A Reappraisal of Surgical Treatment for Intrahepatic Gallstones

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IN a previous paper,[11] the authors reported that there can be three approaches for surgical treatment of intrahepatic gallstones. One is choledochotomy followed by extended exploration of the bile ducts up to the hepatic hilus, which is a basic method to be employed initially in all cases of common duct exploration. The second route is transhepatic cholangiolithotomy by an incision of the liver parenchyma, and the third method is hepatic lobectomy which may be a better definitive procedure in selected cases. In addition to such lithotomy procedures, the authors stressed the need of drainage operations to prevent bile stasis and recurrence of calculi. In the present report, a reevaluation will be given of the surgical treatment for intrahepatic gallstones, based on 46 patients treated in the surgical department of Tohoku University Hospital, Sendai, Japan.

Materials

Gallstones which were located in the intrahepatic ducts above the main hepatic ducts were defined as intrahepatic gallstones. According to this definition, 46 cases of intrahepatic gallstones accounted for 6.9% of all the instances of cholelithiasis treated, as shown in Table 1. Classified by the type of stones, there were 41 cases (89.1%) of calcium bilirubinate stone, three cases of cholesterol stone and two cases of stones composed of fatty acid-calcium. Although in 13 patients stones were located in an intrahepatic bile duct only, ten patients had already undergone one or several operations such as cholecystectomy and choledocholithotomy. Therefore, the remaining three patients (6.5%) clearly had stones in the intrahepatic ducts only. The other patients had intrahepatic calculi combined with extrahepatic calculi. As the cause of intrahepatic calcium bilirubinate stones, bile stasis due to papillitis followed by *E. coli* infection is considered to be the most important factor as in the case of common duct stones.[10] Cholesterol stones were found in three patients, two of whom had stones not only in the intrahepatic duct but also in the common duct and the gallbladder, and the remaining case in the common duct but not the gallbladder. It was considered probable that these cholesterol stones were formed in the gallbladder and then emigrated into the bile ducts, because in each case there was no stricture of the biliary tract and the intrahepatic stones were located relatively near the bifurcation and the intrahepatic stones were similar in type and size as those stones found in the extrahepatic biliary tract. Fatty acid calcium stones can be formed in the bile ducts under the same condition as in formation of calcium bilirubinate stone with severe biliary infection in which fatty acid is isolated from neutral fat and phospholipid by phospholipase of bacteria and pancreatic juice.[13] We have never seen any reports on this type of stone in the western literature and it is very rare even in Japan.

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TABLE 1. *Patients with Gallstones Operated upon by the Authors (1961–1969)*

Type of Stone	Location of Stone			Total
	Gallbladder	Bile Duct	Intrahepatic Duct	
Cholesterol stone	376 (83.9)	69 (15.4)	3 (0.7)	448
Calcium bilirubinate stone	41 (26.3)	74 (47.4)	41 (26.3)	156
Pure pigment stone	56 (94.9)	3 (5.1)	0	59
Miscellaneous	5*	0	2**	7
Total	478 (71.3)	146 (21.8)	47 (6.9)	670

Figures in parentheses show percentages to total number.
* Calcium carbonate stone.
** Fatty acid calcium stone.

As for microorganisms in bile, *E. coli* was detected in all cases of intrahepatic gallstones. Out of 46 cases, 44 cases were subjected to surgical treatment for intrahepatic gallstones. In the remaining two cases surgical intervention was abandoned because they had associated carcinoma of the extrahepatic biliary system.

Surgical Procedure for Intrahepatic Gallstones

Surgical treatment of intrahepatic gallstones has to be directed to the elimination of bile stasis as well as to the removal of stones. In addition to lithotomies, the authors have added some procedures for preventing bile stasis and draining residual stones into the intestinal canal. The indications for various types of lithotomies and drainage operations will be discussed below.

1. Lithotomy by Extended Exploration of the Bile Duct

After confirming the intrahepatic location of gallstones, the common bile duct and common hepatic duct are incised up to the hilus of the liver, and stones are scooped out with a lithotomy spoon or a finger. Lithotomy by this procedure is a basic method for the removal of intrahepatic gallstones and removal can be done relatively easy when stones are located near the bifurcation of the hepatic duct, if the ducts are dilated and not associated with any strictures. However, there is a certain limit to this method, and often a few or many stones may be left. The authors insert Nelaton's catheters into the right and left intrahepatic bile duct, and wash out small residual stones or biliary sludges with physiologic saline as completely as possible. After cleaning by these methods, a T-tube is inserted into the common bile duct. Purposes of this common duct drainage are (a) prevention of bile stasis and infection, (b) resting of the duodenal papilla, (c) draining away residual small stones and sludge by washing through the drain, and (d) postoperative examination. In most cases of intrahepatic gallstones an additional drainage procedure is necessary.

