Clinical experience with the Rhône-Poulenc ascites reinfusion apparatus

P. J. A. MOULT*
M.B., M.R.C.P.

S. P. PARBHOO†
Ph. D., F.R.C.S.

S. SHERLOCK*
M.D., F.R.C.P.

*Department of Medicine, †Academic Department of Surgery, Royal Free Hospital,
Pond Street, Hampstead, London NW3 2QG

Summary

Ascitic ultrafiltration and reinfusion of protein concentrate is of value in selected patients and is, in general, well tolerated. Patients with massive ascites and an unsatisfactory response to diuretic therapy are most suitable, but those with ascitic infection, pulmonary oedema, and terminal liver disease are excluded. Although two of our patients had malignant ascites, reinfusion is not recommended for such patients.

Persistent pulmonary oedema was a contributory cause of death in two patients, and was attributed to reinfusion. Intraperitoneal haemorrhage may occur from a perforated collateral vein and close observation of patients must be continued after the peritoneal catheter has been removed.

A clogged ultrafilter was cleared with urokinase, and further studies of this are indicated.

After ultrafiltration about half the patients were satisfactorily controlled with diuretic drugs, although there is no evidence that reinfusion produces a sustained improvement in diuretic responsiveness.

Patients

Thirty patients have been treated with the ascites reinfusion apparatus. This total includes the seventeen patients reported by Parbhoo, Ajdukiewicz and Sherlock (1974). Six patients were treated twice, and one three times, making a total of thirty-seven treatment sessions. Twenty-seven patients had cirrhosis, two had malignant ascites, and one the Budd-Chiari syndrome (Table 1). One patient was positive for the hepatitis B antigen.

TABLE 1. Diagnosis or type of cirrhosis

Alcoholic	10
Cryptogenic	10
Active chronic hepatitis	4
Post-hepatic	2
Carcinoma of liver	2
HB-Ag positive	1
Budd-Chiari	1

Indications

All patients were treated at first with bed rest, dietary sodium restriction to 22 mEq/day, and then diuretic drugs. The principal indications for reinfusion were a poor response to these measures, or complications of diuretic therapy such as uraemia, portal-systemic encephalopathy, or cramps. Four patients with gastrointestinal haemorrhage from varices were treated in preparation for emergency surgery. Other indications were tense ascites requiring immediate relief, and economic or social reasons to shorten the patients' stay in hospital. Reinfusion of ascites has been advocated for the treatment of the functional renal failure of liver disease (Conn, 1973), and eight of our thirty patients had blood urea concentration over 45 mg/100 ml. In the majority of patients there was more than one indication for treatment.

Results

The duration of reinfusion ranged from 3 to 24 hr per session (mean 11.6 hr), and the volume of ultrafiltrate obtained was from 0.4 to 10.0 l (mean 4.8 l). Body weight was measured at the start of treatment and 24 hr later. Weight loss ranged from 2.0 to 16.0 kg (mean 6.6 kg). The difference between weight loss and ultrafiltrate volume is due to the diuresis which frequently accompanies ultrafiltration.

Complications (Table 2)

Pyrexia up to 40°C occurred in twenty-five patients (68%). In three of these this was associated with marked aggravation of portal-systemic encephalopathy and coliform bacteria were grown from blood and ascites. All three recovered with antibiotic treatment. In the remaining patients pyrexia subsided spontaneously and cultures were negative.

Seven patients (19%) leaked ascites from the site of the peritoneal catheter. Five of the seven leaked externally and two into the scrotum.

