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Risks in Transthoracic Esophageal Transection —Score for Predicting Operative Mortality—

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The surgical treatment of esophageal varices is divided between shunt operations and direct operations. Selective shunt operations such as distal splenorenal shunt¹⁾ are the only types of shunt currently used in Japan. However, almost every surgeon has switched from portal decompression operations to direct operations for esophageal varices. Nonshunting procedures such as esophageal transection, terminal esophago-proximal gastrectomy²⁾, upper gastric transection³⁾ or Hassab's procedure⁴⁾ do not produce portal systemic encephalopathy. The term esophageal transection includes WALKER's simple transection⁵⁾, transthoracic transection with paraesophagogastric devascularization⁶⁾ and transabdominal transection^{7,8)} with or without a mechanical stapling instrument. WALKER's simple transection carries the risk of recurrent hemorrhage and has been abandoned in Japan. Extensive devascularization can not be attained transabdominally, so transthoracic esophageal transection is the procedure most widely performed in Japan. The rate of recurrent hemorrhage from esophageal varices after transthoracic esophageal transection with paraesophagogastric devascularization is very low, 1.5%⁶⁾.

In Japan, when the general condition of the patient is fairly good, idiopathic portal hypertension accompanied by esophageal varices is frequently seen. Recently however, with an increase in the incidence of liver cirrhosis, the number of poor risk cases is increasing, and the decision of indication for transthoracic esophageal transection is frequently difficult. In order to establish the criteria for surgical indication and in an attempt to prevent operative death, we made a review of our cases retrospectively.

Patients and methods

Over the past 23 years, 220 patients with portal hypertension were admitted to the First Department of Surgery, Gifu University Hospital. The direct operation for esophageal varices was performed on 111 patients and of these, 65 underwent transthoracic esophageal transection. For the 56 cases since 1972 when the surgical principle was established, the relationship between

Key Words: Esophageal varices, portal hypertension, Liver cirrhosis, Esophageal transection, Operative indication.

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Table 1. Items studied

RBC, WBC, Ht, Hb, Plt., Na, K, Cl, Urea-N, Glucose, T. Bil., D. Bil., Al-p, LDH, GOT, GPT, Ch.E., Chol., FFA, β -Lipo., Trigly., Creatinine, Creatine, Ca, Mg, SI, Cu, P, Uric acid, CCLF, ZTT, TTT, Ammonia, Amylase, RA, CRP, ASLO. CPK, HBD, LAP, σ -GT, Prothrombin, Thrombo test, Normotest, T.P., Alb., α_1 -G, α_2 -G, β -G, σ -G, A/G, Fibrinogen, Plasmin, SKa-Plasmin, FDP, HBsAg, IgG, IgA, IgM, PSP, ICG R15, K-ICG, WHVP,
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operative death, the age and sex of the patient, the operative urgency, the presence of ascites, the association with diabetes mellitus, a history of hematemesis, the use of the Sengstaken-Blarkmore tube, the time from onset of hematemesis to surgery and the degree of splenomegaly were studied. For the 47 cases from 1976 when preoperative investigations were begun, the relationship between operative death and values of 62 biochemical tests (Table 1) were also studied. Chosen from the general conditions mentioned above and the results of the biochemical tests, 10 factors were selected as the criteria for determining the surgical indication for transthoracic esophageal transection. Death occurring during the period of postoperative hospitalization or within 30 days of surgery was regarded as operative death. Twenty five of the 56 procedures performed since 1972 were transthoracicesophageal transection with paraesophageal devascularization, 23 were splenectomy with paragastric devascularization followed by esophageal transection in two stages, and 6 were splenectomy with paragastric devascularization followed by esophageal transection in one stage.

Results

Operative death occurred in 12 (21%) of the 56 patients undergoing transthoracic esophageal transection. The cause of death was hepatic insufficiency in 6, anastomotic leakage in 5 and bleeding reoccurrence in 1.

Emergency operation was performed in 18 patients, of whom 7 (38%) died, while elective operation was performed in 38 patients, of whom 5 (12%) died. The first step for elective operation in the treatment of hemorrhage from esophageal varices is insertion of a Sengstaken-Blarkmore tube to control the bleeding. However, emergency operation was unavoidable due to uncontrollable bleeding in as many as 32% of the cases in this study.

Operative death occurred in 8 (31%) of 27 cases in which ascites was observed while there were only 4 (14%) operative deaths in 29 cases where no ascites was observed. Cases with controllable ascites are also included in the group of observed ascites cases.

Diabetes mellitus was associated with a very high incidence of operative death. Death occurred in 8 (35%) of 23 cases with diabetes mellitus but in only 4 (12%) of 33 non-diabetic cases.

No significant correlations were observed between operative death and age or sex of patients, the presence or absence of encephalopathy including past history, the history of hematemesis and melena, the use or non-use of the Sengstaken-Blarkmore tube, the interval from hematemesis to surgery, or the degree of splenomegaly. In summary, the relationships between emergency operation, ascites, or diabetes mellitus and operative death are extremely significant (Table 2A).

