Magnetic compression anastomosis is useful in biliary anastomotic strictures after living donor liver transplantation

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This certifies that the Master's Thesis of Sung Ill Jang is approved.

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Despite limitations, magnetic compression anastomosis is less invasive and technically less complicated than alternative

procedures. I hope that this safe and feasible procedure will to be a blessing to the patient because it greatly improves their quality of life.

Dr. Sung Ill Jang

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ABSTRACT

Magnetic compression anastomosis is useful in biliary anastomotic strictures after living donor liver transplantation

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Background: An anastomotic biliary stricture is a complication of living donor liver transplantation (LDLT) performed using duct-to-duct anastomosis. Despite advances in treating this complication, there is no one established treatment protocol.

Objective: To investigate the safety, effectiveness, and mid-term outcome of magnetic compression anastomosis (MCA) for treating biliary obstruction after LDLT when the obstruction cannot be resolved by using percutaneous or peroral methods.

Design: Retrospective, observational study with standardized treatment and follow-up.

Setting: Tertiary-care academic medical center.

Patients: Twelve patients underwent MCA procedures to treat anastomosis site stricture after LDLT.

Interventions: MCA.

Main Outcome Measurements: Bile duct patency, technique performance, and complications were evaluated.

Results: We achieved magnet approximation at the anastomotic stricture in 10 of 12 patients (83.3%). The magnets failed to approximate in 2 patients. We achieved recanalization of the stricture site in 10 of 10 patients.

We removed an internal catheter in 9 patients. The mean interval from magnet approximation to removal was 74.2 days (range 14-181 days). The mean time from recanalization to removal of the internal catheter was 183 days (range 51-266 days). Patients were examined regularly after removing the internal catheter with a mean follow-up period of 331 days (range 148-581 days). The observed MCA-related complications consisted of 1 case of mild cholangitis and 1 recurrence of the anastomotic stricture.

Limitations: Nonrandomized study design.

Conclusions: MCA safely and effectively resolved post-LDLT biliary duct-to-duct anastomotic strictures that could not be resolved using conventional methods, such as ERCP and percutaneous transhepatic biliary drainage. (Gastrointest Endosc 2011;74:1040-8.)

Key word: magnetic compressive anastomosis, biliary stricture, living donor liver transplantation, jaundice, recanalization

Abbreviations: CBD, common bile duct; LDLT, living donor liver transplantation;MCA, magnetic compression anastomosis; MRI, magnetic resonance imaging; PTBD, percutaneous transhepatic biliary drainage;SEMS, self-expandable metal stent.

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I. INTRODUCTION

Despite continual refinement of surgical techniques, potentially fatal complications commonly develop in the biliary system after liver transplantation. Anastomotic stricture occurs in 8.3% to 31.7% of patients who undergo duct-to-duct living donor liver transplantation (LDLT).[1-3] A stricture at a duct-to-duct anastomosis occurs because hypertrophic changes[4] and ischemic injury,[5] caused by extensive stripping of the blood vessels of the bile duct during surgery at the received liver, promote stricture development,6 and the development of acute angulation and torsion between the bile ducts of the recipient and donor makes it more difficult to manage.[7] Although a stricture of the bile duct anastomosis is the most common surgical complication in LDLT, no standardized treatment protocol for it has yet been established.[8-12]

In the early history of LDLT, most bile duct complications were treated surgically. However, surgical treatment leads to high morbidity and mortality and may not be advisable for patients with serious complications, such as bile duct inflammation.[13] When the physician uses an interventional radiology technique after percutaneous transhepatic biliary drainage (PTBD), bile ducts occluded by stenosis may be recanalized with a guidewire and balloon dilator.[12] Balloon dilation or the placement of plastic or metal stents, guided by ERCP, may also give favorable results.[6] Overall, anastomotic stenosis and obstruction after choledochocholedochostomy are treated more effectively using nonsurgical methods.[1,10,14-16] Unfortunately, balloon dilation or stent insertion cannot be performed if the guidewire does not pass through the duct-to-duct anastomotic obstruction either percutaneously or endoscopically because of complete obstruction, severe stenosis, or deviation of the duct. Our group reported that 2 of 60 patients could not be treated using PTBD or endoscopic therapy.[12] An external PTBD catheter must then be maintained to support the patient's life, and this places a burden on both the treating physician and patient.

In 1998, Yamanouchi et al.[17] introduced magnetic compression anastomosis (MCA), which is now an accepted nonsurgical technique for reconstructing anastomotic sites in the digestive system.[13,16,18-24] Recent case reports have described the use of MCA,[16-22,24,25] but the long-term results using MCA in LDLT are unknown. In this study, we examined the use of magnetic compression for anastomotic reconstruction after LDLT in patients for whom conventional methods were unsuccessful. We explored the indications for and the stability, technical aspects, and limitations of MCA. We found several ways in which the treatment could be improved.

