‘O’ Configuration of Biliary-Enteric Drainage: a Preventable Surgical Error

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Abstract Surgical errors in Roux limb reconstruction are not reported widely. A young male who underwent hepaticojejunostomy after biliary injury developed acute obstruction of the proximal jejunum. Barium study revealed the O configuration of alimentary limb—‘O’ sign. At laparotomy, he was found to have the alimentary limb joining on to itself and without any connection with the biliary limb. The O loop complex was resected, and Roux-en-Y construction was refashioned. He made an uneventful recovery and is well at one year follow-up. We have reviewed the literature and propose a classification system for such type of errors. Every effort should be made to prevent this complication.

Keywords Roux-en-Y · Roux-en-O · O loop · Hepaticojejunostomy · Biliary · Injury · Stricture · Reconstruction · Surgery · Error

Introduction

Roux-en-Y reconstruction is the preferred method of biliary reconstruction for benign conditions of the biliary tract [1]. Although this is a safe procedure, there can be a few complications associated with it [1, 2]. Complications pertaining to the biliary system like recurrent infections, anastomotic stricture, and calculi are well described in the literature [2];

however, surgical errors in the Roux limb construction are not widely reported [2–5]. The present report describes misconstruction of the Roux limb after biliary-enteric anastomosis.

Clinical Material

A 25-year-old male undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis at a secondary health-care hospital had a biliary injury, which was identified and repaired in the same sitting. A hepaticojejunostomy was performed through a right subcostal incision. On resuming oral diet, he developed persistent emesis, which mandated nasogastric tube placement. The nasogastric tube output was more than 800 ml/day, and he was referred to us after 1 week.

At admission, he had deranged electrolytes and renal dysfunctions which were corrected after adequate fluid replacement. His hematological, coagulation, and liver function parameters were normal. He was managed with nasogastric tube decompression and parenteral nutrition.

Abdominal radiograph revealed paucity of air in the abdomen. Contrast-enhanced computed tomography (CECT) of the abdomen revealed proximal jejunal dilatation with collapse of the distal bowel [Fig. 1(I)]. Nuclear scan was normal.

Barium meal follow-through revealed a dilated proximal jejunal loop which was joining on to itself without any contrast going distally at all, forming an ‘O’ configuration, the O sign [Fig. 1(II)].

At laparotomy, the alimentary limb was 30 cm long and 5 cm dilated. Instead of joining the biliary limb, the distal end of the alimentary limb was folded and anastomosed upon itself forming an O configuration [Fig. 1(III)]. The biliary limb was collapsed. There was no connection between the two limbs.

The entire O loop complex was resected, and a Roux-en-Y configuration was restored.

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Fig. 1 **I** Axial CECT abdomen showing dilated alimentary loop extending inferiorly. **II** Barium meal follow-through examination showing markedly distended alimentary loop extending inferiorly up to the pelvic inlet and anastomosed back to itself close to the DJ junction forming a closed loop—the 'O' loop sign. **III** Operative picture showing the proximal jejunum forming an O configuration. **IV** Proposed classification of biliary misconnection. **a** Normal anatomy after

hepaticojejunostomy. **b** Type I (error in the alimentary limb) forms an O configuration by anastomosing on to itself, and the type II (error in the biliary limb) proximal end of Roux limb is anastomosed to the bile duct forming an O configuration with the biliary tract. **c** Type IIa (connected) distal limb is anastomosed to the proximal limb. **d** Type IIb (disconnected) distal limb anastomosed on to itself forming an O on P configuration

The patient made an uneventful recovery and is well at a follow-up of 1 year.

Discussion

Biliary complications such as infections, strictures, and stone as sequelae of bilioenteric anastomosis have been well described [2]. Misconstruction of Roux-en-Y, being an iatrogenic error, is usually not reported. Biliary

misconstruction with the usage of antiperistaltic limb to drain the bile ducts after post cholecystectomy biliary injury has been reported previously [3, 4]. Houben et al. [5] reported a twist of the Roux loop after choledochal cyst excision in a pediatric patient. Recently, after the advent of laparoscopic Roux-en-Y gastric bypass, there are a few reports of Roux-en-O misconstruction [6, 7]. Surgeons' inexperience and a long alimentary limb have been attributed for this kind of misconstruction [7, 8]. Inadequate access to infracolic compartment

Table 1 Review of the cases of Roux limb reconstruction after hepaticojejunostomy

Author	No. of cases	Primary diagnosis	Discharge ^a	Presentation	Diagnosis	Outcome	Proposed error type
Zorn et al. [3]	2	Biliary injury	Yes	Recurrent cholangitis	Laparotomy	Improved	Type IIa
Bohm et al. [4]	1	Biliary injury	Yes	Recurrent cholangitis	Laparotomy	Improved	Type IIa
Houben et al. [5]	1	Choledochal cyst	Yes	Recurrent SBO	CECT	Improved	Unclassified
Present case	1	Biliary injury	No	Acute SBO	Barium study	Improved	Type I

SBO small bowel obstruction, CECT contrast-enhanced computerized tomogram

^a Able to discharge after primary operation

through the right subcostal incision and a long alimentary limb could be the factors leading to this surgical catastrophe in the present case.

