Septicaemia in the elderly

J. W. MADDEN
M.B. B.S.

J. R. CROKER
M.R.C.P.

G. P. J. BEYNON
M.R.C.P.

Department of Geriatric Medicine, The Middlesex Hospital, Mortimer Street, London W1N 8AA

Summary

A retrospective study was made of 44 elderly patients with bacteraemia treated in the period 1974-1980. Positive blood cultures in 5 cases were considered clinically insignificant. Twenty-six of the remaining 39 patients were found to have a Gram-negative bacteraemia, mainly associated with urinary tract infection. Abnormalities of liver function were common but 5 jaundiced patients with Gram-negative infection were shown to have stones in the common bile duct. The value of blood cultures as a diagnostic aid in the non-specifically ill elderly patient is emphasized.

Introduction

Wedgwood (1955) emphasized the difficulty of diagnosing infective endocarditis in the elderly. Elderly bacteraemic patients often present with ill-defined symptoms and frequently have normal or subnormal temperatures.

Over the 6 months from September 1979 until February 1980, 91 pairs of blood cultures were taken (182 bottles). Twenty-five bottles grew an organism, and a positive culture was felt to be clinically significant in 22 cases (12%). The preponderance of Gram-negative organisms in these cultures prompted the authors to review the records of their patients with bacteraemia during the years 1974 until 1980. The distinction between bacteraemia and septicaemia is difficult and perhaps artificial in elderly patients. All the patients were symptomatic and they have been termed septicaemic.

Patients and methods

The Middlesex Hospital provides a geriatric admission service for acute problems in the elderly. Most patients over the age of 75 years with either acute medical, or mixed social and medical, problems are admitted under the geriatric firm. There are approximately 500 admissions yearly. Blood cultures were taken where clinically appropriate but

particular indications included pyrexia, pneumonia, suspected urinary tract infection, sudden confusion or collapse, and suspected infective endocarditis. Each blood sample (approximately 10 ml) was divided into 2 parts. One part was cultured aerobically in tryptone soya broth with 0.25% dextrose and the other anaerobically in thioglycollate/0.1% agar. Cultures were inspected daily. If they appeared cloudy a Gram stain was performed on a smear of the fluid and they were immediately sub-cultured. All samples were routinely sub-cultured after 7 days incubation on to blood agar and MacConkey medium and incubated for a further 7 days. The significance of any organism grown was determined clinically as far as possible. Biochemical and haematological investigations were carried out in the majority of patients within 24 hr of admission. Shock was defined as a state of peripheral circulatory collapse associated with a systolic BP below 90 mmHg.

Results

Positive blood cultures were obtained from 41 patients but 5 patients were excluded because of the transient nature of their illness. The organisms isolated from the remaining 39 patients are shown in Table 1. The average age of the patients was 82 years. There were 21 females and 18 males. Twenty-six patients had a Gram-negative infection. In 26 patients a single organism was found whilst blood cultures grew more than one species of bacteria in 3 patients.

Gram-positive infection

Most of these cases were associated with an easily recognizable clinical condition (Table 2). Symptoms were generally non-specific. Ten patients had an altered level of consciousness. Rigors were not known to have occurred in any patient. Although

TABLE 1. Organisms isolated from 39 patients with septicaemia

Gram-positive species	No. of cases	Gram-negative species	No. of cases
<i>Streptococcus pneumoniae</i>	7	<i>Escherichia coli</i>	17
		<i>Proteus</i> sp.	5
Streptococci— <i>viridans</i>	3	<i>Bacteroides fragilis</i>	1
β -haemolytic streptococci	1	<i>Pseudomonas aeruginosa</i>	1
Anaerobic streptococci	1	<i>Proteus</i> sp. and <i>E. coli</i>	1
<i>Clostridium perfringens</i> and micrococci	1	<i>Klebsiella</i> sp. and <i>E. coli</i>	1
Total	13	Total	26

TABLE 2. Diagnosis and culture in Gram-positive infection (13)

Organism	Underlying cause		Clinical features	
<i>Streptococcus pneumoniae</i>	Pneumonia	6	Signs of pneumonia	7
	Pneumonia + meningitis	1	Radiological changes	5
			Sputum available	4
Streptococci— <i>viridans</i>	Endocarditis	3	Embolic evidence	2
β -haemolytic streptococci	Cellulitis of the leg	1		
<i>Clostridium perfringens</i> and micrococci	Sacral bed sore	1		
Anaerobic streptococci	Urinary tract infection	1	Recent urinary retention and catheterization	

only one patient was apyrexial, the body temperature was below 38°C in 6 cases. Three patients were shocked, 2 of whom recovered.

In 3 cases both the total white cell and neutrophil cell counts were normal. Mild abnormalities of liver function were recorded in 4 patients. In 2 patients the blood urea was initially raised above 20 mmol/l but corrected with rehydration and both patients recovered. Two patients died from pneumonia despite appropriate antibiotic treatment (Table 6).

