—Case Reports—

Endoscopic Detorsion for Early Postoperative Roux Limb Torsion after Laparoscopic Gastrectomy: A Case Report and Literature Review

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Various types of obstruction can occur after a gastrectomy for gastric cancer. If proper treatment is not performed, such obstructions can lead to serious conditions. Early postoperative Roux limb torsion is a rare complication, and few reports of endoscopic treatment for this complication have been made. In the present report, we describe the endoscopic detorsion of Roux limb torsion in two patients. The first case was a 77-year-old woman who underwent a laparoscopic distal gastrectomy with Roux-en-Y (R-Y) reconstruction for early gastric cancer and a laparoscopic ileocecal resection (ICR) for early colorectal cancer. On the 12th day after the gastrectomy, a Roux limb torsion was observed. Endoscopic detorsion was performed, and the patient recovered. She was discharged on postoperative day 40. The second case was a 73-year-old man who underwent a laparoscopic-assisted total gastrectomy with a R-Y reconstruction for early gastric cancer. On the 8th day after the gastrectomy, a Roux limb torsion occurred at the Y-shaped anastomosis (Y-anastomosis). Endoscopic detorsion was performed, and the patient recovered. He was discharged on postoperative day 17. In summary, we experienced two cases in which an endoscopic reduction of a Roux limb torsion was performed at the Y-anastomosis after gastrectomy with R-Y reconstruction. This study presents a further review of these cases and a summary of the existing literature. (J Nippon Med Sch 2021; 88: 544–550)

Key words: gastric cancer, Roux-en-Y, Roux limb, torsion, endoscopic detorsion

Introduction

Roux-en-Y (R-Y) reconstruction is a reconstruction method that is often adopted after gastric cancer surgery because it is associated with less postoperative reflux[1,2]. However, postoperative obstruction can occur after a R-Y reconstruction[3]. In most cases, the obstruction is treated by conservative treatment (such as nasogastric tube decompression, bowel rest and intravenous drip) or surgery[4]. To date, there are few reports of endoscopic treatment[4–6]. Here, we report cases in which a rare obstructive condition called Roux limb torsion could be treated with endoscopic detorsion instead of surgery.

Case Presentation

Case 1: A 77-year-old woman was diagnosed as having gastric cancer and double cecal cancer. The patient had no co-morbidities. A laparoscopic-assisted distal gastrectomy was performed with a D1 plus lymph node dissection and a R-Y reconstruction. The residual stomach and jejunum were reconstructed by antecolic-functional end-to end anastomosis and Y-anastomosis of jejunojejunostomy (JJS) was made with end-to-side Jourdan suturing. The distance between residual stomach-jejunostomy and JJS as well as the distance between Treitz ligament and Y-anastomosis were both 30 cm, respectively. Petersen's defect and mesenteric defect at JJS were closed using unabsorbable thread. Simultaneously, laparoscopic ileocecal resection (ICR) with a D3 lymph node dissection and functional end-to-end anastomosis was also performed. The reconstruction of schema is shown (**Fig. 1a**). The opera-

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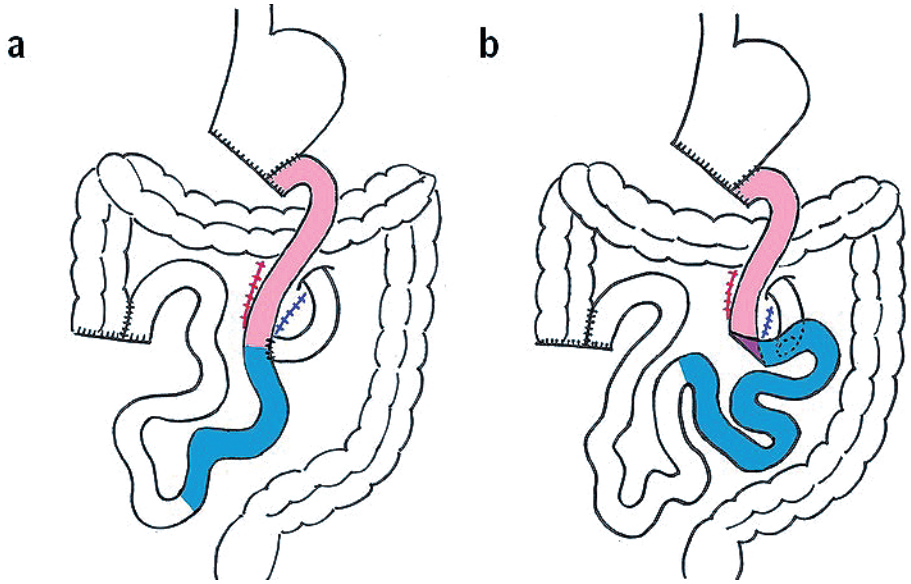

