



## Unexpected Right Side Chyle Leak in Neck Dissection

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### Abstract

Chyle leak is a known iatrogenic complication of neck surgery associated with serious sequelae, although it is not common. It usually occurs on the left side; however, chyle leaks from the right-sided lymphatic system have been reported in a few cases.

A high level of vigilance in the intraoperative identification and treatment of chyle leaks and a high degree of suspicion in the postoperative period during patient monitoring play an important role in preventing metabolic, nutritional, and immunological consequences and reducing the length of hospital stay.

In this study, we share our experience in the management of a rare right chyle leak after neck dissection in a patient with papillary thyroid carcinoma.

**Keywords:** Chyle Leak; Thoracic Duct; Lymphatic Duct; Head and Neck Surgery; Low Output

### Introduction

Since 1875, when Cheever's first case was published [22], many studies have been conducted to show how common chyle leak is associated with head and neck surgery and whether it is associated with risk factors such as the type of surgery, the cancer stage, the patient age, etc.

Anatomically, the final two common vessels of the lymphatic system are the right lymphatic duct and the thoracic duct. The thoracic duct is the largest lymphatic vessel, draining up to 75% of the body's lymph from the entire left side of the body and the right side of the body below the diaphragm. The adult right lymphatic duct receives lymph from the right thorax, arms, and head and neck regions [28].

The thoracic duct is thin-walled, typically 45 cm long and 2-3 mm in diameter; it usually arises from the cisterna chyli, which is usually located at the level of the second lumbar vertebra, to the right of the aorta. The thoracic duct terminates in a cervical lympho-venous junction. Many studies have addressed the wide variation in the thoracic duct anatomy [23].

In comparison, the right lymphatic duct is less well characterised than the thoracic duct; most commonly, it arises from the right jugular, bronchomediastinal and subclavian lymphatic trunks(9), although these vessels may also terminate individually, so that the main duct; is absent. If present, it is 1-2 cm long, is closely related to the anterior scalene muscle, and usually opens into the junction of the right subclavian vein and the internal jugular vein (IJV) [23].

The lymphatic circulation returns proteins and excess interstitial fluid to the systemic circulation, regulates immune

responses by cellular and humoral mechanisms, and absorbs lipids from the intestine [19]. All lymph vessels have one-way valves to prevent fluid from flowing backward. The forward flow of lymph is due to the pressure gradient created by muscle contractions and respiratory movements [20].

The thoracic duct fluid consists of a mixture of lymph and chylomicrons called chyle [13]. The chyle is milky-white, odorless, and strongly bacteriostatic due to the presence of a large number of lymphocytes, while the fluid of the right lymphatic duct is only lymph. Fasting before surgery can drastically reduce the lymph flow to less than 1 ml/min, while it can increase again to more than 200 ml/min after a normal diet [25].

A significant chyle leak will be accompanied by loss of protein, fat, fat-soluble vitamins, and lymphocytes, which lead to hypovolemia, electrolyte disturbances (hyponatremia, hypochloremia, and hypoproteinemia), malnutrition, and immunosuppression [8,15], this can result in wound healing complications and prolonged the patient's hospital stay.

Various algorithms implanted to help in the management of the chyle leak depend on the time of identification, the amount of drainage, and the patient's general condition [6].

### Case Presentation

A 51-year-old gentleman presented to the outpatient department of Hospital Canceled Tuanku Muhriz (HCTM) with bilateral painless neck swelling that gradually increased in size over two years. He complained of hoarseness and unquantified, unintentional weight loss.

The patient was habituated to smoking, and his family history was positive for thyroid malignancy.

On thorough examination, there was bilateral neck swelling, firm, fixed, non-tender with normal skin overlying, on the right measuring 7X5 cm and the left 6X5 cm. The laryngeal assessment showed left vocal cord palsy in the paramedian position, mobile right vocal cord, and anteromedial prolapse of the left arytenoid.

