Double-duct Sign: Do Not Forget the Gallstones

Leendert H. Oterdoom, Stijn J.B. van Weyenberg, Nanne K.H. de Boer

INTRODUCTION

A double-duct sign is seen when both the common bile duct (CBD) and pancreatic duct (PD) are dilated due to a stenosis, stricture or obstruction. Often, a double-duct sign is due to an obstructing cancer of the pancreas head. However, the culprit is not always a malignant mass, and many non-malignant causes have been described. We present a case-report of a patient with a double-duct sign related to choledocholithiasis. Also, we performed a literature search on the diagnostic value of a double-duct sign.

CASE REPORT

A 63-year-old woman presented at the emergency department with pain in the right upper quadrant of her abdomen. She had had this colicky pain the preceding five days. There was no fever, jaundice, discoloured stools or darkened urine. Her medical history consisted of hypertension, peripheral vascular disease and Raynaud's phenomenon. She used acetylsalicylic acid, omeprazole, alendronic acid, amlodipine and losartan. She had quit smoking one year earlier and denied alcohol use. On physical examination, we saw an elderly woman in no distress, without fever and normal haemodynamic and respiratory parameters. There was mild tenderness of the right upper abdomen, without a positive Murphy's sign. Laboratory results were: C-reactive protein (CRP) 21 mg/l (reference value <2.5 mg/l), leucocytes 7.7x10⁹/l (4-10x10⁹/l), serum conjugated bilirubin 6 µmol/l (<20 µmol/l), alkaline phosphatase 186 U/l (<120 U/l), gamma-glutamyl transpeptidase 215 U/l (<120 U/l), ALAT 138 U/l (<30 U/l), ASAT 137 U/l (<35 U/l), and amylase 78 U/l (<100 U/l). An abdominal ultrasound showed a double-duct sign, with a distended CBD of 16 mm and a distended PD of 4 mm. The cause of the obstruction was not apparent. The gallbladder wall was thickened, but no evident CBD concrements were detected. An abdominal ultrasound showed a double-duct sign, with a distended CBD of 16 mm and a distended PD of 4 mm. The cause of the obstruction was not apparent. The gallbladder wall was thickened, but no evident CBD concrements were detected. An abdominal ultrasound showed a double-duct sign, with a distended CBD of 16 mm and a distended PD of 4 mm. The cause of the obstruction was not apparent. The gallbladder wall was thickened, but no evident CBD concrements were detected. An abdominal ultrasound showed a double-duct sign, with a distended CBD of 16 mm and a distended PD of 4 mm. The cause of the obstruction was not apparent. The gallbladder wall was thickened, but no evident CBD concrements were detected. An abdominal ultrasound showed a double-duct sign, with a distended CBD of 16 mm and a distended PD of 4 mm. The cause of the obstruction was not apparent. The gallbladder wall was thickened, but no evident CBD concrements were detected.
tapering towards the ampulla of Vater. She was subsequently referred for a laparoscopic cholecystectomy.

LITERATURE SEARCH

A PubMed search was performed in July 2013 with the search term: double duct sign. There were 41 publications, 27 of which were excluded because the articles were not in English. Seven included original data [1-7] and 7 were case reports [8-14]. References were cross-referenced for further original data and we identified 3 additional relevant studies with original data [15-17]. The 10 studies are summarized according to the imaging modality.

Endoscopic retrograde cholangiopancreatography
Kaladey et al retrospectively reviewed 7,008 ERCPs performed and selected 355 cases with a PD stricture [1]; 75% of malignant cases were confirmed by cytology or histology. Diagnostic test qualities are depicted in Table I.

Menges et al described 43 cases with a double-duct sign in 1209 consecutively reviewed ERCP films [2]. Indications for an ERCP were the following: 22 patients had a pancreatic mass seen with radiological imaging, 14 had an obstructive jaundice, 4 had already histologically proven pancreatic cancer, 2 had suspected choledocholithiasis and 1 was thought to have chronic pancreatitis. Of 41 patients, 35 (85%) had a pancreas carcinoma (21 histologically proven and 14 based on clinical judgement by rapid progression of tumor growth), 1 had a metastasis of lung cancer, 5 patients had benign disease.

