Cardiovascular Collagenosis with Parietal Endocardial Thrombosis
A Clinicopathologic Study of Forty Cases

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Forty cases of endocardial thrombosis of the heart were selected for pathologic study from a total of 9,500 autopsies performed during 1936 to 1951. Widespread focal involvement of the connective tissue throughout the body and particularly in the heart was demonstrated. Although the histopathologic features were similar to those found in the “diffuse collagen diseases” they did not show the characteristic lesions of rheumatic fever, periarteritis nodosa, lupus erythematosus or diffuse scleroderma. The clinical presentation of a rapidly progressive heart failure, together with the pathologic findings, were sufficiently distinctive to consider this condition as a cardiovascular collagenosis with parietal thrombosis. A similar condition has been described under a variety of names and would appear to constitute a large proportion of cases of so-called “idiopathic hypertrophy” or “myocarditis” of the heart.

The occurrence of necrosis or fibrosis of the endocardium with overlying mural thrombosis in the absence of gross vascular disease appears to have been first adequately described by Löfler1 who termed the condition “endocarditis parietalis fibroblastica” and associated it clinically with a syndrome of progressive cardiac failure and eosinophilia. Subsequently, a similar clinicopathological picture was reported under a variety of terms, namely, fibrosis of the endocardium and myocardium with mural thrombosis2; endocardial fibrosis3,4; endomyocardial necrosis5; primary subacute myocarditis6; myocarditis perniciosa7; and chronic fibroblastic myocarditis.8

In these, eosinophilia was not constant and, if this phenomenon can be regarded as variable, many of the cases of idiopathic heart disease, including Fiedler’s myocarditis, reported in the literature may belong in this category.5–30

In this paper we report on 40 cases of this clinicopathologic entity and produce evidence which suggests that the condition is due to disturbances of the connective tissues of the heart. It should accordingly be classified as a diffuse collagen disease along with other well recognized types, such as periarteritis nodosa, lupus erythematosus, diffuse scleroderma, and rheumatic heart disease.

Pathology

The morbid anatomic features in all cases were: (1) Evidence of congestive cardiac failure. (2) Visceral infarction. (3) A characteristic cardiac lesion.

Congestive cardiac failure was the cause of death in all cases and was manifested by edema, ascites, pleural effusions and chronic venous congestion of the viscera.

Solitary or multiple infarction of one or more viscera was found in 78 per cent of patients. In half of these more than one organ was affected. The sites of infarction were as follows: Lungs (25 cases), spleen (6 cases), kidney (18 cases) and brain (3 cases). Infarcts were always bland and were both recent and old. In the majority of cases the cause was clearly embolic.

The cardiac lesion was characterized by: (1) An enlarged, dilated heart, usually without hypertrophy. (2) Mural thrombosis, especially in the left ventricle. (3) Subendocardial necrosis or fibrosis. (4) Fibrosis or necrosis of papillary muscles. (5) Focal or diffuse thickening of the endocardium. (6) Absence of significant lesions in pericardium, cardiac valves, coronary vessels or aorta.
The pathologic features of the heart in 40 cases are summarized in table 1.

**Incidence**

The incidence of the condition in autopsy subjects is 0.42 per cent (40 cases in 9,500 consecutive autopsies). It occurred at all ages and with equal incidence in both sexes, but was somewhat commoner before the age of 40. Thirty-two cases were Bantu subjects (0.71 per cent) and eight were European (0.18 per cent). This difference is significant statistically.

**Histopathology**

**Methods**

The tissues were formol-fixed, dehydrated in alcohol and embedded in paraffin wax. Sections were cut at 4 μ, deparaffinized and stained by the following methods. Metachromasia was demonstrated by either toluidine blue 0.5 per cent in distilled water plus 0.25 per cent borax, or aqueous 0.05 per cent solution of toluidine blue at pH 4.5 as recommended by Bunting; alcohol resistance was tested by the method advocated by Bunting. The reaction of the chromatotropic substance to testis hyaluronidase was tested by the method advocated by Pearse; the reaction to streptococcal hyaluronidase was tested by the application of undiluted filtrate of a 24-hour culture of a Richard-s strain hemolytic streptococcus to the sections for three hours, using cartilage meta-

