Double Duct Sign: Reassessed Significance in ERCP

The double duct sign, defined as an abnormality of both the pancreatic duct and the contiguous part of intrapancreatic common bile duct, was found in 52 of 1180 patients studied by endoscopic retrograde cholangiopancreatography. Thirty patients were proved to have pancreatic malignancy and 22, benign pancreatic disease. Specific ductal characteristics found to indicate a malignant process were ductal obstruction, especially of the common bile duct, close proximity of the biductal lesions, a short stenotic segment of the common bile duct removed from the papilla, and abrupt, irregular transition from normal to stenotic or obstructed duct. Ductal characteristics suggesting a benign process were long length of common bile duct stenosis, calcium deposits, pseudocyst formation, and ectasia of pancreatic ductal branches central to the main duct lesion. This analysis indicates that the double duct sign per se is not disease specific, but when other ductal characteristics are assessed as a component of this finding, the ability to differentiate benign from malignant pancreatic disease is enhanced.

Endoscopic retrograde cholangiopancreatography is an established method for evaluating patients with suspected pancreatic disease [1–3]. As experience has increased, specific signs of pancreatic disease have emerged, some of which have been believed to be disease specific [4, 5]. One of these, the double duct sign, was previously defined as "a combined abnormality of both ducts" [4] and redefined as "nodular, eccentric, or rat-tailed encasement of the pancreatic and common bile duct in contiguity" [5]. The double duct sign was initially proposed as a specific finding of pancreatic carcinoma. Because questions have arisen about the validity of this sign, this study was undertaken to analyze its diagnostic reliability in differentiating benign from malignant pancreatic disease and to determine what ductal characteristics could be used to enhance its diagnostic usefulness.

Materials and Methods

For this study, an encompassing definition of the double duct sign was accepted as an abnormality of both the pancreatic duct and the contiguous part of the intrapancreatic common bile duct. Adequate contrast opacification of the common bile duct and pancreatic duct was required to permit assessment of ductal morphology. During a 5 year period, 1,180 endoscopic retrograde cholangiopancreatographic examinations were performed at the University of Washington Hospital and Virginia Mason Hospital. Of these, 52 cases with a double duct sign fulfilled these criteria for inclusion in this study. In 50 cases, both ducts were opacified by endoscopic retrograde cholangiopancreatography; in two cases, T-tube cholangiography was used to visualize the common bile duct. Proof of diagnosis was based on histologic confirmation (48 cases) and clinical observation of greater than 2 years (four cases).

A blind analysis of the radiographs of each case was performed by one of us who was unfamiliar with the cases, their clinical data, confirmatory information, or radiographs. Radiographic characteristics subjected to evaluation were the presence, site, and length of...
TABLE 1: Ductal Measurements in 52 Patients with Double Duct Sign by ERCP

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Malignant</th>
<th>Benign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Patients</td>
<td>Average (mm)</td>
</tr>
<tr>
<td>Distance of stenosis from papilla:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common bile duct</td>
<td>25</td>
<td>24.0</td>
</tr>
<tr>
<td>Pancreatic duct</td>
<td>17</td>
<td>15.3</td>
</tr>
<tr>
<td>Length of stenosis:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common bile duct</td>
<td>25</td>
<td>19.0</td>
</tr>
<tr>
<td>Pancreatic duct</td>
<td>17</td>
<td>19.3</td>
</tr>
<tr>
<td>Prestenotic diameter:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common bile duct</td>
<td>25</td>
<td>16.5</td>
</tr>
<tr>
<td>Pancreatic duct</td>
<td>17</td>
<td>9.0</td>
</tr>
<tr>
<td>Contiguity of lesions</td>
<td>30</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Note.—Measurements corrected for magnification.

A ductal stenosis or obstruction, prestenotic ductal diameters, and presence or absence of pancreatic inflammatory changes such as multiple stenoses, calcifications, or cavitory lesions.

Many morphologic descriptions that have been used to describe ductal abnormalities [5–7] were condensed into a descriptive scheme evaluating the character of ductal narrowing or obstruction (abrupt or gradual) and margin of the involved ductal segment (smooth or irregular) (fig. 1). Each lesion was described using these criteria. In some cases the ductal character was not readily defined. These were noted as "undetermined." Measurements were made between the projected centers of the duct abnormalities to determine lesion contiguity (fig. 2).

Results

Of the 52 patients, 30 (58%) were proven to have a malignancy of the pancreas; 25 had pancreatic adenocarcinoma, three had peripancreatic carcinoma, one had a lymphoma, and one had a metastatic lesion. Of the 52 patients, 22 (42%) had a benign disease; 21 had chronic pancreatitis and one had peripancreatic stenosis. Table 1 details the ductal measurements obtained.

