

## A case presenting with myocardial ischemia-like electrocardiogram findings after laryngopharyngoesophagectomy

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Laryngopharyngoesophagectomy and reconstruction by using stomach roll with retrocardiac anastomosis were performed in a 60-year-old man with hypopharyngeal cancer. Postoperative electrocardiogram showed marked ST-segment elevation in leads I and aV<sub>L</sub> and depression in leads II, III, aV<sub>F</sub>, and V<sub>1–6</sub>. However, the patient did not present with abnormal findings on physical examination and vital signs were normal. Further, the laboratory data were normal. Echocardiography was a poor technique, but the stomach roll was observed to be expanded due to wall edema with exudates and exerted pressure on the posterior side of the heart. These findings were also ascertained by contrast-enhanced chest computed tomography scanning. Technetium-99m-tetrofosmin myocardial scintigraphy clearly showed that coronary blood perfusion and left ventricular wall motion were quite normal. The characteristic electrocardiogram returned to a near-normal state, and the expanded stomach roll shrank back to its ordinary size after one week. Coronary angiography showed neither organic stenoses nor vasospasm. The physical pressure of the expanded stomach roll might have influenced the electrocardiogram findings.

**Key words:** pseudomyocardial infarction, esophagectomy, electrocardiography, technetium-99m-tetrofosmin

### INTRODUCTION

THE ELECTROCARDIOGRAM (ECG) of patients with esophageal disorders sometimes show ST-T changes that resemble those of myocardial ischemia.<sup>1–4</sup> Although these ECG findings do not cause any problems or prove to be fatal in routine life, the fear of coexisting diseases such as acute coronary syndrome (ACS) result in anxiety during diagnosis. When patients with esophageal disorders have multiple coronary risk factors or a history of ischemic heart diseases, the accurate diagnosis of these myocardial ischemia-like ST-T changes becomes more difficult. Thus, coronary angiography (CAG) would have to be performed as the final alternative to rule out the possibility of ACS. However, CAG must be avoided whenever possible because when compared with other examinations, it is

considerably more invasive and poses a higher risk. We report a case in which ACS was mimicked after esophagectomy during the perioperative period. Further, technetium-99m-tetrofosmin (<sup>99m</sup>Tc-tetrofosmin) myocardial scintigraphy was very useful for diagnosis in this case.

### CASE REPORT

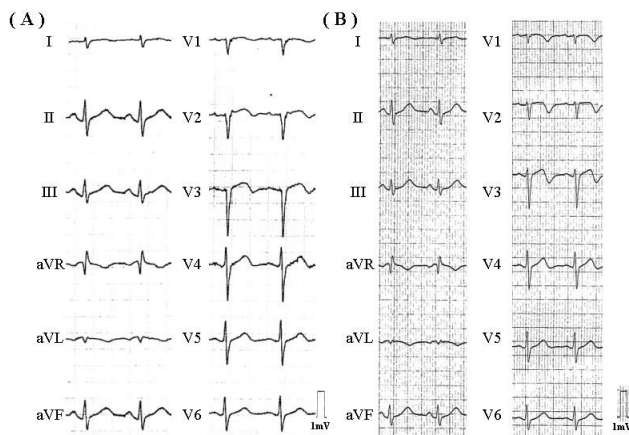
A 60-year-old man was admitted to our hospital to undergo surgery for hypopharyngeal cancer. The patient did not present with preoperative ischemic heart disease, diabetes, hyperlipidemia, or hypertension; however he was a long-term heavy smoker (60 cigarettes/day × 30 years). Preoperative ECG was within the normal range (Fig. 1A). Laryngopharyngoesophagectomy and reconstruction by using stomach roll with retrocardiac anastomosis were performed. The surgery was completed without altering blood circulation and without evident changes in the ECG monitored by lead II.

