Rheumatic Pneumonitis

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In the course of acute rheumatic fever, the occurrence of pulmonary infiltrates is often considered a manifestation of pulmonary congestion, unrelated viral or bacterial pneumonitis, atelectasis, or infarction. These interpretations are undoubtedly correct frequently but cannot apply to all cases. Inasmuch as the pathologic process in acute rheumatic fever is known to be a diffuse one and capable of involving the vascular system and connective tissue in a wide variety of organ systems,1-4 the question of rheumatic pneumonitis may be logically advanced in such cases. The following presentation of two fatal cases with postmortem documentation and one clinically suspected case without autopsy confirmation and the subsequent review of the pertinent literature will serve to bring this entity into focus and to present it as an important development of grave prognostic significance during the course of acute rheumatic fever.

Case Reports

Case 1

R. J. (fig. 1), a 6-year-old boy was admitted on May 11, 1963, with a diagnosis of rheumatic heart disease and died from severe respiratory insufficiency on May 27, 1963. A month earlier he had been given two injections of penicillin for a sore throat, abdominal pain, and vomiting. He failed to improve and was admitted for observation. His blood and throat cultures were negative and after responding to therapy, he was discharged on April 12, 1963, with a diagnosis of viral infection of undetermined type. Cardiac

CASE 1 R. J.

Figure 1

Graph of clinical data in case 1. The extreme tachypnea unaccounted for by the rise in temperature was thought to represent rheumatic pneumonitis.

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examination at that time was negative but neither a chest roentgenogram nor an electrocardiogram was taken. Four days before the second and last admission the child complained of pain in his legs. Subsequently, a persistent anterior chest pain developed and his temperature rose.

At the time of admission his temperature was 102.2 F., pulse rate 120 per minute, respiratory rate 35 per minute, and blood pressure 100/70 mm. Hg. He was acutely ill and dyspneic. There were dullness and tubular breath sounds over both lower lung fields posteriorly, but rales were absent. Cardiac examination revealed cardiomegaly and mitral regurgitation. The electrocardiogram showed left atrial and left ventricular enlargement. Chest roentgenogram demonstrated cardiomegaly and a diffuse pulmonary infiltration interpreted as pulmonary edema secondary to left ventricular failure (fig. 2B). The film taken 2 days earlier had been clear (fig. 2A). Laboratory tests on admission included a white blood-cell count of 4,300/mm.³, hematocrit value of 38 per cent, and a sedimentation rate of 47 mm. per hour, antistreptolysin-O titer of 625 units, a reactive latex globulin test, and a negative throat culture. On the basis of the clinical diagnosis of active rheumatic carditis, treatment with aspirin and penicillin was begun and digitalis was given. His condition improved for a few days but deteriorated again, with fever and a progressive increase in pulse and respiratory rates to 140 and 60 per minute, respectively on the eighth hospital day. Clinical examination revealed essentially unchanged cardiac findings but a definite increase in the extent of pulmonary consolidation. Rales were again absent. Prednisolone therapy was begun at a dosage of 15 mg. every 6 hours to no avail. The pulmonary infiltrates persisted on the roentgenograms (fig. 2C) and the respiratory rate reached 90 a minute on the tenth hospital day. Conspicuously absent pulmonary rales were observed in spite of x-ray suggestion of pulmonary edema. Treatment with oxygen, morphine, more digitalis, and tourniquet failed to afford comfort. Death in severe respiratory distress occurred on the seventeenth hospital day. At no time were there signs of congestive heart failure, hepatomegaly, or venous congestion.

At autopsy the heart was moderately hypertrophied and all cardiac chambers were dilated. All the cardiac valves were edematous and the mitral and aortic valves showed changes of active rheumatic valvulitis. Abdominal viscera were moderately congested. The lungs were airless, dry, rubbery in consistency, deep red throughout and more heavily consolidated in the lower lobes, where nonpurulent secretions were seen in the airways.