Stenosis. There were 47 instances of common bile duct stenosis and 37 of pancreatic duct stenosis. The distance from the papilla to the common bile duct stenosis averaged 24 mm for malignant and 13 mm for benign lesions. The distance from the papilla to the pancreatic duct stenosis averaged 15 mm in malignant and 18 mm in benign lesions. The length of the common bile duct stenosis averaged 19 mm in neoplastic and 31 mm in benign lesions. The length of pancreatic duct stenosis averaged 19 mm for malignant lesions and 24 mm for benign lesions.

Obstruction. A malignant lesion was present in all cases of obstruction of the common bile duct and in 13 of 16 cases of obstruction of the pancreatic duct. In addition, there were five cases of obstruction of both the common bile duct and pancreatic duct. All were adenocarcinomas.

Distance between biductal lesions. Biductal lesions produced by malignant disease averaged 6 mm apart. In benign disease, the average distance between lesions was 25 mm.

Character of stenosis or obstruction. An abrupt terminus with irregular margins was found in 38 cases; 73% were
malignant and 27% were benign. There were 17 cases of abrupt terminus with smooth margins, of which 82% were malignant and 18% benign. Of 25 cases with a gradual terminus with smooth margins, 28% were malignant and 72% were benign. Fifteen cases had gradual termination with irregular margins; 33% were malignant and 67% were benign (table 2).

*Other characteristics.* Three cases with a cavity filling from the pancreatic duct and six with pancreatic calcification were all associated with benign disease. Diffuse dilatation of pancreatic duct branches was found in 21 patients, 67% with neoplasm and 33% with pancreatitis.

**Discussion**

Differential diagnosis of benign from malignant disease of the pancreas has been aided by endoscopic retrograde cholangiopancreatography [4, 5, 8–10]. During its early use, endoscopic retrograde cholangiopancreatography was primarily descriptive, and it became apparent that similar signs could be found in benign and malignant diseases [7]. As experience with endoscopic retrograde cholangiopancreatography has increased, specific ductal morphologic features have been shown to aid in differentiation of benign from malignant disease [6].

Neoplastic disease has been found to be reliably diagnosed using a number of ductal abnormalities. Among these was the double duct sign, which was described as a combined abnormality of both the pancreatic and common bile ducts and was predominately found in malignant lesions [4]. Subsequently, the double duct sign has been more specifically defined as nodular, eccentric, or rat-tailed encasement of the pancreatic and common bile duct in contiguity [5, 11], but its reliability has been questioned when signs of chronic pancreatitis are present [5].

The results of our investigation show that the double duct sign per se is not disease specific; benign and malignant disease are of nearly equal incidence (figs. 3 and 4). If specific features of the abnormal ducts are evaluated, however, certain of these are found to be of value in differentiating benign from malignant pancreatic disease. If ductal obstruction was a component of the double duct sign, malignancy was strongly suggested. This is especially the case in the presence of common bile duct obstruction (fig. 5). Contiguity of the bidual duct abnormality was also useful (fig. 6). Lesions whose centers lay within 5 mm of each other were malignant in three-quarters of cases, and if one lesion was obstructing, all were malignant (12 cases). When the separation of lesions was greater than 20 mm, all were benign. It is clear that as the distance between lesions increases, so does the probability of benign disease.

The distance of the common bile duct abnormality from the papilla also proved valuable. Lesions of the common bile duct were about twice as far from the papilla in malignancy than in benign disease. The lengths of the stenotic segments of the common bile duct were longer in benign disease than in malignant disease.
Ductal morphology was useful in that an abrupt terminus or stenosis, especially when associated with irregular margins, was associated with malignancy in 78% of instances (figs. 2 and 4). Gradual terminus or gradual stenotic segments were more indicative of benign lesions, especially when associated with smooth margins (fig. 7).

Several parameters were found to be indicative of benign disease. Glandular calcifications and opacified pancreatic ducts were more indicative of benign lesions, especially when associated with smooth margins (fig. 7).

Fig. 5.—Adenocarcinoma of pancreas. Bile duct obstructed at cystic duct confluence resulting in exclusive filling of gallbladder (G) and cystic duct. Gradual, smooth stenosis of pancreatic duct (arrow).

Fig. 6.—Adenocarcinoma of pancreas. Close proximity of ductal lesions and abrupt, near total stenosis of common bile duct indicate neoplasm.

Fig. 7.—Chronic pancreatitis. A, Common bile duct shows gradual, smooth stenosis. Pancreatic duct shows dilatation and branch ectasia. B, Close-up shows gradual, smooth stenosis of both ducts.
pseudocysts were found only in cases of inflammatory disease. Clubbed or ectatic branch ducts, especially when central to a main ductal lesion, usually indicated benign disease. Of no apparent value in differential diagnosis were the distance of pancreatic duct lesions from the papilla, length of pancreatic duct stenosis, and prestenotic caliber of either duct.

The double duct sign per se does not indicate malignant disease. Accurate diagnosis depends on careful assessment of all ductal characteristics and their application within the clinical context of the individual patient.

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