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Patient Selection and Survival after Peritoneovenous Shunting for Nonmalignant Ascites

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Patient selection and survival after peritoneovenous shunting for nonmalignant ascites was assessed in 30 patients undergoing 44 peritoneovenous shunting procedures over a 5-year period. Indications for peritoneovenous shunting included refractory ascites alone, refractory ascites complicated by hepatorenal syndrome, and nonrefractory but recurrent ascites. Fifty-six percent of shunting procedures were complicated by shunt malfunction and an additional 13% ended in shunt removal or ligation. Serious perioperative morbidity occurred in 47% of patients. Mean duration of shunt function was significantly less ($p < 0.05$) in the patients with hepatorenal syndrome (15 ± 5 days) compared to the patients with refractory ascites alone (45 ± 13 days), or the patients with nonrefractory ascites (64 ± 34 days). Mean survival was 265 ± 87 days. Survival of patients with nonrefractory ascites (767 ± 214 days) was significantly longer ($p < 0.05$) than that seen in patients with hepatorenal syndrome (28 ± 5 days) or in patients with refractory ascites alone (256 ± 148 days). Combined inhospital mortality was 30%. It was significantly greater ($p < 0.05$) in patients with hepatorenal syndrome (70%) than in patients with refractory ascites alone (14%) or in patients with nonrefractory ascites (0%). We conclude that patient selection significantly influences survival after peritoneovenous shunting and may account for the varying results reported by other groups.

INTRODUCTION

Despite widespread acceptance of peritoneovenous shunting (PVS) for relief of ascites, various medical centers have reported differing experiences (1–3). Caution has been advised as the unreserved application of this technique may be attended by significant complications (4, 5). This study was designed to investigate the impact of patient selection on survival after PVS for nonmalignant ascites.

MATERIALS AND METHODS

Patients undergoing PVS for nonmalignant ascites at the three University of Michigan Affiliated Hospitals (University Hospital, Ann Arbor VA Hospital, Wayne County General Hospital) between 1977 and 1982 were reviewed. Patients were divided into three groups: *1)* 14 patients with ascites refractory to medical therapy (RA); *2)* 10 patients with refractory ascites complicated by hepatorenal syndrome (HRS); and *3)* six patients with nonrefractory but recurrent ascites (NR). Ascites was determined to be refractory if there was not a consistent loss of ½ lb/day of ascitic fluid after 2 wk of intensive inhospital management with salt and fluid restriction accompanied by an individualized diuretic program. Patients were believed to have hepatorenal syndrome when progressive azotemia occurred in the face of a normal or elevated pulmonary capillary wedge pressure (>10 cm H_2O), or did not respond to intravenous fluid challenges. In such cases, urine sodium was uniformly less than 10 mEq/l. Patients with recurrent, NR presented with ascites that could be successfully managed as a supervised inpatient (at least ½ lb weight loss per day with stable electrolytes and renal function), but required repeat hospitalization because of recurrence of ascites as an outpatient. Follow-up data on discharged patients were obtained from chart review or by personal communication. Data are listed as mean ±SEM. Statistical significance was determined by use of the "Student's" *t* test and χ^2 methods. Results were considered significant if $p < 0.05$.

Patient population

Thirty patients (25 men, five women) underwent a total of 44 PVS procedures. Mean patient age was 52 years (range 27–70). Thirty shunts contained a LeVeen pressure activated valve, while 14 shunts used a Denver pump-type valve. Ascites resulted from alcoholic cirrhosis in 25 patients, Budd-Chiari syndrome in three patients, postnecrotic cirrhosis in one patient, and cryptogenic cirrhosis in one patient. PVS was performed for RA alone in 14 patients, RA complicated by HRS in 10 patients, and NR in six patients.

RESULTS

Survival after initial shunt placement is listed in Table 1. Patients with NR survived significantly longer

TABLE 1
*Patient Survival**

	Survival (Days)		Survival (1 Yr)		Inhospital Mortality	
RA (n = 14)	256 ± 148	†	2 (14%)	‡	2 (14%)	†
HRS (n = 10)	28 ± 5		0 (0%)		7 (70%)	
NR (n = 6)	767 ± 214		4 (67%)		0 (0%)	

* Survival listed as days after initial shunt placement.
† $p < 0.05$.
‡ $p < 0.005$.

(767 ± 214 days) than patients with RA alone (256 ± 148 days) or patients with HRS (28 ± 5 days) ($p < 0.05$). Although survival of patients with RA was longer than that of patients with HRS, the difference was not statistically significant ($p = 0.11$). The 1-year survival rate among patients with NR (67%) was significantly greater than the rate seen among patients with RA (14%, $p < 0.005$) or patients with HRS (0%, $p < 0.005$). Inhospital mortality among patients with HRS was 70%. This was significantly greater than that seen among patients with RA alone (14%, $p < 0.025$) or patients with NR (0%, $p < 0.05$). Five of the 30 patients are still living or were alive when lost to follow-up (four NR patients, one RA patient). Length of follow-up has ranged from 62–1384 days.

Multiple causes of death were listed for most patients with progression of liver failure having caused or contributed to the death of 13 patients (52%). Other causes in decreasing order of frequency included gastrointestinal bleeding (24%), sepsis (24%), and renal failure (20%). Disseminated intravascular coagulation, pneumonia, and myocardial infarction contributed to fewer than 10% of deaths.

Excluding shunt malfunction, serious postoperative complications developed in 47% of patients during one or more shunt procedure. Overall, 34% of all shunt procedures were associated with one or more serious complications. Complications included disseminated intravascular coagulation with clinical manifestations (16% of procedures, 23% of patients), sepsis (9% of procedures, 13% of patients), peritonitis (7% of procedures, 7% of patients), congestive heart failure (7% of procedures, 10% of patients), gastrointestinal bleeding requiring transfusion (7% of procedures, 10% of patients), and pneumonia, adult respiratory distress syndrome, abdominal abscess, and encephalopathy not attributable to progression of liver disease (each occurring in 2% of procedures and 3% of patients). There was no significant difference seen in the complication rate between different patient groups.

