

## The validity of electrocardiography in detection of left ventricular hypertrophy as comparing to echocardiography

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### حساسية تخطيط القلب الكهربائي في الكشف عن تضخم البطين الايسر بالمقارنة مع فحص القلب الامواج الصوتية(الايكو)

#### الخلاصة:

#### المقدمة:

تضخم البطين الايسر يعد اكتشاف فعال لدى مرضى ارتفاع ضغط الدم حيث ان وجوده يعتبر عامل خطورة وهو قد يكون معادل لامراض شرايين القلب التاجية. لذا يجب التحري عنة بفحص دقيق، بسيط، لا تداخلي و رخيص

#### الغرض من الدراسة:

لتقييم حساسية تخطيط القلب الكهربائي في الكشف عن تضخم البطين الايسر بالمقارنة مع فحص القلب الامواج الصوتية(الايكو) و امكانية الاعتماد علىة كفحص استكشافي مع دراسة تأثير كل من العمر، الجنس و السبب في حساسية الفحوصات.

#### طريقة العمل و المرضى:

١٧٣ مريض تم شمولهم بالدراسة، جميعهم لديهم تضخم البطين الايسر مشخص بفحص القلب بالامواج الصوتية(الايكو) وقد اجري فحص تخطيط القلب الكهربائي للجميع للتحري عن تضخم البطين الايسر.

#### النتائج:

تخطيط القلب الكهربائي بطرق متعددة يستطيع ان يكتشف فقط ٥٢.٦ % من المرضى المصابين بتضخم البطين الايسر المثبت بفحص القلب بالامواج الصوتية(الايكو)

#### الاستنتاج:

من الصعوبة الاعتماد على تخطيط القلب الكهربائي للتحري عن تضخم البطين الايسر على الرغم من كونه فحص دقيق، بسيط، لا تداخلي و رخيص

#### Abstract

Introduction: left ventricular hypertrophy (LVH) is a vital finding in hypertensive patients as its presence indicates high risk state & can be equal to ischemic heart dis.

So it should be screened thoroughly by a valid, simple, non-invasive & cheap test.

Aim of the study: to assess the role of ECG in detecting LVH as comparing to echocardiography & can we rely upon ECG as a screening test, beside screening for some related factors as gender ,age & the etiology.

Pat. & method: 173 pat. Were involved by the study, all of them have LVH detected by echocardiography & ECG were done for them to detect LVH

Result: ECG by different criteria can detect LVH in 52.6% only out of all pat. Have LVH by echocardiography

**Conclusion:** as seen from the result it is difficult to depend on ECG as a screening tool for detection of LVH although it is easy non-invasive & cheap test

### **Introduction**

Left ventricular hypertrophy (LVH) is an important predictor of cardiovascular risk, and its detection contributes to risk stratification<sup>1</sup>

The increased risk associated with left ventricular hypertrophy (LVH) diagnosed echocardiographically (Echo-LVH) or electrocardiographically (ECG-LVH) is well known, but we have to assess the validity of each in detection the LVH, with their pitfalls.<sup>2</sup>

Regarding ECG detected LVH it is safe noninvasive easily applied tool & available any where but:

ECG is rather insensitive in detecting anatomic LV

Many criteria used with variable validity<sup>2</sup>

Regarding echo it is sensitive & specific tool for LVH detection, non invasive & easy technique but:

It provide no additional prognostic information if a subject's ECG-LVH and hypertension status are known

It is a more expensive and less available method than ECG

it is also sometimes difficult to distinguish physiological from pathological LVH and thereby to grade cardiovascular risk<sup>3</sup>

Left ventricular hypertrophy (LVH) is a well-known marker for an adverse prognosis but it is only recently some studies show evidences that treatment aimed at regressing LVH may have impact on morbidity and mortality. Given its adverse effect on prognosis it is important to accurately detect the presence of LVH.<sup>4</sup>

### **Mechanisms of LVH:**

- 1- Stress theory : as a result of myocardial work against high load lead to muscle hypertrophy by use /abuse mechanism
- 2- an increased left ventricular relative wall thickness are related to the insulin resistance syndrome of potent cardiovascular risk factors, including hypertension, It is not fully known whether the increased cardiovascular risk associated with Echo-LVH or ECG-LVH is independent of the associated metabolic disturbances and hypertension<sup>5</sup>
- 3- Adrenergic stimulation: A number of clinical and experimental observations have shown a close correlation between level of adrenergic activity and the development of LVH; adrenergic blockade has been shown to cause regression of LVH. Recent studies have demonstrated that post-synaptic alpha-blockers cause a reduction of LV mass. Terazosin, by virtue of its long duration of action, may attenuate the pathologic adrenergic pathways in the myocardium. These observations suggest the possible role of adrenergic mechanisms in the complex multifactorial pathogenesis of LVH and suggest the therapeutic impact of alpha-adrenergic blockade in promoting regression of LVH.<sup>2</sup>

### **Objectives:**

In order to determined the validity of ECG as a screening test for LVH in risky pat. as hypertensives, diabetics or ischemic heart disease in comparism to the echo examination, with the test validity in relation to gender ,age &etiology.