II. MATERIALS AND METHODS

1. PATIENTS AND METHODS

A. Patients

From November 2008 to November 2010, we received 15 referrals from 3 university hospitals in Korea for the management of post-LDLT biliary strictures. Conventional endoscopic and percutaneous methods had failed to recanalize the strictures in all 15 patients, and ERCP and PTBD also failed when we repeated them at our hospital. Of the 15 patients, 3 were excluded from this analysis because they had been under regular follow-up, awaiting recanalization. The characteristics of the remaining 12 patients are shown in Table 1. All subjects underwent LDLT with duct to-duct anastomosis. The data after MCA were evaluated retrospectively. The Institutional Review Board at Gangnam Severance Hospital approved this study. All participants gave written informed consent (IRB No. 3-2010-0188).

B. Methods

(A) Magnet preparation

Initially, we used a cylindrical samarium-cobalt (Sm- Co) rare-earth magnet of

3700 Gauss (diameter 5 mm, width 10 mm) that had a side hole connected to a silk thread attached with silicon (Fig. 1A). During the procedure, the silk and magnet would separate, and the magnet was difficult to manipulate because of uncontrolled movement. Subsequently, we developed and used a rare-earth magnet of our own design (M.I. Tech, Pyeongtaek, Korea) (Fig. 1B). A hole was drilled opposite the alignment side of the magnet, and the silk was connected by forming a hook through the hole. The silk thread was fixed firmly to the magnet with strong adhesives. We also produced a smaller (diameter 4 mm) magnet with 50% greater magnetic power than the first. The types of magnets were as follows: (1) type 1 magnet is 5 mm in diameter with a side hole, (2) type 2 magnet is 5 mm in diameter with a hole drilled in the side opposite the alignment side, and (3) type 3 magnet is 4 mm in diameter with a hole drilled in the side opposite the alignment side. The type 3 magnet is more powerful than the other 2 types.

(B) Formation of a transhepatic route

In patients with a previously inserted PTBD catheter, dilation was continued. In patients with a percutaneous tract unsuitable for MCA, the PTBD catheter was reinserted by targeting the posteroinferior or posterosuperior segmental duct of the transplanted liver with a 21-gauge puncture needle under the guidance of US or fluoroscopy. After obtaining a cholangiogram, a guidewire

(Terumo) was passed through the bile duct and a drainage catheter (8.5F) with multiple side holes (Cook Medical, Bloomington, Ind) was placed. The catheter was exchanged every 4 days to enlarge the canal to 18F. Antibiotics (1 g cefoperazone-sulbactam intravenously or 200 mg ciprofloxacin intravenously for patients with allergies) were administered routinely before and after each procedure.

(C) Magnet compressive anastomosis

After an overnight fast for the patient, ERCP wasperformed on all of the patients using a video duode- noscope (JF240 or TJF240; Olympus Optical, Tokyo, Japan). The duodenoscope was passed into the descending duodenum, and a mid-endoscopic sphincterotomy was performed. In the first 2 patients, large balloon dilation was performed to move the magnet from the distal common bile duct (CBD) toward the obstructed anastomosis site via the ERCP. The ability to use a large balloon to deliver the magnet without CBD dilation was restricted, so a covered, retrievable selfexpandable metal stent (SEMS) (ComVi stent, Taewooing Medical, Kimpo, Korea or HANAROSENT stent; M.I. Tech) was inserted into the CBD after an endoscopic sphincterotomy (Fig. 2). Stent expansion was checked 1 to 2 days later to confirm that the CBD was wide enough for the magnet to pass through. After 1 to 2 days, an overtube with a diameter of 15 mm was inserted to ease passage of an endoscope with the magnet grasped at the tip through the esophagus without injury. The silk attached to the magnet was then seized with a polypectomy snare (Fig. 1C). The tip of the snare was wrapped with paper tape to minimize the interaction between the wire of the snare and the magnet. Because the magnet could not be inserted in a biopsy channel, the silk was pulled back tightly so that the attached magnet was held next to the tip of the endoscope for easier insertion in the duodenum (Fig. 1D). When the endoscope reached the ampulla, the magnet was inserted carefully in the covered SEMS placed in the CBD from where it was pushed up to the vicinity of the anastomosis. After the PTBD catheter was replaced with a sheath (18F), another magnet was grasped with alligator forceps and moved toward the obstructed anastomosis site through the 18F sheath. As one magnet approached within 2.5 to 4 cm of the other, they attracted magnetically and compressed the fibrotic anastomotic tissue. For better approximation of the magnets, a balloon catheter could be used to advance the magnets through both the PTBD and ERCP tracts. When the two magnets were approximated, the SEMS was removed through the ERCP using a snare. Approximation of the two magnets was confirmed radiographically. Even if the two magnets were not approximated completely, if the distance between the two magnets was less than 2.5 cm and the magnetic power was ensured, the approximation was confirmed with a follow-up abdominal X-ray the next day. The SEMS that was inserted for delivery of the magnet was removed after confirming approximation of the magnets. Next, the long sheath tube was removed and an indwelling PTBD tube was inserted. Even if the two magnets did not attach immediately, a delay of 1 to 2 days was acceptable if the magnets, although separate, were properly aligned, and the two magnets did not fall apart when released from the snare or alligator forceps. A simple abdominal film was obtained 2 weeks after magnet approximation to confirm that the magnets had passed into the CBD. Simple abdominal films were obtained every 2 weeks thereafter for 6 to 8 weeks. Ideally, if a new tract had formed, the magnets would pass naturally through the body. However, should this not occur within 10 weeks, whether or not a guidewire was able to pass through the magnet, we intervened through the PTBD tract with a balloon to push the magnets out. If this did not succeed, the previously described procedures were repeated every 4 weeks thereafter. Once the approximated magnets had passed the anastomosis site, an internal drainage catheter was passed through the recanalized anastomosis site, and was left in place for 6 months, although the catheter was exchanged every 2 months. After 6 months, the internal drainage catheter was removed during cholangiography or percutaneous transhepatic cholangioscopy.

