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Differential portal pressures in relation to prognosis and to survival of patients undergoing portacaval shunt

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In patients with cirrhosis of the liver and portal hypertension, hemorrhage from esophageal varices is a major cause of death. A portacaval shunt provides excellent protection against recurrent episodes of hemorrhage, and is our preferred procedure for decompression of the portal venous system.

The operative mortality from shunt procedures, however, continues to be from 10 to 15 percent,[1-3] and postoperative complications, particularly chronic hepatic encephalopathy, may be difficult and distressing to manage. The importance of careful selection of patients who will survive the operation and regain satisfactory function of the liver must be repeatedly emphasized. We are continuing to seek means to improve our selection of patients for portal-systemic shunt operations.

Factors that have been shown to influence survival and prognosis in patients undergoing portacaval shunt include the preoperative functional status of the liver, the histologic type of cirrhosis, the age of the patient, and whether the operation can be performed as an elective procedure or must be done under emergency circumstances.[4] Another factor that has been considered to affect prognosis is the hemodynamics of the portal venous system measured at the time of operation.[5-8]

This report presents a study of differential portal pressures measured at

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operation in a group of 77 patients who underwent portacaval shunts at the Cleveland Clinic Hospital, and evaluates these findings in relation to prognosis and to survival of the patients.

CLINICAL MATERIAL AND METHODS

The 77 patients (39 men and 38 women) included in this study were selected from 125 patients in whom portal-systemic shunts were performed in the period 1958 through 1967 at the Cleveland Clinic Hospital. The only requirement for inclusion in the series was that portal pressure values had been documented in reasonably complete records. Sixty-five end-to-side and 12 side-to-side portacaval shunts were constructed in the 77 patients. The ages of the patients ranged between 7 and 72 years, with a mean of 48 years. Previous bleeding from esophageal varices, confirmed by endoscopy or by contrast roentgenography, was the major indication for a shunt. Five patients were operated upon for medically intractable ascites.

Preoperatively, all patients were assigned either to good- or to poor-risk categories based upon liver function studies (*Table 1*).[9] Postoperatively, these data were again used in reassignment either to a good- or to a poor-result group. All postoperative deaths (30-day mortality) and all late deaths from hepatic failure were included in the poor-result group.

The complete series of portal pressures, recorded in millimeters of saline at the time of operation, included: the unoccluded or free portal pressure before the shunt, the hepatic and splanchnic pressures on either side of the occluded portal vein (*Fig. 1*), and the portal pressure after construction of the shunt (postshunt pressure). The difference between the free and the postshunt portal pressures represents the reduction in portal hypertension. The difference between the splanchnic and hepatic portal pressures indicates the perfusion or gradient pressure and suggests the degree of intrahepatic obstruction to portal flow.

Table 1.—*Classification of operative risk on the basis of liver function**

Factor	Good	Poor
Serum albumin, g per 100 ml	>3.0	<3.0
Serum bilirubin (total), mg per 100 ml	<2.0	>2.0
Sulfobromophthalein retention, % in 45 min	<25	>25
Prothrombin time, % of normal	>40	<40
Ascites	Minimal	Moderate
Neurologic findings	Normal	Abnormal
Nutrition	Adequate	Poor

*(Courtesy of Rodríguez, A. E.; Hermann, R. E., and McCormack, L. J.: Portal-systemic shunts in the treatment of portal hypertension. Cleveland Clin. Quart. **32:** 181–189, Oct. 1965; and the *Cleveland Clinic Quarterly*.)

