Stent-Induced Cholangitis Mimicking Biliary Dilatation on Sonography

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Abstract
This study describes the sonographic features of stent-induced cholangitis, which could be mistaken for biliary dilatation and obstruction. It involves six patients with a mean age of 71 years (range, 29–81 years) who underwent endoscopic biliary stenting because of biliary obstruction. Stenting duration varied from nine days to five months. All patients had prestenting and poststenting sonograms. The sonographic characteristics were analyzed in all of the patients, with the diagnosis being confirmed by retrograde cholangiopancreatography. All patients showed biliary dilatation without ductal wall thickening on prestenting sonograms. Follow-up sonograms demonstrated diffuse hypoechoic ductal wall thickening in all patients. In four patients, the ductal lumen was obliterated by wall thickening, which initially led to a misdiagnosis of persistent biliary dilatation. The degree of ductal wall thickening did not correlate with stenting duration. Diagnosis of stent-induced cholangitis should be considered when hypoechoic and thickened bile duct walls are found on sonography. Careful scanning technique and meticulous assessment of the sonographic images helped to separate the echo-free ductal lumen from the hypoechoic edematous mucosal lining. When evaluating patients following stenting, sonographers may need to obtain fine detailed views of the common bile duct to be able to differentiate ductal wall edema from biliary dilatation.

Keywords
cholangitis, biliary dilatation and obstruction, biliary stenting, common bile duct, ductal wall thickening

The role of sonography as a primary screening imaging modality for biliary obstruction has long been established.¹–⁶ The diagnosis of extrahepatic biliary obstruction by sonography is based on the demonstration of biliary ductal dilatation.⁷,⁸ Patient’s advanced age, previous biliary obstruction, prolonged fasting, and previous cholecystectomy can lead to variable degrees of ductal dilatation.⁹–¹¹ Several tests such as the fatty meal,¹² the cholecystokinin,¹³ and the Valsalva maneuver¹⁴ have been used to differentiate obstructive from nonobstructive biliary dilatation. In this report, we present another condition, observed in six patients, which could be mistaken for biliary dilatation and obstruction at sonography: stent-induced cholangitis. We also discuss how to differentiate this entity from dilated bile ducts. To the best of our knowledge, this condition has not been described in the sonographic literature.

Materials and Methods
Because this study was retrospective, the approval and the need to obtain an informed consent from the patients were waived by the hospital’s institutional board. Between February and August 2002, we encountered common bile duct (CBD) wall thickening by sonography, in six patients with indwelling biliary stents. Stenting was performed to relieve biliary obstruction secondary to CBD stricture (n = 2), cholangiocarcinoma (n = 1), pancreatitis (n = 1), and pancreatic carcinoma (n = 2). There were four men and two women, with an age range of 29 to 81 years (mean, 71 years). All patients had recurrent pain, nausea, vomiting, chills, fever, and/or biochemical liver abnormalities. They were referred to sonography to assess the status of the biliary tree and stent position. All patients also had sonograms performed prior to stenting.

Sonographic examinations were performed in the supine and left lateral decubitus positions with a high-resolution real-time sonography imaging unit using a 3.5-MHz sector, vector, or curvilinear transducer (Siemens Medical Systems, Issaquah, Washington).

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The CBD was considered dilated if its internal diameter measured more than 5 mm (adding 1 mm for each decade after 50 years of age). Thickening of the CBD wall was also considered when (1) a hypoechoic stripe was seen lining the normal bright line (wall) internally and (2) the wall measured more than 1 mm (normal ≤1 mm). Stents were seen as two hyperechogenic parallel lines within the lumen of the CBD.

All patients were examined by retrograde cholangiopancreatography (ERCP), which confirmed the sonographic findings. In addition, bile cultures were obtained in all patients.

**Results**

The poststenting sonograms in all six patients showed changes on sonography consistent with CBD wall edema. The stent duration varied between 9 days and 5 months (mean, 3 weeks). Bile cultures were studied in all patients.

