

Cholelithiasis in Koreans

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INTRODUCTION

Surgeons who have had the privilege of working on both sides of the Pacific ocean can not help but be impressed with the difference in the biliary tract diseases found in the Occident and Orient. These difference are most clearly noted in the type and occurrence of cholelithiasis and choledocholithiasis.

Colcock(1955) from the Lahey Clinic reported a 13.5% incidence of common duct stones among 1,356 patients who were operated on for biliary tract disease. Walters(1940) of the Mayo Clinic found stones in the common duct alone in 6%, and in both the gall bladder and the common duct in 7% of his cases. Reports from the United States and from the Europe both emphasize the common duct stones are very rarely found in the absence of associated cholelithiasis. On the contrary, the report below shows that among the patients at Severance Hospital who had surgery for biliary tract disease 34.8% had stones in the common duct only, and 35.6% had stones in both the common duct and the gall bladder an all over rate of 70.4% of the patients had common duct stones. 86% of the Mayo Clinic cases had cholelithiasis without other stones, but only 24.4% of the patients seen at Severance Hospital had cholelithiasis alone. Walters(1960) mentions that intra-hepatic calculi are very rare at the Mayo Clinic. Glenn(1961) is also in agreement with Dr. Walters. Of the patients explored at Severance Hospital during this study, 21 or 18.2% had intra-hepatic stones. Although the early western surgeons in Korea seldom operated for calculous biliary tract diseases, they did note that

common duct stones were found more frequently. Ludlow(1930) reported eight cases of cholelithiasis in Koreans who were operated on between 1916 and 1926. Five of his 8 patients had stones only in the common duct, and three others had stones in the gall bladder. In recent years, Hahn(1959), Jessen(1962) and Hur(1962) each have emphasized the predominance of the ductal stones, a very significant clinical finding of the biliary tract pathology in Korea.

Ludlow, the surgeon who worked at Severance Hospital 30 years ago in the pioneer days of Korean western surgery, made the following statement about cholelithiasis in Korea: "In view of the following considerations it would be hazardous to claim that cholelithiasis is as rare in the Korean as these statistics would seem to indicate; (1) the large number of people in Korea who, except for the most serious lesions, rarely consult a qualified physician or surgeon; (2) the preference of the patient and often of the doctor for medical treatments; (3) the comparative small number of laparotomies; (4) the predominance of male over female patients; (5) the age of the in-patients, 80% being under the age of 40 years; (6) the large number of multipara; (7) the prevalence of infection, both bacterial and parasitical; (8) the small number of autopsies and the absence of any racial peculiarity in the anatomy of the biliary structure." The above statements of Ludlow may still be true in many aspects, although later developments have made more accurate diagnosis possible. The use of the cholangiogram has improved our diagnostic ability, particularly where intra-hepatic calculi are present.

It is hoped that this study will help to explain the relatively high incidence of choledocholithiasis in Korea. In at least one case the "stones" were due to bile precipitation on a fragmented dead ascaris. The close relationship between "muddy bile, bile pigmented stones and chronic cholangitis secondary to parasitic infestation appears to be a real and an important one in the patients seen for biliary surgery at Severance Hospital.

MATERIALS

The present study is an analysis of 115 consecutive cases who were operated on for gallstones in the Department of Surgery, Severance Hospital, Yonsei University, during the five and half years from January 1, 1958 to June 30, 1963.

In order to obtain as accurate as possible study of the clinical features of the Korean cholelithiasis the records of those patients operated prior to 1958 were excluded because the clinical records of the proceeding few years were not sufficiently detailed in the presentation of pathologic changes, particularly the location of gallstones encountered during surgery. Also excluded were the records of patients not having surgery even though there were positive clinical or X-ray findings.

Admissions to the hospital during this period exceeded 25,000. The incidence of cholelithiasis was 4.6 per 1,000 admissions or 0.46 per cent.

SEX AND AGE

The series consists of 46 males and 69 females, a ratio of 1 to 1.5. The extremes of age were 12 years and 77 years, with an average age of 45.7 years. The average age of the 46 males was 42.8 years and that of the 69 females was 47.7 years (Figure 1).

INGREDIENTS OF GALLSTONES

The results of analysis of gallstones obtained from ten patients are shown in Table 1. Stones containing more than 70 per cent of cholesterol were gallstones found only in the gall bladder except one which apparently originated in the gall bladder. Components other than cholesterol were present in only minute amounts. In contrast stones

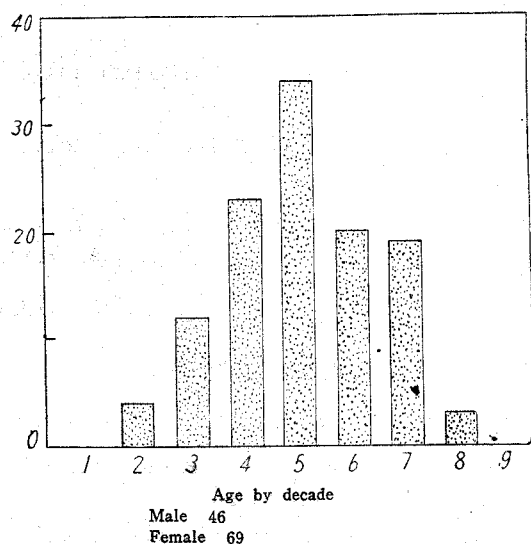


Fig 1. Cholelithiasis by age and sex distribution

Table 1. Chemical ingredients of stones obtained from the biliary system(Hong et al.)

Case No.	Age	Sex	Location of stone*	Ingredient(per cent)				
				Chole-sterol	Cho-late	Calc-ium	Biliru-bin	Othe-rs
62—9	45	F	G.B.	76.8	0.5	11.1	0.4	11.2
62—17	50	M	G.B.	89.9	0	1.2	0.2	8.7
62—18	40	F	G.B.	10.2	0.8	13.2	50.2	25.6
62—25	35	F	G.B.	80.0	0.1	6.3	0.7	12.9
62—2	47	F	C.B.D.	30.0	1.3	14.0	41.7	13.0
62—14	55	F	C.B.D.	3.0	0.1	0	41.5	55.4
62—16	66	M	C.B.D.	4.0	1.6	58.4	—	—
62—19	37	F	C.B.D.	10.2	2.6	12.8	52.7	21.7
63—1	47	M	C.B.D.	20.0	2.7	13.4	49.4	14.5
63—4	68	M	C.B.D.	6.0	6.0	10.0	50.0	28.0

* Location, G.B.: Gall bladder
C.B.D.: Common bile duct

found only in the common bile duct contained 3 to 30 per cent of cholesterol, with an average of 12.2 per cent cholesterol content. The calcium and bilirubin content averaged 55.6 per cent in these stones. There is an apparent difference in either the cholesterol or bilirubin contents of two groups of gallstones, namely, those found only in the gall bladder and those found in the common bile duct. The cholate content in the gallstone was negligible particularly in the case of gall bladder stones. Stones found in both hepatic and common bile ducts contained equivalent amounts of cholesterol

and bilirubin, more than 20 per cent in both. So far as the chemical gradients are concerned, the stones in the Korean are not different from those of Occidentals, however, it may be of interest to note that the calcium and bilirubin stone found in common bile duct is predominant in this country. This feature of cholelithiasis also is noted in other Oriental countries according to Cook et al(1954~55), Maki(1961) or Miyake(1962). In Oriental people the similarity of cholelithiasis in part may come from the dietary habits. The role of bacterial infection in the biliary system or of intestinal parasites is not clear.

