

# ACCURACY OF TRANS-THORACIC ECHOCARDIOGRAPHY AS A PERICARDIAL DISEASES DIAGNOSTIC TOOL

Ekpe E. E. and Anyanwu C. H.

National Cardiothoracic Centre, University of Nigeria Teaching Hospital Enugu, Nigeria

## Summary

A prospective comparison of pre-operative trans-thoracic echocardiographic findings with intra-operative findings of 17 patients operated on for pericardial diseases showed excellent correlation for pericardial calcification and adhesion, and for myo-cardial atrophy, and good correlation for pericardial thickening, constriction and effusion respectively. This excellent correlation identified high-risk cases that should have heart-lung machine kept on the stand-by during operation of peri-cardiectomy in event of iatrogenic cardiac chamber laceration.

## Keywords

Pre-operative transthoracic echocardiography, pericarditis, correlation.

## INTRODUCTION

Pericarditis is the commonest pericardial disease in our service. Idiopathic causes and infections constitute about 95% of causes<sup>1,2</sup> Delay in treatment leads to chronicity with inspissation of effusion, adhesion, fibrosis, calcification, thickening and constriction of the pericardium, and atrophy of myocardium<sup>1-5</sup>. High risk cases predispose to iatrogenic cardiac chamber perforation with potentially fatal haemorrhage during pericardiectomy<sup>1,6</sup>. If identified pre-operatively, these high-risk cases should be operated upon with cardiopulmonary by-pass machine kept on stand-by or as back-up.<sup>1,7,8</sup> The major under taking of setting up heart lung machine as stand by during every operation of pericardiectomy prompted our interest in this study.

## STUDY DESIGN

A prospective comparison of the pre-operative trans-thoracic echocardiographic findings with intra-operative findings of 17 patients who were treated surgically for pericardial diseases in University of Nigeria Teaching Hospital (UNTH), Enugu between November 2003 and September 2005 was done. The pre-operative trans-thoracic echocardiography was done by consultants and senior residents of the

cardiology unit using HP Sonos 2000 while the pericardiectomies were done by the Consultants and Senior Residents of Cardiothoracic Surgery Unit through median sternotomy. The following parameters were assessed and compared: pericardial thickening, pericardial effusion, pericardial calcification, pericardial adhesion, pericardial constriction and myocardial atrophy.

## RESULTS

Table 1: Presentation of Results

Parameter	Intra-op Echo	True	False	Total
Pericardial thickening	Positive	10	1	11
	Negative	6	-	6
	Total	16	1	17
Pericardial Effusion	Positive	10	3	13
	Negative	3	1	4
	Total	13	4	17
Pericardial Calcification	Positive	3	-	3
	Negative	14	-	14
	Total	17	-	17
Pericardial Adhesion	Positive	7	-	7
	Negative	10	-	10
	Total	17	-	17
Pericardial Constriction	Positive	12	1	13
	Negative	2	2	4
	Total	14	3	17
Myocardial Atrophy	Positive	3	-	3
	Negative	14	-	14
	Total	17	-	17

Table 2: Presentation of result analysis

Parameters	Accuracy	False Positivity	Sensitivity	False Negativity	Specificity
Pericardial Thickening	94%	9.1%	90.9%	-	100%
Pericardial Effusion	76.5%	23.1%	76.9%	25%	75%
Pericardial Calcification	100%	-	100%	-	100%
Pericardial Adhesion	100%	-	100%	-	100%
Pericardial Constriction	82.4%	7.7%	92.3%	50%	50%
Myocardial Atrophy	100%	-	100%	-	100%

Tables 1 and 2 depict the correlation of pre-operative trans-thoracic echocardiographic findings with intraoperative findings of 17 patients treated surgically for pericardial diseases in the National Cardiothoracic Centre, Enugu, Nigeria. Of the 11 patients diagnosed on echocardiography to have pericardial thickening, 10 were confirmed at operation. This gave a false positivity of 9.1%. All the 6 patients said on pre-operative echocardiography to have normal pericardium were confirmed at operation with no false negativity. This gave overall accuracy of 94% for pericardial thickening with sensitivity of 90.9% and specificity of 100%.

Thirteen of our patients were diagnosed with pericardial effusion by pre-operative echocardiography. This was confirmed in 10 patients while the remaining three patients did not have pericardial effusion at the time of operation. Of the four patients diagnosed on echocardiography to be without pericardial effusion, at operation, this was confirmed in three while one of the four patients had pericardial effusion. This gave an accuracy of 76.5%, sensitivity of 76.9% and specificity of 75%% for pericardial effusion.

For pericardial constriction, echocardiography diagnosis was made in 13 patients and this was confirmed at operation in 12 patients. One false positive echocardiographic diagnosis of pericardial constriction was proved at operation. Of the four patients said on echocardiography not to, have pericardial constriction, significant constriction was found at operation in two of them. This gave accuracy of 82.4%, sensitivity of 92.3% and specificity of 50% for pericardial constriction.

Echocardiographic findings of pericardial calcification, pericardial adhesion and myocardial atrophy amongst the 17 patients correlated perfectly with intra-operative findings for these parameters, giving an accuracy of 100%, sensitivity of 100%, and specificity of 100%.

