Overwhelming Pneumococcaemia 17 Years after Splenectomy

A Case Report

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SUMMARY

We present a case of fulminant pneumococcaemia and disseminated intravascular coagulopathy in a young adult man 17 years after splenectomy. The clinical presentation, laboratory and postmortem findings are discussed. The diagnosis, management and prophylaxis of overwhelming infections in splenectomized patients are reviewed. The advent of pneumococcal and other vaccines could contribute significantly to the successful protection of asplenic patients against certain severe infections.


The triad of overwhelming pneumococcal infection, disseminated intravascular coagulation (DIC) and asplenism is well recognized. Other infections which commonly occur in patients with splenic inactivity are due to Neisseria meningitidis and Haemophilus influenzae or more rarely, streptococci, staphylococci, Escherichia coli, klebsiellae, salmonellae and Pseudomonas aeruginosa. Nonbacterial infections such as Plasmodium falciparum malaria and babesiosis which occur in asplenic patients are associated with a high mortality rate. The risk is much greater in patients under 3 years of age in the first 3 years after splenectomy. In adults the risk is less than in children, and although it is more common in the first 2 years after removal of the spleen, a number of fatalities due to infection have been recorded more than 10 years after splenectomy. Any case of asplenism, due to splenectomy, disease or absence of the spleen, will cause patients to be highly susceptible to fulminating infections.

The spleen has a threefold role in host defence mechanisms, acting especially against particulate antigens. Firstly, in the non-immune person, the spleen is responsible for sequestering certain bacteria as well as neutrophils which have phagocytosed bacteria. Secondly, opsonizing antibodies against encapsulated bacteria are produced by the spleen. In the immune asplenic patient, such antibodies will permit extrasplenic reticulo-endothelial tissues, as in the liver, to remove certain microbial organisms.

Thirdly, tuftsin, a tetrapeptide, which is produced in the spleen, has been shown to act as a phagocytosis-stimulating agent for neutrophils.

The presence of an overwhelming infection in an asplenic patient constitutes a dilemma and a challenge to the physician. We report a case of fulminating pneumococcal bacteraemia and DIC occurring 17 years after splenectomy, and discuss the management and prophylaxis of infection in splenectomized subjects.

CASE REPORT

The patient was a 29-year-old man who had enjoyed good health and was an enthusiastic sportsman. Two days before the onset of his illness, he developed a mild upper respiratory tract infection which did not deter him from playing rugby. That evening he complained of 'not feeling well', and later that night developed rigors and fever. The next morning his condition had deteriorated further and he was described as having a 'blue and mottled' appearance. He was transferred from a peripheral hospital to a private nursing home in Johannesburg, where a chest radiograph and ECG were normal. The patient was sedated with diazepam 10 mg, given intravenously because of restlessness. He was then transferred to the Fever Hospital in Johannesburg, 20 hours after the onset of his illness.

On admission, the patient's condition was extremely grave. He had generalized purple mottling and his face was a greyish colour. A marked feature was restlessness and he complained of coldness of his limbs, especially his legs, which he was unable to move and which were cold to touch. His temperature was 38,8°C, his pulse was barely palpable, his blood pressure was 80/60 mmHg, and his tongue was dry. There was no neck rigidity and his chest was clear on auscultation. The heart sounds were faint but no gallop rhythm was present. A few purpuric spots were found in the right axilla and there was tenderness in the right hypochondrium where the liver edge was palpable and slightly tender. A laparotomy scar was present on the left side, and on questioning his parents we were informed that at the age of 12 his spleen had been removed because of trauma. With the history of splenectomy and the critical clinical presentation, a provisional diagnosis of overwhelming pneumococcal bacteraemia was made.

Laboratory Findings

A blood count on admission showed a total white cell count of 9,7 × 10⁹/l, comprising 73% neutrophils, 2%
monocytes, and 25% lymphocytes. The neutrophils showed a shift to the left, with toxic granulation. The platelet count was $12.0 \times 10^9/\text{l}$, and the haemoglobin was 15.9 g/dl. On examination of the peripheral blood smear, numerous Gram-positive, encapsulated, lancet-shaped diplococci were seen, both within the neutrophils and free-lying. Blood cultures yielded *Streptococcus pneumoniae* type 4.