LOCATION OF GALLSTONE

In 28 patients(or 24.4%) the gallstone was found only in the gall bladder and in 40 patients(34.8%) the gallstone was only in the common bile duct, while 41 patients(35.6%) had gallstones in the extra-hepatic biliary tree including the gall bladder, common bile duct and both the right and the left hepatic ducts. In the remaining 6 patients, however, a gallstone was not found in extra-hepatic ducts, e.g., the gall bladder or in the common bile duct, but in the intra-hepatic ducts of the biliary tree (Table 2).

Table 2. The location of the biliary tract stones

Gall bladder	Common bile duct	Rt. hepatic duct	Lt. hepatic duct	Total	Per cent
*	—	—	—	28	24.4
—	*	—	—	40	34.8
*	*	—	—	26	22.6
*	*	*	—	2	1.7
*	*	—	*	2	1.7
*	*	*	*	1	0.9
—	*	*	*	7	6.1
—	*	*	—	1	0.9
—	*	—	*	2	1.7
—	—	*	*	1	0.9
—	—	—	*	5	4.3
Total 59	81	12	18	115	100.0

*Stone

Of special interest was the presence of common duct stones in almost three-quarters of the cases, 70.4%, (81 cases) of the entire group. In 6 cases the stones were found only in the hepatic ducts, either right or left, and the incidence of gallstones

in the common and intra-hepatic ducts was 75.6% (87 cases).

SYMPTOMATOLOGY

Pain the commonest complaint, was found in 110 patients or 95.6% of the entire group. Right upper quadrant abdominal pain either colicky or steady in nature usually radiated. Radiating pain was noted in 83 patients or 75.4% of the patients having pain. 5 patients had no complaints of pain. One patient underwent an exploratory laparotomy for carcinoma in the terminal ileum, and a gall bladder stone was incidentally discovered. Two patients with severe jaundice due to common duct stones and one patient with a palpable right upper quadrant mass and gall bladder stone had no complaints of pain. The fifth patient had a cholecystostomy prior to admission, and his hospital chart showed no history of pain.

Dyspepsia was present in 91 patients or 79.1%. Dyspepsia associated with pork was noted in 27 patients, or 29.6% of dyspepsia group. A few patients had a food intolerance to apples or persimmons. Nausea and vomiting occurred in 52 patients or 45.2 per cent. Chills and fever were experienced by 69 patients or 60 per cent of the entire group. A history of jaundice associated with attacks of pain was present in 79 patients or 68.6 per cent(Table 3a).

Table 3a. Patients chief complaints in calculous biliary tract disease*

	No. of cases	Per cent
Dyspepsia	91	79.0
Fat intolerance	27	23.4
Pain	110	95.6
Radiating pain	83	75.5
Chills and fever	69	57.5
Jaundice	79	68.6
Nausea and vomiting	52	45.2

* In a series of 115 cases

Most patients had suffered for a long time with repeated attacks of pain. The average duration was more than 5 years. The longest period of suffering from the intermittent attacks was over 40 years. Abdominal tenderness during physical examination

was found in 103 patients, or 89.5 per cent of the entire group. Rebound tenderness and muscular rigidity in the right upper quadrant of abdomen were present in 58 and 45 patients respectively. Hepatomegaly was found in 30 cases. Ascites was found in three patients (Table 3b).

Table 3b. Clinical observation in calculous biliary tract disease*

	No. of cases	Per cent
Tenderness	103	89.5
Rebound tenderness	58	50.5
Muscular rigidity	45	39.1
Palpable mass	13	11.3
Hepatomegaly	30	26.1
Jaundice	81	70.5
Ascites	3	2.6

* In a series of 115 cases

Fever is not a common symptom of chronic cholecystitis and cholelithiasis, but in the present series the occurrence of the chills and fever was higher than any other series. Patients complaining of a past history of fever usually had a complication of cholelithiasis, such as acute cholecystitis, pancreatitis of a varying degree, or acute suppurative obstructive cholangitis.

On physical examination jaundice was present in 81 cases (or 70.4 per cent of the entire series), showing a high incidence of obstructive jaundice which is very significant, and is a reflection of the prevailing high incidence of ductal stones in Korean patients. However among the 81 ductal stone cases fourteen patients did not have icteric skin at the time of surgery. In another words, 17.2 per cent of the common duct stones did not cause obstructive jaundice. In contrast to the above findings, fourteen patients who had no common duct stones had a mild to moderate degree of jaundice on admission physical examination. At the time of cholecystectomy, five cases of the fourteen had a dilated common bile duct, but subsequent exploration by choledochostomy and or operative cholangiography failed to demonstrate the presence of any ductal stones. In the five of the fourteen a gallstone was not found in the gall bladder nor the common bile duct but a stone was found in the intra-hepatic duct.

In one patient, stones were located in both the right and the left hepatic duct, whereas four patients had a stone in only the left hepatic duct (Figure 2). Three patients had severe inflammatory changes in the gall bladder area. In the remaining patient, beside a stone in the gall bladder, there were numerous adult flukes of *clonorchis sinensis* in the common duct and in the intra-hepatic ducts.



Fig. 2. Case 62-30 intrahepatic calculi in the left hepatic duct: T-tube cholangiogram shows calculi in the left hepatic duct and a stenotic lesion near the bifurcation.

An acute suppurative obstructive cholangitis was seen and treated in 13 patients. Eleven patients complained of intermittent colicky pain and deep jaundice. On admission they were in hypotensive with the other signs of shock and were in a state of mental deterioration with disorientation or even hallucinations. In this group the prothrombin activity was usually delayed and in some cases was less than 30% of normal. In one patient a massive subcutaneous echymosis developed at a site of injection. The leukocyte count usually exceeded 20,000 per cmm.

