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Surgical Resection of Laimer's Diverticulum With Recurrent Laryngeal Nerve Preservation: A Case Report Highlighting Postoperative Suture-Line Edema Considerations

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Abstract

Laimer's diverticulum is a rare pharyngoesophageal diverticulum arising caudal to the cricopharyngeal muscle. A 75-year-old man with progressive postprandial food sticking underwent transcervical diverticulectomy. The diverticulum arose between the cricopharyngeal muscle and the longitudinal muscle of the cervical esophagus, supporting the intraoperative diagnosis of Laimer's diverticulum. Continuous intraoperative neuromonitoring was performed using an electrode placed on the left vagus nerve; the recurrent laryngeal nerve was identified and preserved, with no documented deterioration in neural responses. Resection was performed with a linear stapler, followed by suture reinforcement. On postoperative day (POD) 6, esophagography demonstrated focal narrowing and delayed esophageal passage without leakage, suggestive of suture-line edema. Oral trials were restricted because of impaired passage and documented airway entry of contrast-containing jelly. Endoscopy on POD 21 confirmed luminal patency; nevertheless, subsequent aspiration pneumonia and swallowing impairment necessitated further rehabilitation and nutritional support. The patient was transferred for continued care on POD 44. At follow-up on POD 128, he was alive, and no swallowing dysfunction was noted. This case emphasizes anatomical identification and cautious neural preservation, together with separate assessment of esophageal patency and swallowing safety; a protective effect of neuromonitoring cannot be established from a single case.

Categories: General Surgery, Geriatrics, Gastroenterology

Keywords: esophageal dysphagia, intraoperative neuromonitoring (ionm), laimer's diverticulum, pharyngoesophageal diverticulum, recurrent laryngeal nerve, suture-line edema

Introduction

Laimer's diverticulum is a rare pulsion pseudodiverticulum arising through Laimer's triangle, an anatomically weak region caudal to the cricopharyngeal muscle, between the cricopharyngeal and longitudinal esophageal muscles. Unlike Zenker's diverticulum, which arises more cranially, and Killian-Jamieson diverticulum, which occurs anterolaterally, Laimer's diverticulum originates from the posterior cervical esophagus [1-3]. Its true incidence has not been established because very few cases have been documented; therefore, a reliable numerical population incidence cannot be provided. Because the surgical strategy varies by the site of origin, accurate anatomical discrimination is important.

During open pharyngoesophageal diverticulectomy, direct dissection near the recurrent laryngeal nerve (RLN), traction on the larynx or thyroid gland, and manipulation near neural branches can place the RLN at risk [4,5]. Continuous intraoperative neuromonitoring (IONM) provides functional feedback during exposure, although its ability to prevent nerve injury cannot be established in an individual case. Excessive cervical esophageal manipulation and staple-line reinforcement may also contribute to local postoperative edema. We describe this case to illustrate an anatomy-guided approach to RLN preservation during Laimer's diverticulectomy and to discuss the clinical distinction between transient postoperative esophageal narrowing and impaired swallowing safety.

This case was previously presented at the 85th Annual Congress of the Japan Surgical Association in Okayama City, Okayama Prefecture, Japan (November 16 to 18, 2023).

Case Presentation

A 75-year-old man presented to an outside hospital in June 2021 with cervical discomfort. Upper gastrointestinal endoscopy demonstrated a cervical esophageal diverticulum; initially, only observation was selected because symptoms were mild. His sensation of food sticking after meals subsequently worsened, and he requested surgery. He was referred to our hospital in November 2022. His medical history included surgery for a gastric ulcer, myocardial infarction treated with coronary stent placement, and lumbar disc herniation.

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Upper gastrointestinal endoscopy identified a diverticulum in the left cervical esophageal wall, 17 cm from the incisors (Figure 1). Magnifying narrow-band imaging showed no abnormal vasculature, and Lugol staining showed no unstained area. Esophagography demonstrated a smooth left-sided outpouching measuring 45 × 30 mm (Figure 2). Contrast-enhanced computed tomography (CT) showed the diverticulum posterior to the left thyroid lobe without mural thickening or a mass (Figure 3). A pharyngoesophageal diverticulum was diagnosed preoperatively, and transcervical resection was planned.