2. Transhepatic Cholangiolithotomy

The second route for the removal of intrahepatic gallstones is cholangiolithotomy through an incision of the liver parenchyma. This method is indicated when intrahepatic gallstones are felt on the surface of the liver or when one or more intrahepatic bile ducts show a cystic dilatation. In most cases, this method is performed in combination with lithotomy by extended exploration of the bile duct. After performing this method, a T-tube is inserted into the incised intrahepatic bile duct for postoperative washing and drainage (Fig. 1).

3. Hepatic Lobectomy

When stones are localized in the left lobe, extensively filling up the intrahepatic

ducts (Fig. 2), when combined with a marked stricture of the duct, left hepatic lobectomy may be the method of choice. In such a case, it will be not difficult to resect the lobe including lodged gallstones when the hepatic lobe is fibrously contracted.

4. Additional Operations

In the treatment of intrahepatic gallstones, the addition of drainage procedures to the operation seems to be the most important factor favorably influencing the late results of operation.

(1) **Papilloplasty.** This method may be called transduodenal choledochoduodenostomy and it should be used in combination with T-tube drainage. It is indicated when there is no stricture in the common bile duct and common hepatic duct, and small residual stones or biliary sludge are observed in the biliary passages. This procedure is necessary as a rule, even when intrahepatic stones are removed entirely, to prevent recurrence of calcium bilirubinate gallstones by eliminating the causes of bile stasis. The greatest complication with this method is reflux of duodenal contents into the biliary tract. When the general condition of the patient is favorable, gastric resection for duodenal exclusion may be indicated.

(2) **Cholangiojejunostomy en Roux-Y.** This method is indicated when papilloplasty is not appropriate either because there are many residual stones in the intrahepatic bile ducts or because a stricture exists at the lower part of the common bile duct.

Results of Operation

1. Direct Results

(1) **Direct Results According to Type of Operation.** As shown in Table 2, lithotomy by extended exploration of the bile duct was performed on 25 patients, of whom two died. In one 46-year-old man, the gallbladder and common bile duct as well as the intrahepatic bile ducts were full of stones. The common bile duct was dilated to 25 mm. in outside diameter, and the left hepatic lobe was remarkably fibrotic. Following cholecystectomy, stones were removed by this method. However, as residual small stones were noted by preoperative cholangiography, papilloplasty was performed as an additional operation. His death was due to agranulocytosis combined with erythrodermia attributed to medication. The other death occurred in a

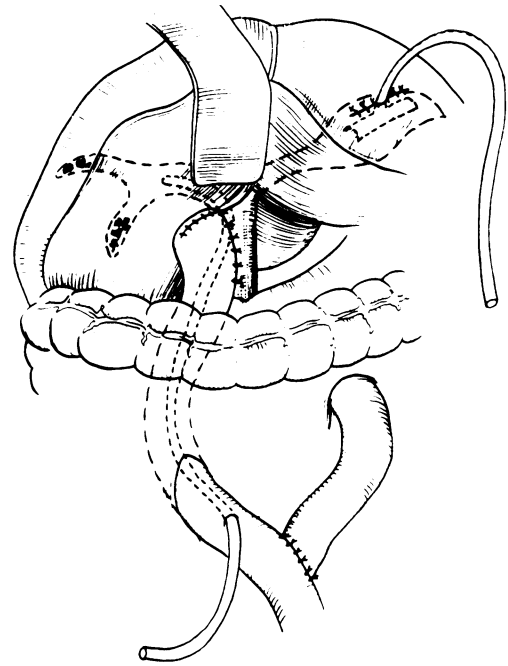

FIG. 1. Schema of a type of cholangiojejunostomy. T-tube was inserted into the intrahepatic duct after performing transhepatic cholangiolithotomy.

TABLE 2. *Result of Lithotomy by Extended Bile Duct Exploration*

Additional Operation	No. of Cases	No. of Deaths
1. Bile duct drainage	4	
2. 1 + papilloplasty	8	1
3. 2 + gastrectomy for duodenal exclusion	3	
4. Side-to-side choledochojejunostomy	9	
5. Choledochoduodenostomy + gastrectomy for duodenal exclusion	1	1
Total	25	2