## **DISCUSSION**

Pericardial diseases are common in cardiothoracic consultation with an annual average of 6-8 cases in UNTH, Enugu, Nigeria with a male: female of 2:1<sup>1</sup>. The disease occurs from early childhood to elderly age.<sup>1</sup> In up to 40% of cases, no cause can be found.<sup>1</sup>

Documented causes include infections by viruses like coxsackie A & B, echovirus, adeno-virus, mumps, mononucleosis, varicella, hepatitis B virus and human immunodeficiency virus; mycobacterium tuberculosis, bacteria like pneumococcus, staphylococcus, streptococcus, Neisseria gonorrhoeae, tularemia, legionella pneumophila; fungi like histoplasmosis, and others like toxoplasmosis, amoebiasis, mycoplasmosis, Nocardia, actinomycosis, ecchinococcosis; and Lyme disease.

Others are myocardial infarction, uraemia, neoplastic disease like lung cancer, breast cancer, leukaemia, Hodgkin's disease and lymphoma; radiation to the chest; chylopericardium; dissecting aortic aneurysm; myxoedema; and delayed post myocardial pericardial injury syndromes like Dressler's syndrome and post pericardiotomy syndrome. Other causes are auto-immune disorders like rheumatic fever, systemic lupus erythematus, rheumatoid arthritis, scleroderma, mixed connective disease, wegner's granulomatosis, polyarteritis nodosa, sarcoidosis, amyloidosis, inflammatory bowel disease, whipple disease, temporal arteritis and Behcet's disease; drugs like hydrallazine, procainamide, isoniazid, diphenylhydantoin, phenylbutazone, dantrolene, doxorubicin, methysergide and penicillin; and trauma like blunt chest trauma, cardiac surgery, thoracic surgery, pacemaker insertion, invasive cardiac diagnostic procedures, oesophageal rupture and pancreatico-pericardial fistula.<sup>1, 2, 9, 10</sup>

Pericarditis can be classified based on time frame and morbid anatomy into acute, subacute and chronic on a time frame of less than two weeks, two weeks to six weeks and greater than six weeks respectively; Effusive and non-effusive, calcific and non-calcific, and constrictive and non-constrictive.<sup>10</sup> Symptoms may be delayed for weeks to years and include fatigue, breathlessness, neck vein distension, fluid retention like oedema, ascitis and pleural effusion, and orthopnoea. Other features include hepatomegaly, pulsus paradoxus, narrow pulse pressure, hypotension, small volume pulse, small quiet heart and pericardial knock.

Diagnosis is facilitated and differential diagnosis excluded by some investigation modalities

including chest radiogram in postero-anterior, lateral and oblique views which may show pericardial calcification in 40%, compression in 60% and globular heart shadow of effusive pericarditis in addition to double heart shadows appearance.<sup>1, 11, 12</sup> Standard 12 lead electrocardiogram shows non-specific S.T. segment and T-wave changes in 90%, low voltage QRS complexes in 40%, and atrial arrhythmias like tachycardia and atrial fibrillation in 30%. 2-Dimensional echocardiogram is diagnostic and can depict pericardial thickening, pericardial effusion, pericardial adhesion, pericardial calcification, pericardial constriction and myocardial atrophy.<sup>13, 14</sup> It can also exclude cardiomyopathy which share many clinical features with constrictive pericarditis.<sup>11, 14</sup>

Other diagnostic modalities that may further be necessary in some patients are computed tomography scanning, magnetic resonance imaging scanning, cardiac catheterization, and minor thoracotomy as an exploratory procedure.<sup>15</sup>

Treatment of pericarditis depends on the type. Acute pericarditis is treated with antibiotic, NSAID, pericardiocentesis or pericardiotomy with occasionally a short course of steroids. Chronic pericarditis require pericardiectomy through median sternotomy or left antero-lateral thoractomy.<sup>1,8</sup> High-risk cases identified pre-operatively should have heart-lung machine kept on a stand-by basis in the event of iatrogenic cardiac chamber perforation with potentially fatal haemorrhage. If this occurs, the patient can be heparinized and blood aspirated and returned to the patient through the heart-lung machine until the laceration is repaired.<sup>7, 8, 10, 14</sup>

Pre-operative trans-thoracic echocardiography in this series gave a false positivity of 9.1%, 23.1% and 7.7% for pericardial thickening, pericardial effusion and pericardial constriction respectively (Table 2). It also gave false negativity of 25.0% and 50% for pericardial effusion and pericardial constriction respectively. Most of the discrepancies between the pre-operative echocardiographic findings and the intra-operative findings may be attributable to time lag and effects of pre-operative medical treatment between the time of diagnosis and operation. This is an unspecific period of time and in our centre depends partly on the time

needed to optimize patient's condition for surgery. During this period most patients are on diuretics, antibiotics or anti-tuberculous drugs.<sup>1,5</sup> We believe that a repeat echocardiography one to two days before operation would reduce the rate of "false positivity" and "false negativity" significantly. We observed excellent correlation between intra-operative findings and pre-operative echocardiographic findings in pericardial calcification, pericardial adhesion and myocardial atrophy which are the high-risk parameters which when present markedly predispose to intra-operative cardiac chamber perforation with potentially fatal haemorrhage. Pre-operative identification of high-risk cases should enable the assembling of heart lung machine for keep on the stand-by in case iatrogenic laceration into cardiac chamber occurs which is extremely difficult to salvage without cardiopulmonary bypass for a bloodless field.

## **CONCLUSION**

The accuracy of pre-operative trans-thoracic echocardiography as a pericardial diseases diagnostic tool is generally rated good, and it excellently identify high-risk cases that should have heart-lung machine kept on stand-by during the operation of pericardiectomy in an event of iatrogenic cardiac chamber laceration.

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