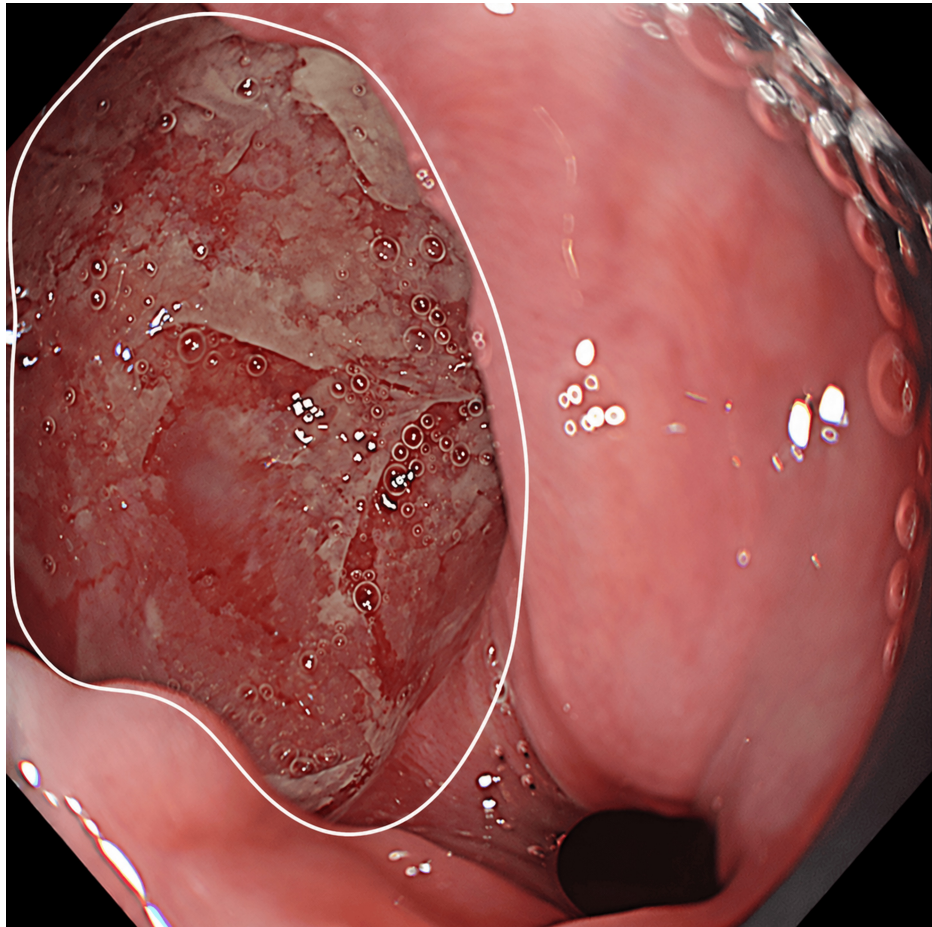


FIGURE 1: Preoperative upper gastrointestinal endoscopy reveals a cervical esophageal diverticulum containing retained food debris.

The true esophageal lumen was observed adjacent to the diverticular cavity.

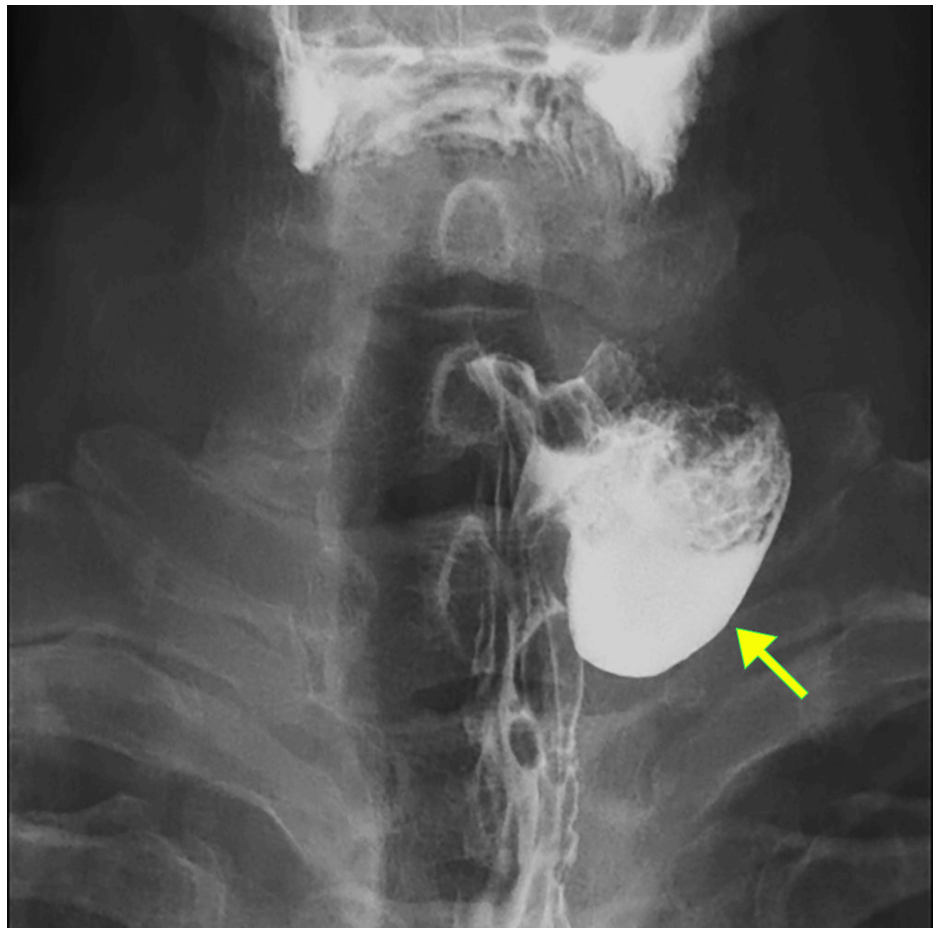


FIGURE 2: Preoperative esophagography demonstrates a left-sided cervical esophageal diverticulum measuring approximately 45 × 30 mm (arrow).