2. Patient follow-up

After successful approximation of the magnets, the patients were monitored for complications, including clinical symptoms, abnormal laboratory findings, and signs of cholangitis. A simple abdominal film was also obtained monthly to evaluate internal catheter migration. After removing the internal catheter, we also evaluated the clinical symptoms and laboratory studies, including liver function tests (total bilirubin, aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase). Abdominal CT or US was performed if liver function declined or restenosis was suspected.

3. Statistics

The data were expressed as the median and range or the mean and standard deviation.

III. RESULTS

1. Patient and stenosis characteristics

The mean age of the patients was 53.8 ± 8.7 years (range 33-63 years), and 9 patients were males. The LDLTs were performed for hepatocellular carcinoma (7 patients) and end-stage liver disease (5 patients) caused primarily by viral hepatitis (4 patients) and drug induced hepatitis (1 patient). The diagnosis of anastomotic stricture was confirmed by ERCP in 12 patients, and the time between LDLT and stricture was 23.3 ± 33.2 months.

2. MCA success

Magnet approximation at the anastomotic stricture was achieved in 10 of the

12 patients (83.3%) and failed in 2. One patient (patient 7) underwent LDLT 9 years (about 107 months) before a stricture developed relatively distant from the anastomosis site (about 30 mm; Fig. 3A). The patient did not want to be treated surgically, so she still has an external PTBD catheter. The other patient (patient 12) had diffuse narrowing to less than 4 mm, and torsion of the CBD (Fig. 3B). A hard guidewire was passed blindly from the PTBD track to the CBD under fluoroscopy guidance and recanalization was successful. In all patients with incomplete approximation of the magnets during the procedure, the magnets were approximated fully the next day (Fig. 4).

3. Follow-up

We achieved recanalization at the stricture site in 10 of 10 patients. The mean interval from approximation of the magnets to removal was 74.2 days (range 14-181 days). In 2 patients (patients 10 and 11), the magnets could not be removed within 3 months because of dense fibrotic tissue between the 2 magnets. We achieved complete removal of an internal catheter in 9 patients (Fig. 5). The mean time from recanalization to removal of the internal catheter was 183 days (range 51-266 days). The patients were examined regularly after removing the internal catheter, with a mean follow-up period of 331 days (range 148-581 days) (Table 2). There was an acceptable procedure-related complication in 1 patient (Table 3) and no procedure-related mortality. In 1 patient (patient 2), mild cholangitis developed after dilation with a large balloon.

The cholangitis resolved in 3 days with conservative care. An anastomosis site stricture after MCA recurred in 1 patient. In this patient, the stricture was confirmed with a cholangiogram. The interval from recanalization to recurrence was 99 days. However, a guidewire was passed through a PTBD tract easily under cholangiography, and an internal drainage catheter was then inserted. The catheter was removed after 4 months, and no further stricture has developed during follow-up. One patient in whom recanalization succeeded died of transplant rejection during follow-up. During the study period, no patient required reconstructive surgery for stricture recurrence after removal of the internal catheter.

IV. DISCUSSION

We found that MCA was a safe, effective therapy in patients with anastomotic biliary strictures after LDLT. Few complications followed MCA, and none were fatal. MCA is well tolerated and can be performed in patients who are older or are poor candidates for surgery because it is less invasive than surgery.[19,26] This retrospective clinical study included the largest number of patients yet reported to undergo MCA after LDLT. Avaliani et al.[13] reported that MCA of a biliaryenteric anastomosis is feasible as palliative treatment for obstructive jaundice caused by malignancy. Although temporary occlusions occurred in 2 patients, these were resolved endoscopically. The median survival time was 10 months, and no restenosis was reported. However, these data may be inadequate for evaluating the long term results because the study concluded too early to evaluate confounding by death from the malignancy.

