Is Portal-systemic Shunt Worthwhile in Child's Class C Cirrhosis?

Long-term Results of Emergency Shunt in 94 Patients With Bleeding Varices

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A prospective evaluation was conducted of 94 unselected patients ("all comers") with biopsy-proven Child's class C cirrhosis (93% alcoholic) and endoscopically proven acutely bleeding esophageal varices who underwent emergency portacaval shunt (EPCS) (85% side-to-side, 15% end-to-side) within 8 hours of initial contact (mean, 6.1 hours) during the past 12 years. Follow-up has been 100% and includes all patients for at least 1 year, and 61 patients (65%) for 5 to 12 years. Incidence of serious risk factors on initial contact was: ascites, 97%; jaundice, 86%; portal-systemic encephalopathy including past history, 71%; severe muscle wasting, 96%; alcohol ingestion within 7 days, 66%; delirium tremens, 16%; serum albumin, ≤2.5 g/dL 76%; indocyanine green dye retention ≥ 50% in 45 minutes, 66%; serum glutamic-oxaloacetic transaminase ≥ 100 units/L, 60%; hyperdynamic cardiac output ≥ 6 L/minute, 98%. Mean Child's point score was 13.7 out of a maximum of 15. EPCS reduced mean corrected free portal pressure from 286 to 23 mm saline, and permanently controlled variceal bleeding in every patient. Of the 94 patients, 74 (80%) left the hospital alive and 68 (72%) survived 1 year. Five-year actuarial survival rate is 64%. Hepatic failure was the main cause of death during initial hospitalization as well as during follow-up, when it was related to continued alcoholism. Portal-systemic encephalopathy, which was present on initial contact in 55% of patients, occurred at some time during follow-up in 18.7%, but was recurrent and required dietary protein restriction in only 9%, all of whom had resumed alcoholism. The low incidence of portal-systemic encephalopathy was attributable to the lifelong program of follow-up with regular dietary counseling and continued emphasis on both protein restriction to 60 g/day and abstinence from alcohol. Abstinence was sustained in 69%, liver function improved in 82%, general health was judged excellent or good in 73%, and Child's risk class converted to class B in 73% and class A in 21%. Excluding retirees because of age, 42% were gainfully employed or engaged in full-time housekeeping. Long-term shunt patency was documented in 100% of survivors by yearly angiography or Doppler ultrasonography. It is concluded that EPCS within 8 hours of initial contact permanently controls variceal hemorrhage and results in prolonged survival and a life of acceptable quality in many alcoholic cirrhotic patients in Child's class C. The improvement in our results compared with the previously reported results of all forms of treatment is attributable to rapid diagnosis, prompt operation, an organized system of care, and rigorous lifelong follow-up. The widespread pessimism about these patients is not justified, and the suggestion that liver transplantation offers the only or best hope is unwarranted.

AT LEAST ONE THIRD of patients who enter general hospitals with bleeding esophageal varices have advanced cirrhosis, most commonly caused by alcoholism, and are in class C of the classification of hepatic functional reserve proposed by Child and Turcotte.[1] Such patients have been reported consistently to have a high mortality rate during and shortly after the episode of variceal hemorrhage, regardless of treatment, and a negligible long-term survival rate. As a result, there has been understandable pessimism about the prognosis of patients who have bleeding varices and Child's class C cirrhosis. Beginning with the suggestion of Child and Turcotte,[1] many clinicians have come to the conclusion that portal-systemic shunt is not worthwhile in Child's class C cirrhotics during the period of bleeding, or even after recovery from bleeding in the relatively small number of patients who survive. Consequently, most patients with variceal bleeding and Child's class C cirrhosis are treated today by endoscopic sclerotherapy, even though such treatment has been demonstrated to have no influence on their survival.[2-12]

Almost every study of bleeding esophageal varices in patients with cirrhosis has shown that the largest number of deaths occur in and around the period of acute bleeding.[13-18] In view of this high early mortality rate, it is clear that improving the results of emergency therapy is the

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best way, and perhaps the only practical way, of increasing the survival rate of the bleeding cirrhotic population. For this reason, we have focused our efforts during the past 34 years on emergency treatment of bleeding esophageal varices and, in particular, on emergency portacaval shunt (EPCS). Almost all patients who have entered our hospital with acute variceal bleeding due to cirrhosis have undergone operation within 8 hours of initial contact. We have concluded on the basis of prospective clinical trials in unselected patients, unrandomized and randomized, that rapid diagnosis and prompt portal decompression results in a substantial increase in survival of cirrhotic patients with bleeding varices.[19-26]

Our results of EPCS have improved progressively over the years. We attribute the improvement to simplification of the diagnostic workup, rapid operation, consistent postoperative care, and regular, lifelong follow-up that emphasizes abstinence from alcohol and dietary protein control. Because no patient has been excluded from operation, we have performed EPCS in many class C cirrhotics during the past three decades. This is a report of the results obtained during the past 12 years in 94 patients with Child's class C cirrhosis who underwent EPCS for acutely bleeding esophageal varices, and it includes data on early and long-term survival, control of bleeding, incidence of portal-systemic encephalopathy (PSE), and quality of life.