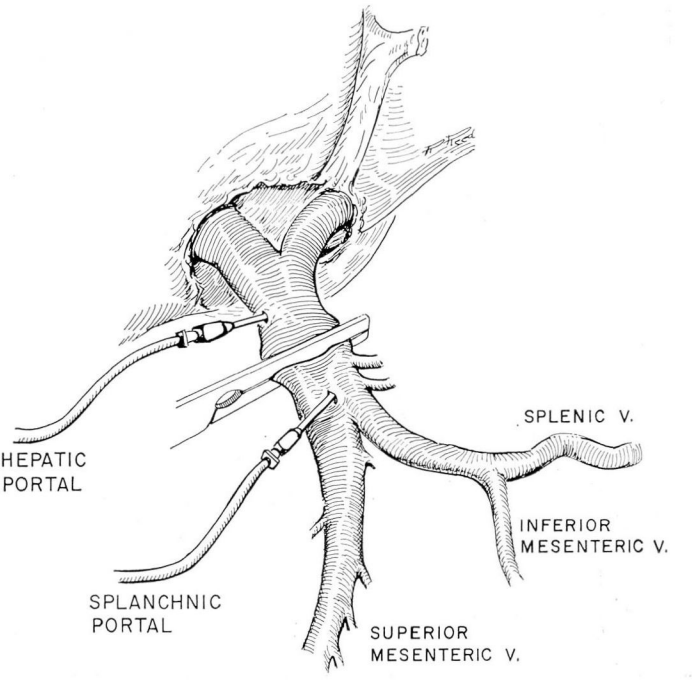

Fig. 1. Artist's illustration showing portal vein occluded by a vascular clamp. Needles are connected to saline-manometer set up to measure hepatic and splanchnic portal pressures.

RESULTS

The operative mortality in the 77 cases was 15.6 percent; since 1962, with improved selection of patients, operative mortality has approached 12 percent. Good results were achieved in 65 percent of all shunts. Among 65 elective operations, 45 (69 percent) good results were obtained; there were nine (14 percent) postoperative deaths, nine (14 percent) late deaths attributed to hepatic failure, and two (3 percent) cases of chronic encephalopathy. Twelve emergency procedures gave five (42 percent) good results, three (25 percent) postoperative deaths, one (8 percent) late death, and three (25 percent) cases of chronic encephalopathy.

The free portal and postshunt pressures in 75 consecutive patients are graphically shown in *Figure 2* to provide a random impression of their distribution. There is no distinct trend. Extremes of free portal and postshunt pressures and pressure drops are comparable in patients with good or with poor postoperative results. A random comparison between the hepatic portal and splanchnic portal pressures in 62 patients is also inconclusive (*Fig. 3*). The greatest extremes in gradient (510 mm and 650 mm) occurred in two patients who had poor results, but no general pattern is apparent. Patient 62

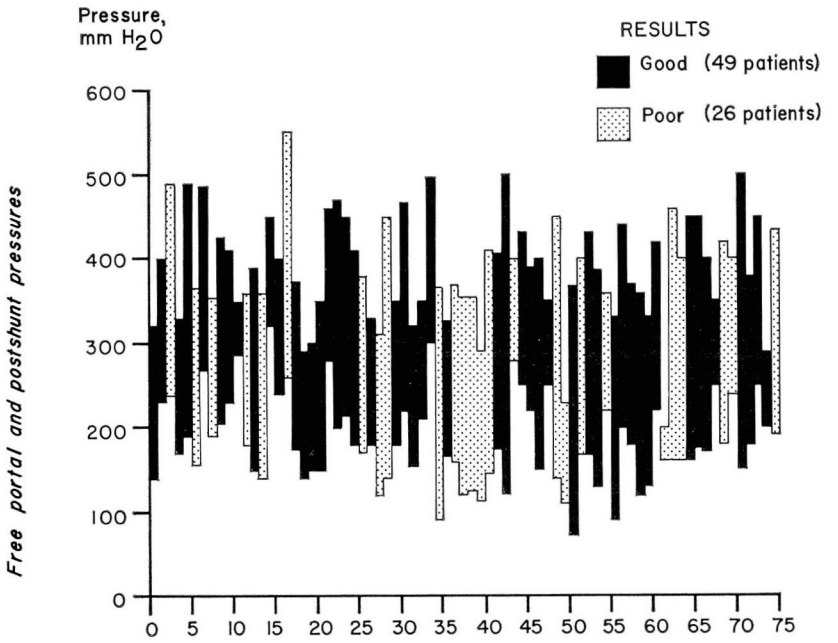

Fig. 2. Bar graph illustrating free portal and postshunt pressures in 75 consecutive patients. The length of the bar between values represents the drop in pressure achieved by the shunt.

represents the only example of reversed hepatic-splanchnic portal flow with the portal vein functioning as an outflow channel.