Several technical developments in MCA were used in our study. Large-balloon dilation was used to deliver the parent magnet in 2 of the earliest patients, whereas an SEMS was used for the subsequent patients because the balloon could cause bile duct complications and might not succeed in patients with a maximum bile duct diameter less than 10 mm. In patients with a narrow ampulla and distal CBD, insertion of the magnet through the ampullary orifice after endoscopic sphincterotomy, and balloon dilation may constitute a forceful manipulation that can injure both the ampulla and distal CBD. Akita et al.[23] found that a covered metallic wall stent could facilitate delivery of the parent magnet through the CBD via the ampulla of Vater. In fact, we could deliver the magnet through an SEMS more easily and effectively than with a large balloon. The stent was removed immediately after approximation of the parent and daughter magnets to avoid granulation tissue formation around the stent and adhesion between the stent and CBD. Of the 10 patients in whom a stent was inserted, none experienced an associated complication, such as bleeding during extraction or perforation. Thus, we strongly recommend using a covered, retrievable SEMS to deliver the magnet.

We used an overtube when the endoscope with the magnet was inserted. The overtube was useful when passing the magnet through the upper esophagus with an ERCP endoscope because it prevented the magnet from injuring the esophagus and helped to keep the magnet stable on the ERCP endoscope so that we could approach the CBD via the stomach with the magnet held in the initial position. Our newly designed magnet was 50% stronger with a smaller diameter than the magnet used previously, enabling MCA in patients with a narrow CBD lumen or with significant separation between the anastomosis and stricture site. Our new method of fixing a silk thread to the magnet also aided the approximation and endoscopic handling with forceps. Because the magnet could not be inserted in a biopsy channel, the silk was pulled back tightly so that the attached magnet was held next to the tip of the endoscope for easier insertion into the duodenum. From this perspective, a 4-mm magnet was more useful than a 5-mm magnet (Fig. 1D). However, further modifications of the magnet may be needed to perform MCA in difficult situations. The magnet approximation failed in 2 patients. One of these (patient 7 in Table 1) had undergone LDLT 107 months previously, and the stricture was about 30 mm long. We suspect that this separation attenuated the magnetic strength and that fibrosis in the stricture had progressed since the LDLT. Another patient (patient 12 in Table 1) had a narrow, tortuous CBD through which the newly designed magnet would not pass. Although it is difficult to determine whether hypertrophic changes actually cause or how much they are contributing to the development of a stricture, a significant association is suggested in that unlike cadaveric transplantation, LDLT has an anastomosis site in a high level and that in many cases, the stricture is tortuous and long. We found that the length of the stricture, time since the LDLT, architecture of the CBD, and strength of the magnet presented technical limitations for MCA. It was difficult to evaluate the maximum distance to an anastomosis site that was feasible to access with the magnets and to quantify accurately the magnet strength required for MCA. These uncertainties must be resolved through further studies on the optimal use of MCA. In this study, only 1 patient had undergone magnetic resonance imaging (MRI) because it was difficult to predict success or failure of magnet approximation by evaluation of stricture length and ductal shape with MRI. As reported in the previous study,12 the only factor that could predict the possibility of guidewire passage before the procedure was the pouched type anastomosis stricture. However, it is necessary to investigate the role of noninvasive methods such as MRI as a means of predicting the possibility of magnet approximation.

Recanalization could take as long as 2 months after approximating the magnets. However, if the magnets did not pass spontaneously, to achieve recanalization, interventions with a guidewire and balloon through a percutaneous tract were used to push the magnets out. Because spontaneous passage of the approximated magnets occurred occasionally, these procedures could be repeated every month if necessary. Generally, the magnets could be removed within 3 months, although it might take longer than 3 months if the fibrotic tissue between the 2 magnets was dense. In our series, successful magnet approximation always ensured recanalization of the anastomosis site. However, the recanalization could take more than 3 months if the connective tissue between 2 magnets was dense. After removing the magnets, an indwelling 16F catheter was inserted for 4 months to prevent restenosis of the new tract. In the initial trial of MCA, bleeding was a concern in patients in whom there were large vessels between the magnets; however, no such problem occurred. In 1 patient, mild pancreatitis developed after insertion of a fully covered SEMS, and this resolved immediately after removing the SEMS, although this patient was not included in this study because the patient is still being followed, awaiting recanalization. Restenosis of the CBD occurred in 1 patient, but recanalization was performed using a guidewire. Before MCA, this guidewire might not have been passed. By creating a new fistula tract instead of dilating a previous stricture, MCA can resolve restenosis. Thus, we expect to see a lower rate of stricture recurrence after MCA than with the conventional method.

The limitations of our study were that it included a small number of patients and lacked long-term data after removing the internal catheter. Nevertheless, our findings support the use of MCA after LDLT as a feasible, effective method for treating a biliary anastomotic stricture that cannot be canalized using conventional means. Despite the limitations, MCA is less invasive and technically less complex than alternative procedures. Because a new route is formed as a result of the ischemia of fibrotic tissue caused by the pressure between the magnets, MCA can be successful in cases with angulated stenosis, which is a strength of this procedure. However, further large studies with long-term follow-up are required to validate the safety and effectiveness of MCA. We believe that this procedure improves patient quality of life because patients do not need to have an external PTBD catheter, and the risk of biliary complications, including infection, is low.

