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ANTENATAL ECHOCARDIOGRAPHIC SCREENING: AN OVERRATED ROUTINE PRACTICE IN ASYMPTOMATIC MOTHERS

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Abstract:

Background: Echocardiographic evaluation is conducted as a part of routine antenatal screening in India. We conducted a study to evaluate if routine echocardiographic screening in asymptomatic patients with no self-reported symptoms and no abnormalities on clinical examination would alter the intrapartum and peripartum care. A single centre retrospective review of case records and echocardiographic images of 472 asymptomatic patients, conducted as a part of routine antenatal screening were reviewed by 2 independent cardiologists. The study excluded pregnant patients with known cardiovascular diseases (CVD) and those with clinical risk factors.

Results: The rate of newly diagnosed CVD in the study was 3.6%. Acquired heart disease was found in 2.7% of the study population which comprised Rheumatic heart disease (RHD) in 0.42%, mitral valve prolapse (MVP) without mitral regurgitation (MR) in 0.84%, and MVP with MR in 1.48%. Congenital heart disease (CHD) was incidentally detected in 0.84% of patients comprising atrial septal defect (ASD), patent foramen ovale (PFO), a bicuspid aortic valve respectively, and prominent coronary sinus and persistent left superior vena cava (PLSVC). None of the patients required changes in the pre-existing treatment plan, and none were recommended for termination of pregnancy or change in the mode of delivery.

Conclusions: Echocardiographic evaluation of asymptomatic antenatal mothers is clinically unjustified. If CVD is diagnosed in asymptomatic mothers, it would primarily belong to the low-risk category and would not contribute to the intrapartum or peripartum care plan in any form but add to the economic burden compromising other essential antenatal care services.

Keywords: Echocardiography, Prenatal Care, Pregnancy, Cardiovascular Diseases

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Text

Background:

Maternal mortality, defined as the death due to complications from pregnancy or childbirth is a major public issue due to its shocking magnitude and substantially slow declining pattern [1,2]. According to the UNICEF, the maternal mortality ratio (MMR) from 2000-2017 was 211 deaths per 100,000 live births [1]. The MMR in LMIC is 14 times higher than in the developed countries [3]. Sub-Saharan Africa and the South Asian region alone accounts for 87% of global maternal deaths. Although India has achieved ground-breaking progress in reducing MMR by 77% from 1990 to 2016, significant challenges remain [4-6].

The direct obstetric causes of maternal deaths include hemorrhage, hypertensive disorders, embolism, sepsis, and abortion [7]. Cardiovascular conditions are known to be an important contributor to indirect maternal mortality in not only the developed world but also in low middle-income countries(LMIC) apart from HIV, malaria, TB, iron deficiency anemia, diabetes, and respiratory diseases [8].

Globally, maternal heart disease is emerging as a major challenge for safe motherhood and women's long-term cardiovascular health [9]. The circulatory system undergoes profound changes during pregnancy and cardiovascular diseases may be manifested for the first time during the antenatal period as physiological changes in pregnancy may compromise the limited cardiac reserve [10,11]. In developed nations, cardiovascular cause for maternal mortality accounts for around 26.5%.This huge burden is due to barriers to pre-pregnancy cardiovascular disease assessment, missed opportunities to identify cardiovascular disease risk factors during prenatal care, gaps in high-risk intrapartum care, and delays in recognition of cardiovascular disease symptoms during the puerperium [12]. In pregnant women, routine complaints such as dyspnea, palpitation, and loss in the effort capacity mimic that of heart diseases and CVD diagnosis is challenging [13].

Due to advances in medicine, an increased number of women with RHD reach childbearing age in LMIC like India [14]. A systemic search for previously undiagnosed congenital heart disease, rheumatic heart disease, and cardiomyopathies is necessary to reduce MMR [12]. Although a routine cardiac screening is not recommended in guidelines, echocardiography is used as a routine cardiac screening tool to identify congenital and acquired heart diseases in asymptomatic pregnant women with no known foetal or maternal risk. We conducted a retrospective study in asymptomatic antenatal patients with objectivesto assess the incidence of newly diagnosed cardiac diseases in asymptomatic antenatal patients using echocardiography, to identify if echocardiographic screening changed the line of intrapartum or peripartum management in such patients and to evaluate if echocardiography is a justifiable routine screening tool in asymptomatic antenatal patients.

