

Case Report

Prone-Position Thoracoscopic Ligation of the Thoracic Duct for Chyle Leak Following Radical Neck Dissection in a Patient with a Right Aortic Arch

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A chyle leak can occur as a complication after neck or chest surgery. Such a leak prolongs the hospital stay and is sometimes life-threatening. The treatment options are conservative management, interventional radiologic embolization, and surgery. Thoracoscopic ligation of the thoracic duct has emerged as a promising and definitive treatment. The case of a 65-year-old Japanese male patient with a rare congenital right aortic arch (type III B1 of Edward's classification) and a severe chyle leak that occurred after a total pharyngolaryngo-esophagectomy (TPLE) is described. The chyle leak was successfully managed by thoracoscopic ligation of the thoracic duct via a left-side approach with the patient in the prone position.

Key words: chyle leak, thoracic duct, thoracoscopy, prone position

A chyle leak is a rare but troublesome complication after neck or chest surgery [1-6]. Such a leak follows injury to the thoracic duct or one of its major tributary branches. Surgical ligation with thoracotomy is a reliable treatment. Thoracoscopic ligation of the thoracic duct has emerged as a promising and definitive treatment for chyle leaks [7-12]. Typically, the thoracoscopic ligation is performed via a right-side thoracoscopic approach (as for thoracoscopic esophagectomy), because the thoracic duct is normally located on the right side of the descending aorta in the middle and lower mediastinum. In the present case, the procedure was difficult because the patient's descending aorta was located on the right

side of the thoracic duct due to the right aortic arch. A good surgical view anatomically via a right-side thoracoscopic approach could not be achieved. A right aortic arch is a rare congenital malformation that occurs at a frequency of about 0.1% [13, 14]. Here we describe a successful ligation of the thoracic duct in a patient with a right aortic arch via a left-side thoracoscopic approach with the patient in the prone position.

Case Report

A 64-year-old Japanese male with Stage IVA hypopharyngeal cancer underwent neoadjuvant chemotherapy consisting of 5-fluorouracil and nedaplatin. He

underwent an uneventful total pharyngolaryngo-esophagectomy (TPLE) and radical neck dissection by the head and neck team to remove the tumor after chemotherapy, and he left the intensive care unit (ICU) on the 3rd postoperative day. The chyle leak in the cervical region occurred after his discharge from the ICU. Conservative therapy and 3 surgical procedures to ligate the duct via a cervical approach were attempted, but the chyle leak was uncontrollable and continued at over 1,000 mL/day (Fig. 1). The interventional radiologic (IVR) team examined the lymphangiography findings and attempted thoracic duct embolization twice but failed. We were thus consulted by the head and neck team regarding surgical ligation of the thoracic duct to control the chyle leak.

Three-dimensional CT angiography showed that the patient had a rare aortic malformation: a right aortic arch Type III B1 of Edward's classification. The aortic diverticulum called Kommerell's diverticulum and the aberrant left subclavian artery branching off from it were identified (Fig. 2A). Lymphangiography and CT lymph angiography showed that the thoracic duct was injured in the cervical region and was located on the normal route in the mediastinum: on the right side of the middle and lower mediastinum and on the left side of the upper mediastinum. However, the descending aorta was located on the right side of the thoracic duct in the middle and lower mediastinum (Fig. 2B-E), and thus the ordinary right-side transthoracic approach could not provide a good surgical view anatomically to

detect and ligate the thoracic duct.

After discussion, we performed a thoracoscopic ligation of the thoracic duct via a left-side approach with the patient in the prone position on the 35th day after the first operation. The operative procedure was as follows. A 12-mm port for the operator's right hand was inserted into the seventh intercostal space on the posterior axillary line with 8-mmHg pneumothorax. A 12-mm camera port was then inserted into the ninth intercostal space on the lower scapular line. A 5-mm port for the operator's left hand was inserted into the fifth intercostal space on the posterior axillary line, and a 12-mm port for the assistant was inserted into the third intercostal space on the middle axillary line. A small pleural effusion was observed, but adhesions and other inflammatory changes were not observed.