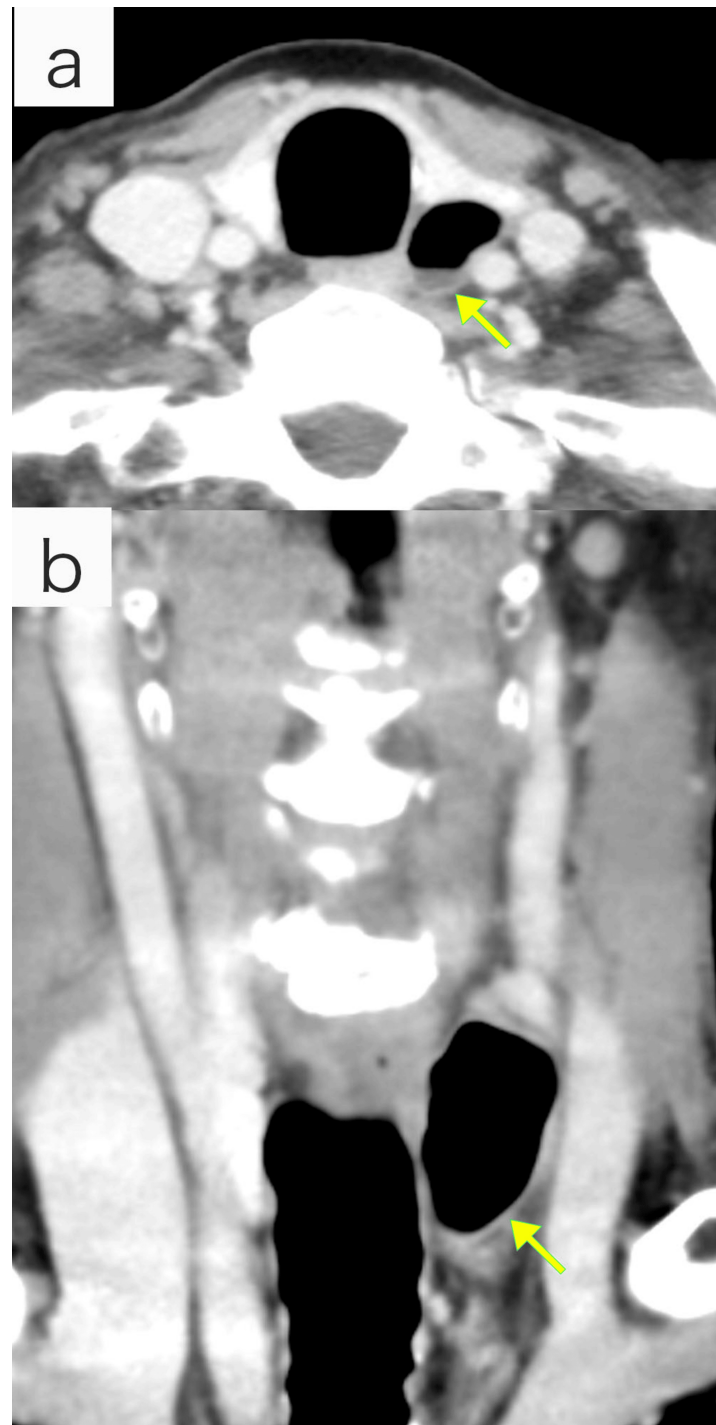


FIGURE 3: Preoperative contrast-enhanced computed tomography of the neck shows an air-containing diverticulum (arrows) posterior to the left thyroid lobe.

(A) Axial image. (B) Coronal image.

Approximately two months after being referred to our hospital, surgery was performed. A 7-cm oblique incision was made along the medial border of the left sternocleidomastoid muscle. After the carotid sheath was opened and the left vagus nerve identified, continuous IONM was established using an NIM Vital system (Medtronic plc, Galway, Ireland) and a 2-mm automatic periodic stimulation (APS) electrode placed on the left vagus nerve (Figure 4). Electrical stimulation was delivered at 1 Hz, and electromyographic amplitude and latency were monitored. Absolute baseline and final amplitude/latency measurements and numerical warning criteria were not available in the retained operative records.