<table>
<thead>
<tr>
<th>Site</th>
<th>Morbid Anatomy</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardium</td>
<td>Moderate excess clear fluid</td>
<td>62%</td>
</tr>
<tr>
<td>Heart size</td>
<td>Dilatation of all cavities</td>
<td>Fibinuous exudate unusual</td>
</tr>
<tr>
<td>Heart weight</td>
<td>340-795 Gm.</td>
<td>Average 501 Gm.</td>
</tr>
<tr>
<td>Left ventricle hypertrophy</td>
<td>Absent in 73%</td>
<td>Measurements within normal limits as</td>
</tr>
<tr>
<td></td>
<td>When present, history of antecedent</td>
<td>a rule, according to criteria of Coggen,</td>
</tr>
<tr>
<td></td>
<td>hypertension</td>
<td>Griggs &amp; Stilsen</td>
</tr>
<tr>
<td>Right ventricle hypertrophy</td>
<td>Present in 8%</td>
<td>Characteristic finding. Commonest site</td>
</tr>
<tr>
<td>Mural thrombosis</td>
<td></td>
<td>between papillary muscles of left ven-</td>
</tr>
<tr>
<td></td>
<td>Left ventricle -100%</td>
<td>tricular apex. Varied in degree</td>
</tr>
<tr>
<td></td>
<td>Left auricle -75%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right auricle -50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right ventricle-5%</td>
<td></td>
</tr>
<tr>
<td>Parietal endocardium</td>
<td>Endocardial necrosis or endocardial</td>
<td>Subjacent to thrombus</td>
</tr>
<tr>
<td></td>
<td>sclerosis</td>
<td></td>
</tr>
<tr>
<td>Valvular endocardium</td>
<td>Normal</td>
<td>Diffuse or focal</td>
</tr>
<tr>
<td>Myocardium</td>
<td>Subendocardial necrosis or fibrosis</td>
<td>100%</td>
</tr>
<tr>
<td>Coronary vessels</td>
<td>Healthy and patent. Occasionally mild</td>
<td>Chiefly subjacent to thrombus</td>
</tr>
<tr>
<td></td>
<td>atheromatosis</td>
<td></td>
</tr>
<tr>
<td>Aorta</td>
<td>Normal</td>
<td>Not significant as a cause of the myo-</td>
</tr>
<tr>
<td></td>
<td>Fine intimal wrinkling</td>
<td>cardial lesions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>92%</td>
</tr>
</tbody>
</table>

In a description of a similar condition Davies found an incidence of 0.95 per cent in 3,759 autopsies on African subjects in Uganda, and the condition accounted for nearly 10 per cent of patients dying of congestive cardiac failure.

**Classification**

The cases have been arbitrarily divided into acute, subacute and chronic depending upon the histologic features in the heart. The acute cases were characterized by acute mucinous edema, fibrinoid necrosis, increased capillary permeability and "serous" myocarditis, parenchymatous degeneration, polypoid verrucous lesions, and thrombosis. In the subacute phase cellular infiltration and organization of the above-mentioned lesions was the predominant finding to the extent of granuloma formation. Endocardial sclerosis and hyperplasia of the elastic tissue were the outstanding features of the cases classified as chronic.

The tissues were formol-fixed, dehydrated in alcohol and embedded in paraffin wax. Sections were cut at 4 μ, deparaffinized and stained by the following methods. Metachromasia was demonstrated by either toluidine blue 0.5 per cent in distilled water plus 0.25 per cent borax, or aqueous 0.05 per cent solution of toluidine blue at pH 4.5 as recommended by Bunting; alcohol resistance was tested by the method advocated by Bunting. The reaction of the chromatotropic substance to testis hyaluronidase was tested by the method advocated by Pearse; the reaction to streptococcal hyaluronidase was tested by the application of undiluted filtrate of a 24-hour culture of a Richard-s strain hemolytic streptococcus to the sections for three hours, using cartilage meta-
chromasia as a sensitive control. In addition, sections were stained with the periodic acid Schiff reagent of McManus and Hotchkiss, before and after extraction with hot chloroform-methanol for 24 hours, and before and after salivary digestion, and for basophilia the methylene blue extinction test, as recommended by Pearse was used.

**Histopathologic Changes**

The earliest reaction which has been observed was swelling of the mural endocardium. For reasons which will be elaborated, we have termed this a mucinous edema. With ordinary (hematoxylin and eosin) stains the subendothelial tissues are swollen and occasionally scantily infiltrated with mononuclear cells. This lesion is usually focal so that normal endocardium passes abruptly into edematous, somewhat myxomatous polyps.

