Portal-Systemic Shunt in Hepatic Cirrhosis:

Does the Type of Shunt Decisively Influence the Clinical Result?

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PORTAL-SYSTEMIC SHUNT has for many years been the treatment of choice for portal hypertension secondary to hepatic cirrhosis. That the form most frequently used, direct portacaval anastomosis, is effective in preventing rebleeding from esophagogastric varices is well established, but whether it significantly prolongs survival is open to question.[7,13,14] The undoubted benefit of protection from variceal bleeding may be outmatched by a high postoperative mortality rate, a high incidence of encephalopathy, and a high mortality rate from hepatocellular failure. The consensus at present is to ascribe these disadvantages to reduction of total blood flow through the liver as a result of diversion of portal venous blood into the vena cava.[21] Surgeons have in consequence investigated the hemodynamic effects of alternative methods of portal diversion, with a view to devising procedures which will cause minimal reduction of hepatic blood flow and, therefore, minimal deterioration of hepatic function.

Previous work, conducted in experimental animals,[3] suggested that partial, as opposed to total, portal-systemic shunt might lower portal pressure enough to preclude the risk of gastrointestinal hemorrhage while leaving it high enough to ensure adequate hepatic blood flow. To achieve this in human subjects there are 2 essential prerequisites: 1) continuity of the portal trunk must be maintained, at least in part, so that the liver still receives some portal blood; and 2) the anastomotic stoma must be of small caliber. The techniques which, *a priori*, seemed most likely to fulfil these requirements were 1) side-to-side portacaval anastomosis using a small stoma, a procedure first proposed by Bismuth *et al.*[4] in 1966 and which is the simplest and the most direct type of partial portal-systemic shunt, and 2) spleno-renal anastomosis, in which the continuity of the portal trunk remains intact and the volume flow through the shunt is limited by the caliber and the length of the splenic vein.[8] Within this context, we have studied 3 different shunt techniques. Analysis of the results has led us to doubt whether hemodynamic status is in fact the cardinal element in determining the future of patients who have undergone shunting operations.

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Patients and Methods

In the years 1965 through 1972 elective portal-systemic shunts were performed in 120 patients, 83 men and 37 women, with portal hypertension resulting from intrahepatic block due to cirrhosis (Table 1). Three types of shunt procedure were used: total direct portal-systemic shunt by end-to-side, or large-stoma side-to-side, portacaval anastomosis in 25 patients; partial direct portal-systemic shunt by small-stoma side-to-side portacaval anastomosis in 23 patients; and central splenorenal anastomosis in 72 patients. Patients were randomly assigned to the different operative groups.

The mean age of the patients was 50 ± 11 (mean ± SD) years. The youngest patient was aged 21 years and

TABLE 1. *120 Patients with Hepatic Cirrhosis Submitted to Portal-Systemic Shunt*

Type of Shunt	Number of Patients	Men	Women	Mean Age (Years)	Good Risk*	Poor Risk*	Cirrhosis Alcoholic		Nature of Operation	
							Yes	No	Therapeutic	Prophylactic
Total portacaval	25	21 (84)	4 (16)	53 ± 9	15 (60)	10 (40)	23 (92)	2 (8)	25 (100)	0
Partial portacaval	23	15 (65.3)	8 (34.7)	48 ± 9	13 (57.6)	10 (43.4)	20 (86.9)	3 (13.1)	23 (100)	0
Splenorenal	72	47 (65.3)	25 (34.7)	49 ± 12	41 (57)	31 (43)	32 (44.4)	40 (55.6)	68 (94.5)	4 (5.5)
Totals	120	83 (69.2)	37 (30.8)	50 ± 11	69 (57.5)	51 (42.5)	75 (62.5)	45 (37.5)	116**(96.6)	4 (3.4)

Figures in brackets are percentages.
* For definition see Table 3.
** For gastrointestinal hemorrhage in 115 patients; for ascites in one patient.

the oldest 74 years; 55% of the patients were aged over 50 years. Age distribution was approximately the same in the three operative groups.

The causes of cirrhosis are listed in Table 2. Alcoholic cirrhosis was the best represented form, being present in 75 (62.5%) of the 120 patients.

All the patients had esophagogastric varices as demonstrated by barium swallow and/or esophagogastroscopy. Two patients also had peptic ulcers. In 4 patients who had associated portal thrombosis revealed by angiography, the thrombus was removed at the time of shunting. The presence of hepatoma was routinely excluded. In 115 patients the indication for portal-systemic shunt was a history of bleeding from esophagogastric varices. We considered only subjects who had portal-systemic shunt as an elective procedure, performed at least 6 weeks after a bleeding episode. The patients were divided into "good-risk" and "poor-risk" categories (Table 3) according to a modification of the criteria proposed by Hermann *et al.*[12]

All the operations were performed under anesthesia with sodium gammahydroxybutyrate (Egic, 45-Amilly, France) and by an abdominal approach. Pressure in the portal vein and in the inferior vena cava, or in the splenic and renal veins, was measured before and after anastomosis. Special care was taken to keep blood loss to a minimum. During the last two years Australia-antigen-negative fresh blood only has been used.

Total portal-systemic shunt was effected either by end-to-side portacaval anastomosis (12 patients) or by large-stoma side-to-side portacaval anastomosis with a minimal stomal length of 20 mm and a portal-caval pressure gradient of about 3 mm Hg (13 patients). In small-stoma side-to-side portacaval anastomosis the maximal length of the stoma was 15 mm and the portal-caval pressure gradient was approximately 7 mm Hg. Splenorenal shunt was done by a modification of the technique introduced by Clatworthy and Boles in children.[8] In order to use as short a length of splenic vein as possible we cut the thick pad of lymphocellular tissue which in many adult cirrhotics lies to the left of the superior mesenteric artery and which may constitute an obstacle to bringing the splenic and renal veins together.