On admission to the intensive care unit, postoperative ECG showed marked ST-segment elevation (maximum: 4 mm) in leads I and aV<sub>L</sub> and depression (maximum: 5

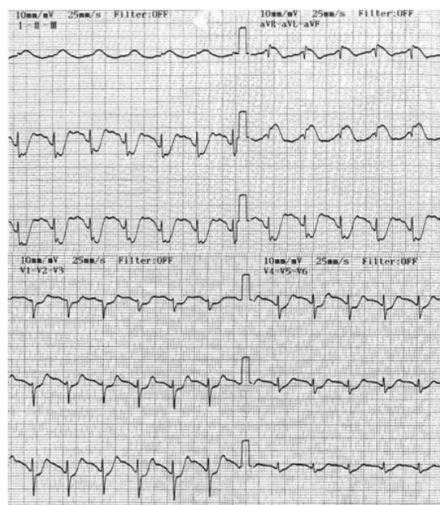
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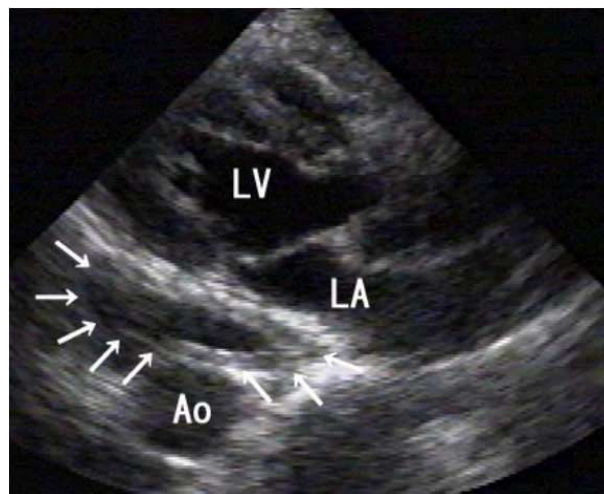


**Fig. 1** (A) Preoperative electrocardiogram was within the normal range. (B) Electrocardiogram was normalized one week after the surgery.

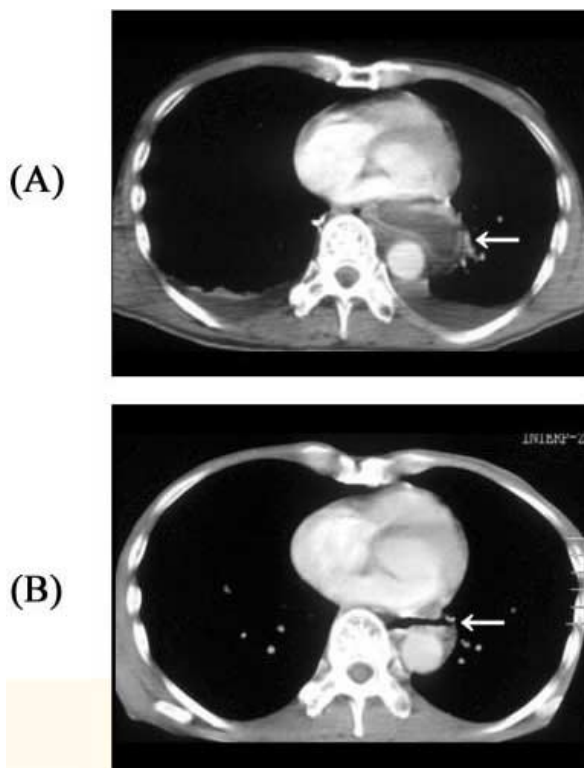


**Fig. 2** Marked ST-segment elevations in the I and aVL electrodes and depressions in the II, III, aVF, and V1-6 electrodes in the electrocardiogram immediately after the surgery.