Materials and Methods

Definitions

Since 1963, we have conducted a prospective evaluation of EPCS in 422 unselected patients with bleeding esophageal varices due to cirrhosis of the liver. The patients have been encountered consecutively, except for a period when we were involved in a randomized trial comparing EPCS and medical therapy[24,25] and a recently initiated randomized trial of EPCS and endoscopic sclerotherapy that is in progress. The study and treatment plans have been applied uniformly from the start, and have been described in detail previously.[19-23] In most of the patients cirrhosis has been due to chronic alcoholism. The term "prospective study" means that the patients were managed according to a well-defined and consistently applied protocol, and specific data were collected in every case at the time of diagnosis, treatment, and follow-up. The term "unselected patients" means that no patient with bleeding varices due to liver disease was excluded from treatment by EPCS. The term "emergency" portacaval shunt means that a direct anastomosis between the portal vein and inferior vena cava was undertaken within 8 hours of the appearance of the patient in the emergency department or, in the case of the few patients who developed bleeding while in the hospital, within 8 hours of the onset of bleeding. Operation within 8 hours and involvement of all patients without selection ("all comers") are important features of our study that distinguish it from all other studies that have been reported.

During the past 12 years, 94 unselected patients in our study were classified at the time of EPCS as being in Child's risk class C, according to the quantitative point scoring system suggested by Campbell et al. in 1973.[27] Table 1 shows the points assigned to various degrees of abnormality of each of the five criteria originally proposed by Child and Turcotte for assessing hepatic functional reserve.[1] A total point score of 5 to 8 places a patient in Child's risk class A, 9 to 11 in class B, and 12 to 15 in class C. The mean point score for the 94 patients in this report was 13.7.

Diagnostic Workup

In each patient, a rapid diagnostic workup was completed within 2.5 to 7 hours of initial contact and consisted of (1) history and physical examination; (2) confirmation of gastrointestinal bleeding by aspiration of stomach contents through a nasogastric tube and chemical testing of the stool for blood; (3) blood studies that included a complete blood count, platelet count, battery of liver function tests including timed indocyanine green dye excretion and arterial blood ammonia, arterial blood gases and pH, serum electrolytes, creatinine, urea nitrogen, coagulogram, alcohol level; and (4) esophagogastroduodenoscopy. On rare occasions when there was a question about the diagnosis, barium contrast upper gastrointestinal roentgenograms, and hepatic vein catheterization for wedged pressure measurements were performed. Additional studies performed routinely included electrocardiogram, chest

TABLE 1. *Point Scoring System Proposed by Campbell et al.[27] for Quantitating Child's Risk Classes*

Child's risk class	A	B	C
Total points based on five criteria	5–8	9–11	12–15
Points	1 point	2 points	3 points
Ascites	None	Moderate and easily controlled	Marked or difficult to control
Serum bilirubin (mg/dL)	<2.0	2.0–3.0	>3.0
Serum albumin (g/dL)	>3.5	3.0–3.5	<3.0
Portal-systemic encephalopathy (neurologic disorder)	None	Minimal	Marked
Muscle wasting (nutrition) (0–3+)	None	1+	2+ or 3+

roentgenogram, and measurements of cardiac output, cardiac index, and systemic vascular resistance. Angiographic studies were not necessary in any patient.

Initial Treatment

While the diagnostic workup was in progress, bleeding was temporarily controlled by intravenously administered vasopressin (Pituitrin, Parke-Davis, Morris Plains, NJ) in a bolus dose of 20 units diluted in 200 mL solution, or in a continuous infusion at a rate of 0.2 to 0.4 units/minute. Transfusions of packed red blood cells and fresh frozen plasma were given through large-bore intravenous catheters inserted in each arm and centrally. The stomach was lavaged with iced saline solution through a large-bore nasogastric tube, and a solution containing 4 g neomycin sulfate and 60 mL magnesium sulfate was instilled. An enema containing 4 g neomycin sulfate in saline solution was administered. Intravenous fluid therapy consisted of a 10% dextrose solution containing large doses of vitamins K, C, and B complex, and substantial doses of potassium chloride when hypokalemia was present. Patients did not receive esophageal balloon tamponade or endoscopic sclerotherapy.

Emergency Portacaval Shunt Operation

Emergency portacaval shunt was undertaken within less than 8 hours after initial contact in all patients. The mean time interval from initial contact to operation was 6.1 $\pm$ 0.32 (standard error of the mean [SEM]) hours. Our technique of direct EPCS has been described in detail previously.[28] Intraoperative pressure measurements were made before and after the shunt procedure by direct needle puncture of the portal vein and inferior vena cava, using a saline manometer positioned at the level of the inferior vena cava. Post-shunt corrected portal pressure, obtained by subtracting the inferior vena cava pressure from the free portal pressure, was less than 50 mm saline in all but one patient. Cardiac output was measured before and after construction of the venous anastomosis. A large wedge liver biopsy was obtained from all patients and confirmed the diagnosis of cirrhosis in each case. Side-to-side portacaval shunt was performed in 85 patients and end-to-side portacaval shunt was done in nine patients.

Postoperative Therapy

The patients were admitted to a surgical intensive care unit, where monitoring consisted of serial measurements of cardiovascular, pulmonary, hepatic, and renal function; fluid, electrolyte, and acid–base balance; blood count; and blood coagulation. Daily neomycin therapy, cathartics, and enemas were continued for 3 days. Hypokalemic alkalosis was treated vigorously by intravenous administration of potassium chloride. The hyperdynamic cardiovascular state was treated prophylactically by administration of digitalis when cardiac output was 6L/minute or greater. All patients received intensive respiratory therapy. An H_2-receptor antagonist and antacids were given throughout the postoperative course to counteract and suppress gastric acid secretion and prevent stress ulceration of the stomach. Delirium tremens was treated with parenteral administration of magnesium sulfate, diazepam, or chlordiazepoxide hydrochloride, and 50% dextrose solution with vitamins. Oral nutrition progressed until a diet that contained 4000 calories, 2 g sodium, and 80 g protein was tolerated. Dietary protein tolerance was carefully evaluated. The patients and their families were given detailed dietary instructions by a dietitian and received repeated counseling about abstinence from alcohol. The patients were discharged from the hospital on a diet limited to 60 g protein and 2 g sodium salt.