In such edematous foci the surface endothelial cells enlarge, their nuclei become darkly staining and their cytoplasm basophilic, and either desquamation or proliferation occurs. These foci of mucinous edema were found especially in the depths of the crypts between the columnae carneae, over the papillary muscles and in the thebesian sinuses. Similar lesions occurred as eccentric foci in the subintimal tissues of the smaller blood vessels of the myocardium but epicardial involvement was rare.

When stained with toluidine blue a marked metachromatic reaction was obtained. Histological

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**Table 2.-Results and Significance of Histochemical Tests**

<table>
<thead>
<tr>
<th>Method</th>
<th>Result</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluidine Blue</td>
<td>Red-violet metachromasia</td>
<td>Acid mucopolysaccharides, acid colloidal substances, nucleic acids, polymer formation. Acid mucopolysaccharide. Suggests chondroitin sulphate A or B. Polysaccharides (glycogen), mucopolysaccharides, mucoproteins, glycoconjugates, glycolipids, phospholipids. Excludes lipids. Excludes glycogen.</td>
</tr>
<tr>
<td>Alcohol resistance Toluidine blue after treatment with testicular hyaluronidase</td>
<td>Positive</td>
<td>Metachromasia persists</td>
</tr>
<tr>
<td>Methylene blue extinction test</td>
<td>Basophilia positive at pH 2.6</td>
<td>Metachromasia persists</td>
</tr>
<tr>
<td>Toluidine blue after treatment with streptococcal hyaluronidase</td>
<td>Metachromasia persists</td>
<td>Acid mucopolysaccharides, acid colloidal substances, nucleic acids, polymer formation. Acid mucopolysaccharide. Suggests chondroitin sulphate A or B. Polysaccharides (glycogen), mucopolysaccharides, mucoproteins, glycoconjugates, glycolipids, phospholipids. Excludes lipids. Excludes glycogen.</td>
</tr>
<tr>
<td>Periodic-acid Schiff reagent (PAS)</td>
<td>Magenta</td>
<td>Acid mucopolysaccharides, acid colloidal substances, nucleic acids, polymer formation. Acid mucopolysaccharide. Suggests chondroitin sulphate A or B. Polysaccharides (glycogen), mucopolysaccharides, mucoproteins, glycoconjugates, glycolipids, phospholipids. Excludes lipids. Excludes glycogen.</td>
</tr>
<tr>
<td>PAS after chloroform-methanol extraction</td>
<td>Positive</td>
<td>Acid mucopolysaccharides, acid colloidal substances, nucleic acids, polymer formation. Acid mucopolysaccharide. Suggests chondroitin sulphate A or B. Polysaccharides (glycogen), mucopolysaccharides, mucoproteins, glycoconjugates, glycolipids, phospholipids. Excludes lipids. Excludes glycogen.</td>
</tr>
<tr>
<td>PAS after digestion with saliva</td>
<td>Positive</td>
<td>Acid mucopolysaccharides, acid colloidal substances, nucleic acids, polymer formation. Acid mucopolysaccharide. Suggests chondroitin sulphate A or B. Polysaccharides (glycogen), mucopolysaccharides, mucoproteins, glycoconjugates, glycolipids, phospholipids. Excludes lipids. Excludes glycogen.</td>
</tr>
</tbody>
</table>
chemical investigation of this chromotropic material showed that it can be attributed to the presence of an acid-mucopolysaccharide—probably chondroitin sulphate B. (See table 2.)

We can therefore regard this lesion as a true mucinous edema (after Talalajew).¹¹

We were unable to obtain this reaction in the normal endocardium or vessels of 12 control hearts and Bunting⁵ has also shown that chromotropic material in this situation or in the stroma accompanying the small blood vessels of the heart is slight or absent.

In addition, there was capillary dilatation and stasis, and lesions which we have interpreted as the result of increased permeability of vessels, namely, interstitial myocardial edema, inflammatory cell infiltration and fibrinous exudation.

Interstitial myocardial edema caused wide separation of the muscle bundles and the overall picture resembled the "serous myocarditis" of Eppinger, Kaunitz and Popper.⁴⁰ Fibrinous exudation was most marked on the surface of the parietal endocardium, but also occurred in a lesser degree in the endocardial tissues and in the subintimal zones of arterioles and veins, but always in relation to areas of mucinous edema. It was the forerunner of the mural thrombosis and the thrombi which occurred in the thebesian sinuses and luminal vessels.