mm) in leads II, III, aVF, and V1-6 (Fig. 2). We were unable to confirm the chest symptoms because the patient was still under anesthesia. Physical examination revealed no abnormal findings, and vital signs were normal. Sufficient evaluation of complete left ventricular asynergy was not possible by transthoracic echocardiography (TTE) because a poor echo image was obtained due to the presence of pulmonary emphysema. However, the stomach roll, which was reconstructed from the stomach and pulled upwards with retrocardiac anastomosis, expanded due to wall edema and exudates, and it exerted pressure on the posterior side of the heart, as shown in the TTE image (Fig. 3). The unprecedented findings were also ascertained by contrast-enhanced chest computed tomography (CT) scanning (Fig. 4A). Serial laboratory data that included cardiac enzymes, electrolytes, amylase, and lipase

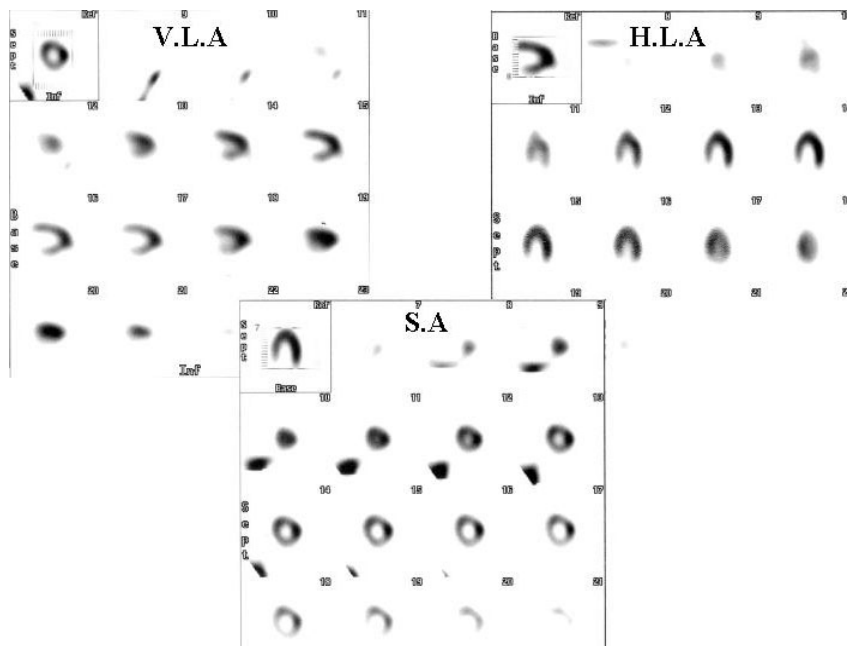


**Fig. 3** Transthoracic echocardiogram showed that the stomach roll was expanded due to wall edema with exudates and exerted pressure on the posterior side of the patient's heart (arrows). Ao: descending aorta, LA: left atrium, LV: left ventricle.

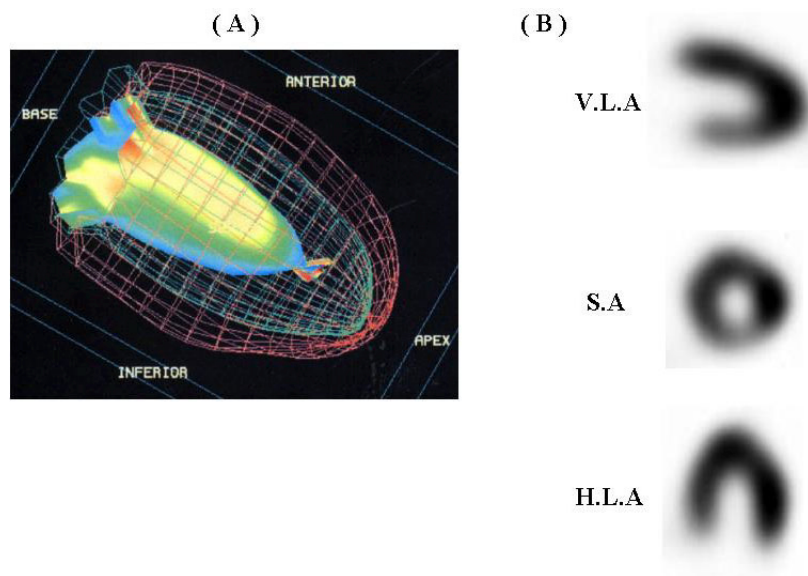


**Fig. 4** (A) Contrast-enhanced chest CT scanning performed immediately after the surgery. The stomach roll was expanded due to wall edema with exudates and exerted pressure on the posterior side of the heart (arrow). (B) Contrast-enhanced chest CT scanning performed one week after the surgery. The expanded stomach roll had shrunk back to its normal size (arrow).