Urea and electrolytes were essentially normal. Immunological and coagulation studies are shown in Table I.

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<th>TABLE I. RESULTS OF IMMUNOLOGICAL AND COAGULATION STUDIES</th>
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<td>FDP latex agglutination</td>
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FDP — fibrin degradation product; PI — prothrombin index; PTT — prothrombin time.

Clinical Course

Intravenous infusion was instituted immediately after physical examination with 2 mega-units of soluble penicillin G given every 2 hours, and he was digitalized with 0.25 mg digoxin intravenously. Treatment of shock included infusions of plasma and electrolyte solutions. Heparin therapy was commenced at the same time with an initial dose of 1 000 units followed by a continuous infusion of 2 500 units every 3 hours. Nasal oxygen was also administered.

Although the patient seemed to be more lucid at times, his condition remained virtually unchanged and critical. An infusion of fresh frozen plasma was started about 2 hours after admission, together with 20 mg furosemide.

He later vomited coffee-ground material and although nasogastric suction was instituted, the vomiting persisted, and was followed by respiratory difficulty and death 6 hours after admission. Lumbar puncture was precluded by the general condition of the patient.

Postmortem Findings

The essential features of the postmortem examination were as follows: the stomach was dilated and contained a moderate amount of coffee-ground material. Multiple small gastric erosions with surrounding hyperaemia were present. The Peyer's patches and lymphoid follicles were prominent in the ileum with some enlargement of the mesenteric lymph nodes. The respiratory and cardiovascular systems were normal. Two small haemorrhagic subcapsular nodules 1 cm and 0.7 cm in diameter were prominent on the surface of the liver (Fig. 1). Both kidneys appeared normal. The central nervous system showed no signs of inflammation. Right axillary, mesenteric and common iliac lymph nodes were slightly enlarged. The thymus weighed 20 g and there appeared to be a moderate increase in the amount of thymic tissue (Fig. 2). The tonsillar tissues were also noted to be hypertrophied, and both adrenal glands were normal.

![Fig. 1. Cross-section through the liver demonstrating one of the two splenunculi found on the liver surface.](image-url)
The kidneys were found to have numerous fibrin thrombi in the glomeruli.

**DISCUSSION**

The case described is an example of fulminant pneumococcal bacteraemia with complicating DIC in a splenectomized subject. Splenectomy was carried out 17 years earlier as a result of trauma. After splenectomy the patient was assured that no ill-effects would result; therefore he took no precautions when a minor upper respiratory tract infection occurred. In fact, at the onset of the infection, he indulged in a strenuous sporting event.

King and Schumacker were the first to draw attention to increased susceptibility to infection after splenectomy. Since then there have been numerous reports on the increased incidence of infection associated with splenectomy, especially in children under 3 years of age and within 3 years after splenectomy. Seventeen cases of overwhelming postsplenectomy infection (OPSI) have been documented in patients over the age of 4 years who had splenectomies for trauma. Several cases of OPSI have been reported occurring many years after splenectomy, and age or length of time after splenectomy does not appear to decrease the risk of OPSI. An important contribution to the problem of infection in splenectomized patients is the increased rate of hospital-acquired infections in the postoperative period, related to exposure to hospital microflora, medical devices or procedures such as respirators, tracheostomies, intravenous and urinary catheters. Community-onset infections which can occur years later are not as well understood, but may occur as complications of minor respiratory infections in the unprotected individual as exemplified in our case.

Because of the increased prevalence of severe infections in splenectomized patients, the wisdom of splenectomy is being challenged. It has been suggested that the policy and teaching of routine splenectomy for splenic laceration could well be reversed in favour of conserving the spleen where possible. The benefits of splenectomy in the management of Hodgkin's disease has still to be proved.

When splenectomy is unavoidable, certain measures may be adopted to minimize the risk of severe and often fatal infections. Splenectomy should be deferred for as long as possible especially for the first 3 years of life, during which time the greatest incidence of infections occurs. In cases of trauma, splenectomy should be considered only when conservative measures have failed or are not feasible. Further studies to evaluate the usefulness of splenectomy in Hodgkin's disease should be undertaken.

