Peripartum Cardiomyopathy

By John G. Demakis, M.D., and Shahbudin H. Rahimtoola, M.D.

Peripartum cardiomyopathy, a disorder of heart muscle, presents clinically with the onset of cardiac failure in the last month of pregnancy or in the first 5 postpartum months. The first description of idiopathic myocardial disease with onset in the puerperium has been attributed to Ritchie in 1849. Postpartum cardiomyopathy was again recognized in 1937 by Hull and Hafkesbring and by Gouley et al. Since some of the reported patients developed cardiac failure in the last month of pregnancy it is probably more appropriate to use the term "peripartum cardiomyopathy" (PPCM) rather than postpartum cardiomyopathy.

The criteria for the diagnosis of PPCM are: (1) development of heart failure in the last month of pregnancy or within the first 5 postpartum months, (2) absence of a determinable etiology for the cardiac failure, and (3) absence of demonstrable heart disease prior to the last month of pregnancy. Thus, congenital, or acquired heart disease or myocardial disease due to determinable causes are presumed to be absent.

Etiology and Pathology

The specific etiologic factors and pathogenesis of this disorder are not known. Excessive alcoholic intake has not been important. Although some authors have mentioned poor nutrition, patients reported by others have been well nourished. Viral infection, autoimmune mechanisms, hormonal changes, genetic disorders, and toxemia have also been suggested as possible etiologies. Data to support these hypotheses are inconclusive.

Eighty-two percent of women with PPCM develop cardiac symptoms in the first 3 postpartum months and only 7% in the last month of pregnancy (fig. 1). Forty-eight percent of the patients with PPCM are 30 years of age or older, and 71% are in their third or subsequent pregnancy as compared with 23 and 48%, respectively, of other pregnant women. Twins and toxemia occur respectively in 7 and 22% of patients with PPCM, an incidence seven and five times higher than in pregnant women without PPCM (fig. 2).

Most patients with PPCM reported in the literature are Negroes. Many such reports emanate from hospitals dealing with predominantly black populations. However, PPCM has been reported from other sources and from most parts of the world.

Pathologically, the heart is soft and grossly enlarged (350-650 g) with dilatation of all four chambers. Mural thrombi are present in practically all cases, but there is no evidence of coronary artery, valvular, or pericardial disease. Light microscopic examination reveals degeneration or hypertrophy of muscle fibers, focal or diffuse myocardial fibrosis, scattered mononuclear-cell infiltration, interstitial edema, and fatty infiltration. Sakakibara et al. recently demonstrated two different types of intrasarcoplasmic deposits in one patient with PPCM, but the myocardial specimen was obtained by catheter biopsy of the endomyocardium. We have not been able to confirm these findings in our five patients in whom full-thickness myocardial biopsies were performed. Electron microscopy of the myocardium in congestive cardiomyopathy shows increase in the number and size of mitochondria, presence of dense intramitochondrial inclusions, fragmentation of the cristae, varying degrees of myofibrillar destruction, frag-
PERIPARTUM CARDIOMYOPATHY

Relationship of Onset of PPCM to Time of Delivery

Figure 1
The frequency distribution of onset of PPCM in 27 women in relationship to delivery.

mentation of sarcoplasmic reticulum, increased number of lipofuscin granules, and increased glycogen deposition. The electron-microscopic findings in a patient with PPCM were similar. Histochemical studies have shown an increased deposition of neutral lipid deposits in the myofibrils and a decrease in myocardial oxidative enzymes, especially succinic dehydrogenase activity.

In summary, pathologic studies have uncovered no significant differences between PPCM and other forms of primary congestive cardiomyopathy. However, it should be stressed that specimens of myocardium that have been studied were obtained several months to several years after the onset of the disease.

Clinical Features
Patients uniformly present with signs and symptoms of left heart failure. Peripheral edema and upper abdominal discomfort (enlarged, congested liver) are also present in about 50%. Chest pain occurs in half of the women. Although this pain may resemble that produced by ischemic heart disease, in some instances chest pain is due to pulmonary embolism. Physical examination usually reveals a young woman in moderate respiratory distress. The jugular venous pressure is commonly elevated. The heart is enlarged, and there is an active left ventricular impulse. A left parasternal impulse due to an enlarged right ventricle may also be present. A ventricular gallop rhythm is invariably present, and a holosystolic murmur of A-V-valve incompetence (mitral and tricuspid) may be present. The murmur usually disappears as cardiac failure improves. In some patients mitral incompetence persists and may be due to cardiomyopathic involvement of the papillary muscles.