Focal parenchymatous degenerations, possibly anoxic, occurred chiefly in the inner third of the myocardium, and were both perivascular and paravascular. They consisted of hydropic degeneration, necrobiosis with loss of staining and granular disintegration of fibers, and foci of basophilic degeneration. The latter resembled the lesions described by Spencer⁴¹ as "mucoid degeneration" of heart muscle and gave similar histochemical reactions. The significance is unknown, although Bragdon and Levine⁴² have observed similar lesions in the myocardium of vitamin E deficient rabbits.

In well-established areas of mucinous edema foci of fibrinoid necrosis appeared. These were manifested by swelling, and disintegration and fusion of collagen into amorphous eosinophilic masses.

Focal endocardial swellings were produced
by a combination of mucoid edema, fibrinous exudate, fibrinoid necrosis and hemorrhage. These resulted in polypoid projections covered by swollen endothelial cells.

Similar endovascular projections were also observed in the thebesian and luminal vessels, in the myocardial venules and arterioles and resembled those described by Holsti as "arteritis verrucosa" and by Siegmund as "fibrin-knotchen."

**Fig. 4.** Section of myocardium of left ventricle showing subintimal fibrinoid necrosis and fibrinous exudation in a venous sinus. Hematoxylin and eosin × 60.

**Fig. 6.** Section of myocardium of left ventricle demonstrating a diffuse necrotising arteriolitis with marked fragmentation of the myofibrils. Hematoxylin and eosin × 60.

Diffuse necrotizing arteriolitis was noted, but occurred infrequently. An additional, but inconstant, finding was the presence of endothelial cell masses in arterioles and capillaries.

Subacute cases showed cellular infiltration and proliferation. Granulomatous tissue was formed in relationship to the fibrinoid, thrombotic, verrucous and parenchymatous lesions so that these could be observed at various stages of absorption and organization.

There were no specific histopathologic features in this granuloma phase except when it was disturbed by an acute exacerbation. Fresh foci of mucinous edema and fibrinoid necrosis
CARI)IOVASCULAR COLLAGENOSIS WITH PARIETAL THROMBOSIS

Fig. 7. Section of myocardium of left ventricle showing organizing of an endovascular thrombotic lesion in the subacute stage. Hematoxylin and eosin × 90.

Fig. 8. A section from the endocardium of left ventricle showing fibroelastosis. Weigert's stain × 400.

were then evident. Altered blood pigment, and chromatin debris were abundant and large histiocytes containing phagocytosed "fibrinoid" material were prominent. Foam cells, eosinophil leukocytes and Anitschkow myocytes were irregularly distributed. Progressive fibrosis resulted in endocardial sclerosis, myocardial fibrosis, and eccentric subintimal connective tissue cushions. These were the characteristics of the chronic stage of the disease.

Wherever endocardial sclerosis occurred it was accompanied by hyperplasia of elastic tissue. These fibroelastic scars occurred as opaque plaques on the endocardium, but occasionally more diffuse thickening of the endocardium was seen.

General Histopathologic Changes

The intima of the aorta showed focal nodular swelling and increased metachromasia in some cases. Similar changes were seen in the subintimal tissues of the vasa vasorum and nodular foci of fibrinoid necrosis were occasionally seen in these regions. Thrombosis in the aorta was not seen in our present series, although it has been reported by Mumme in Löffler's parietal endocarditis.

The lungs showed chronic venous congestion and infarcts, and in several there was thrombosis of the smaller pulmonary vessels. The spleen, liver and kidneys showed the presence of chronic venous congestion. Minute embolization of the glomerular tufts was not uncommon.

DISCUSSION

The recognition of the condition as a type of cardiovascular collagenosis depends upon the demonstration of the degeneration of collagen and its associated ground and cement substances. The early manifestations and subsequent findings in the diffuse collagen diseases have recently been reviewed by several authors, notably Klemperer, Altshuler and Angervine, and Pagel. The earliest change is an increase of the acid mucopolysaccharide of the ground substance manifested morphologically by a mucinous edema and evidence of increased vascular permeability. Precipitation of the acid mucopolysaccharides and swelling and degeneration of the collagen follow. This fibrinoid necrosis is succeeded by inflammatory cell infiltration and hemorrhage or thrombosis, with
subsequent granuloma formation, organization and fibrosis. The nature of these changes differs in detail in each of the diffuse collagen diseases. There are differences in local cytoarchitecture, in the distribution of the lesions and in the presence or absence of epiphenomena such as the valvular vegetations in rheumatic fever and the hematoxylin bodies in disseminated lupus erythematosus. The general design, however, appears constant.