Cholecystographic examination was carried out in 57 of the 115 patients. Of these 51 patients, or 89.4 %, showed a nonfunctioning gall bladder without visible calculi, using either single or double doses of telepaque or orabilex. The remaining 6 patients

showed a good functioning gall bladder. Three of the patients showed a stone shadow in the visualized gall bladder. In one patient ordinary cholecystography failed to demonstrate a gallstone, but a shadow of the stone could be caught in a spot film focused in the fundus of the gall bladder (Figure 3). The other three patients were operated on the basis of typical clinical symptoms in spite of normal X-ray findings. Two of these patients were found to have stones in the gall bladder and one patient had stones in the common duct. 43 patients of the 51 shown nonvisualization of the gall bladder (or 84.3%) had microscopic evidences of acute or chronic cholecystitis. In two patients cholangitis or biliary cirrhosis was reported.

OPERATIVE FINDINGS

An analysis of the main operative findings in the 115 cases disclosed the following:

The pathologic diagnosis of the removed gall bladder is available for 79 (82.3%) of the cholecystectomized patients. Twenty patients had acute cholecystitis, twenty three patients had acute and chronic cholecystitis and the remaining 36 patients had chronic cholecystitis. However it is noted that acute cholecystitis is more prone to occur in the patient with a gall bladder stone, whereas chronic cholecystitis is more frequently reported from the gall bladder of the patients having a ductal stone.

Dilatation of the gall bladder was recorded in 45 patients. Dilatation of the common bile duct was recorded in 65 patients. Six among the 65 patients in whom no common duct stone was found but the intra-hepatic calculi had common duct dilated, and 7 gall bladder stone patients also had common duct dilatation. Total 13 cases of choledochal ascariasis were observed in the present series. In 12 patients common duct or intra-hepatic stones were associated with dead or living ascaris in the common duct (Figure 4). In one patient who had a gall bladder stone an association of ascaris with biliary calculi was also noted.

6 patients had gross evidence of pancreatitis in

addition to the changes in the biliary tract. An enlarged head of the pancreas, and nodular and edematous changes in the pancreatic surface were noted in 5 patients. Frozen and the subsequent paraffin sections of pancreatic tissue showed acute and chronic inflammation but no malignancy. In one patient a dense white material was evacuated from the main pancreatic duct after trans-duodenal sphincterotomy, and also there were other inflammatory changes in the pancreas. After evacuation of the white material a color-less pancreatic juice flowed well through a pancreatic duct cannula.

A biliary-enteric fistula was found in 4 patients. Two of the choledochoduodenal fistula were found in patients following more than 10 months after insertion of a T-tube in the common duct. The other two choledochoduodenal fistula developed spontaneously. One of the spontaneous fistula patients had a gallstone in the terminal ileum, and the other patient had biliary symptoms which nearly completely subsided immediately before the admission probably due to the development of a spontaneous fistula.

On the basis of microscopic examination of the liver tissue ten patients, or 8.6 per cent showed evidence of liver damage. Four had cholangitis, three had biliary cirrhosis. Passive congestion of liver, or chronic portal inflammation or hepatitis were reported in the remaining three.

Spasm or inflammatory changes of the sphincter of Oddi were present in fifteen cases (13%). 14 of these had common duct calculi and one had a gall bladder stone plus liver flukes in the common duct. Microscopic studies of the sphincter are available in six cases, and showed a fibrosis of the sphincter muscle plus acute or chronic inflammatory changes. In the other 9 patients the sphincter spasm was proven on either T-tube or operative cholangiograms.

OPERATIONS

Two hundred seventy seven operative procedures were performed on the 115 patients (Table 4). Cholecystectomy was done in 96 patients or 83.4% of the entire group and choledochostomy for removal of gall stone or ascaris was done in 95 patients or

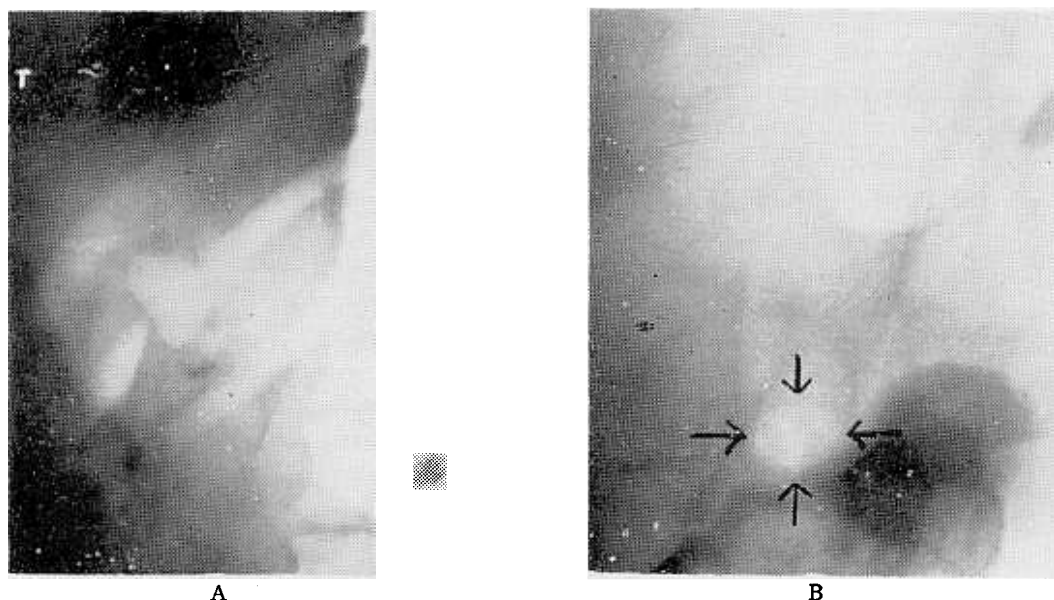


Fig. 3. Case 63-14 oral cholecystography with spot focused on the gall bladder area. Ordinary cholecystography failed to show stones in the gall bladder(A) but a spot film disclosed the stone(B), indicated by arrows.