Histological assessment by fine needle aspiration cytology (FNAC) revealed atypical follicular epithelial cells suggestive of papillary thyroid carcinoma.

Radiologically, the computer tomography (CT) scan revealed the presence of a heterogeneous solid mass arising from the left thyroid lobe measuring 4.7x2.2x4.4 cm with retrosternal extension. The left common carotid artery was displaced, and that mass compressed the left IJV. Multiple cervical lymph nodes were found in level II and IV on both sides of the neck, the largest on the right side measuring 4.3x4.4x6.3 cm.

After a comprehensive clinical and radiological assessment, the patient was diagnosed with papillary thyroid carcinoma, bilateral neck metastasis, and left vocal cord palsy and was electively admitted for total thyroidectomy, bilateral neck dissection, and injection laryngoplasty.

The operation was performed by a multidisciplinary team consisting of head and neck surgeons, endocrine surgeons, and laryngology surgeons.

Intraoperatively, the thyroid mass infiltrated the left tracheoesophageal groove, and a bilateral neck mass involved the levels III and IV levels with a size of 6X5cm on the left side and 5X4cm on the right side with multiple masses on level II on the left side. The mass adhered to the left IJV, but on the right side, the vein was compressed, and there was no clear plane for dissection. Subtotal thyroidectomy was performed, with a residual tumor on the left trachea-esophageal groove and the right jugular vein sacrificed. The left parathyroid gland and left recurrent laryngeal nerve were difficult to identify. The right parathyroid gland was identified and preserved, although the right RLN could not be identified. The common carotid artery, sternocleidomastoid muscle on both sides, and the right vagus nerve were identified and preserved.

A chyle leak was observed in the lower region of the right side of the neck, which was a clear fluid in nature; the site was confirmed by asking the anesthesiologist to raise the intrathoracic pressure. The area was oversewed with nonabsorbable suture material, and a Valsalva maneuver reconfirmed the proper closure. Strap muscle approximated, skin closed, and bilateral drain inserted.

The laryngology team performed direct laryngoscopy, and medialization of the left vocal cord was done by injecting Radiess 1cc in the left para-glottic space.

Postoperatively, the patient was shifted to the ward, and the initial postoperative recovery was uneventful. On the second day, a milky content was detected from the drain, and biochemical analysis confirmed the presence of chyle leakage.

As shown in table 1, the drainage was not increased after conservative measures were applied.

Date	27/09/2022	28/09/2022	29/09/2022	30/09/2022	01/10/2022	02/10/2022	03/10/2022
RT drain	290cc	138cc	63cc	64cc	26cc	20cc	15cc
	Blood	Milky	Milky	Milky	Serous	Serous	Serous
Lt drain	75cc	65cc	45cc	36cc	12cc	16cc	4cc
	Blood	Milky	Milky	Milky	Serous	Serous	Serous

Table 1

Our patient received appropriate conservative measures based on their drain output to facilitate the healing process. These measures included complete bed rest, elevating the head of the bed by 30-40 degrees, using stool softeners, initiating a fat-free diet, and monitoring for dehydration and malnutrition by checking fluid balance and electrolytes on daily basis.

At daily follow-up, his electrolytes were normal, and the drain output dried up on the seventh postoperative day. The patient was discharged, and no complaints were mentioned during his follow-up in the clinic.



Left side



Right side

Figure 1

### Discussion

Chyle leak secondary to the iatrogenic injury of the lymphatic system is an uncommon complication of head and neck surgery with an incidence range from 1-2.5% [8]. However, it is associated with serious morbidity and mortality if not managed probably. Chyle leak occurs in 0.5-1.4% of thyroidectomies [21] and 2-8% of neck dissection [12].

Left-sided chyle leaks are more reported in comparison with the incidence on the right side, which does not exceed a quarter of the incidence on the left side [7]. Because of that, "many surgeons underestimate or are unaware of the incidence of chyle leakage as a complication of right-sided neck surgery" [24,27].