The misconstruction can occur in many ways, and based on the available literature, we propose to classify [Fig. 1(IVa–d)] it as follows:

Type I (error in alimentary limb) which, in the alimentary limb, forms an O configuration by anastomosing on to itself.

Type II (error in the biliary limb) which, in the proximal end of Roux limb, is anastomosed to the bile duct forming an O configuration with biliary tract. The distal limb may be anastomosed to the proximal forming a connected (type IIa) error or may be anastomosed on to itself forming a disconnected (type IIb) error or an O or P configuration.

Type I will present as a closed loop complete proximal obstruction with uninterrupted biliary drainage, while type II will present with recurrent cholangitis due to impaired biliary drainage with (disconnected, type IIb) or without (connected, type IIa) closed loop obstruction. Zorn et al. [3] and Böhm et al. [4] have previously reported the similar misconstruction by the use of antiperistaltic limb which, according to us, should be classified as type IIa error (Table 1).

The condition is difficult to diagnose because of the non-specific findings on CECT. However, careful appearance of the barium can reveal the O sign in type I error. Nuclear scan can be a useful tool showing impaired biliary drainage in type II error.

Once diagnosed, the error can be corrected surgically [3–5]. Refashioning of Roux-en-Y configuration suffices for type I error, while type II error will require revision of biliary anastomosis in addition to above [3, 4].

So, it is important to differentiate the two types of errors as the clinical presentation, imaging modalities, and type of reoperation for the two types will be different.

The following preventive measures should be undertaken to avoid such kind of mishap: (a) keep the alimentary as short

as possible [8]; (b) mark the biliary and alimentary limb separately, so that there is no confusion during reconstruction [6]; (c) perform the jejunal anastomosis prior to hepaticojejunostomy; (d) always recheck before anastomosis; and (e) always have adequate exposure and visualization.

In conclusion, Roux-en-O misconstruction in hepaticojejunostomy is a rare complication. High index of suspicion and knowledge regarding this kind of complication is the way to its diagnosis. Barium study may point towards type I, while nuclear studies can show impaired drainage in type II misconstruction. Every effort should be made to prevent such an error.

Conflict of Interest None

References

1. Shimada H, Ando I, Shimada K, Matsuyama R, Kobayashi N, Kubota K (2012) The current diagnosis and treatment of benign biliary stricture. *Surgery Today* 42:1143–53
2. Liu QG, Geng ZM, Wu SL, Yao HS, Pan CE (2004) Reoperation for benign biliary tract diseases in 149 cases: causes and prevention. *Hepatobiliary Pancreat Dis Int* 3:65–69
3. Zorn GL, Wright JK, Pinson CW, Debelak JP, Chapman WC (1999) Antiperistaltic Roux-en-Y biliary-enteric bypass after bile duct injury: a technical error in reconstruction. *Am Surg* 65:581–585
4. Böhm SA, Beckurts KT, Landwehr P, Hölscher AH (1999) [Anisoperistaltic Roux-en-Y reconstruction: rare cause for recurrent cholangitis after hepatic jejunostomy]. *Chirurg* 70:803–806, Abstract only, article in German
5. Houben CH, Chan M, Cheung G, Lee KH, Tam P, Yeung CK (2006) A hepaticojejunostomy: technical errors with twists and turns. *Pediatr Surg Int* 22:841–844
6. Mitchell MT, Gasparaitis AE, Alverdy JC (2008) Imaging findings in Roux-en-O and other misconstructions: rare but serious complications of Roux-en-Y gastric bypass surgery. *Am J Radiol* 190:367–373
7. Griffith PS, Birch DW, Sharma AM, Karmali S (2012) Managing complications associated with laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Can J Surg*. doi:10.1503/cjs.002011
8. Sherman V, Dan AG, Lord JM, Chand B, Schauer PR (2009) Complications of gastric bypass: avoiding the Roux-en-O configuration. *Obes Surg* 19:1190–1194