Malignant obstructive jaundice is commonly treated by insertion of metallic stents in recent years. Malfunction of the metallic stent can be caused by encrustation of crystals, bacterial sludge, bile salts, and tumor compression or tumor ingrowth. For stent malfunction caused by tumor ingrowth, endoscopic treatment can be frequently unsuccessful. We encounter a patient with recurrent jaundice resulting from tumor ingrowth to the metallic stent. Power Doppler ultrasound demonstrates the neoplastic nature of the obstruction, and the patient was then treated by external biliary drainage.

Key words: Jaundice; Bile ducts, stents and prostheses; Bile ducts, US

Percutaneous transhepatic or endoscopic transpapillary insertion of biliary endoprostheses is now considered the method of choice in nonoperable patients for relief of malignant obstructive jaundice [1,2,3]. These procedures are associated with less morbidity as compared to biliary bypass surgery [4]. The recently developed expandible metallic stent is more preferable than plastic endoprostheses because the former offer a lower reobstruction rate [3,5]. Malfunction of the metallic stent occurs most commonly secondary to compression of the mesh by a tumor. Demonstration of the nature of stent malfunction is chiefly based on the relatively invasive endoscopic cholangiography [6,7]. We report hereby a patient with a known hepatocellular carcinoma (HCC) which has been paliatively treated with metallic stenting. The nature of stent malfunction can be well demonstrated by using power Doppler ultrasound (PDU).

CASE REPORT

A 47-year-old female was admitted due to recurrent jaundice with a known history of HCC for 7 months. She initially suffered from mild right upper abdominal discomfort for 2 months. Routine upper abdominal sonographic examination revealed a 5-cm hyperechoic mass in the right lobe of the liver. The liver parenchyma was coarsened and the liver surface was nodular. The sonographic diagnosis was cirrhosis of liver with HCC. No evidence of portal vein invasion nor biliary dilatation was noticed. The patient received transarterial chemoembolization (TACE) for her HCC after histopathological confirmation by ultrasound-guided biopsy. The patient had an uneventful course following the procedure and was discharged after a 12-days’ hospitalization. Unfortunately, jaundice devel-
oped 4 months after discharge. Imaging study revealed dilatation of the intrahepatic bile ducts (IHD). The aforementioned liver tumor (HCC) was enlarged and compressed the hepatic hilum. This may explain the cause of IHD dilatation, and her hyperbilirubinemia (total bilirubin=13mg/dl) was related to the biliary obstruction and IHD dilatation. A percutaneous transhepatic cholangiography (PTC) was done and confirmed the level of obstruction. A self-expanding stent (Wallstent; Schneider, Zurich, Switzerland) was placed in the region of biliary obstruction through a 7-French delivery catheter. The diameter of the fully expanded stent after the procedure was 8 mm. The patient’s total bilirubin level decreased to 4 mg/dl in the following 7 days, and she was discharged 12 days later. She was quite well for another 2 months. However, recurrent jaundice developed one week before this admission. On admission, laboratory study revealed a significant high level of total bilirubin (17 mg/dl) with direct bilirubin up to 13 mg/dl. Sonography was requested to check the cause of obstructive jaundice. Sonography could not demonstrate any mass lesion in the hepatic hilum. The shape of the metallic stent was not deformed (Fig. 1). Internal echoes inside the stent lumen were noted. The nature was not determined by using gray-scale imaging. PDU was applied then; color flow signals were demonstrated inside the lumen of stent by scanning through the stainless steel mesh (Fig. 2). Spectral Doppler showed pulsatile waveform suggesting arterial flows in the echogenic lumen (Fig. 3). The pulsatile flow pattern is different from a flat (continuous) flow pattern from the portal vein. PDU and spectral Doppler studies were diagnostic of a hypervascular tumor thrombus inside the stent lumen, representing tumor extension into the biliary tree from the previously treated HCC. The subsequent dynamic CT scan also demonstrated the intraluminal soft tissue structure which was suspected to have contrast enhancement by intravenous contrast injection. However, because of the artifacts caused by the stent, this study was not conclusive. The patient was then treated conservatively with percutaneous transhepatic biliary drainage. An

**Figure 1.** Gray-scale ultrasound of the liver depicts a tumor (arrowheads) involving the right lobe; scanning through the hepatic hilum also demonstrates a bright tubular structure (arrows) representing the stent. Evidence of internal echoes inside the stent is noted.

