

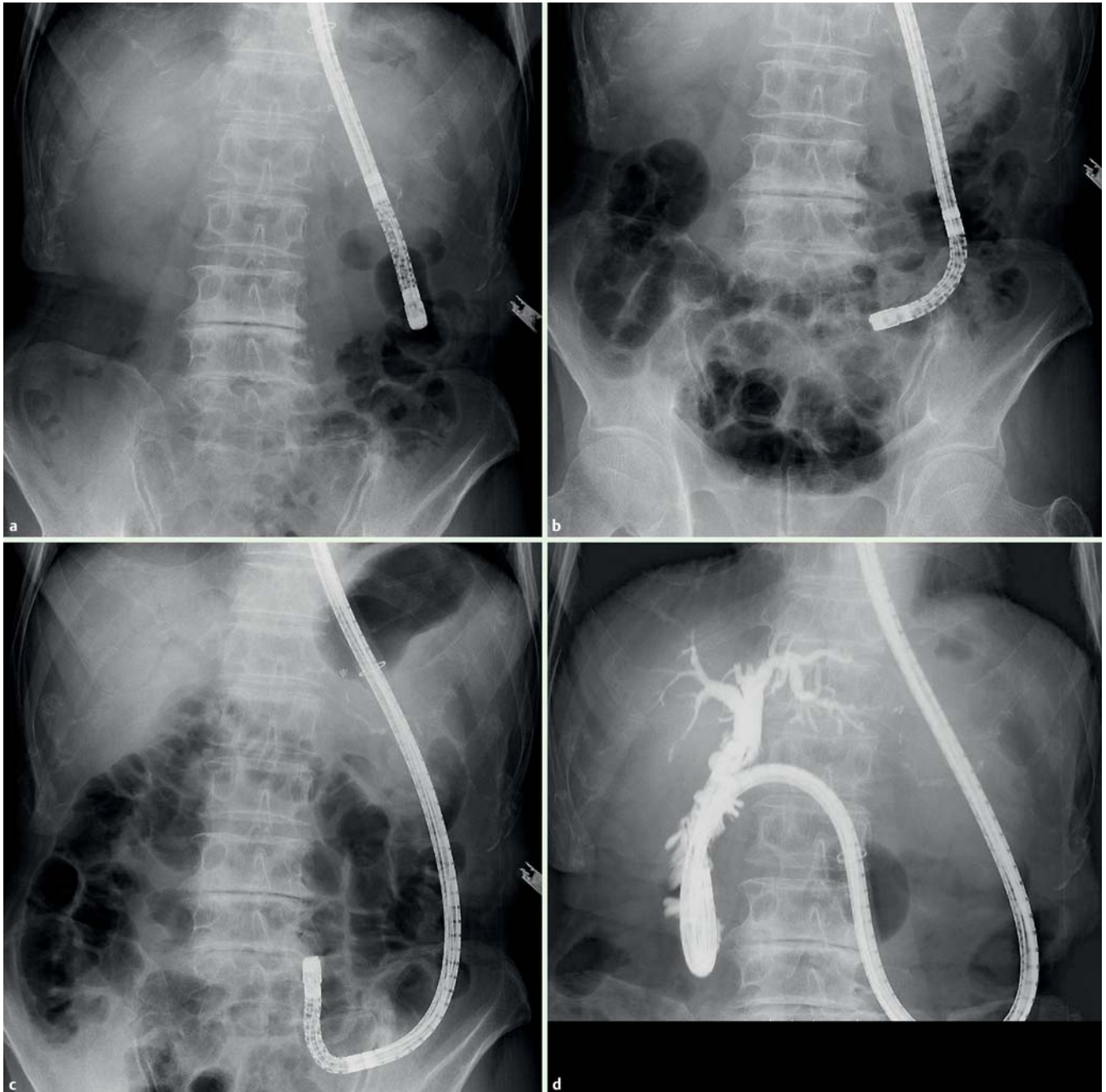
## Carbon dioxide enterography: a useful method for double-balloon enteroscopy-assisted ERCP

Development of double-balloon enteroscopy-assisted endoscopic retrograde cholangiopancreatography (DB-ERCP) has enabled endoscopic treatment of pancreaticobiliary disease in patients with a surgically altered gastrointestinal anatomy [1].

