

Scoring the Bile Duct for the Indication of Additive Biliary Drainage Operation

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Summary. Physiological saline was infused into the bile duct of 20 patients who had undergone open cholecystectomy, and ductal passage parameters, the passage and residual pressure, flow rate and conductive score [Flow rate (ml/min)/(Passage pressure-Residual pressure) (cmH₂O)] indicating the need for a drainage operation on the bile duct were examined. There were close relationships between the flow rate per minute and the conductive score, and a flow rate below 14.0 ml/min and a conductive score below 9.2, respectively. All six patients who had received the drainage operation because of papillary stenosis had values below these. When passage at the ductal end was judged by means of a 3.0 mm diameter catheter, there was good agreement between the manometric and passable catheter findings. These findings suggest that the conductive score should be included in the criteria for diagnosing the need for a biliary drainage operation in papillary stenosis.

Key words—bile ductal manometry, bile conductance, papillary stenosis.

INTRODUCTION

A drainage operation on the common bile duct is done when passage disturbance of the duct is detected after cholecystectomy without a bile duct stone,^{1,2)} and the criteria for the operative treatment have been confirmed from several points of view including morphological and manometric findings in the bile duct.³⁻⁷⁾ However, there are many standards for determining the manometric criteria indicating sur-

gery because of variation in the structure of the human bile duct.⁸⁾

Recently we devised a ductal conductive score which is additively indicative of the need for a biliary drainage operation. The usefulness of the score is here introduced.

MATERIALS AND METHODS

A total of 20 patients with gallstones (10 males and 10 females; age range, 37-68 years; weight range, 48-77 kg) were included in the study.

The patients were classified into two groups: the first group (n=14) were subjects who received only open cholecystectomy; the second (n=6) were subjects who had received a drainage operation on the bile duct after open cholecystectomy because of papillary stenosis. All intraoperative parameters were obtained under uniform anesthetic conditions. No spasmolytic drugs were employed, no morphine was administered, and meperidine was used in doses of 25 mg or less. The latter was injected at least 30 min prior to the manometric estimation.⁷⁾

The cholecystectomy and drainage operation on the bile duct were carried out according to techniques described in the literature.⁹⁾ No bile duct stone was seen at the time of operation.

Following the cholecystectomy, bile ductal pressure was estimated by the method described previously.^{5,7)} Briefly, a Y-shaped catheter was introduced into the proximal cut end of the cystic duct. Another catheter was connected to a saline-primed reservoir and the other end of the Y tube to record pressure. Physiological saline warmed to 36°C was infused into the duct at a rate of 2.4 ml/min, and the passage and

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residual pressures were recorded. The flow rate per minute was calculated at a pressure of 30 cmH₂O.

When a 3.0 mm diameter catheter did not pass through the ductal end, the condition was judged to be papillary stenosis.^{7,10,11)}

Biliary conductive parameters were calculated as follows:

$$\text{Ductal conductive score} = \frac{\text{Flow rate (ml/min)}}{\text{Passage pressure} - \text{Residual pressure (cmH}_2\text{O)}}$$

Regression analysis was done and a significant correlation between values was found.

RESULTS

Bile duct pressure rose after saline injection into the bile duct. The pressure response reached its peak (passage pressure) immediately after infusion, then fell to a stable level (residual pressure) when the

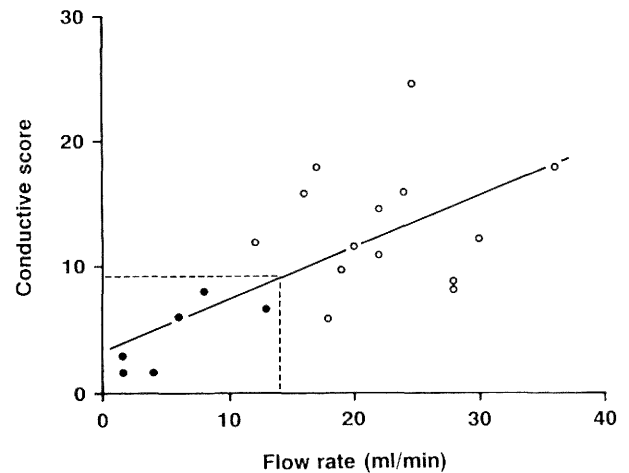


Fig. 1. Correlation between the bile flow rate per minute and the conductive score. The regression line is $Y = 0.4086X + 3.4889$. The subjects were judged as normal (○) or having papillary stenosis (●) in the 3.0 mm catheter test. The dotted line indicates the marginal zone between ○ and ●.

