Viewpoint

Expert consensus on magnetic recanalization technique for biliary anastomotic strictures after liver transplantation

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Biliary anastomotic stricture (BAS) is a common complication after liver transplantation.

Endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangial drainage (PTCD) is the preferred treatment for BAS. However, these methods are helpless for completely occluded strictures. Magnetic recanalization technology (MRT), which is an application of magnetic compression anastomosis, is reported as a revolutionary way to treat BAS, and initially imply a satisfactory result for complicated cases (1-7). However, there are still no consensus reported. On the Third International Conference of Magnetic Surgery held in Xi'an, experts from various countries have discussed associated fields of MRT in treating BAS and achieved the following consensus.

Indications and contraindications of MRT

Indications

(I) Biliary anastomotic occlusion, such as bilo-biliary anastomosis and bilo-enteric anastomosis;
(II) Refractory stricture with multiple failures of ERCP or PTCD;
(III) Two biliary stricture stumps are close to the same axis.

Absolute contraindications

(I) The stricture length is >20 mm;
(II) A large amount of ascites or severe coagulation dysfunction, which do not allow an effective PTCD to be established;

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(III) Presence of contraindications for ERCP or unable establishment of two magnet delivery routes;
(IV) Vital organs failure;
(V) Complicated severe non-anastomotic biliary strictures are present.

Relative contraindications

(I) Bile duct dilation is not obvious due to repeated cholangitis, or there is an angle between the upper and lower ends of the strictures;
(II) A potential risk affected by the magnetic field, such as in cases with implanted cardiac pacemakers, is present;
(III) Evident biliary leakage is present.

Operative steps of MRT

Preoperative evaluation

Abdominal ultrasound can be used as a routine examination for screening biliary strictures or as a tool for PTCD. Magnetic resonance cholangiopancreatography (MRCP) is the first choice for diagnosing biliary stricture, but it is often not accurate enough for MRT; a simultaneous imaging of biliary tract through PTCD and ERCP can not only help understand the location of the narrow site, but also accurately assess their length and local condition (1,2).

Preoperative preparation

PTCD tract is used as a percutaneous delivery route. A larger PTCD catheter is gradually replaced the previous one to expand the diameter of the sinus tract. Generally, 10–16 Fr catheters are indwelled for 2 weeks to enhance the strength of the sinus tract.

Operative steps

Two methods are present depending on whether BAS is occluded: (I) when BAS is completely occluded, a cylindrical magnet without an axial central hole is used (*Figure 1A*). A sheath is inserted into the PTCD tract to protect around tissues. Then, the daughter magnet is advanced into the upper end of the stricture with a pusher (*Figure 1B*). After successful papillary cannulation, an endoscopic sphincterotomy (EST) is performed, followed by balloon dilatation. The parent magnet is connected to the tip of the endoscope with a long thread in the channel. The endoscope is again advanced up to the papilla, and the parent magnet was carefully inserted into the common bile duct with an pusher. For smaller one (<4.2 mm), the parent magnet can be directly inserted into the channel and then introduced into the common bile duct, even without papilla dilation (7). Under X-ray, the two magnets will attract each other once their positions are properly aligned (*Figure 1C*). (II) When the BAS is severely narrow, an cylindrical magnet with axial central hole is selected (*Figure 1D*). A guidewire is advanced through the slim stricture carefully and enter the duodenal cavity. The procedure is then switched to duodenoscopy; the guidewire in the duodenal cavity is grasped and led out of the body through the working channel; then EST and papilla dilation is done. The daughter and parent magnets are put over the two ends of guidewire (*Figure 1E*), and under X-ray monitoring, the magnets are pushed simultaneously to the stricture site to complete the mutual coupling (*Figure 1F*).

Postoperative management

An abdominal X-ray film is obtained on the first day after the operation and every 3–4 days thereafter. When the amount of drainaged bile is significantly reduced or the stool color turns yellow, cholangiography is required to confirm recanalization. If the biliary tract continuity is confirmed, multiple plastic stents or a fully covered metallic stent should be placed across the stricture for more than 6 months (1,2,5-7).

Precautions for MRT

The technical difficulty mainly involves advancing the parent magnet through the duodenal papilla. EST, cylindrical balloon expansion, or a temporary fully covered metallic stent can be used for papilla expansion. Magnetic force, stricture length, and tissue features are the main factors for success. In the early stage after magnet coupling, sequential X-rays are essential to confirm the distance changes between magnets. If separation occurs, another magnet can be added for either magnet to increase power (1). Before magnets removal, patients should avoid strong magnetic field area, so as to prevent the magnets from shifting or falling off.