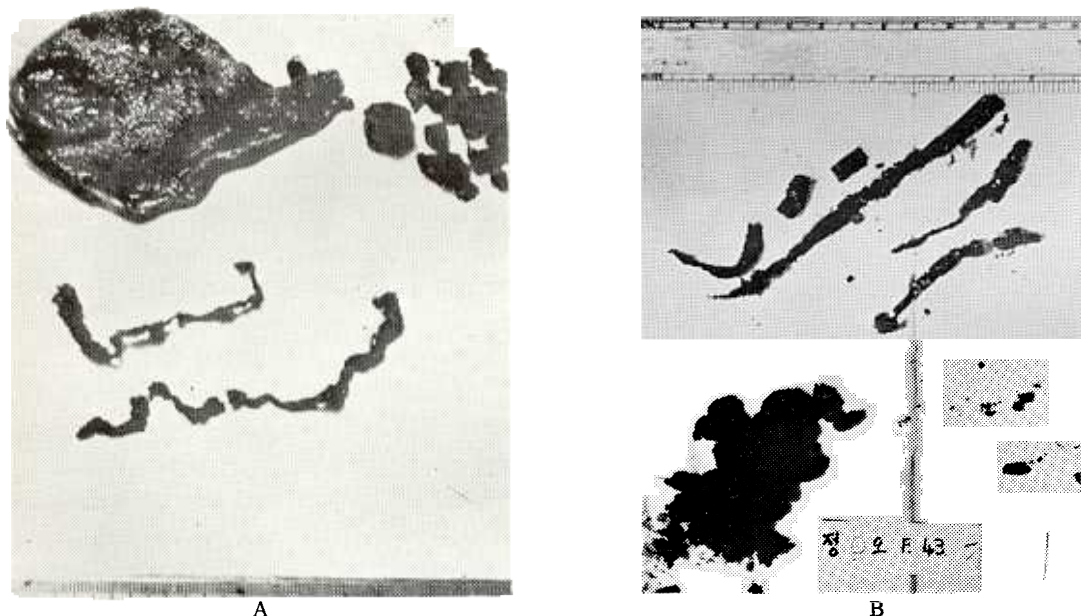


Fig. 4. Photograph of gall bladder and extra-cholecystic calculi associated with the debris of the dead ascaris(A & B).

A: Case 62-11, 52 year old female underwent biliary operation and no stones were found in the gall bladder but numerous calculi were found in both the common and the hepatic ducts. 3 pieces of dead ascaris were removed.

B: Case 59-15, irregular or shapeless calculi removed from the common duct of a 43 year old female patient. Debris of dead ascaris and stony hard material which appeared to be segments of calcified ascaris were removed.

82.6%, of the 115 patients. In addition to cholecystectomy or choledochostomy, 57 patients had an associated operative procedure on the biliary tract, such as trans-duodenal sphincterotomy or a biliary-enteric by-pass procedure. A trans-duodenal sphincterotomy was indicated for 37 patients either for removal of ampullary calculi or for marked narrowing of the ampulla of Vater due to spasm or fibrosis of the sphincter of Oddi. The nine by-pass procedures were cholecysto-duodenostomy in two patients, choledocho-duodenostomy in four patients and a Roux-en-Y choledocho-jejunostomy in three patients. These by-pass procedures were indicated when recurrent biliary symptoms appeared or evidences of retained intra-hepatic calculi were present on operative or on follow-up T-tube cholangiograms.

Fifteen patients had pancreatic duct cannulation and three patients had hepatotomy for removal of intra-hepatic calculi located in the periphery of hepatic tissue. Two patients had a subtotal gastrectomy in addition to cholecystectomy and two patients had a gastro-jejunostomy. Two patients had an ileostomy for removal of a gallstone found in the terminal ileum or a bolus of ascaris in the ileum associated with biliary stones. An appendectomy was done in four patients, in addition to a biliary procedure.

A total of 19 patients did not have a cholecystectomy. Five of the 19 patients had cholecystostomy and an exploration of the common bile duct, while four patients had only a common bile duct exploration. The other five patients had a previous cholecystectomy elsewhere. One case of agenesis of the gall bladder was encountered. In one patient a ductal stone was removed by transduodenal sphincterotomy. In two patients the by-pass procedure of a cholecysto-duodenostomy was done. In the last patient in this group a gall bladder stone was disclosed incidentally during a laparotomy for carcinoma of terminal ileum and was removed by cholecystostomy with closure of the gall bladder (Table 4).

SECONDARY BILIARY SURGERY AND MORTLITY

A total of 24 patients had a repeated biliary surgery for either incomplete primary surgery or

Table 4. Surgical procedures in biliary tract calculous disease

Type of procedure	No. of cases	Per cent
Cholecystectomy	96	83.4
Choledochostomy	95	82.6
Trans-duodenal sphincterotomy	37	32.1
Cholecystostomy	11	9.5
By-pass procedure	9	7.8
Choledocho-duodenostomy	4	—
Cholecysto-duodenostomy	2	—
Roux-en-Y Choledocho-jejunostomy	3	—
Pancreatic cannulation	15	13.0
Hepatotomy	3	2.6
Subtotal gastrectomy	2	1.7
Gastrojejunostomy	2	1.7
Ileostomy	2	1.7
Appendectomy	4	3.4

Total number of cases so classified

their extremely poor general condition. 7 patients were referred in from other hospitals after a cholecystectomy or cholecystostomy. Two of these 7 patients had had a cholecystostomy previously and developed an external biliary fistula. Re-exploration showed residual stones in the gall bladder. Five others had previous a cholecystectomy but the common duct was not explored and biliary symptoms had recurred after the primary operation. Ductal stones were removed after choledochostomy. The remaining 17 patients were treated primarily at Severance Hospital. 5 of these showed the typical symptom complex of an acute suppurative obstructive cholangitis which was treated first by cholecystostomy for decompression of the biliary tract and later cholecystectomy and choledochostomy with removal of ductal stones. The other two patients underwent cholecystectomy and choledochostomy with removal of stones at the first operation. Recurrent biliary symptoms developed soon after the operation and they had to undergo another choledochostomy for the residual stones in the common bile duct.

The other 10 patients requiring secondary biliary surgery had intra-hepatic calculi. In some patients the presence of the intra-hepatic calculi was recognized at the initial operation but in some it was

overlooked. Most of these cases came early in series. In one patient deep seated intra-hepatic calculi were noted but could not be removed. Serial post-operative cholangiograms showed that the calculi were migrating to the common duct and the hepatic tract became cleared. At a second operation a spontaneous choledocho-duodenal fistula was found as well as residual stones which were removed. The patient is well since. One clinical behavior of intra-hepatic calculi was learned from the proceeding case and the intra-hepatic stones were thereafter treated by creation of a wide opening between the common bile duct and either duodenum or a defunctionalized loop of jejunum. Two patients underwent choledocho-duodenostomy and three patients had a Roux-en-Y choledocho-jejunostomy. Of the remaining 4 patients, three had repeated choledochostomy and the stones located near the bifurcation were removed. One developed carcinoma of stomach 2 years later and the unrecognized hepatic duct stone was removed by hepatotomy at the time of gastrectomy.

There were 4 deaths in the 115 patients who had 277 operation, or a mortality of 3.4 per cent. All of the deaths occurred in patients who were jaundiced at the time of operation. The first patient had completely recovered from the acute suppurative obstructive cholangitis treated by cholecystostomy but did not recover from hemorrhage at the secondary operation for cholecystectomy and choledochostomy. The second patient had a gallstone impacted under the mucosa of the terminal common duct and the ampulla of Vater. Operative removal of the stones was traumatic, although a trans-duodenal sphincterotomy was performed for better visualization of operative field. This patient died from an acute hemorrhagic pancreatitis. The third mortality followed removal of a common duct stone and intra-hepatic calculi. The last patient had a cholecystostomy for acute suppurative obstructive cholangitis, but was already in the irreversible stage of hepatic failure.

