Research Article

Determination of Sensitivity and Specificity of Cardio-Goniometry in Detection of Coronary Artery Disease in Patients with Osteoporosis and Rheumatoid Arthritis

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ABSTRACT

Background: This study aimed to determine the sensitivity and specificity of cardio-goniometry (CGM) in detection of coronary artery disease in patients with osteoporosis and rheumatoid arthritis that have symptoms of chest pain through angiography or radionuclide myocardial perfusion imaging (MPI). Study Methods and design:100 patients with osteoarthritis and rheumatoid arthritis, according to WHO criteria suspected to have ischemic heart disease enrolled in study. The patients were studied by cardio-goniometry and then the results were compared with angiography or MPI of the same patient (selected as standard diagnosis method). then sensitivity and specificity of cardio-goniometry were calculated. Results: 71 patients underwent to angiography and in 29 patients MPI was done. In first a group 42 patients had Coronary artery disease (CAD). In MPI group 18 patients had CAD in CGM.Seventy-one of these patients underwent angiography for diagnose of ischemic heart disease .29 of them diagnosed as healthy. Of the 100 patients, 29 patients were evaluated previously using MPI to determine ischemic heart disease .11 patients diagnosed as healthy. All 100 patients were examined by cardio-goniometry among which 47 subjects were healthy and the rest subjects had significant and non-significant ischemia. Statistical analyses didn't show significant difference between the results of cardio-goniometry with angiography and myocardial perfusion (p Value >0/05). the results showed the sensitivity and specificity of cardio-goniometry compared rather than angiography and cardiac scan was equal to 0/86 and 0/63. Conclusion: CGM can be suitable for screening of ischemic heart disease in patients with Rheumatoid arthritis and osteoporosis (who cannot do exercise test).

Keywords: osteoporosis, Rheumatoid Arthritis, cardio-goniometery, sensitivity, specificity.

INTRODUCTION

Ischemic heart disease arises from an imbalance between myocardial oxygen supply and demand. The most common cause of myocardial ischemia is coronary artery atherosclerotic disease. This disease more than any other disease in developed and developing countries causes death and disability and economic costs. by urbanization of developing countries, prevalence of risk factors and ischemic heart disease (IHD) in these areas are rapidly increasing. The myocardial ischemia often pretends with chest pain in activity and even sometimes at rest[1,2].

Rheumatoid Arthritis (RA) is a chronic and multi-organ disease with unknown etiology characterized by stable inflammatory sinusitis and typically involves peripheral joints with symmetrical pattern. Although the incidence of cartilage damage, bone erosion and joint deformity are usual symptoms of the disease, but the course of RA can be varied. The cardiac complications are pericarditis and myocarditis or valve diseases. Osteoporosis refers decrease bone density or fracture due to brittle bones and when the bone density drops to 2.5 standard deviations below the mean value of a normal young person (T score <- 2.5) and in other people reach Tscore < -1 (osteopenia), These patients may suffer from chest pain at rest and intensifying of pain on activity due to joint-osseous problems[3,4].

Methods of determining coronary artery disease are different:

Electrocardiography: (ECG) is the record of heart's electrical potential graph. The clinical application of ECG is caused by its immediate availability as a non-invasive, inexpensive and multifunctional diagnostic tool. But this method has no much sensitivity and specificity for selection of patients need to invasive cardiac procedures[5]. exercise tolerance test (ETT): it is a known screening test

Table 1: Sensitivity and specificity of cardio-goniometry with angiographic findings as gold standard.