Chest X-rays show cardiomegaly and pulmonary venous congestion. The left ventricle is consistently enlarged, and there may be left atrial enlargement as well. The electrocardiogram is usually abnormal, exhibiting left
ventricular hypertrophy or nonspecific S-T and T-wave abnormalities with normal QRS voltage.

**Natural History and Prognosis**

Patients with PPCM experiencing their first episode of heart failure respond quickly to conventional therapy and are usually symptomatically improved within a short period of time. When patients are first seen, we are unable to predict from their clinical manifestations those who will maintain cardiomegaly and those who will have a return of heart size to normal. Long-term prognosis appears to be related to the rapidity with which the heart returns to normal size. Approximately 50% of patients have a return of heart size to normal within 6-12 months of the onset of their disease. Patients who maintain cardiomegaly for 6 months or longer have an extremely poor prognosis (table 1). These patients continue to have an abnormal electrocardiogram and gallop rhythms, and most have recurrent episodes of congestive heart failure leading to death within a few years. In our group of 13 patients with persistent cardiomegaly seven died within the first 5 years, an additional three within 8 years, and one died 16 years later. The average length of survival in this group after the first episode of congestive heart failure was 4.7 years. Analysis of data reported by Walsh et al. shows that of their 12 patients whose heart size did not return to normal, nine died (mortality rate of 75%) in an average time of 29 months (range 4 to 58 months). Of Sefkel and Susser's 11 patients who maintained cardiomegaly, five have died (45%) in an average time of 7 months (range 4 to 10 months). However, the six survivors had been followed for only 4-14 months.

**Table 1**

*Follow-up Data on Twenty-Seven Women with Peripheral Cardiomyopathy*

<table>
<thead>
<tr>
<th>Data</th>
<th>Heart size returned to normal</th>
<th>Maintained cardiomegaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Follow-up:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (years)</td>
<td>10.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Range (years)</td>
<td>3-21</td>
<td>1-16</td>
</tr>
<tr>
<td>Clinical features:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiomegaly</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Gallop rhythm</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Chronic CHF</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Pulmonary emboli</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Systemic emboli</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Electrocardiogram:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Returned to normal</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Remained abnormal</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Subsequent pregnancies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No change</td>
<td>21 (8 patients)</td>
<td>6 (6 patients)</td>
</tr>
<tr>
<td>Temporary deterioration</td>
<td>3 (2 patients)</td>
<td>0</td>
</tr>
<tr>
<td>Permanent deterioration</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Deaths:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 (14%)</td>
<td>11 (85%)</td>
</tr>
<tr>
<td></td>
<td>1 (ca cervix, 6 years later)</td>
<td>3 (exacerbation with subsequent pregnancy)</td>
</tr>
<tr>
<td></td>
<td>1 (renal failure, 16 years later)</td>
<td>8 (chronic CHF)</td>
</tr>
</tbody>
</table>

Functional status of survivors:*  
Class I 8 1  
Class II 4 1

*New York Heart Association classification.  
Abbreviations: CHF = congestive heart failure.
The most common cause of death was congestive heart failure, which was frequently exacerbated by pulmonary emboli, subsequent pregnancies, or supraventricular arrhythmias such as atrial fibrillation and atrial flutter. Systemic embolus can be a distressing complication, which is occasionally fatal.

Many of the patients whose heart sizes returned to normal have resumed active lives. We have followed 14 such patients for an average of 10.7 years. The electrocardiograms normalized in two thirds. There have been two deaths in this group, neither from cardiac causes. However, 10 of the 12 surviving patients still have some markers of previous myocardial damage. Five still have abnormal electrocardiograms. Two have had recurrences of cardiac failure with subsequent pregnancies but their heart sizes have once again returned to normal. Two patients subjected to myocardial biopsy had focal myocardial fibrosis. Four of the 12 patients have cardiac symptoms that place them in functional class II. Recently, we have performed hemodynamic and angiographic studies in two of these patients who were in functional class I and II, respectively. In both, intracardiac and intravascular pressures, cardiac output, left ventricular volumes, and ejection fractions were normal at rest. Although the patient in class I had a normal response to exercise, the patient in class II had an inadequate increase in cardiac output, developed an abnormal elevation of left ventricular end-diastolic pressure, and became symptomatic.