Sufficient information was available to evaluate shunt function in 39 of 44 procedures (Table 2). Overall mean duration of shunt function (from time of insertion until malfunction, removal, ligation, or patient death) was 37 ± 9 days. There was no significant

TABLE 2
*Duration of Shunt Function**

	Total (n = 39)	RA (n = 17)	HRS (n = 15)	NR (n = 7)
Overall (n = 39)	37 ± 9	45 ± 13	15 ± 5	64 ± 34
LeVeen (n = 26)	31 ± 11			
Denver (n = 13)	50 ± 16	†		†

* Units are days after insertion.
† $p < 0.05$.

difference between the functional duration of shunts with LeVeen valves (31 ± 11 days) or Denver valves (50 ± 16 days) ($p = 0.16$). Duration of shunt function was significantly shorter in patients with hepatorenal syndrome (15 ± 5 days) than in either patients with RA alone (45 ± 13 days, $p < 0.05$) or patients with NR (64 ± 34 days, $p < 0.05$). This result may have been partially influenced by the significantly lower survival observed in patients with hepatorenal syndrome as six of 15 shunts in this group were functioning at the time of patient death.

Table 3 lists the fate of each shunt placed. Twenty-two of 39 shunts malfunctioned. Mechanical malfunction was significantly more common in shunts with LeVeen valves (19 of 26) than in shunts with Denver valves (three of 13) ($p < 0.01$). Twelve patients died with a functioning shunt. Currently there are no functioning shunts in this patient population.

DISCUSSION

Treating the patient with advanced liver disease and significant ascites remains a difficult and frustrating task. The prognosis of patients with medically intractable ascites is dismal (6). Mechanical removal of ascitic fluid with or without intravascular reinfusion is not a new idea (7). It was not until LeVeen developed an effective pressure activated valve, however, that chronic PVS was considered feasible (8). Initial reports depicted a safe, technically easy procedure which resulted in dramatic reduction in ascitic fluid and improved patient survival. A flurry of excitement followed and soon many institutions were reporting their experiences. The use of historical controls was an almost universal feature of these initial studies.

Reports of intraoperative and postoperative complications appeared and some investigators began to question the initial optimism expressed by LeVeen and others (1, 9–11). Later series have reported higher mortality and morbidity rates than earlier studies (1, 2, 4). The impact of patient selection and long-term survival has been discussed, but never formally studied (3, 5). Although some authors have attempted prospective evaluation of PVS, the lack of an adequately matched medically treated population has not allowed the im-

TABLE 3
Shunt Fate

	Total (n = 39)	RA (n = 17)	HRS (n = 15)	NR (n = 7)	LeVeen (n = 26)	Denver (n = 13)
Shunt malfunction	22	9	6	7	19*	3*
Ligation due to DIC	3	1	2	0	1	2
Removal due to infection	2	1	1	0	0	2
Functioning at death	12	6	6	0	6	6
Currently functioning	0	0	0	0	0	0

* $p < 0.01$.

pact of patient selection on overall survival to be assessed (12).

Reported criteria for patient selection vary from one series to another and may help to explain the wide range of results. Some investigators limit patient acceptability to those with proven intractable ascites or rigorously documented HRS (3, 4). Other reports expand criteria for operation to include patients who cannot comply with a strict medical program (13). LeVeen's group uses a fairly liberal list of indications including respiratory distress from massive ascites, failure to lose weight after 14 days of low-salt dieting, failure to adhere to prescribed therapy, and repeated hospital admissions (7).

This retrospective study was undertaken to understand better the impact of patient selection on overall mortality and morbidity after PVS. Survival data depicted in Table 1 show that the initial clinical state clearly affects ultimate outcome. Patients undergoing PVS for RA with or without HRS showed significantly reduced survival rate when compared to the group shunted for other reasons. The combined 1-year survival for patients with RA with or without HRS was only 8.3%. In contrast, 1-year survival among patients without RA was 67%. Some authors have reported cases of HRS reversed by PVS (14). In contrast, our experience with hepatorenal patients demonstrated a 70% inhospital mortality rate and average survival of only 28 ± 5 days suggesting that even with PVS, HRS is an essentially irreversible and rapidly fatal condition.

Serious postoperative complications develop in about one-third of shunt procedures. Given that morbidity is often reported differently by different investigators, our incidence is consistent with other reports in the literature (1, 4, 15). The similar morbidity rates reported by different investigators despite differing patient populations is consistent with our finding that operative morbidity appears to be independent of the patient's preoperative condition.

Although duration of function in shunts with LeVeen and Denver valves was similar, mechanical malfunction was significantly more common with LeVeen valves ($p < 0.01$). Since the majority of recent shunts have contained Denver valves, this might simply reflect improved operative proficiency. However, this seems unlikely because LeVeen shunts inserted toward the end of the study period had a malfunction rate similar to those inserted at the beginning. Moreover, similar operative technique was used in all cases. The most plausible explanation is that the Denver valve's pumping mechanism facilitates clearance of blood and fibrinous debris thereby improving shunt patency.

Even with the advent of PVS, the mortality rate in patients with true RA remains very high. Our study shows that those patients most likely to experience long-term survival after PVS are those with recurrent, NR. Divergent results reported by other groups may be accounted for by how rigorously they defined their patient population. Whether PVS offers improved survival or quality of life in the group without RA remains to be shown and must await randomized prospective studies.

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