Ascitic fluid filtration and intravenous infusion versus total-volume paracentesis with infusion of plasma expander in cirrhosis with tense or intractable ascites

NILAY N MEHTA, PHILIP ABRAHAM, VIJAL J ASHAR,* SHEKHAR S SHIKARE,** SHANKAR S SAVANT, DILIP R KARNAD,** FERSOSH P MISTRY

Departments of Gastroenterology, *Pharmacology and **Medicine, K E M Hospital and Seth G S Medical College, Mumbai 400 012

Background: Patients with cirrhotic ascites have low serum albumin levels, and paracentesis of ascitic fluid could compromise them further. Aim: We compared the therapeutic efficacy of ascitic fluid filtration and concentrate infusion (AFI) versus total-volume paracentesis (TVP) with colloid infusion in control of tense or intractable cirrhotic ascites. Methods: Ten patients underwent AFI; their ascitic fluid was filtered repeatedly through hollow-fiber hemodialyzer, and the concentrate reinfused intravenously. In ten patients TVP was done with simultaneous intravenous colloid infusion. Follow-up was done weekly and the study terminated if the patient needed diuretics or developed complications. Results: Pre-study parameters were similar in the two groups. In the AFI and TVP groups, the duration of procedure was median 12 hours and 5.5 hours; fluid removed by paracentesis was 10.2 L and 8.0 L, respectively; and fluid infused intravenously was 0.5 L [with mean (SD) protein content 5.7 (1.3) g/dl] and 1.1 L, respectively. Glomerular filtration rates were lower than normal in the two groups but did not change significantly with the procedure; body weight remained significantly lower up to week 3 and week 2, respectively. The study was terminated at median week 3 (range 1–8) and week 2 (1–4), respectively. Fever was an accompaniment of AFI and one patient developed peritonitis. Conclusion: Patients undergoing AFI remained diuretic-free longer; the procedure is cost-effective but needs to be further evaluated to minimize the side-effects. [Indian J Gastroenterol 1998; 17: 93–96]

Key words: Albumin, hemodialyzer

Dietary sodium restriction and diuretics are the mainstay of treatment of mild to moderate ascites. Therapeutic paracentesis (large-volume or total-volume) is recommended in patients with tense or refractory ascites. This procedure may result in complications like intravascular hypovolemia and renal failure or dilutional hyponatremia secondary to fluid shift; intravenous infusion of albumin after therapeutic paracentesis has been shown to prevent these complications.

Albumin is expensive; also, its infusion in animals has been shown to down-regulate the albumin synthesis gene with consequent decrease in endogenous albumin production. Hence, alternatives have been considered: infusion of a plasma expander is equally effective in preventing post-paracentesis complications.

Various authors have described a method for treating patients with refractory or tense ascites by large- or total-volume paracentesis, filtering the ascitic fluids to concentrate its protein content, and then infusing it intravenously or intraperitoneally. Infusion of ascitic fluid concentrate containing autologous protein seems more physiologic than infusion of albumin or other plasma expanders to maintain plasma volume and prevent the untoward consequences of therapeutic paracentesis.

We carried out this study to evaluate the safety, efficacy and cost of ascitic fluid filtration and intravenous infusion (AFI) in patients with tense or intractable ascites, and to compare AFI with total-volume paracentesis (TVP) and infusion of a plasma expander in the treatment of such cases.

Methods

All consenting adult patients consecutively admitted to our department for the treatment of tense or intractable ascites due to cirrhosis of liver over a 14-month period were considered for admission into this open, randomized study. Patients in poor general condition or with evidence of infected ascites (spontaneous bacterial peritonitis or its variants), pancreatic ascites, malignancy, recent gastrointestinal bleed, grade III or IV hepatic encephalopathy, or pregnancy, were excluded.

The study was approved by the institution's Ethics Committee; all patients gave informed consent.

Patients were defined as having intractable ascites if the ascites was uncontrolled despite 200 mg/day of spironolactone and 60 mg/day of furosemide, or if they developed complications related to diuretics. Tense ascites was defined on the basis of tautness of skin over the abdomen, inability to palpate abdominal viscera, and/or respiratory embarrassment, due to ascites.
All patients were put on a salt-restricted diet (2 g or 88 mEq per day), with fluid intake restricted to 500 mL
day in patients with serum sodium levels <130 mmol/L.
Fluid restriction was needed in two patients in each
group. Diuretics were discontinued at recruitment.

Baseline studies included liver profile (serum bilirubin,
total proteins, albumin, AST, ALT), renal profile (blood
urea nitrogen, serum creatinine, serum sodium and potas-
sium, urinary sodium; and glomerular filtration rate esti-
mation by radioisotope study), and blood coagulation pro-
file (platelet count, prothrombin time). Ascitic fluid protein
and white cell count were determined. Body weight and
abdominal girth were measured. After assessment for
eligibility, patients were randomized to either AFI or TVP.

Ascitic fluid filtration and intravenous infusion (AFI)
AFI was performed by a modification of the method de-
scribed by Landini et al.3 The patient lay in bed at least
one meter above the floor. Ascitic fluid was drained by a
14-gauge needle attached to a prepackaged sterile set con-
sisting of a cellulose acetate hemodialyzer with an effec-
tive surface area of 1.1 m², a suction pump attached to the
dialyzer to create transmembrane pressure gradient of 400
mmHg for collection of filtrate, and a drainage bag (capa-
city 2000 mL) to collect the concentrated ascitic fluid.
The ascitic fluid passed through the dialyzer, gravity and
suction pump providing the transmembrane pressure nec-
ecessary for separation of proteins from water and solutes.
When the drainage bag was filled to capacity, it was raised
and the fluid was returned into the peritoneal cavity.

