# SCREENING AND LOCALIZATION OF SILENT PERICARDIAL EFFUSION IN HEALTHY PREGNANT WOMEN

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During normal pregnancy, the functional load on the heart and circulation are monitored, but the effect of pregnancy on the pericardium has not received the deserved attention. The aim of this study was to assess pericardial sac during normal pregnancy when developing pericardial effusion, with reference to clinical significance and prognostic signs. One hundred and four asymptomatic healthy pregnant women were clinically examined and investigated by M-mode and two-dimensional echocardiography at 12th, 24th and 36th weeks' gestation and in the 8th week after delivery. The findings were compared with those from 50 young age-matched non-pregnant women with no heart diseases. Pericardial effusion of different severity was detected in 24 cases (23 %). The size of the effusion was assessed by a simple method based on volume estimation of a prolate ellipse derived from the measurement of the length and two minor axes of the ellipse which is used to estimate total pericardial sac volume and cardiac volume. The pericardial fluid volume is the difference between these two volumes. The effusion was large in 4 (3.8 %), moderate in 4 (3.8 %) and small in 16 (15 %) cases. Eight weeks after delivery, there was little or no evidence of pericardial effusion in the 16 cases of small effusion, but there was a major reduction in the size of effusion in the eight cases, with a large and moderate pericardial fluid formula.

NORMAL PREGNANCY provides an excellent opportunity to observe the hemodynamic alterations in cardiac functions that occur in pregnant women, with physiological stress in the form of increased demands, a decreased vascular resistance with its resultant diminution in the after load, and an expanded blood volume, with the consequent increase in preload upon the performance of the normal heart. There are conflicting data concerning the function of the pericardial sac during normal pregnancy. The interest in the function of the pericardium extends to the role of its sac in normal cardiac physiology and the major influence of pericardial dynamics on the diastolic properties of both ventricles. The effect of pregnancy on the pericardial sac has not received the deserved attention. In 1955, the ultrasonic detection of pericardial effusion was possible, but the clinical acceptance was only gained after the pioneering work of Feigenbaum and associates.[1,2] The advent of echocardiography produced a major impact on the ability to detect fluid collection in the pericardial sac, as it is sensitive even in the presence of relatively small quantities of fluid in the pericardial sac. Despite the easy recognition of pericardial effusion, its prevalence in normal pregnancy has not yet been defined. Berger et al.[3] and Horowitz et al.[4] have stated that as little as 16 mL of fluid could be detected by a echocardiography.

The categorization of pericardial effusion into small, moderate, or large, according to the width of the pericardial space is roughly semi-quantitative. A new approach to pericardial effusion volume estimation is based on assessing the pericardial sac volume, as compared to cardiac volume by the ellipsoid formula, by which pericardial fluid volume is the difference between total pericardial sac volume and cardiac volume. The aim of this study was to use echocardiography through the ellipsoid formula to study changes that may occur in the pericardial sac in the gestational period and after delivery in normal pregnant women..

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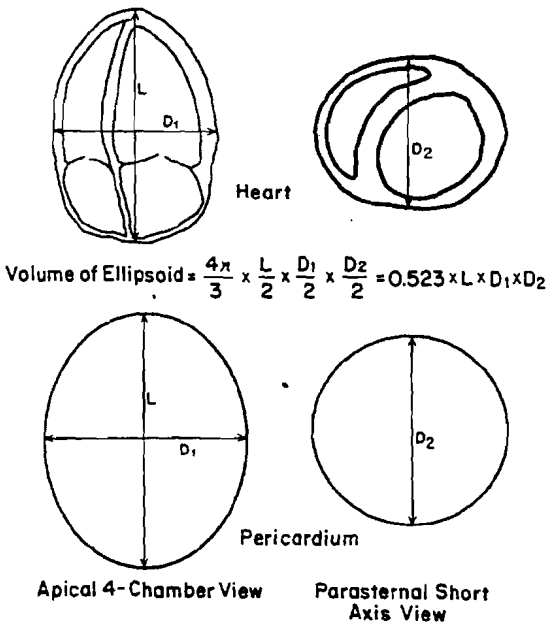


Figure 1:A diagram of ellipsoid formula showing how the major axis Dl and D2 were measured for pericardial sac, and the heart in apical four-chamber and prasternal short-axis views.