Microscopically, myocardial Aschoff bodies were found in abundance throughout the myocardium (fig. 3A). The lungs showed diffuse alveolitis with fibrinous exudation, which appeared as a hyaline membrane in some areas and as conglomerates of fibrin and inflammatory cells typical of Masson bodies in other areas (fig. 3B, C). In certain sections the fibrinous exudate was adherent to the wall of the alveoli and alveolar ducts and appeared to be in the process of incorporation into the surrounding tissues (fig. 3B). A notable feature was the advanced stage of fibrous organization of this exudate in some alveoli giving rise to bundles of fibroblasts obliterating the alveolar spaces (fig. 3B, C). Capillary congestion and alveolar megakaryocytes were other prominent features.

Comment. In this case of acute rheumatic fever with carditis a severe, fulminating pneumonitis of extensive proportions caused death at a time when cardiac failure was not apparent. Intense dyspnea and striking tachypnea were the outstanding features. Pulmonary findings at the bedside were thought by many observers to repre-

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**Figure 2**

Chest roentgenograms in case 1 just before admission (A) and on the second and thirteenth days (B, C). Note the persistence of diffuse pneumonic infiltrations and their resemblance to pulmonary edema.
sent edema secondary to left ventricular failure. The absence of rales and the intense consolidation, however, were somewhat unusual for edema. Treatment directed at amelioration of pulmonary congestion was ineffectual as were steroids. Postmortem findings were those of a diffuse inflammatory, fibrinous pneumonitis with Masson bodies characteristic of rheumatic involvement.

Case 2

M. D. (fig. 4), a 20-year-old housewife was admitted to the Medical Service on January 19, 1962, with the diagnosis of rheumatic heart disease, active carditis, and congestive heart failure and died in one week in severe respiratory distress. An attack of rheumatic fever associated with carditis and mitral regurgitation, prolonged P-R interval, and an antistreptolysin-O titer of 1,250 units occasioned her first admission 3 years earlier. She was first treated with penicillin and aspirin, and prednisone was added on the seventh hospital day, when she became tachypneic. A chest roentgenogram at this time showed pneumonic infiltration in the right, middle, and lower lobes (fig. 5A) and a diagnosis of rheumatic pneumonitis was considered. After a stormy hospital course marked by prolonged pyrexia, tachypnea, and dyspnea the pulmonary infiltrates subsided slowly (fig. 5B), and the patient was discharged on the forty-first hospital day on prophylactic oral penicillin. On January 19, 1962, she presented with chest pain and dyspnea preceded by sore throat. She was thought to have pulmonary edema, and was treated with opiates. Examination revealed dyspnea, orthopnea, and congestive rales throughout both lung fields and a blood pressure of 160/70, a pulse rate of 130, and respiratory rate of 26 a minute. There was a pansystolic murmur of mitral regurgitation, also a diastolic murmur of aortic regurgitation, cardiomegaly, and a loud left ventricular gallop. The admission chest roentgenogram was similar to that taken at discharge in 1959 (fig. 5B). The antistreptolysin-O titer was 830 units. Treatment with penicillin and prednisolone at a dose of 80 mg. daily was begun immediately but her condition deteriorated rapidly. Respiratory rate rose to 70 a minute on the fifth hospital day (fig. 4), but auscultatory findings of pulmonary edema were absent. Chest roentgenograms showed infiltrates in the lower lobes, and the question of rheumatic pneumonitis was again raised (fig. 5C). The dosage of prednisolone was increased to 160 mg./day with no demonstrable benefit. Heavy digitalis and diuretic therapy failed to relieve the dyspnea. Pulmonary infiltrates spread throughout the chest (fig. 5D) and she died a respiratory death on the seventh hospital day. Signs of right ventricular failure never developed, and peripheral edema was minimal throughout the hospital course.

Gross necropsy findings included typical changes of rheumatic valvulitis of mitral, aortic,
and tricuspid valves, left ventricular hypertrophy, and focal fibrinous pericarditis. The lungs were firm and rubbery throughout, somewhat more consolidated in the lower zones. The cut sections were mahogany red in color and dry, with no purulent exudates in the airways.

