Hemodynamic Differences Between Alcoholic and Nonalcoholic Cirrhotics Following Distal Splenorenal Shunt—Effect on Survival?

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The distal splenorenal shunt significantly improves 5-year survival from variceal bleeding in nonalcoholic (70%) compared to alcoholic (45%) cirrhosis patients. This study quantitates hemodynamic differences occurring in the first year after DSRS in 16 alcoholic compared to eight nonalcoholic patients. Portal venous perfusion was retained significantly better ($p < .01$) by the nonalcoholic (seven of eight) than by the alcoholic (four of sixteen) patients. Mean liver blood flow ($p < 0.07$), flow/unit liver volume ($p < .05$), and flow required to perform a specific hepatocyte function ($p < 0.05$) all increased significantly in the alcoholic compared to nonalcoholic group. Cardiac output increased significantly in the alcoholic patients ($p < 0.05$), but was unchanged in the nonalcoholic patients. The alcoholic patients divided into two subsets, 11 who showed increase in flow (1082 ± 260 to 1496 ± 388 ml/min) and five who did not (1246 ± 269 to 994 ± 159 ml/min). The former had significantly ($p < 0.05$) poorer hepatocyte function and had a significant ($p < 0.05$) increase in flow/unit volume and flow/unit function at 1 year, which may have helped to maintain hepatocyte integrity. The latter, in parallel with the nonalcoholic patients, showed no significant change in these parameters and maintained a good functional hepatocyte mass. These data lead us to hypothesize that: 1) alcoholic liver injury has an increased risk of leading to loss of portal perfusion after DSRS, 2) as hepatocyte function falls, there is initial increase in hepatic arterial flow in alcoholic patients, triggered by increase in cardiac output, and 3) progressive injury and/or failure of the compenstory hemodynamic mechanism leads to earlier mortality in alcoholic patients. In contrast, the nonalcoholic cirrhosis patients preserve portal perfusion and maintain liver blood flow, both quantitatively and qualitatively, with retained hepatocyte function and improved survival.

PATIENTS WITH nonalcoholic cirrhosis who have had a distal splenorenal shunt (DSRS) for variceal bleeding survive significantly longer than alcoholic cirrhosis patients managed in the same way (Fig. 1). The improved survival in nonalcoholic patients was first reported from the Miami group who showed a greater than 80% 5-year survival rate.[1] Our own experience[2] showed an overall 5-year survival rate after 349 DSRS of 59%, but the 70% survival rate in nonalcoholic patients was significantly better than the 45% survival rate in alcoholic patients. The enhanced survival of this group raises several questions. Do nonalcoholic patients benefit to a greater degree from the physiologic advantages of the DSRS? Does alcoholic cirrhosis follow a different pathophysiologic course which negates the advantages of the DSRS? Is continued alcohol intake the key factor in the lower survival rate in alcoholic cirrhosis patients?

Review of the reported experience with the DSRS[3] has shown other trends suggestive of a disadvantage to alcoholic cirrhosis patients compared to other etiologies of portal hypertension requiring shunt for variceal bleeding. The six prospective randomized trials[4–9] that have compared DSRS to a variety of total portal systemic shunts to date have shown no significant difference in survival between the two groups; within these studies, more than 80% of the patients have alcoholic cirrhosis. The ability to maintain portal venous perfusion after DSRS has been questioned by many authors[10–12]—is the loss of perfusion found by these groups related to their high number of alcoholic patients?

The DSRS has well defined physiologic aims.[13] All agree that transplenic variceal decompression will control bleeding. What remains to be defined is how well prograde portal venous flow and hypertension in the portal venous bed are maintained and to what extent these can help preserve liver function. This study measures quantitative flow and function before and 1 year

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Presented at the Annual Meeting of the American Surgical Association, May 12–14, 1983, Boca Raton, Florida.

Supported by United States Public Health Service Grants AM15736, Clinical Research Center Public Health Grant 5M01R00039.

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Submitted for publication: May 16, 1983.