After operation, assessment of hepatic and cerebral function and roentgenographic investigation of the esophagogastric varices were performed routinely in each patient before discharge from the hospital. Angiographic visualization of the anastomosis was performed in 11 patients either by means of a catheter left in the umbilical vein, or by selective superior mesenteric angiography. Instructions were given to refrain from alcohol and from certain drugs, in particular drugs containing acetylsalicylic acid. Follow-up examinations were conducted at intervals of 2 months, 6 months, and one year after operation and thereafter annually. All the patients, except one of whom trace was lost, had been seen within 6 months of preparation of this paper in August 1972.

TABLE 2. *Causes of Hepatic Cirrhosis in 120 Patients Submitted to Portal-Systemic Shunt*

Type of Shunt	Type of cirrhosis					Number of Patients
	Alcoholic	Non-alcoholic				
		Postnecrotic	Primary Biliary	Hemochromatosis	Unknown	
Total portacaval	23	0	0	0	2	25
Partial portacaval	20	0	0	0	3	23
Splenorenal	32	7	2	2	29	72
Total	75	7	2	2	34	120

TABLE 3. *120 Patients with Hepatic Cirrhosis Submitted to Portal-Systemic Shunt. Criteria for Grouping in Relation to Surgical Risk*

Criteria	Good-risk	Poor-risk
Previous episodes of hepatocellular failure	0	+
Nutritional status	Good	Poor
Encephalopathy	0	+
Ascites	0 or under control	+
Serum albumin (g per 100 ml)	>3.0	<3.0
Serum bilirubin (mg per 100 ml)	<2.0	>2.0
Prothrombin time (% of normal)	>40	<40

Modified from Hermann *et al.*[15]

Results

Intraoperative Hemodynamics (Fig. 1). Of the 3 portal-systemic shunt procedures used, total direct portacaval anastomosis produced the greatest fall in portal pressure (14.6 mm Hg), the lowest post-shunt portal pressure (11.5 mm Hg), and a post-shunt portal-caval pressure gradient of 3.4 ± 3.1 (mean ± SD) mm Hg. Partial direct portacaval anastomosis lowered the portal pressure by only 9.6 mm Hg to 14.4 mm Hg, and maintained the highest portal-caval pressure gradient, namely, 7.2 ± 2.6 (mean ± SD) mm Hg. The difference between the portal-caval gradients after total and partial portacaval anastomosis respectively is significant ($P < 0.01$) (Fig. 2). Whereas splenorenal anastomosis gave a post-shunt splenic vein pressure of 15.1 mm Hg, that is, in the same order of values as portal vein pressure after partial direct portacaval anastomosis, it left a splenorenal pressure gradient of only 1.8 mm Hg.

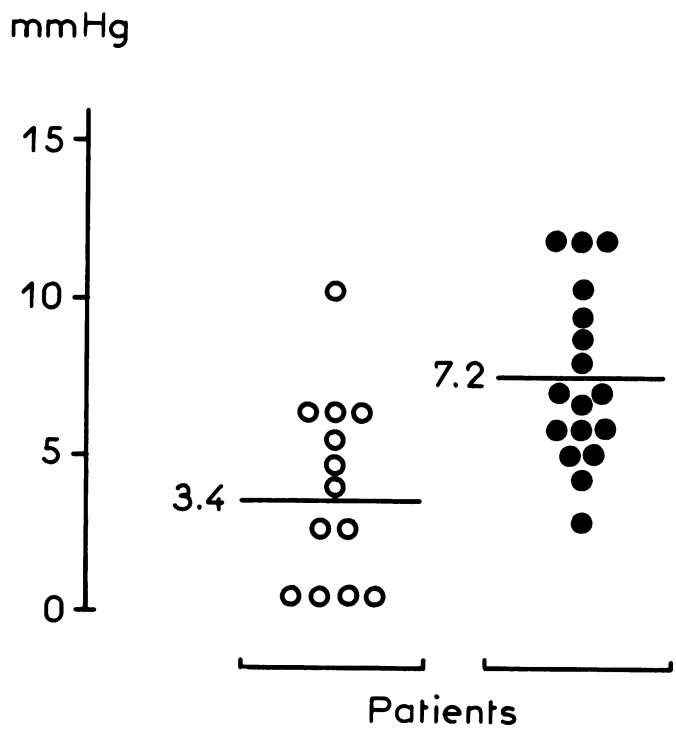

FIG. 2. Portal vein-inferior vena cava pressure gradients in 13 patients who had total direct portacaval anastomosis ○ and 17 patients who had partial direct portacaval anastomosis ● ($P < 0.01$).

Postoperative Angiography. After small-stoma side-to-side portacaval anastomosis diversion of portal blood was partial in all the cases studied; this is well illustrated in Figs. 3 and 4. After splenorenal anastomosis, on the other