Of the 77 patients, 69 were classified preoperatively as having good liver function. Of this group, 45 patients survived and did well; 24 patients had poor long-term results. *Figure 4* shows the comparison of *mean* pressures and the range of pressures for the 45 patients who did well as compared to the 24 patients who had poor results. There is no apparent difference between the two groups in regard to the mean pressures.

Eight patients underwent shunt procedures in spite of poor preoperative liver function; four had good results and four had poor results (*Fig. 5*). In this group also, there was no demonstrable difference in mean pressure values.

Survival of this series of patients was assessed with the aid of the life table method of analysis[10] (*Fig. 6*). The two-year survival for all patients suitable for analysis was 70 percent; the five-year survival was 65 percent. The average length of follow-up in the series was two years; the patient surviving longest is alive at nine years.

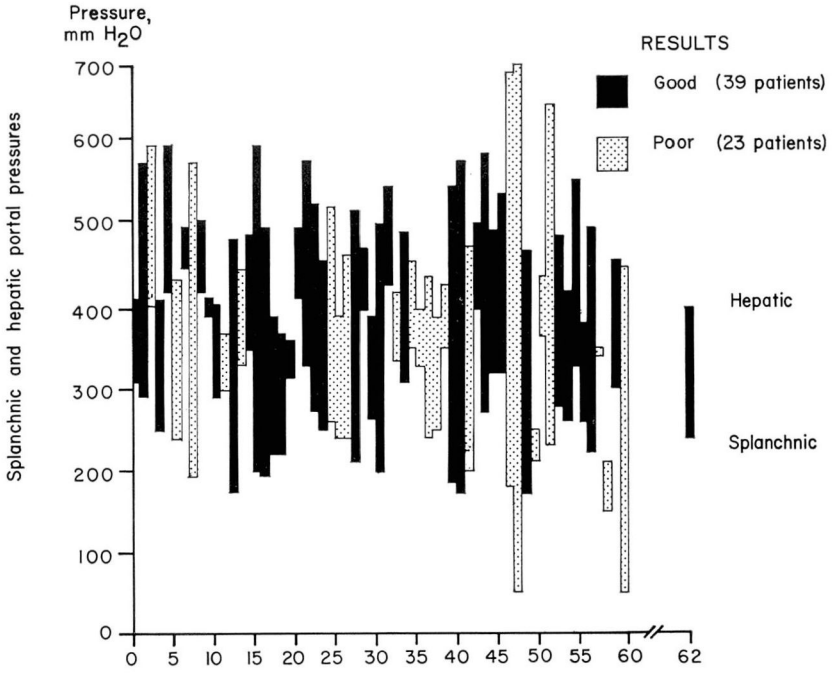

Fig. 3. Bar graph illustrating splanchnic and hepatic portal pressures in 62 consecutive patients in whom these pressures were recorded.

COMMENT AND CONCLUSIONS

The selection of patients for a portacaval shunt depends upon many factors, some of which need further clarification. Liver function is the most important factor we can identify and must be carefully assessed preoperatively. Another possible factor, that of portal hemodynamics, has been studied. From the results reported here, we believe that the pattern of portal pressures measured at the time of operation is not useful in predicting the results of portacaval shunt procedures. There is no apparent correlation between differential portal pressures and prognosis.