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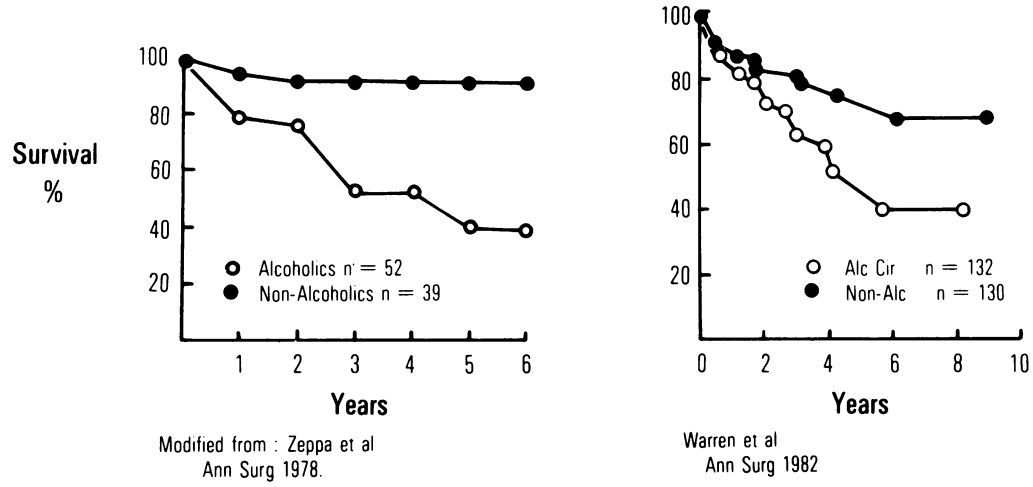

FIG. 1. Comparative survival of alcoholic *versus* nonalcoholic cirrhotic patients following DSRS for variceal bleeding. In both studies, survival was significantly better ($p < 0.05$) for nonalcoholic cirrhotic patients.

after DSRS in an attempt to answer these questions. The specific focus is on the different patterns of hemodynamic change seen at 1 year between alcoholic and nonalcoholic patients, which we suggest may lead to the difference in survival.

Materials and Methods

Patient Population

Twenty-four patients with cirrhosis undergoing elective DSRS for variceal bleeding between January 1981 and March 1982 comprise the study group. These patients were drawn from a total of 53 patients having elective DSRS in this time interval on the following basis: 1) they had cirrhosis as the etiology of their portal hypertension and 2) they had complete data collection, as outlined below, at both time intervals. Exclusions from the study group were: five patients who died within 1 year of DSRS, four patients with noncirrhotic portal hypertension, eight patients who have not completed a 1 year follow-up, and 12 patients with incomplete data, usually angiography, at one or the other study time. This study group is representative of the total DSRS population over this time with no bias towards good- or poor-risk patients.

Methods

The following studies were performed over a two day assessment period. The preoperative studies were done after stabilization following their variceal bleed; 2 g sodium dietary restriction was imposed, with other restrictions as dictated by the clinical course. The 1-year studies were performed on the Clinical Research Facility with a standard dietary background of 2 g sodium and 80 g protein. Medications were controlled on the following basis; diuretics were continued as indicated, lactulose and neomycin were discontinued, cimetidine and antacids were continued before operation but discontinued prior to the 1-year studies, and other regular medications were continued.

Hematologic and biochemical data were collected at both time intervals—the preoperative data were drawn 1 to 2 days prior to DSRS. The following quantitative data were collected.

Visceral angiography. All 24 patients had standardized superior mesenteric artery study prior to and at 1 year post DSRS.[14] Grading of portal venous perfusion was made. Grade I shows prograde visualization of contrast in the portal vein to demonstrate at least the quaternary intrahepatic radicles. Grade II shows the secondary and tertiary radicles of the portal vein, but fails to visualize to the periphery of the liver parenchyma. Grade III shows contrast passing prograde in the portal vein, with or without visualization of the main right and left branches. Grade IV represents no prograde portal venous flow, with nonvisualization of the the portal vein. Wedged hepatic vein injection is required to classify this into reversal of flow or portal vein thrombosis.

Liver blood flow. This was measured by low-dose galactose clearance.[15] Following an overnight fast, 5% galactose is infused (i) at 40 mg/min for 100 minutes; plasma steady stage (c_{ss}) is defined between 60 min and 100 min. At steady state, clearance is i/c_{ss}: in ten normal subjects, galactose clearance = 1378 ± 218 ml/min.

Hepatocyte function. Quantitative liver cell function was measured by galactose elimination capacity (GEC).[16] In contrast to the flow study, a saturating dose (30 g)

of galactose is injected intravenously over 2 to 4 minutes, and the zero order elimination phase defined from 20 to 60 minutes. The maximal removal rate, which is hepatocyte function dependent, is calculated from the slope of the plasma concentration *versus* time curve. In six normal subjects, GEC = 522 ± 140 mg/min.

Liver volume. This was measured by computed tomography.[17] Serial transverse scans of the upper abdomen are taken from the diaphragm at 2 cm intervals until the liver was totally scanned. The liver edges of each slice were traced on the video screen, and the enclosed area was calculated. These areas were summed and multiplied by two to give the liver volume. In 11 normal subjects, liver size was 1493 ± 230 cm.[3]

Cardiac output. Echocardiography was used as a noninvasive method for quantitating this index.[18] In our hands, this method is technically satisfactory in 66% of patients, but technical failure led to incompleteness of this data in 40% of preoperative and 30% of postoperative studies.