We have demonstrated this sequence of events in the condition under review. The disease begins with a degeneration of the ground substance of the endocardial connective tissues, although other sites may be involved. The chief biochemical substrate of the ground substance of the connective tissues of the parietal endocardium is not known with certainty. It would appear that the location of the target reacting substance in this zone is the crucial factor in determining the specific pathognomonic features of the condition. Although the endocardium in the fetal heart is rich in an embryonic gelatinous reticulum it disappears later and, as we have shown, chromotropie material in this situation is scanty in normal adult, human hearts.

The lesions seen in acute cases (mucinous edema, increased permeability with serous myocarditis, fibrous exudation and fibrinoid necrosis) are typical of an acute collagenosis. If these changes are severe and widespread, death usually occurs rapidly as a result of progressive cardiac failure (32.5 per cent in our series). If the changes are severe, but distributed focally, extensive mural thrombosis with granuloma formation and organization ensue. These subacute cases (62.5 per cent in our series) may survive longer. Their course may be punctuated by recurrent acute episodes, any of which may prove fatal. Organized and healed focal endocardial lesions of previous attacks are represented by sclerotic endocardial plaques (5 per cent in our series). In addition, there is evidence to suggest that mild, but more generally distributed endocardial lesions may lead to chronic diffuse endocardial sclerosis through a process of fibrillogenesis and elastic tissue hyperplasia.

This may be the explanation of the rare examples of endocardial sclerosis in the adult. 34, 50-53

Myocardial necrosis and fibrosis are located chiefly in the subendocardial zone and may be anoxic in origin. The source of the anoxia lies in the vascular lesions. In addition, it is possible that the endocardial edema, together with the film of fibrin on the surface endocardium and the endocardium lining the thebesian and luminal vessels may interfere with the blood supply of the endocardium. This may be a factor in the production of anoxia in the inner third of the myocardial wall, although Gregg 34 has warned that the importance of these vessels in the myocardial circulation has not been sufficiently established to warrant statements based on their utilization or nonutilization.

Embolic phenomena arise as a result of the mural thrombus. Another possible source is the narrow-based, imperfectly organized endovascular verruculous lesion.

Morphologic equivalents to the lesions we have described have been frequently reported before. Selve 55, 56 has described an identical process as an integral part of the adaptation syndrome under the term "cardiovascular hyalinosis." Mucinous edema has been reported in the endocardium (auricular, ventricular and valvular) and in Aschoff nodes in rheumatic fever 43 and in the subcutaneous nodules from cases of rheumatoid arthritis; in disseminated lupus erythematosus and occasionally in cysts, bursas and ganglia; in the tissues of patients with diabetes mellitus and myxedema 46; in the arterial walls in pyridoxine-deficient monkeys 47; in dissecting aneurysms. 58

The pathogenesis of fibrinoid necrosis occurrence and distribution has been recently reviewed. 45, 46 It has been previously reported in the condition under review. 24

Fibrinous exudation has been reported in the endocardium in rheumatic fever 59; in other collagen diseases, for example disseminated lupus erythematosus, 60 periarteritis nodosa, 47 dermatomyositis, and in this condition. 19

Verrucous lesions have been described in rheumatic fever, in animals immunized by bacteria; in the vessels of the heart, lung, pancreas and spleen in cases of nonthrombotic endocarditis associated with fever, arthritis.
and serositis; in degenerative verrucal endocarditis; in disseminated lupus erythematosus; in allergic syndromes; in disseminated arteriolar and capillary platelet thrombosis; in acronecrosis and tuberculosis.

These are the essential features of the acute phases. The subsequent reactions of endomyocardial necrosis and fibrosis, mural thrombosis, granuloma formation, organization and endocardial sclerosis have been repeatedly and adequately described in the many cases previously recorded in the literature.