Lifelong Follow-up

The patients were seen in the Portal Hypertension Clinic monthly for the first postoperative year and every 3 months thereafter. At each clinic visit, clinical status was evaluated and the presence or absence of portal-systemic encephalopathy (PSE) was determined by a battery of tests that included a timed number connection test, evaluation of mental status, search for asterixis, and measurement of arterial blood ammonia. In addition, measurements were made of blood count, liver function, renal function, and fluid and electrolyte balance. A dietitian interviewed the patients and their families at each clinic visit and counseled them on restricting protein intake to 60 g and sodium intake to 2 g per day. Each year, a needle liver biopsy was obtained and portacaval shunt patency and function were assessed by Doppler duplex ultrasonography or shunt catheterization with pressure measurements and angiography. No patient has been lost to follow-up before 5 years after operation. Two thirds of the patients were operated on 5 to 12 years ago, and their status is known.

Data Collection and Analysis

Beginning with initial contact and continuing through lifelong follow-up, 220 categories of data were recorded on standard forms and entered into a computer program for analysis. Statistical significance was determined by Student's t test, by analysis of variance for numeric variables, and by the chi square test with Yates' correction for non-numeric variables. Long-term survival was calculated according to the actuarial or life-table method,[29,30] adjusted by age and sex for the California population.[31]

Results

Characteristics of the Patients

The clinical characteristics at the time of initial contact of the 94 unselected cirrhotic patients in Child's class C who underwent EPCS are summarized in Table 2. The patients ranged in age from 22 to 71 years (mean, 49.1 ± 0.6 SEM years), and 77% were men. Forty-five patients (48%) were bleeding from esophageal varices for the first time, 28 (30%) for the second time, and 21 (22%) for the third, fourth, or fifth time. A history of hematemesis and blood in the stool was obtained from every patient, and all were observed to have gross blood in the gastric aspirate and stool. Ninety-three per cent of the patients reported many years of heavy alcohol consumption, and 66% had been drinking heavily within 7 days of the onset of bleeding.

All patients had clinical manifestations of advanced cirrhosis on initial contact. Ascites was detected in 97% by physical examination and was confirmed and quantitated at operation. Jaundice was observed in 86% and was confirmed by finding an elevated serum bilirubin level. Portal-systemic encephalopathy was present in 55% of patients on initial contact, and an additional 16% had a documented past history of PSE. Thus, 71% were known to have or have had PSE. Poor nutrition manifested by severe muscle wasting was found in 96%. Delirium tremens was present in 15 patients (16%).

Table 3 summarizes the endoscopic, pathologic, and laboratory findings in the 94 Child's class C patients. In all patients, emergency esophagogastroduodenoscopy showed esophageal varices, fresh blood in the esophagus and stomach, and no other mucosal lesion that could account for bleeding. A spurting esophageal varix was observed in 28%. A wedge liver biopsy obtained at operation showed cirrhosis in all patients. Based on the history, results of serologic tests for hepatitis, and microscopic findings in the biopsy, 93% of patients had alcoholic cirrhosis, and 7% had post-hepatitic cirrhosis. Almost all patients (98%) had a hyperdynamic cardiovascular state, defined as a cardiac output of 6 L/minute or greater and a low systemic vascular resistance.

Liver function tests showed evidence of advanced hepatic disease. Total serum bilirubin level was elevated in all patients and was 4 mg/dL or greater in 86%. Serum albumin concentration was 2.9 g/dL or less in all patients. Every patient had marked retention of indocyanine green dye, and in two thirds 50% or more of the dye was retained after 45 minutes. Serum glutamic-oxaloacetic transaminase level (or aspartate amino transaminase) was 100 units/L or above in 60% of patients, often as a result of acute alcoholic hepatitis superimposed on cirrhosis.

On admission, point scores according to the quantitative modification of Child's classification ranged from 12 to 15, and averaged 13.7.

TABLE 2. *Clinical Characteristics at Time of Initial Contact of 94 Unselected Cirrhotic Patients in Child's Class C Treated by Emergency Portacaval Shunt*

Characteristic	% of Group
History	
Age (yr)	
<50	52
50–59	32
≥60	16
Male sex	77
Bleeding episodes	
1	48
2	30
3+	22
Hematemesis	100
Blood in stool	100
Recent alcohol ingestion (≤7 days)	66
Physical examination	
Ascites	97
Jaundice	86
Portal-systemic encephalopathy	
Current	55
Past history	40
Current and/or past history	71
Severe muscle wasting	96
Delirium tremens	16
Blood in gastric aspirate and stool	100

TABLE 3. *Endoscopic, Pathologic, and Laboratory Findings at Time of Initial Contact in 94 Unselected Cirrhotic Patients in Child's Class C Treated by Emergency Portacaval Shunt*

Finding	% of Group
Varices on endoscopy	100
Cirrhosis proven by biopsy	100
Alcoholic	93
Posthepatitic	7
Hyperdynamic state, cardiac output ≥6 L/min	98
Serum bilirubin	
≥4 mg/dL	86
2.0–3.9 mg/dL	14
Serum albumin	
≤2.5 g/dL	76
2.6–2.9 g/dL	24
Indocyanine green dye retention	
≥50% in 45 min	66
24–49% in 45 min	34
SGOT ≥ 100 units/L	60

Control of Bleeding

Variceal bleeding was controlled temporarily while the diagnostic workup was in progress in most patients by systemic intravenous administration of vasopressin. Bleeding often resumed after several hours, however, sometimes during the early stages of the operation. Emergency portacaval shunt promptly and permanently stopped variceal bleeding in every patient. No patient bled from varices or any other cause related to portal hypertension during lifelong observation. The average total

units of blood transfusion before and during operation was 9.6 units, with a range of 0 to 42 units. A Jehovah's Witness received no blood transfusions and survived.

