.37
	Std. Deviation	40.184
Control	Mean	105.00
	Std. Deviation	33.235
Total	Mean	117.21
	Std. Deviation	41.114

ANOVA = 3.994, P value = 0.022 (S)
Post-HOC test (individual p values)

Comparison	P value
Hand OA vs knee OA	0.056 (NS)
Hand OA vs control	0.007 (S)
Knee OA vs Control	0.418 (NS)
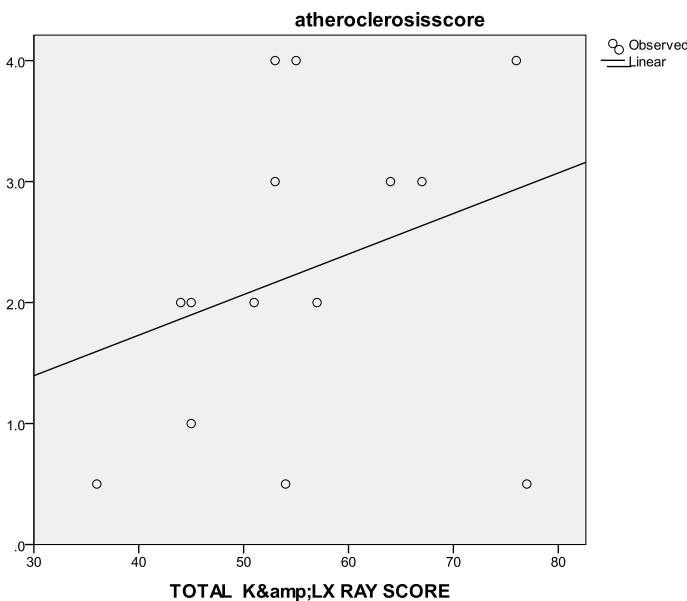
Figure 5. Correlation between atherosclerosis score and K & L score.

(number of sites with presence of plaques) was assigned, ranging from 0 (no plaque) to 6 (three plaques bilaterally); a score of 0.5 was assigned when intima media thickness (IMT) was above the normal level, in absence of plaques (Figures 5 and 6) [8].

Cardiac catheterization was done in 7 cases (5 hand OA and 2 knee OA). 4 cases out of 5 in hand OA cases and the two knee OA cases showed critical stenotic lesions >60% that required revascularization. One patient in the hand osteoarthritis group showed moderate atherosclerosis of coronary arteries with no significant lesions.

Follow up for adverse cardiovascular events for all groups at 18-24 months interval. 2 patients (6.6%)in hand osteoarthritis group developed stable angina with no admission in CCU but diagnosed on the basics of outpatient clinic, one of them had coronary angiography and revascularization, another patient developed myocardial infarction at 10 months follow up and revascularization at discharge of CCU. One patient (3.3%) in Knee OA developed stroke with partial recovery. One patient in the control group lost during follow up time.

Discussion

Osteoarthritis and atherosclerosis are two seemingly un-connected degenerative chronic diseases that happen to have a high incidence of occurrence in developed countries. Both are silent processes and may remain virtually asymptomatic until decades later, as they are evolving with age and they both bear high economic cost that becomes evident when complications become overt [9].

Our study included 30 hand OA patients, 30 knee OA patients and 30 healthy subjects as a control group. Our cases were age and sex matched.

There was non-significant difference between the three groups.

Our results are to some extent, in agreement with the data obtained by Rahman, *et al.,* [10] who found a statistically significant positive associations of OA with heart disease, angina and CHF among both men and women.

Theoretically, osteoarthritis would lead to less physical activity and consequently, obesity and higher serum cholesterol levels. On the other hand, hypercholesterolemia may be working through systemic mechanisms to cause osteoarthritis. The association between hypercholesterolemia and OA of the hands as part of generalized OA would favour such a mechanism. In the current study LDL cholesterol level was highest among hand OA and lowest among control cases, with a significant difference in between the 3 groups.

ECG examination of the studied population revealed that (26.7%) of patients with hand OA patients had ECG findings suggestive of ischemia, compared to (16.7%) in knee OA patients and (3.3%) in the control group. Echo examination of all patients revealed that hand OA patients had the highest Echo findings suggestive of ischemia, followed by knee OA patients and least in the control group. The difference was statistically significant. Data from the Third National Health and Nutritional Examination Survey (NHANES III) by Singh**,** *et al.,* [11] and other study by Haara, *et al.,* [12] indicate that U.S. adults with OA have a significantly higher prevalence of cardiovascular risk factors (increased BMI, hypertension, diabetes mellitus, physical activity, lipid profile, etc.) than the non-arthritic population, which may place OA

patients at risk for developing CHD.

Carotid doppler of the studied population revealed that evident atherosclerosis was more prevalent in hand OA cases, followed by knee OA and least in control subjects. Possible explanation is that: the vascular pathology is an integral part of osteoarthritis process, possibly contributing to the initiation or progression of HOA, in which a suggestive pathway that OA leads to a state of hypercoagulation and hyperfibrinolysis, and subsequently to circulatory disturbances in the subchondral bone contributing to the perpetuation of cartilage destruction and the pathophysiological process of OA [14]. Our results were similar to those seen by Al-Rawi, *et al.,* [14]. Such finding coincides with that obtained by Hoeven, *et al.,* [15] who found an association between atherosclerosis and OA of the knee, MCP and DIP joints in women.

18-24 months follow up of the 3 groups patients confirmed that hand OA group are at a significant risk of adverse cardiovascular outcome. 2 patients had stable angina and one patient developed myocardial infarction (Total 10% of HOA patients). 3.3 % of patients with knee OA (one patient) had cerebro-vascular stroke and no cases with adverse out come for control group.

Conclusion

The exploration of the relationship of OA specially hand OA with heart disease, MI, CHF and angina and atherosclerosis remains a promising and important area of research. Since OA is a very common health condition, an association between OA and CVD and astherosclerosis would be important from a public health perspective.

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