**Table 3.—Symptoms in 35 Cases with Adequate Clinical Histories**

<table>
<thead>
<tr>
<th>Complaint</th>
<th>No. of Cases</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dyspnea.</td>
<td>33</td>
<td>95</td>
</tr>
<tr>
<td>2. Cough.</td>
<td>24</td>
<td>70</td>
</tr>
<tr>
<td>3. Swelling of legs.</td>
<td>22</td>
<td>62</td>
</tr>
<tr>
<td>4. Pain in abdomen.</td>
<td>13</td>
<td>38</td>
</tr>
<tr>
<td>5. Swelling of abdomen.</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>6. Pain in chest.</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>7. Hemoptyis.</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>8. Anorexia.</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>9. Swelling of face.</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>10. Nausea.</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>11. Vomiting.</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>12. Bouts of dyspnea</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>13. Loss of weight.</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>14. Swelling of hands.</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>15. Palpitations.</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>16. Diarrhea.</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Clinical Presentation**

The clinical presentation was that of a rapidly fatal condition, the average duration being about six months with a range of less than a month to three years.

The commonest initial manifestation was progressive exertional dyspnea (68 per cent). In two cases the onset of the breathlessness was sudden and suggested pulmonary edema. Pulmonary infarction or embolism appeared to initiate the illness in two cases. Sudden breathlessness, pain in the chest and hemoptysis characterized this group. Pain in the chest and subsequent dyspnea (two cases), cough and subsequent dyspnea (two cases) hemoptysis (one case) and syncopal attacks, coma and hemiplegia (one case) were the first indications of the illness in the remainder.

Dyspnea figured prominently in the histories of 95 per cent of the cases. In many, swelling of the legs, abdomen and occasionally the face and hands appeared soon after the dyspnea; the development of edema averaged three weeks, after the onset of dyspnea in the groups classified as acute or subacute. Edema followed exertional dyspnea by one and two years in the two cases classified as chronic. Hemoptysis tended to occur later in the illness, although it could be the first indication. The average interval between the onset of dyspnea and hemoptysis was seven weeks with a range of a few days to three months.

An average duration of two months, ranging from a few days to 12 months preceded the admission to hospital in the acute and subacute types. The complaints that developed during this relatively short time are listed in table 3.

Many were in congestive cardiac failure on admission to hospital. This was absent in a few patients who were first seen in peripheral circulatory failure and died soon afterwards. The physical findings are shown in table 4.

Pyrexia up to 102 F. occurred in 81 per cent
and varied from an occasional solitary elevation to bouts which lasted from a few days to weeks. Deterioration of the patients' condition was noted during these pyrexial periods. A tachycardia from 100 to 150 was present in 81 per cent, tachypnea was noted in 78 per cent.

A blood pressure estimation was available in 24 patients. The average systolic, diastolic and pulse pressures were 116, 83 and 32 mm. Hg, respectively. The diastolic pressure exceeded 100 mm. Hg in six cases and in an equal number the systolic pressure was below 100 mm. Hg.

A radiologic examination of the chest was carried out in 20 cases. The cardiac silhouette was considered to be enlarged in 19 of these, the majority at the initial examination and in two cases during subsequent examinations. The cardiac enlargement was generalized with the exception of one case with hypertension which showed marked enlargement of the left ventricle and left auricle. A characteristic feature of the group with marked enlargement was the slight movement of the heart borders. A gross pericardial effusion was diagnosed in one case and in others it may have been partly responsible for the enlargement and diminished movements of the heart.

A right-sided pleural effusion was present in nine and a left-sided pleural effusion in 10 cases. A mottled loss of translucency in the hilar regions ("bats-wing" appearance) with clear peripheral lung fields was present in three cases and varied in intensity with the increase or decrease of the heart failure. The lesser fissure of the right lung was prominent in seven, the pulmonary arteries in three, congestion of the lung bases in six, and radiologic evidence of infarction in two cases.

From one to seven electrocardiograms were available in 17 cases. A sinus rhythm was present in 13 cases. Four cases showed ventricular extrasystoles. In two of these cases a bigeminal rhythm resulted. One subject had a supraventricular tachycardia probably of nodal origin. The P-R interval exceeded 0.21 second, in two cases, while one example of a left and another of a right bundle branch block pattern were seen. Eight cases showed a prolongation of the Q-T time. Abnormalities of the P wave occurred in six cases, in three of which the amplitude exceeded 2.5 mm. in lead II. The P waves were markedly notched in one case, flat topped in another and had a duration of 0.14 second in two cases. One electrocardiogram showed RS-T segment elevation in the standard leads. All the remaining cases showed depression of the RS-T or flat or inverted T waves.