were within the normal ranges. We performed  $^{99m}\text{Tc}$ -tetrofosmin (Nihon Medi-Physics Co., Ltd., Nishinomiya, Japan) myocardial scintigraphy to completely rule out the



**Fig. 5** The SPECT images of technetium-99m-tetrofosmin revealed absolutely normal perfusion in the left ventricle. V.L.A: vertical long axis, S.A.: short axis, H.L.A: horizontal long axis.

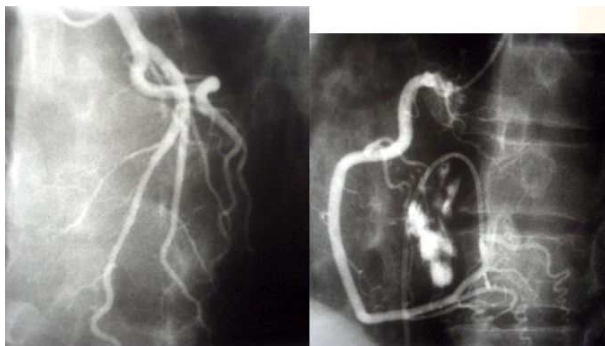


**Fig. 6** (A) The images of quantitative gated SPECT showed no wall motion abnormalities. (B) The SPECT images of  $^{123}\text{I}$ -15-(*p*-iodophenyl)-3-*R,S*-methylpentadecanoic acid revealed absolutely normal fatty acid metabolism in the left ventricle. V.L.A: vertical long axis, S.A.: short axis, H.L.A: horizontal long axis.

possibility of postoperative ACS. 740 MBq of  $^{99\text{m}}\text{Tc}$ -tetrofosmin was intravenously injected and image acquisition (PRISM IRIX, Marconi Medical Systems, Inc., Cleveland, Ohio) was begun 30 minutes after the injection of a tracer. Single photon emission computed tomography (SPECT) images of  $^{99\text{m}}\text{Tc}$ -tetrofosmin showed absolutely normal perfusion in the left ventricle (Fig. 5), and the quantitative gated SPECT (QGS) images showed no wall

motion abnormalities either (Fig. 6A). The ECG did not show any changes during the scintigraphic examination. Based on the cardiac scintigraphy findings, we decided against performing emergency CAG at that time. We also performed  $^{123}\text{I}$ -15-(*p*-iodophenyl)-3-*R,S*-methylpentadecanoic acid ( $^{123}\text{I}$ -BMIPP; Nihon Medi-Physics Co., Ltd., Nishinomiya, Japan) myocardial scintigraphy on the 2nd postoperative day and ascertained normal accumulation





**Fig. 7** The images of coronary angiography after intracoronary administration of acetylcholine (50  $\mu$ g for the right coronary artery and 100  $\mu$ g for the left coronary artery) are shown. Coronary vasospasm was not provoked and no organic stenoses were observed. *Left panel:* left coronary artery at the cranial 30° view. *Right panel:* right coronary artery at the left anterior oblique 30° view.

of the tracer (Fig. 6B).

