Large haematomas are, of course, frequent after blunt trauma, and it is surprising that more arteriovenous fistulae do not develop. As stated above, a special anatomical situation must necessarily exist in which vessels rupture into a confined space. The open venous channel affords the line of least resistance for the blood under arterial pressure, rather than diffusion of the blood into the tissues such as normally occurs. If the vascular shunt is maintained the channel will gradually become organized and lined with endothelium, and an arteriovenous fistula will have been established.

I thank Professor Sir James Paterson Ross for allowing me to publish this case and for advice and help in the preparation of this paper.

PHILIP H. FRANDSEN, M.D.,
Clinical Research Assistant, Surgical Professorial Unit,
St. Bartholomew's Hospital.

Empyema Caused by *Pasteurella septica*

In the fatal case of empyema described below, *Pasteurella septica* was isolated both during life and after death. This organism is not infrequently isolated from the upper respiratory tract in man, but its importance as a pathogen is extremely difficult to assess. In Britain it has only twice been incriminated as the causal agent in infection of the respiratory tract—once in a case of sinusitis (Bartley and Hunter, 1947), and once as the cause of repeated exacerbations in a case of bronchiectasis (Cawson and Talbot, 1955). Elsewhere, cases of empyema caused by *P. septica* have been described, but only nine reports can be regarded as adequately substantiated by the bacteriological findings.

CASE REPORT

A 76-year-old woman was admitted to hospital on December 20, 1955, complaining of pain in the right hypochondrium and vomiting for three days. On examination she was dyspnoeic and pyrexial—99.2° F. (37.3° C.). Right subcostal tenderness and guarding were present, but there were no other abnormal findings. She had a remittent pyrexia for two days, and then developed grunting respirations and a rust-coloured sputum. Signs of a right lower-lobe pneumonia with pleural effusion were confirmed by x-ray examination. A blood count revealed a leucocytosis of 22,900/c.mm. Treatment with penicillin (crystalline) intramuscularly, 500,000 units six-hourly, produced temporary improvement, but after two more days signs of congestive cardiac failure developed. There now seemed to be an effusion only at the right base, and, in view of the continued deterioration, chest aspiration was performed. A small volume of blood-stained pus was withdrawn, which contained numerous polymorphonuclear leucocytes and minute Gram-negative coccobacilli. Culture yielded a heavy pure growth of *P. septica*. Penicillin was instilled into the loculus entered, and chlortetracycline was given orally, but in spite of all supportive therapy the patient became increasingly feeble, dying on January 16, 1956.

Necropsy Findings.—Necropsy was performed four hours after death. A fibrino-purulent pleurisy involved the lower lobe of the right lung. In the right costophrenic recess there was a collection of 50 ml. of thick yellow pus, walled off by dense fibrous tissue. No gross consolidation was detected in the lungs, but histological examination showed the right lower lobe to be the site of an organizing pneumonia. Other positive findings were confined to the kidneys, which were contracted and coarsely scarred, and the large intestine, which presented an appearance compatible with a uraemic colitis. Cerebrospinal fluid taken at necropsy gave a urea level of 322 mg./100 ml. A specimen of the empyema pus produced, as before, a heavy growth of *P. septica*. The organism was not recovered from material taken from the lungs, trachea, fauces, liver, spleen, heart blood, or cerebrospinal fluid, nor did Gram stains on all organs sectioned show any evidence of Gram-negative coccobacilli. The

final post-mortem diagnosis was "chronic pyelonephritis, pneumonia with empyema occurring as a terminal event."

Bacteriological Findings.—In films prepared from the empyema pus the organism was seen to be a coccobacillus measuring approximately 1.5 by 0.5 μ . Bipolar staining was easily demonstrable, but capsules were not seen. The organism was Gram-negative and non-acid-fast. Its cultural characteristics were typically those of *P. septica*. It grew easily on blood agar and on nutrient agar, but not at all on MacConkey's agar. Two notable features were a peculiar brownish discoloration produced on blood agar after 48–72 hours' incubation, and a semen-like odour given by cultures on this medium. Biochemical reactions were again typical, with the single but important exception of the production of acid from lactose. The antigenic structure and pathogenicity of the organism were investigated by Dr. G. H. Tee. He found it to be agglutinated to a titre of 1:5,120 by an antiserum prepared against a lactose-fermenting organism which had been isolated from a cat-bite and which appeared to be *P. septica*. He also inoculated two mice intraperitoneally with 0.1 ml. of an 18-hour broth culture of our organism diluted 1:100. Both mice died within 24 hours, and were found to have peritonitis with free fluid in the abdominal cavity. A pure growth of an organism with similar properties was recovered from their spleens. Finally the organism was tested against antibiotics, using a standard dried-disk technique; it was found to be sensitive to penicillin, streptomycin, chloramphenicol, the tetracycline group, and polymyxin, but resistant to erythromycin.

COMMENT

Two features in this case are noteworthy. First, it adds to the slowly accumulating body of evidence implicating *P. septica* as a definite potential pathogen in the respiratory tract in man. When Schipper (1947) reviewed human infections with *P. septica*, he divided them into two main groups—local infections due to animal bites, and infections, usually systemic, not obviously attributable to any direct cause. It seems to us, however, that cases of respiratory infection might well be separated from this second rather vague group, with consequently increased emphasis on their frequency and importance. The relatively large series of cases of bronchiectasis, including two complicated by empyema, reported by Olsen and Needham (1952) lends support to this view.

The second feature is of primarily bacteriological interest, and concerns the unusual property possessed by our strain of *P. septica* of producing acid from lactose. There is no published reference to a lactose-fermenting strain being isolated from man. However, such strains have often been described by veterinary workers (Jones, 1921; Rosenbusch and Merchant, 1939), and were referred to by Allin (1942) in a review of cat-bite infections. Moreover, Tee (1956, personal communication) has obtained from sputa several strains of lactose-fermenting organisms which otherwise seemed typically *P. septica*. There is therefore strong evidence that the production of acid from lactose is a property of certain not uncommon strains of *P. septica*, and that such strains may on occasion be pathogenic for man.

We are indebted to Dr. G. H. Tee for his invaluable assistance in carrying out the serological and pathogenicity tests; to Dr. C. S. S. Don for permission to publish the clinical details of the case; to Dr. A. Nicol for the necropsy report; and to Dr. R. W. Fairbrother for his advice and encouragement.

W. I. HORNE, M.B., D.Path.,
Late Registrar.

G. M. BERLYNE, M.B., M.R.C.P.,
Late Senior House Officer.

Department of Clinical Pathology,
Manchester Royal Infirmary.

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