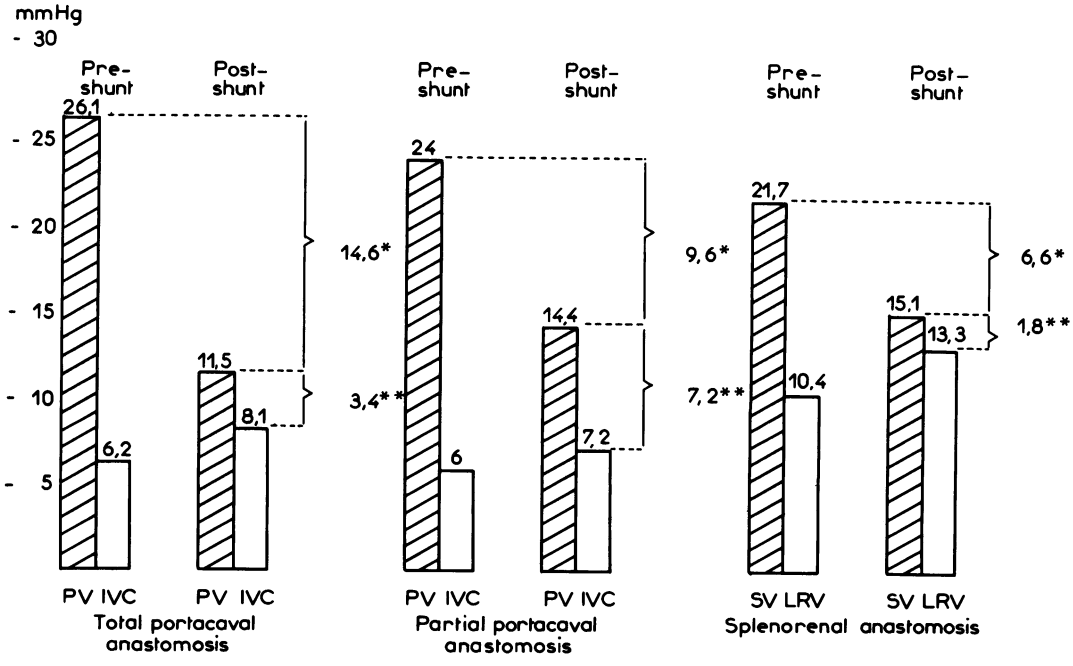

FIG. 1. Pre-shunt and post-shunt pressures (in mm Hg) after total direct portacaval anastomosis in 25 patients, partial direct portacaval anastomosis in 23 patients, and splenorenal anastomosis in 72 patients. P.V. = portal vein pressure. I.V.C. = inferior vena cava pressure. S.V. = splenic vein pressure. L.R.V. = left renal vein pressure. * Fall in portal (or splenic) vein pressure. ** Portacaval (or splenorenal) pressure gradient after shunt.

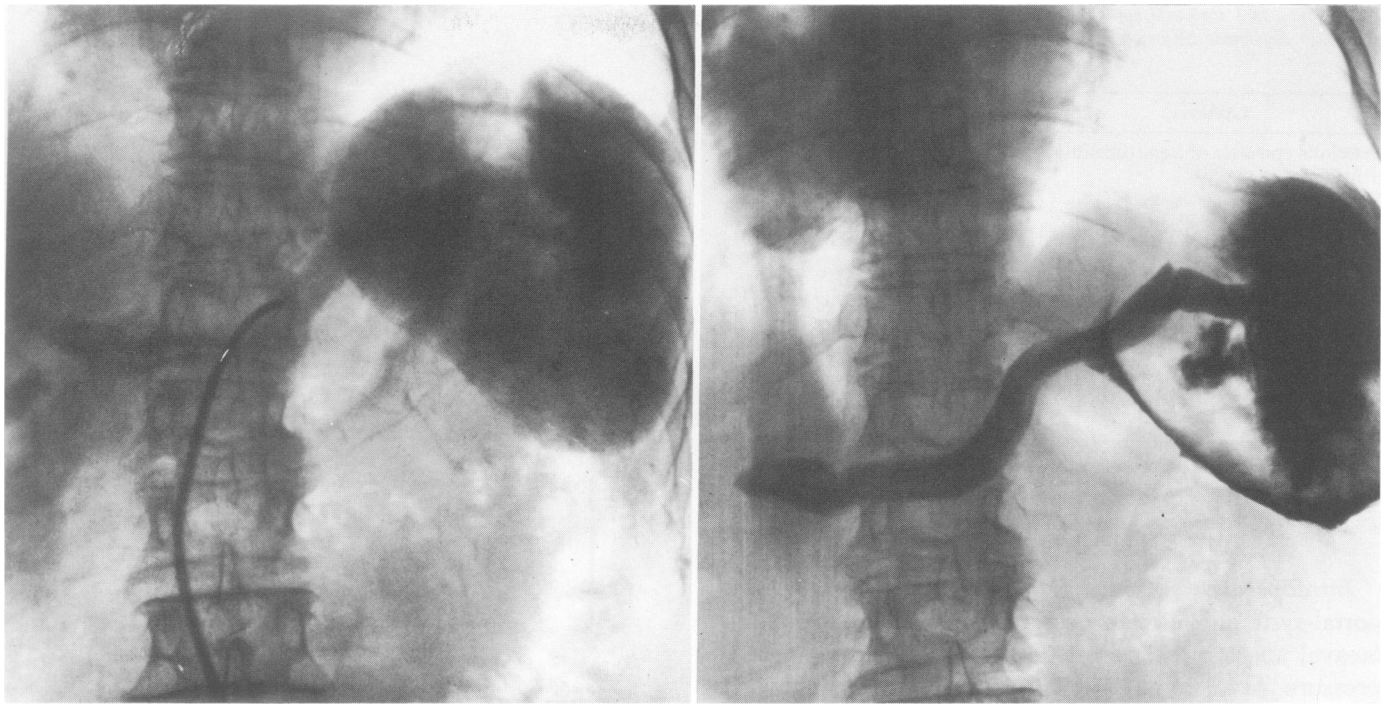

FIG. 3. Partial direct portacaval anastomosis. Postoperative angiographic follow-up study. a. Celiac arteriography, venous phase. The portal vein and its intrahepatic branches are visualized. b. Splenoportography. The portal vein is not visualized. All the contrast medium enters the vena cava.

hand, 2 types of hemodynamic pattern were observed, partial diversion of portal blood (Fig. 5) and total diversion of portal blood (Fig. 6).

Mortality. To the time of writing, 30 patients (25%) have died, 2 (1.6%) during the first 60 postoperative days and 28 (23.4%) at a later date. The operative mortality was nil.