COMMENT

The first report of cholelithiasis in Korea is

attributed to Ludlow who, in 1930, reported eight cases of the gallstone patients operated at the Severance Hospital. Among the general admissions at that time the incidence of gallstone patients was 0.039 per cent. The incidence of admission of patients having gallstones is approximately 0.46 per cent. Thus the present incidence of gallstones in general admissions is more than 10 times of that of 30 years ago. According to autopsy figures the incidence of cholelithiasis among Koreans is generally low, however, there were 181 autopsy records for the period between 1958 to 1962 available at our department of pathology. Among these a gallstone was found in only 2 cases, an incidence of 1.1 per cent. Since the incidence of gallstones under the age of ten is nearly zero, if 130 protocols of patients under ten are excluded, the incidence becomes about 3.9 per cent(Hur and Yoon, 1963). Indeed, the incidence of gallstones among 425 autopsies, performed in the National Medical Center, Seoul, was 3.8 per cent, according to the report of Ringsted(1963). This figure is equivalent to that calculated by Hur and Yoon(1963). However, if only patients more than 15 years old are included, the incidence was 5.0 per cent. This indicates that the gallstones in Koreans are not rare as generally believed though it is far less than the incidence of gallstones in Occidentals, namely 20 to 25 per cent of routine autopsies (Hansen, 1922; Mentzer, 1926).

In the Ludlow's series(1930) and recently Jessens (1961), the proportion of male to female was 1 to 1, but others report a ratio of 1.5 to 1 (Hahn, 1959). Maki(1961) or Miyake(1962) reported the sex distribution of Japanese patients with cholelithiasis is more evenly balanced, e.g., the ratio of male and female is 75 : 76 or 207 : 226, respectively. As to the sex distribution in the Occidental, female patients usually outnumber male patients, and Colcock and McManus(1955) reported the ratio of males to females of 1 to 2. In the present series the sex ratio of male to female is 1 to 1.5. As more patients submit to surgery because of an increasing awareness of a necessity of the operative treatment for gallstones and of the safety of laparotomy, it is becoming obvious that cholelithiasis

Table 5. Location of calculi in the biliary tract of Korean patients

Reporters	Years	Method of study	No. of patients (sex ratio M:F)	Stones in gall bladder only	Stones in common duct and gall bladder	Stones in common duct only	Stones in hepatic duct only
Ludlow	1930	Surgical	8 (1 : 1)	2	1	5	—
Hahn	1959	Cholangiogram	21 (1.5 : 1)	5	1	15	—
Jessen	1962	Surgical	24 (1 : 1)	3*	3*	16	8**
Hur & Yoon	1963	Surgical	100 (1 : 1.6)	23	37 ⁺	35	5
Ringsted	1963	Autopsy	16 (?)	10	2	3 ⁺⁺	1
Authors	1963	Surgical	115 (1 : 1.5)	28	41 ⁺	40	6

* Each of the 3 cases was not included in total of 24 patients but had cholelithiasis and was operated on by Jessen.

** 8 patients with stones in hepatic duct also had stones in common bile duct.

⁺ In these 37 and 41 cases, gallstones were found in combined locations, not only in the gall bladder and common bile duct but in both hepatic ducts as well.

⁺⁺ Includes two cases in which stones were also found in the intra-hepatic ducts.

in the Korean also is more frequently encountered in the female (Table 5).

Hur and Yoon (1963) previously observed that the average age for gall bladder stone patients was 46.0 years and for common duct stone was 42.9 years. According to their report, the sex distribution of cholelithiasis was 1 male to 1.8 females while it was 1 male to 1.2 females for choledocholithiasis. The average age of male patients is 42.8 years which is about 5 years younger than the average age of female patients, 47.6 years. The peak incidence occurred between 41 to 50 years of age with an average age of 45.7 years, while the peak incidence in western patients occurred between 51 to 60 (Lund, 1960) and 50 to 59 (Strohl, 1952), with an average age of 51.6 years (Colcock and McManus, 1955).

Ludlow (1930) cautiously stated it would be hazardous to claim that cholelithiasis as his statistics showed, is rare in the Korean, because the number of male patients was more than female, and the age of the hospitalized patients was usually under 40. This statement is still partially appreciable, for in our series the peak incidence is noted at a younger age and over average patients age is still younger than that the western patients. This fact is well illustrated by Ringsted (1963) who reported the incidence of gallstones in different age groups of Koreans. Ringsted's autopsy material showed the incidence of gallstone in Koreans is increasing as age increased. If more patients having gallstones

are hospitalized, both women as well as men, and when autopsy rate increases, different findings of cholelithiasis in Korea may be expected in the future.

81 cases of the common duct stone and 6 cases of the intra-hepatic calculi total over 87 cases of extra-cholecystic calculi, that is biliary calculi located in the common bile duct and both right and/or left intra-hepatic ducts. The incidence of extra-cholecystic calculi is thus 75.6 per cent (87 out of 115 total cases). This figure is higher than that of any other report noted. Colcock and McManus (1955) reported the incidence of the ductal calculi to be 11.5 to 13.5 per cent. Crump and McGregor (1931) reported the incidence to be 32.5 per cent. Chik-Chang (1959) found that the incidence of common duct stone in China was between 40 to 71 per cent, and in Japan the common duct stones also outnumbered the gall bladder stones (Maki, 1961; Miyake, 1962). In another series from Korea, Hahn (1959) reported the incidence of the common duct stone as 76 per cent. Although the incidence of cholelithiasis much lower in Korean patients than in patients in the West, these figures, together with the present results, are in agreement that the incidence of biliary duct calculi is considerably higher in Korea as well as in other Oriental countries. Compared with western series, Korean cholelithiasis occurs in younger patients, and it is particularly noted that the extra-cholecystic calculi occur more commonly in the younger male patients.

Chemical analysis of biliary calculi revealed that

the stones found in gall bladder contain mainly cholesterol(over 70%) the same as noted in stones from Occidental gall bladder. The stones from the common bile duct contain mostly calcium and bilirubin. In one patient a stone found in the gall bladder was similar to the bilirubin-calcium stones of the common duct(Table 1). Miyake(1962) postulated that, when the gall bladder loses its characteristic function such as the concentrating of bile, it may cause alterations in the contents of the bile, which favor the formation of bilirubin-calcium stones rather than cholesterol stones such as occurs in the common bile duct.