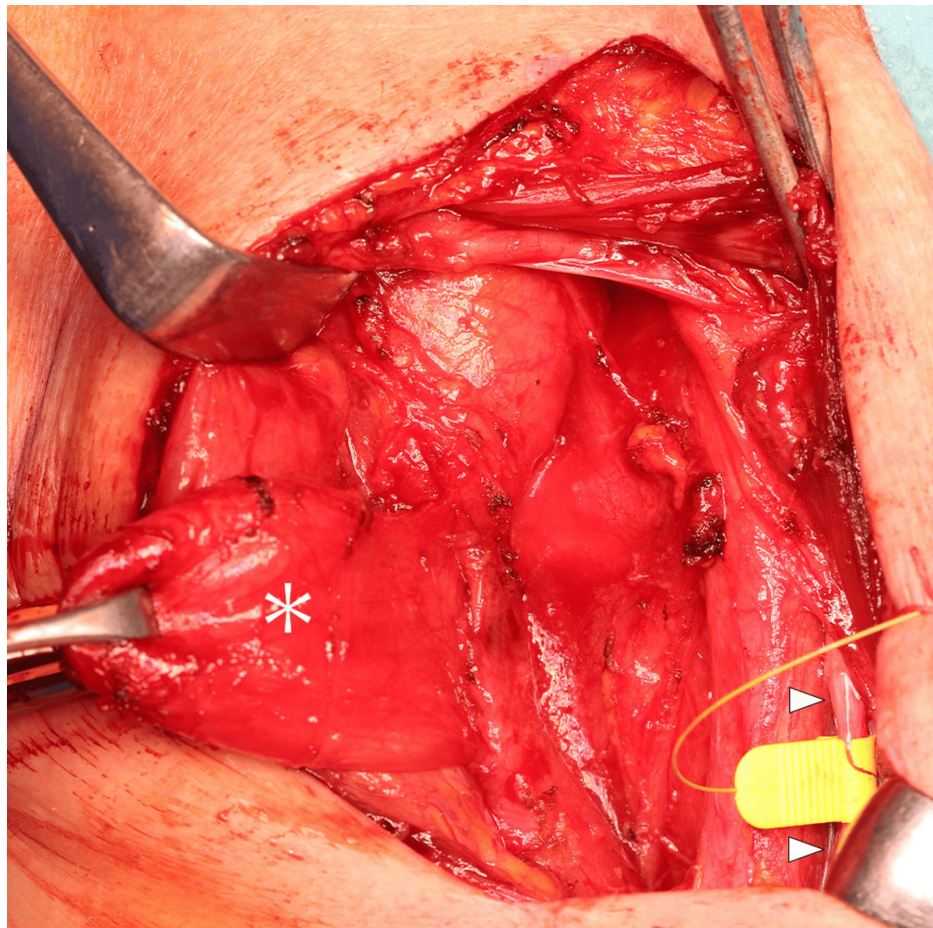


FIGURE 4: Continuous intraoperative neuromonitoring during diverticulectomy

An automatic periodic stimulation electrode was placed on the left vagus nerve for continuous intraoperative neuromonitoring (arrowheads). The diverticulum is indicated by an asterisk.

The posterior cervical esophagus was mobilized medial to the carotid sheath, and the left thyroid lobe was dissected to expose the diverticulum. The assistant retracted the larynx and thyroid gland toward the right, with traction limited to that required for exposure. The left RLN was identified on the medial aspect and preserved with careful dissection. The cricopharyngeal muscle lay cranial to the diverticulum, which arose between the cricopharyngeal and longitudinal esophageal muscles, establishing the intraoperative diagnosis of Laimer's diverticulum (Figure 5). No cricopharyngeal myotomy was performed.

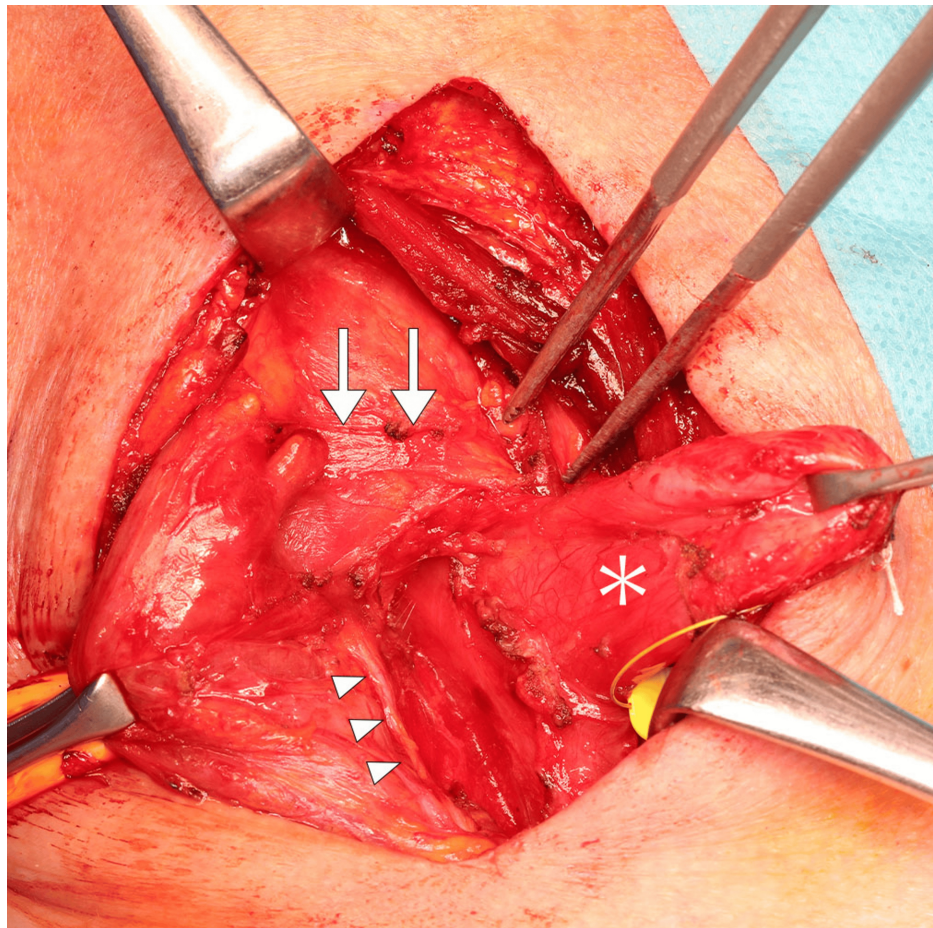


FIGURE 5: Intraoperative anatomical identification of Laimer's diverticulum.