Pressures Measured During Operation

All patients had portal hypertension with corrected free portal pressures, obtained by subtracting the inferior vena cava pressure, that ranged from 192 to 408 mm saline and averaged 286 ± 8 (SEM) mm saline. Emergency portacaval shunt reduced the mean corrected free portal pressure to 23 ± 2 (SEM) mm saline (Fig. 1). One patient, a man who underwent an end-to-side shunt, had a post-shunt corrected free portal pressure of 62 mm saline. All other patients had a pressure gradient across the shunt between the portal vein and inferior vena cava of less than 50 mm saline. In 18% of patients, the pre-shunt pressure on the hepatic side of a clamp occluding the portal vein (hepatic occluded portal pressure) was higher than the free portal pressure, which indicates severe hepatic outflow obstruction and raises the possibility of spontaneous reversal of portal blood flow. Our previous studies have shown this finding to be associated with a significant decrease in survival rate.[22,32]

Postoperative Complications

Table 4 summarizes the complications that developed during the postoperative period in the hospital. Hypokalemic metabolic alkalosis occurred in 82% of patients and was treated by infusion of substantial amounts of potassium chloride. Hepatic stupor or coma due to liver failure continued or developed in 22 patients (23%). Seventeen patients (18%) who had been drinking heavily during the period just before admission, developed delirium tremens after operation. Sixteen patients (17%), all heavy cigarette smokers, developed pneumonia during the postoperative period. Four patients developed generalized sepsis, two developed generalized coagulopathy with bleeding from multiple sites, and two developed deep wound infections. Two patients had postoperative gastrointestinal bleeding, in both cases from hemorrhagic gastritis related to multisystem organ failure.

TABLE 4. *In-hospital Postoperative Complications in 94 Unselected Cirrhotic Patients in Child's Class C Treated by Emergency Portacaval Shunt*

Complication	% of Group
Hypokalemic metabolic alkalosis, pH ≥ 7.5	82
Hepatic stupor or coma	23
Delirium tremens	18
Pneumonia	17
Sepsis	4
Generalized coagulopathy with bleeding	2
Gastrointestinal bleeding	
Hemorrhagic gastritis	2
Deep wound infection	2

Survival

Figure 2 shows the cumulative survival rate of the patients in this study. Of the 94 unselected, cirrhotic patients in Child's class C who were treated for bleeding varices by EPCS, 75 survived more than 30 days and left the hospital alive, an early survival rate of 80%. All patients

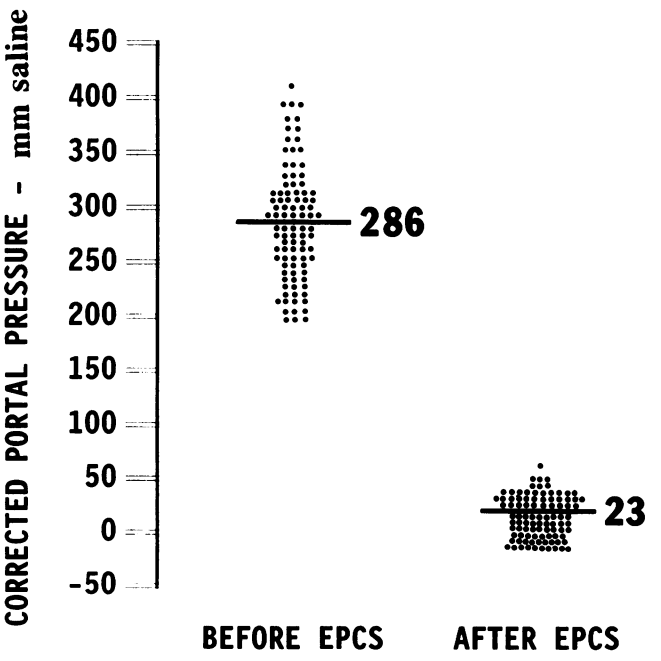

FIG. 1. Corrected portal pressure, obtained by subtracting the inferior vena cava pressure, measured during operation before and after emergency portacaval shunt in 94 unselected cirrhotic patients in Child's class C.

