FREQUENCY OF PERITONEAL INFECTIONS AMONG PATIENTS UNDERGOING CONTINUOUS PARACENTESIS WITH AN INDWELLING CATHETER

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Background: Ascites is a common clinical manifestation of advanced liver disease which can be managed with repeated large volume paracentesis. We sought to determine if continuous paracentesis via placement of an indwelling catheter for the management of ascites is safe and effective. **Methods:** We placed 38 peritoneal drainage catheters in 30 patients for durations ranging from 1–10 days. Patients underwent ascites fluid culture and cell count determinations immediately before and after the completion of paracentesis. Serum WBC count, BUN and creatinine levels were available on all patients before and after paracentesis. The descriptive data were analysed to assess the rate of peritoneal infections, change in renal function and ultimate clinical outcome of patients. **Results**: A mean 12.73 litres of peritoneal fluid was removed via continuous peritoneal drainage accomplished with the use of an indwelling abdominal catheter. Eight peritoneal cultures obtained after paracentesis grew out. The mean peritoneal cell count before and after paracentesis in each subject did not show evidence for spontaneous bacterial peritonitis. Five patients underwent successful liver transplantation (OLTX) and did not develop any peritoneal infections post OLTX. **Conclusion:** Continuous large volume paracentesis using an indwelling abdominal catheter for several days is effective in removing large volumes of peritoneal fluid in patients with end-stage-liver-disease (ESLD). The peritoneal fluid can grow out bacteria if it is left in the abdomen for ≥3 days.

Keywords: Large volume Paracentesis, indwelling catheter

INTRODUCTION

Patients admitted to hospital with advanced liver disease and refractory ascites pose a formidable challenge to their physicians. Current management strategies include diuretic therapy, large volume paracentesis, creation of porto-systemic shunt and liver transplantation.[1] Only liver transplantation has shown to increase life duration, while the other modalities described provide temporary symptomatic relief.[2] While patients are awaiting liver transplantation, management of ascites becomes exceedingly important to ensure that patients remain good candidate for the operation.

On one hand removal of all ascitic fluid can produce post-paracentesis circulatory disturbance with attending haemodynamic instability[3,4], but on the other repeated paracentesis of smaller amounts of fluid can result in bowel perforation, bleeding and infection[5]. The present study was initiated to determine the feasibility of performing repeated paracentesis using an indwelling abdominal catheter until all ascites is drained. The associated infections with peritoneal catheter were also studied.

MATERIAL AND METHODS

All hospitalised patients with refractory ascites were considered for inclusion in the study and underwent placement of an indwelling peritoneal catheter. The diagnosis of refractory ascites was documented based on the standard criteria prior to considering the experimental medical management consisting of an indwelling peritoneal catheter or a TIPS (transjugular-portosystemic shunt) procedure. The indwelling peritoneal catheter was placed on the medical floor or in the intensive care unit. A special treatment cart was developed and used for this purpose. The treatment cart helped to organize the performance of paracentesis as instead of individually picking things from the supply station, all of the following items were already packed in the treatment cart.

a. Pericardiocentesis set manufactured by Cook critical care (catheter with multiple side holes and an end hole)
b. Blood Culture bottles
c. Vital Mix feeding bag (3,000 cc by PDI Med produce) Sterile drapes
d. Single intravenous administration set with 15 microns filter
e. Suture placement kit
f. Macro drip by Baxter 10 cc syringe
g. 1% lidocaine
h. Blood collection set with 15 gauge rubber piercing needle
i. 18 and 22 gauge needle
j. Lavender and red top blood collection tubes