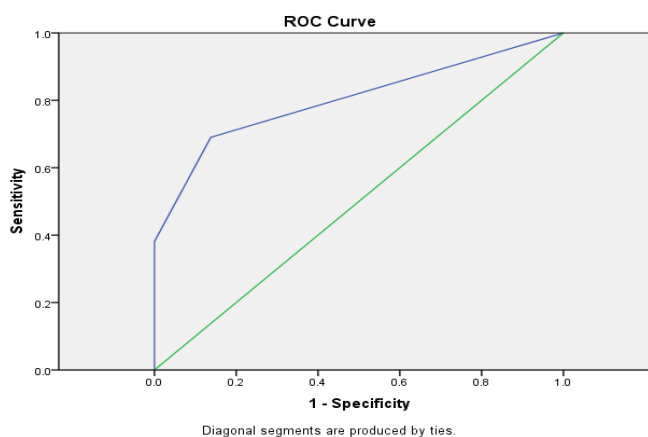| Angiography (n=71)					
Negative (n=29)		Positive(n=42)			
Specificity	frequency (percent)(	sensitivity	frequency (percent)		
---	0(0)	38	16(38)	specific CAD	cardio-
---	4(13/4)	30	13(30)	Non-specific CAD	goniometry
---	4(13/4)	69	29(69)	Total specific and non-specific positives	
86	25(86)	---	13(30)	negative	

Figure 1: ROC curve and the correlation with the standard.

for ischemia. Clinical on of indications for exercise test is When clinically presence or absence of coronary artery disease is in question, the guide lines of ACC / AHA, consider exercise test for patients with intermediate likelihood of coronary artery disease such as patients with atypical angina and younger patients with typical chest pain. Otherwise, Inappropriate cases for ETT are LBBB in ECG, ST changes in the base ECG, taking digoxin, high blood pressure and acute systemic disease or unable to do test because of bone pain and paralytic patients[6].

Nowadays myocardial radionuclide scan widely is used to assess ischemic heart disease. Yet it is used to select patients before angiography. In MPI method radioisotope is injected once at rest and once during stress, areas with coronary artery disease has not radioisotope uptake. This method is time-consuming and expensive and is not possible everywhere and requires specialized personnel and the patient must be irradiated radioactive materials[7].

Angiography with coronary CT scan (CTA): This method has shown accuracy similar to the MRA imaging of the aorta and great vessels. The limits of CTA include X-ray exposure and need to contrast material which in the patients with renal insufficiency or allergy is problematic. This method in patients with an irregular heartbeat or fast heart rate also has limitation. Additionally, high cost and the need for specialized personnel and expensive equipment's are other limitations[8].

Catheterization and Angiography: Despite considerable progress in non-invasive methods, cardiac catheterization is still considered as a gold standard diagnostic tool for the study of anatomy and physiology of the heart and associated blood vessels for diagnosis of coronary artery disease. Complications of this method are arrhythmias, reaction to contrast material, stroke, local vascular complications and hematoma of procedure site. In one thousandth of cases, death occurs[9].

Cardio-goniometer (CGM) is a new diagnostic method based on the ECG that using computer processing of three-dimensional information of the incoming potential cardiac. This method is non-invasive and useful for diagnosing ischemic patients. The main advantages of this method is performing the test at resting and simply done in the ordinary situation for all patients. Also the CGM is a method without the risks of radiation or contrast agent. Does not require the presence of specialized personnel, its device is a portable one not time-consuming, expensive, no specific side-effect. so far no certain functional limitations have determined for it[10].

In patients with rheumatoid arthritis and osteoporosis who are suspicious to have CAD, exercise test cannot do easily due to inflammation and pain of the small joints of the chest and sternum and foots. Other diagnostic methods such as MPI and coronary CTA and MRA are expensive and unsuitable for screening[11,12]. In this study, we examine the sensitivity and specificity of cardio-goniometry in patients with rheumatoid arthritis and osteoporosis who studied previously for chest pain by angiography or cardiac scan. goniometry results compared with angiographic or MPI to know whether goniometry has a good sensitivity or specificity for detecting ischemia in patients with chronic chest pain such as osteoporosis and rheumatoid arthritis group or not. If acceptable sensitivity and specificity with this method would obtain, cardio-goniometry can be used to screen such patients and even can be used for other unable patients for exercise test. According to the description above, this study aims to answer this basic

Table 2: Sensitivity and specificity of cardio-goniometry rather than MPI.