Plumey et al found 52 cases of a double duct sign in 1,180 reviewed ERCP films [3]. Thirty (58%) patients had a proven malignancy of the pancreas: 25 with pancreas cancer, 3 periampullar cancer, 1 lymphoma and 1 metastasis of an unknown primary tumour. Twenty-two patients (42%) had a benign underlying disease.

The first study to coin the term “double-duct sign” as a combined abnormality of the CBD and PD was published in 1976 by Freeney and colleagues [4]. After having performed 250 ERCPs between 1972 and 1974, 11 ERCP films of patients with pancreas cancer were correctly recognized amongst 29 ERCP films of healthy controls by blinded reviewers. The only diagnostic information given was: “A combined abnormality of both ducts (double-duct sign) increased diagnostic...
certainty." Unfortunately, no numbers are given how many of the selected patients had a double-duct sign.

Ralls et al reviewed 72 patients with narrowing of the CBD or PD by ERCP [5]. Forty-nine patients were selected who had histological conformation or at least two years clinical follow-up. Diagnostic test qualities are given in Table I.

Shemesh et al [6] investigated the diagnostic qualities of ERCP in 55 patients diagnosed with chronic pancreatitis, 10 of whom also had a pancreas cancer; 52 patients underwent ERCP. All 10 patients with a pancreas cancer had both a PD stricture (>10 mm) and a distal CBD stricture. Of the 45 patients without a pancreas cancer, it was not mentioned how many patients had both a PD and CBD stricture.

Inoue and colleagues performed endoscopic retrograde balloon pancreatography-compression studies (ERBP-CS) and retrospectively analysed 48 patients. Twenty-one patients had proven pancreas cancer and 27 had chronic pancreatitis [16]. An ERBP-CS uses fluoroscopy after the placement of a long occluding balloon catheter within the PD, after removing the endoscope to obtain better quality pancreatograms. Diagnostic test performances are presented in Table I.

Magnetic resonance imaging and or CT-scan followed by EUS

Krishna et al retrospectively reviewed all 234 patients with a double duct sign and a suspected pancreas cancer who had an EUS and a CT and/or MRI-scan [7]. The CBD was considered dilated if the diameter was >7 mm or >9 mm after cholecystectomy. The PD was considered dilated if the diameter was >3 mm in the head, >2 mm in the body and >1 mm in the pancreas tail. Of those patients with jaundice, 142 of 166 (86%) had a pancreas carcinoma. Of those without jaundice only 4 of 68 (6%) had a malignant pancreatic tumour.

Magnetic resonance imaging

Lopez and colleagues reviewed 66 patients with a suspected pancreas cancer in whom a MRI was performed [15]. Forty-four patients had a malignancy and 22 had a benign diagnosis, after reviewing all clinical data, including 47 open surgeries, 1 laparoscopy and 13 percutaneous biopsies. Eighteen of the 44 (41%) patients with a malignancy had a double duct sign. Presence of a double-duct sign was not reported in patients with a benign diagnosis.

Abdominal ultrasound

Blangy et al reported in 10 patients with proven cancer of the ampulla, that 2 (20%) had a double-duct sign, as detected with abdominal ultrasound [17].

Case reports

Table II shows a summary of all published case reports.

DISCUSSION

The term double-duct sign was used by Freeney in 1976 [4], shortly after the introduction of the ERCP [18]. Interestingly, there is no set definition of a double-duct sign in literature, but the common consensus is a stenosis, stricture, obstruction or abnormality of both CBD and PD resulting in dilatation of both ducts. Physiologically, the mean diameter of the CBD is 4 mm [19, 20], and the PD ranges from 2 to 4 mm, and is widest in the head of the gland [21, 22]. Post-cholecystectomy, the CBD is somewhat wider at a mean of 5 mm. Freeney et al reported that the double-duct sign was highly diagnostic for a pancreas carcinoma, but diagnostic information was not specified [4]. In selected patients with an increased likelihood of pancreas cancer, based on the presence of jaundice or observed pancreatic mass on CT-scan, up to 85% of patients did indeed have a pancreas cancer [2]. These observations were confirmed by a more recent and larger study performed in 2012 [7]. In an unselected population, without an increased likelihood of malignancy, a double duct sign seen by ERCP was caused by a pancreas malignancy in 58% of patients. In patients without jaundice, pancreas cancer was only seen in 6% of patients with a double duct sign [7]. Three studies gave detailed diagnostic test qualities [1, 5, 16]. The two studies performed with ERCP

