in cases of Marfan's syndrome, aortic angiographic studies show severe dilatation of the aorta at the level of the valvular ring.

Holman demonstrated that poststenotic dilatation may be a direct consequence of the stenosis. He used rubber tubing in a system simulating the circulation and produced "aneurysmal dilatation" in the poststenotic segment with continuous pumping. Fluid travelling through the stenosis at high velocity was slowed when it entered the poststenotic region, producing eddying currents and lateral dispersion. Holman postulated that the excess kinetic energy was dissipated laterally to dilate the tube. The work of de Vries and van den Berg cast doubt upon this hypothesis because in their model the manometric pressure was lower in the poststenotic region during the simulated systole. These investigators considered turbulence to be the main factor. A more attractive hypothesis was offered by Rodbard, who suggested that vascular caliber is determined by shear stress on the endothelial cells. In the normal circulation the vascular diameter adjusts to the volume of flow, but the abnormal increase in caliber seen in poststenotic dilatation results from a marked accentuation of surface shear from the high-energy turbulent ejection stream impinging on the wall. Regardless of the precise mechanism, it appears that hemodynamic factors in the poststenotic segment cause dilatation. The most probable explanation for the combined occurrence of aortic stenosis and cystic medial necrosis of the ascending aorta is that the changes in the ascending aorta are a direct consequence of the poststenotic dilatation of the aorta. The marked dilatation induced by the hemodynamic abnormality produces stretching, elastic disruption, and pools of mucoid material with irregularly disposed myocytes.

The diagnosis of dilatation of the ascending aorta may be difficult because the chest x-ray film may not show the aortic root. We recently studied a patient with Marfan's syndrome who had aortic regurgitation and died from a dissecting aneurysm; two months earlier, his chest x-ray film had revealed no abnormality, but an echocardiogram and shown marked dilatation of the aortic root. The patient described herein had a normal aortic root on the echocardiogram, but the chest x-ray film revealed a markedly dilated ascending aorta. In attempting to distinguish Marfan's syndrome from poststenotic dilatation, it may be wise to use both of these studies in the evaluation of the ascending aorta.

Lupus Erythematosus Cells in Pleural Effusion*

The Initial Manifestation of Procaineamide-Induced Lupus Erythematosus

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A 63-year-old man developed an asymptomatic pleural effusion following the administration of 500 gm of procaineamide hydrochloride over a six-month period. The diagnosis was initially suggested by the finding of lupus erythematosus cells in the pleural fluid. Lupus erythematosus cells and antinuclear antibodies appeared in the blood two months later and remained for a period of six months. The diagnosis was corroborated by the presence of antibodies to denatured DNA, but not to native DNA.

Procaineamide hydrochloride is probably the drug most frequently associated with induction of the lupus erythematosus-like syndrome. Procaineamide may cause asymptomatic serologic changes in as many as 50 to 77 percent of the patients receiving the drug. The most frequent manifestations of procaineamide-induced lupus erythematosus are rheumatic symptoms, antinuclear antibodies, lupus erythematosus cells, pleurapulmonic involvement, and fever. Although pleural effusion is found in 30.3 percent of the cases of idiopathic lupus erythematosus and 33.3 percent of the cases of procaineamide-induced lupus erythematosus, there is no mention of the presence of lupus erythematosus cells in the pleural fluid, nor has any report observed the sequence of time between the documentation of lupus erythematosus cells in the pleural fluid and the development of lupus erythematosus cells and antinuclear anti-

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References


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bodies in the blood. The patient presented in this report is unique in that the diagnosis of procainamide-induced lupus erythematosus was established following the discovery of lupus erythematosus cells in the pleural fluid, whereas lupus erythematosus cells appeared in the blood two months later.

**Case Report**

The patient, a 63-year-old man, was first hospitalized for an acute myocardial infarction in 1972. He was readmitted in October 1973, following a second acute myocardial infarction. Treatment was started with oral administration of 3 gm of procainamide hydrochloride daily, because of frequent episodes of multiple ventricular premature beats. The patient’s serum was examined for the presence of lupus erythematosus cells and antinuclear antibodies one month after discharge from the hospital, and none was found.

Congestive heart failure appeared in January 1974. A chest x-ray film showed signs of congestive heart failure, but no pleural fluid was present. Therapy with digoxin, furosemide, and warfarin was given, in addition to treatment with procainamide, with remission of all symptoms.

The patient was admitted six months after the initiation of therapy with procainamide for the evaluation of anemia. The hemoglobin level was 9.0 gm/100 ml, the hematocrit reading was 23 percent, and the prothrombin time was 19 percent. Physical examination revealed minimal dullness over the base of the right lung, with diminution of pulmonary sounds.

A chest x-ray film showed a small right pleural effusion. Pleural aspiration yielded a clear yellow fluid. The protein content was 5.6 gm/100 ml, the albumin level was 3.4 gm/100 ml, the lactic dehydrogenase level was 415 international units, and the cholesterol content was 102 mg/100 ml. Microscopic examination of stained sediment from the pleural fluid demonstrated numerous lupus erythematosus cells (Fig 1). Hematologic examination of the pleural fluid showed a red blood cell count of 60,000/cu mm and a white blood cell count of 7,400/cu mm, with a differential count of 76 percent polymorphonuclear leukocytes, 17 percent monocytes, 6 percent lymphocytes, and 1 percent basophils. The fluid was sterile.

