# Postsplenectomy sepsis due to influenzal viremia and pneumococcemia

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**A 31-year-old man, who had undergone splenectomy 18 months previously because of hereditary spherocytosis, suddenly became ill, with fever, vomiting, epigastric pain and shock, and died 10 hours after the onset of his symptoms. Autopsy showed influenzal viremia, pneumococcemia and bilateral adrenal hemorrhage. The rapid course of the patient's illness emphasizes the serious risk of sepsis for individuals who have had a splenectomy. Anti-influenza immunization in such patients should be considered.**

**Un homme de 31 ans, ayant subit 18 mois précédemment une splénectomie à cause d'une sphérocytose héréditaire, est tombé soudainement malade, avec présence de fièvre, de vomissements, de douleur épigastrique et d'un état de choc; il est décédé 10 heures après l'apparition des symptômes. L'autopsie a révélé une virémie grippale, une pneumococcémie et une hémorragie bilatérale des surrénales. L'évolution brutale de la maladie souligne le risque sérieux de septicémie chez les sujets qui ont subit une splénectomie. On devrait considérer chez ces patients la possibilité d'une vaccination contre l'influenza.**

The diminished ability of persons who have undergone splenectomy to combat infections successfully is now widely recognized. This complication of splenectomy has been most frequently observed in young children,[1-3] although older persons have been shown to be at some risk.[4] Bacterial infections have been responsible for most of the reported illness and death in these individuals,[5] but only rarely have viral infections been reported as a cause of postsplenectomy sepsis.[6]

In this paper we present a fatal case of postsplenectomy viremia complicated by pneumococcal sepsis.

## Case report

*Clinical history and findings*

A 31-year-old man became ill Jan. 29, 1973 (during the 1972-73 influenza epidemic), 18 months after having had a splenectomy because of hereditary spherocytosis. He had been in good health until 10 hours before his death, when fever, chills, rigors, headache and low back pain began suddenly. Soon afterwards he had severe difficulty in breathing and epigastric pain radiating to the right shoulder, with nausea and vomiting. When he arrived at hospital 8 hours after the onset of symptoms he was in severe shock, with unrecordable blood pressure. He had striking cyanosis and conjunctival injection and was breathing in a gasping, grunting manner. There were no other physical abnormalities. Electrocardiogram revealed supraventricular tachycardia, at 150 beats/min.

Hematologic investigation was undertaken with the Coulter Counter, Model S (Coulter Electronics Inc., Hialeah, Florida) and by standard methods.[7] Hemoglobin value was 23 g/dl. Leukocyte count was 36.0 x $10^9$/l, with the following differential: segmented neutrophils, 44%; bands, 33%; lymphocytes, 8%; monocytes, 8%, myelocytes, 6%; basophils, 1%; and nucleated erythrocytes, 2/100 leukocytes. A platelet count was not done and no comment was made on their relative numbers in the smear. Blood drawn into a clean tube, without anticoagulant, reportedly would not clot.

Large infusions of intravenous fluids, potassium supplements and furosemide were given. The patient's condition deteriorated suddenly 1¾ hours after admission and he died shortly thereafter in ventricular asystole.

*Autopsy methods and findings*

For histologic study, tissue specimens were fixed in buffered formalin, embedded in paraffin and stained with hematoxylin–eosin. Fibrin was identified in sections by the Martius scarlet blue technique. Bacteria were identified in paraffin-embedded sections after Gram-staining and counterstaining with neutral red.

For virus isolation, tissue was inoculated into the amniotic cavity of a 9- to 12-day-old chick embryo. The amniotic fluid was harvested after 72 hours and tested for the presence of virus by hemagglutination of guinea pig erythrocytes. The virus was identified by the hemagglutination-inhibition technique.[8] Titres of antibody to influenza viruses were determined by the hemagglutination-inhibition technique, using reference virus antigens.[8]

Petechial hemorrhages were widespread on the trunk, limbs and conjunctiva. Bilateral adrenal hemorrhage and virtual destruction of the adrenal cortical parenchyma were noted (Fig. 1). The lungs were congested but showed no evidence of active pneumonia. Multiple fibrin thrombi were present in the submucosa of the bronchi. No splenic tissue was noted. Pneumococcus type 12 was cultured from the lungs, blood, cerebrospinal fluid, adrenals and meninges. Gram-positive diplococci were demonstrated in histologic sections of the adrenals (Fig. 2). Postmortem serum immunoglobulin values, determined with a nephelometer (Technicon Instruments Corp., Tarrytown, New York), were as follows: IgA, 406 mg/dl (normal, 90 to 400 mg/dl); IgG, 920 mg/dl