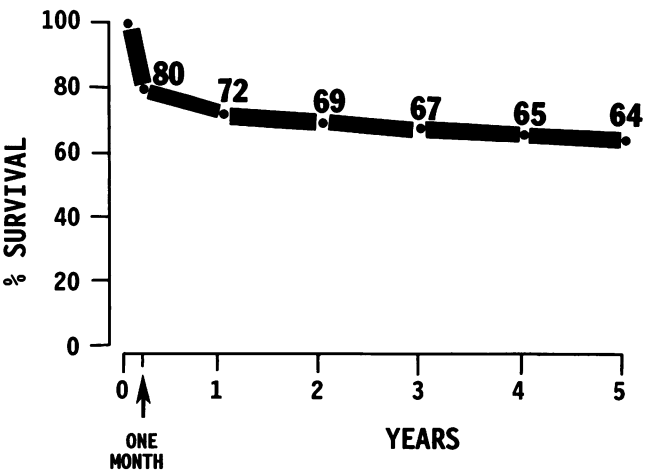

FIG. 2. Cumulative survival rate calculated by the acturial method of 94 unselected cirrhotic patients in Child's class C treated by emergency portacaval shunt.

were observed for at least 1 year. Seven patients died during the first postoperative year after hospital discharge, giving an actual 1-year survival rate of 72%. Subsequently, eight patients died during the second through the fifth postoperative years. The actuarial survival rates for the second, third, fourth, and fifth years after EPCS were 69%, 67%, 65%, and 64%, respectively. It is clear that the bulk of deaths occurred during the immediate period after the operation and the few months after discharge from the hospital.

Table 5 shows the causes of death during the first 5 years after EPCS. Hepatic failure, often accompanied by hepatorenal syndrome, was the main cause of death during the initial period of hospitalization. Subsequently, hepatic failure due to continued chronic alcoholism was responsible for most late deaths. Gastrointestinal bleeding played no role in the death of any patient.

Sixty-one of the 94 patients (65%) underwent EPCS 5 to 12 years ago. The actual 5-year survival rate of those patients was 64%. Thirty-four (56%) of those long-term survivors are still alive. Five patients died after the fifth postoperative year as a result of myocardial infarction, hepatoma, lung cancer, carcinoma of the pancreas, and hepatic failure due to resumption of alcoholism, respectively.

TABLE 5. *Causes of 19 Early Deaths and 15 Late Deaths Among 94 Unselected Cirrhotic Patients in Child's Class C Treated by Emergency Portacaval Shunt*

Cause of Death	No. of Patients
Initial hospitalization	
Hepatic failure	14
Sepsis	3
Generalized coagulopathy	2
Late	
Hepatic failure (chronic alcoholism)	11
Hepatoma	1
Myocardial infarction	1
Sepsis	1
Gunshot wound	1

Portal-Systemic Encephalopathy

Portal-systemic encephalopathy was observed on initial contact in 55% of patients. A past history of PSE was obtained from 40%, but was not considered to be as reliable as our direct observations of the manifestations of PSE. A total of 71% had PSE on initial contact and/or past history.

During follow-up, the four-test index described by Conn and co-workers[33-35] was used to detect PSE at each clinic visit. The overall incidence of PSE occurring at any time after operation in the 75 survivors was 18.7%. Seven patients (9%) had recurrent PSE requiring dietary protein restriction of less than 60 g/day. All of them had resumed heavy alcohol intake. An additional seven patients (9%) had mild PSE, defined as a single episode of PSE. Preoperative PSE was documented in all 18 patients who had postoperative PSE. The incidence of PSE was very low in patients who abstained from alcohol and adhered to simple dietary instructions that restricted protein intake to 60 g/day.

TABLE 6. *Quality of Life in 75 Long-term Survivors of Emergency Portacaval Shunt in Child's Class C*

Criteria	% of Group
Shunt patency	100
Gastrointestinal bleeding	0
Portal-systemic encephalopathy at any time	
Recurrent	9
Mild (single episode)	9
Existed before and after shunt	19
Alcohol intake	
Abstention	69
Occasional use	16
Regular use	15
Liver function after 1 yr	
Improved	82
Unchanged	15
Worse	3
General health after 1 yr	
Excellent or good	73
Fair	21
Poor	5
Child's class after 1 yr	
A	21
B	73
C	5
Work status	
Retired	15
Employed or full-time housekeeping	42

Quality of Life

Table 6 summarizes some data that reflect the quality of life in the 75 long-term survivors of EPCS. The portacaval anastomosis was shown to be patent and functioning effectively in every patient by yearly Doppler duplex ultrasonography or angiographic studies with pressure measurements. None of the patients had gastrointestinal bleeding. As described previously, 18.7% of the survivors had PSE, but it was recurrent in only 9% and was observed only in patients who had had PSE before operation and who resumed chronic alcoholism. Sixty-nine per cent of survivors abstained from alcohol, 16% consumed alcohol occasionally, and 15% resumed drinking regularly. Most of the late deaths occurred in patients who continued heavy use of alcohol.

Results of liver function tests 1 year after operation compared with before operation showed improvement in 82% of survivors, no change in 15%, and worsening in 3%. All patients whose liver function declined or failed to improve had resumed drinking alcohol. Physicians examining the patients at the regular follow-up visits were asked to record a conclusion about the patient's overall

condition at each visit. One year after EPCS, general health was judged excellent or good in 73%, fair in 21%, and poor in 5%. The four patients in poor condition had resumed drinking regularly. Child's risk class was determined at each monthly clinic visit. One year after operation, 21% of patients had converted from class C to class A, and 73% had converted to class B. Only 5% of survivors, all heavy users of alcohol, were still in class C.

Excluding patients who were 65 years of age or older and were classified as retired, 42% of survivors were gainfully employed or, in the case of some female patients, engaged in full-time housekeeping for part or all of the follow-up period.

Of the 61 patients who underwent EPCS 5 to 12 years ago, 39 (64%) survived 5 or more years. The incidence of PSE in those 5-or-more-year survivors was 13%, but it was recurrent in only one patient. Thirty-three of the long survivors (85%) abstained from alcohol, and none of the remainder consumed alcohol regularly. Liver function test results after 5 years showed improvement in 87% and worsening in only one patient compared with before operation. Child's risk class after 5 years was A in 31% of patients, B in 67%, and C in 2%. Child's class improved in all but one of the 5-or-more-year survivors. Of those who were not classified as retired on the basis of age, 52% were employed or doing full-time housekeeping.