Methods:

This retrospective observational study was conducted at a tertiary care centre in south India after approval from the Institutional Human Ethics Committee (20/162). The study involved a retrospective review of cardiac case records and echocardiographic images of antenatal patients referred to the Department of Cardiology for echocardiographic evaluation between February 2018 and February 2020. The exclusion criteria for the study were patients with a known history of congenital heart disease, acquired heart disease, patients with cardiac risk factors like diabetes, hypertension, obesity, or the presence of cardiac symptomslike shortness of breath at rest, resting heart rate of 120bpm or more, resting systolic blood pressure of 160mmHg, resting respiratory rate of 30 or more, oxygen saturation less than or equal to 94% and severe orthopnea.

Patient's demographic details,obstetric and medical history of patients were collected from the hospital electronic medical records. A routine antenatal cardiac screening includes evaluation of symptoms and clinical examination by a cardiologist, and echocardiography from standard views, parasternal long axis, short axis (basal, mid, apical), apical view (4 chambers, 5 chambers, and 2 chambers) as well as suprasternal views which was reviewed by two independent cardiologists and final diagnosis would be reported.

In the present study, 2 independent cardiologists retrospectively assessed the obstetric history, cardiac symptoms, physical examination findings, and echocardiographic diagnosis from cardiology case records as reported by the cardiologist involved in the screening of antenatal patients. Abnormal echocardiogram findings were classified as either congenital or acquired. MVP was defined as fibromyxomatous changes in the mitral leaflet tissue with superior displacement of 1 or both leaflets into the left atrium. MR quantification was based on qualitative and quantitative measurements. Valvular lesions if present, was graded based on severity as per the 2014 AHA/ACC guideline for the management of patients with valvular heart disease.

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Cardiac lesions concerning maternal outcome were classified according to the modified WHO classification of maternal cardiovascular risk. Change in antenatal care or treatment plan after the diagnosis of heart disease like termination of pregnancy or change in the mode of delivery was evaluated. Data were entered and analyzed using SPSS IBM software.

Results:

A total of 472 asymptomatic antenatal patients,referred for echocardiographic cardiac evaluation from February 2018 to February 2020 were enrolled in the study after screening for inclusion criteria. The mean age of the study participants was 27±3.2 years. The mean heart rate of patients was 87.89±5.6 bpm whereas the mean systolic and diastolic blood pressure measured was 107mmHg±2.7 and 63±4.2mmHg respectively.52.96% of patients had multiparity and 47.03% patients were primigravida.

As per the cardiac case records of antenatal mothers, none had self-reported cardiac symptoms. A medical history interview of patients revealed that 42 patients, accounting for 8.89% of patients revealed a history of dyspnea on extreme physical exertion. None of the antenatal mothers had symptoms above class I NYHA. Upon questioning, about 4.87% of patients revealed a history of palpitation with emotional exertion and not at rest. The recorded 12 lead electrocardiography of these patients was found to be within normal limits.

Clinical examination findings revealed the presence of pedal edema in 23 patients (4.87%), elevated jugular venous pressure in 13 patients, accounting for 2.75% of the study population. 1.27% of patients were found to have an audiblemurmur (systolic<2/6) with cardiac auscultation.

The echocardiographic evaluation revealed that the LV size of all patients were within the normal range (39mm to 53mm). The echocardiographic diagnosis revealed that 17 asymptomatic patients (3.60) with no known cardiac history were found to have cardiac disease (Fig 1). Congenital heart diseases were incidentally found in 4 patients (0.84%). The congenital abnormalities observed in echocardiography included 1 patient each with ASD, PFO, a bicuspid aortic valve respectively, and prominent coronary sinus and PLSVC, each accounting for 0.84% of the study cohort(Table 1). The aortic root dimensions were measured for the patient with a bicuspid aortic valve, which was found to be within normal limits.