Progressive protein concentration was obtained by suc-
cessive passages of partially concentrated fluid back into
the abdominal cavity and again into the drainage bag while
the filtrate was drained out. The endpoint for the procedure was thick,
concentrated (opalescent) fluid in the drainage bag, with cobweb forma-
tion. The concentrate obtained after the last passage was reinfused intrava-
nously.

Total-volume paracentesis (TPV) and infusion of plasma expander
TPV was carried out as a standard single-step procedure. A synthetic
polymerized gelatin (Haemaccel) was infused as 150 mL for each liter of
ascitic fluid removed.

Evaluation of patients
Body weight and abdominal girth were measured daily for a week af-
ter the procedure, and weekly there-
after. Liver and renal profiles and
blood coagulation profile were re-
tained the day after the procedure
and every week thereafter.

Patients were followed up for three months as above or
till termination of the study, whichever was earlier. The
study was terminated if the patient required diuretics due
to a gain in body weight of at least five Kg from the
immediate post-procedure value; or developed complications
like tense ascites, peritonitis, encephalopathy or gastrointesti-
nal bleed.

Analysis of data
Data are expressed as median (range) or mean (SD) as
appropriate. Statistical analysis was done using the Student’s
\( t \) test for paired data or the Kruskall-Wallis test for non
parametric data, as applicable.

Results
The pre-treatment characteristics of the two groups are
shown in Table 1; there was no difference between the
groups.

The median (range) time for the procedure in the AFI
and TVP groups was 12 (8 - 26) hours and 5.5 (4 - 6)
hours, respectively. In the AFI group, a median (range) of
10.7 (5.0 - 12.8) liters of ascitic fluid was drained; this
included a median of 10.2 liters of protein-free filtrate and
0.5 liters of concentrated ascitic fluid. The amount of fluid
drained in the TVP group was 8.0 (6 - 12) liters. The med-
ian (range) volume of fluid infused was 0.5 (0.2 - 0.8)
liters (concentrated ascitic fluid) and 1.1 (1.0 - 2.0) liters
(Haemaccel), respectively. The mean (SD) final ascitic fluid
protein content in the AFI group was 5.7 (1.3) g/dL.

Both treatment protocols resulted in symptomatic im-
provement immediately after the procedure. The Fig shows
the mean body weight in the two groups on follow-up.

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<th>Table 1: Pre and post treatment characteristics of the two groups</th>
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<td>Prothrombin time (s)</td>
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<td>Ascitic fluid protein (g/dL)</td>
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* Control of 13 s
* Measured from bag
Ascitic fluid reinfusion for tense or intractable ascites

Albumin is expensive and has its potentials for complications; we therefore preferred a synthetic polymerized gelatin (Haemaccel) as plasma expander for infusion after total-volume paracentesis.

Assisted dialytic ascites ultrafiltration and spontaneous ascites filtration and infusion have also been proved effective in treating tense or refractory ascites.1,2,13 These methods provide the patient a safe and cost-effective treatment of ascites with the added benefit of conservation of endogenous protein and enhancement of opsonic activity of the remaining ascitic fluid. Serum albumin level remained unaltered in our patients when measured about 24 hours after infusion; a similar finding was noted in another study.12 Albumin is estimated to leave the intravascular compartment at a rate of 7 per cent per hour.16

The time taken for ascitic fluid filtration and intravenous infusion was higher than that reported earlier because we used a hemodialyzer instead of a hemofilter. The hemofilter has an ultrafiltration rate three to four times higher than that of the hemodialyzer. We applied an ultrafiltration pressure of 400 mmHg instead of 500 mmHg used in the previous study14 to avoid the potential risk of membrane rupture and fluid leakage.

We used a lower cut-off level for defining diuretic-intractable ascites than has been used to define refractory ascites in previous studies. The reason for this was that, in our clinical experience, higher doses lead to an unacceptably high complication rate which precludes their use.

We were able to drain large volumes of ascitic fluid by both the methods, and weight loss was significant. Although the difference was not statistically significant, there was a trend towards delayed and slower weight gain in the AFI group. Termination of study was also later in the AFI group than in the TVP group (p = ns).

No patient from either group developed renal impairment or hyponatremia. We did not find clinical evidence of disseminated intravascular coagulopathy (DIC) or cardiovascular problems in any of the patients. The absence of DIC may be explained by the membrane characteristics of the hemodialyzer. The absence of cardiovascular problems may be due to infusion of small amounts of protein-rich concentrated ascitic fluid. Minor febrile reaction, probably due to pyrogenic substances in the ascitic fluid, was an accompaniment of the AFI procedure but did not require any therapy other than antipyretics. One patient developed peritonitis and required antibiotics.

The advantage of our method over the others described is that it does not require any special apparatus and can be assembled indigenously, so that it can be used in less well-equipped centers also. We have used a hemodialyzer instead of a hemofilter to cut down the cost; further reduction in cost can be achieved by reusing each hemodialyzer for the same patient, a common practice in patients undergoing hemodialysis.

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Analysis of the cost-effectiveness of our method (excluding the cost of treating the episode of bacterial peritonitis) shows AFI to be about 33 per cent cheaper than TVP if the hemodialyzer is used twice.

In conclusion, our study indicates that ascites filtration and intravenous infusion as described by us is safe (except for minor febrile reaction and the risk of bacterial peritonitis if aseptic precautions are not strict) and effective, does not require a specialized set-up, and is lower in cost than TVP; the procedure, however, requires more time.

References


Correspondence to: Prof Abraham. Fax (22) 414 3435
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