From the Table 2, it is observed that 31 cases were gall stones associated with extra-cholecystic calculi and 28 patients had gallstones in the gall bladder only. Thus 59 cases had cholelithiasis only or associated ductal stones, while the remaining 56 cases(or 48.6%) did not have any gallstones in the gall bladder but did have them in the extra-cholecystic biliary tract. Jessen (1961) noted that the common duct stones which were not associated with gall bladder stones were seen in 24 cases among 47 Korean patients having biliary tract disease, an incidence of 51.0%. He stated that intestinal parasites are found much more frequently in Korean patients and believed this fact explained the high frequency of calculi in the biliary tract. Numerous theories have been proposed to explain the cause of ampullary narrowing, including chronic spasm, common duct stone or duodenitis but all of these lack proof. Maki(1961), in Japan, postulated that a papillitis caused by the continuous irritation of intestinal parasites could cause biliary concretions in gall bladder and in common duct as well. Cook et al(1954~1955), in a thorough study of the mechanism of stone formation among Chinese in Hong Kong, considered in cases with evidence of infestation by *clonorchis sinensis*, that some of the stones which were not accompanying a suppurative cholangitis might be of aseptic origin. The etiology of the gallstone formation in the gall bladder and in the extra-cholecystic ducts may be different, and a number of theories need further consideration.

Wangensteen et al(1959) reported stone formation in the biliary ducts after creation of partial obstruction in the terminal common duct of dogs. They observed in dogs that common bile duct stones occurred as early as 5 weeks following the creation of incomplete biliary stenosis. In our own experience the majority of cases the extra-cholecystic calculi were associated with marked narrowing of the orifice of the duodenal papilla or direct invasion of *ascaris* into the common duct.

The duodenal mucosa and sphincter muscle were submitted for pathologic examination after sphincterotomy, and eight specimens were examined. Two showed normal sphincter muscle and the remaining 6 showed acute or chronic inflammation in the muscle with fibrosis of thickened mucosa. It is of great interest to note that the 6 patients having a pathologic sphincter also had ductal calculi. In the present study, the association of gallstones and choledochal ascariasis is noted in 13 patients. Nine patients who had dead or living *ascaris* in the common duct did not have gallstones in the gall bladder but had common duct stones, three other patients had intra-hepatic calculi only, and one patient had gall bladder stone(Figure 4).

One case of choledochal ascariasis is needs special mention. This 43 year old female had been suffering from repeated right upper quadrant colicky pain for over 5 years. The Graham-Cole test showed a non-visualized gall bladder and other typical symptoms of acute biliary trouble were present. She underwent cholecystectomy and choledochostomy.. There were no gall bladder stones but numerous small "stones" and a living *ascaris* were removed from the common bile duct and the operation was completed after T-tube insertion. This case was not included in the present study because of the stony hard material which was removed from her common bile duct appeared like stones but on further observation were obviously segments of dead *ascarides*(Figure 5).

Wright(1963) reported 35 cases of ascariasis of the biliary system operated at Pusan, Korea. He, however, did not mention the association of biliary calculi with choledochalascariasis. He found 4 cases of cal-



Fig. 5. Photograph of common duct stones and an ascaris. Case, # 31939 a 43 year old female underwent cholecystectomy and choledochostomy for repeated attacks of colicky pain and intermittent jaundice. No gall stone was found in the gall bladder but numerous stony hard materials and a living ascaris were removed from the common bile duct. The stony hard materials was identified multiple segments of dead ascaris.

Fig. 6. Photograph of gall bladder and stones. Case 62-25, numerous pale, brownish colored multifaceted mixed stones were removed from a 35 year old female underwent a cholecystectomy. A cross section of the stone showed a firm outer shell with a center which was hollow and had radiating crystals. The stones were generally equal in size.

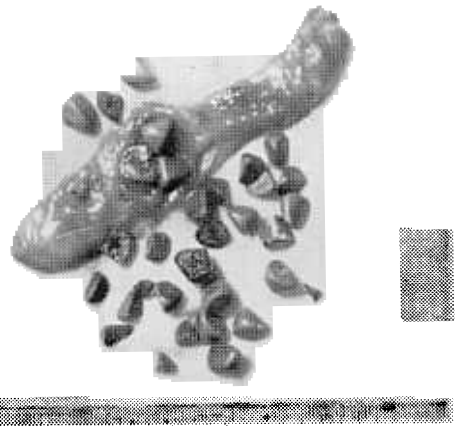


Fig. 7. Photograph of common bile duct stones Case 63-12, a 62 year old man had suffered from deep jaundice, and severe colic in right upper quadrant for a long period of time. At the time of admission he was hypotensive. Exploration showed that the common duct contained numerous stones of different shape and size. He recovered from the choledochostomy and exploration of common bile duct. At time of second surgery no stone was found in either the gall bladder or the common bile duct. The gall bladder showed an acute and chronic cholecystitis.



culous cholecystitis and 8 cases of common duct calculi, and the disintegrated remains of dead ascarides as well as calculi were found in some of the latter group.

In the present series there were 4 patients under the age of twenty. All four patients were male and they did not have gall bladder stones but did have common duct calculi. Three of them had ascaris in the common duct and although in one no ascaris was found in the common duct but all of them were heavily infested with intestinal ascariasis. These patients did not have any previous history of hemolytic anemia.

As in the custom in Korea, most patients receive an injection of analgesics for right upper quadrant colicky pain, these young men also had injection treatments for a long period of time. It seems that soon the migration of ascaris into the biliary duct causes colicky pain and obstructive jaundice but may not immediately cause stone formation. Since most of our patients had suffered from the repeated attacks of colicky pain for over 5 to 10 years (some patients over 30 years) prolonged stasis of bile in the common duct due to a partial biliary obstruction may be a factor in the formation of ductal calculi following migration of ascaris.

A high incidence of pain, fever and tenderness in the right upper quadrant of abdomen be expected in acute cholecystitis. The fact that acute or subacute inflammation in the gall bladder was reported in 54.4 per cent (43 out of 79 specimen) reflects the increased frequency of surgery in the acute stage. This is probably caused by the fact that most patients prefer medical treatment unless severe colicky pain associated with chills and fever and vomiting make the patients ready to accept surgical relief. Most early gallstone attacks have been treated by morphine or other analgesics under a diagnosis of acute gastric spasm, "Ga Sum Ali", which literally means trouble under the chest.

13 cases of acute suppurative obstructive cholangitis were encountered, and surgically treated. In every case the obstruction was caused by large common duct stones. Five out of the 13 patients first underwent cholecystostomy for decompression

of the biliary tract and later had cholecystectomy and removal of the calculi from the terminal common duct. The clinical improvement after the cholecystostomy for this condition was dramatic and we consider that the decompression cholecystostomy under local anesthesia as advocated by Reynolds et al. (1959) is a preferred and most effective treatment (Fig.7).

Choledochostomy (82.6%) is frequently done due to the fact that a large number of patients with ductal calculi were treated. The most frequent indication for choledochostomy is jaundice, a dilated or thickened common bile duct, and/or a palpable stone or cord like ascaris in the common duct. Operative cholangiogram is indicated usually after the exploration of the common bile duct and removal of the ductal calculi to determine the presence of residual common duct or intrahepatic calculi. Only a few patients had an operative cholangiogram before choledochostomy.