A standard sterile technique was used for each procedure. The site for the placement of the peritoneal catheter placement was determined by percussion and catheters were placed either in the left or the right lower abdominal quadrant. Upon entering the peritoneal space, a long needle from the pericardiocentesis set was used to

aspirate 30 cc of the ascitic fluid which was immediately inoculated into blood culture bottles as well as blood collection tubes and sent to the laboratory for peritoneal cell counts, protein and albumin as well as peritoneal culture. A guide wire was passed through the needle deep into the peritoneal cavity. The needle was removed and a dilator was passed over the guide wire to create a tract. Finally, the indwelling peritoneal drain was gently pushed over the guide wire via the tract into the peritoneal cavity. No incision in the skin was made to insert the peritoneal drain in order to avoid oozing of fluid around the catheter. The peritoneal drain was connected to an intravenous administration set and the feeding bag was placed in a dependent position enabling the ascites fluid to be removed slowly but continuously by gravity. Finally, the peritoneal catheter was secured to the abdominal wall using sutures that were stitched around the drainage catheter and secured to the skin in order to avoid catheter movement.

The patients were seen daily and had their vital signs obtained every 6 hours. The ascitic fluid was allowed to drain continuously until a maximum of 6 litres of ascitic fluid was removed every 8 hours. Patient whole blood and ascitic fluid cell counts were obtained daily. Serum creatinine and BUN levels were assessed daily. With any increase in the peripheral blood WBC count of 20% or more or a change in the character of the ascitic fluid, repeat ascitic fluid cell counts and cultures were obtained.

The statistics were performed using Microsoft Excel, Data Analysis Tools. All data are presented as Mean±SD.

RESULTS

Forty attempts at inserting a peritoneal catheter resulted in placement of 38 catheters in 30 patients. Two patients required ultrasound guidance for placement of their peritoneal catheter. All 30 patients had Child C cirrhosis. Twenty four patients had a single catheter placement, 5 had 2 catheter placed sequentially and One patient had a total of 4 sequential catheters placed. A peritoneal culture was obtained at the time of initial placement of the peritoneal catheter in each case. Three of these cultures grew out an enterococcus, a coagulase negative staphylococcus and a coagulase positive staphylococcus. Thirty-one cultures were obtained upon removal of the peritoneal catheter from a site other than the original site. Eight out of 38 cultures grew out and the identified organisms are reported in Table-1. The descriptive statistics for each peritoneal catheter as well as the data related to the clinical condition of the patients with positive peritoneal fluid cultures are shown in Tables 2 and 3 respectively.

Three patients with a positive culture developed fever after insertion of the peritoneal catheter. Two were treated with antibiotics and were discharged home. One patient expired who had a peritoneal fluid culture positive for VRE. He also grew out VRE from his central venous catheter. The white blood cell count of his peritoneal fluid remained normal. The total peritoneal white cell count upon removal of peritoneal drainage catheter in two patients was greater than $1,000/mm^3$ with a total Polymorphonuclear PMN count of 730 and 20 cell/mm^3 respectively. Four patients had a cell count greater than $500/mm^3$ (total PMNs less than 250 in all four) after removal of the catheter. Only one of these six patients had a peritoneal culture that grew out a coagulase negative staphylococcus, and subsequently became febrile. He was placed on appropriate antibiotics and the infection was eradicated successfully. The other 5 patients did not manifest any clinical signs of infection; their peritoneal cultures remained negative and their subsequent peritoneal cell counts normalized spontaneously. Seven patients expired as a result of the severity of their underlying liver disease. None of these deaths were related to a peritoneal infection. Five patients underwent liver transplantation (OLTX) after undergoing this method of large volume paracentesis. None of these five patients had infective complications post transplantation. Eight patients in the study also underwent a TIPS procedure. The mean creatinine levels before and after paracentesis did not differ significantly. Two patients developed a clinical hepatorenal syndrome. One of these 2 underwent successful OLTX, while the other expired as a consequence of the severity of his underlying liver disease. Fourteen of 34 removed peritoneal catheter tips grew out the following organisms: 9 coagulase negative staphylococcus, 4 coagulase positive staphylococcus and 1 enterococcus. No relationship between the results of peritoneal fluid cultures and peritoneal catheter tip culture was observed.