## Subjects and Methods

*Patient Selection:* In this study, 104 healthy pregnant women, between the ages of 20-35 years, with a mean age of 25 years were selected. They were systematically examined clinically and investigated by echocardiography at the 12th, 24th and 34th weeks of gestation, and at the 8th week after delivery. All participants were free of any cardiac problems, and pregnancy was within normal limits according to obstetric criteria in all instances.

*Echocardiographic Methods:* Echocardiography was performed using the left lateral position. This was performed using the *M*-mode and two-dimensional modalities in the parasternal long axis, short axis and apical four-chamber views utilizing SONO S1000 (Hewlett Packard Ultrasound Imaging System) as well as ATL MK700 System with 2.5 MHz transducer.

Echocardiographically, pericardial effusion was defined by the presence of a posterior echo-free space which persisted throughout the cardiac cycle, and separating the epicardium from the pericardium, and which was associated with flattening of the pericardial echo relative to the epicardial echo. This was obvious and clear in the short axis plane of the left ventricle. Specific attention was focused on the echocardiographic anatomy of the pericardial space and on the distribution of different sized effusions. The ellipsoid formula was used to measure the pericardial sac volume and the cardiac volume. The difference between the two measured the pericardial volume.

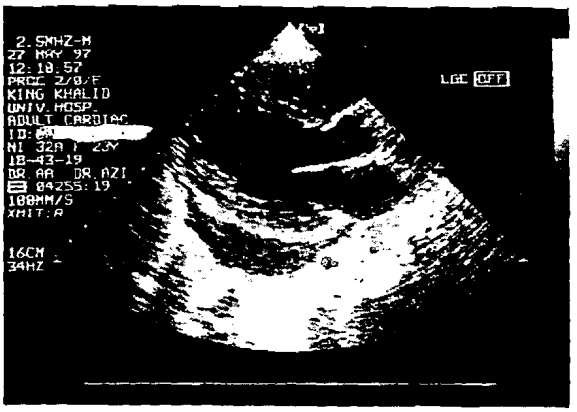


Figure 2. Long-axis view showing mild posterior pericardial effusion.

## Clinical Data

All participants in the study were asymptomatic with no past history of cardiac illnesses Examination of the cardiovascular system showed no evidence of pericardial rub or any sign of pericardial involvement.

## Results

Using the Horowitz criteria, pericardial effusion was detected by M-mode and cross-sectional echocardiography in 24 cases. By using the ellipsoid formula (Figure 1) the effusion was large in four cases (3.8 %, Figure 2), moderate in four (3.8 %, Figure 3) and small in 16 cases (15.3 %, Figure 4).

## Follow-up Screening

Eight weeks after delivery, echocardiographic studies did not show any evidence of pericardial effusion in 16 participants, but there was major reduction in the posterior echo-free space in eight participants.

## Discussion

Echocardiography is a sensitive technique for identifying pericardial effusion, and has become the

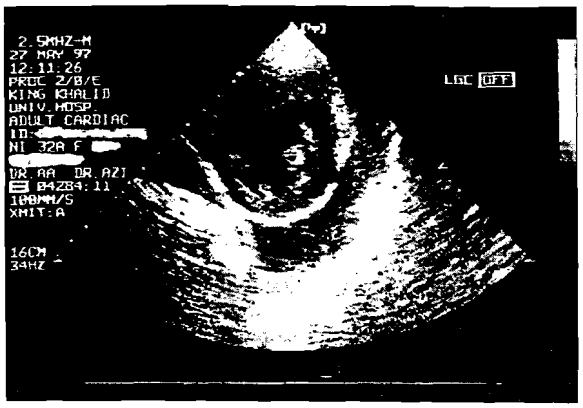


Figure 3. Short-axis view showing moderate posterior pericardial effusion.