**Patients & methods:**

173 patients were involved in the study, conducted in Babylon from December 2007 to feb.2009, 78 male & 95 female.

Inclusion criteria:

- 1- Age between 30-70 years of age.
- 2- Have LVH by echo. By any cause as hypertension, hypertrophic cardiomyopathy or aortic stenosis<sup>6</sup>

The patients were divided by age into 2 groups

- 1- 30-50 years: 67
- 2- 51-70 years: 106.

The etiology of LVH were distributed as:

- 1- hypertension: 126
- 2- aortic stenosis: 20
- 3- HOCM: 6
- 4- Unexplained: 21`

ECG is done form all by computerized machine (fakuda) with speed 25mm, amplitude 10 with filter on.

There are more than 30 different ECG criteria that can be used to determine the presence of LVH, including the <sup>7</sup>

- 1- Classic Sokolow-Lyon (SV1 + maxRV5/6) if both > 35mm or each >30mm
- 2- Cornell (SV3 + RaVL) criteria: Cornell voltage of (SV<sub>3</sub>+RaVL) >2.8 mV,
- 3- Newer Cornell product of [(SV<sub>3</sub>+RaVL)x QRS duration] >244 μV
- 4- Left ventricular strain was defined as a downsloping ST-segment depression >0.1 mV with T-wave flattening or inversion in leads V<sub>4</sub> to V<sub>5</sub><sup>8</sup>

All these procedures were done & if the patient had any of the above methods +ve, was labelled as +ve

Echocardiography (2D, M mode & Doppler ) were done by HDI 1500 machine type.

Echocardiography is used as the standard method for LVH detection .

Left ventricular dimensions (interventricular septal thickness [IVS], posterior wall thickness [PW], and left ventricular end-diastolic diameter [LVEDD]) were measured at end of diastole with M-mode by using the leading-edge-to-leading-edge convention. <sup>9</sup>

Left ventricular mass was determined by using the Troy formula according to the recommendations of the American Society of Echocardiography (ASE): <sup>10</sup>

Left ventricular mass (g) = 1.05[(LVEDD+ IVS+PW)<sup>3</sup> -LVEDD<sup>3</sup> ].

Left ventricular mass was divided with body surface area to obtain the left ventricular mass index (LVMI), and by using sex-dependent cut-offs of 116 g/m<sup>2</sup> for men and 104 g/m<sup>2</sup> for men, echo-based LVH was defined <sup>10</sup>

**Statistical analysis:**

The tests used for the analysis include test for proportion between & chi square test for the parameters

**Results:**

52.6% (91 pat.) were labeled by ECG as having LVH out of 173 patients detected by echo & this finding represented graphically in figure No.1 & table No. 1.

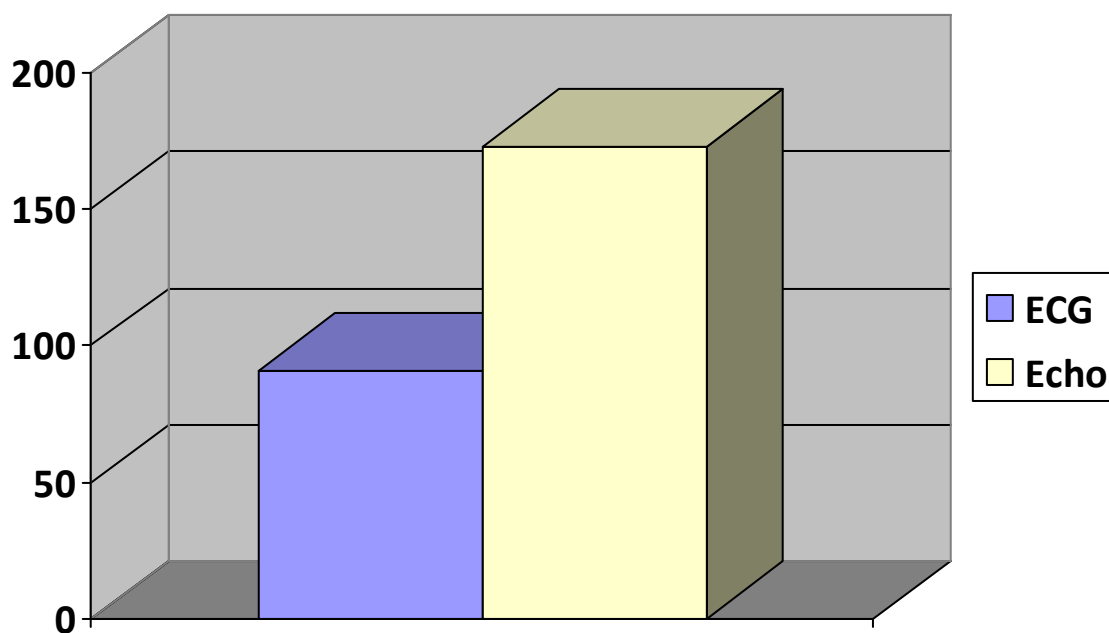


figure No.1

Table No. 1

Echo +ve	ECG +ve
100%	52.6%

The different 4 criteria used to detect LVH by ECG show all no significant differences in their sensitivity with each other as shown in figure No.2