Table 1. Bile flow and manometric parameters in subjects who received passage examination with a 3.0 mm catheter

Catheter passage	Number of subjects	Flow rate (ml/min)	Bile ductal pressure (cmH ₂ O)	
			Passage pressure	Residual pressure
Possible	1	36.0	17.0	15.0
	2	22.0	12.5	11.0
	3	19.0	18.5	16.5
	4	16.0	19.0	18.0
	5	18.0	12.5	9.5
	6	12.0	8.0	7.0
	7	17.0	8.5	7.5
	8	24.0	9.0	7.5
	9	28.0	15.5	12.5
	10	28.0	15.5	12.0
	11	22.0	14.0	12.0
	12	20.0	11.5	9.0
	13	24.5	11.5	10.5
	14	30.0	11.5	9.0
		22.6±1.6	13.2±0.9	11.2±0.9
Impossible	1	13.0	20.0	18.0
	2	8.0	17.0	16.0
	3	6.0	12.0	11.0
	4	1.5	25.5	25.0
	5	4.0	22.0	19.0
	6	0.5	27.0	22.5
		5.5±1.7	20.6±2.1	18.6±1.8

Values are the mean±SEM.

infusion had stopped. The passage and residual pressures were recorded to calculate the conductive score. When the flow rate per minute and conductive score were plotted, there was a predictable correlation between the two components (Fig. 1). The regression coefficient (r) was $+0.781$, and the difference was significant ($p < 0.01$).

When a catheter was introduced into the ductal end, there was good passage in 14 of 20 patients. But in 6 of the 20 patients, the catheter failed to pass through the end, and the condition was judged to be papillary stenosis. The associated parameters for bile flow and manometry are shown in Table 1. Transduodenal sphincteroplasty⁹⁾ was done for the stenosis as a biliary drainage operation.

One characteristic feature was seen in the regression line between the flow rate per minute and the conductive score (Fig. 1); the patients who were judged as having papillary stenosis were included among the patients with a flow rate below 14.0 ml/min, which corresponded to a conductive score below 9.2.

DISCUSSION

The ductal flow rate has been shown to be an important component indicating the need for drainage surgery on the bile duct: a flow rate below 10.0–14.0 ml/min has been an operative standard.^{4,5,7,9)} In this study, the finding that patients who received the drainage operation had a flow rate below 14.0 ml/min (Fig. 1) was consistent with previous reports.^{4,5,7,9)} Moreover, we wish to emphasize that the ductal conductive score should be included in the criteria for the drainage operation because a reliable correlation between the flow rate and conductive score was established (Fig. 1). A conductive score below 9.2 may be taken as an indicative standard. Although the score seems inferior to the flow rate because of a higher false positive rate, the conductive score has some value in diagnosing papillary stenosis more accurately when used in combination with the flow rate.

The practice of drainage surgery on the bile duct requires quick and accurate additive diagnosis, and a simple test is useful when deciding whether or not to drain the bile juice. In view of this, the conductive score proposed may satisfy the need for simplicity because it is easy to calculate from the flow rate and pressure that are routinely recorded in clinical practice.

Recently laparoscopic cholecystectomy has become more popular than open procedure.¹²⁾ In order to check papillary stenosis, this kind of examination is recommended regardless of surgical procedure.

To sum up, estimation of the conductive score coupled with the bile flow rate appears to give us stricter indicative criteria for diagnosing when papillary stenosis needs drainage surgery on the bile duct.

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