Data Analysis

The main emphasis of this paper is change in liver hemodynamics following DSRS. The different components of flow obtained directly or derived from the above methods are:

1) Functional flow in ml/min, calculated directly from plasma galactose clearance. This index, which is based on the very high extraction of the very low plasma galactose concentrations by all functional liver tissue, measures flow to functional liver.[15]

2) Flow per unit liver volume is derived as flow per 100 cm^3 liver. In normal subjects, this is 90 ml/min/100 cm^3 liver; reduction in this index may result from either fall in flow or a disproportionate amount of the liver being nonfunctional.

3) Flow per unit function is derived as flow divided by GEC. In normals this is 2.8 ml/mgGEC. This index measures the blood flow required to perform a specific quantitative function, and for the first time gives a method of assessing the quality of blood flow to the liver.

4) Portal venous perfusion, as measured on venous phase angiography, gives an index of large, moderate, small, or no contribution of total flow coming via this route.

Statistical analysis

The data were analyzed by four groups, as it became apparent that there were two distinct patterns within the alcoholic group: 1) non-alcoholic patients (n = 8), 2) all alcoholic patients (n = 16), 3) alcoholic patients (subset 1) (n = 11) who showed increase in liver blood flow despite loss of portal perfusion, and 4) alcoholic patients (subset 2) (n = 5) who did not show increase in liver blood flow as in subset 1.

Statistical analysis considered first nonalcoholic against all alcoholic patients and, second, a three-way analysis of nonalcoholic patients and the two alcoholic subsets. Repeated measure analysis of variance was used to compare the average changes in groups from pre- to 1-year postshunt and to compare the average differences between groups.[19] Pearson product-moment estimates were used in the correlational analyses.[20]

Results

Clinical and Biochemical

None of the 24 study group patients had further variceal bleeding, and all shunts were documented to be patent at 1 year. One patient had an episode of alcohol-precipitated clinical encephalopathy, which cleared with appropriate therapy; in two patients, subclinical encephalopathy was suspected. Ascites was detectable in three patients at 1 year follow-up, being readily controlled with diuretics.

The pre- and 1-year post shunt biochemical data are summarized in Table 1. There were no statistically significant changes in the pre-shunt to 1 year data, and none of the groups behave significantly differently from the others.

TABLE 1. *Biochemical Changes at 1 Year after DSRS: Alcoholic* versus *Nonalcoholic*

	Nonalcoholic		Alcoholics					
	(n = 8)		All (n = 16)		Subset 1 (n = 11)		Subset 2 (n = 5)	
	pre	1 year	pre	1 year	pre	1 year	pre	1 year
Bilirubin (mg/dl)	1.1 ± 0.5	1.8 ± 0.7	1.0 ± 0.4	2.1 ± 1.0	1.2 ± 0.4	2.0 ± 1.0	0.8 ± 0.3	2.4 ± 0.9
Albumin (g/dl)	3.9 ± 0.4	3.5 ± 0.5	3.6 ± 0.6	3.6 ± 0.4	3.5 ± 0.6	3.5 ± 0.4	3.8 ± 0.3	3.8 ± 0.1
Prothrombin Time (+secs)	1.8 ± 1.0	1.5 ± 1.3	2.6 ± 0.9	1.7 ± 0.9	2.9 ± 0.9	1.9 ± 0.9	1.9 ± 0.3	1.1 ± 0.6

Analysis shows no significant difference between groups, and no significant pre- to postoperative changes between groups.

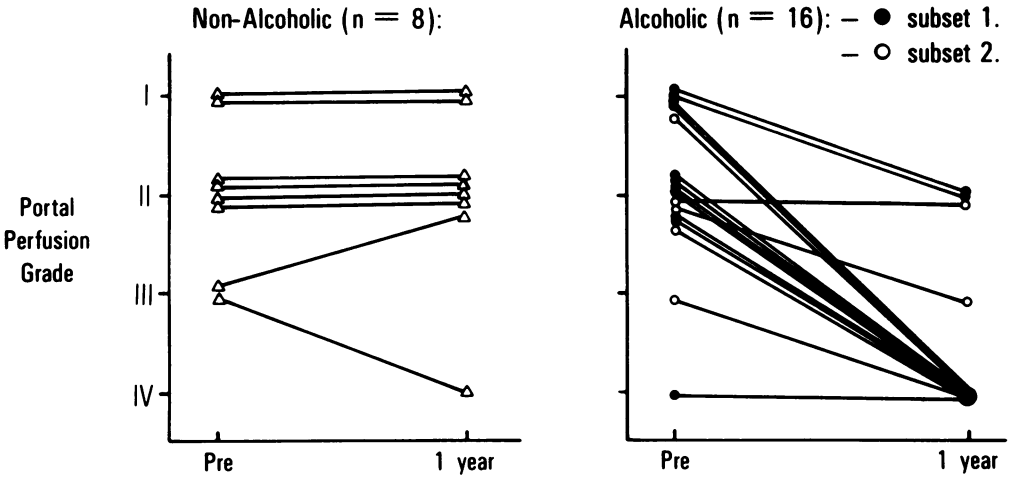

FIG. 2. Portal venous perfusion grades prior to and one year after DSRS. The loss of portal perfusion in the alcoholic group is statistically significant ($p < 0.01$) both within the group and compared to the nonalcoholic group.

