

Percutaneous Patency Recovery and Biodegradable Stent Placement in a Totally Occluded Hepaticojejunostomy After Paediatric Living Donor Liver Transplantation

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Abstract Biliary complications after living donor liver transplantation (LDLT) cause severe morbidity and mortality, with biliary anastomotic stricture being the most common form of presentation. Surgical revision is risky, and it is avoided whenever possible. When a Roux-en-Y hepaticojejunostomy (RYHJ) is used for bilioenteric reconstruction, endoscopic approach is more difficult, if not impracticable. Therefore, percutaneous approach remains as a first-line treatment in these patients. In this case presentation, a percutaneous approach was used to recover patency in an intractable, totally occluded RYHJ stricture in an LDLT paediatric recipient, using a Rösch-Uchida needle to access to the collapsed jejunal loop from the bile duct. Once recanalization of the RYHJ was achieved, a biodegradable stent was placed with middle-term patency at follow-up.

Keywords Hepaticojejunostomy stricture · Biodegradable stents · Biliary stents · Interventional radiology

Introduction

Biliary complications after living donor liver transplantation (LDLT) may cause severe morbidity and mortality, occurring in up to 40% of recipients [1]. Biliary anastomotic stricture is the most common form of presentation. In cases of duct-to-duct biliary reconstruction, endoscopic retrograde cholangiography (ERCP) is considered the preferred treatment [2]. However, endoscopic approach may not be feasible when Roux-en-Y hepaticojejunostomy (RYHJ) is present. In the case reported here, a percutaneous approach was used to recover patency in a totally occluded hepaticojejunostomy stricture in an LDLT paediatric recipient. Once recanalization of RYHJ was achieved, a biodegradable stent was placed.

Case Report

A 6-year-old girl, with RYHJ stricture following LDLT, was referred to our minimally invasive surgery unit. Medical history was relevant for biliary atresia requiring a Kasai procedure at 5 weeks of age. In July 2010, an LDLT with hyper-reduction technique was performed using a left lobe from her aunt [3]. Four years later she developed pruritus and alteration of alkaline phosphatase, 409 IU/L (normal < 360 IU/L), and gamma-glutamyl transferase, 109 IU/L (normal < 22 IU/L), with normal bilirubin, AST and ALT. A Doppler ultrasound showed adequate liver perfusion, while a magnetic resonance cholangiopancreatography (MRCP) revealed biliary dilatation and a severe, 2-cm-long stricture of the hepaticojejunostomy (Fig. 1A–D).

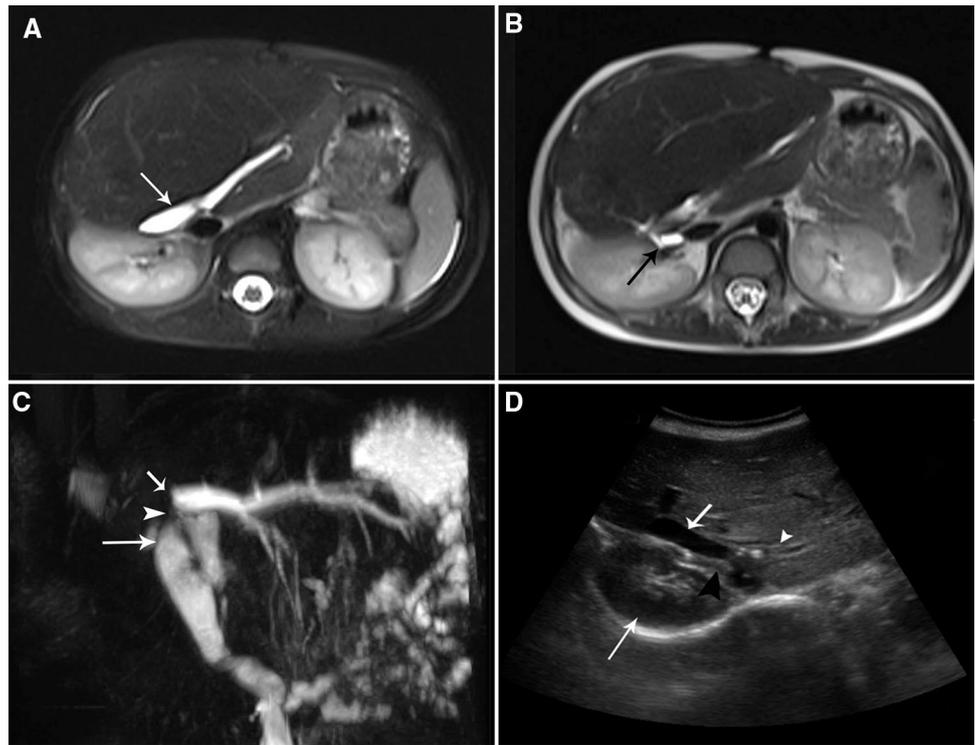
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Fig. 1 **A** Magnetic resonance cholangiopancreatography (MRCP) on T2-weighted image showing bile duct dilatation of segment II (white arrow); **B** MRCP, T2-weighted image, showing jejunal loop of Roux-en-Y hepaticojejunostomy (RYHJ) (arrow); **C** MRCP showing segment II bile duct (short arrow), anastomotic stricture (arrowhead) and jejunal loop (long arrow). **D** Ultrasonography showing portal vein (white short arrows), segment II bile duct (white arrowhead), jejunal loop and right kidney (white long arrow)