**Figure 2.** Using power Doppler ultrasound, color flow signals are depicted (long arrows) inside the stent (short arrows). In the territory of tumor, color flow signals are portrayed, representing the tumor vessels (arrowheads).

**Figure 3.** Spectral Doppler US with the sample volume placed in the region with color signals (long arrow) demonstrates pulsatile spectral waveform, indicating presence of arterial flow in the stent lumen. This finding is consistent with tumor vessels in the “thrombosed” common duct.
external drainage catheter was placed into each of the right and left IHDs. The patient died of repeated biliary infection and hepatic failure 5 weeks later.

**DISCUSSION**

Patients with malignant biliary obstruction are frequently treated with palliative biliary drainage if surgery is not indicated. Large bore plastic stenting has been one of the choices for years [1, 8]. However, a large series from 10 groups including 3,337 patients demonstrated an occlusion rate of 21-31% after a mean observation of 3 months [9]. Clogging of percutaneously placed plastic stents occurs in 6-23% of cases [1, 8]. The recently introduced metallic stents provide larger diameter and are considered to have a lower re-obstruction rate.

Metallic stents are advantageous in the treatment of hilar malignancy [3]. The design of stainless steel endoprosthesis with mesh allows drainage of side branches into the stent. Bilateral or multiple drainage can be achieved by insertion of multiple stents side by side. After accumulation of experience with the implantation of metallic stents, the stent blockage rate is declined from 15-42% to 7-18% [3,5,10-15]. One major drawback of metallic stents is ingrowth of tumor tissue through the mesh. This has been observed by some authors in 4-7% of cases [3,10,11,14]. Besides ingrowth of the tumor into the stent, the function of endoprosthesis can be also limited by encrustation of cholesterol crystals, bile salts, and bacterial sludge on its inner surface [16,17].

Demonstration of stent malfunction can be chiefly achieved by endoscopic cholangiography. When examined with ultrasound, the stainless steel mesh is highly echogenic. Although the transmitted sound from the transducer may not be totally reflected or blocked by the stent, the relatively dense mesh may cause artifacts and obscures soft tissue in the stent lumen. Tumor ingrowth of the metallic stent may thus not be appreciated by conventional gray-scale ultrasound. Most HCC are hypervascular with many small abnormal vessels throughout the tumor. Tanaka et al reported the sensitivity of color Doppler ultrasound (CDU) to be superior to that of hepatic angiography in certain circumstances. However, its ability to display low-velocity blood flow is still inadequate [18]. On the other hand, reports on the more recently developed PDU have shown that PDU has a higher sensitivity in flow detection than CDU. The PDU technique uses more of the available dynamic range when producing flow images, and shows more tumor vessels in HCCs than CDU does. PDU can portray the course of vessels and map the distribution of tumor vessels [19,20]. The comparison between PDU and CDU indicates that PDU almost always performs better than CDU in the visualization of tumor vessels, and can demonstrate more and finer vessels than CDU can. In addition, since PDU does manifest relative angle independence and does not alias, flow signals of tumor vessels are better registered [20]. In the present patient, identification of flow signals in the lumen of metallic stent is indicative of tumor ingrowth, which can distinguish this particular condition from other causes of stent malfunction (e.g., encrustation of crystals or bacterial sludge). Further management can be therefore facilitated.

**REFERENCE**

能量都卜勒超音波呈示肝細胞癌侵入膽管金屬支架

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恶性腫瘤阻塞所引起的黃疸在近年來常使用金屬支架作治療。金屬支架的功能障礙可以由膽管內的結晶凝塊、細菌性汗泥、膽鹽，及腫瘤壓迫或腫瘤直接侵入支架。如果因為腫瘤侵入支架而導致支架功能不良，則內視鏡或其導引所進行的治療通常無法成功。我們經歷一個病人，有復發性的黃疸，源自腫瘤直接侵入先前置放的金屬支架之內。能量都卜勒超音波證實其阻塞是腫瘤所引起，因此患者接受體外膽管引流術而獲得改善。

關鍵詞：黃疸；膽管金屬支架；膽道，超音波