Hemodynamics

Portal perfusion. Portal venous perfusion status prior to and 1 year after DSRS is summarized in figure 2. One patient in the nonalcoholic group had a deterioration in perfusion grade, while in contrast, all but one in the alcoholic group had poorer perfusion. Eleven of the 15 alcoholic patients with preoperative perfusion had lost this by 1 year. The difference between nonalcoholic and alcoholic patients is statistically significant ($p < 0.01$). Figure 3 illustrates pre- and 1-year post-DSRS angiography in a nonalcoholic patient, and figure 4 illustrates the change in an alcoholic patient.

Liver blood flow. The changes in liver blood flow, uncorrected and corrected to units of reference, are summarized in Table 2. Preoperative flow was not significantly different between the alcoholic and nonalcoholic groups. The increase at 1 year in the alcoholic (all) group is statistically significant at $p < 0.07$ when compared to the nonalcoholic group.

The breakdown of the alcoholics into subsets 1 and 2 is based on the postoperative flow change: subset 1 is comprised of patients who had a rise in flow at 1 year, while subset 2 had a flow reduction. Two patients in each subset retained some portal venous perfusion. Two patients in each subset had totally stoped drinking, while alcohol intake was variable in the others; these were not the same four patients who retained portal perfusion.

Flow per unit liver volume was not significantly different before operation between the alcoholic (all) and the nonalcoholic patients. After operation, there was no significant difference between the groups, but the alco-

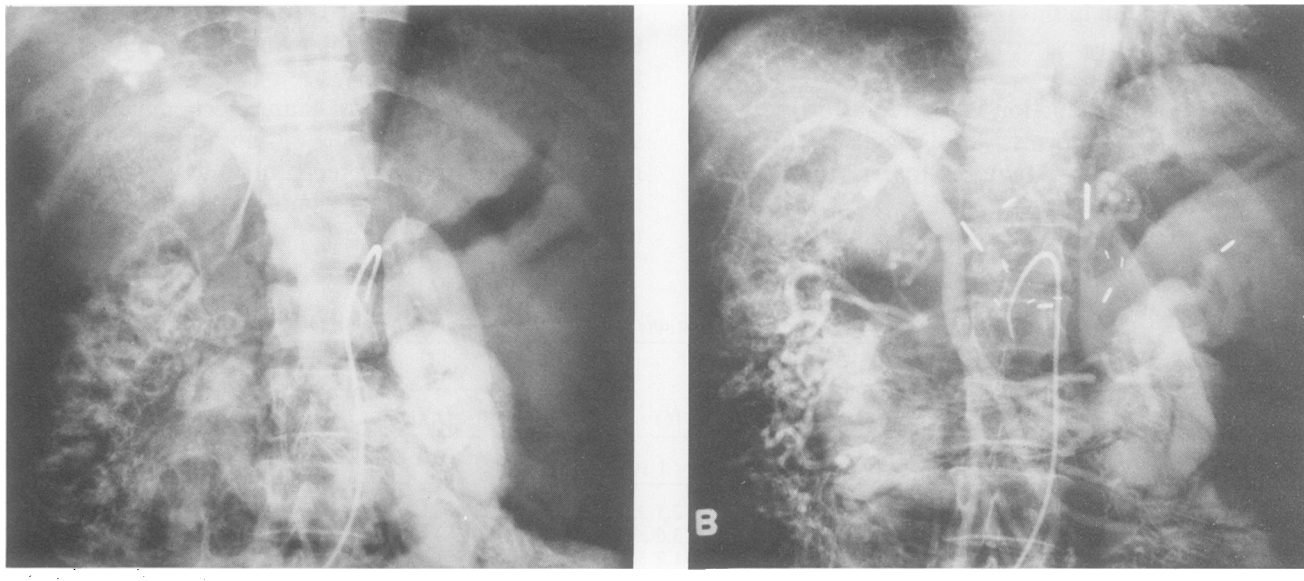

FIG. 3. Preshunt venous phase SMA angiography in a nonalcoholic cirrhotic patient showing grade I portal venous flow (left). The same patient at 1 year showing good continuing perfusion (right).