Fig. 1 Operative schema of case 1. (a) Ideal Roux-en-Y anastomosis. (b) Actual post-operative condition: Roux limb torsion at Y-anastomosis.
Pink color: Roux Limb, light blue color: distal jejunum, purple color: torsion of Roux limb at Y-anastomosis, red color's line: closing of Petersen's defect, blue color's line: closing of jejunojejuno-mesenteric defect.

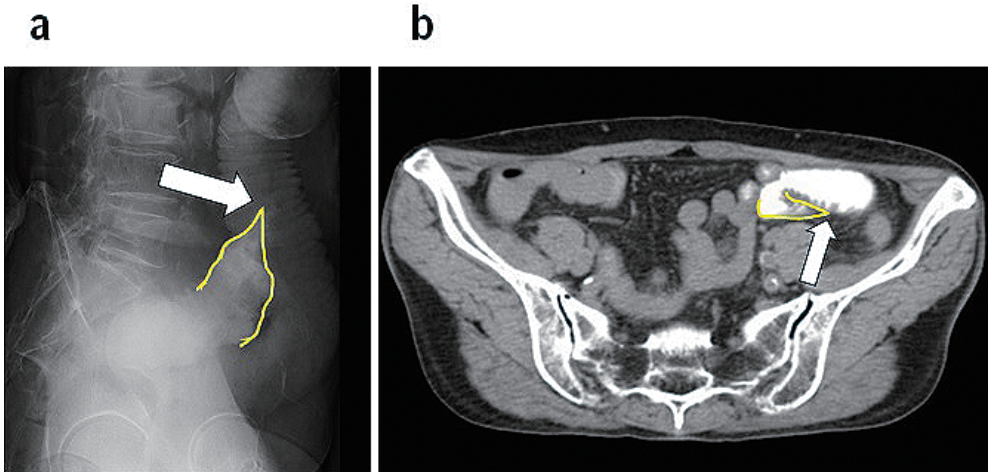

Fig. 2 Radiological findings of case 1. (a) Fluoroscope imaging; white arrow shows obstruction point and beak sign (yellow color's line). (b) CT imaging; white arrow shows obstruction point and beak sign (yellow color's line).

tion time was 298 min and the blood loss was 10 mL.

On postoperative day (POD) 10, the patient developed nausea and abdominal pain, and tenderness was noted in the upper abdomen without rebound tenderness or muscular defense. The patient's white blood cell count (WBC: 8,360/μL) and C-reactive protein (CRP: 1.29 mg/dL) levels were normal. Conservative treatments such as fasting, an intravenous drip, and antibiotics were prescribed but the obstruction persisted. On POD 12, an upper gastrointestinal contrast study showed a distinctive beak sign indicating a torsion (**Fig. 2a**). A contrast-enhanced CT study showed the maintenance of blood flow in the Roux limb Based on these findings, the patient was diagnosed as having a Roux limb mild torsion at the Y-anastomosis site (**Fig. 2b**). The of schema is shown (**Fig. 1b**). And endoscopic detorsion was performed after obtaining informed consent (**Fig. 3**).

The torsion was corrected, and an ileus tube was placed across the obstruction point after the torsion had been released for several days. The patient's condition improved, and she was discharged from our hospital on POD 40.

