Peritoneal dialysis in infants

M D C DONALDSON, P SPURGEON, G B HAYCOCK, C CHANTLER

Abstract

A commercially available closed dialysis system and a new peritoneal cannula with potential advantages for infants have been developed. The dialysis set includes three dialysate bags that may be connected to the filling burette; the warming coil of the set is placed in a thermostatically controlled water bath. The peritoneal catheter comprises a flexible tube with side holes and a sharp short bevelled needle with obturator.

Advantages of the new equipment over previously available equipment are that the cannula is easier to insert; there is less risk of contaminating the dialysate since the tubing set is unbroken from supply to cannula; the mix of the dialysate may be changed easily without interrupting dialysis; and the equipment may be assembled easily by unskilled staff.

Introduction

Acute renal failure, though rare in children, is fairly common in infancy,[1 2] particularly during the neonatal period, when the immature kidney is vulnerable to such hazards as prematurity, hypoxia, and sepsis.[2 3] Normally such infants are transferred to a centre familiar with peritoneal dialysis in this age group, but sometimes the severity of the underlying condition associated with the renal failure (for example, extreme prematurity, severe respiratory disease, or cardiac surgery) makes this impracticable. A simple and efficient infant dialysis system, which can be easily assembled by staff without extensive experience of the procedure, is therefore required. We report the development of a commercially available closed delivery system and a new peritoneal cannula with potential advantages for infants.

Equipment

Figure 1 shows the dialysis set (Avon Medicals Ltd, Redditch) and dialysis solutions (Dialaflex solutions; Boots Hospital Products, Nottingham). Up to three dialysate bags can be connected to the filling burette, but usually only two are required—for example, Dialaflex 61 solution (lactate) containing 6·36% Dextrose and 142 mmol(mEq) sodium/l, and Dialaflex 62 solution containing 1·36% dextrose and 140 mmol sodium/l. The warming coil is placed in a thermostatically controlled water bath (Grant BWI water bath (approved by the Department of Health and Social Security); Grant Instruments, Barrington, Cambridge) containing tap water, which with the delivery system is charged every 24 hours.

Figure 2 shows the peritoneal cannula (cannula No 14147; H G Wallis, Colchester), which consists of a flexible Teflon tube with side holes and a sharp short bevelled 14 gauge needle with obturator.

Department of Paediatrics, Guy's Hospital, London SE1 9RT
M D C DONALDSON, MB, MRCP, senior registrar
P SPURGEON, SRN, RSCN, ward sister
G B HAYCOCK, MB, FRCP, consultant paediatric nephrologist
C CHANTLER, MD, FRCP, professor of paediatric nephrology

Correspondence to: Professor C Chantler.

Procedure

The bladder is emptied and the site of insertion chosen, taking care to avoid enlarged organs such as the spleen and liver. Normally the cannula is inserted in the flank at a point level with the umbilicus and lateral to the inferior epigastric artery. Under full aseptic conditions the abdominal skin is cleansed and towelled and the insertion site infiltrated with local anaesthetic. Warmed dialysate (20-30 ml/kg) is instilled into the peritoneum via a 19 gauge needle to facilitate subsequent insertion of the cannula. A small skin incision is made and the

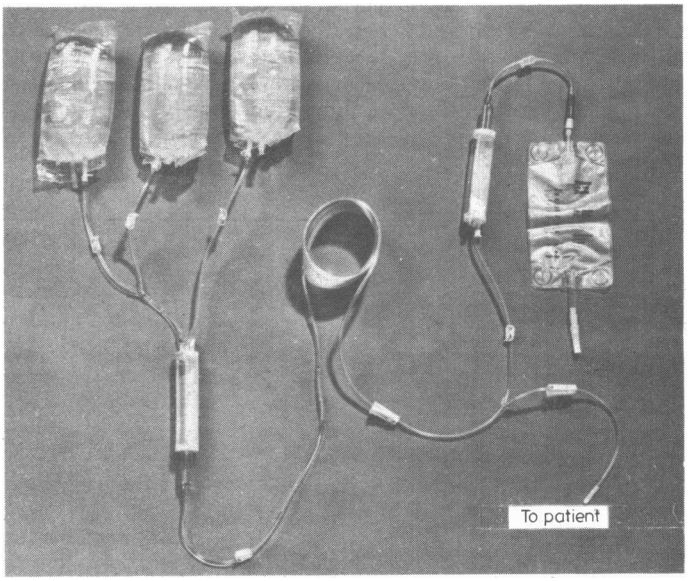

FIG 1—Peritoneal dialysis circuit consisting of dialysis solutions, filling burette, warming coil, draining burette, and bag.

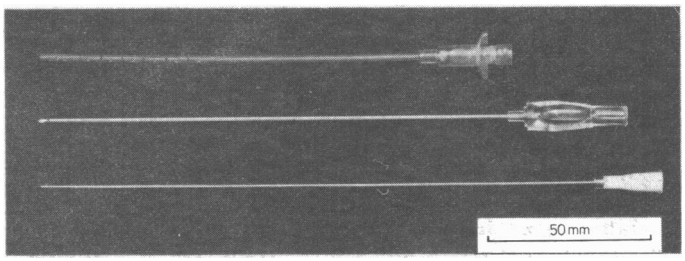

FIG 2—Wallace paediatric peritoneal dialysis cannula.

cannula inserted perpendicular to the skin using steady, controlled pressure. It is important to avoid an uncontrolled lunge into the peritoneum since this may cause damage to the viscera, especially the inferior vena cava—a potentially fatal complication. Once the peritoneum has been entered the obturator is withdrawn a few millimetres and the cannula advanced until all the side holes are within the peritoneal cavity. The system is then connected, and once free flow of dialysate in and out of the peritoneum has been observed the cannula is stitched into place.