| Number | Number and type of patients | Number of patients | Imaging type | Malignant Sens Spec PPV NPV Ref |
|--------|-----------------------------|--------------------|--------------|-------------------------------|-------|-------|-------|-------|-------|-------|
| 1.     | 355 with pancreatic duct stricture | 7008 | ERCP | 65% | 76% | 80% | 65% | 88% | [1] |
| 2.     | 43 with double duct sign | 1209 | ERCP | 85% | - | - | - | - | [2] |
| 3.     | 52 with double duct sign | 1180 | ERCP | 55% | - | - | - | - | [3] |
| 4.     | 11 with pancreas cancer, 29 control patients | 250 | ERCP | Unknown | - | - | - | - | [4] |
| 5.     | 49 with double duct sign | 72 | ERCP | 21% | 50% | 63% | 21% | 87% | [5] |
| 6.     | 55 with chronic pancreatitis | 55 | ERCP | 18% | - | - | - | - | [6] |
| 7.     | 21 with proven cancer, 27 with chronic pancreatitis | 293 | ERCP-CS | 80% | 38% | 93% | 80% | 65% | [16] |
| 8.     | 234 with double duct sign | unknown | MRI/CT-scan and EUS | Icteric: 86% Non-icteric: 6% | - | - | - | - | [7] |
| 9.     | 66 with suspected pancreas cancer | 67 | MRI | 41% | - | - | - | - | [15] |
| 10.    | 10 with proven ampulla cancer | 10 | Abdominal ultrasound | 20% | - | - | - | - | [17] |

Sens: sensitivity; Spec: specificity; PPV: positive predictive value; NPV: negative predictive value; Malignant: percentage of those patients with double duct sign with a pancreas cancer.
[1, 5] gave comparable results with a sensitivity of 50% and 76% and a specificity of 63% and 80%.

CONCLUSION

In our patient, choledochoolithiasis was the obstructing cause for the double duct sign. The patient had a suggestive history of cholelithiasis, a stone in the CBD seen during EUS and ERCP (with stone extraction), and no mass on the CT-scan. This is, to our knowledge, the first description of a double-duct sign due to choledochoolithiasis. Our case emphasizes that a double-duct sign is not always related to a pancreas cancer, especially in non-jaundiced patients. Nevertheless, a cancer of the pancreas should be ruled out in this group of patients.

Conflicts of interest: None to declare.

Acknowledgement: We thank Indra Pieters, radiologist at the VU University Medical Center (Amsterdam, The Netherlands), for reviewing the radiological imaging and helping with selecting and describing the images for Fig. 1.

REFERENCES


Table II. Case reports of double duct sign

<table>
<thead>
<tr>
<th>Number</th>
<th>Conditions causing double duct sign</th>
<th>Imaging modality</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kaposis sarcoma</td>
<td>CT-scan</td>
<td>[8]</td>
</tr>
<tr>
<td>2.</td>
<td>Strongyloides</td>
<td>MRCP</td>
<td>[9]</td>
</tr>
<tr>
<td>3.</td>
<td>Sphincter of Oddi dysfunction</td>
<td>EUS</td>
<td>[10]</td>
</tr>
<tr>
<td>5.</td>
<td>Retroperitoneal fibrosis</td>
<td>ERCP</td>
<td>[12]</td>
</tr>
<tr>
<td>6.</td>
<td>Pancreas carcinoma not seen on abdominal ultrasound or CT-scan</td>
<td>ERCP</td>
<td>[13]</td>
</tr>
<tr>
<td>7.</td>
<td>Large ampullary tubulovillous adenoma</td>
<td>CT-scan</td>
<td>[14]</td>
</tr>
</tbody>
</table>