Postoperative Mortality. The 2 patients who died during the immediate postoperative period, arbitrarily defined as the first 2 months after operation, were among

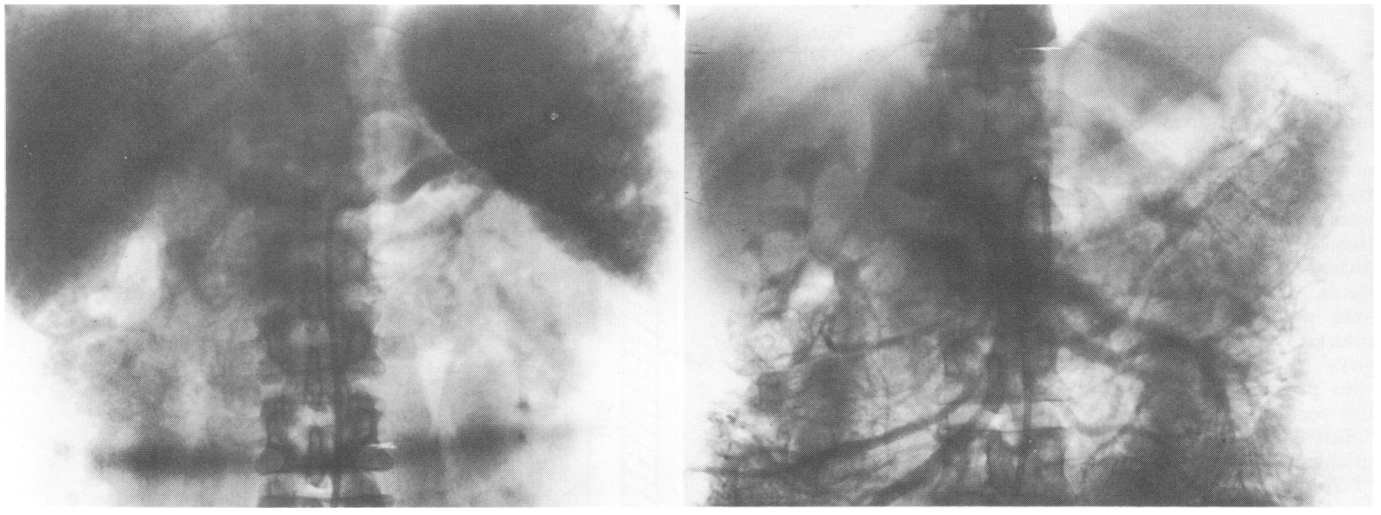

FIG. 4. Partial direct portacaval anastomosis. Postoperative angiographic follow-up study. a. Celiac arteriography, venous phase. The portal vein is opacified. b. Superior mesenteric arteriography, venous phase. Contrast medium is passing from the superior mesenteric vein into the vena cava.

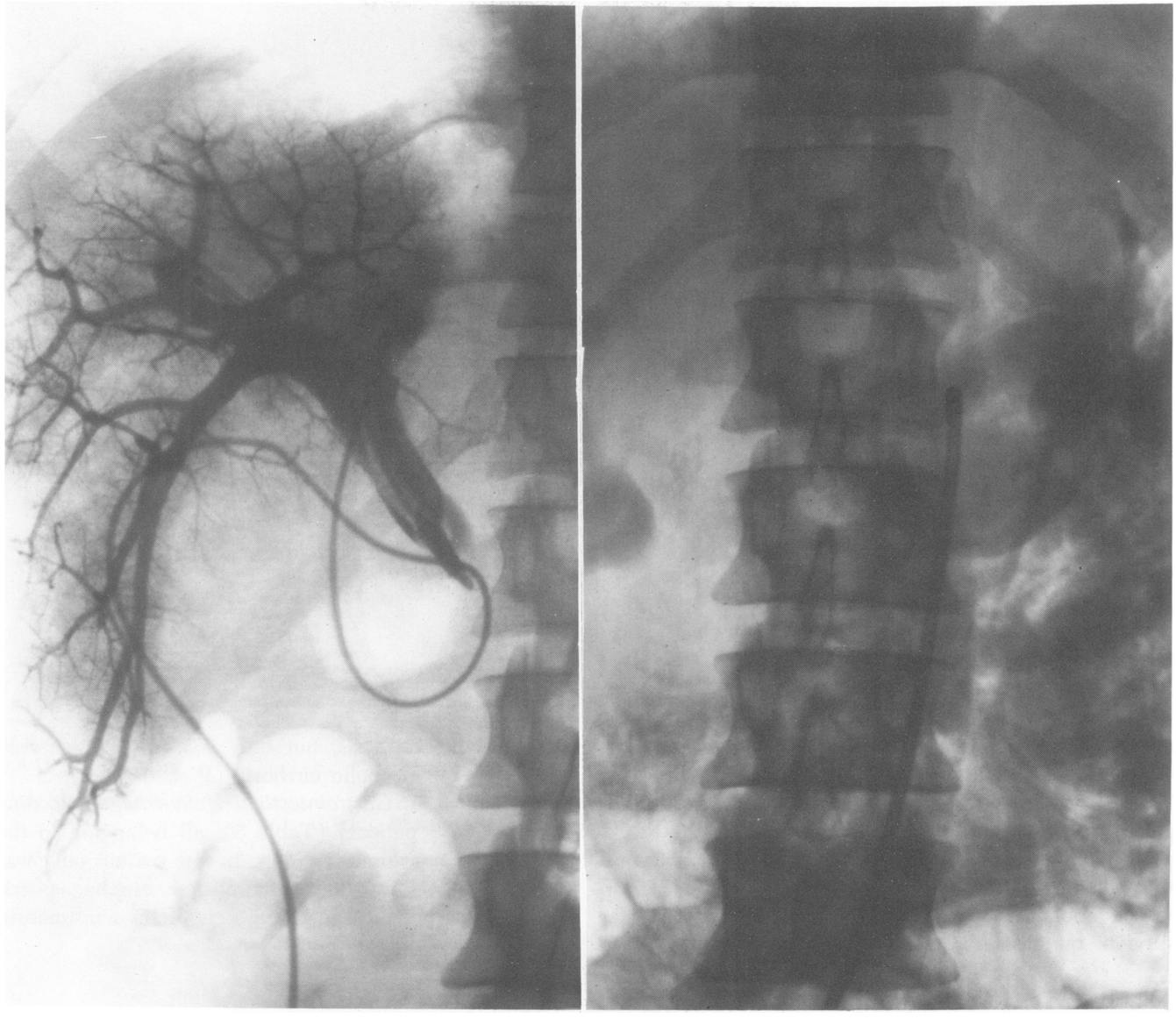

FIG. 5. Splenorenal anastomosis producing partial deviation of portal flow. Postoperative angiographic follow-up study. a. Umbilicography. The intrahepatic branches of the portal vein are opacified. The splenic vein is not opacified. b. Superior mesenteric arteriography, venous phase. All the contrast medium is flowing from the superior mesenteric vein into the splenic vein.

the first 20 patients operated on in our series of 120. They were a man aged 42 with non-alcoholic cirrhosis in whom septicemia developed 12 hours after splenorenal anastomosis and who died on the fourth postoperative day, and a man aged 46 with alcoholic cirrhosis who died from renal failure and ascites 17 days after end-to-side portacaval anastomosis.