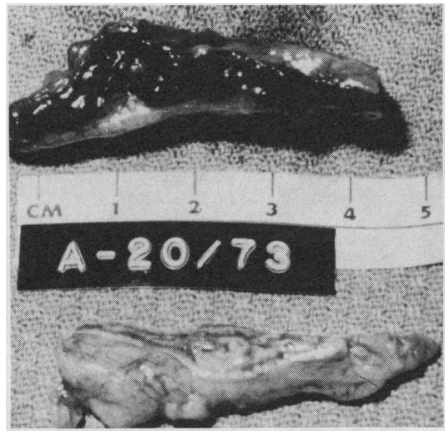


**FIG. 1—Above: hemorrhage in right adrenal. Below: normal adrenal from another subject.**

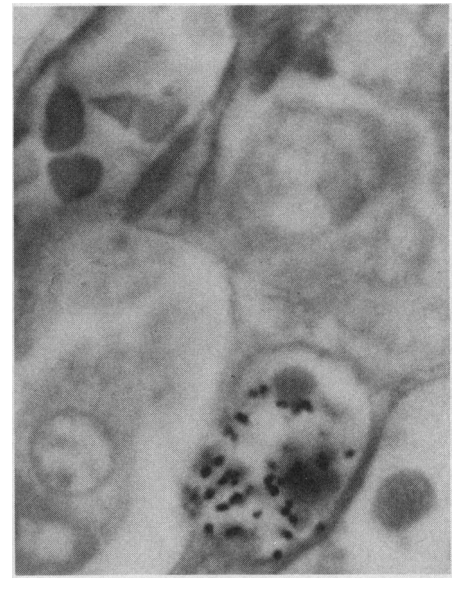

**FIG. 2—Gram-positive diplococci in adrenal cortical parenchyma (Gram's and neutral red stains; x100).**

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(normal, 500 to 1800 mg/dl); IgM, 68 mg/dl (normal, 60 to 250 mg/dl).

Influenza virus $A_2$/England 42/72 was cultured from the lungs, adrenals and meninges. Postmortem serum samples showed a 1:40 titre of antibody to influenza virus $A_2$/England 42/72 and a 1:80 titre of antibody to influenza virus $A_2$/Hong Kong/72.

## Discussion

Several reports have emphasized the increased susceptibility to bacterial sepsis of persons who have undergone splenectomy, but viral infection as a cause of sepsis in these people has rarely been reported. Diamond, Allen and Magill,[6] reviewing their experience with children who had undergone splenectomy because of congenital hypoplastic anemia, found one fatal case of varicella. To our knowledge our case is the first to be reported of postsplenectomy sepsis in which both a viral and a bacterial pathogen were isolated.

In experimental studies investigating the mechanisms of failure of immune protection in mammals who have had a splenectomy, bacteria have almost invariably been used; as a result, the available knowledge is limited to the interactions between bacteria and these mammals.

Little is known about the pathogenetic mechanisms leading to an increased susceptibility to bacterial sepsis in humans who have had a splenectomy. Whitaker[9] has provided evidence that the filtering function of the spleen may be important in the early clearance of a potentially lethal load of bloodborne bacteria. It appears also that the spleen is involved in the production of antibody, especially IgM, the immunoglobulin class that is associated with the early humoral response to antigenic stimulus. However, no consistent correlation has been found between serum antibody concentrations after splenectomy and susceptibility to infection. Serum opsonin activity seems to be diminished after splenectomy, and Constantopoulos and colleagues[10] have presented evidence indicating that an opsonic factor is deficient in the serum of individuals who have had a splenectomy. Confirmation of their findings is required.

Our case showed the classic features of overwhelming postsplenectomy sepsis: fulminant pneumococcemia, with indirect laboratory evidence of disseminated intravascular coagulation, terminating in the Waterhouse-Friderichsen syndrome and death. The unusual feature was that a viral pathogen, influenza virus $A_2$/England 42/72, seems to have contributed to this patient's death. The virus was isolated from lungs, adrenals and meninges, which indicates that viremia must have been present. The pneumococcus was also isolated from these sites and it would therefore appear that the action of the two infective agents was related. The association between influenzal pneumonitis and subsequent bacterial pneumonia is well known. An association between meningococcemia and infection of the upper respiratory tract with echovirus was noted by Levitt and colleagues.[11] Young and associates[12] observed a highly significant association between the acquisition of group B meningococci and serologic evidence of acute influenza. They hypothesized that influenza may directly affect the host in a way that enhances the likelihood of acquisition of meningococci on exposure to them.

Thus, we consider that our patient's terminal illness almost certainly started as an influenzal infection, which is in keeping with the clinical features of the early phase of the illness. The subsequent acquisition of pneumococcal infection, which rapidly became overwhelming, resulted in the patient's death.

Immunization against the various types of pneumococcus has been advocated for individuals who have had a splenectomy, but the value of this procedure has not been tested. However, we believe that anti-influenza immunization for these individuals should be considered. It would be relatively easy to administer the appropriate vaccine during or at the onset of an epidemic.

Permission to publish this case was granted by Dr. Thomas Ryan, who, with Dr. R. Bloch, cared for the patient.

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