Such ST-segment changes observed in the ECG of acute phase gradually returned to the baseline without showing any coronary T waves from day to day. Seven days postoperatively, the characteristic ECG reverted to a near-normal state; this result was quite normal (Fig. 1B). The expanded stomach roll gradually shrank back to its normal size (Fig. 4B). A CAG performed on the 13th postoperative day did not demonstrate any organic stenoses or vasospasm, which is provoked by acetylcholine (Fig. 7; 50  $\mu$ g for the right coronary artery and 100  $\mu$ g for the left coronary artery). Left ventriculography did not reveal wall motion asynergy either. During the patient's clinical course, his circulatory state was stable, and the creatine kinase-MB titer remained low. No subjective chest symptoms, such as chest pain or dyspnea, were observed after he emerged from anesthesia.

## DISCUSSION

There are several reports on the ECG findings mimicking ACS after esophagectomy<sup>2-4</sup> and those ST-segment changing patterns are polymorphic. However, a case of esophagectomy with retrocardiac reconstruction is rare. Kamimura<sup>2</sup> and Sonoda<sup>3</sup> et al. reported that a large volume of air in the reconstructed esophagus might cause such myocardial ischemia-like ECG changes during the perioperative period of esophagectomy with retrosternal reconstruction because the heart moves toward and away from the sternum during the cardiac cycle. They also concluded that such ECG changes cannot be produced by a retrocardiac reconstruction because the heart will not move; however, even in this case of retrocardiac reconstruction, we observed myocardial ischemia-like ECG changes. Furthermore, unlike the reported case of

retrosternal reconstruction,<sup>2</sup> the ST-segment changing patterns of precordial leads observed in the present case were entirely symmetrical to that case. In that reported case, ST-segment elevation was observed in leads V<sub>1</sub> to V<sub>4</sub> while depression was observed in leads II, III, and aV<sub>F</sub>. The symmetrical ST-T segment changing patterns would depend on the relative location of the heart and the shifting of the stomach roll due to the retrocardiac or retrosternal reconstruction method. Ferrari<sup>4</sup> reported an unusual ECG finding in a patient with total esophagectomy, i.e., an electrical activity of gastric contractions because the stomach was positioned in the anterior mediastinum as a result of the surgery. In this case, however, the stomach roll was located in the posterior mediastinum and an undulating baseline of ECG—believed to be an electrical activity of gastric contractions—was not observed. Considering these facts and the sudden disappearance of the ST-segment changes after the decrease in massive exudates in the stomach roll, we hypothesize that the mechanical and chemical influences exerted by the expanded stomach roll on the partial pericardium might have caused these ST-segment changes mimicking myocardial ischemia after esophagectomy; however the details remain unclear.

Perioperative cardiac complications occur frequently in thoracic and upper abdominal surgery,<sup>5,6</sup> particularly in esophageal surgery.<sup>7</sup> Therefore, under emergency conditions such as the present case, we must accurately interpret whether these perioperative myocardial ischemia-like ECG findings are due to ACS or not. However, in the present case, we were unable to confirm the patient's chest symptoms because he was still under anesthesia and laboratory data are rarely helpful in a hyperacute stage of ACS. In addition, the left ventricular wall motion could not be assessed accurately using TTE because poor echo images were obtained due to pulmonary emphysema. When required, <sup>99m</sup>Tc-tetrofosmin can be rapidly prepared in a hospital<sup>8</sup>; therefore, the SPECT and QGS images could be obtained immediately in this case and a prompt and accurate diagnosis was possible by the exclusion of ACS on the basis of normal blood perfusion and wall motion. We could also affirm the absence of myocardial ischemia from the normal <sup>123</sup>I-BMIPP scintigraphy findings on the 2nd postoperative day because they did not show any ischemic memory images.<sup>9</sup> Currently, CAG is an indispensable method for the diagnosis of ACS; however, it is invasive and many complications are associated with it. In the present case, we were able to avoid CAG at the perioperative acute stage, and the emergency <sup>99m</sup>Tc-tetrofosmin scintigraphy method was performed instead. Emergency myocardial scintigraphy with <sup>99m</sup>Tc-tetrofosmin is reported to be useful for diagnosis for patients with ACS.<sup>10</sup> In addition, we believe that it is very useful in diagnosing cases of pseudomyocardial infarction.

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