V. CONCLUSION

Magnet compressive anastomosis (MCA) can be used to canalize biliary anastomotic stricture after living donor living transplantation (LDLT) when conventional methods cannot be used. MCA can avoid a lifelong external drainage bag and risk of reoperation for anastomotic stricture after LDLT.

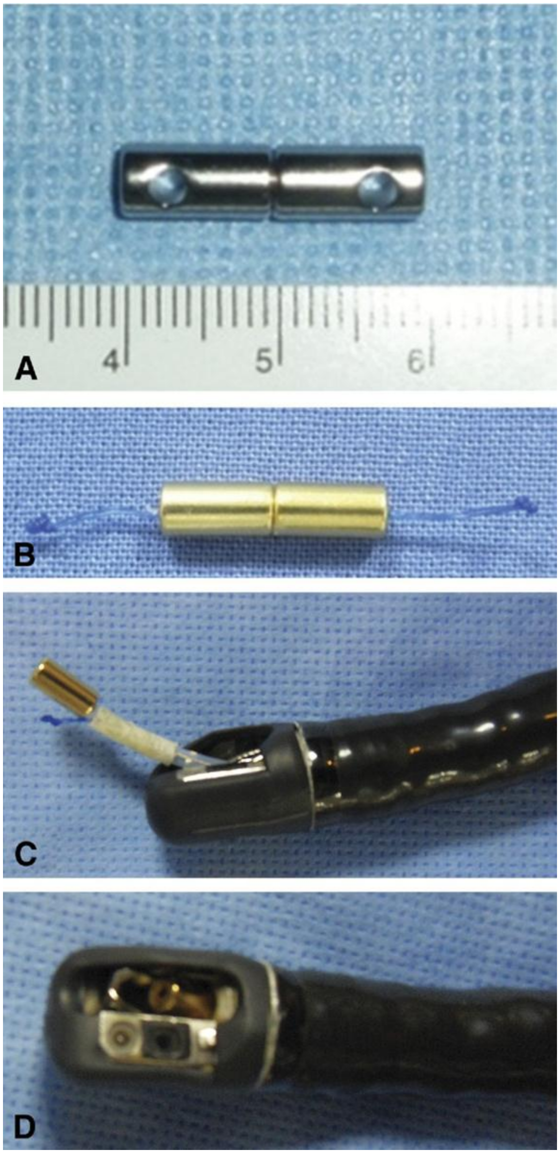

Figure 1. The magnets used in this study. **A,** The magnet used originally had a side hole. **B,** In the new magnet, a hole was drilled in the side opposite the alignment side. A silk thread was passed through the hole and attached with strong adhesives. This magnet was smaller but stronger than the first. **C,** The magnet was grasped with a polypectomy snare. **D,**

The magnet positioned at the tip of the endoscope.