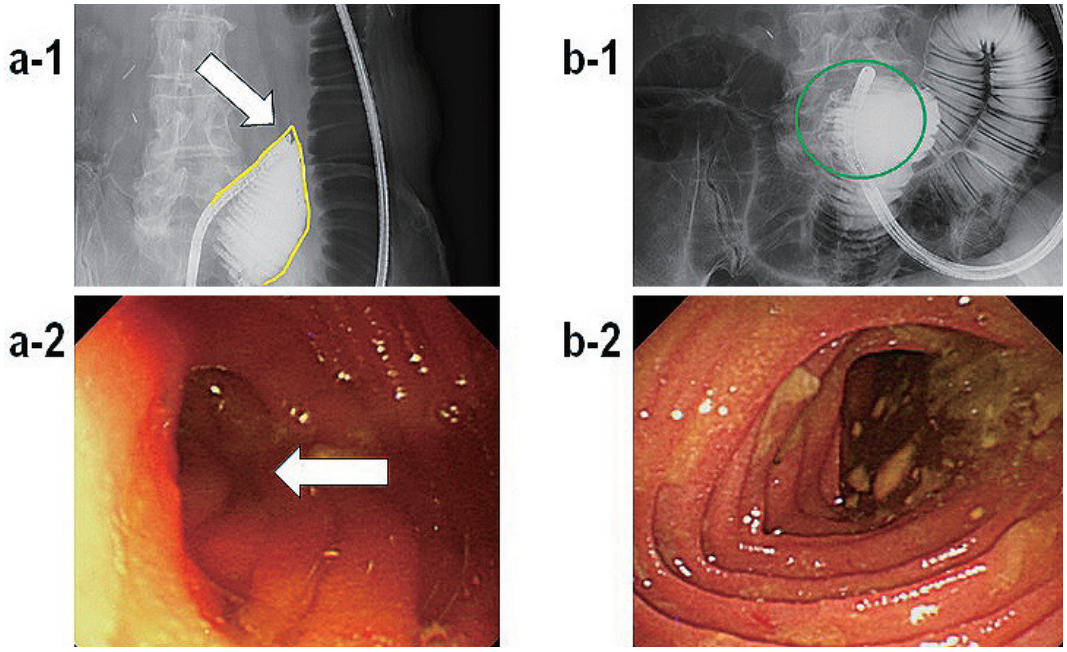

Fig. 3 Image findings of case 1. (a-1) Fluoroscopic findings before endoscopic detorsion; white arrow shows obstruction point and beak sign (yellow color's line). (a-2) Endoscopic findings before endoscopic detorsion; white arrow shows obstruction point. (b-1) Fluoroscopic findings after endoscopic detorsion: green circle shows normal diameter at distal jejunum. (b-2) Endoscopic findings after endoscopic detorsion: normal diameter at distal jejunum.

The pathological findings were as follows: for the gastric cancer, poorly differentiated adenocarcinoma, 0-I type, 25x18 mm, T1b (SM), int INFb, ly2, v1, PM (-) 39 mm, DM (-) 110 mm, s0M0 stage IA; for the first cecal cancer, Isp, 16x14x10 mm, tub1, lyo v0 PN0, PM (-) 65 mm, DM (-)100 mm; for the second cecal cancer, Isp, 16x14x9 mm, tub1, lyo v0 PN0, PM (-) 117 mm, DM (-) 77 mm. The patient has survived for 5 years and 2 months without cancer recurrence or SBO involving the Roux limb.

Case 2: A 63-year-old man was diagnosed with double gastric cancer. The patient had no co-morbidities. A laparoscopic-assisted total gastrectomy was performed with a D1 plus lymph node dissection and a R-Y reconstruction. The esophagojejunostomy was reconstructed by antecolic-overlap anastomosis and Y-anastomosis of jejunojejunostomy was made by end-to-side Jourdan suturing. The distance between residual esophago-jejunostomy and JJS was 50 cm and the distance between Treitz ligament and Y-anastomosis was 30 cm. Petersen's defect and mesenteric defect at JJS were closed by using unabsorbable thread. The reconstruction of schema is shown (**Fig. 4a**). The operation time was 284 min and total blood loss was 30 mL.

On POD 8, the patient developed nausea and abdominal pain, and tenderness was noted in the upper abdomen without rebound tenderness or muscular defense. On the same day, an upper gastrointestinal contrast study showed a distinctive beak sign indicating a torsion (**Fig. 5a**). A contrast-enhanced CT study showed the maintenance of blood flow in the Roux limb (**Fig. 5b**). His white blood cell count (WBC: 5,470/μL) and C-reactive protein (CRP: 4.79 mg/dL) levels were almost normal. Based on these findings, the patient was diagnosed as having a Roux limb mild torsion at the Y-anastomosis site. The of schema is shown (**Fig. 4b**). And endoscopic detorsion was performed after obtaining informed consent (**Fig. 6**).