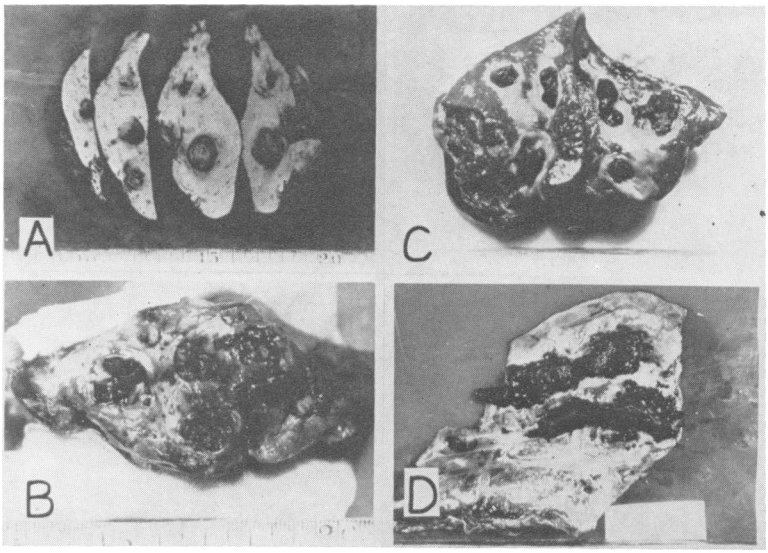

FIG. 2. Resected left lobe of the liver in a 30-year-old woman (A), 30-year-old man (B), 44-year-old woman (C), and 36-year-old man (D).

59-year-old woman. She had undergone previous cholecystectomy and choledocholithotomy. The right and left hepatic bile ducts and the common bile duct were filled with calcium bilirubinate stones, and the outside diameter of the common duct was increased to 30 mm. After removal of stones by this method, choledochoduodenostomy and gastric resection for duodenal exclusion were performed as an additional operation. This patient died of purulent peritonitis due to an impaired gastrojejunostomy.

As shown in Table 3, transhepatic cholangiolithotomy was performed on 11 patients, of whom two died. One was a 68-year-old woman who had previously undergone operation for cholelithiasis. At laparotomy, the right and left hepatic ducts and the common duct were full of calcium bilirubinate stones, and the common duct was dilated to 30 mm. Many stones which were palpable on the surface of the left hepatic lobe were removed transparenchymally and a T-tube was inserted in the intrahepatic duct. Furthermore, papilloplasty and gastric resection for duodenal exclusion were performed as additional operations. The patient died due to impaired gastrojejunostomy. The other patient was at 59-year-old man. The right and left hepatic ducts, the gallbladder and the common duct were full of calcium bilirubinate stones, and the common duct was dilated to 50 mm. Cholecystectomy, lithotomy by extended exploration of the bile duct, and right transhepatic cholangiolithotomy were performed combined with side-to-side cholangiojejunostomy Roux-en-Y. In this patient, jaundice was observed with an icteric index of 51. On the eighth postoperative day, this patient died of massive gastric hemorrhage.

TABLE 3. *Operative Result of Transhepatic Cholangiolithotomy*

Additional Operation	No. of Cases	No. of Deaths
1. Choledocholithotomy + papilloplasty	2	
2. 1 + gastrectomy for duodenal exclusion	2	1
3. Side-to-side choledocho-jejunostomy	4	1
4. Choledochoduodenostomy + gastrectomy for duodenal exclusion	3	
Total	11	2

As shown in Table 4, left hepatic lobectomy was performed on eight patients of whom three died. In all cases, the left hepatic lobe was full of stones. One case was associated with choledocholithiasis. A

patient, in whom a T-tube was inserted, died of peritonitis caused by bile leakage from the choledochostomy wound. The other patient, in whom T-tube drainage and papilloplasty were performed, died of hemorrhage from the biliary tract. Another patient who underwent choledocholithotomy, T-tube drainage, papilloplasty and gastric resection for duodenal exclusion gradually developed symptoms of hepatic damage and died on the 104th day after operation. Overall, the operative mortality in 44 cases of intrahepatic gallstones was seven deaths (15.9%). The rate is high as compared with 1.1% and 6.1% mortality of cholecystolithiasis and choledocholithiasis respectively performed in the authors' department.

(2) Factors Affecting the Direct Results. Regarding mortality by age, there was no operative death in seven cases in the third decade, there was one death in 17 cases (5.9%) in the fourth decade, two of seven (28.6%) in the fifth decade, three deaths in eight cases (37.5%) in the sixth decade, and one death in five cases (20%) in the seventh decade, showing a higher risk in the older age groups.

It was further observed that patients with intrahepatic gallstones had symptoms of long duration and that most had undergone several operations previously. As shown in Figure 3, only seven of the 44 patients visited the authors' department within one year after the onset of the initial symptom, and 24 patients (55%) had symptoms which had lasted more than 10 years. Of the seven patients that died after operation, five had symptoms which lasted from 15 to 34 years.

