The Effect of Stone Size on the Frequency of Biliary Pain

Mohamad A. Bakhotmah, FRCS(Ed); Ahmad Bahnassy, MSPH, PhD

Objectives: This study was aimed at assessing the relationship between cystic duct and stone diameter with the frequency of biliary pain.

Design and Setting: A prospective study of 30 patients admitted for cholecystectomy due to symptomatic cholelithiasis. The pattern of their frequency of pain was recorded since the first attack until admission and related to the diameters of their gallbladder stones and cystic ducts.

Results: Patients with a cystic duct diameter of 5 mm or less had more frequent attacks of pain per week than those with a diameter more than 8 mm (p = 0.0003). The smaller the cystic duct diameter, the smaller the stone diameter (p < 0.0001), and the smaller the stone the more frequent are the attacks of pain (p = 0.0001).

Conclusion: This study showed that there is a significant relationship between the frequency of biliary pain and the size of stone and the diameter of cystic duct. This observation may give a useful clue to surgeons in arranging priorities for operations.

Keywords: Biliary pain. Frequency. Gallstone size. Cystic duct diameter.


Biliary pain is the most common presentation of gallstones. Its activity tends to remain about the same over long periods; if the patient has been experiencing frequent attacks they usually continue with the same frequency. It has been observed that there is possible association between stone size and gallbladder cancer, and that large calibre cystic ducts together with small gallstones have important role in the pathogenesis of acute pancreatitis, so physical and anatomical factors play an important role in cholelithiasis. This study is aimed at assessing the relationship between cystic duct and stone diameter with the frequency of biliary pain.

From the Department of Surgery, King Abdulaziz University Hospital, PO Box 6615, Jeddah 21452, Saudi Arabia
M. A. BAKHOTMAH, A. BAHNASSY
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Method

We studied 39 consecutive patients going for cholecystectomy because of symptomatic gallstones. None was receiving regular analgesia. Eight patients stated that their attacks occurred only after fatty meals and since another could not tell how regular the pain was, those nine cases were excluded from the study. The data on the remaining 30 patients were used because they were able to give a regular history of biliary pain attacks.

Regarding the frequency of the attacks of biliary pain, the patients were divided in two groups—those who have one attack or more every week—and those who are free of attack for one week or more. This was done retrospectively, i.e. from the first attack of pain until admission for surgery. The patients were asked if the biliary pain attacks were regular or not and how many times per week they occurred. After cholecystectomy the gallbladder was opened from fundus and all the stones were retrieved. The diameters were measured using an engineering micrometer, and the mean diameter calculated. The cystic duct lumen diameter was also measured. This was done by opening the jaws of the engineering micrometer inside the cystic duct lumen until it was fully stretched; this reading was considered to represent the cystic duct diameter.

The data were analysed using SPSS PC + on an IBM microcomputer. Since the variables were not normally distributed, non-parameter statistics were used in the analysis. The Wilcoxon rank test was used. The test was considered statistically significant at $\alpha = 0.05$ at least.

Results

There were 23 females (76.7%) and seven males (23.3%). (sex ratio of 3.2:1). There were 23 patients (76.7%) with a cystic duct equal to or less than 5 mm in diameter whilst the remaining seven patients (23.3%) had cystic duct diameters of more than 5 mm. Twenty patients (66.67%) had a stone diameter equal to or less than 10 mm; and the stone diameter was more than 10 mm in 10 patients (33.33%). Regarding the frequency of biliary pain attacks per week 17 patients (56.7%) were in the group of those who had one or more attacks per week and 13 patients (43.3%) were in the group who were free of attacks for one week or more.

Patients with a cystic duct diameter of 5 mm or less had significantly more frequent attacks of pain per week than those with a diameter more than 5 mm ($p=0.0003$).