Our concern over the importance of creating a wide patent ampulla is indicated by the fact that 37 patients had a transduodenal sphincterotomy in addition to a cholecystectomy and choledochostomy. We do hesitate not to open the duodenum whenever there is any question regarding patency of the lower end of the common bile duct. The transduodenal sphincterotomy is, however, indicated to remove an impacted ampullary stone or to facilitate choledochostomy in presence of severe inflammatory adhesions in and around the gall bladder, and in addition to determine the patency of the lower end of the common bile duct and the orifice of the pancreatic duct.

A free flow of bile into the gastro-intestinal tract is important to relieve or prevent the pain of the post-cholecystectomy syndromes. Walters (1960) stated that a spasm of the sphincter of Oddi may cause the attacks of pain in the cases of idiopathic biliary dyskinesia, and to accomplish this free flow of bile into the duodenum he performed either a sphincterotomy or lateral choledcho-duodenostomy. Two patients in the present series had a lateral choledcho-duodenostomy.

Star (1953) reported cases of stenosis of the

pancreatic duct at its entrance with retention of pus or pancreatic fluid behind it, and advocated sphincterotomy with catheterization and dilatation of the pancreatic duct at its entrance into the ampulla as a means of relieving attacks of pain after cholecystectomy.

Instrumentation of the ampulla of Vater for sphincterotomy may cause bleeding and edema in and around the orifice of pancreatic duct, which may cause a post-operative pancreatitis. One of our fatalities had an ampullary stone which was removed after trans-duodenal sphincterotomy. Since the ampullary stone in this case was partially undermining the ductal mucosa, the operative removal was traumatic even though better visualization had been provided by section of the sphincter of Oddi. No pancreatic duct cannulation was done. The post-operative course was eventful and evisceration developed on the 10th post operative day. During the closure of the evisceration, an acute hemorrhagic pancreatitis was also discovered and the patient expired 16 days after the closure. We advocate decompression of the pancreatic duct if there were any evidence of severe trauma around the orifice of the pancreatic duct or in cases of pre-existing pancreatitis associated with biliary calculi. In 15 cases pancreatic cannulation was done either by method described by Doubilet and Mulholland(1951) or author's modification(Hur 1962). In some patients observation of pancreatic secretion under various experimental condition was carried out, a part of this study is already reported(Hong et al. 1961; Hur, 1962).

Problems of the etiology and a satisfactory surgical treatment of intra-hepatic calculi remains to be solved. Most cases of the repeated biliary surgery were due to the intra-hepatic calculi. The total number of the intra-hepatic calculi is 21, and the most of them were associated with either gall bladder or common duct stones but 6 patients had only intra-hepatic calculi (Table 2). It is generally accepted that small calcareous fragments pass from the gall bladder into the common duct where they are increased in size by the deposition

of solid material derived from the bile. In case of intra-hepatic calculi associated with gall bladder or common duct stone the following pathogenesis may be presumed: small calculi from either the gall bladder or common bile duct may have migrated into an intra-hepatic duct and become lodged there for example because of stenosis of hepatic duct and later gradually increase in size. Stone thus formed may be considered as secondary intra-hepatic calculi. However primary intra-hepatic calculi, formed within the lumen of the hepatic duct, and in which there is no associated gall bladder or common duct stones, may be caused by a different pathogenesis.

Although the pathogenesis of intra-hepatic calculi is not fully understood yet as in case of stone formation in the gall bladder, there are 3 as follows: 1) metabolic disturbance, 2) obstruction and stasis of bile, and 3) infection.

In 2 cases in our survey, the cause of the intra-hepatic calculi could not be traced but in 4 there was a stenosis of the distal portion of the hepatic ducts and, in addition, 3 of them had ascaris in the common bile duct. Figure 1 shows intra-hepatic calculi in the left hepatic duct near the bifurcation and stenosis of the duct distal to the site of calculi. The ductal stenosis associated with the intra-hepatic calculi was observed in four out of 6 primary cases. The intra-hepatic calculi are more frequently encountered in the left hepatic duct. Of the 6 cases of primary intra-hepatic calculi, 5 were in the left hepatic duct only and in one case calculi were found in both right and left hepatic ducts. In the remaining 15 patients, right duct calculi were found in 3 and left duct calculi were found in 4 while 8 patients had calculi in both right and left hepatic ducts.

In case of intra-hepatic calculi, the wider opening created in the papillary orifice by sphincterotomy did not prevent recurrent biliary symptoms. By-pass procedure of choledcho-duodenostomy or Roux-en-Y choledcho-jejunostomy is further indicated in five patients having recurrent symptoms or X-ray visualization of intra-hepatic calculi.

Figure 8 shows follow-up cholangiograms taken through a fine Nelaton catheter leading into the

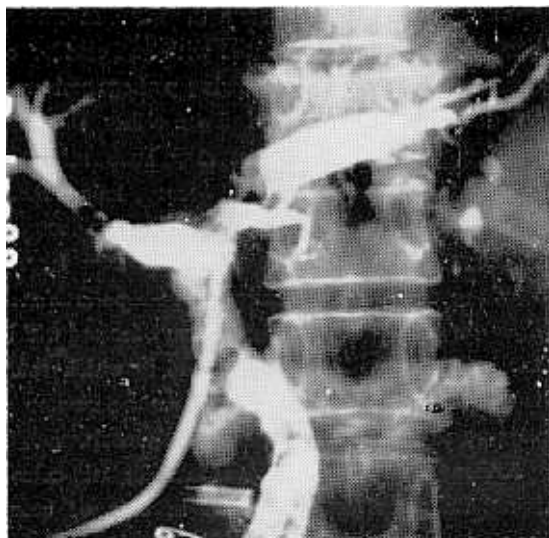


Fig. 8. Serial cholangiographic studies after Roux-en-Y choledocho-jejunostomy.

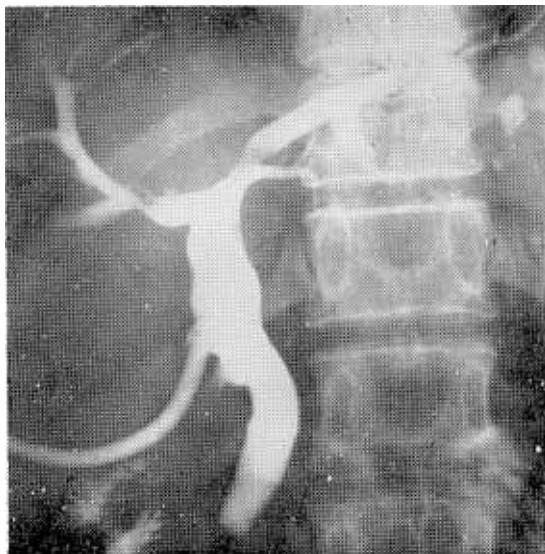
A: Case 63-16, 49 year old lady had suffered from "Gallstones" for over 30 years. Intermittent jaundice and repeated right upper quadrant colicky pain and indigestion were her main complaints. On exploration, Numerous calculi were noted in the common bile duct and both right and left hepatic ducts. A mild pressure irrigation of the hepatic ducts removed some of the calculi but operative cholangiogram showed calculi and stenosis in the both hepatic ducts

A Roux-en-Y choledocho-jejunostomy was done. This cholangiogram was taken about one month later through a fine Nelaton catheter leading into the hepatic duct. It still showed numerous calculi in the common bile duct and both hepatic ducts.