Cycle volumes of 20-30 ml/kg are usually appropriate for infants; if blood is visible initially in the dialysate frequent exchanges should be carried out until the fluid is no longer bloodstained. If the baby is oedematous a 50/50 mixture of 1·36% and 6·36% dextrose may be made up in the burette, changing to 1·36% dextrose when sufficient

fluid has been removed. Unless there is a contraindication heparin (500 units/l) is added to the dialysate, while antibiotics and additional electrolytes including potassium may also be added as required.

Since the introduction of the cannula we have used it to dialyse on average one or two infants a month. No mortality or morbidity has been associated with use of this equipment, and effective dialysis was achieved in every case.

Discussion

The principles of peritoneal dialysis in children are the same as those in adults and have been described previously.[1] A particular problem, however, is posed by infants who require delivery of small and accurately measured volumes of warmed dialysate via a suitably sized cannula to the peritoneum, and accurate measurement of the effluent. Automated equipment is available for older children, but its use in the newborn especially is limited because small enough volumes of dialysate cannot always be delivered and the dialysate content cannot be altered readily. Moreover, automated equipment can be used only by staff who have been specially trained, thus restricting its use to dialysis centres. In the past non-automated open dialysis systems have had to be made up using intravenous giving sets, thus increasing the risk of contamination. Finally, the suitability of the peritoneal cannula has proved a problem in infants, in whom large cannulas with a trocar (as opposed to a sharp short bevelled needle) are particularly apt to cause damage to abdominal viscera.

The new cannula and dialysis set has the following advantages compared with previously available equipment: insertion of the cannula is easier, quicker, and less traumatic; there is less risk of contaminating the dialysate since the tubing set is unbroken from dialysate supply to cannula; the dialysate mix being used may be altered easily and conveniently without interrupting dialysis; and the equipment is much easier for relatively unskilled staff to assemble.

References

1 Chantler C. Renal failure in childhood. In: Black D, Jones NF, eds. *Renal disease.* 4th ed. Oxford: Oxford Press, 1979:825-68.

2 Haycock GB. Acute renal failure in infancy and childhood. In: Andreucci VE, ed. *Acute renal failure.* The Hague: Martinus Nijhoff Medical Division (in press).

3 Chantler C. The kidney. In: Godrey DS, Baum JD, eds. *Clinical paediatric physiology.* Oxford: Blackwell Scientific, 1979:391-8.

4 Scharer K, Chantler C, Donckerwolcke RA. Peritoneal dialysis. In: Drukker W, Parsons F, Maher JF, eds. *Replacement of renal function by dialysis.* The Hague: Martinus Nijhoff Medical Division, 1978:444-61.

(*Accepted 5 January 1983*)

Acute respiratory distress in diabetic ketoacidosis: possible contribution of low colloid osmotic pressure

R C F LEONARD, C ASPLIN, C V McCORMICK, T D R HOCKADAY

Abstract

The "shock lung" syndrome may occur in diabetic ketoacidosis in association with disseminated intravascular coagulation; occasionally it occurs alone after treatment of the ketoacidosis. Two patients developed pulmonary opacities with clinical features of acute respiratory distress such as are seen in the shock lung syndrome; in both, however, the findings suggested a different mechanism from that occurring in the syndrome. Hypoalbuminaemia was prominent, and it is postulated that a low plasma osmotic pressure caused by high volume crystalloid infusions may have precipitated the acute respiratory complications.

Plasma osmotic pressure may be an important variable in patients given large volumes of crystalloid infusions; further studies are required to elucidate mechanisms of pulmonary oedema in such patients.

Introduction

The "shock lung" syndrome, a discrete clinicopathological entity, has been described in diabetic ketoacidosis in association with disseminated intravascular coagulation.[1] Disseminated intravascular coagulation, sometimes with cerebral intravascular coagulation, is a well recognised feature of ketoacidosis.[2 3] Occasional reports, however, have indicated that pulmonary oedema may develop without disseminated intravascular coagulation after the treatment of diabetic ketoacidosis.[4-6]

We report on two patients with diabetic ketoacidosis who developed radiological pulmonary opacities with clinical features of acute respiratory distress such as are seen in the shock lung syndrome but in whom the findings suggested a different mechanism from that occurring in the syndrome.

John Radcliffe Hospital, Oxford

R C F LEONARD, MD, MRCP, senior registrar
C ASPLIN, MD, MRCP, senior registrar
C V McCORMICK, MRCP, registrar
T D R HOCKADAY, MD, FRCP, consultant

Correspondence to: Dr R C F Leonard, Department of Clinical Oncology, Western General Hospital, Edinburgh EH4 2XU

Case reports

CASE 1

A 34 year old electronics engineer presented with severe diabetic ketoacidosis. He had a three month history of weight loss, polyuria, and polydipsia and increasing confusion. He was appreciably dehydrated, but there was no evidence of infection, the lungs were clear, and a chest *x* ray film was normal. He was acidotic and was given 100 mmol(mEq) sodium bicarbonate as well as physiological saline, potassium, and soluble insulin; the volume infused over the first 12 hours was 5·5 l.

There was a good initial response, but on day 3 he suddenly developed severe dyspnoea and cyanosis. Auscultation of the chest disclosed widespread coarse crepitations, but jugular venous pressure was normal. Arterial hypoxaemia was confirmed, and a chest *x* ray film showed bilateral pulmonary oedema without cardiac enlargement, compatible with the shock lung syndrome. He was transferred to the intensive therapy unit, where a Swan Ganz catheter was inserted and pulmonary vascular pressures were found to be normal.. Blood cultures were negative and he was treated initially with oxygen by