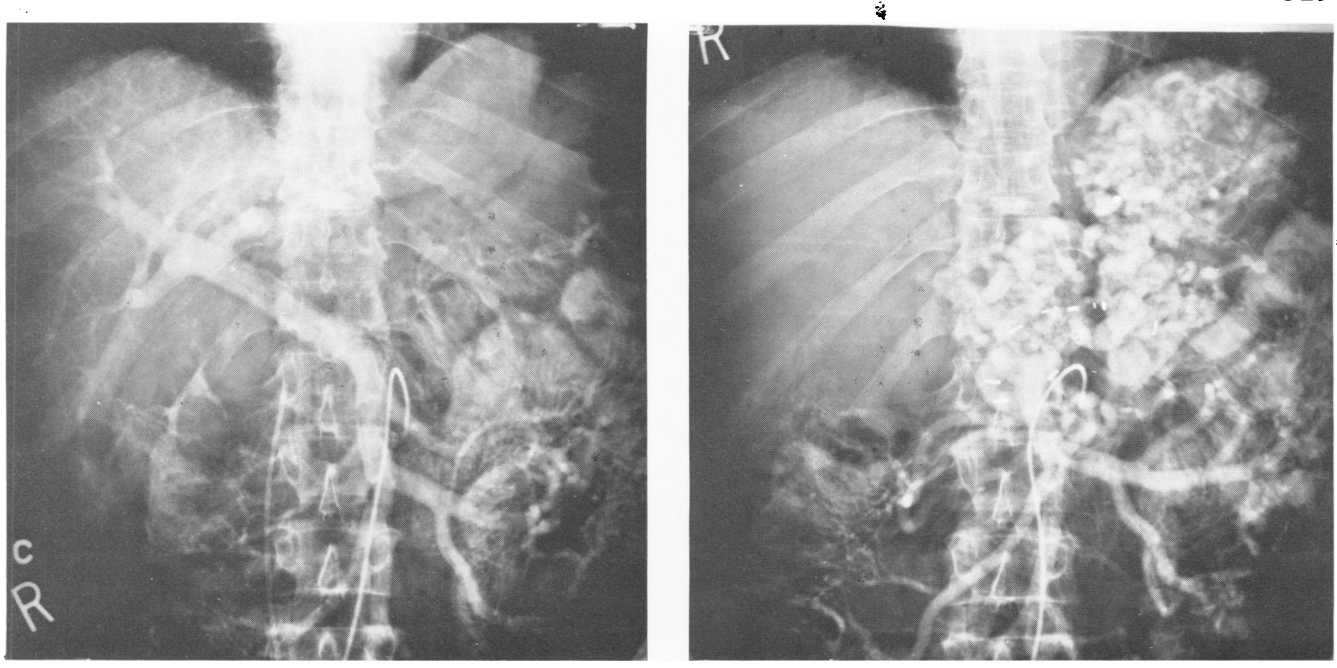

FIG. 4. Preshunt grade I portal venous perfusion in an alcoholic cirrhotic patient (left). The same patient's study at one year shows loss of portal venous flow, and the development of larger portaprival collaterals (right).

holic (all) group has increased significantly ($p < 0.05$) from preoperative level.

The flow required to perform a specific function (flow/mgGEC) was not significantly different between nonalcoholic and alcoholic groups before operation. While this index did not change in the nonalcoholics, there was a significant ($p < 0.05$) rise in this index in the alcoholic (all) group at 1 year (Fig. 5). This increase, which must be in hepatic arterial flow (portal perfusion was lost in this group), indicates that the liver requires significantly more of this type of flow to perform the same function.

TABLE 2. *Flow Changes at 1 Year after DSRS: Alcoholic* versus *Nonalcoholic*

	Preoperative	1 Year Post DSRS	Pre to 1 Year (p*)
Flow (Normal: 1378 ± 218 ml/min)			
Nonalcoholic	1045 ± 269	964 ± 169	
Alcoholic (all)	1133 ± 265	1339 ± 406*	$p < 0.07$
Alcoholic (subset 1)	1082 ± 260	1496 ± 388	
Alcoholic (subset 2)	1246 ± 269	994 ± 159	
Flow/unit vol (Normal: 90 ml/min/100 c^3)			
Nonalcoholic	73 ± 21	79 ± 21	
Alcoholic (all)	56 ± 18	76 ± 26	$p < 0.05$
Alcoholic (subset 1)	49 ± 13	82 ± 28	
Alcoholic (subset 2)	69 ± 22	64 ± 21	
Flow/unit GEC (Normal: 2.8 ml/mg GEC)			
Nonalcoholic	3.0 ± 0.7	3.1 ± 0.5	
Alcoholic (all)	3.5 ± 0.9	4.6 ± 1.5*	$p < 0.05$
Alcoholic (subset 1)	3.8 ± 0.9	5.4 ± 0.9	
Alcoholic (subset 2)	2.9 ± 0.5	2.7 ± 0.3	

* This measures diffference in the pre- to 1 year post-DSRS changes between the alcoholic (all) and nonalcoholic patients.