The diverticulum (asterisk) arose from the cervical esophagus caudal to the cricopharyngeal muscle (arrows), confirming the diagnosis of Laimer's diverticulum. The left recurrent laryngeal nerve was identified and preserved under nerve monitoring (arrowheads).

After adequate exposure of the diverticular neck, longitudinal resection was performed with a powered Echelon 45 linear stapler (gold cartridge; Ethicon, Inc., Cincinnati, Ohio, United States) (Figure 6). Both ends of the staple line were reinforced with Z-sutures of 3-0 Polysorb (Medtronic plc), and the esophageal muscular layer was approximated using interrupted 3-0 Polysorb sutures (Figure 7). Intermittent stimulation was also used to reassess neural function; no intraoperative decline in the neural response was documented. A 15-Fr Blake drain was placed between the esophagus and the carotid sheath. A nasogastric tube used perioperatively was removed on POD 1. Operative time was 115 minutes, and blood loss was minimal.

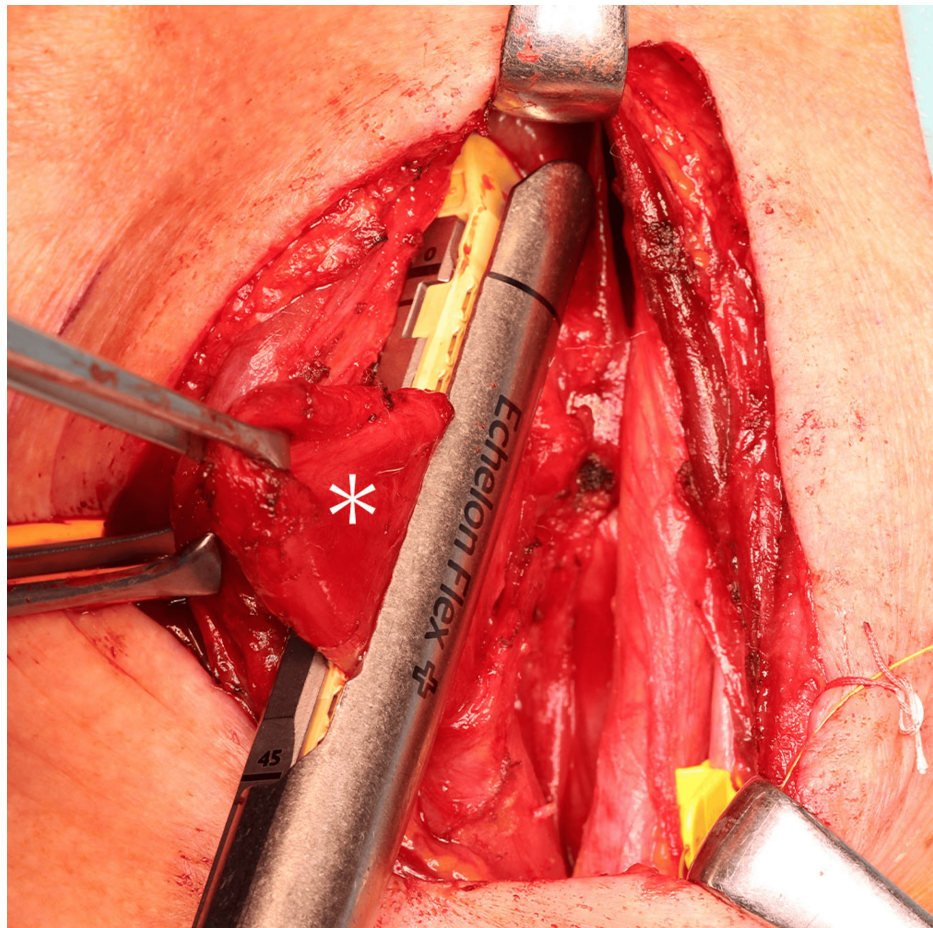


FIGURE 6: Resection of Laimer's diverticulum with a linear stapler.

After adequate mobilization and preservation of the recurrent laryngeal nerve, the diverticulum (asterisk) was resected longitudinally using a linear stapler.