<table>
<thead>
<tr>
<th>Complication</th>
<th>Stone diameter</th>
<th>Cystic duct diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\leq 10 \text{ mm}$</td>
<td>$&gt;10 \text{ mm}$</td>
</tr>
<tr>
<td>Acute choledocholithiasis</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Mucocele</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Obstructive jaundice</td>
<td>1</td>
<td>-</td>
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</table>

Table 3

<table>
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<tr>
<th>Relationship of stone diameter, and cystic duct diameter to various clinical events</th>
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<tbody>
<tr>
<td>Stone diameter</td>
</tr>
<tr>
<td>Small</td>
</tr>
<tr>
<td>$&lt; 10 \text{ mm}$</td>
</tr>
<tr>
<td>Large</td>
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<tr>
<td>$&gt; 10 \text{ mm}$</td>
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<tr>
<td>Cystic duct diameter</td>
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<tr>
<td>Small</td>
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<tr>
<td>Large</td>
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<td>$&gt; 5 \text{ mm}$</td>
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</tbody>
</table>

In each cell the five numbers show from left to right number of patients with less than one attack of biliary pain per week; number of patients with one or more attacks per week; number of patients with acute choledocholithiasis; number of patients with mucocele of gallbladder; and number of patients with obstructive jaundice.

With respect to stone diameter; there was a significant relationship to cystic duct size—the smaller the cystic duct diameter, the smaller the stone diameter ($p<0.0001$).

Among the 20 patients (66.67%) having stone diameters of 10 mm or less there were 12 patients (60%) who had cystic duct diameter $\leq 5 \text{ mm}$; stone diameter $\leq 10 \text{ mm}$ and frequency of pain $\geq 1$ attack per week.

There was a significant relationship between the frequency of pain per week and the stone diameter ($p=0.0001$); the smaller the stone the more frequent are the attacks of pain (Table 1).

Complications due to gallstones occurred in 11 patients (36.6%). Seven (63.6%) had cystic duct diameters less than 5 mm and stone diameters less than 10 mm (Tables 2 and 3).

Discussion

Cholelithiasis has received a great deal of attention in medical, surgical and radiological studies. However, the effect of physical characteristics of gallstones together with the anatomical configuration of the biliary system on the presentation, symptomatology and clinical manifestations of cholelithiasis has received relatively little attention.

Patients with acute gallstone pancreatitis have smaller and more numerous stones in association with a wide cystic duct than controls.4 This finding was demonstrated by other investigators;3-7 so the concept of a small stone
migrating through a wide cystic duct as a cause of acute biliary pancreatitis indicates that the size of the stone together with the anatomy of biliary system plays an important role in the clinical manifestation of cholelithiasis. This present study showed significantly that patients with a stone diameter of 10 mm or less, having a cystic duct of 5 mm or less have more frequent episodes of biliary pain per week than those with larger stones and wider cystic ducts.

The cause of biliary pain may be due to stone impaction in Hartman’s pouch which produces obstruction of the cystic duct thereby causing stasis of gallbladder bile. Our findings support this concept and add that it is not necessary that the stone should impact in Hartman’s pouch but it can also obstruct the inlet or the lumen of the cystic duct and act as a ball valve which explains the intermittent nature of the pain. The cause of acute cholecystitis may be due to a small stone inside the cystic duct obstructing the lumen or in Hartman’s pouch causing cystic duct occlusion. This present study seems to be more in agreement with intraluminal obstruction as a suggested mechanism.

From the eight cases of acute cholecystitis; five had small stones and six had narrow cystic duct diameter. In all complicated cases the stone diameter was larger than the cystic duct diameter; the only exception was the single case of obstructive jaundice. However, one published study showed that the stone size had no significant relation to the presence or absence of cholelithiasis.

This present study supports the concept that biliary pain tends to be regular in that from the 39 patients 30 (77%) gave a history of regular attacks of biliary pain. This observation is important when considering treatment. A patient who has started with very frequent attacks will tend to continue to suffer them and so deserve quicker management.

The results of this study in addition to those previously published show that small stones may be an important factor in increasing the frequency of biliary pain attacks and causing complications. Although previous reports declared that a wide cystic duct is an important factor, this study showed that a narrow cystic duct is also important. This can be explained as follows: if the cystic duct is wide then complications are more likely to occur outside gallbladder while if it is narrow then acute cholecystitis is more likely and biliary pain is more frequent.

In conclusion, the findings of this study showed a significant relationship between stone diameter, cystic duct diameter and frequency of biliary pain. The smaller the stone and cystic duct, the more frequent is the pain. This observation may give a useful clue to the surgeon in arranging priorities of admission and operations for patients and possibly forecasting the natural history of the disease.

References