Long-term Survival. Survival rates (Figs. 7 and 8) were computed by the actuarial method of analysis described by Cutler and Ederer.[9] Five-year survival was 65.9% for the whole series: 69.7% for total portacaval anastomosis; 65.8% for partial portacaval anastomosis; and 65.4% for splenorenal anastomosis. The differences between the groups are not statistically significant.

The principal non-immediate cause of death (Table 4) was hepatocellular failure, which was responsible for 60.7% of the deaths in the whole series. The group in which hepatocellular failure was most lethal was the splenorenal anastomosis group, in which it accounted for 70.6% of the deaths; this represented 12 patients, in 3 of whom hepatocellular failure was a consequence of viral hepatitis transmitted by blood transfusion. No deaths were due to recurrent bleeding. There was a statistically significant difference between survival in the "good-risk" patients and in the "poor-risk" patients (73.2% and 52.7% respectively ($P < 0.02$)) (Fig. 9). Patients

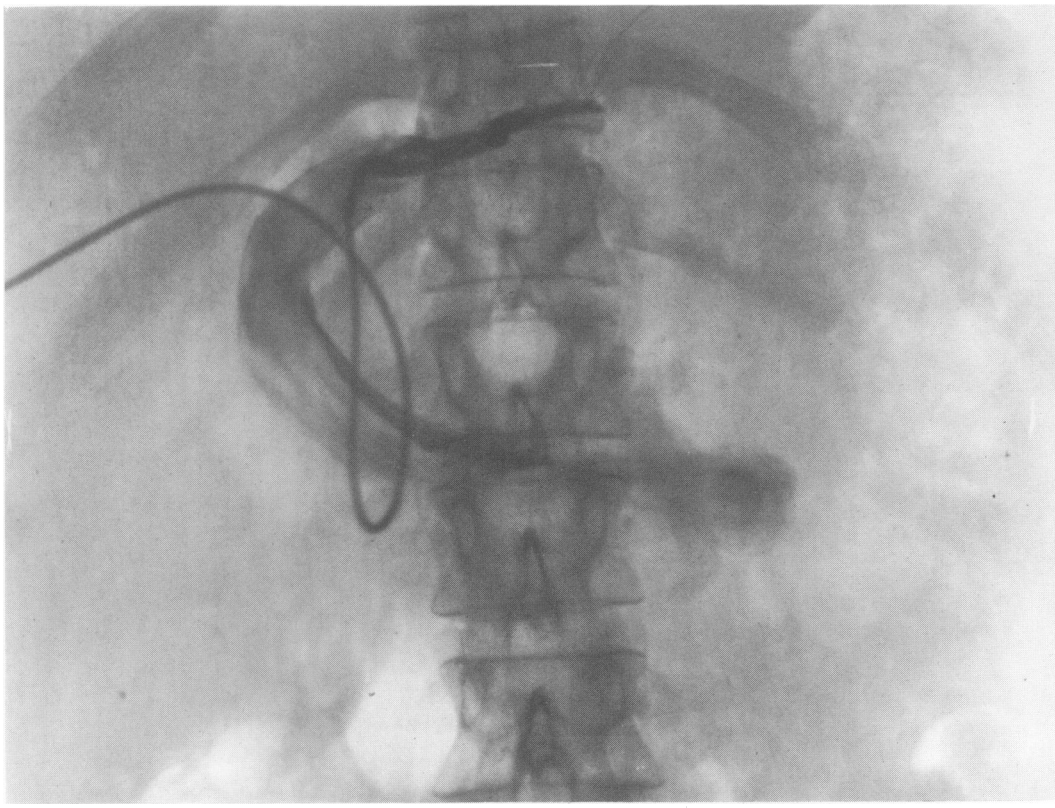

FIG. 6. Splenorenal anastomosis acting as a total shunt. Postoperative angiographic follow-up study. Umbilicography. All the contrast medium is flowing into the portal trunk and the splenic vein. The intrahepatic branches of the portal vein are not opacifed.

over 60 had a slightly better survival rate than patients under 60 (78.1% and 62.8% ($P < 0.05$)) (Fig. 10). Whether the cirrhosis was of alcoholic origin or not appeared to have no effect on survival during the first 2 postoperative years. Thereafter, survival was better in the non-alcoholic group than in the alcoholic group (77.8% and 55.5% ($P < 0.02$)) (Fig. 11). The 5-year survival rate was 88.2% in 31 "good-risk" patients with non-alcoholic cirrhosis, but only 38% in 38 "poor-risk" patients with alcoholic cirrhosis ($P < 0.001$).

Recurrence of Gastrointestinal Hemorrhage. Bleeding recurred in 5 patients (Table 5), all belonging to the splenorenal anastomosis group. In one patient only was recurrent bleeding due to ruptured esophagogastric varices; this patient had thrombosis of his anastomosis, confirmed by angiography.

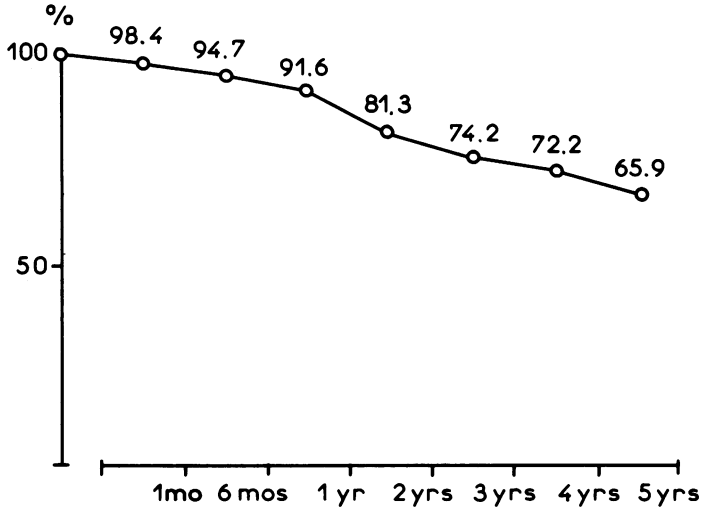

FIG. 7. Five-year survival curve, calculated by the actuarial method of analysis,[9] in 120 patients who underwent portal-systemic shunt operations.