A percutaneous transhepatic cholangiography (PTC) done in January 2016 evidenced a complete obstruction of the RYHJ. Since initial attempts at crossing the obstruction were unsuccessful, an external transhepatic biliary drainage (PBD) was established with an 8.5-Fr multipurpose drainage catheter (Cook Medical, Bloomington, IN, USA). Several attempts to cross the stricture, using a variety of guidewires and angiographic catheters, were done 15 days later without success. Surgical revision was discarded because it deemed to carry a high risk of morbidity, while endoscopic approach was considered not feasible by experienced gastroenterologists.

Following multidisciplinary discussion, decision was made to attempt a percutaneous, fluoroscopic ultrasonography-guided endobiliary puncture of the jejunal loop.

Procedure Details

The procedure was performed in an operating room, under general anaesthesia, using a C-arm. Intravenous piperacillin/tazobactam was administered as prophylaxis, and gonadal shielding was used. The major concern was avoiding puncture of the portal vein, as the jejunal loop was located behind its trunk. The PBD was removed over a 0.035-in angled, hydrophilic guide wire. Using a Rösch-Uchida Transjugular Liver Access Set (Cook Medical), the 10-Fr introducer sheath was inserted and the tip of the sheath was advanced to the anastomotic stricture. The

dilator of the sheath was removed and a 14-G stiffening cannula was inserted. Under fluoroscopic guidance, a trocar stylet with a 5-Fr angiographic catheter was introduced through the Rösch-Uchida sheath and advanced to the biliary stricture. The tip of the stylet was aimed to the jejunal loop orienting its baseplate posteriorly. Using colour Doppler ultrasound, the portal vein was identified and the stylet advanced from the hepatic duct to the jejunal loop. Injection of contrast material confirmed the jejunal loop puncture (Fig. 2), and then the guide wire was progressed, and an 8.5-Fr external-internal PBD was placed.

Once patency of the hepaticojejunostomy was achieved, the decision was made to place a biodegradable stent. The size of the stent was based on review of fluoroscopy, being the main issue to avoid migration. Since the length of the newly formed tract was 5 mm, a stent exceeding 20 mm on each side of the hepaticojejunostomy with a convenient diameter was considered adequate for anchoring. Thus, with approval of the hospital's institutional review board, a custom-made, 45-mm-long by 10-mm-diameter stent was ordered (ELLA-CS, s.r.o., Hradec Kralove, Czech Republic).

While awaiting for tract maturation, the PBD was exchanged three times, every 2 months, to maintain patency and upsize the diameter to 17-Fr. Eight months after initial drainage, a biodegradable stent was placed. Pre-procedural PTC evidenced a stricture of the bilioenteric tract (Fig. 3A). Over a 0.035-in guidewire, the stent deployment system, consisting in an 11.8-Fr sheath, was

Fig. 2 Cholangiography and intraoperative ultrasound.
A External biliary drainage (arrow) and segment II bile duct (short arrow). **B** Jejunal loop puncture, stylet tip (short arrow and arrow head), jejunal loop (arrow). **C** Contrast material confirms jejunal loop puncture, stylet tip (arrowhead), stricture (arrow). **D** Percutaneous internal–external drainage