B: Cholangiograms taken one month after the first cholangiogram (Fig. 8-A) showing a large calculus in the distal common duct and the anastomosed loop of jejunum filled well with the dye injected into the hepatic duct. No leakage is noted.



C: This was taken immediately prior to the removal of the Nelaton catheter, and showed the entire biliary system had been cleared of calculi, but the stenotic findings in the both hepatic ducts persist. The patient is doing well.



hepatic duct after Roux-en-Y choledochojejunostomy for the intra-hepatic calculi. Figure 8a taken about one month after the operation showed numerous calculi in the common duct and in both hepatic ducts. Stenosis of hepatic duct is also noted on both sides about 1.5 cm proximal to the bifurcation. Approximately one month after the first cholangiogram, spot films were taken during a fluoroscopic examination of the biliary duct. Figure 8b showed the ductal calculi which were noted in previously had almost disappeared but a large stone was present in the distal common bile duct. The Roux-en-Y choledochojejunostomy was functioning well. Figure 8c, taken immediately prior to removal of the Nelaton Catheter, showed the entire biliary tract was clear of residual ductal calculi and no evidence of demonstrable stone shadow is noted. Icteric discoloration in the sclera had gradually subsided and the patient was doing well.

Various surgical procedures have been advocated for the treatment of intra-hepatic calculi such as hepatic lobectomy, choledochoduodenostomy, Roux-en-Y choledochojejunostomy, and repeated choledochostomy. In our own experience, bilateral intra-hepatic calculi are frequent and when left hepatic duct calculi were present they were usually located near the bifurcation where they were readily accessible by choledochostomy. For the above reasons we would think that the most satisfactory surgical procedure is either immediate direct removal of the calculi by a long incision made in the longitudinal direction of common bile duct or the long term treatment by a Roux-en-Y choledochojejunostomy in case of deeply seated intra-hepatic calculi inaccessible by choledochostomy.

SUMMARY AND CONCLUSION

115 cases of cholelithiasis in Korean patients were reviewed. The incidence of cholelithiasis in general admissions is 0.46 per cent. In the present series extra-cholecystic calculi are more frequently encountered than gall-bladder stone, and the incidence is 75.6 per cent of the total patients studied. The gall bladder stone is usually cholesterol and the common duct stone or extra-cholecystic stone is

predominantly bilirubin and calcium. With regard to the patient's age and the site of Korean cholelithiasis, there are evident differences between gall bladder stones and the extra-cholecystic calculi, and the later often being associated with common duct ascariasis or narrowing of the ampullary opening. The clinical and the operative features of Korean cholelithiasis are also different from the features of cholelithiasis found among western patients. The high incidence of choledochostomy and the other auxiliary procedures of sphincterotomy, by-pass operations or of repeated biliary surgery reflect the prevalence of extra-cholecystic calculi showing characteristics of cholelithiasis peculiar to the Korean. Cases should be divided to permit separate investigations of gall bladder stones and of extra-cholecystic calculi.

An possible cause of the intra-hepatic calculi is considered, and the surgical treatments using choledochoduodenostomy or Roux-en-Y choledochojejunostomy are discussed and follow-up cholangiograms are illustrated. Operative mortality is 3.4 per cent. All of the deaths occurred in patients who were jaundiced at the time of operation.

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REFERENCES

- Chih-Chang, H.: *Chin. Med. J.* 79 : 40, 1959.
- Colcock, B. P. and McManus, J. E.: *Surg. Gynec. & Obst.* 101 : 165, 1955.
- Cook, J., Hou, P. C. and McFadzean, A.J.S.: *Brit. J. Surg.* 42 : 188, 1954—55.
- Crump, C. and McGregor, M.: *Surg. Gynec. & Obst.* 53 : 447, 1931.
- Doubilet, H., Mulholl and J. H.: *Proc. Soc. Exper. Biol. & Med.* 76 : 113, 1951.
- Glenn, F. and Moody, F. J.: *Ann. Surg.* 153 : 711, 1961.
- Hahn, S. S.: *Korean Med. J.* 4 : 555, 1959.

- Hansen, S.: *Ugeskr. Laeger.* 84 : 405, 1922.
- Hong, S. U., Hur, K. B. and Hong, S. S.: *Unpublished.*
- Hong, S. S., Chin, D. S. and Hur, K. B.: *J. Appl. Physiol.* 16 : 810, 1961.
- Hur, K. B.: *J. Korean Med. Assoc.* 5 : 1599, 1962.
- Hur, K. B. and Yoon, S. O.: *J. Korean Surg. Soc.* 5 : 349, 1963.
- Immamoglu, K., Perry, J. F. and Wangenstein, O. W.: *Surg.* 42 : 623, 1959.
- Jessen, C.: *Acta Chir. Scandinav. (Supp.)*, 283 : 242, 1961.
- Jones, K. K.: *Quart. Bull. Northwestern U. Med. School* 19 : 197, 1945.
- Ludlow, A. I.: *Surg. Gynec. & Obst.* 50 : 51, 1930.
- Lnud, J.: *Ann Surg.* 151 : 153, 1960.
- Maki, T.: *Arch. Surg.* 82 : 599, 1961.
- Mentzer, S. H.: *Surg. Gynec. & Obst.* 42 : 782, 1926.
- Miyake, H.: *Arch. Surg.* 85 : 425, 1962.
- Reynolds, B. M. and Dargan, E. L.: *Ann. Surg.* 150 : 299, 1959.
- Ringsted, J.: *Danish Med. Bull.* 10 : 90, 1963.
- Star, K. W.: *Arch. Surg.* 66 : 398, 1953.
- Strohl, E. L., Diffenbaugh, W. G. and Guynn, V.: *Arch. Surg.* 64 : 788, 1952.
- Thompson, J. A., Howard, J. M. and Vowless, K. D. J.: *Surg. Gynec. & Obst.* 105 : 706, 1957.
- Walters, W. and Snell, A. M.: *Diseases of the gall bladder and bile duct.* p. 244, Saunders Co., Philadelphia, Pa. 1940.
- Walters, W.: *Arch. Surg.* 81 : 1, 1960.
- Wright, R. M., Donough, R. L. and Ditmore, H. B.: *Arch. Surg.* 86 : 402, 1963.