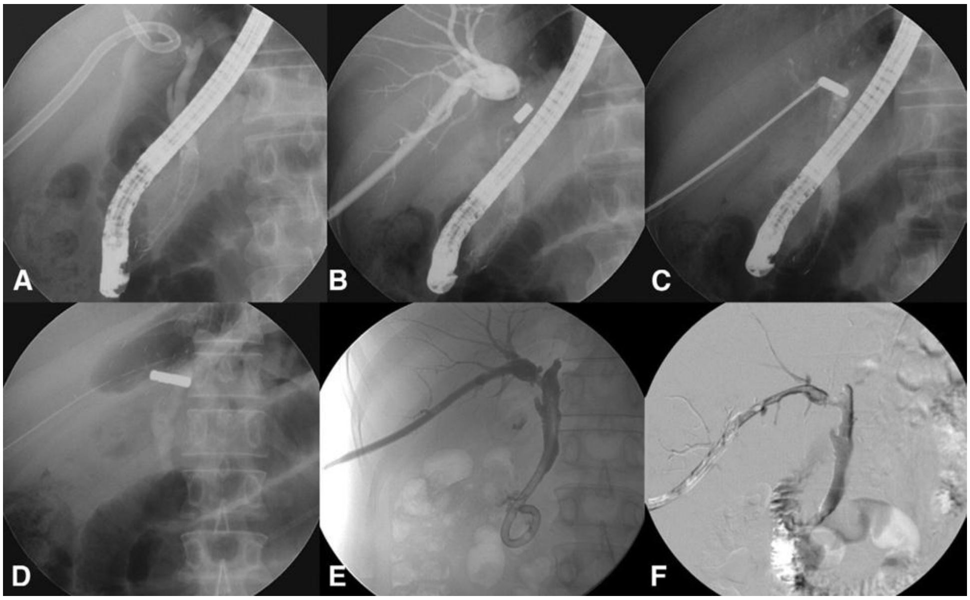

Figure 2. Cholangiogram showing the process of magnetic compression anastomosis formation. **A,** After a percutaneous transhepatic biliary drainage catheter was inserted, and the tract was dilated to 18F, a covered self-expandable metal stent was inserted into the common bile duct. **B,** A magnet combined with a polypectomy snare was delivered via ERCP through the CBD. **C,** Another magnet was fixed to alligator forceps and moved toward the anastomosis site through the percutaneous tract. **D,** The magnets were approximated, and the PTBD catheter was inserted. **E,** After the approximated magnets passed through the CBD, an internal drainage catheter was inserted for 6 months. **F,** After 6 months, the catheter was removed.

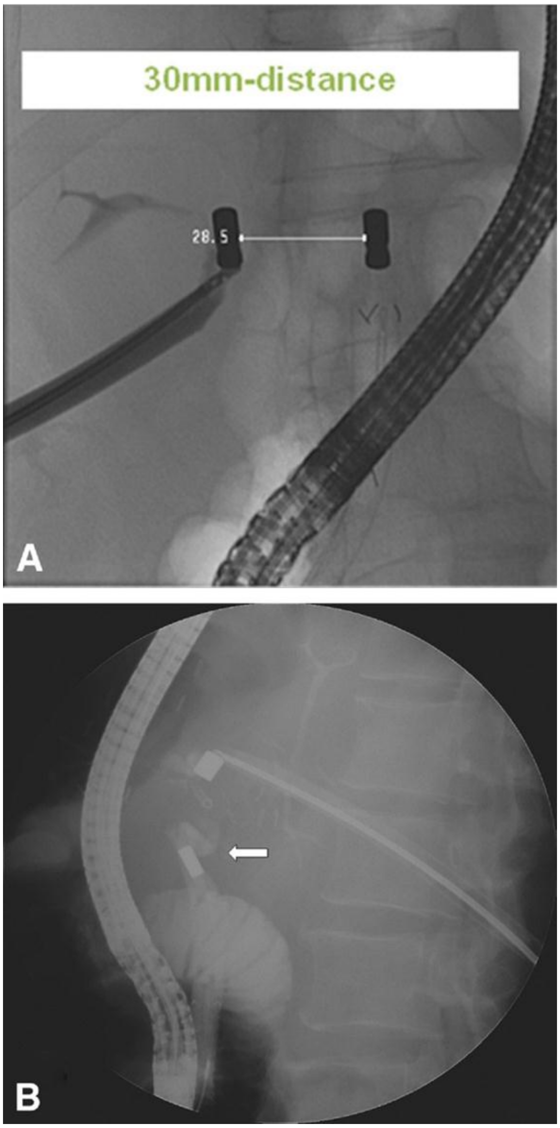

Figure 3. Cholangiogram showing failure of magnet approximation. **A,** Across the length of the stricture (about 30 mm), the magnetic attraction was weak, and the magnets would not come together. **B,** The magnet could not be delivered to the stricture because the distal common bile duct was tortuous and angulated like the letter W (*white*

arrow).