The CBD size and its wall thickness in prestenting and poststenting as determined by abdominal sonography are summarized in Table 1. The initial sonogram showed dilation of the CBD in all of the six patients (Figure 1). All patients underwent a second examination, and ductal dilatation was not demonstrated in any of the patients. Instead, sonography demonstrated marked thickening of the CBD walls (Figure 2). In four patients, the lumen of the duct was obliterated and not identified (Figure 3). Sonography demonstrated the stent as two echogenic parallel lines within the lumen of the CBD (Figure 4). Despite the presence of the stent within the lumen, the CBD anteroposterior diameter and the wall thickness were adequately visualized and measured in all patients.

Scans of the CBD showed hypoechoic inner mucosal lining relative to the outer echogenic bile ducts’ walls in all the patients. In four patients, the lumens of the common bile ducts were obliterated as a result of the markedly diffused hypoechoic wall thickening. The lumen of the CBD usually appears anechoic. In two of the patients, the CBD lumen was demonstrated after further scanning and assessment (Figure 5). On the basis of these findings, the diagnosis of stent-induced cholangitis was suggested.

After the sonography examinations, ERCP was performed in all patients and confirmed the sonographic findings. Furthermore, ERCP findings—irregular and beaded appearance of extrahaepatic CBD (calipers) are demonstrated. Note the size of the CBD, which measured 13 mm in the anteroposterior diameter compared to the portal vein (PV). The hepatic artery (HA) is also visualized.

The duration of stenting ranged from 9 days to 5 months and did not correlate with the degree of ductal wall thickening (Table 1).

The bile cultures were positive for streptococci and *Escherichia coli* in only two patients. No bacterial growth was found in the other four bile samples.

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**Table 1. Summary of Sonographic Findings Measurements of Bile Ducts in Pre- and Poststenting**

<table>
<thead>
<tr>
<th>Case #</th>
<th>Age, y</th>
<th>Stent Duration</th>
<th>CBD Wall Thickness, mm</th>
<th>CBD Size, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>1</td>
<td>64</td>
<td>4 weeks</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>2.5 weeks</td>
<td>&lt;1</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>29</td>
<td>1 week, 2 days</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>4</td>
<td>71</td>
<td>21 weeks</td>
<td>&lt;1</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>72</td>
<td>3 weeks</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>6</td>
<td>81</td>
<td>3 weeks</td>
<td>&lt;1</td>
<td>3</td>
</tr>
</tbody>
</table>

CBD, common bile duct.
Discussion

Although transhepatic stent implantation has become a common procedure for the palliation of biliary system obstruction, it is not without risk.\textsuperscript{15–17} Complications such

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure2.png}
\caption{Longitudinal oblique sonogram of the common bile duct (CBD) in a patient who was misdiagnosed as having ductal dilatation (case 4). Note the markedly thickened hypoechoic duct walls (TW) and the echogenic outer layer of the duct (calipers). The portal vein (PV) appears as a tubular structure posterior to the bile duct. The two echogenic parallel lines within the lumen of the duct represent the stent (S). In this patient, the thickened ductal walls obliterated the lumen and caused an inaccurate measurement of 18 mm of the duct, which led to the misinterpretation of ductal dilatation.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure3.png}
\caption{Longitudinal oblique sonogram through the porta hepatis of another patient misdiagnosed with ductal dilatation (case 5). The thickened common bile duct (CBD) walls (TW) resulted in complete obliteration of the duct lumen. Note the centrally located stent (S), which appears as two parallel echogenic walls. The electronic calipers demarcate the anteroposterior diameter of the CBD, which measured 18 mm.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure4.png}
\caption{Longitudinal sonogram through the porta hepatis of a patient with the correct diagnosis of cholangitis (case 2). The centrally located structure with two parallel echogenic walls represents the stent (S) within in a thick-walled (TW) common bile duct (CBD). Note the echogenicity of the thickened walls compared to the wall echogenicity seen in Figure 2.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure5.png}
\caption{Longitudinal sonogram through the porta hepatis of a patient with the correct diagnosis of cholangitis (case 6). Note the anechoic lumen of the bile duct (L) and the thickened hypoechoic inner mucosal lining relative to the outer echogenic serosal layer of the duct (ML).}
\end{figure}
as cholangitis, misdiagnosis of the stent, leakage around the stent, and death have been documented.\(^1\)\(^{-21}\)