Five patients developed mild abdominal pain at the site of the peritoneal catheter. The pain improved in 3 patients by simply pulling the catheter 3–4 inches out of the abdomen while in the other 2 pain improved after the catheter was removed following completion of total paracentesis. All patients were allowed to have acetaminophen for minor pain relief. One patient experienced a bowel puncture at the time of insertion of the catheter. This patient was prophylactically treated with antibiotics and a repeat peritoneal count 24 hours later remained normal. This patient grew a vancomycin resistant enterococcus (VRE) from the peritoneal drain and from his central venous catheter. Eight patients experienced oozing of peritoneal fluid from the catheter site after removal of the catheter. The site was covered with an ostomy bag and the drainage stopped over a period of 2–3 days. Six patients experienced mild oozing around the peritoneal catheter during the time it was in the abdomen.

Table-1: Types of infections and antibiotic sensitivities in patients with positive peritoneal cultures

Bacteria	Sensitivities
Coagulase negative Staphyloccous	Quinolones, Penicillin
Coagulase positive Staphylococcus	Cephalothin
MRSA	Bactrim and Vancomycin
Enterococcus	penicillin
Micrococcus	NA

Note: The patient with MRSA (methicillin resistant staphylococcus aureus) had infection in both central venous catheter and Swan-Ganz catheter as well as the peritoneal catheter.

Table-2: Descriptive Statistics for Each PD Catheter

Parameters	n	Mean±SD	Range
Age (patients only)	30	53.3±11.89	33–88
PD Volume (litres)	38	12.73±6.20	4–31
PD (Days)	38	4.29±1.69	1–10
WBC (serum): Difference (final-initial) $(10^3/\mu l)$	38	0.10±2.56	-6–8.1
BUN: Difference (final-initial) (mg/dl)	38	-2.66±18.86	-49–63
CR: Difference (final-initial) (mg/dl)	38	-0.061±1.15	-2.3–5
PD Cell Count Initial WBC $(/mm^3)$	38	313.45±383.05	10–1650
PD Cell Count Final WBC $(/mm^3)$	33	362.15±289.08	30–1350
PD Cell Count WBC : Difference (final-initial) $(/mm^3)$	33	95.64±345.17	-1150–765

Table-3: Data Related to Peritoneal Fluid, Use of Antibiotics during the Admission and Outcome of Patients with a Positive Peritoneal Fluid Culture

PF C/S	PFCC I $(/mm^3)$	PMN $(/mm^3)$	PD Catheter (Days)	PF CC F $(/mm^3)$	PMN	Fever	Central line	Antibiotics	Outcome
Coag (-) Staph	290	49.6	5	640	0	(+)	Y	(-)	Alive
Coag (+) Staph	105	26.25	6	160	20.8	(+)	N	(-)	OLTX
Coag (-) Staph	244	58.56	4	180	41.4	(-)	Y	(-)	OLTX
Coag (+) Staph	378	49.14	3	180	12.6	(-)	N	(+)	OLTX
Coag (-) Staph	320	22.4	10	170	5.1	(-)	N	(-)	Tips
Enterococcus	40	0.8	7	403	32.24	(-)	N	(-)	Tips
Coag (+) VRE	92	34.96	7	70	32.2	(+)	Y	(+)	Dead
Coag (-)	110	1.4	4	81	2.43	(-)	N	(-)	Alive