The electrocardiogram was abnormal in every case. The abnormalities found were chiefly present in the RS-T segments and T waves. Only one case showed evidence of RS-T segment elevation and an organizing fibrinous pericarditis was present at autopsy. Nine cases showed depression of the RS-T segments which may have been related to the predominant subendocardial damage found at post-mortem examination. In some, this change may have been produced by digitalis administration. The prolongation of the Q-T time is in keeping with the generalized myocardial damage found at autopsy. The P-wave changes may have been due to the pathologically observed involvement of the auricles or dilatation of the auricle with failure of the left ventricle. 67

Albumin was present in the urine of 21 of 30 patients in whom the urine was examined. Microscopic examination showed pus cells in three, a few squamous cells, granular and hyaline casts in two, and the latter plus red blood cells in two cases. The Wassermann test was negative in 11 cases, strongly positive in one and doubtful in another case. The blood urea nitrogen was estimated in eight cases. It was raised in all with an average of 70 mg. per 100 ml. blood and a range of 40 to 144. One case showed a progressive increase from 49 to 144 mg. per 100 ml. blood while another showed a drop to normal limits with serial estimations. From one to five blood counts were available in 13 cases. Seven of these were considered to show slight to moderate anemia, five were normal and one case showed an initial anemia which subsequently become normal. A white blood cell count had been done in 12 cases, seven showing a leukocytosis (10,700 to 29,000 per cu.mm.), one a leukocytosis and subsequently a leukopenia, one a leukocytosis which
subsequently became normal and in one case the count was normal throughout the illness. A marked absolute eosinophilia was present in one case and moderately elevated in another. The blood sedimentation rate was raised in the three patients on whom the estimation was made. The blood proteins were low, less than 5.6 Gm. per 100 ml. blood in four of the eight patients examined. The blood albumin was low, less than 3.4 Gm. per 100 ml. blood in five and normal in two cases. The globulin was raised in one, reduced in another and within normal limits in the remainder. The albumin-globulin ratio was below 1.5:1 in five cases. This was due to an absolute increase in the globulin in one case and a disproportionately larger decrease in albumin than globulin in the others. A normal decrease in the blood eosinophil count following the injection of adrenocorticotropic hormone (ACTH) was found in one case.

The broad outline of the clinical picture is the absence of the common etiologic factors usually found in heart failure, the early onset of congestive cardiac failure following progressive exertional dyspnea and the rapidly fatal course of the illness.

The physical and laboratory findings generally differed in no way from those commonly associated with a severe and rapidly progressive congestive cardiac failure. However, the dyspnea, tachycardia, hepatomegaly and serous cavity effusions appeared in many to be disproportionately increased in comparison with the degree of congestive cardiac failure. Eosinophilia was inconstant.

**SUMMARY**

1. Forty cases of endomyocardial necrosis and fibrosis with parietal endocardial thrombosis have been studied.
2. Histopathologic evidence is produced indicating that the condition belongs to the group of diffuse collagen diseases.
3. The clinical picture and pathologic findings are sufficiently distinctive to warrant the recognition of this condition as a specific disease entity for which we have suggested the name of cardiovascular collagenosis with parietal endocardial thrombosis.

**SUMARIO ESPAÑOL**

Cuarenta casos de trombosis del endocardio fueron seleccionados de un total de 9,500 autopsias practicadas durante 1936 a 1951. Envolvimiento focal diseminado del tejido conectivo en todo el organismo y particularmente en el corazón fue demostrado. Aunque los hallazgos histopatológicos fueron muy similares a los encontrados en enfermedades difusas de tejidos colágeno, no demostraron las características de las lesiones en fiebre reumática, periarteritis nodosa, lupus eritematoso o esclerodermia difusa. El síndrome clínico de decompensación cardíaca rápidamente progresiva con los hallazgos patológicos fueron suficientemente distintivos para considerar esta condición como una colagenosis cardiovascular con trombosis parietal del endocardio. Una condición similar ha sido descrita bajo una gran variedad de nombres y ha parecido constituir una gran proporción de los casos de llamada hipertrofia idiopática o miocarditis del corazón.

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