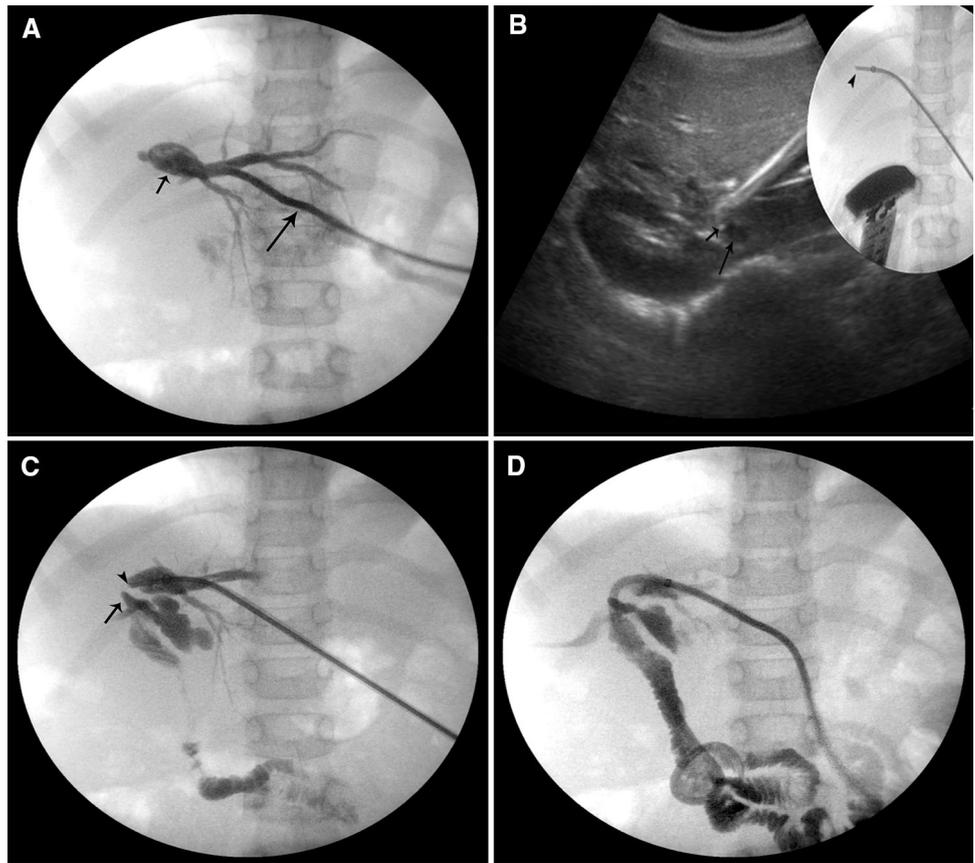
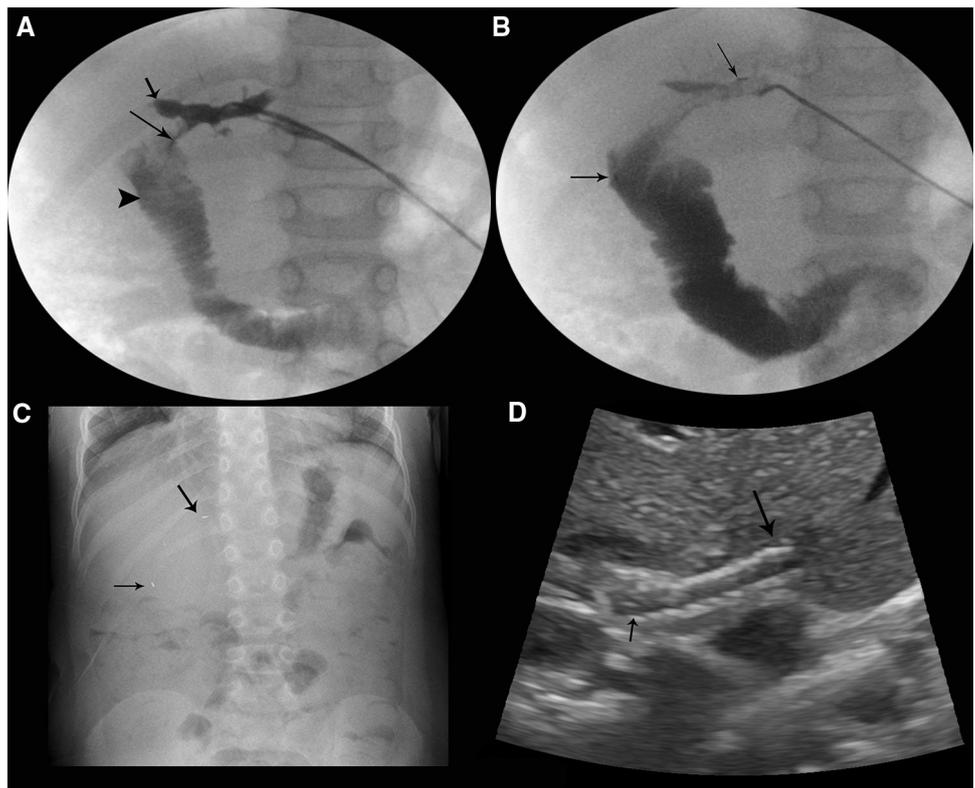