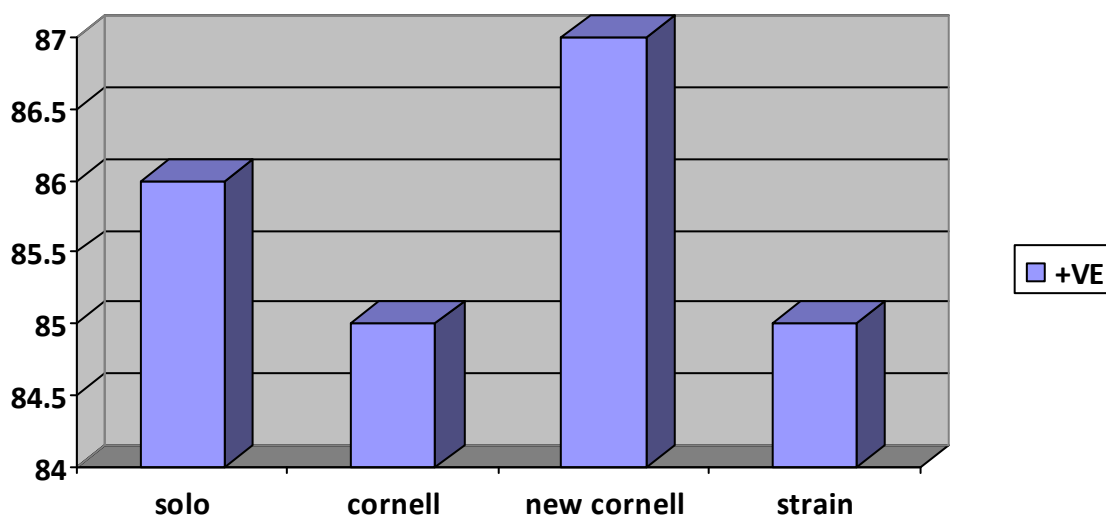


Figure No. 2

**The gender variable**

The validity of echo. In detection LVH is not statistically significant from that of ECG with P value>0.05 as shown in table No.2

**Table No.2**

gender	Echo +ve	ECG +ve
Male	95(54.9%)	63(69.2%)
female	78(45.1%)	28(30.8%)
total	173(100%)	91(100%)

**The age variable**

The echo. Is statistically more valid than ECG in detection of LVH in elderly patients with P value < 0.005 as shown in table No.3

**Table No.3**

Age	Echo +ve	ECG +ve
30-50	67(38.7%)	67(73.6%)
51-70	106(61.3%)	24(26.4%)
total	173(100%)	91(100%)

**The etiology variable**

There are no statistical significance regarding etiology between the 2 tests with p value >0.05 as shown in table 4 except for hypertension where the echo. Is statistically more valid.

etiology	Echo +ve	ECG +ve
hypertension	126(72.8%)	60(66%)
Aortic stenosis	20(11.6%)	14(15.4%)
HOCM	6(3.5%)	6(6.5%)
Unexplained	21(12.1%)	11(12.1%)
total	137(100%)	91(100%)

**Discussion:**

The results presented above are consistent with most of the previous studies which recommend that echo. is more sensitive tool in LVH detection as compare with ECG by all the criteria chosen as Johan Sundström et al. Study<sup>1</sup>, Graham Jackson study<sup>2</sup> & Sheldon G. Sheps; Edward D. Frohlich myo clinic study<sup>3</sup>

The gender show no strong relation to the validity of the tests while the age does so because the elderly usually have chest wall deformity because of musculoskeletal stiffness or associated respiratory dis. That seen commonly in those age group that make the ECG technique & interpretation more difficult & non conclusive.

regarding the etiology the hypertensive patients show more differences because it is the commonest cause & the LVH is the mildest one in comparing with other causes as HOCM so can be detected by the more sensitive test i.e. echo.

As shown that ECG is insensitive & can detect only around half of cases of LVH but it is still safe easy applied & cheap test

In spite of the high sensitivity & specificity of echo for detection of the LVH with other information as its causes (hypertrophic cardiomyopathy) or aortic stenosis or associated ischemic heart dis. ,it is still need skilled hands with wide inter-individual variation i.e. operator dependent.

The cardiac MRI is the investigation of choice in detection of LVH but it is far more unavailable & expensive than echo.<sup>10</sup>

The choice of echo. As the standard tool for LVH detection is done because of its availability (not as MRI)

**Recommendations**

1. Echo is easy, a sensitive & specific test for LVH detection & can be recommended as screening test in the place of ECG
2. Presence of normal ECG does not exclude LVH since it sees only 52.6% of cases with echo-proved LVH
3. Do not depend on multiple types of criteria because the results is the same as any one (insensitive in compare to echo)
4. special care should be provided for elderly & hypertensive since the difference is significant

**Conclusions**

In any patient need LVH screening it is preferred to do ECG, if normal proceed for echo. study to exclude false negative results so can not be used as screening test

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