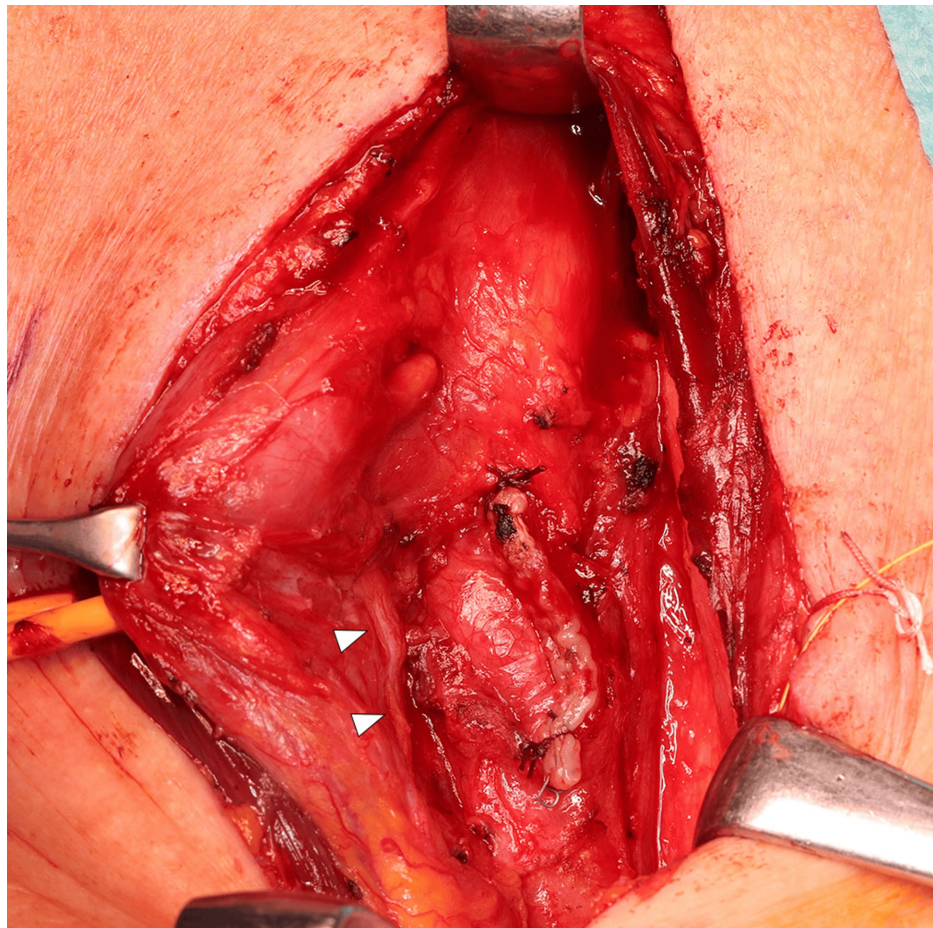


FIGURE 7: Operative field after diverticulectomy

The muscular layer of the cervical esophagus was reinforced with interrupted absorbable sutures after diverticulectomy. The left recurrent laryngeal nerve was preserved (arrowheads).

Histopathological examination of the resected specimen showed esophageal wall tissue lined by mildly thickened stratified squamous epithelium without evidence of malignancy or other significant histopathological abnormalities. Representative histopathological images could not be retrieved. The specific classification as Laimer's diverticulum was based on intraoperative anatomical relationships rather than a distinctive histological feature.

The patient left the intensive care unit on POD 1. Limited, supervised water-jelly trials were initiated on POD 4. On POD 6, esophagography demonstrated focal narrowing and delayed passage of contrast medium at the cervical esophageal staple/suture line without extraluminal contrast leakage (Figures 8A, 8B). Airway entry of contrast-containing jelly was also observed. Water-jelly trials were discontinued, and antibiotics were started for suspected aspiration pneumonia. On POD 7, fiberoptic endoscopic evaluation of swallowing showed a Hyodo score of 3 [6], without RLN palsy. Jelly-assisted swallowing therapy was initiated under supervision, but unrestricted oral intake was not resumed because esophageal passage and swallowing safety had not been established. CT on POD 7 showed no leakage around the suture line, and the cervical drain was removed. The initial antibiotic course ended on POD 11.