In regard to the history of previous biliary tract operations, 27 patients or 61% of the 44 in the series had undergone one to four previous operations. As to the relationship between previous operation and death following operation, four of the seven patients who died had undergone one to four operations

TABLE 4. *Operative Result of Left Hepatic Lobectomy*

Additional Operation	No. of Cases	No. of Deaths
1. Choledocholithotomy + Bile duct drainage	2	
2. 1 + papilloplasty	1	
3. 2 + gastrectomy for duodenal exclusion	5	3
Total	8	3

The preoperative studies showed that 29 (66%) of 44 patients had anemia with red cell count less than 4 million per cubic millimeter as shown in Figure 4 and three showed red cell counts of less than 3 million. An icteric index above 10 was found in 21 (47%) of the 44 patients with a slightly higher frequency in incidence of jaundice in the patient with choledocholithiasis. However, the highest icteric index was 65 and there was no case of severe jaundice. BSP showed less than 5% dye retention after 30 minutes in only three instances. Only seven patients had less than 10 units of alkaline phosphatase (K.

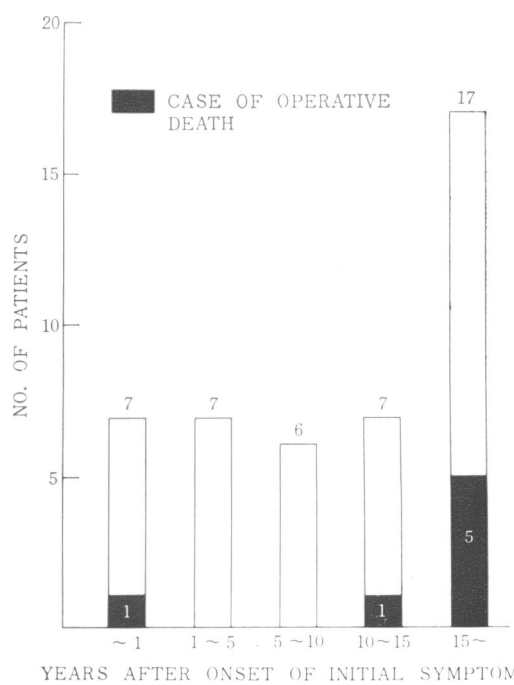

FIG. 3. Duration of symptoms and operative mortality in instances of intrahepatic gallstones.

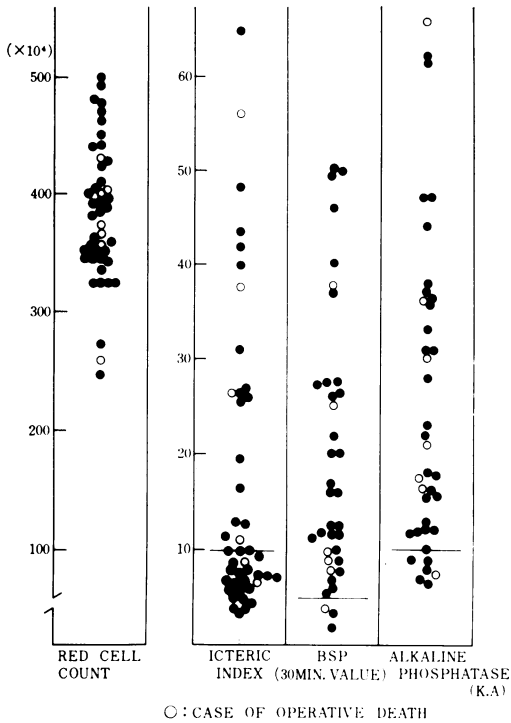

FIG. 4. Results of preoperative examinations in patients with intrahepatic gallstones.

A. unit). However, analyzing the results of these tests in patients who died after operation, no relationship was observed between the functional disturbance of the liver and the mortality rate.

The above facts show a longer duration of symptoms is associated with a higher operative mortality rate, particularly after major operation. For example, when papilloplasty and gastric resection for duodenal exclusion were performed as additional operations following lithotomy by extended exploration of the bile duct or hepatic lobectomy, a majority of the patients could not tolerate the procedures and early postoperative death was encountered in a high percentage of patients so managed.

2. Late Results

Five hundred forty-one patients with cholelithiasis underwent operation in the authors' department from 1961 to 1968. Twenty-eight patients died immediately after operation. Questionnaires were sent to the remaining 513 patients and postoperative complaints were analyzed. Of the 513 patients, 491 (95.7%) responded to the questionnaires by letter, particularly all patients with intrahepatic gallstones. Among the 491 cases, 57 cases were associated with malignant tumor. The remaining 434 cases were subjected to follow-up study in three stages as indicated in Table 5.

(1) Late Deaths in Follow-up Period. Two patients died in the follow-up period. One of the two had advanced liver cirrhosis with splenomegaly at the time of operation. Lithotomy by extended exploration of the bile duct and T-tube drainage were performed on this patient. He died later of bleeding esophageal varices. Another patient underwent lithotomy by extended exploration of the bile duct, T-tube drainage and papilloplasty. He did not undergo gastric resection for duodenal exclusion and subsequently developed repetitive ascending infections after discharge from the hospital. Although advised to re-enter the hospital, he refused and finally died of multiple liver abscesses. The diagnosis was confirmed by autopsy.