Acquired heart disease was incidentally found in 2.96% of the study population. Two patients had rheumatoid heart disease accounting for 0.42% of the study cohort. Eleven patients (2.33%) had a prolapsed mitral valve. (Fig. 2) Assessment of valvular function revealed that 456 patients had a normal valvular function. A proportion of 2.7% of the study cohort had mild valvular dysfunction. (Fig. 3)

Analysis of the recommendation of the screening cardiologist in terms of the line of cardiac, intrapartum, and peripartum management exhibited that although a heart disease was diagnosed in 17 patients (3.60%), all the 472 patients studied were advised to continue with the pre-existing treatment plan, with none being recommended for termination of pregnancy or change in the mode of delivery.

Table 1.Cardiovascular diseases detected by antenatal echocardiographic screening

Cardiac disease (n=472)	**Number(Percentage)**
Acquired heart disease	13(2.7)
Rheumatic heart disease`	2(0.42)
Mitral valve prolapsed without MR	4(0.84)
Mitral valve prolapsed with mild MR	7(1.48)
Congenital heart disease	**4(0.84)**
Atrial septal defect	1(0.21)
Patent foramen ovale	1(0.21)
Bicuspid aortic valve with no AS/AR	1(0.21)
Prominent coronary sinus with persistent superior vena cava	1(0.21)
Total	**17(3.6)**