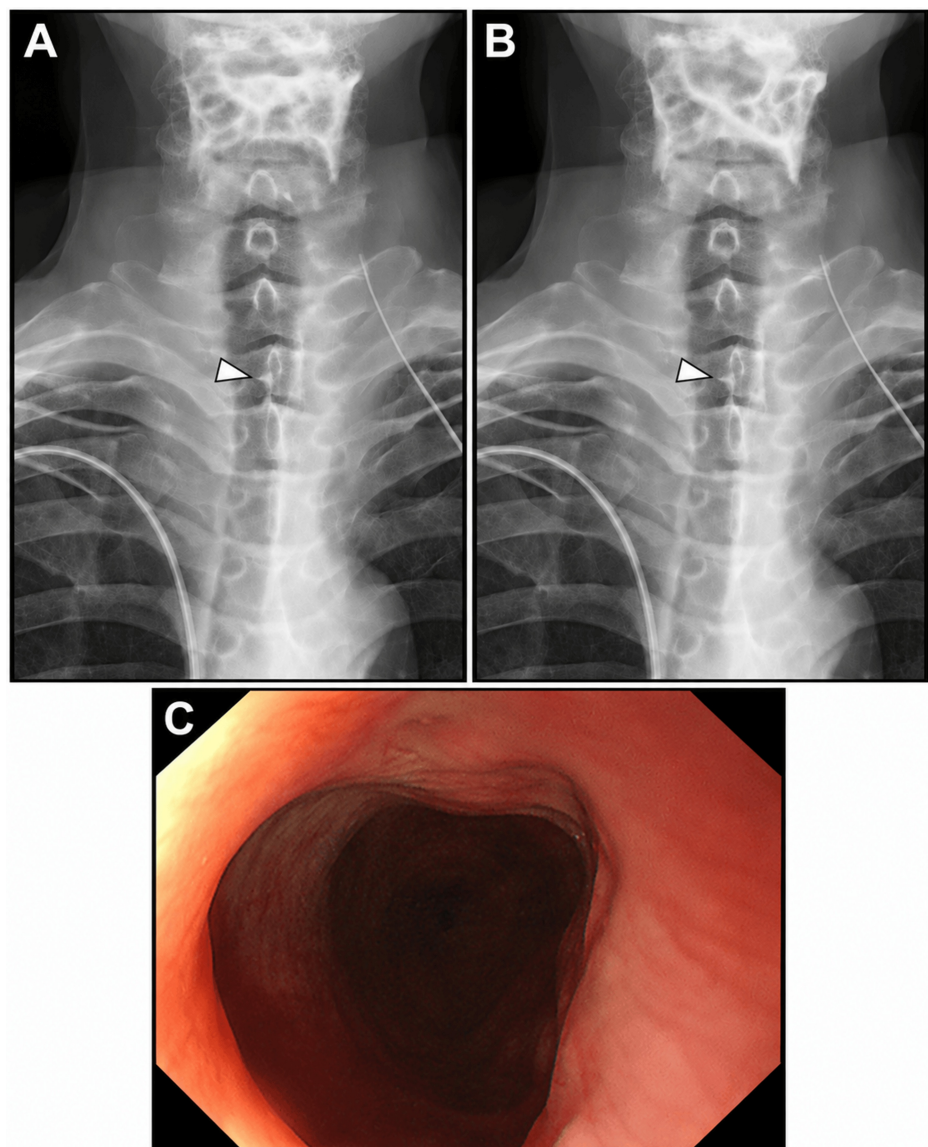


FIGURE 8: Postoperative evaluation of the cervical esophagus

(A, B) Esophagography performed on postoperative day 6 demonstrated focal narrowing and delayed passage of contrast medium at the cervical esophageal suture line (arrowhead), consistent with postoperative edema. No contrast extravasation was observed. (C) Upper gastrointestinal endoscopy performed on postoperative day 21 demonstrated a patent esophageal lumen without obvious fixed stenosis, supporting resolution of the transient postoperative narrowing.

Upper gastrointestinal endoscopy on POD 21 demonstrated a patent lumen, a linear staple line, and no fixed stenosis or resistance to passage of the endoscope (Figure 8C). Supervised water-jelly trials were restarted on POD 22. On POD 23, the patient developed a fever above 38°C, and CT revealed findings consistent with pneumonia; additional antibiotics were administered. On POD 28, repeat swallowing assessment yielded a Hyodo score of 9, and the patient continued swallowing rehabilitation and nutritional support. By POD 43, pneumonia had improved, but swallowing dysfunction with aspiration risk persisted. Total parenteral nutrition and mainly indirect swallowing therapy were continued, and he was transferred for further care on POD 44. Representative postoperative vital signs and laboratory findings are shown in Table 1.

Parameter	POD 1	POD 3	POD 5	POD 7	POD 11	POD 22	POD 32	POD 41	Unit	Reference range
Body temperature	36.6	36.6	37.0	36.8	36.4	36.5	36.7	36.5	°C	36.0–37.5
Heart rate	75	80	85	80	70	80	75	75	beats/min	60–100
Systolic blood pressure	145	140	135	125	140	130	135	130	mmHg	90–140
SpO ₂	97	97	98	97	97	98	98	99	%	≥95
WBC	14.92	16.48	9.20	9.90	7.89	6.63	9.12	9.42	×10 ³ /μL	3.3–8.6
Hemoglobin	13.6	13.9	11.8	11.9	12.4	12.9	12.1	12.5	g/dL	13.7–16.8
Platelet count	157	144	141	160	206	148	168	169	×10 ³ /μL	158–348
CRP	1.71	2.64	1.69	0.92	0.33	0.25	0.43	2.47	mg/dL	0.00–0.14
Total protein	6.6	6.7	6.1	6.3	6.5	6.3	5.9	6.4	g/dL	6.6–8.1
Albumin	3.4	3.7	3.3	3.4	3.4	3.4	3.1	3.1	g/dL	4.1–5.1
BUN	12.4	17.6	14.3	14.9	16.6	18.5	17.5	20.6	mg/dL	8.0–20.0
Creatinine	0.69	0.85	0.83	0.88	0.94	0.88	0.89	0.85	mg/dL	0.65–1.07
Sodium	136	140	141	140	140	141	142	141	mmol/L	138–145
Potassium	5	4	4	4	5	4	5	4	mmol/L	3.6–4.8
AST	23	47	28	24	24	25	23	27	U/L	13–30
ALT	11	16	13	15	18	22	19	28	U/L	10–42
LDH	183	247	211	213	191	174	169	173	U/L	124–222
ALP	64	58	51	55	55	66	58	69	U/L	38–113
GGT	22	28	31	30	30	34	25	39	U/L	13–64
Total bilirubin	0.7	1.1	0.7	0.8	0.4	0.7	0.5	0.8	mg/dL	0.4–1.5
PT	10.7	10.6	11.3	11.9	12.1	—	—	—	s	9.6–13.1
PT-INR	0.94	0.93	1	1.06	1.07	—	—	—	—	0.85–1.10
APTT	25.3	24.5	24.9	26.4	25.9	—	—	—	s	24.0–34.0

TABLE 1: Vital signs and laboratory findings during the postoperative course

SpO₂, peripheral oxygen saturation; WBC, white blood cell count; CRP, C-reactive protein; BUN, blood urea nitrogen; AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDH, lactate dehydrogenase; ALP, alkaline phosphatase; GGT, gamma-glutamyl transferase; PT, prothrombin time; PT-INR, prothrombin time-international normalized ratio; APTT, activated partial thromboplastin time; POD, postoperative day

A subsequent hospital admission was documented after the transfer. At the latest documented follow-up (POD 128), approximately four months after surgery, the patient was alive, and no swallowing dysfunction was noted.