OLTX= Liver Transplantation; TIPS = Trans-jugular Intra-hepatic Porto Systemic Shunt; PFCCI = Peritoneal cell count initial;
PFCCF= Peritoneal cell count final; PMN= Neutrophils in the peritoneal fluid;
Note: Two patients outlined in this table were on antibiotics for an unrelated reason
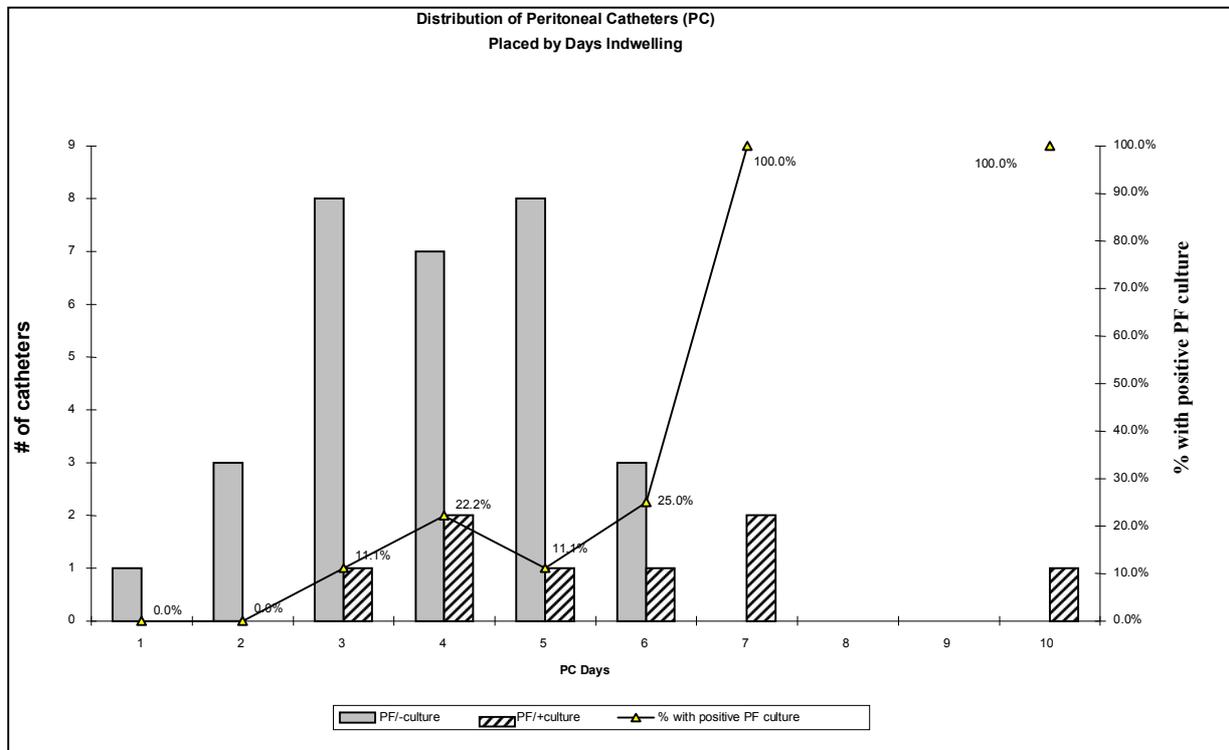

Figure-1: Distribution of peritoneal catheters (PC) placing by day indwelling

DISCUSSION

Paracentesis is an easy procedure to perform technically, but can become cumbersome for a physician or health worker who has to monitor the ascitic fluid drain over a relatively long period of time. Although usually safe, complications including purulent discharge at the site of the paracentesis, sepsis, haematoma, haemorrhage, visceral perforation, loss of a foreign body (the catheter or a piece of the catheter) in the abdominal cavity and even mortality have been reported following paracentesis.[5] Among stable cirrhotics undergoing either repeated or total paracentesis (one tap only) abnormalities of fluid and electrolyte balance are encountered uncommonly.[7,8]

Indwelling catheters have been placed successfully in patients with malignant ascites as a palliative measure. Both surgically and radiologically guided catheters have been placed into the abdomen for prolonged periods. Surgically placed pertioneovenous shunts require frequent revisions and are associated with several unique complications.[9,10] Currently TIPS has become the procedure of choice for recurrent ascites serving as a bridge to transplantation for patients with non-malignant portal hypertensive diuretic refractory ascites. Patients admitted to the hospital with refractory ascites because of either non-compliance with sodium restriction, or overzealous use of diuretics, are best treated with a large volume paracentesis and albumin replacement. While in hospital these patients should receive instructions concerning a 2-gram sodium diet by a nutritionist and have their doses of diuretics maximized.[11]