There have been reports in which sonography revealed thickening of the wall of the biliary tree associated with cryptosporidia or cytomegalovirus in AIDS patients.\(^22\)\(^{,23}\)

To the best of our knowledge, this sonographic appearance (thickening of bile duct walls) has not been previously reported as the primary manifestation of stent placement.

Several factors may contribute to the development of cholangitis in patients with biliary stenting. These include (1) trauma to the epithelium of the biliary tree created by the stent insertion, (2) stent blockage or change in stent position, and (3) colonization and attachment of bacteria to the tip or surface of the stent.\(^24\)\(^{,25}\)

Patients with biliary obstruction are usually on biliary prostheses drainage for weeks or months, which maintains an adequate bile passage and drainage and results in continuous contact and irritation of the duct mucosa by the stent surface and tip. The mechanical irritation leads to hyperemia, followed by edematous changes to the mucosa. Although the presence of the stent predisposes the patient to infection, this in itself does not seem to play a significant role in the development of cholangitis. Four of six patients in our series had no evidence of bacterial growth. Our findings are similar to Carrasco et al.,\(^26\) who found that cholangitis also developed in the majority of cases without infection.

The duration of stenting does not seem to be a major factor in determining the incidence and severity of cholangitis.\(^26\) This was demonstrated in our series in which the thickening of the ductal walls was diffuse and about the same in all the patients.

Besides biliary system inflammations due to a variety of disease processes, bile duct wall thickening has also been reported to occur with primary biliary tumors such as cholangiocarcinoma.\(^27\)\(^{-30}\) Consequently, differentiating between these pathologic entities may prove difficult without ERCP or biopsy.\(^31\)\(^{,32}\) Nevertheless, at sonography, the bile duct wall changes seen with indwelling biliary stents are usually very suggestive of cholangitis, as demonstrated in our cases. The mucosa of the bile duct shows a very smooth and uniform thickening, which may suggest the possibility of diffuse inflammation. The thickened mucosa is usually hypoechoic because of its high fluid content. Bile duct tumors, on the other hand, tend to have a more irregular and polypoid appearance, have an abrupt termination, and are more echogenic sonographically.\(^33\)\(^{-36}\) They are also frequently associated with marked ductal dilatation and lymphadenopathy.\(^33\)

The hypoechoic thickened bile duct wall can be also easily overlooked or misdiagnosed as biliary dilatation, especially when the duct lumen is partially or entirely obliterated by the thickened duct walls, unless close attention is paid to the internal echotexture. To avoid making a misdiagnosis, it should be emphasized that the anechoic bile duct lumen should be visualized. Initially, an obliterated duct lumen by the thickened walls was misdiagnosed as ductal dilatation by the sonographers in four patients. Also, in our series, the lumen of the bile duct was identified in two patients. In the other four patients, the anechoic lumen of the bile duct was not identified because of the presence of the transhepatic stent. However, the echogenic linear reflections representing the anterior and posterior walls of the transhepatic stents were not an impediment but helped to define and demarcate the thickened hypoechoic walls of the ducts for proper identification and measurements.

In summary, cholangitis could be detected by sonography. If the possible clinical significance of thickened common bile duct walls in a patient needs to be further investigated, it will be important for the sonographer or the sonologist to be aware that the hypoechoic and thickened common bile duct walls may be related to the presence of the transhepatic stent. Proper detection, identification, and interpretation of the aforementioned sonographic findings are necessary to avoid a misdiagnosis of biliary dilatation.

**Declaration of Conflicting Interests**

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**References**