Microscopic examination revealed the specific myocardial Aschoff bodies (fig. 6A) and fibrinous vegetations of active valvulitis on the affected valves. Few small emboli were present in tertiary pulmonary arterial branches and resulted in microscopic infarcts. The striking finding was a widespread acute inflammatory and congestive pneumonitis with thickening of alveolar septa and extensive exudation of fibrinous material into the alveoli. Condensation of this fibrinous exudate resulted in the formation of Masson bodies in certain areas and obliteration of alveolar spaces in others (fig. 6B, C). Intracapillary megakaryocytes and desquamated alveolar cells were conspicuous throughout the lungs.

Comment. Pneumonic infiltrations developed in the active stage of acute rheumatic fever during both hospital observations. Dyspnea and tachypnea were prominent and responsible for a protracted hospital stay at the first admission. During the last admission death was caused by severe respiratory distress again associated with severe tachypnea. Rheumatic pneumonitis was a favored diagnosis on both occasions. Signs and symptoms of congestive heart failure were not prominent. Nevertheless, many observers attributed the respiratory symptoms to the presence of heart failure. Vigorous diuretic therapy was instituted to no avail.

The striking postmortem finding was a severe, diffuse pneumonitis with features characteristic of rheumatic involvement.

Case 3

N. P. (fig. 7), a 10-year-old girl with known rheumatic heart disease and mitral and aortic regurgitation since 1958 was admitted on October 5, 1961, with dyspnea and died in severe respiratory distress on March 25, 1962. She had been discharged from the hospital 3 weeks previously after having received steroid therapy for active rheumatic carditis complicated by mild failure. About a week before her last admission she became dyspneic and complained of a dry cough and fever.

At the time of admission, she was dyspneic and moderately orthopneic. Her pulse rate was 136 per minute, blood pressure 112/70, temperature 97 F., and respiratory rate 23 per minute. She had the typical moon-face due to previous steroid therapy. The heart was considerably enlarged, and there were signs of severe mitral regurgita-
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Figure 5
Chest roentgenograms in case 2 taken at the time of clinically manifest pneumonitis on the first admission (A) and before discharge showing complete clearing of the infiltrate (B). C and D demonstrate reappearance of pneumonic infiltrate during the second admission.

Figure 6
Photomicrographs of myocardium and lung in case 2. A. Early myocardial Aschoff nodule: central core of smudgy fibrinoid necrosis surrounded by typical histiocytes. B. Acute exudative and fibrinous alveolitis: alveolar septa are thickened and infiltrated by inflammatory cells. Fibrinous exudate fills the alveolar duct (small arrows). C. Two typical Masson bodies filling the alveolar spaces or ducts (arrows).
tion and mild aortic regurgitation. Congestive rales were heard over both lung bases, and the venous pressure was 170 mm Hg. Her sedimentation rate was 3 mm per hour, white blood-cell count 5,950/mm³, hematocrit value 49 per cent, and antistreptolysin-O titer 12 units. A provisional diagnosis of congestive heart failure secondary to severe mitral regurgitation was made and the patient was treated with low-salt diet, bed rest, diuretics, and, subsequently, digitalis to which she responded favorably with a loss of 10 pounds in body weight and disappearance of heart failure. Her effort tolerance remained low, however, and she complained of persistent fatigue.

Persistence of fatigue, effort intolerance, and cardiomegaly suggested the existence of rheumatic activity and prompted resumption of steroid therapy on December 28, 1961. She failed to respond and complained of malaise, dyspnea, tachypnea, and tachycardia without edema or other manifestations of congestive heart failure. Cardiac examination remained unchanged. Increasing lassitude, dyspnea, rising respiratory rate to 64 a minute, signs of consolidation and occasional rales over right lower lung field, and low-grade fever developed during the last 2 weeks of her life. Chest roentgenograms showed diffuse patchy pneumonitis in both lower lung fields. She died from a progressively increasing respiratory distress. Necropsy examination was not performed.

Comment. Even though necropsy confirmation is lacking in this case, rheumatic pneumonitis appears as a possibility. Inasmuch as rheumatic pneumonitis possesses no pathognomonic clinical features, this diagnosis and its differentiation from bacterial and viral processes remain speculative. Nevertheless, the association of pulmonary consolidation, tachypnea, the resistance to steroid therapy and the fatal outcome in a patient with known active rheumatic carditis is reminiscent of cases 1 and 2.