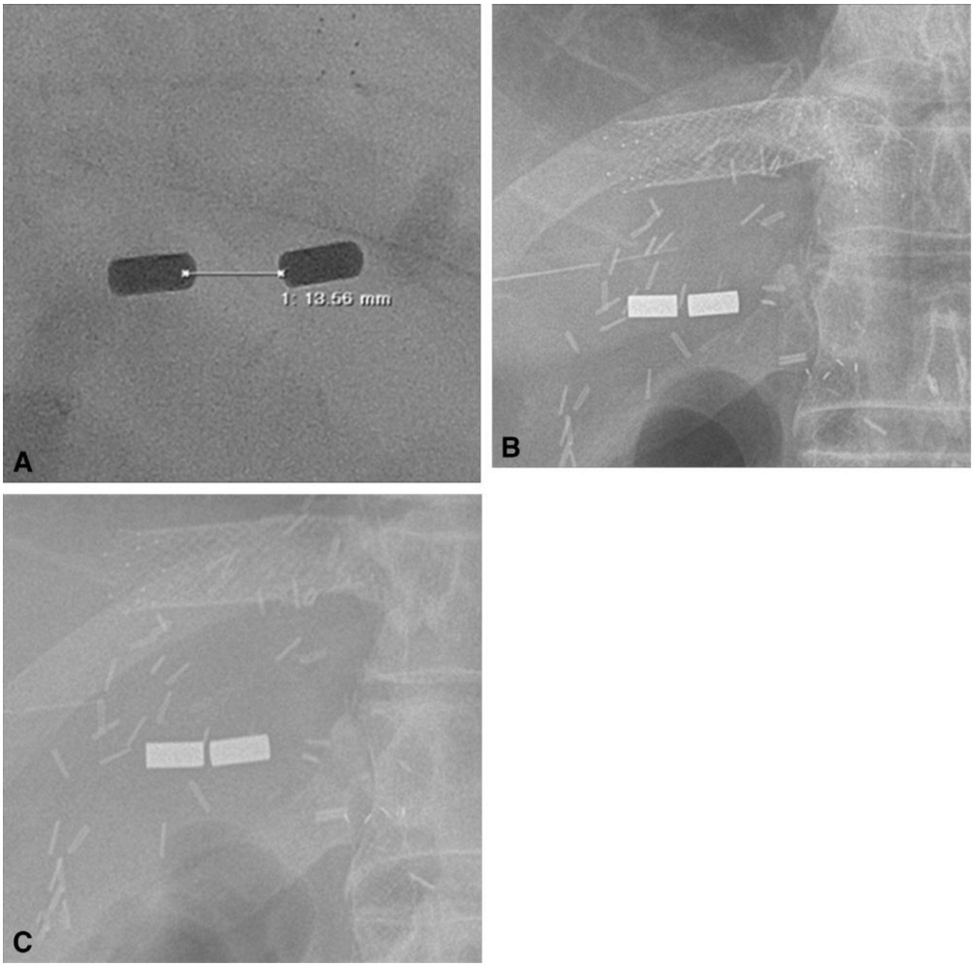

Figure 4. Successful approximation of magnets that were incompletely approximated during the procedure. **A,** Cholangiogram shows incomplete approximation of the magnets, which are 1.5 cm apart. **B,** Abdominal radiograph showing the shortened distance between the magnets just 1 hour after the procedure. **C,** Abdominal radiograph showing complete approximation of the magnets after 1 day.

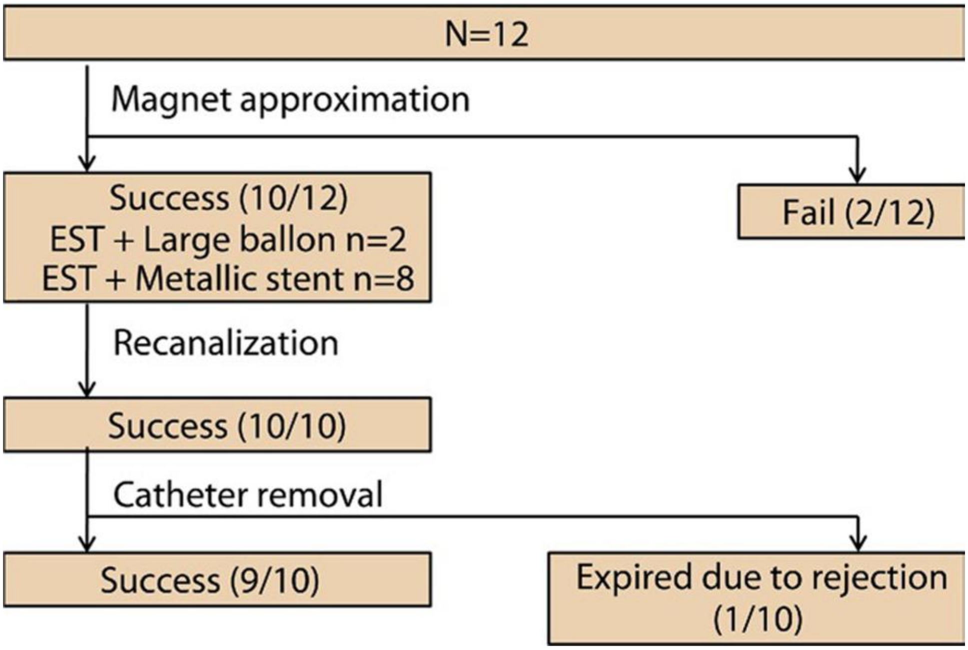

Figure 5. Magnet compressive anastomosis flow diagram. The mean follow-up period after removal of internal catheter was 331 days (range 148-581 days). Magnet approximation occurred in 10 of 12 patients (83.3%). Recanalization occurred in 10 of 10 patients (100%); mean duration was 74.2 days (range 14-181 days). The catheter was removed in 9 of 10 (90%); the mean duration was 183 days (range 51-266 days).

Table 1. Patient characteristics, indications for LDLT, postoperative duration, magnet approximation, type of magnet, and ERCP method in 12 patients with anastomotic stricture after LDLT

Patient no.	Sex/ Age	Indication for LDLT	Post-op duration (months)	Magnet approximation	Type of magnet	Trans-papillary route
1	F/63	LC, HCC (HBV)	71	success	Type 1*	Large balloon
2	M/49	LC, HCC (HBV)	6	success	Type 1	Large balloon
3	M/54	LC, HCC (HBV)	55	success	Type 2†	SEMS
4	F/64	LC, HCC (HBV)	71	success	Type 2	SEMS
5	M/54	LC (HBV)	15	success	Type 2	SEMS
6	M/48	LC, HCC (HBV)	13	success	Type 2	SEMS
7	F/63	HF (drug-induced)	107	fail	Type 2	SEMS
8	M/33	HF (HAV)	5	success	Type 2	SEMS
9	M/61	LC, HCC (HBV)	4	success	Type 2	SEMS
10	M/54	LC, HCC (HBV)	9	success	Type 2	SEMS
11	M/52	LC (HBV)	1	success	Type 2	SEMS
12	M/51	LC (HBV)	5	fail	Type 2, type 3‡	SEMS