(2) Late Results Judging from Postoperative Complaints. Among cases followed from 1 to 3 years after operation, 90% of the cases of cholecystolithiasis and 82% of the cases of choledocholithiasis showed good results, while none of the patients with intrahepatic gallstones had complaints (Fig. 5). In cases followed from 3 to 5 years and more than 5 years after

TABLE 5. *Patients Subjected to Follow-up Study*

Years after Operation	Location of Stone			Total
	Gallbladder	Bile Duct	Intrahepatic Duct	
1–3 yr.	102	25	5	132
3–5 yr.	97	38	6	141
5 yr.–	109	39	13	161
Total	308	102	24	434

operation, the patient with choledocholithiasis had a decrease in symptoms compared with the patients who had complaints from 1 to 3 years after operation. All patients with intrahepatic gallstones were living in good health, irrespective of the postoperative period. As a whole, in cases of cholelithiasis, 88% of cholecystolithiasis, 89% of choledocholithiasis, and 100% of intrahepatic gallstones showed good results after operation.

(3) **Rehabilitation.** In cases followed from 1 to 3 years after operation, 94% of patients with cholecystolithiasis, 91% with choledocholithiasis, and 100% with intrahepatic gallstones returned to their preoperative jobs and were leading pleasant social lives. As shown in Figure 6, in cases followed more than 3 years after operation, more than 96% of the patients, irrespective of the location of stones, were completely rehabilitated and gainfully employed. Only 1% of the total were unable to rehabilitate. All patients with intrahepatic stones, irrespective of length of our follow-up after operation, were living in good health.

(4) **Results of Clinical Examination at the Time of Follow-up.** Twenty-two of the patients with intrahepatic gallstones returned for clinical examination and direct cholangiography. As shown in Figure 7, all patients except one showed a red cell count of more than 3.5 million per cubic millimeter and the preoperative anemias were remarkably improved. All the patients had icteric indexes of less than 10 and there was no case of apparent jaundice. BSP showed more than 10% dye retention after 30 minutes in eight of the 17 patients examined. However, six of the eight patients distinctly improved in BSP test, as compared with preoperative values. Seven patients had abnormal values of more than 15 units of alkaline phosphatase. However, four of the seven showed improvement, as compared with preoperative values. Patients who showed abnormal hepatic function in follow-up study, including those with aggravation in hepatic function after operation had mostly long duration of symptoms lasting more than 10 years.

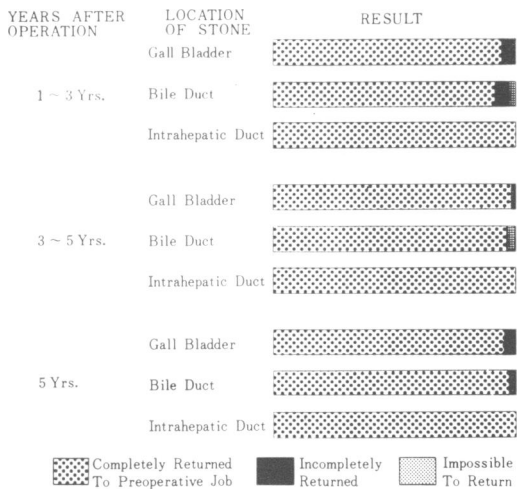

FIG. 5. Late results of postoperative complaints in patients with gallstones. Good: Free from sequelae, Fair: Mild pain occurs several times a year, Unchanged or Aggravated: Persistence of severe pain.

On direct cholangiography, all the patients still showed mild dilatation of the bile ducts, but notable shadow defects due to residual stones had disappeared in the majority of cases with drainage of the opaque dye into the digestive canal. Several cholangiograms are shown in Figures 8, 9 and 10.

Discussion

The treatment of intrahepatic gallstones has been a serious problem for surgeons. However, because of the small number of such cases, the procedures for surgical treatment have not been established until recently. In 1964, the authors [6] reported that the basic method of treatment is lithotomy by extended exploration of the bile duct and, depending on the case, it may be necessary to perform transhepatic cholangiolithotomy or, when stones are restricted to a single hepatic lobe, it may be necessary to perform hepatic lobectomy. It may also be necessary to perform an additional drainage procedure to prevent