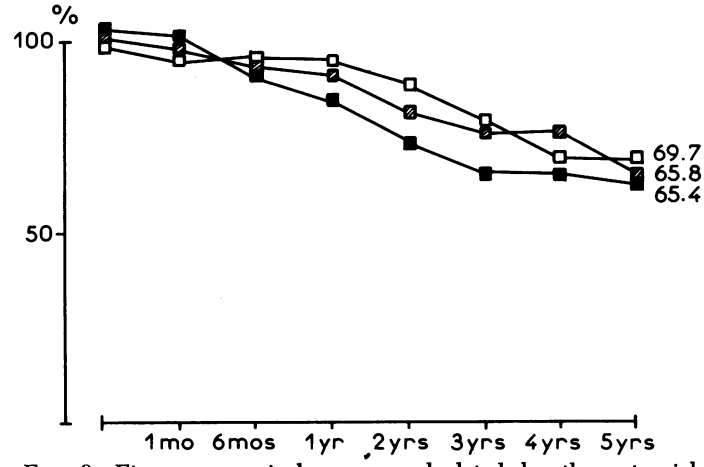

FIG. 8. Five-year survival curves, calculated by the actuarial method of analysis,[9] in 25 patients who had total direct portacaval anastomosis □, 23 patients who had partial direct portacaval anastomosis ▨, and 72 patients who had splenorenal anastomosis ■.

TABLE 4. *Causes of Death Later than Second Postoperative Month in 28 of 120 Patients Submitted to Portal-Systemic Shunt*

Type of Shunt	Cause of death: Hepatocellular Failure	Hepatoma	Cerebral Hemorrhage	Unknown	Total Deaths
Total portacaval	2 (50)	1 (25)	0	1 (25)	4
Partial portacaval	3 (42.8)	0	1 (14.4)	3 (42.8)	7
Splenorenal	12* (70.6)	1 (5.8)	0	4 (23.6)	17
Total	17 (60.7)	2 (7.2)	1 (3.6)	8 (28.5)	28

It is to be noted that there were no deaths from recurrence of gastrointestinal hemorrhage.
Figures in brackets are percentages.
* In 3 of these patients hepatocellular failure was due to viral hepatitis transmitted by way of blood transfusion.

Esophagogastric Varices. Roentgenographic examination by barium swallow 15 days after operation in 86 patients (Table 6) revealed disappearance of the esophagogastric varices in 65 (75.5%), diminution in 18 (20.9%), and no change in 3 (3.6%). The varices had disappeared in 84% of the patients who had had total direct portacaval anastomosis, in 80% of those with partial direct portacaval anastomosis, but in only 71% of those with splenorenal anastomosis. In 2 of the 3 patients in whom the state of the varices was unchanged angiographic examination disclosed thrombosis of the anastomosis.

Hepatic Encephalopathy. The 14 patients in whom encephalopathy developed constituted 15.5% of the 90 survivors (Table 7). The severity of encephalopathy did not vary appreciably with shunt type. The percentage incidence of the severe form was highest in the patients with small-stoma portacaval anastomosis (6.2%), but this was the smallest group.

Discussion

Many types of portal-systemic shunt have been elaborated, but careful perusal of the literature reveals no outstanding clinical advantages in any of them.

Splenorenal anastomosis has long been regarded as a better procedure than direct portacaval anastomosis. Grace *et al.*,[10] in their analysis of the data in 154 papers, found a lower incidence of encephalopathy after splenorenal shunt (13.4%) than after portacaval shunt (22.2%). Barnes *et al.*[1] found a 5 times lower incidence of fatal liver failure and of shunt encephalopathy in patients selected for splenorenal shunt than in patients selected for portacaval shunt; their 5-year survival was 47% with splenorenal shunt as opposed to 31% with portacaval shunt. However, although these studies showed that the splenorenal shunt had less severe hepatic repercussions than the portacaval shunt, they also showed that it had a higher incidence of recurrent hemorrhage and of thrombosis of the anastomosis. They did not demonstrate a clear-cut relation between the hemodynamic characteristics of shunts and their clinical results.

The better results reported as regards long-term survival and incidence of encephalopathy with splenorenal than with other types of portal-systemic shunt[1,10,11,16] are as yet unexplained. It may be that the low frequency of

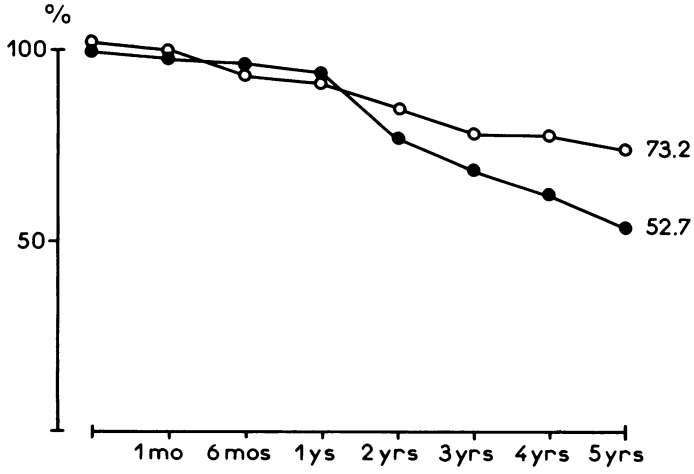

FIG. 9. Five-year survival curves after portal-systemic shunt in 69 "good-risk" patients ○ and 51 "poor-risk" patients ● ($P < 0.02$).