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

Fig1. Distribution of study population based on echocardiographic screening

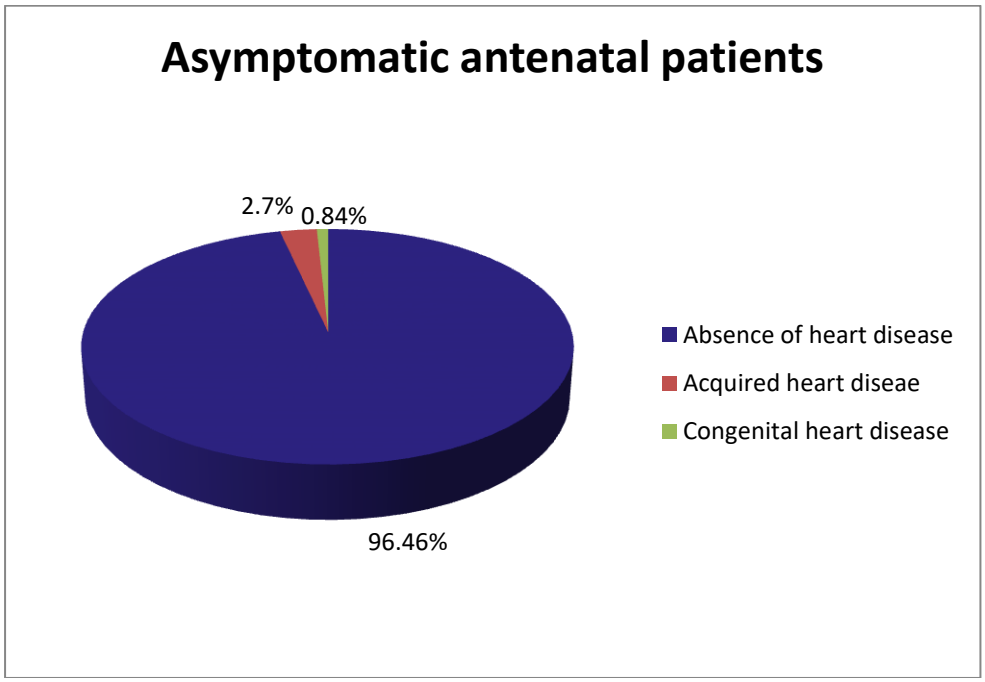


Fig 2. Distribution of patients with acquired heart disease

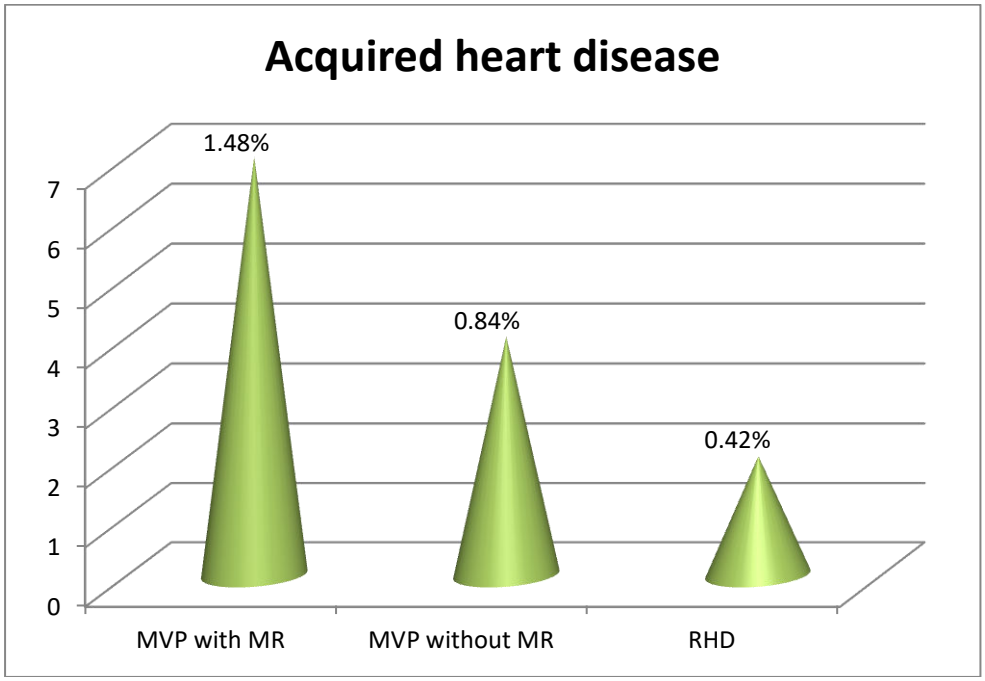
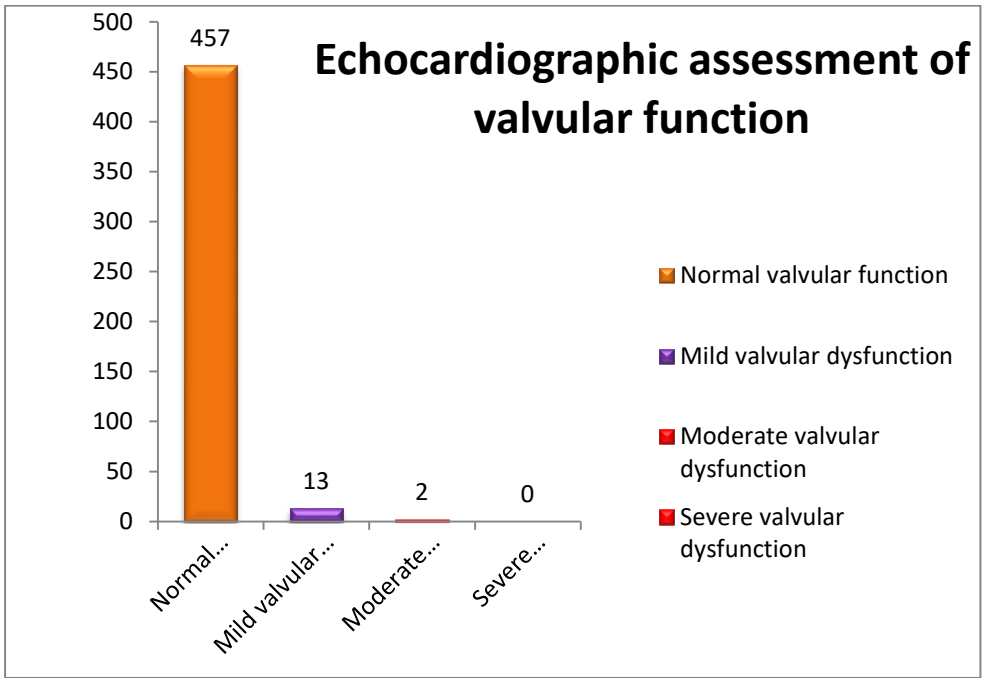


