—Report on Experiments and Clinical Cases—

Peritoneovenous Shunts for Palliation of Malignant Ascites

Yasuhiro Mamada, Hiroshi Yoshida, Nobuhiko Taniai, Kouichi Bandou, Tetsuya Shimizu, Daisuke Kakinuma, Yoshiaki Mizuguchi, Yoshinori Ishikawa, Koho Akimaru and Takashi Tajiri

Surgery for Organ Function and Biological Regulation, Graduate School of Medicine, Nippon Medical School

Abstract

Background: Malignant ascites may produce a cluster of symptoms that include abdominal distention, early satiety, respiratory embarrassment, impaired mobility, and lethargy, and relief of these symptoms is often difficult to achieve. We report on the placement of peritoneovenous shunts (PVSs) in a group of patients with malignant ascites, with particular reference to the effectiveness and complications of the procedure.

Patients and Method: PVSs were inserted in 9 patients with malignant ascites after obtaining their informed consent. The patients were 6 men and 3 women with a median age of 59 years. All had previously been treated with vigorous diuretic therapy or repeated paracentesis or both. Shunt insertion was carried out via a percutaneous approach under local anesthesia.

Results: The procedure was well tolerated by all patients. The abdominal distention resolved in all patients, and urine volume increased significantly, demonstrating that the PVS did not affect renal function. The platelet count was reduced, and prothrombin time was prolonged. Two patients had the complication of shunt occlusion, and both patients underwent shunt replacement. There were no lethal complications. Median survival time after PVS placement was 21 days (range, 10～90 days), and the shunt was functioning at the time of death with good control of ascites in all patients.

Conclusions: Malignant ascites produces troublesome symptoms for patients, who may live for some time. Placement of a PVS is a well-tolerated, relatively minor surgical procedure that can provide excellent control of ascites in most patients selected. The selection of optimal patients requires further study.

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Key words: malignant ascites, peritoneovenous shunt, percutaneous approach

Introduction

Malignant ascites is common in patients with certain types of end-stage cancer. It is extremely uncomfortable for patients, because it inhibits mobility, impairs oral intake, and compromises respiratory function. Because it is accompanied by these debilitating symptoms, ascites usually worsens quality of life, but there are few effective options for relieving these symptoms. Diuretic therapy is generally performed first but is often ineffective and

Correspondence to Yasuhiro Mamada, Department of Surgery, Nippon Medical School, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: mamachan@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

Table 1 Clinical findings in the 9 cases of malignant ascites treated by peritoneovenous shunt

Case	Age	Sex	Primary disease	Discharge	Outcome
1	76	M	cholangioma	no	34d*, dead
2	64	M	colon cancer	no	10d, dead
3	50	F	gallbladder cancer	yes	89d, dead
4	56	M	pancreas cancer	no	90d, dead
5	71	M	gallbladder cancer	no	21d, dead
6	52	M	cholangioma	no	32d, dead
7	68	F	colon cancer	no	10d, dead
8	47	M	pancreas cancer	no	14d, dead
9	47	F	pancreas cancer	yes	27d, dead

*days for survival after PVS

usually leads to depletion of electrolyte stores and a reduction in circulating blood volume. Draining the peritoneal fluid may provide temporary relief, but paracentesis must be repeated frequently and results in the loss of endogenous circulating proteins. The placement of a peritoneovenous shunt (PVS) reduces the symptoms related to ascites and is an alternative to nonsurgical therapies. In 1974, LeVeen[1] described a device that is placed internally and redirects ascitic fluid back into the systemic circulation, and the Denver[2] shunt is a contemporary version of the LeVeen shunt.

The aim of this study was to evaluate our experience with the PVS and the outcomes of patients with malignant ascites treated with it.

Patients and Methods

From March 2003 through October 2006, PVSs were inserted in 9 patients (6 men and 3 women) to treat malignant ascites after obtaining their informed consent. Their mean age was 59 years (range, 47～76 years). All patients had previously undergone medical therapy with diuretics, salt restriction, and repeated paracentesis. Most of them had ascites-related symptoms, such as pain, dyspnea, nausea, vomiting, and dysphagia. The sources of the peritoneal carcinomatosis were bile duct cancer (4 patients), pancreatic cancer (3 patients), and colon cancer (2 patients). The patients' clinical characteristics are shown in **Table 1**. Data on abdominal circumference, preoperative and postoperative laboratory values, complications, and outcome were collected.

Surgical Procedure

A suitable peritoneal entry site for the device (DENVER® PAK) is chosen under ultrasonographic (US) guidance. As in the surgical technique, a subcutaneous pocket is created under local anesthesia. After the ascitic fluid is drained, the peritoneal end of the shunt is placed in the abdomen with an 18-gauge needle and a 16-French peel-away sheath.

Venous access is achieved by percutaneous and, sometimes, US-guided puncture of the right or left subclavian vein. The venous catheter is tunneled from the pump chamber and introduced into the vein with a 12-French peel-away sheath. Fluoroscopic control is useful to avoid kinking of the catheter and to position the tip at the atriocaval junction.

Results

The abdominal distention resolved in all patients, and abdominal girth tended to decrease. Urine volume increased significantly. There were no changes in the levels of blood urea nitrogen, creatinine, or serum albumin or and platelet count postoperatively. By the seventh day, prothrombin time was prolonged but had recovered to the previous values by day 14 (**Table 2**).