Fig. 3 **A** Cholangiography showing segment II bile duct (short arrow), RYHJ (arrow), jejunal loop (arrowhead). **B** Biodegradable stent with radiopaque markers (arrows). **C**, **D** Abdominal X-ray and ultrasound, 3 months after stent placement showing radiopaque markers (arrows)



advanced under fluoroscopy, and the stent was released centred at the stricture. Given that the stent's radial force was sufficient to achieve full expansion, no balloon dilatation was done. A new cholangiography evidenced a marked improvement in tract diameter and the absence of leak (Fig. 3B). A 4-Fr silicon catheter was placed as a biliary drainage and was retrieved 15 days after. There were no postoperative complications, and the patient was discharged 48 h post-procedure.

The whole treatment included six percutaneous procedures over a period of 8 months with total radiation dose of 517 mGy. Complete degradation of the stent occurred at 5 months of placement, as evidenced by ultrasonography, MRCP and an abdominal X-ray (Fig. 3C, D). An MRCP performed 3 months after stent placement showed resolution of bile duct dilatation. No complications related to stent degradation occurred. Twenty months after biodegradable stent placement, the patient remains asymptomatic with normal growth and liver function test.

Discussion

In one of the largest series of RYHJ strictures treated by percutaneous approach, R. Imamine and colleagues reported excellent results in treating 54 of 57 patients, with three cases requiring redo surgical anastomosis due to failure to cross the occlusion [4]. In the case reported here, patency of hepaticojejunostomy was re-established by means of a minimally invasive technique, thus avoiding re-surgical anastomosis. Similarly, Miraglia et al. [5] reported achieving patency by puncture of the jejunal loop using only fluoroscopy. As our group reported previously, we routinely perform percutaneous balloon dilatation for benign bilioenteric strictures [6] with high patency rates. In the case reported here, recent recanalization of the stricture was considered to be a fresh biliary anastomosis. In the context of an immunosuppressed patient, stent placement or bilioplasty was precluded for at least 6 months, as per institutional protocol, to prevent tract disruption or bile leakage.

Long-term catheter placement or dual catheter technique were described with good patency rates, but both techniques require long-term permanency of PTD affecting patients' quality of life [4, 7]. Endoscopic interventions, such as double balloon enteroscopy, have been reported as an effective treatment option for biliary anastomotic stricture [8]. However, this method is unsuitable for children under 15 kg weight, it is not readily available and success rates are lower in the paediatric population with RYHJ [9].

Polydioxanone (commercially available as PDS® II suture) is absorbed by a hydrolytic degradation process. In

contact with bile, all absorbable sutures may accelerate degradation, but PDS® II showed to be the most resistant, with a half-life of 63 days [10]. Regarding PDS biliary stents, degradation occurs in a period of 3–6 months, maintaining a relatively lower radial force and a higher axial force as compared to nitinol stents [11]. Although biodegradable stents have been widely used in adults, there is little evidence about its utility in paediatric LDLT recipients [12]. To our knowledge, no paediatric patients have been treated with a combination of percutaneous patency recovery of bilioenteric anastomosis and biodegradable stent placement.

Conclusion

Recanalization of a totally occluded Roux-en-Y hepaticojejunostomy is feasible by a percutaneous approach, avoiding surgical revision. Once patency is secured, placement of a biodegradable stent may prolong clinical, laboratory and imaging patency.

Compliance with Ethical Standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed Consent Informed consent and consent for publication were obtained from the patient's parents.

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