Gram-negative infection

Twenty-six patients had a Gram-negative infection (Table 1). Rigors and abdominal pain were more common in jaundiced than in non-jaundiced patients (Table 3). Eight patients were noted to have indwelling catheters.

Two patients were apyrexial and one other was frankly hypothermic (28°C). Six were clinically shocked and 2 of these subsequently died. In 4 patients the white cell count was normal. A raised

TABLE 3. Symptoms in Gram-negative septicaemia

Symptoms	Raised serum bilirubin (7 cases)	Other patients (19 cases)	Total
Nausea and vomiting	2	8	10
Confusion	2	6	8
Rigors	4	3	7
Abdominal pain	4	3	7
Dysuria	1	5	6
Drowsiness	0	4	4
Diarrhoea	2	2	4

TABLE 4. Results in 7 patients with Gram-negative infection and raised from serum bilirubin levels

Blood culture	Diagnosis	Method of diagnosis
<i>Klebsiella</i> sp. } <i>Escherichia coli</i> }	CBD stone	IVC and laparotomy
<i>E. coli</i>	CBD stone	IVC and laparotomy
<i>E. coli</i>	CBD stone	ERCP and laparotomy
<i>E. coli</i>	CBD stone	ERCP
<i>E. coli</i>	CBD stone	ERCP (died)
<i>E. coli</i>	?CBD stone	Clinical
<i>E. coli</i>	Urinary tract infection	MSU

IVC=intravenous cholangiography; ERCP=endoscopic retrograde cholangio-pancreatography; MSU=mid-stream urine specimen; CBD=common bile duct.

blood urea generally reflected dehydration and was > 20 mmol/l in 5 cases, 2 of whom died.

Abnormalities of liver function were present in 14 patients. Seven patients had a serum bilirubin above 15 mmol/l. Common bile duct stones were demonstrated in 5 of these 7 patients (Table 4). In 4 the stones were successfully removed; in 3, by formal surgery and in one case by endoscopic sphincterotomy. Endoscopic sphincterotomy failed to extract an enormous common bile duct stone (diameter

3 cm) in one patient who was unfit for surgery and who subsequently died. One patient fulfilled the criteria of Charcot's triad and was diagnosed clinically as having cholangitis. This patient recovered and further investigation was not performed. In the remaining patient liver function returned to normal after urinary tract infection was treated. Of the 19 patients with normal serum bilirubin levels, 8 had moderate elevations of either serum alkaline phosphatase or serum transaminase concentrations.

TABLE 5. Results of blood and urine cultures (mid-stream urine and catheter specimen urine) in 19 patients with Gram-negative infection and normal serum bilirubin levels

Blood culture	Urine	Numbers
<i>Escherichia coli</i>	<i>E. coli</i> (CSU)	2
<i>E. coli</i>	Mixed growth (CSU)	1
<i>Proteus</i> sp.	<i>Proteus</i> (CSU)	2
<i>Proteus</i> sp.	Mixed growth (CSU)	2
<i>Pseudomonas</i> sp.	Mixed growth (CSU)	1
<i>E. coli</i>	Coliforms (MSU)	5
<i>E. coli</i>	Mixed growth (MSU)	1
<i>E. coli</i>	No growth 100 WBC (MSU)	1
<i>E. coli/Proteus</i> sp.	Coliform (MSU)	1
<i>Proteus</i> sp.	Mixed growth (MSU)	1
<i>Bacteroides</i> sp.	Mixed growth (MSU)	1
<i>E. coli</i>	No record	1
	Total	19

CSU=catheter specimen of urine; MSU=mid-stream urine specimen.

TABLE 6. Details of patients who died

Type	Source	Comments
Gram-positive	Pneumonia	Shock, hypothermia, malnourished
Gram-positive	Pneumonia	Recent resection of Dukes 'C' carcinoma of rectum
Gram-negative	CBD stone	Impacted stone
Gram-negative	Urinary tract	Uraemia. Catheterized 6 days
Gram-negative	Bowel	Shock. Perforated bowel
Gram-negative	Urinary tract	Uraemia, hypotension, hypothermia, diabetic ketoacidosis

CBD = common bile duct.

The source of infection in patients without elevation of serum bilirubin levels was more difficult to establish. Urine was obtained for culture before antibiotic therapy was commenced in 18 of the 19 patients (Table 5). Two patients were catheterized during the 24 hr preceding symptoms. A pure growth of organism was obtained in 10 cases (4 of 8 with indwelling catheters). It is the practice of the Bacteriology Department not to sub-group coliform organisms in urine specimens. Comparison of the antibiotic sensitivities of blood and urine cultures in these cases, however, supported a diagnosis of urinary tract infection. A mixed growth of organisms was found in the remaining 8 patients (4 with indwelling catheters), 2 of whom had significant urinary symptoms. There was therefore reasonable evidence to support a diagnosis of underlying urinary tract infection in 12 patients.

Four patients with Gram-negative infection died with septicaemia (Table 6).

