Plastic Biliary Stents for Malignant Biliary Diseases

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KEYWORDS

• Malignant • Biliary • Plastic stent • Occlusion

Several malignancies can cause biliary obstruction at different levels with resultant jaundice. These malignancies include carcinoma of the papilla of Vater, pancreatic cancer, gallbladder cancer, distal cholangiocarcinoma, proximal cholangiocarcinoma (also known as Klatskin tumors), and metastatic disease involving pancreatic head and liver hilus. However, obstructive jaundice is often a manifestation of advanced disease, and curative surgery is often not possible. Consequently, palliative relief of common bile duct obstruction is an important part of patient management. Biliary stents can be placed not only to relieve obstructive jaundice for palliative treatment but also for preoperative biliary decompression. Endoscopic biliary stenting is now a well-established palliative treatment modality, and because of its lower risk and cost, this technique has almost completely replaced palliative surgery.[1,2] Plastic endoscopic biliary prostheses were first used to treat malignant obstruction in 1979.[3] Initially, 7F gauge plastic stents were used, but subsequently 10F stents were found to provide longer patency. Over the years, stents of different plastic materials, such as polyethylene, polyurethane, and polytetrafluoroethylene (Teflon), have been used. All plastic biliary stents clog within a few months after insertion (**Fig. 1**). In the late 1980s, uncovered (bare metal) self-expandable metal endoprostheses were introduced. The larger-diameter metal stents still occlude because of tumor ingrowth and/or overgrowth. Furthermore, these uncovered metal stents cannot be removed endoscopically. More recently, fully covered expandable metals stents have become available, which although not designed for removability, can often be endoscopically removed. In this review, the authors discuss the history of plastic biliary stent development and the current use of plastic stents for malignant biliary diseases.

HISTORY

The first endoscopic biliary stent was placed in 1979, an intervention that had been thought to be impossible. In those days, the instrumentation channel of the available

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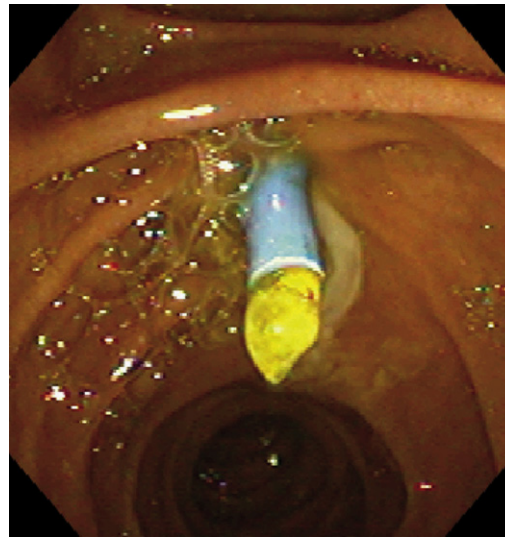

Fig. 1. Occluded 10F stent exiting the bile duct. (*From* Baron TH, Ponsky JL. Plastic pancreatic and biliary stents: concepts and insertion techniques. In: Baron TH, editor. ERCP. Elsevier; 2008. p. 153–63; with permission.)

duodenoscopes only allowed for the insertion of a 7F catheter.[3] The guidewires were at that time rather stiff and had a rough surface, which made stent placement technically difficult. The first endoprosthesis was cut off from an angiographic pigtail catheter. The high incidence of recurrent cholangitis in the first patients treated suggested that hindrance of bile flow in the stent caused occlusion, and the development of larger-diameter stents was deemed necessary. In 1981, Huibregtse and colleagues[4] from the Amsterdam group were the first to describe the insertion of a newly developed straight 10F endoprosthesis with side flaps on both ends, which was passed through a forward-viewing large-channel gastroscope. The significantly prolonged patency and improved outcomes using these larger-diameter stents prompted development of side-viewing endoscopes with a larger-diameter working channel to allow insertion of a 10F endoprosthesis. In April 1981, the first prototype duodenoscope with a 3.7-mm channel was tested. In 1982, the first series of 30 patients with distal malignant biliary obstruction who underwent endoscopic insertion of a 10F stent was published.[5] The technical success rate of endoscopic biliary stenting in distal and mid–common bile duct strictures improved and now exceeds 90% with low insertion-related complication rates. Over time, different stent diameters were tested, ranging from 7F to 12F.[6] Any further increase in stent diameter longer than 10F to 11.5F or even 12F increased the technical difficulty of stent placement without improving stent patency.[7–9] Therefore, a diameter of 10F is thought to be the best combination of patency and technically easy placement.

PLASTIC STENTS

When designing plastic stents, an endoprosthesis should ideally have all of the following characteristics: should be technically easy to insert, should effectively relieve biliary obstruction, should not occlude, and should not cause injury to the bile duct or duodenal wall. Several different materials, sizes, and shapes have been used to try