The importance of stone size on success rate of endoscopic extractions of common bile duct stones.

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ABSTRACT
Objective: To evaluate the importance of common bile duct stone size on success rate of extraction. Design: A retrospective analysis of medical records of patients with common bile duct stones.
Setting: Gastroenterology unit at King Khalid University Hospital, Riyadh. Patients were admitted from our clinic or referred from the medical and surgical wards or from other hospitals.
Subjects: All medical records of patients with choledocholithiasis diagnosed by endoscopic retrograde cholangiopancreatography between 1985 and 1992 were reviewed. Patients’ age, sex, nationality, number and size of bile duct stones and success rate of extraction were recorded.
Results: A total of 211 patients, 86 males and 125 females. Mean age 53.2±17.4 years were included in the study. Endoscopic sphincterotomy was successful in 97.6%. Endoscopic common bile duct clearance was achieved in 75.4% (group 1), while 24.6% of stones could not be retrieved (group 11). There was no significant difference between stone number in both groups. However, stone size was significantly larger in group II (p<0.0001). Ninety-five percent of stones <10 mm were extracted compared to 69% of stone size less than 15 and greater than 10 mm and 31% of stones ≥15 mm in size.
Conclusion: Stone size has significant impact on success rate of extraction.

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Keywords: Stone size, endoscopic, success.

Endoscopic extraction of common bile duct stones has become possible since the introduction of endoscopic sphincterotomy. Success rate of endoscopic sphincterotomy is reported as being between 90-99%, with common bile duct clearance in 80-85% of patients. Causes of failure to clear bile duct include large stone, distal biliary stricture, impacted stone in the ampulla of Vater, intrahepatic stone and previous biliary surgery. Other modalities dealing with difficult common bile duct stones include mechanical lithotripsy, with a high success rate of 85-100% and extracorporeal shock wave lithotripsy which is reported to be effective in 85%. Further nonsurgical approaches for management of large bile duct stones include laser lithotripsy and chemical treatment with methyl-tert butyl ether. Reported success rates are 66%, 100% and 36%, respectively. Although surgical exploration is associated with low mortality in the young, the incidence rises sharply in the elderly and unfit patients. Reported rates are 1% and 30%, respectively. Endoscopic stone extraction in relation to stone size has not been fully explored. Only a few articles have addressed this issue, therefore we retrospectively analyzed our results of endoscopic stone clearance in regard to stone size.

Methodology The medical records of all patients who underwent endoscopic retrograde cholangiopancreatography between 1985 and 1992 and who were found to have choledocholithiasis at King Khalid University Hospital were reviewed. Of 256 patients, 211 fulfilled the criteria of inclusion (presence of choledocholithiasis and accurate measurement of stone number and size). The remaining 45 patients who had sludge, or stone size and number which could not be accurately evaluated, were excluded. All patients received sedation in the form of diazepam (5-10 mg) and pethidine (25-100 mg) before procedures were carried out. Side-viewing endoscopes (JFIT, OES JFIT 10) were used. The procedures were performed by RSR&IAM. Common bile duct
intubation was achieved in all patients, endoscopic sphincterotomy was performed as described previously. Stone extraction was attempted using Dormia basket or balloon catheter. The bile duct clearance was confirmed by cholangiography. Failure to extract the stone was treated with nasobiliary drainage or stenting. Stones which could not be extracted were further treated by external mechanical lithotripsy (ML), extracorporeal shock wave lithotripsy (unmodified Dornier HM3 apparatus), or surgery. Mechanical lithotripsy and extracorporeal shock wave lithotripsy (ESWL) were only available in the last three years of the study period. Stone number and size corrected for magnification was calculated from cholangiogram. Stone size was measured at the longest diameter. Patients were divided into two groups: successful endoscopic stone extraction (group I) and failure to retrieve endoscopically (group II). The two groups were compared with regard to age, sex, stone number and size. Endoscopic success rate of stone retrieval in patients with stone size ≥15 mm was calculated and compared to those with stones <15 mm and greater than 10 mm and patients with stone size ≤10 mm. Unpaired Student's t-test and chi square were used for statistical analysis. Results are expressed as mean ± SD. The p-value of <0.05 was considered significant.

Results The study included 211 patients: 125 females and 86 males, mean age±SD: 53.2±17.4 years, who underwent a total of 273 procedures. Eighty four percent were Saudi nationals. Endoscopic sphincterotomy was successful in 97.6%. The reasons for failure were abnormal anatomy in 2, previous surgery with sutures at the periampullary region in 1, uncooperative patient in 1 and 1 was considered unsuitable because papilla of Vater was embedded in a large duodenal diverticulum. Common bile duct stone clearance was confirmed in 159 (75.4%) patients. In the remaining 52 (24.6%) patients other therapeutic modalities were applied (Fig. 1). In 6 patients mechanical lithotripsy was successfully used. Twelve patients underwent extracorporeal shock wave lithotripsy which was successful in 9 (75%) patients, 2 of the remaining patients were subjected to surgery while the 3rd refused further management. The remaining 33 patients were treated surgically. Mortality was encountered in 1 patient.