MPI(n=29)

Negative (n=11)		Positive (n=18)			
Specificity	frequency (percent)(	sensitivity	frequency (percent)		
---	0(0)	38	7(38)	specific	cardio-
---	4(36)	50	9(50)	Non-specific	goniometry
---	4(36)	88/8	16(88/8)	Total specific and non-specific positives	
63	7(63)	---	2(11)	negative	
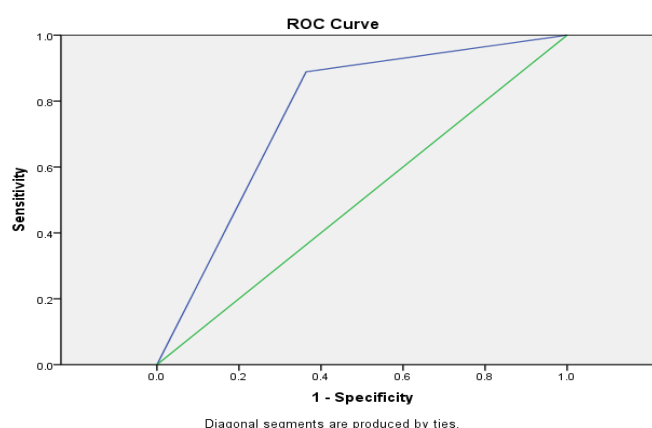
Figure 2: ROC curve and the correlation with the standard. P=0/687.

questions: how much the sensitivity and specificity of cardio-goniometry device for diagnosis of coronary artery disease in patients with Rheumatoid Arthritis (RA) and osteoporosis with chest pain compared with angiography and MPI?

MATERIALS AND METHOD

This study was a cross-sectional one. In the present study, study population included patients with osteoporosis and rheumatoid arthritis referred Golestan hospital of Ahvaz city. sample size was obtained 100 subjects taking into account the 95% confidence interval and statistical power of 80% using the software NCSS. those who their angiographic results have been positive were patient group and those with normal angiography considered as control group. Inclusion criteria consist of full satisfaction for inclusion, having osteoporosis and Rheumatoid Arthritis, the patient is suspected ischemic heart disease (chest pain, in association of each old age or presence of two concurrent risk factors, diabetes, hyperlipidemia, hypertension, smoking, ischemic changes on ECG). exclusion criteria included the patient's unwillingness to do angiography or MPI study, no need for diagnostic procedures for ischemic heart disease as cardiologist decision.

In this study, patients with osteoarthritis and rheumatoid arthritis according to WHO criteria for osteoporosis and ACR for rheumatoid arthritis who had chest pain were selected by rheumatologist and referred to heart clinic .patients with typical chest pain or atypical pain in old age, presence of two major risk factors such as diabetes, dyslipidemia, hypertension, smoking or obvious ST depression and T inversion in ECG were undergoing

angiography or myocardial perfusion scan as cardiologist decision. cardio-goniometry performed for all patients. results reported as negative for ischemia (healthy) and positive for ischemia. coronary artery disease criterion was presence of (coronary artery stenosis more than 50% in angiography) or presence of reversible perfusion defect in MPI.

The results of CGM reported by device as negative for CAD, specific positive (area of ischemia defined by equipment) and nonspecific positive (area of ischemia was not defined). Before beginning of study, the patients with inclusion criteria were informed about research goals and after signing the informed consent form were enrolled in the present study. After confirming the inclusion, the demographic questionnaire included age, sex, disease duration, jobs and Et al was completed.

Data analysis

For data analysis, SPSS version 21 was used. The quantitative data were reported as mean ± SD and qualitative data as frequency percentage. In this study, Sensitivity Analysis and ROC curve were used to determine the sensitivity and specificity. McNamara's test was used to compare the results of different methods.

RESULTS

In this study, 71 patients with osteoporosis and rheumatoid arthritis were evaluated by angiography for ischemic heart disease. Of these 71 patients, 42 patients had positive angiographic results as ischemia and 29 patients had negative angiographic result. All of them evaluated by cardio-goniometry. Of the 42 patients with positive angiography, 16 patients had specific ischemia, 13 non-

Table 3: Sensitivity and specificity of cardio-goniometry V.S (cardiac scans + angiography).