The torsion was corrected, and an ileus tube was placed across the obstruction point after the torsion was released for several days. The patient's condition improved, and he was discharged from our hospital on POD 17.

The pathological findings were as follows: for the first gastric cancer, 0-IIc, 44x37 mm, tub1, T1b2 (SM), int INFb, ly1, v0, PM (-) 21 mm, DM (-) 146 mm, N0M0 stage IA; for the second gastric cancer, 0-IIc, 5x5 mm, tub 1, T1 (M), no invasive PM (-) 140 mm, DM (-) 58 mm, N0 M0 stage IA. The patient has survived for 2 years and 6 months without cancer recurrence or SBO involving the Roux limb.

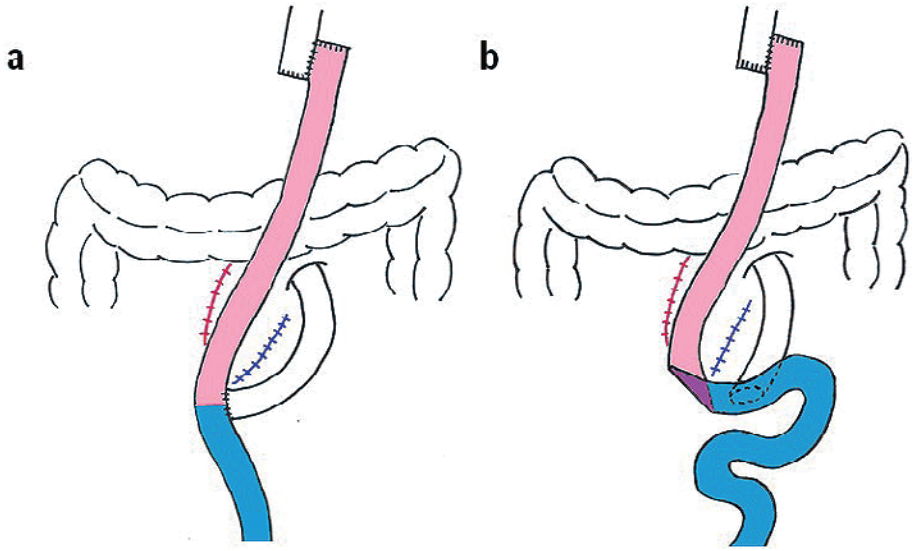

Fig. 4 Operative schema of case 2. (a) Ideal Roux-en-Y anastomosis. (b) Actual post-operative condition: Roux limb torsion at Y-anastomosis.
Pink color: Roux Limb, light blue color: distal jejunum, purple color: torsion of Roux limb at Y-anastomosis, red color's line: closing of Petersen's defect, blue color's line: closing of jejunojejuno-mesenteric defect.

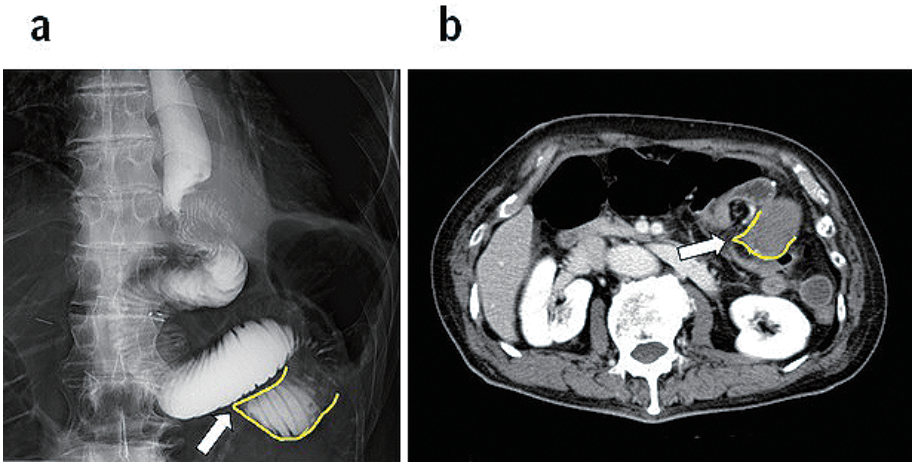

Fig. 5 Radiological findings of case 2. (a) Fluoroscope imaging; white arrow shows obstruction point and beak sign (yellow color's line). (b) CT imaging; white arrow shows obstruction point and beak sign (yellow color's line).