Cardiac output. The cardiac output was similar in all groups before operation, with a mean (±SD) of 6.9 ± 1.7 L/min. One year after operation, the nonalcoholic patients' cardiac outputs were unchanged (7.3 ± 2.8 L/min), but the alcoholic (all) group had significantly increased ($p < 0.05$) their cardiac output to 10.0 ± 3.5 L/min. The mean (±SD) cardiac outputs for the alcoholic group (subset 1) was 11.4 ± 2.7 L/min, and for subset 2 was 6.0 ± 1.9 L/min.

Liver function. **Liver volume.** The changes in liver volume are presented in Table 3. The mean liver volume in the alcoholic group prior to shunt was larger than in the nonalcoholic group, but not significantly so. The volume reduction was similar in nonalcoholic and alcoholic patients, and at one year was statistically significant ($p < 0.05$).

Galactose elimination capacity (GEC). The GEC changes are summarized in Table 3. The preoperative data shows no significant difference between the alcoholic (all) and nonalcoholic groups; however, alcoholic patients of subset 2 had significantly higher ($p < 0.05$) GEC than alcoholic patients of subset 1. In none of the groups was the pre- to 1-year post-shunt change statistically significant.

GEC per unit liver volume. The data in Table 3 shows that the alcoholic (all) group had significantly poorer ($p < 0.05$) function per unit volume than the nonalcoholic group before operation. This was primarily due to the low GEC/unit volume in alcoholics (subset 1). In none of these groups was there a significant change at 1 year post shunt.

Correlational analysis between liver function and flow. The relationship between liver blood flow and function is illustrated in figure 6. Preoperative correlational analysis between flow and GEC shows no significant difference between groups in this relationship with a significant correlation ($r = 0.64$) of function to flow. However, at one year, the overall correlation is lost ($r = 0.14$), but each subgroup maintains a significant flow/function relationship (nonalcoholic $r = 0.70$, alcoholic [subset 1] $r = 0.72$, alcoholic [subset 2] $r = 0.70$).

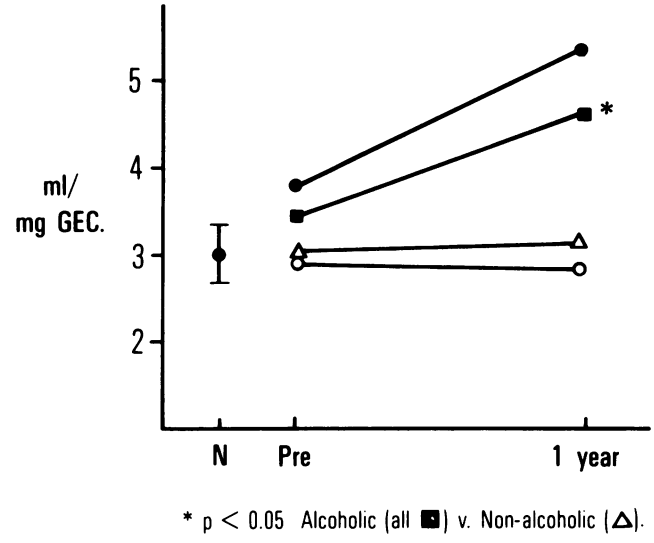

FIG. 5. Significantly more ($p < 0.05$) liver blood flow is required to perform the same quantitative liver function in the alcoholic (all) group at 1 year after DSRS than in the nonalcoholic group.

Discussion

Three findings in this study show that alcoholic patients behave significantly different hemodynamically from nonalcoholic cirrhotic patients in the first year after DSRS. First, they show a reduction in portal perfusion; second, they have an increase in hepatic arterial inflow; and third, there is cardiac output increase. Can these findings be related in any way to the observed poorer 5-year survival of alcoholic patients? To answer this question, we need to bring into play the quantitative function data and its interrelationship with these hemodynamic differences. The nonalcoholic group shows no changes in their hemodynamic pattern at 1 year post shunt; they retain portal perfusion and the same flow, flow/unit volume, and flow/unit function profile. This hemodynamic and hepatic function stability is prognostically favorable. In contrast, the alcoholic group shows a changing pattern; the fall in portal perfusion and increase in flow combine to give a significant increase in flow/unit volume and flow/unit function. While function has been maintained at 1 year, this has required significantly more blood flow than prior to shunt; this hemodynamic instability is prognostically unfavorable.

The hemodynamic changes, however, are more complex, as shown by the breakdown of the alcoholic patients into subsets 1 and 2. The distinguishing feature of subset 2, who do not show increased hepatic arterial inflow, is that before operation, they had significantly better hepatocyte function (GEC) than subset 1. This leads us to conclude that the hyperdynamic state occurs when there is both loss of portal venous flow and reduction of hepatocyte function below a critical level. Further follow-up of this alcoholic group will clarify if patients of subset 1 are at greatest risk of earlier death and if patients of subset 2 will become hyperdynamic when there is further reduction in their hepatocyte function.