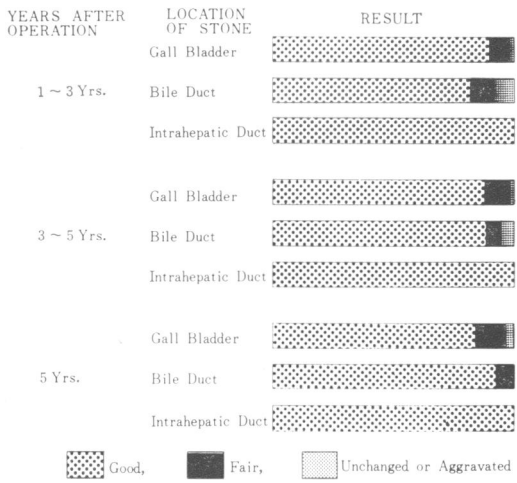

FIG. 6. Late results in terms of rehabilitation in patients with gallstones. Completely Returned: Return to the same preoperative position and doing well, Incompletely Returned: Return to same preoperative work but needing occasional rest. Impossible to Return: Unable to return to preoperative position.

bile stasis, especially in cases of calcium bilirubinate gallstones. This thesis describes surgical treatment for intrahepatic gallstones most systematically. The most controversial issue concerning these methods is hepatic lobectomy. Although this is the most complete method for removal of stones restricted to the left hepatic lobe, hepatic lobectomy had not been regularly performed because the procedure is too extensive for gallstones. However, if the number of stones cannot be removed by any other method mentioned previously or there is a marked stricture in the intrahepatic bile duct, this may be the only feasible method. Ong [12] and Huang [7] performed hepatic lobectomy for treatment of intrahepatic gallstones and reported good results. Braasch [3] performed segmental hepatectomy for removal of stones in the anterior segment of the liver. The authors performed left hepatic lobectomy in eight patients, of whom three died. Five patients including three who survived more than 5 years after operation were leading pleasant social lives without remarkable hepatic disturbance. This method should be adopted in cases in which it seems strongly indicated.

Except in the case of cholesterol gallstones the most important factors in the cause of intrahepatic gallstones appear to be bile stasis and subsequent ascending infection. There will be a recurrence of stones unless the above conditions have been removed. To prevent this, various additional procedures may be necessary. Except for cases effectively treated by hepatic lobectomy, complete removal of intrahepatic gallstones seems to be impossible in most cases. After the lithotomy procedure, repeated washing through a T-tube inserted into the bile duct removes any remaining stones which flow away into the intestinal canal. For this reason, formation of a comparatively large stoma is necessary at operation.

For this reason, when there are residual small stones or biliary sludge and there is no stricture at the upper portion of the extrahepatic bile duct, papilloplasty, that is transduodenal choledochoduodenostomy, is considered to be appropriate. However, in this condition the greatest problem is

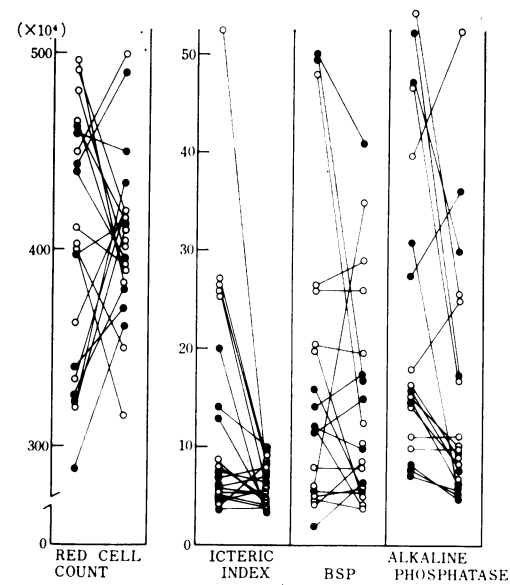

FIG. 7. Changes in laboratory examinations before and after operation.

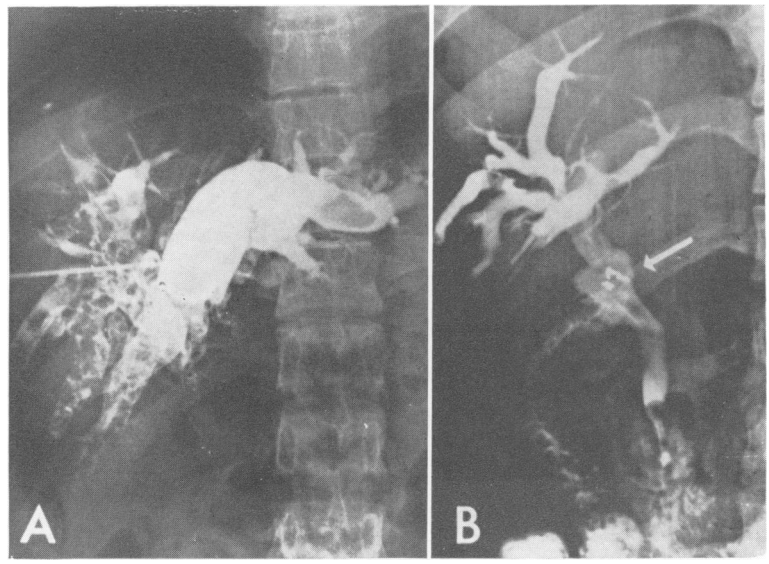

FIG. 8. Percutaneous transhepatic cholangiograms in a 25-year-old man. A: Preoperative cholangiogram. Note marked dilatation of both intrahepatic ducts with multiple stones. B: Cholangiogram at the time of follow-up after performing lithotomy by extended exploration of bile duct and cholangiojejunostomy. There were no remnant calculi, the contrast medium flowed freely into the jejunum and the diameter of bile ducts were revealed to be greatly reduced. Arrow shows the site of anastomosis.