The parietal pleura was cut open in the upper mediastinum, and the aortic diverticulum (called Kommerell's diverticulum) and the aberrant left subclavian artery branching off from it were identified. The thoracic duct was identified between the aberrant left subclavian artery and the vertebral bodies (Fig. 3A) and ligated with Hem-o-lok[®] polymer clips (Teleflex, Limerick, PA, USA). We dissected the thoracic duct and confirmed the lumen to be ensure that the thoracic duct was ligated (Fig. 3B). The chyle leak decreased immediately after the operation (Fig. 1). All drains were removed on the third day after ligation. No recurrence was seen after the beginning of enteral feeding.

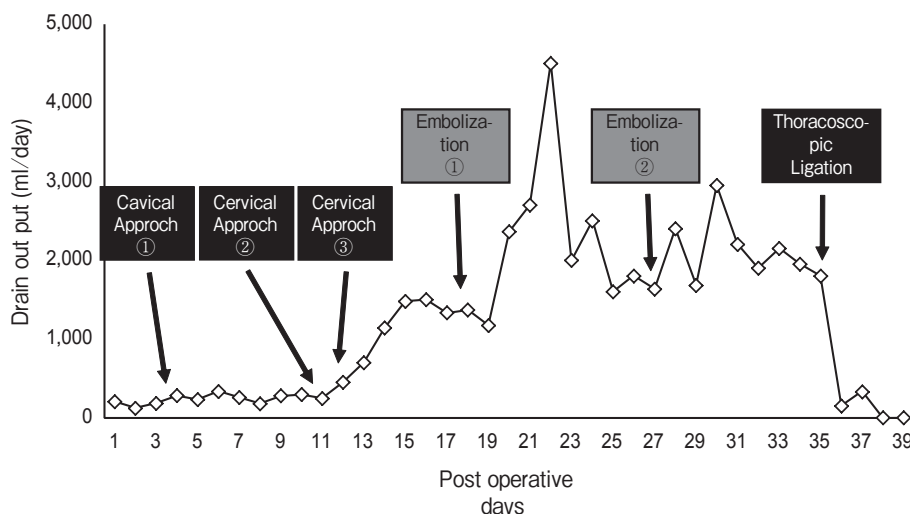


Fig. 1 Treatment progress and total drain output changes.

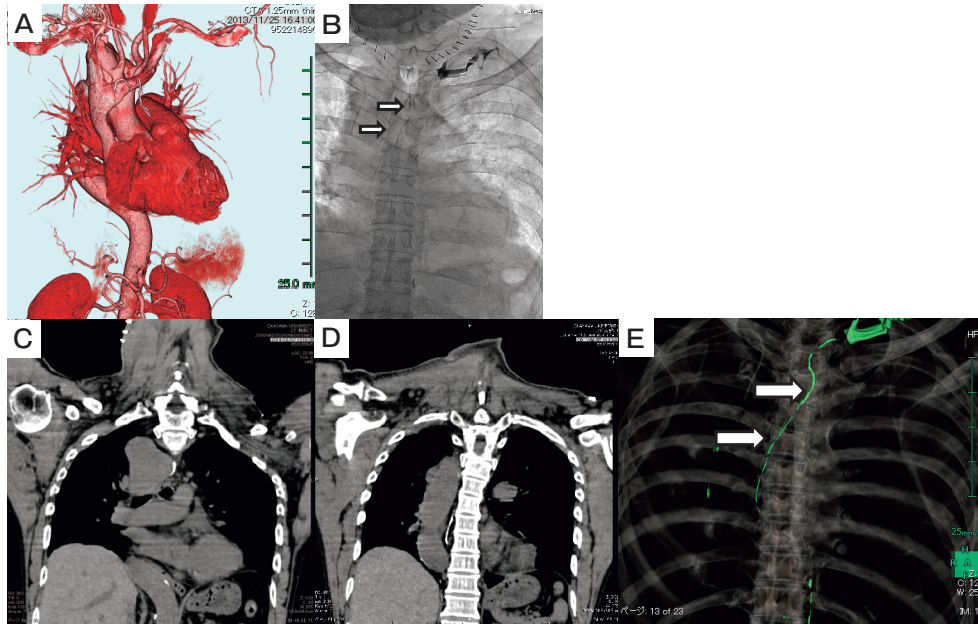


Fig. 2 CT and Lymphangiography findings. (A) Three-dimensional CT angiography shows the right aortic arch and the aberrant left subclavian artery. (B) Lymphangiography shows the normal location of the thoracic duct and the chyle leak in the cervical region. (C, D) CT shows the normal location of the thoracic duct and the abnormal location of the aorta. (E) CT lymphangiography clearly shows the location of the thoracic duct.