Discussion

In 1964 Child and Turcotte proposed a classification of "hepatic functional reserve" based on five clinical and laboratory criteria, and related it to the suitability or risk of performing portal decompression in patients with bleeding esophageal varices due to cirrhosis.[1] The classification, which for brevity became known by the last name of the senior author, C. Gardner Child III, described three groups: A, good hepatic function; B, moderately impaired hepatic function; and C, advanced hepatic dysfunction. Despite its several shortcomings, Child's classification has been adopted throughout the world, in original or modified form, as the most widely used method for assessing the clinical status, prognosis, indications for, and results of various forms of treatment of patients with cirrhosis and its complications.

It is important to recognize several problems associated with Child's classification.[36] Firstly, three of the five criteria (ascites, nutrition, neurologic disorder), are subjective and, therefore, imprecise and subject to substantial observer variation. It is not unusual for two experienced observers to classify a patient differently. To minimize this problem in our study, severity of ascites was confirmed and quantitated by immediate operation, and neurologic disorder (PSE) was quantitated by use of Conn's four-test index. Assessment of the third subjective criterion, nutrition (muscle wasting), however, remained a potential problem in our study, as it does in all studies. Secondly, Child's classification as originally proposed is entirely descriptive, nonquantitative, and impossible to apply uniformly. Therefore, several methods have been used to quantitate and standardize Child's classification by assigning points to various degrees of abnormality of the five criteria.[36] For many years we have used the point scoring system described by Campbell et al., shown in Table 1.[27] Thirdly, it is usually not valid to apply Child's classification retrospectively, as has been done in many reports based on retrospective reviews of medical records. Nutritional status is seldom mentioned in the medical record, mild or moderate ascites is not infrequently overlooked, and neurologic disorder is often not accurately assessed unless required in advance by a specific protocol. In our study, patients were classified at the time of initial contact according to a prospective protocol. Fourthly, the method used to allocate patients to Child's three risk classes is often not stated in publications. As a result, it is difficult to compare reported results of treatment. "Child's class C" is sometimes applied on the basis of instinct rather than fact. A final problem is that many variations of Child's classification have been introduced, some of them impractical and occasionally extreme. In one widely quoted study, patients were placed in Child's class C if any one of the five criteria fell within the class C range of abnormality, a method that potentially exaggerates the number of class C patients in a series.[2,3]

Reported survival rates of patients with Child's class C cirrhosis, particularly those with variceal bleeding, have been very poor regardless of the type of treatment. As a result, portal decompression in these patients is considered by many to be contraindicated. On the basis of their experience with portacaval shunt in 128 patients, Child and Turcotte stated in 1964[1]: "Patients in group C tolerate operations poorly, are burdened postoperatively with serious and often uncontrolled ammonia intoxication and have a limited life expectancy for prolonged lives." Furthermore, they stated that the surgical price for protection from further variceal hemorrhage "is nearly prohibitive for group C." With regard to emergency treatment of variceal bleeding, they wrote: "In general, we do not apply the principle of emergent decompression to poor-risk (C) patients, for here the mortality of any operation appears to be equivalent or greater than that of medical therapy." These sentiments have been echoed subsequently by many clinicians. The operative mortality rate of urgent portal-systemic shunt in Child's class C patients has been reported to be about 50%, and the 2-year survival rate has been 25% or less.[2,3,37-39] In the only randomized trial of urgent shunt in patients classified as Child's class C, only 12.5% of patients were alive after 18 months.[2,3] Survival rates associated with elective portal-systemic shunt have

been similarly poor, with more than 50% of patients dying during or soon after operation, and only 8 to 18% surviving 3 to 5 years.[38,40–43]

The reported record of treatments other than portal decompression is similarly poor. Esophageal devascularization procedures have had operative mortality rates of 54 to 100%,[44,45] and 5-year survival rates below 25%[46,47] in cirrhotic patients in Child's class C. Endoscopic sclerotherapy in class C cirrhosis has been associated with a 30-day mortality rate of 54 to 63%[2,3,6,48,49] a 1-year survival rate of 14 to 30%,[2,3,8,48,49] and a 2-year survival rate of 0 to 15%.[6,8,48,49] Conventional medical treatment of bleeding varices, including esophageal balloon tamponade and parenterally administered vasopressin, has produced 1-year survival rates of 0 to 21%, and 2-year survival rates of 12 to 13%.[8,50,51]

The reported outcome in Child's class C cirrhosis has been dismal whether or not the patients had variceal bleeding. In a study of 53 such patients admitted to the medical intensive care unit, Shellman et al.[52] reported that only 11% left the hospital alive. They went so far as to suggest "that heroic measures and expenditure of health care resources to support cirrhotic patients in the MICU be undertaken with this knowledge." Similarly, Albers et al.[53] reported a 1-month mortality rate of 67%, Ollson[54] described a 6-month mortality rate of 100%, Merkel et al.[55] observed a 20-month mortality rate of 100%, and Villeneuve et al.[56] found a 2-year mortality rate of 64% in Child's class C cirrhotics.