Antibiotic therapy

Except for patients with suspected endocarditis, all patients were treated while blood culture results were awaited. The choice of antibiotic was governed by the clinical presentation. Where Gram-negative infection was suspected, as in cholangitis or urinary tract infection, ampicillin was the commonest antibiotic used, frequently in combination with gentamicin or metronidazole. Gentamicin dosage was controlled by serum levels. Corticosteroids were used in one shocked patient, who recovered.

Discussion

The incidence of bacteraemia is rising in hospital practice (Altemeier, Todd and Inge, 1967) and is owing in part to the increasing contribution from the geriatric population. More blood cultures are now performed because of increased awareness, and this partly accounts for increasing diagnosis (Crowley, 1970). Gram-negative bacteraemia is now

more common and *Escherichia coli* is the predominant offending organism (Geddes, 1978). In this series, two-thirds of cases were due to Gram-negative organisms.

Disease in the elderly commonly presents non-specifically, and bacteraemia is no exception to this rule. Altogether 22 of the 39 patients presented with confusion or drowsiness. Although the clinical presentation may not distinguish between Gram-positive and Gram-negative infection (Winslow *et al.*, 1973), in this series rigors and jaundice were more common in Gram-negative infection and the source of infection was more obvious in patients with Gram-positive bacteraemia (Table 2).

Abnormalities of liver function were common and present in 18 cases (4 Gram-positive, 14 Gram-negative), although a raised serum alkaline phosphatase was not always proved to be of hepatic origin. Elevation of serum transaminase concentration is thought to be the rule in septicaemia (Geddes, 1978) but was found in only 7 cases. The serum bilirubin concentration was raised in 9 patients, 7 of whom had Gram-negative infections. Common bile duct stones were subsequently demonstrated in 5 of these 7 cases and suspected in one other. Although a selective defect in excretion of conjugated bilirubin has been described in severe infection (Miller *et al.*, 1976) it is believed that the presence of jaundice with Gram-negative septicaemia necessitates exclusion of biliary stones even when clinical features of cholangitis are lacking. Gall stones occur in about 30% of the over-70 age group (Bateson and Bouchier, 1975), and although frequently 'silent' in the elderly (Sato and Matsushiro, 1974) they may present suddenly with septicaemic shock (Faber *et al.*, 1978). Grey scale ultrasonography readily demonstrates intrahepatic duct dilatation and accurately detects calculi in the gall bladder. Stones in the bile duct, however, are more difficult to see and may cause jaundice without biliary dilatation (Vallon, Lees and Cotton, 1979). Endoscopic cholangiography is accurate, and

non-operative removal of bile duct stones by duodenoscopic sphincterotomy is a major advance in elderly and high risk patients (Cotton, 1980).

Significant underlying disease may be present in 95% of cases of Gram-negative bacteraemia (McHenry, Martin and Wellman, 1962) and multiple pathology was common amongst most of the present patients. Increasing surgery and instrumentation contribute to infection. The urinary tract may be the source of Gram-negative bacteraemia in over 50% of patients (Altemeier *et al.*, 1967). In this series, the urinary tract was the proved source of infection in 11 cases (10 with Gram-negative infection) and the suspected source in 6 others. Eight of the patients with Gram-negative bacteraemia had indwelling catheters at presentation. In 2 cases, catheters had been inserted in the 24 hr before illness and in a third patient 6 days earlier.

Blood cultures both confirm a diagnosis of bacteraemia and provide a rational basis for antibiotic therapy. In many cases the results of blood culture led to changes in antibiotic treatment, but this influence was difficult to assess retrospectively. In 3 patients a positive blood culture confirmed a diagnosis of suspected endocarditis. Blood cultures are of value in the management of pneumonia since sputum, even when available, may not accurately reflect the pathogenic organism growing in the lung (Barrett-Connor, 1971). Many elderly patients present non-specifically and a high index of clinical suspicion is required to make a diagnosis of bacteraemia. In particular, a history of recent catheterization made the authors suspect bacteraemia, and the presence of jaundice with a positive blood culture made them suspect cholangitis.

Although blood cultures are of value in confirming a diagnosis of bacteraemia, suspected cases require early active treatment. Intravenous antibiotics should be given whilst blood culture results are awaited; the choice of antibiotic being governed by the clinical situation. Mortality in septicaemia may rise to 50% (Altemeier *et al.*, 1967) and may reach 90% in the presence of shock (Winslow *et al.*, 1973). There were 6 deaths in the patients in this study (mortality 15%) but mortality rose to 33% in those patients who were shocked (23%). Catecholamines (Tinker, 1979) have been used in treating septicaemia complicated by shock, but the value of steroids is

based on uncontrolled haemodynamic studies (Schumer, 1976). The outcome of septicaemia in this series was related to the general health of the patient and to the presence of underlying disease. All 15 patients who died had serious illness (Table 6). Two patients who were found to be hypothermic on admission both died.

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