Fig 3. Echocardiographic assessment of valvular function in the study population

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021



Discussion:

There is an alarming trend towards the rise in cardiovascular-related maternal mortality. Early identification of a cardiac disease with the potential to prevent maternal death is imperative [15]. In LMICs like India, with a higher predominance of RHD, antenatal patients without known or suspected cardiac disease are referred for echocardiographic screening due to the lack of a validated screening algorithm to identify high-risk patients.Echocardiography, being non-invasive does not involve radiation exposure and is considered safe in pregnancy. A key area of competence for obstetric care providers is the ability to differentiate common symptoms experienced during pregnancy from those suggestive of cardiovascular diseases [16]. It is well proven that echocardiography is a useful tool for routine evaluation of maternal cardiac status in patients with cardiac symptoms, clinical signs, or with risk factors for cardiac dysfunction such as hypertension, diabetes, or obesity [17]. This study demonstrates the findings of echocardiographic cardiac screening in asymptomatic pregnancies and projects the outcome of screening in contributing substantially to the obstetric care plan.

Acquired heart disease often presents acutely and catastrophically in pregnancy with no pre-existing cardiac disease [18]. The prevalence of newly diagnosed acquired heart disease including RHD, MVP, and isolated valve pathologies in the present study accounted for 2.7% of patients in the study cohort, which is comparable to an incidence of 3.7% in a study conducted in Turkey to screen and evaluate asymptomatic women in first trimester of pregnancy [19].

India is considered the RHD capital of the world. RHD is attributed to the poor public health system and continues to be an important cause of disease burden in LMICs [20,21]. In a prospective study conducted in 2029 participants in north-east India to review the spectrum of heart diseases in pregnancy,echocardiographic screening revealed RHD in 23 patients, accounting for 1.1% of pregnancies [22]. This finding is in line with the present study, wherein the prevalence of RHD was 0.42%. The registry of pregnancy and cardiac disease (ROPAC) which, to date is the largest prospective cohort of pregnant women with RHD highlights that women with mild to asymptomatic RHD tolerate pregnancy well with very few complications [23]. A retrospective study conducted in 486 pregnant patients with RHD to evaluate maternal and perinatal outcomes revealed that NYHA class III-IV patients had significant maternal and perinatal morbidity [24]. In the current study, however the 2 (0.42%) pregnant patients with RHD and moderate MR were asymptomatic with none having symptoms classified as per NYHA class II or above. Thus, echocardiographic screening with an incidental RHD finding in asymptomatic pregnant patients did not add to the obstetric care plan in any form.

MVP is known to be a common echocardiographic finding in pregnancy, contributing to 39.2% of cardiac disease in pregnancy [25]. The routine use of echocardiography in pregnancy has facilitated the identification of MVP. Asymptomatic pregnant women with MVP, with a normal ventricular function, mild MR are generally at low risks for pregnancy-associated cardiovascular

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

complications [26]. In the present study, 4 patients had MVP (0.84%), including 3 patients with a prolapsed anterior mitral leaflet and 1 patient with a prolapsed posterior mitral leaflet which accounted for 23.5% of patients with cardiac disease in the cohort. As pregnant patients with mild MR, were asymptomatic and had a normal cardiac function, no change in the treatment modality was opined by the screening cardiologist.

Isolated mild MR was prevalent in the study participants at a rate of 1.4%, accounting for 41.1% of the cardiac disease identified by echocardiographic screening. This finding is supported by The ROPAC study which exhibited that out of 2966 patients, 117 pregnant patients were found to have isolated mild MR(3.944%) [23]. Mild MR belongs to the modified WHO pregnancy class1, with no detectable increased risk of maternal mortality with no or mild risk of morbidity. In the present study, as none of the patients had symptoms above class I NYHA, echocardiographic detection of mild MR did not change the existing treatment plan or mode of delivery.

