Gentamicin extraction from an anuric patient by combined haemodialysis and charcoal haemoperfusion

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Summary

A 39-year-old woman who developed acute renal failure following intra-abdominal sepsis was treated with gentamicin. Her serum concentrations reached potentially toxic levels. Combined haemoperfusion and haemodialysis removed approximately 70% of the given drug and the patient made a complete recovery.

Introduction

Gentamicin has been noted by Avery (1976) to have a narrow therapeutic range and that toxicity is particularly associated with renal dysfunction. It can be removed by haemodialysis. Christopher *et al.* (1974) reported a clearance of 24 ml/min equivalent to a half-life of 10.1 hr and Lockwood (1973) a clearance of 42 ml/min equivalent to 6.1 hr. These differences may be due partly to variations in technique and blood flow rate.

The present authors report a more rapid reduction in plasma concentration by combined haemoperfusion through acrylic resin-coated charcoal and haemodialysis in an anuric patient who had received excessive quantities of the drug.

Case Report

A 39-year-old woman was admitted with a 24-hr history of abdominal pain, fever and rigors. Laparotomy was performed and a grossly infected pyosalpinx was removed. Initially her postoperative course was normal. However, 18 hr later she collapsed and became hypotensive. *Streptococcus pyogenes* was isolated 48 hr later from blood cultures taken at the time of collapse. In the interim she was started on gentamicin as a Gram-negative septicaemia was feared. After receiving a total of 540 mg she became anuric and was given frusemide; 24 hr later the gentamicin level was 15.6 mg/l, falling to 15.3 mg/ml 12 hr later. Gentamicin was measured by the acetyltransferase method reported by Broughall and Reeves (1975). A Scribner shunt was then inserted and combined haemoperfusion and

haemodialysis using a charcoal column and an RSP haemodialyser was performed for a 6-hr period. Blood was passed from the radial artery to the column, on the coil, and back to the patient. Blood flow was measured by bubble transit times. Serial blood concentrations were obtained. Gentamicin concentration differences across the column and coil are shown in Fig. 1. The amount of drug

FIG. 1. Serial gentamicin concentration in a patient undergoing combined haemodialysis and haemoperfusion.

removed was calculated (Table 1). In all, 402.7 mg were removed: 206.6 mg were taken up by the column, of which 76% came out during the first 3 hr, and 196.1 mg were removed by dialysis (Fig. 2).

At the end of dialysis and haemoperfusion the gentamicin concentration had fallen from 15.1 mg/l to 5.1 mg/l. This was equivalent to a gentamicin half-life of 3.4 hr. It later rose to a peak of 5.9 mg/100 ml after equilibration. Platelets fell from 210×10^9 to 132×10^9 /l. Seven days later the patient entered the diuretic phase and then recovered completely.

TABLE 1. Serial gentamicin levels during combined haemoperfusion and haemodialysis

Time after start of perfusion (hr)	Patient gentamicin (mg/l)	Post-column pre-coil gentamicin (mg/l)	Post-column and coil gentamicin (mg/l)	Amount gentamicin removed by column (mg)	Amount gentamicin removed by coil (mg)
0.5	15.1	6.5	3.1	92.9	36.7
1.5	10.5	5.9	3.3	49.7	28.1
2.5	8.9	7.1	3.4	18.0	37.0
3.5	8.5	6.7	3.9	18.0	28.0
4.5	9.1	7.2	3.5	17.0	40.3
5.5	7.2	6.0	3.1	11.0	26.0
Total gentamicin removed				206.6	196.1

Clinical and caloric testing of vestibular function did not reveal any evidence of damage.

Discussion

Gentamicin is a dangerous drug which may cause vestibular damage and, especially when associated with frusemide, can produce proximal tubular damage. It is hoped that it will be replaced by new penicillins or cephalosporins with similar antibacterial activity but less toxicity. At present, however, gentamicin is the drug of choice in some Gram-negative bacterial septicaemias. Acute renal

failure is a complication of septicaemia and, as gentamicin is excreted solely via the kidneys, cumulation is liable to occur. The above results show that gentamicin can be removed approximately twice as rapidly by combined haemoperfusion and haemodialysis as by haemodialysis alone. Similar extraction could have been attained by haemodialysis alone only if the procedure had continued for at least 12 hr. If the column had been changed at 3 hr an even better extraction rate would have been obtained. Gentamicin half-life in an anuric patient is 48 hr or more, so it is likely that this patient would have sustained vestibular damage if active measures had not been taken to reduce blood concentrations. Whether the more rapid extraction attained by the combined procedure is necessary to protect against ototoxicity remains unproved. However, addition of the column to the dialysis circuit is simple and does not add to the technical complexities of the procedure.

References

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FIG. 2. Total gentamicin extraction during haemoperfusion and haemodialysis. ■ Column extraction (mg), □ coil extraction (mg).