Discussion

Pharyngoesophageal diverticula are classified according to their anatomical origin. Zenker’s diverticulum originates at Killian’s triangle between the inferior pharyngeal constrictor and cricopharyngeal muscles, whereas Killian-Jamieson diverticulum arises anterolaterally below the cricopharyngeal muscle. Laimer’s diverticulum arises posteriorly through Laimer’s triangle, caudal to the cricopharyngeal muscle [1-3,7]. Its incidence remains uncertain because of its exceptional rarity. In the present case, the intraoperative observation of the diverticular neck relative to the cricopharyngeal and longitudinal esophageal muscles was central to diagnosis; the histological description of squamous-lined esophageal tissue supported the nature of the resected specimen but was not specific for the Laimer subtype.

Anatomical distinction affects treatment. In Zenker’s diverticulum, cricopharyngeal myotomy is often considered because cricopharyngeal dysfunction contributes to pathogenesis [8,9]. Laimer’s diverticulum

arises caudal to the cricopharyngeal muscle, and routine cricopharyngeal myotomy may not be required. In this case, direct anatomical confirmation permitted diverticulectomy without myotomy.

Preservation of the RLN is a central technical concern. Open pharyngoesophageal surgery may expose the nerve to traction, dissection-related injury, or mechanical pressure during exposure [4,5]. Early vagus nerve identification, APS-based monitoring, intermittent neural assessment, and careful limitation of laryngeal traction were used. No deterioration in the intraoperative neural response was documented, and postoperative RLN palsy was not identified. Nevertheless, without a control and without retained quantitative baseline and final nerve-response measurements, it cannot be concluded that continuous IONM prevented nerve injury. The technique should be described as an adjunct for intraoperative functional assessment rather than a proven protective intervention in this single case.

Another important postoperative finding was temporary narrowing at the stapled and reinforced cervical esophagus. Intraoperative endoscopy or a luminal sizing device can help delineate a diverticular neck and residual esophageal caliber [10], but endoscopy was not used in this case because the diverticular boundary was clearly visualized. Tissue handling, traction, stapling, and reinforcement sutures may contribute to postoperative swelling; related postoperative edema has been described in other upper gastrointestinal procedures [11]. The absence of contrast leakage on POD 6 did not establish that the esophagus permitted satisfactory passage. Subsequent endoscopy on POD 21 demonstrated patency without fixed narrowing, supporting a transient rather than a fixed obstructive process; the exact mechanism of narrowing cannot be proved.

The postoperative course also illustrates why assessments of esophageal luminal patency and swallowing safety should be distinguished. Although the POD 7 endoscopic swallowing assessment showed a relatively low Hyodo score and no RLN palsy, the earlier contrast study documented airway entry of swallowed material. Therefore, unrestricted feeding was not considered safe, despite the absence of suture-line leakage. Subsequent pneumonia, worsening swallowing-assessment findings, and the need for rehabilitation were observed even after the esophageal lumen was shown to be patent. These findings should not be attributed exclusively to postoperative suture-line edema. At follow-up on POD 128, no swallowing dysfunction was noted; however, detailed dietary information and the status of diverticular recurrence remained unavailable.

For rare Laimer's diverticulum, operative identification of the relevant muscular anatomy and cautious RLN handling are essential. Avoiding unnecessary esophageal dissection and reinforcement, and reassessing both passage and swallowing before advancing oral intake, are reasonable considerations.

There are a few limitations to this report. The absolute baseline and final amplitude/latency measurements and numerical warning criteria are not available. Detailed information regarding the type of oral intake, objective assessment of diverticular recurrence, and any subsequent diverticulum-directed intervention is not available. The lack of histopathological images, unavailable quantitative IONM data, and limited follow-up information on oral intake and diverticular recurrence constrain the conclusions that can be drawn from this case.

Conclusions

A 75-year-old man underwent transcervical resection of Laimer's diverticulum with intraoperative identification and preservation of the left recurrent laryngeal nerve. Although no intraoperative deterioration in neural responses or postoperative RLN palsy was documented, transient cervical esophageal narrowing and subsequent swallowing-related complications required prolonged conservative management and rehabilitation. The esophageal lumen was confirmed patent on POD 21, but oral feeding remained restricted at transfer because aspiration risk persisted. By POD 128, no swallowing dysfunction was noted. Continuous IONM may support real-time functional assessment during dissection; this case alone does not demonstrate that it prevents nerve injury. Surgical planning should address both neural preservation and postoperative luminal patency and swallowing safety.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Yasuhiro Nagaoka

Acquisition, analysis, or interpretation of data: Yasuhiro Nagaoka

Drafting of the manuscript: Yasuhiro Nagaoka

Critical review of the manuscript for important intellectual content: Yasuhiro Nagaoka

Disclosures

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