Two patients developed pulmonary oedema. These

TABLE 2. Complications of reinfusion (thirty-seven treatment sessions)

Pyrexia	25 (68%)
Ascitic leaks	7 (19%)
Infected ascites	3 (8%)
Pulmonary oedema	2 (5%)
Intraperitoneal haemorrhage	1 (3%)

were male, one aged 34 and one 54, with cryptogenic cirrhosis. Both were admitted with variceal haemorrhage, tense ascites and portal-systemic encephalopathy. Ascites reinfusion was performed in order to reduce the intra-abdominal (and therefore portal) pressure, to minimize protein loss at laparotomy, and to improve respiratory function. After about 12 hr of ultrafiltration both patients developed severe pulmonary oedema which persisted despite blood volume depletion with diuretics and paracentesis. Both required positive pressure ventilation with a positive end-expiratory pressure to maintain arterial oxygen saturation, and this had to be continued until death, 7 and 16 days later respectively. Although fluid overload may have contributed to their pulmonary oedema initially, it is likely that other factors were involved. Hypotension, endotoxaemia, and myocardial failure were considered. Blood cultures were negative. At postmortem the older man had evidence of left ventricular hypertrophy, foci of myocardiolytic and recent subendocardial haemorrhage and fibrosis. Nevertheless pulmonary oedema is an uncommon complication of variceal haemorrhage, and the temporal relationship between reinfusion and the onset of pulmonary oedema makes it likely that reinfusion was a major contributory factor, although the mechanism is unknown.

Another patient being prepared for surgery was found at laparotomy to have bled from a collateral vein on the inner aspect of the anterior abdominal wall. The vein had been perforated by the peritoneal catheter, which was inserted at the usual site, in the midline, 5 cm below the umbilicus.

Clogging of the ultrafilter

In the majority of patients the procedure is well tolerated, and in these circumstances it is economical to extract as much oedema fluid as possible. Complete removal of excess extracellular fluid is not achieved since some ascites reforms from the expanded plasma volume when reinfusion ceases. In only about 30% of our series was there no detectable ascites at the end of reinfusion. In 20% reinfusion ceased because the tip of the catheter lay high in the abdomen, in a potential space and above the main fluid level. This emphasizes the importance of placing the catheter well down into the pelvis. In the remaining patients (about 50%) reinfusion was halted because the ultrafiltration membrane had

become clogged with fibrinous material. This occurs either because of a low flow rate through the apparatus, or because of clots which form within the abdomen, and are seen to pass along the input tubing and into the ultrafilter. The addition of a filter at the input of the ultrafilter has unfortunately not prevented this complication since minor agitation allows the clots to pass through. There was no relationship between the incidence of clogging and the ascitic protein concentration.

An attempt to prevent clogging in one patient was made by infusing urokinase, a plasminogen activator, into the ascitic fluid immediately after leaving the abdomen. This was given at the rate of 1000 Ploug u/hr, but failed to prevent obstruction by fibrinous clots. The membranes were then isolated (Fig. 1) and flushed with 5000 Ploug u of urokinase in 50 ml 0.9% NaCl, followed by 50 ml 0.9% NaCl

Fig. 1

alone. This procedure was successful in unblocking the ultrafilter and restoring normal function in one patient, but failed on another occasion. 5000 Ploug u of urokinase cost £10.75 which compares with £29 for a fresh ultrafilter.

Follow-up

Six patients died within 3 weeks of treatment, one from severe alcoholic hepatitis, and five from gastrointestinal haemorrhage. Reinfusion may have contributed to the deaths of the two who developed pulmonary oedema.

Of the remainder, thirteen were followed up after discharge from hospital, for periods up to 2 years (mean 10 months). Nine of these thirteen patients have died. All thirteen required diuretic drugs for recurrence of ascites although one patient remained ascites-free without diuretics for the first 4 months.

In about 50% of the patients followed up, ascites was satisfactorily controlled with diuretic drugs.

Acknowledgments

We thank the house physicians and nursing staff who assisted with the reinfusions, and May and Baker Limited for providing the apparatus.

References

- CONN, H.O. (1973) A rational approach to the hepatorenal syndrome. *Gastroenterology*, **65**, 321.
- PARBHOO, S.P., AJDUKIEWICZ, A. & SHERLOCK, S. (1974) Treatment of ascites by continuous ultrafiltration and reinfusion of protein concentrate. *Lancet*, **i**, 949.