FIG. 10. Five-year survival curves after portal-systemic shunt in 26 patients over age of 60 years at time of operation ○ and 94 patients under age of 60 years at time of operation ● ($P < 0.05$).

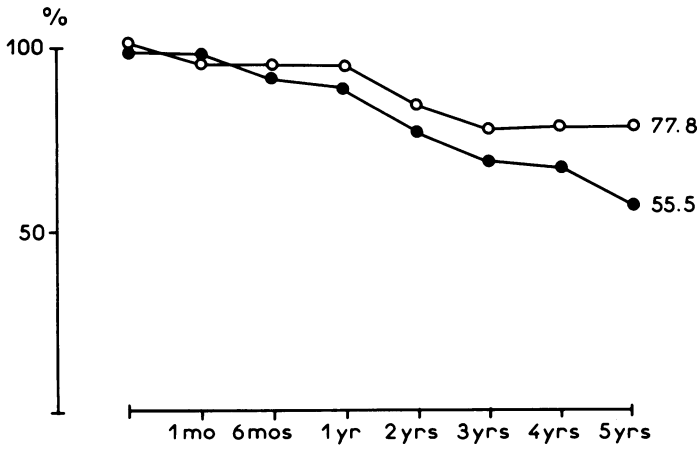

FIG. 11. Five-year survival curves after portal-systemic shunt in 49 patients with non-alcoholic cirrhosis ○ and 71 patients with alcoholic cirrhosis ● ($P < 0.02$).

encephalopathy is due to a high frequency of thrombosis of the anastomosis.

Much work has been done in recent years in devising new shunt techniques, especially in the search for decompressive procedures which would maintain portal perfusion of the liver;[2,6,17,19,22] these techniques include arterialization of the hepatic stump of the portal vein, side-to-side splenorenal shunt, and selective decompression of esophageal varices by a distal splenorenal shunt.

In 1970 Britton and his colleagues[6] reported side-to-side central splenorenal venous anastomosis with preservation of the spleen. It does not emerge clearly from these authors' hemodynamic studies that the deviation was truly selective, or, more specifically, that splenic flow alone was shunted into the systemic system leaving a substantial portal flow to the liver. Their clinical results, moreover, do not plead convincingly in favor of the procedure.

Decompression by a selective distal splenorenal shunt was proposed by Warren *et al.*[22] in 1967, and favorably reported on in a comparative study by Salam *et al.*[19] in 1971. Portal vein perfusion of the liver was well maintained and total hepatic blood flow unchanged or only mildly decreased. There was no long-term mortality, no encephalopathy, and no recurrence of variceal bleeding. However, the number of patients is too small and the follow-up period too short to justify a conclusion that this device for preserving portal flow is superior to large shunts. As the authors say, these studies do not show that hemodynamic differences in shunts exert a significant effect on postoperative morbidity and on longevity.

In our experience, hemodynamics had no discernible effect on the clinical results of portal-systemic shunts. That each of the 3 types of portal-systemic shunt constructed in this study produced its own specific hemodynamic consequences is clear from the pressure readings (Figs. 1 and 2). Equally clear is the fact that early postoperative mortality (2 out of 120), long-term survival, recurrence of gastrointestinal hemorrhage (Table 5), persistence of esophagogastric varices (Table 6), and incidence of encephalopathy (Table 7) were independent of the type of shunt and therefore of the hemodynamic alterations which the shunt had effected.

The hemodynamic consequences of splenorenal anastomosis in our hands were not uniform: in some cases it acted as a partial shunt, in others as a total shunt. The effects depend on several factors, notably the caliber of the splenic and renal veins, and the caliber and technique of the anastomosis. The post-shunt splenorenal pressure gradient in our patients with splenorenal anastomosis was low (1.8 mm Hg (Fig. 1)). Salam *et al.*[19] noted the same phenomenon after splenorenal shunt and attributed it to inability of the left renal vein to accommodate the increased flow without an elevated pressure. Perhaps it is the most important factor in limiting shunt flow in this procedure. On the other hand, if the anastomosis is wide, and centrally placed on the splenic vein, the shunt is liable to have the same effect as a total side-to-side direct portacaval anastomosis, and thus divert all portal blood into the systemic system. The different effects of the shunts illustrated in Figs. 5 and 6 are of interest in this connection. In addition, the hemodynamic effects of a splenorenal shunt may well change after operation. An increase in the caliber of the splenic and renal veins will increase the volume of blood shunted. In one of our patients a 14 mm stoma at operation measured 30 mm at necropsy. These considerations suggest that

TABLE 5. *Recurrence of Gastrointestinal Hemorrhage in 5 of 120 Patients after Portal-Systemic Shunt*

	Cause of Recurrent Hemorrhage				
Type of Shunt	Esophagogastric Varices	Duodenal Ulcer	Aspirin	Unknown	Total Recurrences
Total portacaval	0	0	0	0	0
Partial portacaval	0	0	0	0	0
Splenorenal	1* (1.4)	1 (1.4)	1 (1.4)	2 (2.6)	5 (6.8)
Total	1 (0.8)	1 (0.8)	1 (0.8)	2 (1.7)	5 (4.1)

Figures in brackets are percentages.
* Shunt thrombosed.

TABLE 6. *Status of Esophagogastric Varices as Revealed by Barium Swallow in 86 of 120 Patients on 15th Day after Portal-Systemic Shunt*

Type of Shunt	Status of Varices			Number of Patients
	Disappeared	Reduced	Unchanged	
Total portacaval	16 (84)	3 (16)	0	19
Partial portacaval	12 (80)	3 (20)	0	15
Splenorenal	37 (71)	12 (23)	3* (6)	52
Total	65 (75.5)	18 (20.9)	3 (3.6)	86

Figures in brackets are percentages.
* Shunt thrombosed in 2.

splenorenal anastomosis cannot be utilized for study of the hemodynamic consequences of portal-systemic shunt. Analysis of 2 hemodynamically different shunts, conventional direct portacaval anastomosis and small-stoma side-to-side portacaval anastomosis, discloses no significant difference in the clinical results. It would thus appear that hemodynamic changes are not the chief factor determining the outcome in portal-systemic shunt.