Discussion

The specificity of rheumatic pneumonitis has been the subject of controversy for nearly 40 years. Many clinicians have observed a characteristic clinical picture and, combined with postmortem findings, have accepted the pneumonitis as a specific manifestation of rheumatic fever. Pathologists, on the other hand, have not been unanimous in their acceptance of the pathologic process as distinctly rheumatic, mainly because they have found pathologic differentiation difficult from some viral and uremic pneumonitis. A moderate attitude is perhaps the most logical, for a di-
agnosis of rheumatic pneumonitis should preferably be based on a consideration of the clinical features as well as microscopic findings. In fact, most of the illuminating work in this area is represented by those studies that embody both clinical and pathologic features.

As long ago as 1845, Latham wrote "but the heart is not the only vital organ liable to suffer inflammation in acute rheumatism. The lungs may suffer also . . . . And the diseases which result are bronchitis, pneumonia, pleurisy." In 136 cases of acute rheumatism, he observed pneumonia in 18 and noted a graver outcome in those cases. He further made the observation that pneumonia was much more common in patients with carditis than in those with the articular manifestation alone. Nine years later, Fuller described inflammation of the lungs in rheumatic fever. In his experience, the incidence of pulmonary inflammation was one in 127 cases of simple acute rheumatic fever and 18 in 27 cases of acute rheumatic fever associated with endocarditis and pericarditis (rheumatic myocarditis was not well recognized in that era). Rheumatic pneumonia was described as an entity by such prominent clinicians as Walsh, Trousseau, Cheadle, and Garrod in the second half of the nineteenth century. Cheadle described six instances of pneumonia during an outbreak of acute rheumatic fever involving 26 cases and described hypopnea and fever as its manifestations. In most of these early observations autopsy studies were infrequent and there was failure clearly to distinguish between passive congestion from left ventricular failure and active congestion caused by inflammation.

The first quarter of this century was marked by an almost complete absence of references to rheumatic pneumonia probably because Aschoff's description of the specific lesion of rheumatic fever in the myocardium suggested that these nodules were sine qua non of rheumatic inflammation irrespective of the organ involved. Thayer in 1925 and Bezançon and Wiel in 1926 briefly mentioned rheumatic pneumonia. The excellent paper of Von Glahn and Pappenheimer in 1926 describing a specific type of vasculitis in rheumatic fever perhaps served as a stimulus for further search for rheumatic pneumonia without demanding the presence of Aschoff bodies. In 1926, Rabinowitz reported a specific rheumatic pneumonia even though he failed to find Aschoff bodies in histologic sections. He observed that the pulmonary lesions could not be explained on the basis of heart failure or compression of the lung by serous effusions because these factors were not present in all his cases of rheumatic pneumonia. Several important publications attested to the specificity of rheumatic pneumonia. Naish preferred the term "rheumatic lung" because the lesions he described were not lobar in distribution but tended to be widespread. His description of gross and microscopic appearance of rheumatic lung served as the basis for many future descriptions. He characterized the inflammatory lesions as, "unlike anything else," and "constant from case to case," and "dry, rubbery consistency, color of purple red and not granite or marble like it is in other pneumonias." Microscopically, Naish observed thickening of the alveolar wall, proliferation of alveolar cells, and multinucleated large endothelial cells within the alveoli.

Paul, in a classic review, pointed out the extremely hemorrhagic nature of the lesions in rheumatic pneumonia and suggested the failure to recover bacteria in such patients as a strong point in favor of rheumatic pathogenesis of the pulmonary infiltrates. Gooley and Eiman analyzed the pathologic features of rheumatic pneumonitis and considered the process specific for this disease. They noted its frequent occurrence in the fatal cases of rheumatic fever and indicated the high incidence of pleural effusion but emphasized the basic difference between rheumatic pneumonitis and compression atelectasis, which might result from excessive effusion. In their experience the combination of an interstitial pneumonitis, alveolar cell damage, and a necrotizing, hemorrhagic vasculitis was the hallmark of rheumatic pneumonitis. In subsequent classical studies Rich and Gregory stressed the similarity between the vasculitis
in rheumatic pneumonitis and that occurring in anaphylactic reactions.