Discussion

R-Y reconstruction is often used after gastric cancer surgery, but postoperative obstruction has occasionally been reported[3]. Bowel obstruction is classified as functional or mechanical obstruction, which is in turn divided into a simple obstruction with the maintenance of blood flow and a strangulated obstruction without the maintenance of blood flow[7,8].

In previous reports, functional bowel obstruction was cured through conservative treatment such as nasogastric tube decompression, bowel rest or intravenous drip.

Among mechanical bowel obstruction, simple bowel obstructions are initially treated with conservative treatment. The success rate for that operation is reported to be 65-80%[9,10]. Unsuccessful cases are treated with surgery. Among mechanical bowel obstructions, strangulated bowel obstruction with blood flow disorder is an indication for emergent surgery[7].

According to most of reports about small bowel obstruction (SBO) including obstruction after R-Y reconstruction, there are only two options: conservative treatment or surgery[7]. Endoscopic treatment other than the

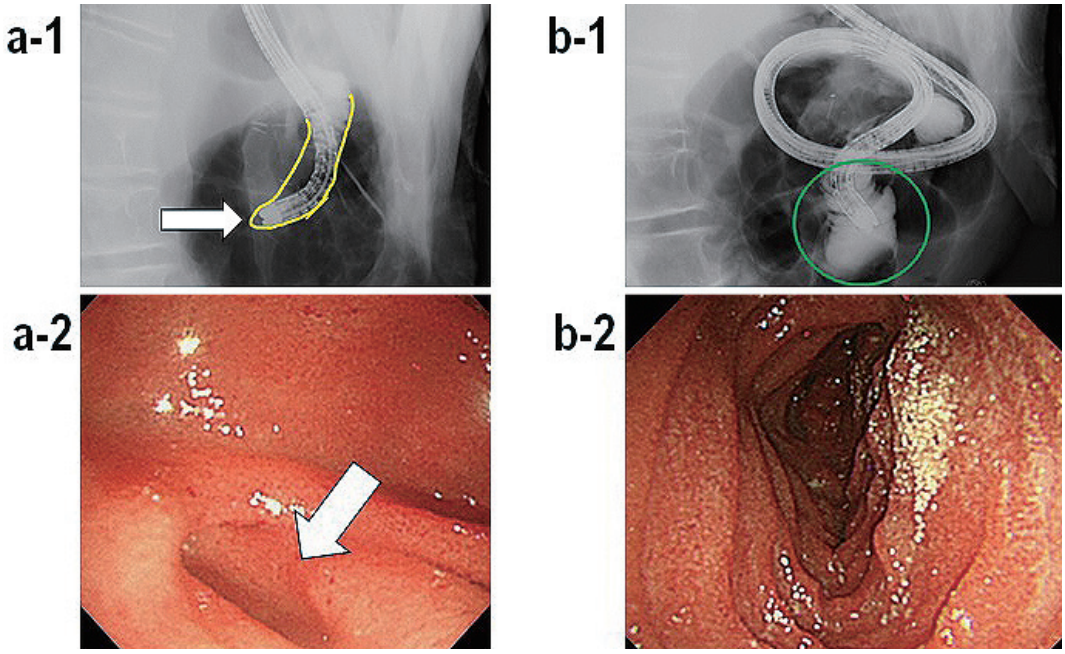

Fig. 6 Image findings of case 2. (a-1) Fluoroscopic findings before endoscopic detorsion; white arrow shows obstruction point and beak sign (yellow color's line). (a-2) Endoscopic findings before endoscopic detorsion; white arrow shows obstruction point. (b-1) Fluoroscopic findings after endoscopic detorsion: green circle shows normal diameter at distal jejunum. (b-2) Endoscopic findings after endoscopic detorsion: normal diameter at distal jejunum.

above two treatment options have been reported, but there are few reports about SBO treated by endoscopic treatment, especially about the obstruction after surgery with R-Y reconstruction[4–6]. In our reported cases, we performed endoscopic detorsion for the Roux limb torsions, enabling a safe torsion release.