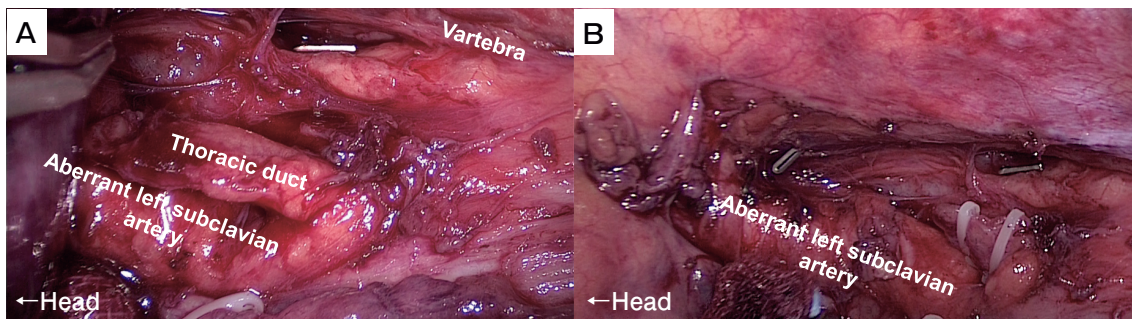


Fig. 3 Operative findings during thoracoscopic surgery in the prone position. (A) Separation of the thoracic duct from the aberrant left subclavian artery and vertebral bodies. (B) After dissection and resection of the thoracic duct.

Discussion

A chyle leak is a rare but potentially life-threatening complication after neck or chest surgery, with a reported incidence of 1%–2.5% [15]. Initial treatment is conservative, including the use of intestinal nutrition with medium-chain triglycerides (MCTs) and free fat, total parenteral nutrition (TPN), and the somatostatin analogues orlistat and etilefrine [15]. Wound exploration and fistula ligation often fail to stop a chyle leak. Thoracic duct embolization using the

IVR technique was recently introduced as a minimally invasive approach. Embolic therapy is performed via percutaneous transabdominal cannulation. However, its efficacy is not sufficient to replace the surgical procedure [16–18]. Surgical ligation of the thoracic duct is still thought to be the most reliable therapeutic method for a severe chyle leak [7–12].

Surgical ligation is ordinarily performed via a right-side transthoracic approach because the thoracic duct is located on the right side of the middle and lower mediastinum in almost all cases, but there are

several variations of it at the upper mediastinum [19]. This procedure has been performed via thoracoscopy [12, 20]. In the present case, the preoperative radiological findings showed that the patient had a rare, congenital aortic malformation, a right aortic arch Type III B1 of Edward's classification. Lymphangiography and CT lymphangiography showed that a good surgical view could not be obtained via a right-side thoracoscopic approach. Therefore, the thoracoscopic ligation was performed via a left-side approach with the patient in the prone position. Advances in thoracoscopic surgery using the prone position have been remarkable, especially for esophagectomy [21, 22]. The biggest advantage of the prone position is the good view of the surgical field. With the patient in the prone position, the heart and lungs can be displaced by gravity and the artificial pneumothorax.

We have also reported the ergonomic usefulness of thoracoscopic surgery using the prone position for esophagectomy [23]. In the present case, the technique of thoracoscopic esophagectomy in the prone position was used for ligation of the thoracic duct, and these benefits allowed successful ligation of the thoracic duct and a good postoperative course.

Conclusion

The successful thoracoscopic ligation of the thoracic duct to stop a severe chyle leak in a patient with a right aortic arch was described. Thoracoscopic surgery using the patient-prone position also has the potential to become a useful surgical approach for such a rare complication because of its minimal invasiveness, good surgical field, and reduced ergonomic burden for the surgeon.

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