The principle that postsplenectomy patients should be placed on prophylactic antibiotics is accepted by several workers, although there have been no controlled studies to assess their effectiveness in these patients. Furthermore, consensus of opinion as to how long penicillin prophylaxis should continue has not been reached. In children the prophyllactic use of penicillin over a period of 2 - 3 years after splenectomy may be justified. Other workers advocate the use of prophylactic antibiotics up to and including adolescence. The use of prophylaxis in adults with asplenia presents the physician with a problem. Due to the low incidence of overwhelming infection and the occasional long time lag, the use of prophylaxis is queried. A worthwhile practice in asplenic adults who develop febrile illnesses would be early intensive therapy, e.g. with penicillin G or ampicillin, after blood cultures have been taken.

The advent of polyvalent pneumococcal vaccine and an *H. influenzae* vaccine may play a vital role in the prevention of overwhelming infection in splenectomized patients. Ammann et al. have found that pneumococcal polysaccharides are immunogenic in hypoplastic patients and may protect them against systemic pneumococcal infection. Immunization with this vaccine is discussed by several authors and its use seems justified. In malarial areas, splenectomized patients should receive adequate antimalarial prophylaxis.

Patients who are rendered asplenic through trauma or during abdominal surgery may benefit from subcutaneous implantation of autologous splenic tissues. Likhite in experiments with rats was able to reconstitute, by ectopic autotransplantation of splenic tissue, the depression of opsonin and leucophilic globulin activity, seen in these splenectomized rats. Whether similar results can be obtained in splenectomized patients remains to be seen.

The low levels of various complement components, namely: C1q, C4, C5, C6 and properdin are of interest. Coonrod and Rylko-Bauer showed low levels of alternate complement pathway proteins, properdin and C3 with factor B levels within the normal range in patients with pneumococcal pneumonia. They suggested that this may be due to a selective activation and consumption of the alternate pathway proteins in pneumococcal pneumonia. The patient observed in this report had normal factor B and C3 levels, but markedly depressed properdin levels. A possible explanation for this could be that complement levels were estimated at an early stage of the disease before the other factors could be consumed. Alternatively this patient could have had some impairment of serum proteins antedating the infection. In particular his C6 levels were within the heterozygous-deficient range, but...
unfortunately family studies could not be performed to verify this finding. Furthermore, Coonrod and Rykko-Bauer were unable to show any significant relation between C3 levels, and C4 and Clq levels. Whereas the C3 level in our patient was normal, the C4 and Clq levels were depressed.

The finding of splenunculi and hypertrophy of the primary (thymus) and secondary lymphoid tissues (tonsils, Peyer's patches) is of interest. The presence of splenunculi is not an uncommon observation in splenectomized patients, and is most likely due to seeding during surgery. They have been found in a variety of abdominal tissues such as the mesocolon, omentum and tail of pancreas. It would seem that in this case, the splenunculi were incapable of restoring the deficiency state created by the absence of the spleen. A possible reason for this is that the amount of 'splenic' tissue was inadequate in the face of the severe infection. Hypertrophy of the thymus and secondary lymphoid tissues has not previously been reported. The mechanism of this hypertrophy is not known, but could reflect some compensatory reaction. Alternatively this could represent the questionable entity of 'status thymolymphaticus' which is characteristically associated with sudden death. The management of OPSI constitutes a challenge to the physician. Prompt hospitalization is essential and blood culture for the recognition of the offending organism is most important. The finding of pneumococci in peripheral blood smears is not uncommon, and may reveal the nature of the invading organism long before blood culture does. Penicillin G or other appropriate antibiotics in adequate doses should be administered intravenously. As DIC is commonly found in this condition, a coagulation profile and follow-up are essential for the successful management of these patients. The replacement of coagulation factors and platelets is undisputed, but the use of prophylactic heparin remains controversial. The state of the coagulopathy may serve as a guide as to whether heparin should be used. Supportive therapy must be instituted early, and will depend on the requirements of the individual patient.

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REFERENCES