Two of the 9 patients (22%) had the complication of shunt occlusion; shunts were replaced in both

Table 2 Hematological parameters, weight, abdominal girth and diuresis, before and after PVS placement

	preoperative period	3-POD	7-POD	14-POD
PT (%)	72.8 ± 12.5	55.2 ± 13.1*	59.5 ± 19.4*	71.5 ± 10.4
Platelets (10^3/mm^3)	20.1 ± 9.0	14.8 ± 6.6	13.9 ± 8.7	17.2 ± 10.4
Albumin (g/dL)	2.5 ± 0.5	2.6 ± 0.5	2.8 ± 0.4	2.7 ± 0.6
BUN (mg/dL)	20.5 ± 11.3	23.2 ± 15.8	22.1 ± 13.7	27.2 ± 21.2
Cr (mg/dL)	1.1 ± 0.8	1.2 ± 0.9	1.3 ± 0.9	1.1 ± 0.9
Largest abdominal girth (cm)	87.4 ± 7.4	84.1 ± 10.4	78.9 ± 4.8	81.4 ± 12.5
Diuresis 24hrs (mL)	856 ± 422	1,694 ± 618**	1,781 ± 416**	1,333 ± 408*

(mean ± SD)

POD: postoperative day
PT: prothrombin time
*p<0.05
**p<0.01

patients. There were no lethal postoperative complications.

Two patients could be discharged after PVS placement, and they survived for 27 days and 89 days. To date, all patients have died, 1 each of subarachnoid hemorrhage and myocardial infarction, and the others of cancer. The median survival time after PVS placement for all patients was 21 days (range, 10～90 days) (**Table 1**).

Discussion

The PVS was first described in 1974 by Le Veen et al. for the treatment of ascites due to liver cirrhosis[1]. The Denver PVS is a modified device that includes a pump chamber between the peritoneal end and the silicone tube end in the vein[2]. This pump chamber is useful for preventing and clearing shunt obstructions during the management of malignant ascites. When the Denver PVS was first introduced, placement required surgical dissection of the jugular vein to introduce the venous end[3]. A percutaneous method of placement that allows an easier, faster, and less-invasive procedure has recently been developed[4], and laparoscopically assisted positioning of the Denver PVS has also been described[5].

PVSs are effective in relieving refractory malignant ascites in gynecologic malignancies. The development of nongynecologic malignant ascites is an end-stage event for most patients[6]. Because of the short interval between the onset of disabling ascites and death, a placement of a PVS is not indicated in most patients with pancreatic cancer[3], but survival was lengthened in our patients with pancreatic cancer.

The abdominal distention resolved in all patients in our study, and abdominal girth tended to decrease. Placement of the PVS resulted in a significant increase in urine volume. Levels of blood urea nitrogen, serum creatinine, and serum albumin did not change postoperatively, showing that PVS placement did not affect renal function.

Minor complications of the Denver PVS are moderate postoperative fever, edema, tachycardia, changes in liver function variables, and leakage of ascitic fluid near the site of peritoneal puncture. Major complications that have been described are disseminated intravascular coagulation (DIC) and shunt occlusion, especially of the venous limb, after the development of fibrin sheaths or thrombi. Tempero et al. have described a correlation between DIC and PVS placement[7]. Patients with advanced malignancy often have subclinical DIC that may become clinically evident after surgical procedures. Edney et al. have reported laboratory evidence of DIC in almost all patients[3]. Thrombocytopenia is common, but the incidence of clinical DIC following shunt placement is only 15%. Zanon et al. have reported that the reductions in platelet, total protein, and hemoglobin values may have been due to blood dilution[8]. As in our study, by day 7, the platelet count had decreased and prothrombin time had prolonged, but both had recovered to their previous values by day 14. Since there were no lethal complications in the form of clinical DIC in our

study, these changes can be explained as consequences of increased hydration of the extravascular compartments. Shunt occlusion is a common complication and occurred in 2 of our patients, but the percutaneous approach allowed safe reinsertion of the PVS. Smith et al. have reported that shunt failure has no effect on overall survival[9]. In spite of these side effects, the Denver PVS has had efficacy rates in the treatment of neoplastic ascites of 62% to 77% and a mean functioning time of 68 to 83 days[8]. For this reason, we believe the beneficial effects of the procedure exceed the potential risks in patients requiring palliative treatment of refractory malignant ascites. The Denver PVS is a good device for relieving refractory ascites and eliminating the risk of infections and intestinal perforation associated with repeated paracentesis (1%～3%)[10]. Furthermore, paracentesis causes plasma proteins loss and sodium and potassium imbalance, which lead to a worsening of the patients' clinical condition.

The median survival time of our patients after PVS placement was 21 days (range, 10～90 days). The results were not satisfactory, but 2 patients could be discharged after PVS placement, and 2 patients could live ascites-free for 3 months. The effects on quality of life require further study.

In summary, the Denver PVS is a good device for relieving malignant ascites, thereby eliminating the risk of complications due to repeated paracentesis and improving quality of life. Careful patient selection and proper follow-up could improve shunt performance, allowing wider application of the Denver PVS.

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