A Case of Esophageal Cancer With Right Vertebral Artery Variation Observed During Thoracoscopic Esophagectomy

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Case report

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Abstract

Background

Variation of the vertebral artery bifurcation is rare. This branching abnormality can make it difficult to identify the recurrent laryngeal nerve (RLN) during thoracoscopic esophagectomy. There are a few reports on abnormal branching of the vertebral artery but none related to esophagectomy. We report the case together with the results of the evaluation of vertebral artery bifurcation and length in 50 patients with esophageal cancer in our hospital.

Case presentation

Thoracoscopic esophagectomy was performed on a 70-year-old patient with esophageal cancer. During lymph node dissection, an unusual blood vessel was found running along the right subclavian artery (RSA). This blood vessel made it difficult to identify the right RLN. We determined this blood vessel to be the right vertebral artery (RVA) branching far more centrally than usual. Because this anatomical abnormality was clarified, we could then recognize that the right RLN coursed around the RVA and the RSA and thus was running in a larger arch than usual.

Conclusion

Knowledge of such anatomical variation is important in thoracoscopic esophagectomy to prevent iatrogenic injury of the RLN and the vertebral artery.

Background

The vertebral artery usually takes its origin from the subclavian artery and ascends to enter the transverse foramen of the sixth cervical vertebra [1]. Different variations in the origin of the vertebral artery can make it difficult to identify the recurrent laryngeal nerve (RLN) during thoracoscopic esophagectomy. There are some reports on variations of vertebral artery bifurcation, but none as they relate to esophagectomy [2–6].

Knowledge of such anatomical variation is important in thoracoscopic esophagectomy to prevent iatrogenic injury of the RLN and the vertebral artery.

Case Presentation

A 70-year-old man with a height of 161.0 cm, weight of 54.6 kg, and body mass index of 21.0 kg/m² complained of difficulty in swallowing a meal and was referred from another hospital. He was diagnosed as having thoracic esophageal cancer (T3N1M0, Stage IIIA). We performed thoracoscopic esophagectomy after chemotherapy. The thoracoscopic operation time was 299 minutes, and blood loss was 20 ml. During lymph node dissection around the right RLN, an unusual blood vessel was found running along the right subclavian artery (RSA). We confirmed from a preoperative contrast-enhanced

computed tomography (CT) image that the blood vessel was the right vertebral artery (RVA), which was very long at 7.02 cm. Because this anatomical abnormality was clarified, we could recognize that the right RLN coursed around the RVA and the RSA and thus was running in a larger arch than usual. As a result, lymph node dissection could be performed safely without damaging the right RLN, and no metastasis was found in the excised station number of 106recR (Fig. 1).

Discussion

The RSA branches from the brachiocephalic artery, runs laterally across the anterior and middle oblique muscles, and bifurcates into the RVA as its first branch. The RVA often enters the transverse process of the sixth cervical vertebra after bifurcation. In the presented case, the RVA branched from the RSA at a very central location, so it appeared in the surgical field during lymph node dissection around the right RLN as an unusual blood vessel running along the RSA. This unusual anatomical variant complicated the identification of the right RLN and had the potential for causing damage. The vertebral artery is anatomically classified into four segments, and that from the bifurcation of the RSA to the transverse process of the vertebral body is called the V1 segment [7]. In this patient, V1 of the left vertebral artery (LVA) was 3.78 cm long, whereas V1 of the RVA was 7.02 cm. In a study of 266 cases, Woraputtaporn et al. reported that the average length of the RVA and LVA V1 segments was 3.88 ± 1.14 cm [8]. The V1 segment of the vertebral artery of 50 esophageal cancer patients operated on at our hospital was measured on contrast-enhanced CT images. The average length of the RVA was 3.69 cm, and that of the LVA was 4.14 cm, which were almost the same as those reported by Woraputtaporn et al. (Fig. 2). Various variations have been reported at the origin of the RVA, and Newton and Potts classified them into six types [9]. Type A, which branches within 2 cm from the thyrocervical trunk, is reported to be the most common at 83.12%, and Type B, which branches more than 2 cm away from the thyrocervical trunk, is much less common at 8.27% (Fig. 3).

In the 50 patients with esophageal cancer in our hospital, Type A was seen in 45 patients (90%) and Type B, including that in the presented case, was seen in 5 patients (10%), which were almost the same proportions as those reported by Newton and Potts. The length of the V1 segment was compared and examined between Type A and B, and the results are expressed as the median (interquartile range) for quantitative variables. The nonparametric Wilcoxon rank sum test was used for continuous variables. A *p* value of less than 0.05 was considered to be statistically significant. The median length of the Type B RVA was 5.05 cm, which was significantly longer than the 3.56 cm measured in the Type A RVA, and it was proved that the length of the blood vessel was not affected by patient height or weight (Table 1). Type B was considered to be longer than Type A because the RVA branched from the central side of the RSA. In the present patient, the RVA branched especially from the very central side of the RSA and was a very long Type B artery of 7.02 cm in length. The V1 segment of the Type B RVA may be visible in the surgical field during lymph node dissection around the right RLN in thoracoscopic esophagectomy; therefore, attention should be paid to misidentification of the right RLN and the potential for damage to the vertebral artery.

Table 1
Median length of vertebral artery, height and weight of 50 patients in our hospital

	Type A	Type B	PValue
Number of cases	n = 45	n = 5	
Length of RVA (cm)	3.56 [1.87–5.24]	5.05 [4.12–7.02]	0.0020
Length of LVA (cm)	3.96 [2.05–8.89]	4.47 [3.78–5.08]	0.1501
Height (cm)	162.0 ± 1.30	166.9 ± 1.53	0.2014
Weight (kg)	53.2 ± 1.72	55.9 ± 4.28	0.3483
<i>RVA</i> right vertebral artery, <i>LVA</i> left vertebral artery			

This study has been approved by the Gifu University Ethics Committee (approved ID: 2020 – 172).

Conclusion

We report a case in which the right RLN could have potentially been misidentified due to an abnormal bifurcation of the RVA. Knowledge of such anatomical variation is important in thoracoscopic esophagectomy to prevent iatrogenic injury of the RLN and to perform lymph node dissection safely.

Abbreviations

RLN
recurrent laryngeal nerve; RSA:right subclavian artery; RVA:right vertebral artery; CT:computed tomography; LVA:left vertebral artery

Declarations

Ethics approval and consent to participate

This case report was approved by the ethics committee of Gifu University School of Medicine.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Availability of data and materials

Not applicable

Competing interest

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Authors' contributions

YS drafted the manuscript. KY and YT performed the operation. TI and YH participated in the operation. NO, NM and TT provided academic advice. All authors read and approved the final manuscript.

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Tables

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RVA right vertebral artery, LVA left vertebral artery			

Figures

Figure 1

An unusual blood vessel running along the right subclavian artery was found during a thoracoscopic esophagectomy. a The right vagus nerve (white arrow) running on the dorsal side of the right subclavian artery (white arrowhead). b An unusual blood vessel (black arrow) was found on the ventral side of the right recurrent laryngeal nerve (black arrowhead). c Surgical field after dissection was completed

Figure 2

The vertebral artery from the bifurcation of the right subclavian artery (black arrow) to the transverse process of the sixth vertebral body (white arrow) is called segment V1

Figure 3

In Type A, the RVA branches within 2 cm from the thyrocervical trunk, whereas in Type B, the RVA branches more than 2 cm away from the thyrocervical trunk

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