reflux of contents of the duodenum into the bile ducts. Concerning late results of papilloplasty, Böhmig *et al.*[2] reported that no complaints were observed in 162 (88%) of 183 patients despite duodenobiliary reflux which was observed in 43% of 123 patients of whom underwent x-ray examination. He stated, accordingly, that no relationship existed between duodenobiliary reflux and complaints after operation. Kourias *et al.*[8] reported that 87.9% of 113 patients were found in good condition and duodenobiliary reflux was observed in 15%. In Europe and the United States, few of the patients with complaints were reported although duodenobiliary reflux was observed in many. Therefore, most authors in these areas have been little concerned as to whether or not the duodenum should be excluded. In the author's case, however, one of two patients died later due to multiple liver abscesses caused by ascending infection, because he had not undergone gastric resection for duodenal exclusion. In Japan, many patients have suffered from fever and jaundice after papilloplasty.

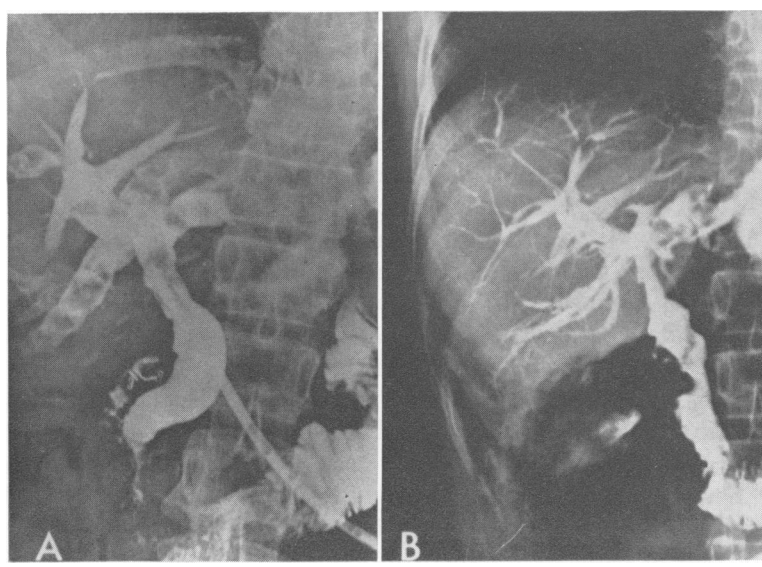

FIG. 9. Cholangiograms in a 31-year-old woman. A: Preoperative cholangiogram through a T-tube. Multiple stones were observed in the intrahepatic ducts of both lobes and the left hepatic duct was interrupted due to gallstones. B: Percutaneous transhepatic cholangiogram at the time of follow-up after performing lithotomy by extended exploration of bile duct, left hepatic lobectomy and papilloplasty. Note disappearance of notable shadow defects due to gallstones, reduction in diameter of the bile ducts and free passage of contrast medium into the duodenum.

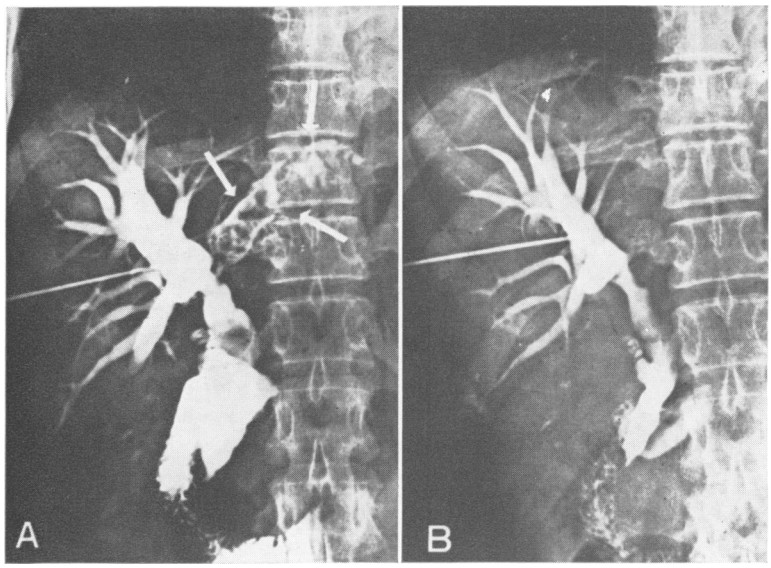

FIG. 10. Percutaneous transhepatic cholangiograms in a 44-year-old woman. A: Preoperative cholangiogram. Arrows show the presence of gallstones in the left intrahepatic ducts. B: Cholangiogram at the time of follow-up after performing choledocholithotomy and left hepatic lobectomy. Note complete disappearance of gallstone shadows.