The ability to retain portal venous perfusion of the liver following DSRS has become a major focus of controversy. In our prospective randomized study group of patients[21] studied at 7 to 10 years after DSRS, nine out of 12 patients retained some prograde portal venous flow[22]; seven of these nine patients had nonalcoholic

TABLE 3. *GEC and Liver Volume Changes 1 Year after DSRS: Alcoholic* versus *Nonalcoholic*

	Preoperative	1 Year post DSRS	Pre to 1 Year (p)
GEC (Normal: 500 ± 50 mg/min)			
Nonalcoholic	362 ± 98	324 ± 93	NS
Alcoholic (all)	337 ± 99	305 ± 69	NS
Alcoholic (subset 1)	297 ± 94	279 ± 64	NS
Alcoholic (subset 2)	425 ± 29*	363 ± 39	NS
Volume (Normal: 1493 ± 230 c^3)			
Nonalcoholic	1489 ± 433	1311 ± 487	$p < 0.05$
Alcoholic (all)	2113 ± 600	1836 ± 637	$p < 0.05$
Alcoholic (subset 1)	2241 ± 689	1933 ± 714	$p < 0.05$
Alcoholic (subset 2)	1857 ± 256	1640 ± 452	$p < 0.05$
GEC/unit volume (Normal: 33 mg/min/100 cc)			
Nonalcoholic	25 ± 4	26 ± 5	NS
Alcoholic (all)	17 ± 7†	18 ± 7	NS
Alcoholic (subset 1)	14 ± 6	16 ± 6	NS
Alcoholic (subset 2)	23 ± 5	23 ± 6	NS

Preoperative intergroup changes:
* $p < 0.05$ alcoholic (subset 2) *vs.* alcoholic (subset 1).
† $p < 0.05$ alcoholic (all) *vs.* nonalcoholic.

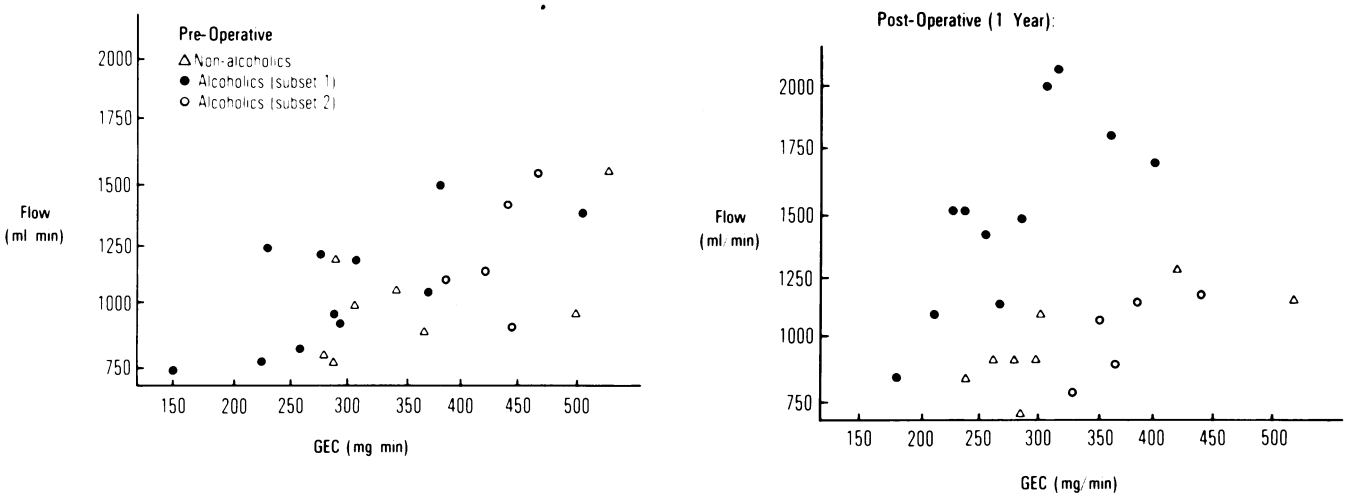

FIG. 6. Preoperative correlational analysis between flow (galactose clearance) and hepatic function (GEC) for all groups. There is a significant correlation (r = 0.64) between function and flow (left). The same patients 1 year post shunt fall into two distinct groups. The overall flow/function correlation is lost, with alcoholic patients (subset 1) separating out from alcoholic (subset 2) and nonalcoholic patients (right).

cirrhosis. Review suggests that continuing portal perfusions is seen in predominantly nonalcoholic population,[23,24] while loss of perfusion is observed in predominantly alcoholic populations,[10] although the etiologic detail is not always given.[11,12,25] The data from this study show that the alcoholic patient is at greatest risk of losing portal perfusion.