The results of serum protein electrophoresis, a VDRL test for syphilis, latex-fixation test, Coombs’ test (direct and indirect), tests for antinuclear antibodies, and lupus erythematosus preparations were all normal. The level of C3 complement was 90 mg/100 ml (normal, 137 ± 37 mg/100 ml). Iron-deficiency anemia was present, but the source of the loss of blood was not found. Iron was administered, and therapy with warfarin was discontinued. Administration of procainamide was discontinued 172 days after the initiation of treatment, following administration of a total of 500 gm of procainamide hydrochloride.

Antibodies to denatured DNA were present in samples of serum examined one week after the initial pleural aspiration. Antinuclear antibodies and lupus erythematosus cells were detected in the blood two months later and remained for a period of six months. Antibodies to native DNA were not found. There was no recurrence of the pleural effusion. The patient died one year after the cessation of therapy with procainamide, following a third myocardial infarction. Permission for postmortem examination was denied.

**Discussion**

This patient initially had an asymptomatic pleural effusion induced by the administration of procainamide. The diagnosis of procainamide-induced lupus erythematosus was substantiated by the following observations: lupus erythematosus cells were negative when treatment with procainamide was initiated and disappeared six months after the cessation of therapy; and antibodies were present for denatured DNA, but not native DNA. The presence of hypocomplementemia has also been previously reported in patients with procainamide-induced lupus erythematosus.

Although the presence of lupus erythematosus cells in the pleural fluid has been mentioned, we could find only one case of actual documentation of this phenomenon. This occurred in a 49-year-old woman with pleuritis and pleural effusion as part of the initial manifestations of systemic lupus erythematosus. To our knowledge, the present communication is the first to report lupus erythematosus cells in the pleural fluid as the initial finding suggesting the diagnosis of procainamide-induced lupus erythematosus. This diagnosis was first considered by serendipity, following the documentation of lupus erythematosus cells in a stained smear of sediment of the pleural fluid. The pleural fluid in this patient presented an ideal milieu for generation of lupus erythematosus cells; it had a white blood cell count of 7,400/cu mm, with 76 percent of the cells being polymorphonuclear leukocytes. Nucleoprotein was released from stagnating cells and subsequently phagocytized by intact polymorphonuclear cells. This may explain the presence of lupus erythematosus cells in the pleural fluid two months before their appearance in the blood.

Lupus erythematosus cells were found in the pleural fluid six months after the initiation of therapy with procainamide. Blomgren et al noted that the average time of onset of symptoms in procainamide-induced lupus erythematosus was 12 months after the initiation of therapy, but that symptoms could occur as early as within one month. There was no relationship to the total amount of the drug ingested. The presence of lupus erythematosus cells in the pleural fluid is not emphasized.

**Figure 1.** Sediment of pleural fluid, demonstrating lupus erythematosus cell in midst of many polymorphonuclear leukocytes (May-Grünewald-Giemsa stain, original magnification × 400).

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in the literature as a means of making the diagnosis of either systemic lupus erythematosus or procainamide-induced lupus erythematosus. It would seem advisable to search for lupus erythematosus cells in any pleural fluid of undetermined etiology, especially in a patient receiving a drug associated with induction of lupus erythematosus. These cells may be the first observable evidence of drug-induced or genuine systemic lupus erythematosus.

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Bronchiectasis and Spontaneous Pneumothorax in Marfan’s Syndrome*

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A Chinese girl with Marfan’s syndrome had spontaneous pneumothorax and bronchiectasis. Spontaneous pneumothorax is not an infrequent pulmonary manifestation of Marfan’s syndrome, but bronchiectasis is rarely reported to occur. So far, it has not been reported that both bronchiectasis and spontaneous pneumothorax can occur in the same patient with Marfan’s syndrome.

Marfan’s syndrome is a rare, but well defined, hereditary disorder with skeletal, cardiovascular, and ocular abnormalities. Pulmonary abnormalities occur frequently in this syndrome, and they include congenital malformations, cystic disease, bullae, emphysema, spontaneous pneumothorax, and bronchiectasis.1 So far, bronchiectasis and spontaneous pneumothorax have not been reported to have occurred together in Marfan’s syndrome. Therefore, it appears worthwhile to report such an occurrence in a young Chinese girl.

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CASE REPORT

A 15-year-old Chinese girl was admitted with a history of sudden onset of pain in the right anterior portion of the chest and severe dyspnea. She was found to be very breathless. Her fingers and toes were mildly clubbed. The heart was not enlarged, and no cardiac murmur was heard; however, the pulmonic component of the second heart sound was loud. Examination of the chest revealed that the patient had pneumothorax of the right hemithorax and bilateral coarse crepitations and rhonchi.

A chest x-ray film showed a 40 percent pneumothorax on the right side, with multiple cystic opacities in the middle and lower zones bilaterally (Fig 1). A diagnosis of pneumothorax with underlying bronchiectasis was therefore made, as the patient also gave a history of a recurrent cough productive of a large amount of foul-smelling sputum over the last five years. She was treated immediately with closed chest tube drainage, and the right lung was reexpanded completely over the next few days.

The patient was tall and thin, with long tapered fingers. Her height was 160 cm (5 ft 3 in), in her arm span was 165 cm. The distance from crown to pubis measured 75 cm, and from pubis to heel measured 85 cm. The ratio of upper segment to lower segment was 0.87. Pectus excavatum, cubis valgus, knock knees, high arched palate, and hyperextensibility of the joints of the wrists were also noted. Ophthalmic examination revealed no ectopia lentis. Wrist sign, a useful finding in the Marfan’s syndrome, was present. The metacarpal index of 9.4 was in the range for Marfan’s syndrome.5 Family history revealed that the patient’s father, elder brother, and another younger sister were of thin and tall habitus with long...

Figure 1. Chest x-ray film showed 40 percent right pneumothorax with multiple cystic opacities in both middle and lower zones bilaterally.