CLINICAL STUDY

Therapeutic Application of Percutaneous Peritoneovenous (Denver) Shunt in Treating Chylous Ascites in Cancer Patients

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ABSTRACT

Purpose: To evaluate the safety and efficacy of percutaneous peritoneovenous shunt (PPVS) placement in treating intractable chylous ascites (CA) in patients with cancer.

Materials and Methods: Data from 28 patients with refractory CA treated with PPVS from April 2001 to June 2015 were reviewed. Demographic characteristics, technical success, efficacy, laboratory values, and complications were recorded. Univariate and multivariate logistic regression analysis was performed.

Results: Technical success was 100%, and ascites resolved or symptoms were relieved in 92.3% (26 of 28) of patients. In 13 (46%) patients with urologic malignancies, whose ascites had resulted from retroperitoneal lymph node dissection, the ascites resolved, resulting in shunt removal within 128 days ± 84. The shunt provided palliation of symptoms in 13 of the remaining 15 patients (87%) for a mean duration of 198 days ± 214. Serum albumin levels increased significantly (21.4%) after PPVS placement from a mean of 2.98 g/dL ± 0.64 before the procedure to 3.62 g/dL ± 0.83 ($P < .001$). The complication rate was 37%, including shunt malfunction/occlusion (22%), venous thrombosis (7%), and subclinical disseminated intravascular coagulopathy (DIC) (7%). Smaller venous limb size (11.5 F) and the presence of peritoneal tumor were associated with a higher rate of shunt malfunction ($P < .05$). No patient developed overt DIC.

Conclusions: PPVS can safely and effectively treat CA in patients with cancer, resulting in significant improvement in serum albumin in addition to palliation of symptoms.

ABBREVIATIONS

CA = chylous ascites, DIC = disseminated intravascular coagulopathy, LAM = lymphangioleiomyomatosis, LND = lymph node dissection, PPVS = percutaneous peritoneovenous shunt

Chylous ascites (CA) in patients with cancer is an uncommon but debilitating complication of abdominal surgery that is described mainly after extended retroperitoneal lymph node dissection (LND) for urologic malignancies (1). The mainstay of treatment for CA is conservative management with diet modification, involving a high-protein, low-fat, medium-chain triglyceride oral diet or total parenteral nutrition (1). However, considerable controversies exist regarding the effectiveness of this method. Paracentesis is performed as needed to palliate symptoms.

Peritoneovenous shunt placement for treatment of refractory ascites was first described by Smith in 1962.

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In 1974, LeVeen reported his experience with a pressure-sensitive unidirectional mechanical valve shunt. The shunt redistributed the ascitic fluid from the abdomen into the central circulation based on a pressure gradient between the abdomen and central venous system. In 1979, Lund and Newkirk modified this shunt by incorporating a compressible valve chamber between the peritoneal limb and the venous limb. This valve prevented reflux of fluid back into the peritoneal cavity and provided unidirectional flow. The Denver shunt (CareFusion Corporation, San Diego, California) pump is either single-valved or double-valved. The single-valve pump provides faster flow rates (30–55 mL/min). Peritoneovenous shunt placement has been primarily used for symptomatic relief in patients with intractable malignant ascites, and the procedure has been described as effective and safe in this population (2). However, limited information, provided mainly by case reports and small case series, is available regarding the use of peritoneovenous shunt placement in the management of CA (1,3–12). The purpose of this study was to evaluate the safety and efficacy of peritoneovenous shunt placement in patients with cancer and intractable CA.

MATERIALS AND METHODS

Study Design

This retrospective study was conducted under an exemption from the institutional review board. Data from 28 patients with refractory CA who were treated with percutaneous peritoneovenous shunt (PPVS) placement between April 2001 and June 2015 were reviewed.

CA was defined by milky appearance of the ascites with an ascitic fluid triglyceride concentration $>$ 110 mg/dL. The peritoneal fluid was evaluated for cytology, culture, and triglyceride level before shunt placement at the time of diagnostic/therapeutic paracentesis. Persistent or refractory CA was defined as CA that did not respond to 2 weeks of conservative treatment and repeated paracentesis. Laboratory values recorded before PPVS placement (within 14 days of the procedure) were complete blood count; blood urine nitrogen; creatinine; serum albumin level; liver function tests; and coagulation profile, including prothrombin time, international normalized ratio, and activated partial thromboplastin time. In the last 2 years, disseminated intravascular coagulopathy (DIC) profiles were added to the routine screening laboratory tests, including fibrinogen and D-dimer levels.

Shunts were placed using the previously described technique (13). The internal jugular vein, preferably the right side, was accessed. The procedure was performed under moderate sedation or monitored anesthesia care. Patients received a first-generation cephalosporin antibiotic intravenously within 1 hour of the procedure as prophylaxis. Before shunt placement, the ascites was drained close to completion, leaving only a small amount of ascites with which to prime the shunt. Ascites drainage was performed using a 12-F all-purpose drainage catheter (Cook, Inc, Bloomington, Indiana). The pigtail drainage catheter was ultimately exchanged for the peritoneal limb of the shunt. If too much ascitic fluid was drained, 1 L of warmed saline was injected into the peritoneal cavity and used to prime the shunt.

All patients were admitted. Patients were observed for signs of DIC and fluid overload. The complete blood count was checked the night of the procedure and then daily until the platelet count plateaued or started to increase. The DIC profile was repeated daily for 3 days. Asymptomatic DIC or subclinical DIC was defined as the absence of clinical signs or symptoms of bleeding but with abnormalities in clinical laboratory tests, including platelets $<$ 50 $\times$ 10^9/L, prothrombin time $>$ 6 seconds above the highest normal value, and fibrinogen level $<$ 100 mg/dL. Overt DIC was defined based on the International Society for Thrombosis and Hemostasis guideline using the International Society for Thrombosis and Hemostasis scoring system (14).

Patients' high-protein, low-fat diet was switched to a regular diet after the procedure. Patients were instructed to pump the shunt 20 times, twice a day, once in the morning and once before bedtime while in the supine position. Effective palliation was defined as improvement in at least one of the patient's symptoms and no more need for paracentesis. Complete resolution of ascites was defined as no clinical or imaging evidence of ascites while the patient was on a regular diet. All patients were seen in the clinic at 1 week and 1 month after shunt placement. Initial symptomatic relief was evaluated at the 1-week visit. Patients had follow-up cross-sectional imaging every 3 months as part of routine cancer care. All patients (except for three patients in whom shunt placement was performed within the last month) were followed for a minimum of 6 months. Patients were advised to contact the interventional radiology department if they experienced abdominal distention, fever, ascites leakage, or problems with pumping. Patients who noticed any changes in their pump or who had evidence of recurrent ascites were evaluated in the interventional radiology clinic. If shunt malfunction was suspected, a shunt study was performed by inserting a 20-gauge Huber needle into the pump and injecting contrast material. If shunt malfunction or occlusion was detected in patients with recurrent ascites, the shunt was revised. In patients with evidence of pump change with no clinical evidence of ascites, a limited abdominal ultrasound or computed tomography scan was performed. If imaging confirmed resolution of ascites, the shunt was removed. Overall shunt survival was defined as the time from the shunt placement to removal or death from any cause. Adverse events were graded according to the National Cancer Institute