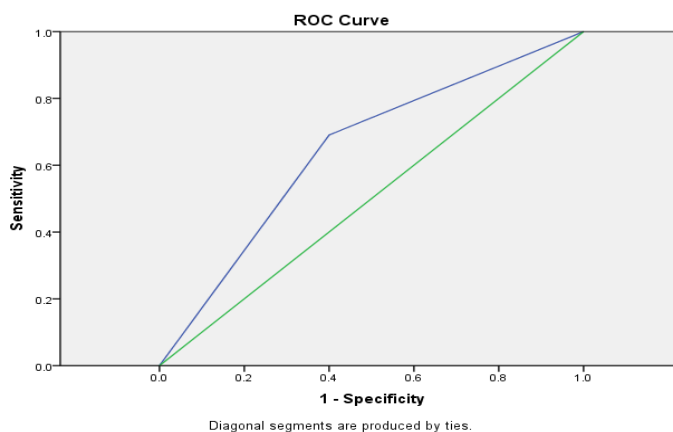| Angiography + cardiac scan (n=100)					
Negative (n=40)		Positive (n=60)			
Specificity	frequency (percent)(	sensitivity	frequency (percent)		
---	8(20)	75	45(75)	positives	cardio-
80	32(80)	---	14(25)	negative	goniometery

Figure 3: ROC curve and the correlation with the standard. P=0/21.

specific ischemia and cardio-goniometry results of 13 patients was negative. Totally 42 patients with positive coronary angiogram, 29 patients had positive cardio-goniometry result. As a result, cardio-goniometry sensitivity with regard to angiography as the gold standard method was obtained 69 percent. Among the 29 patients with negative angiographic result, only 4 people according to cardio-goniometry test has non-specific ischemia and the 25 remaining people were diagnosed as healthy. Therefore, the cardio-goniometry specificity upon angiography gold standard was calculated 86 percent (Table 1). The ROC curve (Figure 1) and the correlation with the standard value, showed no difference between sensitivity and specificity of cardio-goniometry and angiography (p=0/051).

In this study, 29 patients with osteoporosis and rheumatoid arthritis were evaluated for ischemic heart disease using cardiac scan. 18 patients, had positive scan result and 11 had negative scan result. After cardiac scan, these people underwent cardio-goniometry. 7 of 18 patients with positive scans, had specific ischemia, 9 people nonspecific ischemia and for 2 people. the cardio-goniometry result was negative. Totally, of 18 patients with positive scan, 16 patients had a positive cardio-goniometry result. cardio-goniometry sensitivity with regard to cardiac scan was 88.8%. A reassessment of the people using cardio-goniometry showed that among the 11 patients with negative MPI result, only 4 people according to cardio-goniometry test has non-specific ischemia and the 7 remaining people were diagnosed as healthy. Therefore, the cardio-goniometry specificity regarded to MPI was calculated 63 percent (Table 2). The ROC curve (Figure 2) and the correlation with the standard value, showed no difference between sensitivity and specificity of cardio-goniometry and MPI (p=0/68).

In this study 100 patients with osteoporosis and rheumatoid arthritis were evaluated for ischemic heart disease using cardiac scan or angiography. Of these, 60 people had positive angiographic or cardiac scan result and 40 people had negative result. Of the 60 patients with positive angiography or cardiac scan result, 45 people had positive cardio-goniometry and 15 people had negative one. As a result, cardio-goniometry sensitivity was 75 percent regarded to both Angiography and MPI. among the 40 patients with negative angiography and scan result, only 8 people according to cardio-goniometry test has non-specific ischemia and the 32 remaining people were diagnosed as healthy. Therefore, the cardio-goniometry specificity with angiography gold standard and MPI was calculated 80 percent (Table 3). The ROC figure (Figure 3) and the correlation with the standard value, showed no difference between sensitivity and specificity of cardio-goniometry and two other methods (p=0/21).