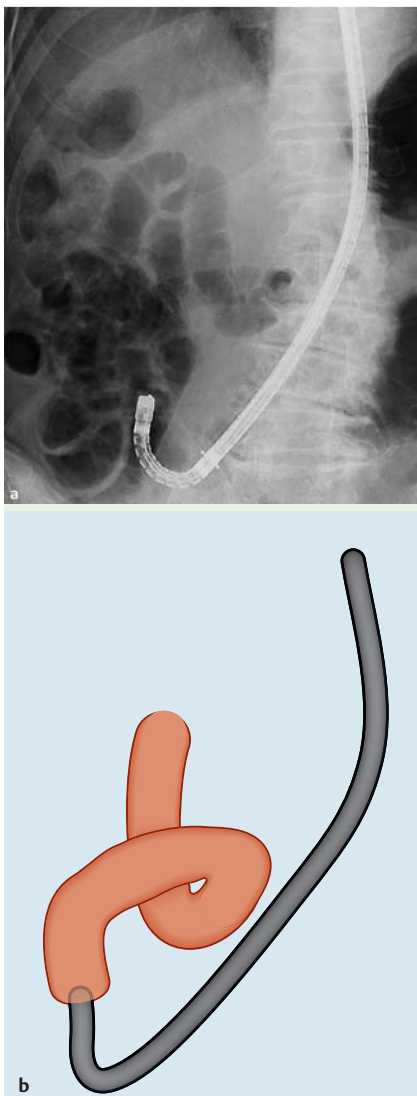
However, scope insertion requires experience because of the maze-like gastrointestinal tract [2]. Intraluminal injection of indigo carmine to identify the afferent loop of Roux-en-Y anastomosis [3] may cause susceptibility to peristalsis and is

unsuitable for complex reconstruction. To develop a smooth insertion method, we used a negative contrast technique with carbon dioxide to confirm the correct tract, termed CO<sub>2</sub> enterography, and we present case results here.

An 86-year-old man had previously undergone pancreatoduodenectomy had a suspected anastomotic stricture of the choledochojejunostomy. **Fig. 1 a** shows the double-balloon enteroscope at the jejunojunction, after which the operator inserted the tip of the scope into one of



**Fig. 1** **a** Double-balloon enteroscope at the jejunojunction in an 86-year-old man who had previously undergone pancreatoduodenectomy and had a suspected anastomotic stricture of the choledochojejunostomy. **b** Fluoroscopy revealed CO<sub>2</sub> directed to the anal side, indicating the incorrect tract. **c** Insertion into another tract. CO<sub>2</sub> enterography revealed the correct tract for the choledochojejunostomy. **d** After reaching the target site, cholangiography showed no strictures.



**Fig. 2** An 84-year-old man underwent a distal-gastrectomy with Billroth II reconstruction. **a** CO<sub>2</sub> enterography confirmed the correct tract with Billroth II reconstruction. **b** Schema. Orange area corresponds to the afferent loop.

the two tracts and injected CO<sub>2</sub> under the obstruction caused by scope balloon inflation. Fluoroscopy revealed CO<sub>2</sub> directed to the anal side (● Fig. 1 b), indicating the incorrect tract. ● Fig. 1 c shows insertion into another tract, after which CO<sub>2</sub> enterography revealed the correct tract for the choledochojunostomy. After reaching the target site, cholangiography showed no strictures (● Fig. 1 d). In an 84-year-old man who underwent a distal gastrectomy with Billroth II reconstruction, CO<sub>2</sub> enterography confirmed the correct tract (● Fig. 2). CO<sub>2</sub> enterography was suitable for various surgically altered gastrointestinal tract cases.

We retrospectively investigated target site arrival times with (n=39) and without (n=16) CO<sub>2</sub> enterography in post-surgical patients, excluding those with Billroth I reconstruction. The average time was significantly shorter in the CO<sub>2</sub> enterography group (26 vs. 38 minutes, P=0.026). No adverse events related to CO<sub>2</sub> enterography were observed. Using CO<sub>2</sub> enterography, the correct tract was easily identified without wasted effort from insertion into the incorrect tract. Thus we consider it useful for insertion in DB-ERCP cases.

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**Competing interests:** None

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