Understanding the anatomy and its variations is essential for conducting any surgical treatment safely, accurately, and without any complications.

As mentioned earlier, the right lymphatic duct is 1-2 cm long and less well-defined than the thoracic duct [23]. Both the right and left lymphatic ducts are subject to a wide range of anatomic variations. An unusual thoracic duct opening into the right IJV has been reported [10], and the suggested prevalence of a right-sided termination of the thoracic duct is between 1-5%; however, the true figure is unclear, as some studies document only a left-sided termination [24]. Because the right lymphatic duct originates from the right jugular, bronchomediastinal, and subclavian lymphatic trunks, the absence of the right lymphatic duct has been reported when these vessels terminate individually.

Radiologically, identification and evaluation, the right lymphatic vessel poses more challenges compared to the thoracic duct due to its shorter length. Kammerer, *et al.* [16] achieved a 64.2% identification rate for the right lymphatic duct, whereas Liu, *et al.* reported a mere 4% rate. Interestingly, the presence of head and neck pathology did not show any significant association with the identification rate or diameter of the right lymphatic duct in the studies conducted by Kammerer, *et al.* (2016) [16].

Lymphatic duct injuries are inherently difficult to prevent due to their anatomical variations and thin walls. Additionally, certain patient-specific factors, such as a short and wide neck circumference, scarring from prior surgery or radiation, and the presence of metastatic lesions around the lower part of the internal jugular vein and subclavian, contribute to the increased risk of injury [1,5,6,17,26]. In our specific case, the presence of metastatic lymph node compressing the right jugular vein at level IV further amplifies the risk of lymphatic injury.

Intra-operative detection and repair play an essential role in preventing chyle leak morbidities, with particular concern when

dissecting the lower part of the neck [8]. The characteristic thin wall of the lymphatic ducts and preoperative fasting, which affect chyle production and consistency of lymphatic fluid, make identification difficult, as in our case, where we noticed clear, transparent, small amounts of fluid in the right lower part of the neck. Different maneuvers are used to increase the intrathoracic or intrabdominal pressure, which facilitates the identification of chyle leaks as the Valsalva maneuver, Trendelenburg positioning [18], and manual abdominal compression [4]. In our center, the Valsalva maneuver is performed with the anesthesiologist's help to confirm the leak's presence. Using the loops and the microscope may ease the identification [10].

Chakedis, *et al.* (2018) [5] conducted a study on the intraoperative identification of the lymphatic duct and leak site using Indocyanine green. The study concluded that this technique could be particularly beneficial in challenging dissections, such as re-operative cases or patients with a history of neck radiation or trauma. It enables the identification of the thoracic duct, determination of the injury site, and confirmation of successful repair.

Once a chyle leak is identified, immediate repair is essential and can be achieved through various single or multi-modal approaches [7]. In our case, the duct was ligated and oversewn using a nonabsorbable suture. Some studies suggest the use of locoregional flaps, such as an anterior scalene flap or pectoralis major flap, as additional measures. Furthermore, topical agents such as fibrin/cyanoacrylate glue, a sclerosing agent, or an absorbable hemostat can be applied to the wound bed during surgery [7,10].

After completion of intraoperative leakage control, a milky material was noted in the drainage tube on the second postoperative day after the start of oral feeding. Cherian, *et al.* study showed that 55% of cases after intraoperative control might develop a chyle leak postoperatively. Attributing this to the presence of multiple terminations, means that even if the leak site is identified and ligated, an unidentified end branch may still result in a chyle leak postoperatively [7]. For that reason, postoperative monitoring is mandatory.