The results of the current study are substantially better than those reported previously in the literature. Of the 94 unselected patients in Child's class C who were treated for bleeding esophageal varices by EPCS within 8 hours of initial contact, 80% survived more than 30 days and were discharged from the hospital alive. One-year survival rate was 72%, and 5-year survival rate is 64%. The direct portacaval anastomosis, which was side-to-side in 85% of patients and end-to-side in 15%, has remained patent in every patient to date. As a result, there was no recurrence of variceal hemorrhage, and gastrointestinal bleeding was not involved in the subsequent hospitalization or death of any patient.

We attribute this improvement in outcome to three factors. The first and most important was prompt and permanent control of bleeding by portal decompression. As a result of rapid diagnosis within a few hours of initial contact and EPCS within 8 hours (mean, 6.1 hours), blood loss was limited and the operation was done before hepatic decompensation had reached its peak or complications such as pneumonia and delirium tremens had developed. Conventional emergency treatment of variceal hemorrhage has been nonoperative, based on the premise that delay in operation provides the opportunity to prepare the patient for elective portal decompression by improving hepatic function and even converting the patient from Child's class C to class B. Almost all studies of bleeding varices in cirrhotic patients, however, show that the major mortality rate occurs during or shortly after the bleeding episode, so that many patients die before elective portal decompression or other elective treatment is possible.[16,17,22,24,57] This early mortality rate has a profound influence on ultimate outcome. Moreover, during the emergency period before and after nonoperative treatment, more patients show a deterioration of Child's risk class than an improvement. Graham and Smith[16] reported that "improvement in hepatic functional reserve was unusual and, in general, there was no need to delay an operation while hoping for major changes in operative status."

We believe the second factor responsible for the improvement in outcome was the development of an organized system of care that emphasized prompt diagnosis, early and rapid operation, and knowledgeable postoperative care. Patients were admitted from the start to a surgical intensive care unit without long delays in the emergency department. The diagnostic workup was simplified by elimination of unnecessary procedures such as angiography, and usually was completed within 3 hours. Operation was performed expeditiously, usually in less than 4 hours and with blood transfusion requirements less than 6 units. Postoperative treatment was given in a surgical intensive care unit where personnel had long experience with the care of cirrhotic patients. Postoperative care was guided by a specific protocol and was consistent.

The third factor responsible for our results undoubtedly was the rigorous, lifelong program of follow-up in which there was a continuing emphasis on abstinence from alcohol and dietary protein control. Patients were seen in the Portal Hypertension Clinic monthly for the first postoperative year and every 3 months thereafter. Attempts were made to enroll all patients in an alcohol rehabilitation program such as Alcoholics Anonymous. As a result, 69% of patients abstained from alcohol and 16% consumed alcohol only occasionally. Our experience[21,23] and that of others[58–60] has shown that resumption of alcoholism has a significant adverse influence on long-term survival.

Portal-systemic encephalopathy was present on initial contact before operation in 55% of our patients, and 40% gave a past history of PSE. This high incidence of preoperative PSE is not surprising in view of the severe hepatic dysfunction, extensive portal-systemic venous collaterals, and large quantities of blood in the intestines of these bleeding cirrhotic patients in Child's class C. After EPCS, 18.7% of survivors had PSE at some time during life, but 9% had but a single episode of PSE. Only 9% of patients, all of them consumers of alcohol, had recurrent PSE requiring dietary protein restriction of less than 60 g-day. We attribute the low incidence of PSE to four fac-

tors. Firstly, the patients were counseled by a dietitian at each clinic visit on restriction of protein intake to 60 g/day, an amount that is quite ample for nutrition and is compatible with an appetizing diet. Repeated emphasis and education about the importance of dietary protein restriction produced a high level of patient compliance. Secondly, liver function improved and stabilized in a substantial majority of patients, in large part as a result of abstinence from alcohol. Thirdly, no patient had a recurrence of gastrointestinal bleeding. Finally, follow-up was rigorous and lifelong. The results of this study demonstrate that it is possible to achieve a low incidence of PSE, even in class C patients, if the patients abstain from alcohol and restrict their dietary protein intake to 60 g/day or less.

Quality of life was satisfactory in most of the patients who survived EPCS for a year. In addition to the high rate of abstinence from alcohol, the low incidence of PSE, and the absence of gastrointestinal bleeding, liver function improved in 82% of survivors, and general health was judged to be excellent or good in three fourths. Child's risk class after 1 year improved in 95% of survivors, rising to class B in 73% and class A in 21%. Of the 64 survivors who were not of retirement age, 42% obtained employment or performed full-time housekeeping. Once a patient survived EPCS and lived for 6 months, the chances of prolonged survival were excellent. The overall survival rate declined only 8% between the first and fifth years after operation. The single most important determinant of long-term survival appeared to be whether the patient resumed regular alcohol consumption.

In recent years, orthotopic liver transplantation (OLT) has been used with increasing frequency for the treatment of alcoholic cirrhosis in selected patients. One-year survival rates after OLT in alcoholic patients have been 66 to 90%, which are comparable to those obtained in adult patients undergoing OLT for other hepatic diseases.[61-65] Moreover, few patients have resumed alcohol consumption in short-term follow-up. On the basis of these promising results and retrospective reviews of highly selected, mainly nonalcoholic patients who underwent OLT for advanced liver disease with an incidental past history of variceal bleeding, it has been suggested that OLT is the treatment of choice for "patients with advanced liver disease after failure of sclerotherapy,"[66] and for "all patients with end-stage liver disease (group C) and variceal bleeding . . . in the absence of any contraindications."[67] As others have pointed out,[68-70] there are no data to support this suggestion. On the contrary, substantial evidence indicates that had the patients in the current series been treated by endoscopic sclerotherapy followed, in survivors, by OLT, the overall survival rate would have been poor.[2,3,6,8,48,50,51] It remains to be demonstrated that endoscopic sclerotherapy followed by OLT in a population of patients such as that described in this report is capable of achieving results comparable to those of EPCS in terms of mortality, morbidity, requirement for blood transfusion, and economic cost.