These findings are in contradistinction to those of Warren and associates[8] who, in a study of 29 patients, indicated that the operative portal pressures might have prognostic implications. They classified patients into three stages, depending upon the degree (height) of portal hypertension measured at the time of surgery (*Table 2*). In their study, patients with stage 1 portal hypertension, had a greater incidence of postoperative liver failure after portacaval shunt than did patients with stage II or stage III portal hypertension. In *Table 3,* the 77 patients in our study have been grouped according

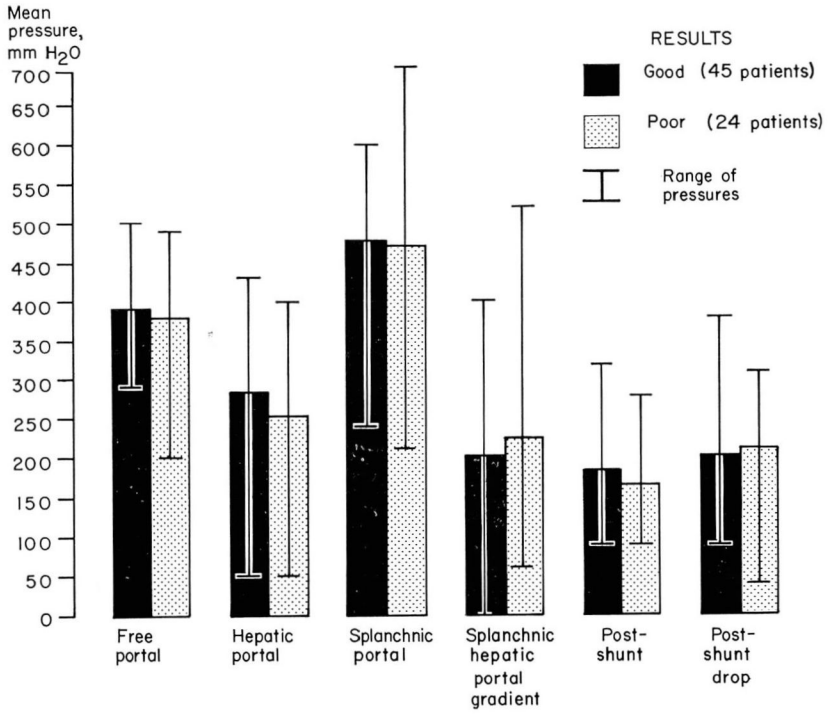

Fig. 4. The mean and range of pressures in 69 patients with good preoperative liver function, contrasting good and poor postoperative and long-range results.

to Warren and associates' classification into three stages. There is no clear-cut difference, in regard to good or poor results, among the stages.

Portal hemodynamics, determined at the time of surgery, have also been considered by Price, Voorhees, and Britton[2] as an important factor in the survival of patients. They state that operative pressures may be useful in selecting the type of shunt to be performed, but conclude that the functional capacities of the liver vary widely and independently of the portal pressures that are measured.

A careful analysis of our data for the group of 77 patients, reported here, supports the conclusion that there is no correlation between differential portal pressures and preoperative liver function or postoperative results.

SUMMARY

This study of 77 patients examines the prognostic significance of portal pressure measurements recorded at portacaval shunt. The pressures investigated included free portal pressure, hepatic and splanchnic portal pressures, the gradient pressure, and the fall in portal pressure after the shunt proce-