Pulmonary Aschoff bodies identical with those found in the myocardium were described by Fraser\textsuperscript{24} but most other authors have been satisfied with the specificity of the pneumonitis in the absence of Aschoff bodies. That hemorrhagic inflammation is a prominent feature of rheumatic pneumonitis was again emphasized by Coburn,\textsuperscript{25} Hatfield,\textsuperscript{26} and Epstein and Greenspan.\textsuperscript{27}

Masson et al.\textsuperscript{28} described specific deposits of hyaline material filling the terminal air ducts in all the 13 cases of fatal acute rheumatic fever. These formations were called "Masson bodies" by Neubuerger et al.,\textsuperscript{29} but their specificity has been variously doubted\textsuperscript{30, 31} and confirmed.\textsuperscript{32} The genesis of these bodies were explained by Kuzma and Lustok\textsuperscript{31} as a conglomeration of fibrinous exudate complicated by ingrowth of young fibroblasts. These authors pointed out that similar lesions occur in polyarteritis, uremia, chemical pneumonitis, and other nonrheumatic conditions. However, because they are developed to such greater extent and occur with such higher frequency they deserve to be recognized as a typical feature of rheumatic pneumonitis.

Recent publications indicate a greater acceptance of rheumatic pneumonitis as a specific manifestation and not simply an intercurrent complication of severe rheumatic fever.\textsuperscript{31-38}

The full spectrum of this process is yet to be defined. Rheumatic pneumonitis may be extremely mild and only an incidental finding when death is caused by severe rheumatic valvular or myocardial involvement. The more usual picture, however, is that of a massive pneumonitis of rapid onset causing considerable respiratory difficulty, aggravating the clinical state, and even causing death.\textsuperscript{21, 25, 26, 35, 39, 40}

The picture of rheumatic pneumonitis may be summarized as follows. Rheumatic pneumonitis occurs in the course of acute severe rheumatic fever, usually associated with active carditis, and aggravates the clinical picture. Severe dyspnea and tachypnea, toxicity and a worsening course are the hallmarks of this process. Massive consolidation of the lung without rales is the rule; roentgenologically, the picture often resembles pulmonary edema so that clinical differentiation may be almost impossible. For this reason Debré and associates\textsuperscript{40} have suggested the term "acute inflammatory edema of rheumatic origin." At postmortem examination the lungs are dark red, severely congested, firm, dry, of rubbery consistency, and often mottled with hemorrhagic spots. Microscopically, alveolitis with fibrinous exudation within the alveoli and alveolar ducts, fibrinoid vasculitis, infiltration of the interstitial tissue with inflammatory cells and erythrocytic filling of alveoli, proliferating endothelial cells, and Masson bodies within the terminal airways seem to be the most commonly accepted features.

Our cases appear to fulfill most of these criteria. The occurrence of pulmonary lesions at the height of rheumatic activity—twice in case 2—speaks strongly in favor of a rheumatic pathogenesis. Failure of steroid therapy to alter the fatal course is noteworthy.

**Summary and Conclusions**

Two cases of fatal rheumatic pneumonitis with necropsy confirmation occurring during the active phase of acute rheumatic carditis are presented and the distinguishing features are pointed out. A third, unconfirmed case is also presented in order to demonstrate the difficulty of establishing a firm diagnosis before necropsy examination.

The rheumatic pathogenesis of the pneumonic process cannot be proved at bedside. The diagnosis is suggested through observation in a patient with active rheumatic carditis of an unremitting, diffuse pulmonary consolidation, marked tachypnea, and unresponsiveness to steroid and antibiotic therapy usually terminating in death. The postmortem finding of dry, dark red lungs of rubbery consistency, marked congestion, severe fibrinous alveolitis, and Masson bodies in the terminal air ducts completes the picture.

It is hoped that a more ready acceptance
of rheumatic pneumonitis as a nosologic entity will lead to recognition of many cases that would otherwise be classified as pulmonary edema and, eventually, to a better understanding of its behavior and its therapy.

References
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