Congenital heart disease in pregnancy is associated with adverse maternal and foetal outcomes and women with congenital heart disease may be unable to tolerate the hemodynamic changes associated with pregnancy [27,28]. Additionally, it is also associated with an increased risk of birth defects, Bozkeya et al. screened and evaluated 900 asymptomatic pregnant women in Turkey and had reported 13 newly diagnosed congenital heart disease (1.44%) [19]. This observation was similar to the present study, wherein the prevalence of congenital heart disease was 0.84% (n=4). ASD is a common congenital anomaly and pregnancy is usually well-tolerated in women with ASD with an exception of patients with concomitant pulmonary artery hypertension [29]. Physiological and hemodynamic changes in pregnancy may unmask previously unrecognized ASD and may lead to obstetric complications [30]. Among the 4 patients with CHD in the current study, 1(0.21%) had ASD. It is noteworthy that the diagnosis of ASD in this asymptomatic patient did not change the line of management. Also, 1(0.21%) patient in had a bicuspid aortic valve without stenosis or root dilatation which could be managed as a normal pregnancy as per evidence [31]. Additionally, 1 patient had a tiny PFO with no remarkable clinical manifestations.A prominent coronary sinus and persistent left superior vena cava present in a patient (0.21%) was also an incidental finding without evidence of other cardiac anomalies, thus was devoid of significant hemodynamic alterations [32].

A study conducted by Head C.E in congenital heart diseases in pregnancy emphasizes that in parallel to the cause-specific risks, presence of cyanosis (oxygen saturation<90%), NYHA functional class>II, left heart obstruction, systemic ventricular dysfunction (EF<40%) or a prior cardiac event (pulmonary edema, arrhythmia, cerebrovascular disease or transient ischemic attack) increases the risk of adverse maternal outcome whereas smoking, anticoagulation, and multiple pregnancies can predict the adverse foetal and neonatal outcome [31]. Furthermore, the European guidelines recommend a primary caesarean section for patients with oral anticoagulants in preterm labor, patients with aortic root diameter >45mm, in severe heart failure, or patients with acute or chronic aortic dissection [33]. As the present study involved only asymptomatic pregnant women, none required any medical or surgical intervention for cardiac disease, and no change in the existing treatment plan or mode of delivery was advised by the cardiologist.

The outcomes of pregnancies were uneventful regardless of the echocardiographic finding as all patients belonged to class I WHO classification of maternal cardiovascular risk. This study has inherent limitations specific to a retrospective observational study conducted at a single centre. The study involved only those asymptomatic pregnant patients, referred for echocardiography in the department of cardiology by the treating obstetrician and not all patients receiving obstetric care at the hospital.

Conclusion:

The study emphasizes the importance of medical history interviews and clinical examination in asymptomatic pregnant patients as the first step of cardiac screening. A detailed cardiac evaluation is warranted only for patients with pre-existing cardiac disease, patients with excess symptoms than which is expected in a normal pregnancy, evidence of heart failure on physical examination, or arterial oxygen desaturation in the absence of pulmonary disease. This present study reinforces that asymptomatic pregnant patients with no self-reported complaints would usually belong to the low-risk category for maternal or foetal complications even if a cardiac disease is diagnosed by echocardiography. An algorithm-based approach forrisk stratification of patients based on the above would be clinically justified. An echocardiographic evaluation as a routine cardiac screening practice may increase the economic burden of maternal healthcare services in a low-middle-income country like India, which may inturn compromise essential antenatal care services.

ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

Abbreviations:
CVD: Cardiovascular diseases; RHD: Rheumatic heart disease; MVP: Mitral valve prolapse; MR: Mitral regurgitation; CHD: Congenital heart disease; ASD: Atrial septal defect; TPFV: Tiny patent foramen ovale; PLSVC: Persistent left superior vena cava; MMR: Maternal mortality ratio; LMIC: low middle-income countries.

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ISSN: 0975-3583, 0976-2833 VOL 12, ISSUE 03, 2021

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