It has been suggested repeatedly that, in potential candidates for OLT, portal-systemic shunts or other operations in the right upper quadrant of the abdomen be avoided because they make the subsequent transplantation operation difficult and even impossible. There are several fallacies in this suggestion. For many reasons, a substantial majority of cirrhotic patients with variceal hemorrhage, particularly those with alcoholic cirrhosis, are not potential candidates for OLT. Moreover, many patients undergoing OLT have had previous right upper quadrant operations, and there is a long record of success in such patients. Children with biliary atresia are an example of patients who have had previous operations in the hepatic hilus. Most important, examination of this issue in at least six recent studies has shown that previous portal-systemic shunts, regardless of type, had no influence on the outcome of OLT.[66,67,71-74] The group in London, Ontario, has emphasized that long-term shunt patency should be the foremost concern of the surgeon in deciding on what type of shunt to use in a potential candidate for OLT, because thrombosis of the shunt may seriously compromise the performance of OLT.[74] In this regard, direct portacaval shunt has the lowest incidence of occlusion of all portal decompression procedures. In our experience, the incidence of thrombosis in 1500 direct portacaval shunts has been 0.1%.

The results of the current study indicate that there is no justification for the widespread pessimism and fatalistic attitude about patients with Child's class C cirrhosis who bleed from esophageal varices. We conclude that EPCS within 8 hours of initial contact promptly and permanently controls variceal hemorrhage and thereby results in prolonged survival and a life of acceptable quality in many patients with advanced alcoholic cirrhosis.

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Discussion

DR. WILLIAM V. MCDERMOTT, JR. (Boston, Massachusetts): I'm sure that many of you have followed Dr. Orloff's work over the years with admiration for his cheerful and optimistic approach to a terrible problem, and I have been most interested in seeing what he does with this.

With the advent of widespread use of esophageal sclerosing for emergency treatment of varices, most of us have had the operation of portal-systemic shunt in emergency situations put on the back burner. To get any kind of a comparable series, I found I had to go back almost 30 years when we introduced a randomized series of three approaches to the problem of bleeding gastric and esophageal varices: (1) emergency portacaval shunting; (2) transthoracic ligation of varices; or (3) management by any noninvasive procedure.

Patients were randomized into these three groups and were compared during their initial emergency therapy. It was quite interesting because the highest mortality rate was in the emergency shunt group, with only 70% leaving the hospital after the operation. Next was surgical intervention by ligation of varices, with a 69% survival through the initial operation, and then 62% in the medically treated group. I might add that if portacaval shunting became necessary during the operation or later in either of the second two groups, they were still categorized under their initial randomized heading, because otherwise it would get too confusing.

Now, the long-term follow-up was interrupted by our academic move, but I have some data for you.

One, the emergency shunts had a 62% survival at the end of 1 year, and, as far as we could tell without absolutely accurate data, a rather surprising long-term survival, whereas the other two groups, many of whom required later portal-systemic shunts, had survivals of less than 50% after a year, with a rapidly decreasing life span as far as we could tell, over the subsequent years. As I say, this has never been published because it was an interrupted series and I was not sure exactly what it proved.

I did want to ask Dr. Orloff a question. We sent patients out of the hospital on protein restriction at 70 g, and on that program almost 30%—I'm talking about the emergency shunt group now—developed some form of encephalopathy; protein intake was reduced to 40 g daily for that group, and finally we were left with a hard core of about 10% who had intractable encephalopathy and either died or were treated with colon bypass. I was a little surprised at the low incidence of encephalopathy that Marshall presented, but perhaps his exuberant optimism was transmitted to his patients.

DR. BERNARD LANGER (Toronto, Ontario, Canada): Dr. Orloff is to be congratulated for his enthusiastic pursuit of this difficult topic. As one of my colleagues would say, he's been toiling for years in the vineyards of shunt surgery.

This report is remarkable both for its low reported operative mortality rate and for its long-term survival figures. It is remarkable because both are at odds with almost everything else that has been published in the literature. I think we have to question whether these differences are the result of differences in treatment between San Diego and elsewhere or differences in the patient populations that are being treated in San Diego and elsewhere.

As far as the differences in treatment, it is true that the universal application of shunt surgery as the first line of therapy is not practiced in many other places. In our own institution we do use shunt surgery early when other therapy fails, but that means in 24 to 48 hours. Our mortality rate, like most others, is about 30% overall, and more than 50% for Child's C patients. There is one controlled study of emergency shunt surgery by John Cello in San Francisco, where he used shunt surgery within 6 hours compared with sclerotherapy in Child's C patients. In those Child's C patients, the mortality rate of early shunt surgery was more than 50%, which corresponds to general experience.

The other question is related to the definition of Child's C patients. In Dr. Orloff's manuscript, he identifies the problem of subjectivity of criteria in the original Turcotte-Child classification. The Campbell modification, however, uses exactly the same subjective criteria and just applies some numbers to them. I wonder if Dr. Orloff could comment about that.

The other remarkable thing in this study is that 94% of the Child's C patients that survived surgery reverted to Child's A or B at the end of the first postoperative year. This is certainly not a common occurrence either in my experience or in that of others, and makes one wonder if the chronic liver status of these patients is actually much better than the Child's C status that is being identified at the time of their operation. In