Therefore, most surgeons here are of the opinion that generally, gastric resection for duodenal exclusion may be necessary after papilloplasty. Furthermore, three of the seven postoperative deaths were due to impaired gastrojejunostomy. Therefore, in patients in poor general condition, gastrectomy for duodenal exclusion should be performed as a secondary operation, if necessary.

When many residual stones in intrahepatic bile ducts or stricture at the lower part of common bile duct are observed, cholangioenterostomy is indicated for operation of intrahepatic gallstones. Some advocate cholangioduodenostomy [1, 6] and others recommend cholangiojejunostomy Roux-en-Y.[4,,5] In cases of intrahepatic gallstones, the latter may be a method of choice, because ascending infection is infrequent with the Roux-en-Y anastomoses and because gastric resection for duodenal exclusion is unnecessary since a wide stoma is available. Though Longmire *et al.*[9] recommend a side-to-end anastomosis in choledochojejunostomy, we prefer a side-to-side-cholangiojejunostomy because of the wide stoma which is obtainable.

Seven operative deaths occurred (15.9%) of 44 cases. In Japan, the operative mortality rate in cases of intrahepatic gallstones was 8–16.7%, which is very high compared to extrahepatic gallstones. Many believe that intrahepatic gallstones are often associated with liver cirrhosis which may account for this high mortality at operation. Lindenauer *et al.*[14] reported that instances of bile duct stricture may be often associated with liver cirrhosis and result in high mortality at operation.

From 1961 to 1964, the authors had attempted to remove all intrahepatic gallstones. However, it was confirmed recently that after the initial effort, most of the residual stones will drain away into the intestinal canal through a wide cholangiojejunostomy. If a few stones remain in the intrahepatic ducts, no noticeable complications have occurred after operation in most cases, provided that the causes of bile stasis have been eliminated. In the past 3 years, 14 patients have undergone this procedure and there was only one operative death.

Generally speaking, the late results of operation for intrahepatic gallstones has been considered inferior to that for extrahepatic gallstones. However, the follow-up study by questionnaire revealed opposite results contrary to our expectation. Namely, the rate of good results of surgical treatment for intrahepatic gallstones was superior when compared with 88% of cholecystolithiasis and 89% of choledocholithi-

asis. One reason may be that patients with intrahepatic gallstones feel less uneasy about trifling troubles after operation because of improved cardinal symptoms which had often lasted for a long duration prior to operation. The other reason may be related to the drainage procedure. In some instances of choledocholithiasis, drainage procedures are indicated at first operation. Actually, in two cases of choledocholithiasis, the drainage procedure was added secondarily because of the so-called postcholecystectomy distress.

Summary

Forty-six patients with intrahepatic gallstones were treated by the authors, surgical procedures for this disease were analyzed and the following results were obtained:

1. The basic method of operation for intrahepatic gallstones is lithotomy by extended exploration of the bile duct and, in some cases transhepatic cholangiolithotomy or hepatic lobectomy should be performed. To eliminate bile stasis and permit residual stones to flow away into the intestinal canal, additional procedures such as papilloplasty or cholangiojejunostomy were necessary.

2. The operative mortality rate was 15.9%. Clinical analysis revealed that most patients had anemia and abnormal hepatic function. Death generally occurred in those with long duration of symptoms, and particularly among those who underwent major operations such as lithotomy by extended exploration of the bile duct or hepatic lobectomy with such additional procedures as papilloplasty and gastric resection for duodenal exclusion. Serious consideration should be given to indications for hepatic lobectomy. The question as to whether or not gastric resection for duodenal exclusion should be performed as primary procedure is also important.

3. Two late deaths occurred in the follow-up period. One patient died of hemorrhage from the esophagus due to liver cirrhosis which had developed prior to operation. The other patient died of ascending infection. Gastric resection for duodenal exclusion was not performed after papilloplasty. All of the patients who survived operations had no complaints and were enjoying social lives. In clinical examinations in the follow-up period, most patients were improved as compared with preoperative conditions. Some patients, however, still had abnormal hepatic function. All had had symptoms which lasted more than 10 years before the definitive operation was performed.

4. If early and accurate diagnosis is made in this disease and adequate operations are performed, the prognosis will never be pessimistic.

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