According to Tracy, *et al.* (2017) [27], a chyle leak of up to 1L/day can be tolerated for 1-2 days without causing electrolyte

abnormalities. Therefore, any increase in drain output, particularly after initiating a diet containing fat, should raise suspicion of a chyle leak. Confirmation can be made by observing a change in the color of the drain, which becomes creamy or milky in appearance. Additionally, some patients may exhibit the development of a subcutaneous mass in the medial neck or supraclavicular fossa, accompanied by induration, edema, and erythema of the overlying skin. In our specific case, a color change without an increase in volume was observed on the second postoperative day, as indicated in Table 1.

The diagnosis of a chyle leak primarily relies on clinical evaluation, although laboratory investigations may be performed in certain situations. Confirmation of a chyle leak can be achieved through the presence of elevated levels of chylomicrons and triglycerides, exceeding 110 mg/dL. Additional parameters that can aid in the diagnosis include measuring fat content (0.4-4.0 g/dL), protein levels (3 g/dL), pH greater than 7.5, and a specific gravity higher than 1.010 g/dL [2,10,11,14].

The management plan must be initiated promptly and tailored according to the drain output, which is categorized as either low output (< 500 mL/day) or high output (> 500 mL/day). Given that the thoracic duct drains both lymph and chyle, with the right lymphatic duct primarily draining lymph, it is expected that low-volume leaks would predominantly occur on the right side [7,24], which aligns with the findings in our specific case as presented in table 1. The patient's comorbidities and the availability of an experienced surgeon also play an important role in the management plan.

A variety of methodologies are employed to optimize the healing process by effectively mitigating lymphatic flow. These strategies encompass the implementation of bed rest and the elevation of the bed's head at an incline ranging between 30 to 40 degrees. Additionally, the utilization of stool softeners is advocated to prevent the raise of intrathoracic and intra-abdominal pressure, thereby facilitating a reduction in lymphatic flow [8]. Monitoring for dehydration and malnutrition are mandatory by daily checking the fluid balance and the electrolyte and weekly checking the albumin level. Diet control with non-fat, low-fat, or medium-chain fatty acids is recommended [3].

In cases where the suspected duration of the chyle leak is short, the option of Nothing By Mouth (NPO) may be considered. However, it is currently not recommended as there are alternative dietary options available to prevent dehydration and malnutrition. Total parenteral nutrition (TPN) is an alternative in persistent refractory cases, but it necessitates central venous access, which carries the risks of infection, metabolic disturbances, and high cost [10].

To address the chyle leak, an additional measure implemented was the application of a pressure dressing and the use of suction drainage. However, there is a concern about the potential risk of the pressure dressing on the skin flap [10]. Suction drainage was placed during the surgery to facilitate effective monitoring of drainage and serve as an indicator of treatment efficacy. Some experts recommend removing the suction drainage in a timely manner once its output decreases sufficiently to avoid impeding the complete resolution of the chyle leak [10,12].

Several studies addressed the efficacy of somatostatin in treating chyle leakage by reducing gastric, pancreatic, and intestinal secretions. It can also minimize lymph production and flow by contracting smooth muscle in the spleen and lymphatic vessels [3]. Octreotide is also used for the same purpose but has the advantage over somatostatin in that it must be injected subcutaneously rather than continuous intravenous infusion. Octreotide is a cost-effective therapy for iatrogenic chyle leaks that significantly reduces morbidity, length of stay, and the need for surgical intervention [10,11].

It has also been reported that intraoperative or postoperative application of a topical sclerosant through the drain should be done with caution, as reoperation may be challenging due to obliteration of the surgical field as a result of the sclerosing effect [10].

If all conservative management fails, surgical re-exploration, percutaneous transabdominal cannulation, embolization, and thoracoscopic ligation of the lymphatic duct could be performed.

## Conclusion

Chyle leak is an uncommon complication with serious sequelae that could happen in head and neck surgery. Although the incidence on the right side is rare, many cases were reported. Prevention is the

gold standard, and intraoperative identification and management are crucial to prevent postoperative morbidity. Utilizing various techniques to control chyle extravasation is recommended, and close postoperative monitoring is crucial to promptly identify any potential repair failure.

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