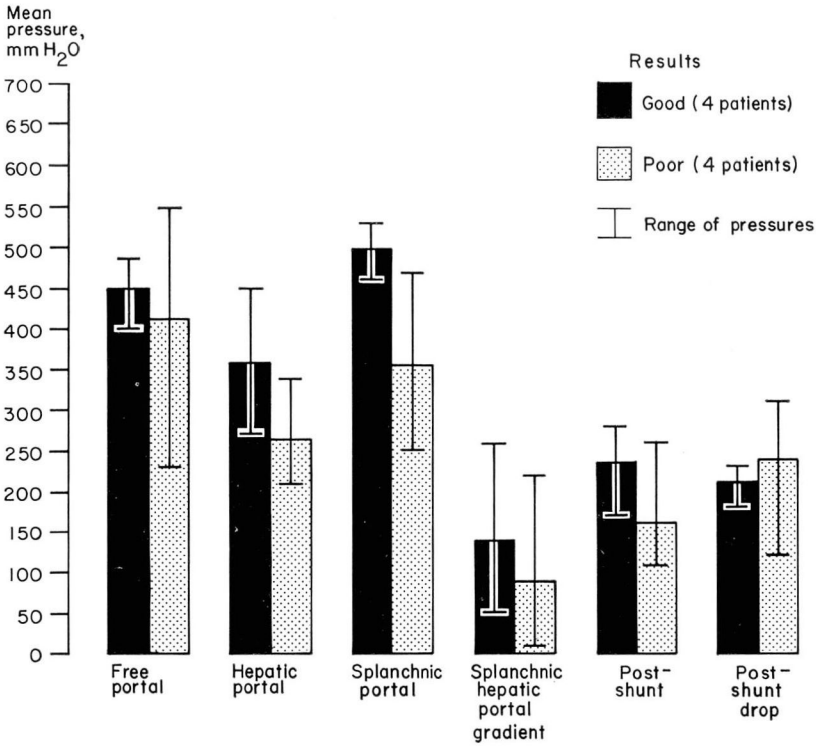

Fig. 5. The mean and range of pressures in eight patients with poor preoperative liver function, contrasting good and poor postoperative and long-range results.

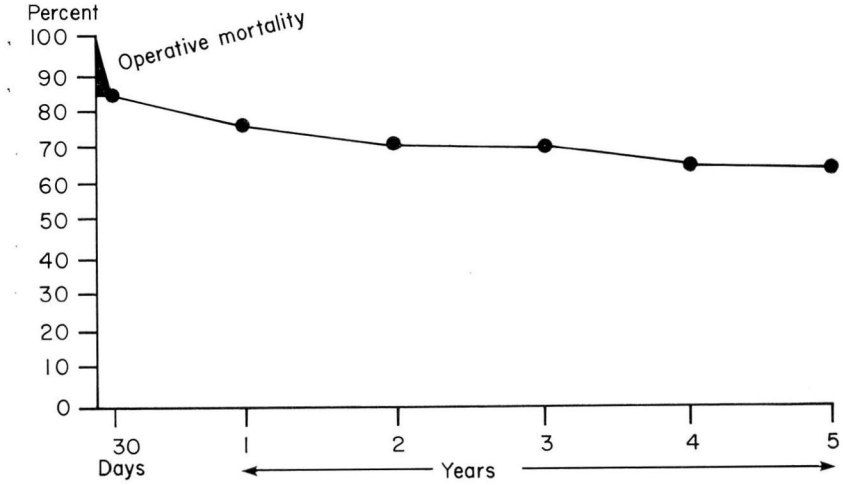

Fig. 6. Survival of 77 patients after portacaval shunt.

Table 2.—*Stages* of portal hypertension*

Stages	Pressures, mm of H_2O		
	Free portal	Hepatic portal	Gradient
I	<350	<250	>30
II	350–400	250–400	>400
III	>400	>400	<15

* Adapted from Warren and associates.[8]

Table 3.—*Stages* of portal hypertension—postshunt results in 77 patients*

Stage	Results, no. of patients	
	Good	Poor
I	14	10
II	20	12
III	15	6
	—	—
Total	49	28

* Adapted from Warren and associates.[8]

dures. These differential pressures were evaluated in regard to preoperative and postoperative liver function and to postoperative survival and long-term results. Our studies show no correlation between differential portal pressures and liver function or postoperative survival. We have concluded that portal pressure measurements are of no value in predicting survival or functional recovery of patients who have undergone portacaval shunt.

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