

Relation of Size and Number of Common Duct Calculi to Success of Sphincterotomy and Stone Extraction

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Abstract. Endoscopic sphincterotomy (ES) for common bile duct calculi (CBDC) was performed on 210 patients, and 190 of these were available for follow-up. One hundred seventy-three patients (91%) were successfully treated with ES alone, whereas 17 patients required operation. Stone size was of importance to attain complete clearance of CBDC as larger stones (>1 cm) were significantly more difficult to extract endoscopically than smaller stones ($p < 0.01$). A comparison between patients with one CBDC and those with two or more show a statistically significant difference in that the former group is easier to treat successfully ($p < 0.001$).

Key words: Common bile duct calculi – Endoscopic sphincterotomy – Stone extraction, technique.

Endoscopic sphincterotomy (ES) is being used with an increasing frequency for treatment of common duct calculi [1–4]. Empirical observations indicate that this technique is most successful in patients with small biliary calculi lodged in the distal common bile duct. The purpose of this article is to analyze the statistical correlation between the size and number of gallstones versus the success rate of ES.

Materials and Methods

During a recent 9-year period (1979–1988) a total of 214 patients with common bile duct calculi (CBDC) were referred for ES to the Endoscopy Unit, Department of Diagnostic Radiology at the Karolinska Hospital. There were 91 men and 123

women, ranging in age from 22–95 years (average age 71.4 years). ES was performed successfully in 210 patients (98%).

This paper is based on the study of 190 patients who were available for follow-up studies after ES. One hundred forty-one patients were investigated with endoscopic retrograde cholangiography (ERC) within 10 days after ES, 33 patients with secondary cholangiography either via T-tube or nasobiliary drainage, two patients with intravenous cholangiography (IVC) with tomography, and in 14 patients stone release and complete duct clearance could be confirmed by cholangiography immediately following ES.

Of the 190 patients, 112 patients had a remaining gallbladder and of these, 41 also had stones in the gallbladder. The other 78 were postcholecystectomy patients.

Successful ES treatment was defined as complete clearance of CBDC. The size of calculi was measured on cholangiograms and their projected magnification was estimated to be 28%. The largest diameter of the largest stone was directly measured on the x-ray images as most of the stones were oval or somewhat rectangular. In no case was the relationship between the longitudinal and the transverse diameter more than 2:1. The size of the stones varied between less than 0.5 cm to 3×4 cm.

The number of CBDC was defined by the largest number that could be identified on the x-ray images. CBDC varied from one to at least 15 stones.

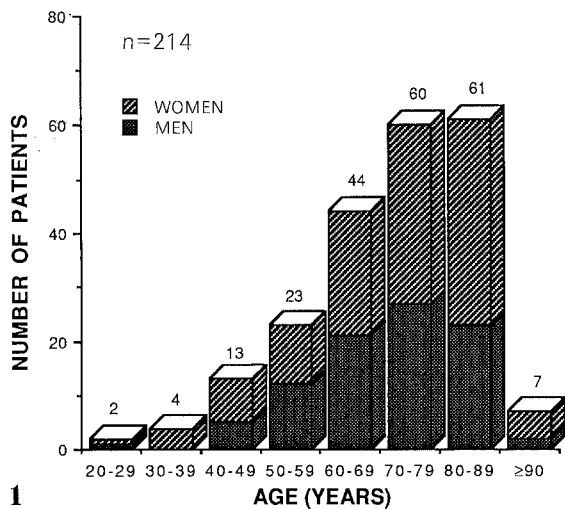
Standard methods for statistical analysis were used (chi-square analysis and Wilcoxon's rank sum test).

Results

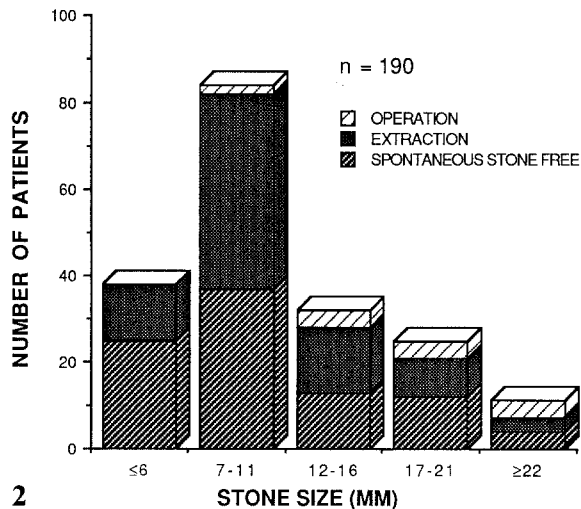
ES was successfully performed in 210 of 214 patients (98%) with CBDC. Complications were encountered in seven cases (3.3%) and resulted in three deaths. This article is based on a review of 190 patients who had follow-up studies. These showed complete clearance of CBDC in 173 patients (91%). The other 17 patients (9%) required operation mainly because several had residual stones in their common duct and gallbladder. The age distribution of our patients is shown in Fig. 1.