When a catheter is used to drain malignant ascites, a mortality rate of 1.6% to 4.4% has been reported. In one series, symptomatic peritonitis was encountered in four of 24 patients.[12] In another small series no infections in 10 patients were reported.[13] In yet another clinical experience, accidental removal of the catheter, abdominal wall cellulites and persistent leakage around the catheter were reported as complications.[14] In one relatively large experience of 45 catheters, the rate of infection was reported to be 1.6 episodes per 100 catheter days and the median time for which catheters were indwelling before the onset of symptomatic infection was 42 days. Two cases of fatal hypotension occurring as a result of the removal of a large volume of abdominal fluid were reported also in this study.[15]

Nineteen of the 40 catheters placed in our experience were inserted while the patients were in the ICU. All had Child C cirrhosis with a mean creatinine of 1.66 mg/dl. A creatinine value of >1.5 mg/dl in patients with cirrhosis reflects a greater than 50% reduction in GFR.[16] In addition, on an average we removed 12.73 litres of fluid with a mean reduction in their serum creatinine across time despite the fact that we included a pre-dialysis creatinine of 7.3 mg/dl was present in one of the patient's in our series. This patient's pre-paracentesis creatinine was 2.3 post-haemodialysis. None of the patients in this series experienced a major complication such as fatal hypotension or haemorrhage that required either a transfusion or the use of pressors. Both asymptomatic bacterascites cases as well as a case of neutrocytic ascites were recognized in patients in this series, who were either successfully treated with antibiotics or simply observed until a repeat paracentesis documented clearance of their infection as well as a reduction in their ascites fluid cell count spontaneously. Several patients underwent either a successful liver transplant or TIPS procedure without any post procedure evidence of a peritoneal infection. Peritoneal cultures were obtained on 81.5% of the patients and 86.9% had repeat cell counts at the time of their catheter removal. The cell counts were obtained from the peritoneal catheter before removing it. The cultures were obtained from a site other than used for the peritoneal catheter. In a recent publication, it was concluded that routine culture of the ascitic fluid following a large volume paracentesis is not necessary when there is a low index of suspicion for infection.[17] In order to obtain specific data to assess the presence and frequency of infection following large volume paracentesis using an indwelling catheter without any obvious signs of infection, cultures were obtained in the majority of the cases in this series when the catheter was removed. Because routine cultures and cell counts were obtained on the majority of patients in this series, sub-clinical putative infection when present was recognised as either neutrocytic ascites or bacterascites. This experience supports the position that neutrocytic ascites and bacterascites can resolve spontaneously and do not have the same clinical implications as overt SBP.[18-20] Currently, we do not recommend routine culture of the residual ascitic fluid when an indwelling catheter is removed, but a cell count and differential should be obtained. Moreover, culturing the tip of the removed peritoneal catheter was of no value in the management of these patients. A peritoneal culture should be obtained, however, if the cell count is increased (greater than 250 PMNs) or if there are overt clinical signs of infection.

Only 1/8 and 2/7 patients who had a peritoneal catheter in place for 3 or 4 days had a positive peritoneal cultures at the time the catheter was removed. The one patient, who had a positive peritoneal culture after 3 days of peritoneal drainage had a normal peritoneal cell count and was on antibiotic for an unrelated reason and underwent successful OLTX without subsequent infective complications. Because the peritoneal catheter was left to gravity drainage, the physician caring for the patient need not wait until a total paracentesis has been achieved particularly as one of the goals of such a treatment is to remove the fluid slowly (physiologically) over 2–3 days.

Moreover, others have reported that intermittent gravity drainage rather than use of suction bottles reduces the incidence of peritoneal infection.[12]

CONCLUSION

In summary, the placement of an indwelling peritoneal catheter to slowly drain of a large volume of peritoneal fluid over 2–3 days in cirrhotic patients is effective. The presence of an indwelling catheter for 3 or more days can result in the ascitic fluid bacterial culture being positive. However, such infections can be treated successfully with the addition of antibiotics based upon sensitivity results with or without the removal of the indwelling catheter.

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