Table 2A. Operative mortality in transthoracic esophageal transection

Esophageal transection	56 cases	Operative mortality
		12 cases (21%)
Emergency operation	18 cases	7 cases (39%)
Elective operation	38 cases	5 cases (13%)
With ascites	27 cases	8 cases (30%)
Without ascites	29 cases	4 cases (14%)
Diabetes	23 cases	8 cases (35%)
No diabetes	33 cases	4 cases (12%)

The test results for surgical patients who survived, the operative survival group, versus those who died, the operative mortality group, were compared for the 62 preoperative biochemical test items shown in Table 1. Items showing a significant difference were selected as risk factors. The values of the test results as performed immediately before surgery were adopted since they showed a better correlation with operative death than the values of the test results on admission. With similar tests such as prothrombin time, thrombotest and normotest, the test showing the most significant variable was adopted. As a result of these considerations, seven items, total bilirubin, cholinesterase, cholesterol, prothrombin time, albumin, fibrinogen and ICG R15 were selected as risk factors. All of these seven factors showed significant differences between the two patients groups as shown in Table 2B.

If the criteria for surgical indication were established for each of these factors individually (for example, total bilirubin below 3.0 mg/dl, albumin over 3.0 gr/dl, ICG R15 less than 20%, etc.), it would be difficult to assess the risk when most of the factors were within the acceptable range, but one or two items are not. Because of this, the criteria for surgical indication were established such that the indication would be based on a total score of the factors' points. Each of the 7 biochemical factors was given three grades of importance and thus could be assigned one of 3 values; 0, 1, or 2 points (Table 3). The 3 general conditions, ascites, association with diabetes mellitus and emergency operation, were graded only by whether or not they were present and thus could only be assigned a value of 0 if not present and a value of 2 if present. Therefore a patient's score could range from a low of 0 to a high of 20 points.

Table 2B. Biochemical test results for operative survival vs. operative mortality

Test	Normal	Survival group	Mortality group
total bilirubin	<1.0 mg/dl	1.3±0.6 mg/dl	2.0±1.0 mg/dl
cholinesterase	0.60-1.20 ΔpH	0.55±0.12 ΔpH	0.41±0.13 ΔpH
cholesterol	150-230 mg/dl	150±46 mg/dl	112±24 mg/dl
prothrombin time	70-100%	70±16%	51±12%
albumin	3.5-5.0 g/dl	3.7±0.5 g/dl	3.2±0.4 g/dl
fibrinogen	200-400 mg/dl	208±71 mg/dl	133±44 mg/dl
ICG R15	<10%	25±14%	38±13%

Table 3. Score for predicting operative mortality.

Factor	Points assigned		
	0	1	2
Albumin (g/dl)	≥ 3.5	$3.5 > 3.0$	≤ 3.0
Fibrinogen (mg/dl)	≥ 200	$200 > 150$	≤ 150
Cholesterol (mg/dl)	≥ 150	$150 > 100$	≤ 100
Prothrombin (%)	≥ 70	$70 > 50$	≤ 50
T. Bilirubin (mg/dl)	≤ 1.0	$1.0 < 2.0$	≥ 2.0
Cholinesterase (Δ pH)	≥ 0.6	$0.6 > 0.4$	≤ 0.4
ICG R15 (%)	≤ 20	$20 < 40$	≥ 40
Ascites	none	—	present
Diabetes mellitus	none	—	present
Operative urgency	elective	—	emergency

Of the 47 cases which could be scored, there were 37 survivors and all except one had scores below 11. The exception had a score of 18 and was scheduled for prophylactic esophageal transection but instead had an emergency operation immediately following the onset of hematemesis. All except for 2 of the 10 cases of operative death had score over 12 and they ranged to a maximum of 19 points. The two cases had scores of 7 and 8 had esophageal transection, paraesophago-

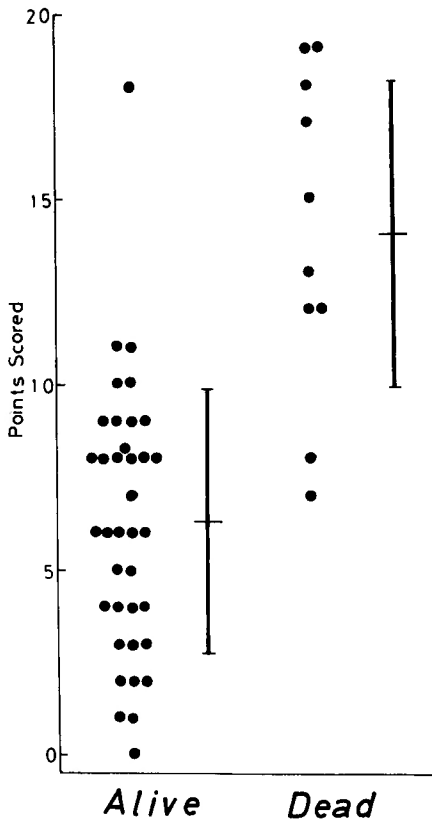


Fig. 1. Operative mortality predicted by score.

gastric devascularization and splenectomy performed in one stage. Postoperative hemorrhage resulted in fatality and it was felt that the procedure was erroneously selected in these cases.