Subsequent Pregnancies

Many authors have observed that the women who have had one episode of PPCM are likely to have recurrences in subsequent pregnancies. We have found that the influence of a subsequent pregnancy depends on whether the heart size returned to normal after the initial episode of peripartum cardiac failure. Eight patients whose heart size returned to normal had 21 subsequent pregnancies, and there was temporary deterioration of cardiac function in only two women during three pregnancies. Six patients whose heart size did not return to normal also had subsequent pregnancies. In three, there was no change in cardiac function, but the other three had severe deterioration in cardiac function resulting in death. Although Seftel and Susser have reported one patient whose heart size returned to normal but who sustained a fatal recurrence after a subsequent pregnancy, our experience suggests that only the patients with persistent cardiac enlargement must avoid subsequent pregnancies.

Therapy

Patients with PPCM usually respond to conventional therapy for congestive cardiac failure, although they may be unduly sensitive to digitalis. Because of the high incidence of pulmonary and systemic emboli, anticoagulants are recommended for the duration of cardiomegaly. Ambulation is initiated at a slow but progressive rate as soon as the patient is relieved of clinical cardiac failure. Patients whose heart sizes return to normal can lead active lives if they are asymptomatic but should avoid competitive exercise. Patients whose heart sizes do not return to normal should lead restricted lives commensurate with their cardiac disability. Appropriate birth-control measures are recommended for patients with enlarged hearts. However, oral contraceptives are to be avoided because of the risk of increasing the incidence of thromboembolism.

Prolonged Bed Rest

Burch et al. stressed the value of prolonged bed rest in altering the course of PPCM. These authors advocate bed rest for 3 months after the heart size has returned to normal. In those patients with persistent cardiac enlargement, ambulation is commenced when no further reduction in heart size is achieved after a 6-12-month period of bed rest. With prolonged bed rest, the hearts of 50% of patients reported by Burch et al. returned to normal size. We have been unable to effect prolonged bed rest in the few patients in whom this was attempted. In our patients, as well as those reported by Seftel

Circulation, Volume XLIV, November 1971
and Susser, heart size returned to normal within a year without prolonged bed rest in 50%, indicating that prolonged bed rest is not always necessary. For practical reasons, it is difficult to maintain prolonged bed rest in the majority of the patients with whom we deal.

Differentiation from Other Forms of Congestive Cardiomyopathy

Since the symptoms, signs, and pathologic findings in PPCM are not different from those seen in other forms of congestive cardiomyopathy, it has been suggested that PPCM may be a form of occult primary congestive cardiomyopathy made overt by the pregnant state. However, peripartum cardiomyopathy has certain specific clinical features: (1) PPCM has a time relationship to pregnancy—93% of the cases occurring in the postpartum period. If these patients had preexisting heart disease one would expect a deterioration in their cardiac status at the time of maximum cardiovascular load, i.e. during pregnancy. (2) If cardiac failure recurs in subsequent pregnancies, it once again manifests clinically in the peripartum period. (3) Excluding patients with PPCM, congestive cardiomyopathy is relatively uncommon in nonalcoholic women.15, 16 (4) These patients have certain clinical characteristics, namely, PPCM is more common in the older multiparous woman and in women who have had toxemia and twins. (5) The heart size returns to normal in half of the women with PPCM, whereas this recovery occurs uncommonly in patients with nonalcoholic primary congestive cardiomyopathy (J. F. Goodwin: Personal communication). The patient whose heart size returns to normal has a good prognosis and should be managed differently from the patient whose heart size does not return to normal.

Because of the above considerations we feel it is important to maintain peripartum cardiomyopathy as a nosologic entity at least until the etiologic factors and pathogenesis are further elucidated.

References

15. Spodick DH, Littmann D: Idiopathic myocardial hypertrophy. Amer J Cardiol 1: 610, 1958
Peripartum Cardiomyopathy
JOHN G. DEMAKIS and SHAHBUDIN H. RAHIMTOOLA

Circulation. 1971;44:964-968
doi: 10.1161/01.CIR.44.5.964
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1971 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/44/5/964.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/