patient (case 8) there was a significant fall of plasma potassium during the anaesthesia, but he was on oral potassium-absorbing resin.

The observations in the present work suggest that plasma potassium increases during anaesthesia in the presence of metabolic acidosis due to renal failure may be explicable on a rise in $Paco_2$ and a consequent fall in blood pH. Our results do not support the suggestion that suxamethonium is an important factor, and previous publications ascribing such a hyperkalaemia to the effect of suxamethonium have failed to present any evidence on gas exchange.

In the presence of metabolic acidosis of renal failure safe anaesthesia must take into account the compensatory overventilation which is present in these patients. The characteristic findings on gas analysis are lowered $PAco_2$ and a high or higher level than normal Pao_2. The high oxygen partial pressure can be explained on the basis of a raised PAo_2 (alveolar oxygen tension) as a consequence of the lowered $PAco_2$ (alveolar CO_2 tension) because of the compensatory overventilation. Ideally, blood gases should be measured shortly before a patient with renal metabolic acidosis has to undergo anaesthesia, so that the ventilation during anaesthesia will maintain the $Paco_2$ unchanged during anaesthesia. Frequently blood gas analysis is not practicable, but fortunately in the metabolic acidosis of renal failure there is a close correlation in the absence of pulmonary morbidity between the arterial carbon dioxide tension and the plasma bicarbonate as measured in the laboratory.

It must be emphasized that halothane anaesthesia with spontaneous breathing can also lead to hypoventilation in the context of a metabolic acidosis.

Results

Arterial blood gases were measured at the beginning and end of 12 peritoneal dialysis cycles; in seven before and after running in the dialysate and in five with the dialysate run in and after emptying. In Table IV the direction of change and absolute values are given, as well as the volume of the dialysis cycle. The values for Pao_2 and $Paco_2$ and for the calculated PAo_2 are also given. It is clear that Pao_2 is reduced when the abdominal cavity is filled with dialysate. In most but not all cases the $Paco_2$ moves in the opposite direction to the Pao_2. The calculated alveolar Po_2 (PAo_2), however,

II. Pulmonary Gas Exchange during Peritoneal Dialysis

Summary

Blood gas analysis studies have been made in patients undergoing peritoneal dialysis. It has been shown that oxygen tensions are reduced when fluid has been run into the peritoneal cavity and that this fall in Pao_2 is reversed after running out the dialysate. The change in Pao_2 is greater with 2-litre than with 1-litre cycles.

Introduction

Infective pulmonary complications of peritoneal dialysis were well described by Berlyne *et al.* (1966). He concluded that it was preferable to carry out peritoneal dialysis with 1-litre rather than 2-litre cycles to lessen the pulmonary complications. More recently Finn and Jowett (1970) described a case of acute hydrothorax complicating peritoneal dialysis.

The present observations have been made during different phases of peritoneal dialysis in patients who had no clinical evidence of pulmonary disease, in order to assess the effect on ventilation of introducing or removing fluid from the peritoneum.

Methods

Blood gas changes across 12 phases of peritoneal dialysis were studied in seven patients whose clinical details are given in Table III. Arterial blood samples were collected into heparinized syringes and Pao_2, $Paco_2$, and pH were measured as soon as they reached the laboratory. Radiometer equipment was used and all blood estimations were carried out by one of us (M.J.G.). Details of the method are given in Part I.

Samples of blood were taken fairly near the start of dialysis, once it was established that the dialysis was proceeding satisfactorily. The sample was taken when the fluid had been run in or run out. In order that the *change* in blood gases could be measured, if the first sample was taken during the full phase another was taken as soon as that fluid had been run out or vice versa.

TABLE III—*Clinical Details of Patients who had Blood Gas Studies during Peritoneal Dialysis. Creatinine Clearance was less than 5 ml/min in All Cases*

Patient's No.	Exchanges Listed in Table II	Diagnosis
1	1	Polycystic renal disease
2	3	Cystinuria. End-stage renal failure
3	7	Congenital abnormalities with end-stage renal failure.
4	6	Glomerulonephritis
5	2	Obstructed single kidney
6	5	End-stage renal disease
7	8, 9, 11, 12, 13, 14	Glomerulonephritis

The patients were all male, undergoing peritoneal dialysis during the assessment period of their end-stage renal disease. All the patients had endogenous creatinine clearance of less than 5 ml/min.

Values for the alveolar oxygen tensions were calculated according to the method suggested by Benzinger (1937). PAo_2 (partial pressure of alveolar O_2) = PIo_2 (partial pressure of inspired O_2) − $Paco_2$ (partial pressure of arterial CO_2). To make this less approximate, allowing for the difference in the volumes of inspired and expired gases, $PAo_2 = PIo_2 - Paco_2/RQ$, where RQ (respiratory quotent) = 0·8.

TABLE IV—*Direction and Absolute Values of Changes in* $Pao)$, $Paco_2)$, *and* $PAo_2)$ *in Relation to the Volume of Cycle during Peritoneal Dialysis, in Patients whose Details are given in Table* I

Exchanges	Direction of Change			Changes in mm Hg			Cycle Change in Litres
	Pao_2	$Paco_2$	PAo_2	Pao_2	$Paco_2$	PAo_2	
1	−	−	+	136→132	15 →14·5	142 →142·5	+1
3	−	+	−	82→ 77	34·5→36·5	115 →113·5	+1
7	−	−	+	111→ 98	32 →29	120·5→122·5	+1
9	−	+	−	137→132	33·5→37·5	115·5→110·5	+1
14	−	+	−	121→118	22 →22·5	132·5→132	+1
12	−	+	−	122→113	24·5→25·5	129·5→128	+2
6	−	+	−	112→ 86	28 →31	124 →120	+2
2	+	−	+	85→101	36 →33	114 →117·5	−2
8	+	−	+	105→119	36·5→35	112 →113·5	−2
11	+	+	−	112→122	24 →24·5	130 →129·5	−2
13	+	−	+	113→121	25·5→22	128 →132·5	−2
5	+	−	+	73→78·5	41 →38	108 →112·5	−1