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Laparoscopic double duodenal atresia repair

Clinical Note

**Laparoscopic reconstruction of double duodenal atresia in a neonate: A novel procedure**

**Running title:** Laparoscopic double duodenal atresia repair

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## Laparoscopic double duodenal atresia repair

**Key words:** double duodenal atresia, diamond-shaped anastomosis, neonate, laparoscopic, duodeno-duodenostomy

Duodenal atresia (DA) is a common cause of neonatal obstruction and is sometimes associated with additional atresias. Although there are several reports of double duodenal atresia (DDA)<sup>1,2</sup>, the optimal reconstruction of DDA has been debated. Herein we describe our novel laparoscopic reconstruction for DDA in the neonate.

Antenatal ultrasonography and MRI at 28 weeks gestation showed the double bubble sign. A male infant was born at 38 weeks gestation with a birthweight of 3.2kg. Duodenal atresia was suspected by abdominal X-ray and ultrasonography. We performed laparoscopy at 6 days of life. A patient was positioned to supine position. Four trocars were inserted: a transumbilical camera port (5 mm), two working ports (5 mm and 3 mm, respectively) and one assistant's port (3 mm) (Fig. A). After duodenum mobilization by Kocher's maneuver, the proximal end of the dilated duodenum combined with annular pancreas was identified. A transverse enterotomy was made on the anterior surface of the bowel proximal, and a longitudinal enterotomy was made on distal to the first atretic segment. The inferior aspect of the proximal enterotomy (Fig.B, blue line) is sutured to the superior aspect of the distal enterotomy (Fig.B, blue line). Vater papilla was detected distal part of annular pancreas. After suturing posterior part of enterotomy (Fig.B, blue line), the second atresia at 1cm distal to the first atresia was revealed by the fact that the nasogastric tube was not able to insert and the findings of direct view. The second atresia was so small and thickened that resection of membrane was difficult to perform and to create sufficient lumen of anastomosis. Thus, we reconstructed DDA by Kimura's diamond-shaped anastomosis(DSA) with modification (Details of our laparoscopic procedure were described in Figure C.D.E.)<sup>3</sup>.

## Laparoscopic double duodenal atresia repair

Oral intake started on 4<sup>th</sup> postoperative days. In the early post-operative period, temporary obstructive jaundice which is thought to be caused by pancreaticobiliary maljunction causing from a protein plug was observed but it improved spontaneously. As a result of the upper abdominal gastrointestinal contrast examination at 1 month after surgery, the anastomotic part was slightly narrowly imaged, but the contrast medium passed smooth and the distal duodenum was also growing(See Supporting Information). As a year and a half have passed since surgery, the patient has taken a normal diet and has been asymptomatic.

DDA was firstly reported by Boyd et al in 1845, and until now, there has been twenty-five case reports in English literature<sup>2</sup>. Each type of atresia and the obstructing lesion were different from each report, and reconstructive surgical procedures for DDA have been included combinations of duodeno-duodenostomy (DSA and/or side to side anastomosis), resection of web, and duodeno-jejunostomy, however, each long term outcome was not well-described<sup>1, 2</sup>.

In considering of optimal reconstruction for DDA, we are convinced that there are three important aspects; to create larger anastomosis, to avoid injury of the outlet of pancreatic/bile duct, and to prevent blind loop syndrome. DA are sometimes combined with pancreatic/biliary anomaly and it was sometimes impossible to detect all the outlet of pancreatic/bile duct under direct vision intraoperatively, therefore, to create the enterotomy on anti-mesenteric aspect is important to avoid injury the orifice of pancreatic/bile duct. A stagnant pouch might predispose to the blind loop syndrome in the late follow-up, therefore duodeno-jejunostomy should not be introduced for definitive operation of DA. From above-mentioned perspectives, we believe that DSA is one of ideal reconstruction for DDA<sup>3</sup>.

Laparoscopic repair of duodenal atresia has showed comparable safety and efficacy with the open repair<sup>4</sup>, and merits of laparoscopic repair lies in better visualization, cosmetic results and

Laparoscopic double duodenal atresia repair

less adhesive obstructions, and to best of our knowledge, this is the first case report of laparoscopic DDA reconstruction.

In conclusion, we believe that our modified DSA has the potential to be one of optimal surgical options in case of DDA.

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### **Authors' contributions**

Y.B., H.M, Y.A, T.N, and Y.O. managed the patient and contributed to conception of the manuscript; Y.O. drafted the manuscript; and Y.B. and Y.O. reviewed the manuscript. All authors read and approved the final manuscript.

**The authors declare no conflict of interest.**

### **Figure Legend**

**Figure.** Scheme of Laparoscopic reconstruction of DDA. **(A)** Placements of ports, **(B)** An enterotomy is made on the anterior surface of the bowel proximal and distal to the first atretic segment. The inferior aspect of the proximal enterotomy (blue line) is sutured to the superior aspect of the distal enterotomy (blue line). White arrow is the first atretic segment, grey arrow is the second atretic segment, and asterisk is ampulla of Vater. **(C)** A second enterotomy is made distal to the ampulla of Vater on the anterior surface of the bowel distal to the second atretic segment. The inferior portion of the proximal anastomosis (green line) is sutured to the superior aspect of the distal enterotomy (green line). **(D)** Finally, after it was confirmed that there was no atresia further distal by inserting nasogastric tube and normal saline, the superior

Laparoscopic double duodenal atresia repair

aspect of the proximal enterotomy (yellow line) and the inferior aspect of the most distal enterotomy (yellow line) are sutured to complete the single layer anastomosis. We did not place trans-anastomotic tube(E). (F) Scheme of each atretic segment and enterotomy.

### Supporting information

The lateral view of upper abdominal gastrointestinal contrast examination at 1 month after surgery. P; proximal site of anastomotic part, D; distal site of anastomotic part.

The anastomotic part was slightly narrowly imaged (arrow head), but the contrast medium passed smooth and the distal duodenum(D) was also growing. There was no caliber change suggesting another stenotic lesion distal of anastomotic site.

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