Laboratory features of pleural effusions

The clinical history, physical examination, and chest radiograph may give clues to the cause of a pleural effusion, but often this remains obscure. Examining the fluid may provide further clues. Blood staining suggests a traumatic or neoplastic origin, but may occur in infarction of the lung or pneumonia. Classically serous effusions are divided into transudates and exudates. Transudates have protein concentrations of 0.5-1.5\%, and a specific gravity of less than 1.015, and do not clot on standing. They occur in cardiac or renal failure or in deficiency disorders in which there is generalised oedema. Exudates result from inflammation of the pleura; they have a higher protein concentration of 3-5\%, and a specific gravity over 1.018, and they clot on standing. Microscopy will show the type of cells present—usually lymphocytes in tuberculous effusions and polymorphonuclear leucocytes in postnecrotic effusions, though exceptions occur. Cytological studies may show malignant cells. Bacteria may be visible or may grow under the correct culture conditions. These standard tests are useful in diagnosing the commoner causes of pleural effusions, but are less applicable to the more unusual causes.

Pleural lesions are a frequent manifestation of rheumatoid arthritis and systemic lupus erythematosus. Up to a fifth of patients with systemic lupus erythematosus may develop effusions. In rheumatoid arthritis, however, although pleuritis is common, effusions occur in only 2-3\% of patients. Here they may present a difficult diagnostic problem, especially when they antedate or accompany the rheumatic disorders. When acute febrile pleurisy occurs in rheumatoid arthritis, tests must establish whether this is part of the rheumatoid process or an infective or neoplastic condition in a possibly immuno-suppressed individual.

The clinical usefulness of the various diagnostic tests for determining the cause of pleural effusions has recently been evaluated by Halla and his colleagues. Several laboratory tests emerged as reliable discriminators between rheumatoid and systemic lupus effusions. All seven rheumatoid pleural fluids had an acidosis (pH < 7.2), while all five systemic lupus fluids tested had a pH of 7.35 or more. This study also confirmed that rheumatoid pleural fluids are characterised by low glucose concentrations: all had less than 1.4 mmol/l (25 mg/dl) glucose, whereas all fluids from patients with systemic lupus erythematosus contained 4.4 mmol/l (80 mg/dl) or more. Lactic dehydrogenase concentrations exceeded 700 IU/l in rheumatoid effusions and were 500 IU/l or less in seven of the eight patients with systemic lupus erythematosus. Rheumatoid factor titres were measured by the latex fixation method; all rheumatoid effusions from seropositive patients were positive for rheumatoid factor with a titre greater than in the serum, while only one effusion from a patient with systemic lupus erythematosus was positive. Rheumatoid factor is not, however, specific for or limited to rheumatoid disease, for it is present in the pleural fluid of 41\% of patients with bacterial pneumonia, 21\% of patients with carcinoma, and 14\% of patients with tuberculosis.

More important, Halla and his colleagues assessed the laboratory variables that might distinguish the effusions of systemic lupus erythematosus and rheumatoid disease from effusions due to other causes. Complement activity has been suggested as one such variable, but Halla et al found significant differences only for C4. The presence of immune complexes in the pleural fluid, however, appeared to provide a basis for a useful diagnostic test of rheumatoid disease. They used three detection reagents—monoclonal rheumatoid factor radioimmunoassay, Clq binding assay, and Raji cell radioassay. Each assay recognises a different biological property of immune complexes. The rheumatoid effusions contained immune complexes, nearly all at concentrations greater than those in the serum, on all three tests. In contrast, immune complexes in systemic lupus effusions were detected only by the Raji cell radioassay and then at concentrations similar to those in the serum. Only one patient with systemic lupus erythematosus gave a positive result with the monoclonal rheumatoid factor assay. Immune complexes in the pleural fluid from patients with other diseases were rare. The high concentration in rheumatoid pleural effusions suggests that immune complexes are produced within the pleural cavity in rheumatoid disease, whereas in systemic lupus erythematosus immune complexes in effusions seem to reflect the serum concentration. This is in keeping with the current theory that systemic lupus erythematosus is an intravascular and rheumatoid arthritis an extravascular immune complex disorder.

Halla and his colleagues believe that measuring soluble immune complexes aids the differentiation of pleural effusions of rheumatic and non-rheumatic diseases. Measurement can be based on agar gel diffusion with monoclonal rheumatoid factor and human Clq. The test is technically simple and, although not quantitative, it yields frequencies of positive
results similar to those observed by radioassay. It seems to be a useful addition to the diagnostic tests on pleural fluid.


The intra-aortic balloon pump

The principle of the intra-aortic balloon pump is simple enough. A catheter with a sausage-shaped balloon is passed through a femoral artery to the descending aorta. The balloon is rapidly inflated during diastole, thus raising the pressure with which the coronary arteries are perfused and so increasing coronary blood flow and myocardial oxygenation. The balloon is suddenly deflated immediately before systole, so reducing the cardiac afterload, increasing the stroke volume and ejection fraction, and decreasing the tension in the myocardial wall and myocardial oxygen consumption.¹ ² Balloon pumping has been shown to improve the haemodynamic performance in a wide variety of conditions in which cardiac function is impaired.¹ ³ ⁸

Unfortunately, the practice of balloon pumping (or counterpulsation) is not so simple. The standard catheter has to be inserted through a side arm sewn into the femoral artery by a vascular surgeon—a time-consuming procedure which inevitably stresses a patient who is possibly already critically ill. Complications are common⁹ and include dissection of the aorta or of one of its branches, perforation of a major artery, thrombosis, embolism, and infection. Most of these complications seem to occur at the time of insertion of the catheter, and they may become less frequent with the newer catheters that can be inserted percutaneously.

The technique was introduced with general acclaim a decade ago and in some parts of the world it has been used extensively, but its value remains uncertain: Balloon pumping is certainly useful after cardiac surgery in cases when it proves difficult to take the patient off the cardiopulmonary bypass, when a limited period of pumping may allow the myocardium to recover from the operation. Preoperative pumping may also be useful to maintain the patient and his heart in the best possible shape while preparations for surgery are being made.¹⁰ The main debate, however, is the place of the balloon pump in emergencies not connected with cardiac surgery, and in particular in patients with severe myocardial infarction.

A recent paper from Rotterdam¹ⁱ has described experience in 181 patients treated by balloon pumping for the complications of myocardial infarction or for unstable angina. Seventy-one patients had cardiogenic shock, defined clinically as a low blood pressure, a cool periphery, mental dullness, basal lung crepitations, and a urinary output of less than 40 ml/h, the patient already being treated with digitals, diuretics, dopamine, and vasodilators. Patients in this state would be expected to have a high mortality, yet about half survived three months or more. Forty-two further patients with angina at rest that was refractory to medical treatment were treated with the balloon pump, and in 41 relief of pain was rapid and surgery was performed later with a low complication rate.

So should all coronary care units be equipped with balloon pumps? Enthusiasts have claimed that only with such techniques can mortality rates after myocardial infarction be kept really low.¹² Yet though the data from Rotterdam are impressive they do not really answer this question: the patients with cardiogenic shock who seemed to benefit most were those aged under 60, who had not had a previous myocardial infarction, and who were treated with the pump within six hours of the onset of symptoms. No district general hospital is going to see many patients with cardiogenic shock who fit this description, while such patients probably neither could nor should be immediately transferred to regional centres specially for pump treatment. The conservative physician might argue that such patients are precisely those most likely to improve with relief of their pain and minimal interference: the widespread and indiscriminate use of balloon pumping might well lead to more complications than clinical benefit.