Biliary duct calculi with varying size from less than 0.5 cm to 4 cm were found in this group of 190 investigated patients. Spontaneous stone re-

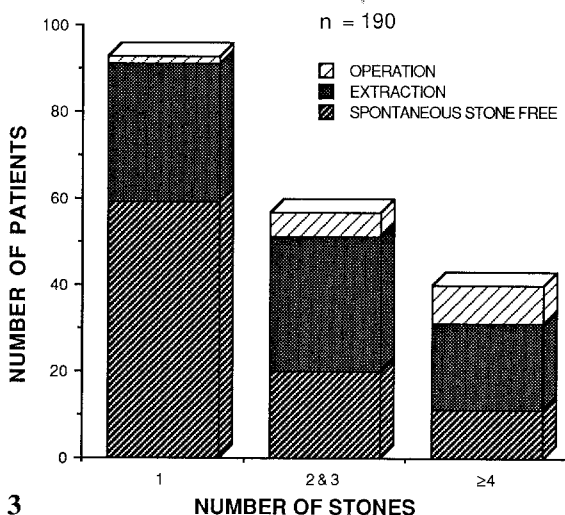
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Fig. 1. Age and sex distribution of 214 patients who had endoscopic sphincterotomy for CBDC.

Fig. 2. Relation between the size of CBDC and results of treatment.

Fig. 3. Relation between the number of CBDC and results of treatment.

lease after ES was seen in 90 patients (47%). In 83 patients the stones were endoscopically extracted (44%), about half of them directly at the time of ES without awaiting spontaneous release. The size of biliary calculi and its relation to spontaneous release, endoscopic, or surgical extraction is shown in Fig. 2. All patients with small calculi (i.e., less than 0.7 cm) were successfully treated. The most common size of the calculi was approximately 1 cm (0.7–1.1 cm) in 84 of 190 (44%) investigated patients, of whom 82 were successfully treated with ES (98%) and two were operated on (2%). In the group with 1.5-cm large stones (1.2–1.6 cm), 26 of 32 cases were successfully treated with ES (81%) and six patients were operated on (19%). Similarly, 20 of 25 patients who had calculi 2 cm in size became stone free (80%), and the remaining five were operated on. Stones larger than 2 cm were present in only 11 patients;

in four of them stones up to 3.5–4 cm passed spontaneously after ES. In three patients stones were extracted during ES and four patients were operated on.

Stones larger than 1.1 cm are significantly more difficult to remove endoscopically than those that are less than 1 cm ($p < 0.01$ by chi-square analysis). Wilcoxon's rank sum test shows a strong correlation ($p < 0.001$) between unsuccessful endoscopic stone removal and the size of the stones. However, most patients with medium-sized and large stones are successfully treated with ES.

The number of stones in the hepatobiliary tract varied between one and at least 15. The relationships between number of calculi, their spontaneous passage after ES, endoscopic stone extraction, and operation can be seen in Fig. 3.

Most common was a solitary stone in 93 of 190 investigated patients (49%), of whom 91

(98%) were successfully treated with ES alone and two were operated on. Two or three stones were seen in 44 and 13 patients respectively; the combined group resulted in successful endoscopic treatment in 51 of 57 investigated patients (89%) and operation in six (11%). Forty patients had more than three stones; 31 of them were successfully treated with ES (77%) and nine were operated on (23%).

A comparison between patients with one calculi and those with two or more shows that endoscopic treatment is far more successful in the former group, which is statistically significant ($p < 0.001$ chi-square analysis). However, most patients with two or more stones also had a successful treatment with ES.

Discussion

Endoscopic stone removal was performed successfully in 173 of the 190 patients (91%). This result is comparable with that reported by Askew et al. [1] with 72%, Classen [2] with 85%, Kullman et al. [3] with 91%, and Leese et al. [4] with 91%.

There was a fairly large group of 20 patients who could not be investigated after ES and they are not included in the analysis of stone size and stone number. Of those 20 patients, eight had recovered uneventfully and follow-up evaluation was regarded as unnecessary by their consultants, six patients had poor general condition, four refused further studies, and the remaining two were not examined for other reasons.

An unfavorable anatomy of the common bile duct with angulation could hypothetically interfere with spontaneous release of calculi and failure of stone extraction after an adequate ES. However, there are no published studies concerning the relationships between the size and number of common bile duct stones and the results of ES.

This material shows that the size of the stones is of importance for a successful clearance of calculi by ES. However, it is also shown that even very large stones can be released spontaneously after ES or be extracted. Large and medium-sized stones can be removed in most cases, and small stones can almost always be removed endoscopically. ES is therefore a good alternative in the treatment of most patients with common bile duct stones.

The number of stones in the biliary ducts also affects the successful endoscopic treatment with ES. Among patients with a single stone only two of 91 required an operation. A comparison between patients with one stone and those with two or more stones shows a statistically significant difference ($p < 0.001$); the former patients are much easier to treat successfully. However, even multiple stones can be successfully managed with ES alone, so that ES is a good alternative to surgical treatment in such cases as well. Our experience did not include patients with combination of CBDC larger than 1.5 cm and more than three in number, but those are probably more suitable candidates for stone extraction during biliary tract surgery.

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