What is the mechanism of loss of portal perfusion in alcoholic cirrhosis? It will occur if the sinusoidal pressure exceeds portal pressure on the basis of either a) change in outflow resistance, b) increased arterial inflow, c) fall in portal pressure due to lower collateral resistance with the shunt, or d) a combination of the above.

Increase in outflow resistance may occur on a differing pathologic basis between alcoholic and nonalcoholic cirrhosis. The injury of alcoholic hepatitis is primarily perivenular, while that of viral hepatitis is mainly periportal. The superimposition of cirrhosis complicates the picture, making it difficult to ascribe a differing degree of postsinusoidal obstruction to the two etiologies. However, support for greater outflow resistance in alcoholic cirrhosis comes from higher wedged hepatic vein pressures in such patients compared to those with nonalcoholic cirrhosis.[26] The role of continued drinking and active alcoholic hepatitis, documented in five of our alcoholic patients at one year, is not clear; loss of portal perfusion occurred in both alcoholic patients who did, as well as in those who did not, stop drinking.

The significant rise in cardiac output in two-thirds of the alcoholic patients with compensatory hepatic arterial inflow may also contribute to higher sinusoidal pressure in that group. In this study, we cannot document whether loss of portal perfusion or increase in cardiac output was the primary event; hence, we cannot incriminate this mechanism as the initiating factor. The behavior of subset 2 of the alcoholics, who show loss of portal perfusion without development of a hyperdynamic state would argue against increased hepatic arterial inflow as a mechanism for reduction in portal venous flow.

Does the shunt play a role in the loss of portal flow? All patients in both groups had angiographically documented prograde portal flow 1 week after DSRS; restoration of flow was even achieved at this time in the one patient with grade IV perfusion before operation following ligation of a large coronary vein. Both groups developed collateral pathways from the high-pressure portal system to the low-pressure shunt over the subsequent year; this in itself is testimony to the maintenance of portal hypertension following DSRS. The crucial question however is: can such pathways alone be the cause of loss of portal perfusion? The data in this study suggest this is not usually the case, since collateral pathways develop in both those who retain and those who lose perfusion.

The concept of measuring the flow required to perform a specific function is new. Is it valid? The criticism of earlier clearance methods for measuring liver blood flow was that with progressive liver disease, there was parallel decline in extraction and underestimation of flow.[27] We have presented data[15] in support of galactose clearance, as used in this study, to measure liver blood flow, which show it overcomes this criticism. The data in this study lends support to this concept. Before operation, a flow/function relationship holds regardless of disease etiology, as illustrated in figure 6. The corollary of this is that flow/unit function is not significantly different between groups before operation (Table 2). How-

ever, at 1 year, this relationship is disturbed with distinctly different patterns by groups (Fig. 6) (Table 2); the patients with loss of portal perfusion and poorest hepatocyte function now require significantly more flow to maintain that function.

Does continued alcohol intake play a central role in these observations? Our data suggests it does not; loss of portal perfusion and compensatory flow occurred whether or not the patient stopped drinking. Hepatocellular function was more related to the duration and stage of liver disease than to continued alcohol ingestion in this study group. While continued alcoholism is unquestionably detrimental to the liver, our data suggests it is not the primary factor in the observed hemodynamic changes.

Finally, emphasis should perhaps be placed on the nonalcoholic group. Control of variceal bleeding, maintenance of portal venous perfusion, and hemodynamic and hepatocyte functional stability must contribute to the improved survival of this group. Having documented the changes which occur in alcoholic patients, elucidation and control of the mechanisms may lead to improvement in the management of this group to bring it on par with nonalcoholic patients.

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Discussion

Dr. Robert Zeppa (Miami, Florida): The data presented indicate that portal perfusion was maintained for a year in seven out of eight nonalcoholic patients, but in only 1 of 16 alcoholics. Conversely, liver blood flow increased in the alcoholic group as a whole, but the P value was a little under 0.07, and I think that more data points will be required to cement that particular fact down.

Subgroup 1 of the alcoholics was demonstrated to develop an increased hyperdynamic state, and an increase in nonnutrient liver blood flow. Our measurements, presented some years ago, which were acute measurements within the first 24 hrs, showed that virtually all of our patients developed an increase in cardiac output. I don't mean to imply that these data are comparable for measurements at 1 year. I mention them only to indicate that when one takes the clamp off the splenic artery at the time of constructing the distal shunt, cardiac output goes up; the preload increases quite strikingly.

Now, the pathophysiologic mechanism involved in these two different responses among alcoholics is obscure. One of my questions is: Is there any correlation between the changes seen in the subsets and the initial corrected sinusoidal pressures?

To the extent that the level of sinusoidal hypertension is a deter-