However endoscopic treatment can not cure all types of SBO. It was important that the type of obstruction is precisely diagnosed as a simple mechanical obstruction before endoscopic treatment. Additionally, the first choice should be conservative treatment. If endoscopic treatment as second choice fails, open surgery should quickly be concern as a final choice[7]. In the two case reports presented, the first choices were conservative treatment but they were not cured. The diagnosis showed that postoperative fluoroscopic examinations revealed a beak sign at the obstruction point. That sign is known to be a typical sign of torsion[11].

The Roux limb torsions showed that blood flow was maintained by contrast-enhanced CT studies in both cases. Therefore, we decided to perform endoscopic detorsion as second choice using the technique developed for the endoscopic detorsion of sigmoid colon torsion. Because endoscopic detorsion has become widely accepted treatment for sigmoid colon torsion in recent years and the technique has been well established[12–14].

What is the cause of bowel obstruction after R-Y reconstruction? It is considered that the cause of SBO after R-Y reconstruction is the structure itself. Roux stasis is a functional obstruction specific to R-Y reconstruction. In this condition, a new pacemaker occurs in the Roux limb, causing reverse peristalsis on the oral side[15]. Conservative therapies such as fasting, intravenous infusion, and decompression in the remnant stomach using a nasogastric tube are commonly used. R-Y reconstruction makes some mesenteric defects (JJS or Petersen's defect) that do not occur with B-I reconstruction.

An internal hernia might occur after R-Y reconstruction[3]. The most serious internal hernia is strangulated bowel obstruction among mechanical SBO, so usually emergent surgery should be selected[7]. Among simple mechanical obstruction, obstruction around Y-anastomosis have been reported[4–6]. Roux limb torsion (our cases), Roux limb kinking and afferent limb syndrome are also in the category of simple mechanical obstruction[4,16]. The same complications were reported not only in the gastrectomy for gastric cancer but also in other surgery such as R-Y bypass for bariatric surgery[17–20]. Roux-en-Y gastric bypass for weight loss surgery is widely used and the frequency of internal hernia could be reduced by closing the Petersen's defect and the mesenteric defect of JJS. This procedure was shown to reduce the frequency of in-

ternal hernia but kinking also increased[21].

What is a prevention strategy for bowel obstruction around the Y-anastomosis after R-Y reconstruction? There are two reports that speculate about how to reduce the obstruction around the Y-anastomosis after R-Y reconstruction with closure of mesenteric defects. Pierre M et al. also thought that narrow JJS should induce J-J kinking. They reported that widening of JJS reduced this kind of kinking. The wide JJS was made bidirectionally using two linear staplers. However, the disadvantage of the wide JJS is it has as much postoperative bleeding as[22]. Brolin RE et al. explained that JJS's bending should induce J-J kinking. They reported that antiobstruction stich prevented bending between Roux limb and distal jejunum and reduced the JJS kinking[23].

In light of these findings, we reviewed our cases by video. The first case, DGR and R-Y reconstruction was completed. After the DGR, the head of patient's position was lowered and was turned to the right. Finally, most of the small intestine was folded and placed in the upper left abdomen around JJS to secure a visual field for ICR surgery. However, it was unclear how to reposition to straighten between Roux limb and distal jejunum after ICR surgery. This might be the causes the obstruction. In the second case, R-Y reconstruction was made normally and Y-anastomosis position was unremarkable. After experiencing these cases, we repositioned Roux limb and distal jejunum so that they are straight at JJS.

There are several reports of endoscopic treatment for SBO after R-Y reconstruction[4–6]. However, these observation periods were not so long. Because these treatments were not radical treatments such as surgery, SBO may recur. In our report, the recurrence-free period was 5 years and 2 months for case 1. Case 2 had a recurrence-free period of 2 years and 6 months. These follow-up times are not so long time, so it is necessary to carefully observe the recovery of these patients for future recurrence. Surgical treatment should be considered if SBO occurs frequently even after endoscopic treatment.

Conclusion

We report two cases of Roux limb torsion after laparoscopic gastrectomy that were successfully resolved endoscopically. Endoscopic treatment can be another option to cure for selective SBO.

Conflict of Interest: The authors declare no conflicts of interest.

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