Table 1 shows a comparison of patients with successful stone retrieval (n=159) mean age 53.3±16.9 years with those in whom it failed
Table 2 - Summary of complications and management.

<table>
<thead>
<tr>
<th>No of patients</th>
<th>Complication</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Impacted Domia basket with stone</td>
<td>Surgery</td>
</tr>
<tr>
<td>2</td>
<td>Bleeding post endoscopic sphincterotomy</td>
<td>1 epinephrine injection</td>
</tr>
<tr>
<td>2</td>
<td>Retroperitoneal perforation</td>
<td>1 stopped spontaneously</td>
</tr>
</tbody>
</table>

(n=52) mean age 52.9±18.6 years. There was no significant difference in regard to age, sex and stone numbers in both groups. The mean number of stones in group I was 3.85±9.2 compared to 3.56±7.8 in group II (p=0.42). However, there was a significant statistical difference (p<0.0001) when comparing the stone size 9.0±3.85 versus 15.6±5.01 in groups I and II, respectively. Stone sizes of ≥15 mm were encountered in 48 patients, successful endoscopic stone retrieval was achieved in 31%, while the success rate was 95% in 121 patients with stones ≤10 mm and 69% of 42 patients with stone size less than 15 and greater than 10 mm.

Mortality was recorded in 1 patient after termination of procedure accounting for 0.47%. Death was most probably related to premedication resulting in respiratory arrest. Morbidity was encountered in 7 patients (3.3%) in the form of stone impaction, bleeding and retroperitoneal perforation (Table 2). Table 3 shows the indications for surgical approach in 35 patients.

Discussion It has been previously observed that common bile duct stones, more than 15 mm, are difficult to extract endoscopically. Furthermore, Sivak reported that endoscopic retrieval of biliary stones ≥20 mm may be difficult. However, endoscopic attempt to remove large stones is always justified as some of these are fragile and may be extracted endoscopically. This study showed that success rate of stone retrieval depends largely on the stone size. Whereas 95% of stones ≤10 mm in size were successfully extracted, only 31% of those ≥15 mm could be endoscopically removed. The rate of endoscopic extraction of large stones was higher than the one reported by Lavri et al. This difference is probably due to variation in stone consistency and size of endoscopic sphincterotomy. Endoscopic sphincterotomy was achieved in 97.6%, similar to other authors’ experiences. The all over success rate of endoscopic clearance of common bile duct (75.4%) is also in agreement with other reports.

Other treatment modalities in our hospital for difficult common bile duct stones included mechanical lithotripsy which was successful in 6 patients (100%) similar to previous reports. Success rate of mechanical lithotripsy depends on stone size and breaking strength of the basket. Twelve patients underwent extracorporeal shock wave lithotripsy and fragmentation of stones was achieved in 9 patients (75%). Reported success rate of fragmentation varies considerably and ranges from 53-94%. The most important factor in determining the likelihood of successful fragmentation is stone size. Other factors which affect the success fragmentation, but to a lesser degree, are chemical composition, stone numbers and radiolucency. Number of sessions of extracorporeal shock wave lithotripsy also has an impact on the fragmentation rate. There was no complication of extracorporeal shockwave lithotripsy in any of the twelve patients treated.

The decision for surgical consideration is difficult one in elderly or unfit patients as the associated mortality is considerable. However, surgical approach should be seriously considered when other means of stone extraction fails. Neoptolemos et al. found a significantly higher mortality among patients having either failed stone extraction or where common bile duct clearance was not confirmed, compared with those having confirmation of common bile duct clearance. In the present study, surgery was performed on 22 patients. There were no significant complications.

The high number of surgically treated patients in the present study reflects the availability of complementary modalities for treating difficult common bile duct stones. Electrocryoprobe shock wave lithotripsy (ESWL) and ML were only available during the last three years of the study.

Table 3 - Reason for surgical treatment (n=35).

<table>
<thead>
<tr>
<th>Patients</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Large stones</td>
</tr>
<tr>
<td>5</td>
<td>Failed endoscopic sphincterotomy</td>
</tr>
<tr>
<td>3</td>
<td>Impacted Domia basket with stone</td>
</tr>
<tr>
<td>2</td>
<td>CBD packed with stones</td>
</tr>
<tr>
<td>2</td>
<td>Impacted stone at the distal CBD</td>
</tr>
<tr>
<td>2</td>
<td>Failed ESWL</td>
</tr>
<tr>
<td>1</td>
<td>Distal stricture in CBD</td>
</tr>
</tbody>
</table>

BD: common bile duct.
ESWL: extracorporeal shock wave lithotripsy.
period. Furthermore, many of the patients were referred from our surgical units. Mortality and morbidity in the current study were 0.47% and 3.3% respectively, which are well within the reported range by other authors in patients who underwent endoscopic sphincter-otomy.21,23

Conclusion This study confirms and supports the previous observation that stone size affects the success rate of extraction and the success rate is inversely proportional to stone size. Difficult common bile duct stones can be managed by a number of different and effective modalities.

References