Prevention and treatment of complications of MRT

The complications of MRT may include cholangitis,

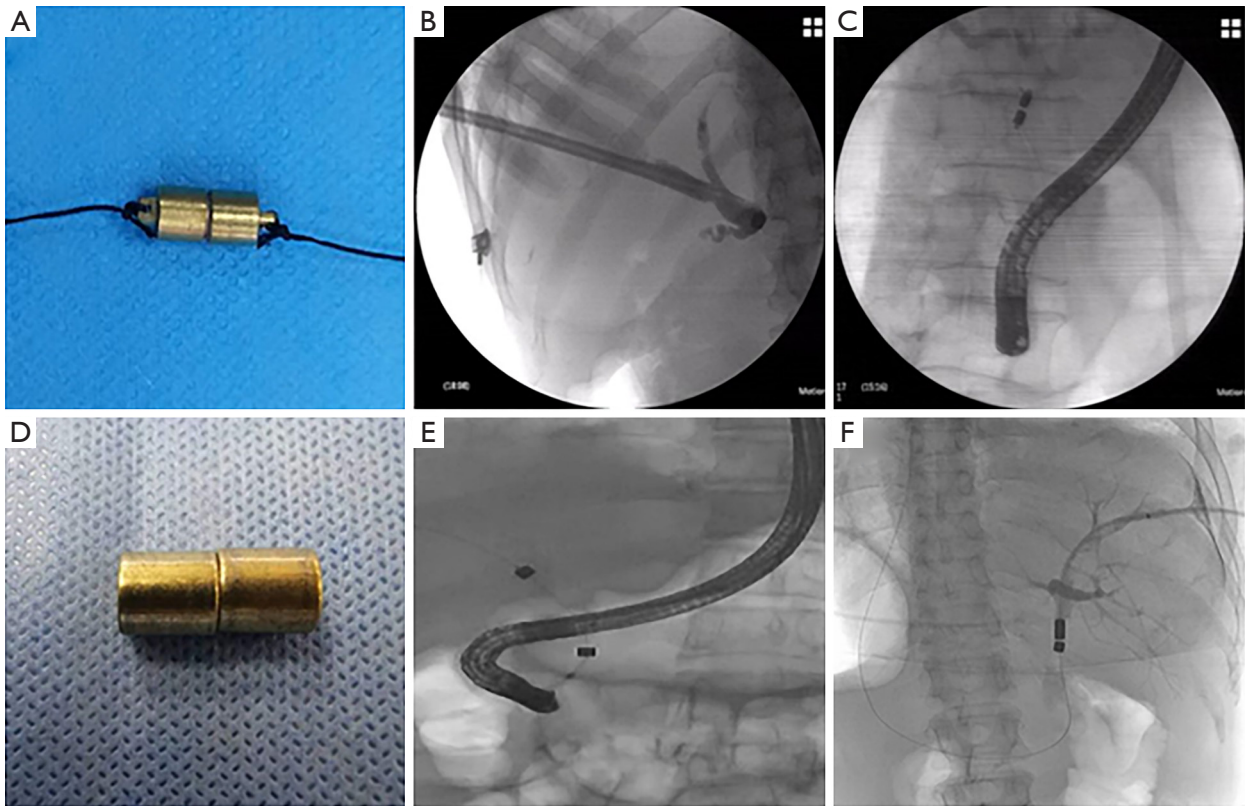

Figure 1 The magnets and methods used in MRT. (A) Cylindrical magnets with a tail at one end connected with a silk thread; (B) the daughter magnet was pushed to the superior end of stricture through the PTCD tract; (C) the parent magnet was advanced to the inferior end of stricture through papilla, and two magnet coupled with each other; (D) cylindrical magnets with an axial central hole; (E) a guide wire was inserted through the slim stricture, and two magnets were advanced to each other over the guide wire; (F) two magnet coupled with each other.

biliary leakage, bleeding and stricture recurrence. Sterile procedures in operation and proper drainage of the biliary tract post-operation are the keys to prevent cholangitis. Bile bacterial culture is useful for selection of antibiotics. Biliary tract bleeding may occur when the PTCD sinus tract is dilated or the stenosis is compressed and recanalized. The PTCD procedure should avoid injury of major hepatic blood vessels and tract dilation needs to wait for the sinus healing. Advancement of the parent magnet through the duodenal papilla is critical. It is recommended to use small magnets in combination with EST and papilla dilation. When advancing parent magnet to the narrow site, it should be gentle to reduce damage to the biliary tract. The compression of stricture tissue by magnets is a relatively slow process. The blood vessels between tissues are gradually closed, and the probability of bleeding is extremely low (1).

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Footnote

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