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Association Between Costo-iliac Distance /Arm Span Ratio and Lumber Height and its Relation with Osteoporosis in a Group of Egyption Post-menopausal Women

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Abstract

Background: Osteoporosis is a common condition, especially affecting the older female population. The ability to predict loss of lumbar height using simple anatomical measurements would be a useful tool.

Aim: To examine the relationship between CID/AS ratio and spinal height. And if there was a correlation between CID/AS ratio and early osteoporosis.

.**Methods:** A case-control study was designed, 50 post-menopausal women as cases and 50 as controls aged 50-70 were recruited who attending DEXA unit, Eldemerdash hospital, Ain Shams University during the period between June 2016 to Marsh 2017. Arm span (AS) and the costo-iliac distance (CID) was measured as the number of cm between the costal margin and the pelvic ridge of a patient, measured in the midaxillary line, the CID/AS ratio was calculated. The L1–L4 vertebral height of each patient was obtained from dual-energy X-ray absorptiometry (DEXA).

Results: The age of the studied cases, mean age 59.65 and SD 5.25. While the age of studied controls, mean age 57.67 and SD 5.48 (P value 0.07), the study was showed that no significant association between CID/AS ratio and lumber vertebral height, but there was a statistically correlation between CID/AS ratio and DEXA results (T score) with best cut off value CID/AS ratio $\geq$ 0.058, Sensitivity = 74% Specificity = 60%

Conclusions: The CID/AS ratio is a useful bedside test in identifying patients with osteoporosis.

Keywords: Osteoporosis - Costo-iliac distance - Arm span - dual-energy X-ray absorptiometry – Lumber height

Background

Osteoporosis is a common condition in the older female population, with an incidence of 15% in women over 50 years of age. Prevalence in the 80- to 89 -year-old age group is approximately 48% in the United States [1]. In Egypt, calculation shows that 53.9% of postmenopausal women have osteopenia and 28.4% have osteoporosis. As 26% of men have osteopenia and 21.9% have osteoporosis [2], osteoporosis is projected to impact approximately 14 million adults over the age of 50 by the year 2020. Osteoporotic fractures are associated with increased mortality and major morbidity, including loss of independence, reduced function and mortality, pain, kyphosis and respiratory compromise [3]. Although the mortality rate associated with hip fractures is higher, vertebral fracture is associated with substantial morbidity, including chronic back pain, reduced truncal postural flexion, restricted movement and increased risk of falls [4].

The gold standard for the diagnosis of osteoporosis is dual-energy absorptiometry (DXA) [5].

We wish to highlight reduced costo-iliac distance (CID) as a reliable clinical sign of degenerative spinal disease in older people. In health, there is normally a space of at least two finger breaths between the lower costal margin and the upper iliac crest margin. Reduced CID occurs when the lower costal margin and the apex of the iliac crest are opposed, as a result of reduced vertical height of the lumbar and/or dorsal spine. Sometimes, reduced CID is so marked as to cause the iliac crest to overlap the costal margin, resulting in chronic abdominal pain in the lumbar and iliac fosse areas. The phenomenon is much more prevalent in elderly females than males, given their higher prevalence of osteoporosis. Decreased CID is associated with a loss of standing height. Arm span (AS) is a valid surrogate marker of standing height which changes little as a person ages. Therefore the ratio of CID to AS may be a useful clinical indicator of reduced lumbar spinal height (from degenerative changes in the spinal vertebrae and intervertebral discs). There has been little research to date examining this clinical phenomenon [6], the study aimed to examine if these two simple measurements might prove to be a useful tool for the identification of patients with early spinal vertebral height loss or occult vertebral fracture. **The aim of this study was** to estimate if there was a relationship between CID/AS ratio and spinal height, and its relation with early diagnosis of osteoporosis.

Methods

A case control study was designed to achieve the study objectives; Data was examined from 100 postmenopausal participants (50 cases and 50 controls), attending El demerdash hospital for DEXA. After ethical approval of the study, each subject was subjected to full history taking, had measurement of their weight, height and had measurement of their CID using a caliper device and corrected for standing height by dividing the average CID by the subject's AS (in metres), AS being a reliable surrogate marker for peak adult standing vertical height; this was referred to as the CID/AS ratio. Antero-posterior lumbar spine vertical height (LSVH) was then measured from each subject's lumber bone densitometry. A DEXA scan was performed in all the participants, measurement of spinal height from L1 to L4 was obtained as part of the bone densitometry, BMD and T-score were obtained as well.
The correlation between the CID/AS ratio and lumbar vertebral height and between the CID/AS ratio and T score were calculated

Statistical Analysis

Analysis of data performed by using SPSS package version 22.0.
Description of data in the form of mean (M) and standard deviation (SD) for all quantitative variables and frequency and percentage for all qualitative variables. Comparison of qualitative variables was done using chi-square test (X2). Correlation was done using Pearson correlation coefficient Significance levels measured according to P value (probability) P>0.05 insignificant, P<0.05 significant, P<0.01 highly significant.