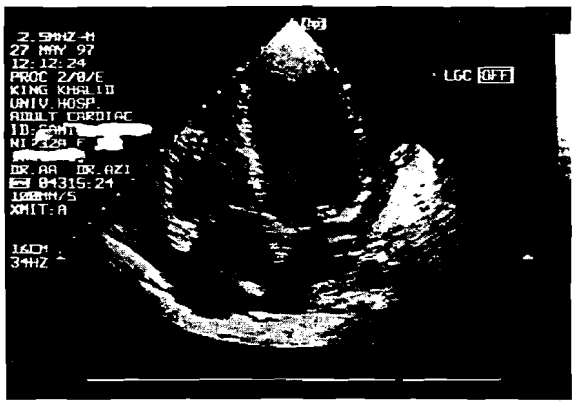


Figure 4. Four-chamber view showing large pericardial effusion.

specific tool for diagnosing and identifying effusions and evaluating pericardial sacs.[5] To gain a better understanding of echocardiographic studies, it is essential to review the anatomy of the pericardial sac which is flask-like, with its neck closed by the great vessels. In the healthy pericardial sac, its two serous membranes are closely opposed to each other and contain about 10-15 mL of fluid,[6,7] although Elias et al. have stated that the pericardial recesses contain a substantial amount of fluid.[8] D'cruz et al. stated that the fluid-filled pericardial sac is of an irregular contour, and moreover does not always conform to a uniform geometric shape as some pericardial effusions are wider anteriorly than posteriorly, whereas others are larger posteriorly.[9]

This study confirmed the presence of pericardial effusion in the late stages of gestation in normal pregnancy. In our studied group, effusion was considered small in 16 cases, moderate in 4, and large in 4 other cases. Follow-up screening showed resolution of effusion in 16 cases and a major reduction in 8 cases. Our observation of complete resolution of pericardial effusion in two-thirds of our studied cases agrees with the work of Enein et al[10] and Haiat and Halphen,[11] where complete resolution in their cases occured within two months after delivery.

Echocardiographic diagnosis of pericardial effusion necessitates careful scanning, the use of multiple views, and alteration of the gain to determine the position of the most intense echo band. Martin et al. Have stated that localization of small pericardial effusions behind the left ventricular posterobasal myocardium is just slightly caudal to, or at the site of the single dimensional left ventricular study. Moderate-sized pericardial effusions retain this prominent posterior localization, with a more even distribution of the pericardial fluid anteriorly, apically and laterally. Regarding large pericardial effusion, they suggested that the posteromedial and apical recesses of the pericardial sac contain a disproportionate amount of fluid.[12] Although the mechanism that leads to the development of pericardial effusion in these cases is obscure, the higher prevalence in our studied cases compared to those of previous reports[10,11] could in part be due to the ability of the echocardiogram to detect small effusions that may go unrecognized by previously used diagnostic tools.

Martin et al. concluded that wide angle, long- and short-axis sector images give a clear anatomic definition of the pericardial space and permit identification of pericardial effusion. They stated that *M*-mode echocardiography appears most accurate for moderate-sized effusion, and less valid for small and large effusions.[12] It should be emphasized that the mechanism of pericardial fluid collection in our participants in the last eight weeks of pregnancy remains unclear. It is likely that pericardial effusions developing during normal pregnancy is a manifestation of generalized retention of salt and water.[1,11] As the pericardial effusion disappeared within a few weeks of delivery, a definite explanation could not be established. Shabatai et al. pointed out the importance of the pericardium in lymphatic drainage of the myocardium and ventricular hemodynamics.[13] Enein et al. did not find any correlation between the presence and the amount of pericardial effusion and total serum proteins, serum albumin level or serum

albumin/globulin ratio. They concluded that left ventricular systolic function assessed by echocardiography was within normal limits, thus ruling out perinatal cardiomyopathy or congestive heart failure as a cause of effusion.

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