To sum up, it is our view that the volume of portal vein flow in portal deviations is less important than many studies suggest. It is possible, although not yet proven, that in certain cirrhotic subjects, especially those with a high pre-shunt portal flow, the maintenance of a hepatopetal post-shunt portal flow may be beneficial. The practical application of this concept, however, is fraught with difficulty. The ideal would be to select patients for this or that type of shunt according to their preoperative hemodynamics,[15] in particular their portal vein flow, but no method for measuring this before operation has as yet been devised, and current methods for measurement during operation are not altogether reliable. The fashioning of a shunt which would ensure adequate and time-resistant portal venous perfusion of the liver is not easy and is not achieved satisfactorily either by the side-to-side splenorenal anastomosis described by Britton *et al.* or by central splenorenal anastomosis as performed by us. More reliance, one feels, can be placed on the distal splenorenal procedure of Warren and his colleagues, but whether it is practicable in all patients, and whether certain complications inherent in the technique and which are liable to lead to operative and postoperative deaths and to anastomotic thrombosis are within acceptable limits, has yet to be determined.

In parallel with the quest for portal deviation procedures which would be better tolerated by the cirrhotic liver, there has been a steady fall in the postoperative mortality from portal-systemic anastomosis, at least in patients not operated on during episodes of gastrointestinal bleeding. Over the last 2 decades postoperative mortality rates have been reported as follows: in 1955, 23%;[5] in 1966, 17.7%;[10] and in 1970, 10%.[7] The 5-year survival rate has also improved in recent years. In the series reported here early postoperative mortality was 1.6% and 5-year survival was 65.9%.

A further noteworthy feature of this study, and one which is contrary to the experience of many investigators,[12,18] is the better 5-year survival after portal-systemic shunt in patients over 60 years of age (Fig. 10). A possible explanation is that at this time of life cirrhosis is non-progressive. It would thus appear that age is not a contra-indication to a shunting procedure. Like most workers, we found a particularly good life expectancy in patients with non-alcoholic cirrhosis belonging to the "good-risk" group, that is, the group without hepatocellular failure. These facts go to show that complications inherent in hepatic cirrhosis, and the evolution of the disease itself, have an important bearing on the prognosis after portal-systemic shunt.

Encephalopathy was less frequent in our patients than in other series; at 5-year follow-up we had an incidence of 12.5%, which compares favorably with the 57% reported by Voorhees *et al.*[20] Persistent alcoholic indulgence is generally held to be a major factor in the production of encephalopathy in shunted cirrhotic subjects. It may be that the relative facility with which French patients give up alcohol was contributory to the low incidence of encephalopathy in our series. Alcoholism in France is more a misguided social habit than a symptom of deep-rooted psychologic abnormality.

Whatever the reason for these improved figures, they are unlikely to be related to hemodynamic factors, since they emerged independently of the type of portal deviation used. More probably they are attributable to improvement in accessory conditions such as preoperative preparation of the patient, operative technique, in particu-

TABLE 7. *Incidence of Encephalopathy Among 90 Survivors of 120 Patients Submitted to Portal-Systemic Shunt*

Type of Shunt	Grade of encephalopathy*				Total with encephalopathy	Total survivors	Total operated on
	None	Minimal	Moderate	Severe			
Total portacaval	18 (90)	2 (10)	0	0	2 (10)	20	25
Partial portacaval	12 (75)	2 (12.6)	1 (6.2)	1 (6.2)	4 (25)	16	23
Splenorenal	46 (85.1)	4 (7.4)	2 (3.7)	2 (3.7)	8 (14.8)	54	72
Total	76 (84.5)	8 (8.9)	3 (3.3)	3 (3.3)	14 (15.5)	90	120

Figures in brackets are percentages of the 90 survivors.
* As defined by Voorhees *et al.*[26]

lar the use of the abdominal approach, and postoperative care. A variety of non-specific influences, which may at first sight seem to be of minor relevance, may trigger postoperative complications, and some of these may form the starting point of terminal hepatic failure. Preoperative detection of hepatoma, use of Australia-antigen-negative blood for transfusion in order to minimize the risk of hepatitis, frequent follow-up examinations, and surveillance of continued abstention from alcohol, all contribute to better long-term survival statistics, and should not be lost to view in the search for more sophisticated surgical procedures. These latter may produce results which are hemodynamically superior but whose advantages are liable to be annulled by complications inherent in the techniques themselves. Perhaps complex procedures are better tolerated by some patients than by others, but no accurate methods for preselecting such patients are available.

Summary and Conclusions

Portal-systemic shunts have been performed in 120 patients with portal hypertension due to hepatic cirrhosis. Three types of shunt procedure were used: 1) total direct portacaval anastomosis in 25 patients; 2) partial direct portacaval anastomosis in 23 patients; and 3) splenorenal anastomosis in 72 patients. The greatest reduction in portal pressure was obtained with total direct portacaval anastomosis. Although splenorenal anastomosis is, theoretically, a partial portal-systemic shunt, it was found to function in some cases as a total shunt. No significant differences were found between the 3 shunt types as regards postoperative mortality, long-term survival, recurrence of gastrointestinal hemorrhage, persistence of esophagogastric varices, or occurrence of hepatic encephalopathy. Therefore the authors believe that type of shunt and hemodynamic factors are not of primary importance in determining the results of shunting procedures. The results obtained in the study reported here, including an immediate postoperative mortality of 1.6% and a 5-year survival rate of 65.9%, with a very low incidence of recurrent hemorrhage and of encephalopathy, are better than those hitherto reported for portal-systemic shunts in cirrhosis. This is in step with the current general trend towards improved results in the surgery of portal hypertension, a trend which the authors ascribe to better understanding of the disease, better patient management, and more active attempts to eliminate the non-specific factors which augment the mortality and morbidity of the surgical procedure. Efforts to devise shunting techniques which may appear, in theory, to be more effective hemodynamically should not divert attention from these other influences.

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