Results

Table 1: Correlation between CID/AS ratio and DEXA results:

	CID/AS	
	r*	P value
T score at L2-L4	0.30	0.04
Z score at L2-L4	0.21	0.15
T score at femur neck	0.40	0.004
Z score at femur neck	0.35	0.01
T score at femur troch	0.41	0.003
Z score at femur troch	0.37	0.01
T score at forearm radius33%	0.30	0.03
Z score at forearm radius33%	0.25	0.08
T score at L1-L4	0.338*	0.016

Table 2: Correlation between CID/AS ratio and LSVH results:

	CID/AS	
	r*	P value
L1 average Ht	0.09	0.53
L2 average Ht	0.18	0.22
L3 average Ht	0.15	0.30
L4 average Ht.	0.19	0.20

Table 3: Comparison between patients and controls regarding CID/AS ratio

	Patients (N=50)		Controls (N=50)		P value
	Mean	SD	Mean	SD	
CID	9.78	0.79	9.55	1.07	0.226
AS	161.32	5.80	165.06	5.57	0.001
CID/AS ratio	0.061	0.005	0.058	0.006	0.018

Table 4: Comparison between patients and controls regarding Age and Age of menopause:

	Patients (N=50)		Controls (N=50)		P value
	Mean	SD	Mean	SD	
Age	59.65	5.25	57.67	5.48	0.07
Age of menopause	49.42	3.17	49.16	2.93	0.67

Discussion

Regarding Costo-iliac/Arm span ratio, the study finding showed no statistical significant difference between cases and controls as regard the costo-iliac distance and showed statistical significant difference ($P<0.05$) as regard the arm span. Overall there was significant difference between cases and controls as regard CID/AS ratio which agree with study by ***Barry and O'Mahony***[7], (best cut off value CID/AS ratio $\geq$ 0.058). Regarding Lumbar spine vertebral height (LSVH) the study showed no statistical significant difference ($P>0.05$) between cases and controls, since osteopenia and osteoporosis may be present but not cause reduced LSVH when there is no crush fracture deformity of vertebral bodies. Regarding the correlation between CID/AS ratio and DXA results this study finding showed that there is a highly statistically significant positive correlation ($P<0.01$) between CID/AS ratio and DEXA results as regard T score at femur neck and T score at femur trochanter, also shows a statistically significant positive correlation ($P<0.05$) between CID/AS ratio and DEXA results as regard T score at L2-L4, T score at femur neck, Z score at femur neck, T score at femur trochanter, Z score at femur trochanter, T score L1-L4 and T score at forearm radius 33%. This finding is not similar to study by ***Barry and O'Mahony*** [7] may be because there study was done on older women, mean age + SD = 71.9 + 4.1 years).

This experimental evidence would appear to correlate with what would appear to be a very common clinical observation. However, there are several possible confounders to the measurement including previous degenerative intervertebral disc disease. The simple bedside investigation described is not meant to replace more detailed investigation but may help identify patients who would benefit from DEXA/LVA scanning and evaluation. Medical students and clinicians should be aware of this sign.

It was believed that CID measurement in the future may have a role as part of routine clinical assessment of all elderly female patients as the treatment options for osteoporosis continue to develop.

Conclusion:

There was no significant correlation between CID/AS and LSVH, which is not surprising since osteopenia and osteoporosis may be present but not cause reduced LSVH when there is no crush fracture deformity of vertebral bodies. Similarly, lumbar vertebral height may be reduced to a degree as a result of intervertebral disc degeneration, without osteopenia or osteoporosis. Nevertheless, we contend that in old age, reduced CID, relative to height (as measured by AS) usually indicates significant osteoporosis with fragility fracture compression of vertebral bodies and loss of lumbar spinal height.

Measurement of CID/AS is therefore a simple and valid indicator of lumbar vertebral height, reduction of which can usually be attributed to partial or complete lumbar vertebral collapse due to more advanced osteoporosis in elderly women.

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