

Septic Shock

A SEVEN-YEAR SURVEY OF 105 SURGICAL PATIENTS

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SUMMARY

Septic shock continues to be a leading cause of surgical mortality. Between 1965 and 1971, 105 cases of septic shock were observed at a large teaching hospital in Glasgow. The diagnosis was made, in most cases, by the presence of refractory hypotension of doubtful origin and confirmed by positive blood cultures. Gram-negative organisms accounted for the majority of cases of bacteraemia.

Sepsis was further suspected when thrombocytopenia was associated with leucocytosis.

The metabolic acidosis present in cases of septic shock was due to lacticacidaemia.

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The septic shock syndrome has been described by many clinics, but it was Waisbren¹ who in 1951 first described bacteraemic shock in which profound hypotension was associated with Gram-negative enteric bacteria. Weil and Spink² reported on 278 cases of bacteraemia at the University of Minnesota hospitals. Borden and Hall³ and later Braude *et al.*⁴ postulated that the endotoxin from Gram-negative organisms was the cause of the severe toxæmia and shock.

In the survey, certain bacterial species, previously considered to have little pathogenicity for man, are shown to have severe and sometimes fatal implications for the host. However, the more important pathogens remain the Gram-negative bacilli of the *Proteus*, *Pseudomonas*, *Escherichia*, *Klebsiella-Aerobacter*, and *Bacteroides* genera.

POSITIVE BLOOD CULTURES

In patients with hypotension where the cause is obscure, blood cultures and other bacterial specimens must be taken every hour. Up to a maximum of 6 may be necessary before the diagnosis of bacteraemia is confirmed.

In this study, 105 patients were surveyed, of whom 94 yielded positive cultures. Table I illustrates the bacteria isolated from blood cultures of patients in septic shock.

Although other organisms are important, it can be seen that in the surgical patients studied, the most common organism to be isolated was *Escherichia coli*.

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TABLE I. BACTERIA ISOLATED FROM BLOOD CULTURES OF PATIENTS IN SEPTIC SHOCK

Organisms	No.
<i>Escherichia coli</i>	49
<i>Alcaligenes faecalis</i>	1
<i>Monilia</i>	1
<i>Pseudomonas</i>	1
<i>Bacteroides</i>	4
<i>Proteus</i>	6
<i>Klebsiella-Aerobacter</i>	14
<i>Staphylococcus aureus</i>	2
<i>Streptococcus faecalis</i>	7
<i>Coliform</i>	2
<i>Enterobacter</i>	2
<i>Pneumococcus</i>	2
<i>Staphylococcus albus</i>	3
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	94

MORTALITY

Over a 7-year period, 105 surgical cases were studied in the Surgical Unit of the Southern General Hospital, Glasgow. General surgical and urological patients received treatment in this combined unit. Table II shows those patients with a positive blood culture, and whether they were undergoing general surgical or urological procedures before the onset of bacteraemia. Urological operations are further divided into procedures on the upper and lower urinary tracts respectively. It can be seen that in this study, bacteraemic shock was more common after general surgical procedures, than after those done on the lower urinary tract.

TABLE II. SEPTIC SHOCK — CLASSIFICATION OF PATIENTS

Year	Surgery	Upper urinary tract	Lower urinary tract
1965	4	2	2
1966	0	0	2
1967	4	2	2
1968	9	2	4
1969	11	2	6
1970	18	3	8
1971	9	0	6

Mortality was, however, assessed on an over-all study of patients, irrespective of their classification. In 1965, 70% of patients treated died, and there was a death rate of 100% the following year. In 1967 a high mortality of 90% was noted, with a sharp decrease to 66% in 1968.

Over the next 3-year period the trend improved, with a death rate of 60% in 1970, and an acceptable 54% in 1971. Barnett and Sanford⁵ have shown that more than half of all patients with bacteraemia and hypotension die.

DIAGNOSIS AND TREATMENT

The diagnosis of septic shock was made by continuous clinical and laboratory observation. Patients with severe refractory hypotension of doubtful origin where blood loss and myocardial damage had been excluded, were treated as cases of septic shock. Positive blood culture, together with leucocytosis, thrombocytopenia and lactacidaemia in the peripheral blood, confirmed the diagnosis.

Treatment was directed towards rapid infusion of intravenous fluids under central venous pressure monitoring. The choice of fluid was tailored to the patient's requirements and included whole blood, dextrose/saline or plasma. Hydrocortisone was given intravenously in a dose of 7 mg/kg body weight every 4 hours.

Antibiotics were administered concurrently and during the first 2 years of this study, the Melbourne regimen comprising methicillin 1 g every 4 hours, chloramphenicol 750 mg every 6 hours, and kanamycin 1 g *stat* then 0.5 g every 8 hours, was adopted. This treatment was abandoned in favour of intravenous cephaloridine 1 g intravenously every 4 hours.

Satisfactory response to treatment was assumed when the central venous pressure rose to 8-12 cm water, with

a fall in temperature and white cell count, as well as a relative thrombocytosis.

Renal vasoconstriction with disturbed renal function was common in patients in bacteraemic shock. Oliguria and anuria were associated with elevated blood urea and high serum potassium levels. Serum sodium and chloride levels were normal and low. A return to normal renal function offered a satisfactory index of adequate treatment.

PROBLEMS WITH BLOOD COAGULATION

Blood coagulation mechanisms are frequently upset in septic shock. Hardaway⁶ showed a diphasic response in shock: firstly, there is hypercoagulability followed by a phase of hypocoagulability and fibrinolysis.

Intravascular clotting has been demonstrated in the microcirculation in shock.^{7,8} In several patients in the present review, where hypotension was associated with severe infection, thrombocytopenia was observed with platelet counts under 100 000/mm³.

At the time of study all patients showed marked polymorphonuclear leucocytosis. There was a striking divergence of platelet and leucocyte counts.

Thrombocytopenia associated with leucocytosis in a patient with refractory hypotension usually indicates Gram-negative sepsis.

REFERENCES

1. Waisbren, B. A. (1951): *Arch. Intern. Med.*, **88**, 467.
2. Weil, M. N. and Spink, W. W. (1958): *Ibid.*, **101**, 184.
3. Borden, C. W. and Hall, W. M. (1951): *New Engl. J. Med.*, **245**, 760.
4. Braude, A. I., Siemienski, J., Williams, D. and Sanford, J. P. (1953): *Univ. Mich. Med. Bull.*, **19**, 23.
5. Barnett, J. A. and Sanford, J. P. (1969): *J. Amer. Med. Assoc.*, **209**, 1514.
6. Hardaway, R. M. (1962): *Ann. Surg.*, **155**, 325.
7. McKay, D. G. and Shapiro, S. S. (1958): *J. Exp. Med.*, **107**, 353.
8. Spink, W. W. and Vink, J. A. (1961): *Proc. Soc. Exp. Biol. (N.Y.)*, **106**, 242.