DISCUSSION

This study designed to evaluate sensitivity and specificity of Electro goniometry in osteoporotic RA patients. Cardio-goniometer is a new diagnostic method based on the ECG that using computer processes three-dimensional information of the incoming cardiac potential with the patient in supine position at rest. This method is non-invasive and is applied in diagnosing ischemic patients. The main advantages of this method include in resting state and simply done in the ordinary situation for all patients both with motional limits and without motional limits. Also the CGM is a method without any risk, does not require the presence of specialized personnel, its device is a portable one, not time-consuming and no specific side-effect and so far no certain functional limitations has determined for it.

The quality of screening and diagnostic tests is very important. Regardless of the type and shape of these tests (physical examination, chest x-ray, electrocardiogram or blood and urine tests) one thing is true about all of them: How much these tests are useful to distinguish between those with disease and healthy people?[3].

When a screening program is performed, often a large group of people are diagnosed as patient. These include sick people who are really sick (true positives) and healthy subjects who have been shown patient (false positives). False positives are important regarding all people who have a positive screening result, are required to be tested by more sophisticated tests. This poses several problems, first is pressure of work and cost that the health care system could be encountered. Another problem is anxiety in people with positive test result[14]. Other criteria that must be considered in a diagnostic test assessment, is the predictive value of a test. In fact, about a diagnostic test this question is asked that if the screening test is done with this test, what proportion of people are diagnosed correctly. However, in clinical conditions, another question may be created for the doctor: If a person's test is positive, how much the probability of this person is sick? This question is called positive predictive value of the test. In other words, what percentage of people whose test result is positive, are patient? By dividing the true positives on all people whose test result is positive the predictive value is calculated[3,5]. In the case of negative results, another question arises: "If the test is negative, how likely a person is healthy? " This value is called negative predictive value. This value is determined by dividing the actual negative values on all people whose test result is negative. All the tests that doctors perform include: History, physical examination, radiography, electrocardiogram and other measures are made to strengthen the ability of physician reach the correct diagnosis. What the doctor wants to know is that "if the result is positive test how likely a person is ill patient?". Unlike the sensitivity and specificity of test that can be considered as characteristics of used test, the predictive value of the test is influenced by two factors: 1- the prevalence of disease in the population tested and If the disease is not prevalent, then specificity test is used (5.6 and 15).

The findings of this study showed that the sensitivity and specificity of cardio-goniometry in the total population is 75% and 80%, respectively. Similar studies have also reported similar results for sensitivity and specificity of cardio-goniometry. Ghadrdoost and colleagues in a cross sectional study, evaluated the sensitivity and specificity of cardio-goniometry in patients undergoing angiography to diagnosis of cardiac ischemia. This study was conducted on 390 patients undergoing angiography. The cardio-goniometry was performed shortly before angiography. Results of the study of these researchers showed cardio-goniometry sensitivity in the diagnosis of cardiac ischemia compared with angiography was 84%. its specificity was 81 % in that study[7]. In another similar study Seyedian and colleagues evaluate the sensitivity and specificity of cardio-goniometry in 190 patients before angiography and found sensitivity and specificity 72 and 60 percent[14]. The

results of present study were lower than similar studies. Because our sample group include patients with chest pain having two non-cardiac diseases that frequently produce chest pain similar to ischemia that may not have cardiac source. therefor prevalence of CAD in our group was lower than two other mentioned studies with high probability of ischemia. based on the results of the statistical analysis, this diagnostic method can also be a good way to screen for susceptible individuals to cardiac ischemia.

In this study small size of subjects and the lack of a separate study of osteoporosis and rheumatoid arthritis are the main limitations. Based on the limitations of this study, the suggestion of further research is implementation of study with larger sample sizes and use of people with osteoporosis and rheumatoid arthritis separately in the study.

CONCLUSION
Cardio-goniometer have acceptable sensivity and specifity in osteoporotic RA patients with chest pain and can replace for primary screening instead of invasive procedures.

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