LC, liver cirrhosis; HCC, hepatocellular carcinoma; HF, hepatic failure; HAV, hepatitis A; HBV, hepatitis B; LDLT, living donor liver transplantation; SEMS, self-expandable metal stent

*Type 1: a magnet has 5mm sized diameter and side hole

†Type 2: a magnet has 5mm sized diameter and a hole is drilled on the side opposite to the alignment side

‡Type 3: a magnet has 4mm sized diameter and a hole is drilled on the side opposite to the alignment side, which has more magnetic power than previous magnets

Table 2. Method of magnet removal, days required for recanalization, duration of internal catheter placement, follow-up duration after removing the internal catheter, and outcome in 12 patients with anastomotic strictures after LDLT

Patient no.	**Method for removal of magnets**	**Days for recanalization**	**Duration of maintaining internal catheter (days)**	**Follow-up duration after removal of internal catheter (days)**	**Outcome**
1	Method 2†	42	193	581	No restenosis
2	Method 1*	26	199	491	No restenosis
3	Method 1	18	266	343	No restenosis
4	Method 2	71	206	99	Restenosis after MCA
5	Method 2	102	187	284	No restenosis
6	Method 2	102	180	264	No restenosis
7	-	-	-	-	Maintaining external PTBD
8	Method 2	33	187	312	No restenosis
9	Method 1	14	178	208	No restenosis
10	Method 2	181	51	148	No restenosis
11	Method 2	153	indwelled	-	Expired due to transplant rejection
12	-	-	-	-	Recanalization by blind puncture

MCA, magnet compression anastomosis
*Method 1: spontaneous passing of magnets through common bile duct
†Method 2: pushing approximated magnets with balloon after passing of guide wire through anastomosis site

Table 3 Complications after magnet compressive anastomosis

Complication	**Patients (n)**
Pancreatitis	0
Cholangitis*	1
Recurrence of anastomosis site stricture†	1
Mortality	0

CBD, common bile duct;
*resolution after conservative care
†anastomosis site stricture was evaluated with magnetic resonance cholangiopancreatography or computerized tomography.

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ABSTRACT(IN KOREAN)

자석 압박 문합술은 생체 간 이식 후 발생한
담도 협착에서의 유용성

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배경: 문합부 담도 협착은 담도-담도 문합술을 이용하는 생체 간이식에서 나타나는 합병증이다. 이러한 합병증의 치료에 많은 발전이 있음에도 아직 정립된 치료법이 없다.

목적: 본 연구는 생체 간 이식 후 발생한 담도 협착에서 내시경적으로나 경피경간적인 치료에 효과가 없는 환자에서 자석 압박 문합술의 안정성과 유용성, 그리고 예후를 알아보고자 한다.

연구모델: 치료 후의 결과에 대한 후향적, 관찰 연구

연구 장소: 단일 3차 대학 병원

대상 환자: 생체 간 이식 후 담도협착으로 자석 압박 문합술을 시행 받은 12명의 환자를 대상으로 함

시술명: 자석 압박 문합술

주된 결과물: 담도 개통율, 기술적 수행율, 합병증을 평가함

결과: 총 12명의 환자 중에서 10명에서 자석 근접술을 성공하고 (83.3%). 2명에서 자석 근접술이 실패하였다. 자석 근접술이 성공한 10명에서 협착의 재관통을 성공하였다. 재관통을 성공한 환자 중 9명에서 내부 카테터를 제거하였다. 자석 근접술이 성공하고 자석을 제거하는데 평균 74.2일(범위 14-181일)소요되었다. 재관통이 성공하고 내부 카테터를 제거하는데 평균 183일 (범위 51-266일)이 소요되었다. 내부 카테터를 제거하고 환자들은 평균 331일 (범위 148-581일) 동안 추적 관찰 하였다. 자석 압박 문합술에 관련된 합병증은 1명에서 경한 담도염과 1명에서 문합부 협착이 발생하였다.

연구의 한계점: 비 확률 표본의 연구

결론: 자석 압박 문합술은 담도-담도 문합술로 생체간이식을 시행 후 발생한 담도 협착에서 내시경적 역행성 췌담도 내시경이나 경피적 담도 배액관을 통한 치료로 해결되지 않는 경우에 안정적이고 효과적으로 해결할 수 있는 방법이다.

(Gastrointest Endosc 2011;74:1040-8.)

핵심되는 말 : 자석 압박 문합술, 담도 협착, 생체 간 이식, 황달, 재개통

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