In our opinion, transthoracic esophageal transection is contraindicated for cases with scores of 15 and over. The operation can be performed at moderate risk in cases with scores between 11-14 (borderline cases) and in relative safety in cases with scores of 10 or less (Fig. 1).

Discussion

CHILD'S⁹⁾, MCDERMOTT'S¹⁰⁾, and MALT'S¹¹⁾ classifications of the severity of liver cirrhosis are well known. Child's classification is the most widely used and it fairly applicable in surgery of esophageal varices. However, it is an inappropriate criterion for the decision of indication for esophageal transection. It does not assess all of the relevant risk factors because it is originally a classification of the severity of liver cirrhosis. CHILD'S classification does appear useful in cases of emergency operation since the severity of the disease is judged by determining bilirubin and albumin alone. On the other hand, auxotherapy, with blood and fluid transfusions, is usually used for patients with bleeding from esophageal varices in an attempt to yield hemostasis and avoid an emergency operation. Also, surgery, even in an emergency case is usually postponed until a few days after admission and the data necessary for determination of the indication for esophageal transection could be obtained during this period. The routine biochemical parameters which we have chosen could be examined without difficulty in any hospital during this preoperative period.

Compared with the values of the biochemical test results on admission, those results obtained immediately before surgery showed a better correlation with the surgical risk. This is in part due to the hepatic function factors. In cases where hepatic function decreases due to bleeding, successful hemostasis may produce recovery of the hepatic function enough to allow the patients to have safe elective surgery. When hemostasis is unsuccessful, emergency operation is unavoidable and the test results relative to hepatic function in these cases often show further deterioration. Therefore, it seems more applicable to adopt the test data obtained immediately before surgery as the criteria.

CHILD classified ascites into two grades depending on its controllability. In our experience, a decrease of ascites occasionally causes bleeding from associated esophageal varices, therefore, we actively manage ascites following surgery. Because of this, we did not classify the ascites factor in grades but rather as present or not present.

Although CHILD'S classification uses the presence or absence of encephalopathy as one of the factors, and many others mention it as a criterion for surgical indication, we did not include the presence or absence of encephalopathy as a factor in our score. Encephalopathy associated with hemorrhage from esophageal varices is easily treated by the removal of blood clots in the intestinal tract and the administration of antibiotics. The same is true for ammonia blood levels. While these factors may help define CHILD'S severity classifications of liver cirrhosis, they are not relative to the surgical indication for esophageal transection.

The 10 factors, albumin, fibrinogen, cholesterol, prothrombin time, total bilirubin, cholin-

esterase and ICG R15, and the presence or absence of ascites, diabetes mellitus or emergency operation were combined to produce the scoring system as shown Table 3. These items were selected because they were statistically significant based on our retrospective study.

The criteria for surgical indication mentioned above are for cases with hematemesis or melena from esophageal varices, to predict the operative risk for cases with active bleeding. The score system was set up based on the 3 general conditions and 7 of the preoperative biochemical tests. A good correlation was found between the score and the operative survival and mortality groups for the esophageal transection cases. The scoring system ranged from a low of 0 points to a high of 20 points. As the number of points increases, the risk increases. The mortality rate for patients with bleeding from esophageal varices used to be high because esophageal transection was performed without classifying the risk.

In cases where surgery is not indicated, it is possible to lower the score by administration plasma. This has recently been proven valuable in hepatic resection. Embolization of esophageal varices with percutaneous transhepatic portography¹³⁾ and the injection of a sclerosing agent under an endoscope¹⁴⁾ is also beneficial for these cases. The condition of patients managed by these techniques should be improved enough for esophageal transection to be safely performed.

Summary

On the basis of a retrospective review of 65 cases of transthoracic esophageal transection, a method was determined for the prediction of operative risk based on a calculated score. The score ranged from a low of 0 to a high of 20 with the risk increasing as the score increase. Scores of 15 and greater showed absolute surgical contraindication, while scores between 11-14 showed moderate risk and scores of 10 or less seemed very safe. The score is thought to be a useful tool for determining the surgical indication for transthoracic esophageal transection.

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和文抄録

経胸的食道離断術の手術適応 —各因子の score 化による手術危険率の推測—

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岐阜大学第一外科で経験した経胸的食道離断術65例において、術前の検査62項目について手術死亡例と耐術例を、retrospective に比較検討し、有意差の大きい7項目を選び出した。これら7項目 (アルブミン、フィブリノーゲン、コレステロール、総ビリルビン、コリンエステラーゼ、ICG 15分値、プロトロンビン時間) について、それぞれの検査値を3段階に分け、0、1、2の各点を与えた。さらに一般的諸条件の中より

有意差の大きかった腹水例、糖尿病合併例、緊急手術例に各2点ずつを与え、その合計が最低0から最高20点となるよう score を作成した。本 score は点数が大きくなるにしたがい危険率が増すものであり、15点以上は手術絶対禁忌、11~14点は境界域、10点以下はきわめて安全に手術可能であり、食道離断術の手術適応決定に対して有力な指標となると思われる。