

Abdominal compression: A new intraoperative maneuver to detect chyle fistulas during left neck dissections that include level IV

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ABSTRACT: *Background.* Chyle fistulas may occur after left neck dissections that include level IV, due to injury of the thoracic duct or of 1 of its major branches. Despite being unusual, this complication carries substantial postoperative morbidity and even mortality. So far, no effective intraoperative maneuver has been reported to detect this fistula at the end of a neck dissection. In this cohort study, we sought to describe a simple new maneuver, intraoperative abdominal compression, which can effectively help to identify an open major lymphatic duct on level IV at the end of a neck dissection.

Patients and Methods. From March 1989 to September 2010, 206 patients underwent neck dissections involving left level IV, and underwent intraoperative abdominal compression. There were 119 men and 87 women, with ages ranging from 18 to 81 years (median, 52 years). One hundred forty-four patients had squamous cell carcinomas, 54 had thyroid carcinomas, 5 had malignant melanomas, and 3 had salivary cancers. Distribution by type of left neck dissection was: selective including levels II, III, and IV (73 cases; 35.4%), selective including levels II, III, IV, and V (55 cases; 26.6%), selective including levels I, II, III, and IV (12 cases; 5.8%), modified radical (47 cases; 22.8%), and radical (19 cases; 9.2%). In all cases, at the end of the procedure, the endotracheal tube was temporarily disconnected from the ventilator. Keeping the dissected level IV area under clear visualization, an abdominal compression was performed. At this moment, any detected lymphatic leak was carefully clamped and tied with nonabsorbable sutures. After ventilating the patient, the

intraoperative abdominal compression was repeated to reassure complete occlusion of the lymphatic vessel.

Results. In 13 cases (6.3%), a chyle leak was detected after performing the intraoperative abdominal compression. All leaks except for 2 were successfully controlled after 1 attempt. In these 2 patients, a patch of muscle and fat tissue was applied with fibrin glue on the top. In 1 of these patients, another chyle leak in a different location was detected only at the second intraoperative abdominal compression, and was also effectively closed. Postoperatively, there were 2 (1%) chyle fistulas, both among these 13 cases, and all were successfully managed with clinical measures only. No fistulas occurred among the remaining 193 patients in whom intraoperative abdominal compression did not demonstrate lymphatic leak.

Conclusion. To our knowledge, this is the first description of a specific maneuver to actively detect a lymphatic fistula at the end of a left neck dissection involving level IV. In this study, intraoperative abdominal compression was able to detect an open lymphatic vessel in 6.3% of the cases, as well as to assure its effective sealing in the remaining 93.7% of the patients. Moreover, no life-threatening high-volume fistula was noted in this study. © 2012 Wiley Periodicals, Inc. *Head Neck* 34: 1570–1573, 2012

KEY WORDS: neck dissection, chyle fistula, lymphatic fistula, neck dissection complications, neck metastases

Chyle fistulas may occur after left neck dissections that include level IV (inferior jugular lymph nodes), due to injury of the thoracic duct or of 1 of its major branches.^{1–3} Despite being unusual, this complication carries substantial postoperative morbidity and may even cause the death of the patient.^{4,5} The postoperative recovery is delayed, even when the fistula is managed conservatively with a low-fat medium chain triglycerides diet or full parenteral nutrition. Reoperations are usually very

difficult to perform and may not discover the fistula location.⁵

In order to manage the injured duct, some very creative techniques or even surgical approaches to the intrathoracic portion of the thoracic duct have been proposed.^{6,7} So far, however, no effective intraoperative maneuver has been reported to detect this fistula at the end of a neck dissection.

The objectives of this study were: (1) to describe a simple new maneuver that we have developed, the intraoperative abdominal compression, which can effectively help to identify an open major lymphatic duct on left level IV, at the end of a neck dissection; and (2) to report the use of this maneuver in a series of consecutive patients submitted to neck dissections involving left level IV.

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MATERIALS AND METHODS

Patients

From March 1989 to September 2009, 206 patients underwent neck dissections involving left level IV, and underwent intraoperative abdominal compression. There were 119 men and 87 women, with ages ranging from 18 to 81 years (median, 52 years). One hundred forty-four patients had squamous cell carcinomas, 54 had thyroid carcinomas, 5 had malignant melanomas, and 3 had salivary cancers (2 high-grade mucoepidermoid carcinomas and 1 poorly differentiated adenocarcinoma). Distribution by type of left neck dissection was: selective including levels II, III, and IV (73 cases; 35.4%), selective including levels II, III, IV, and V (55 cases; 26.6%), selective including levels I, II, III, and IV (12 cases; 5.8%), modified radical (47 cases; 22.8%), and radical (19 cases; 9.2%). In all cases, at the end of the procedure, after looking for any unexpected bleeding under pulmonary hyperpressure, the endotracheal tube was temporarily disconnected from the ventilator. Keeping the dissected left level IV area under clear visualization, 1 of the assistants leaned the upper part of his or her body on the abdomen of the patient, carefully keeping a compression on the upper half of the belly for about 20 to 30 seconds. At this moment, any detected lymphatic leak was carefully clamped and tied with non-absorbable sutures (Figures 1 and 2). After ventilating the patient, the intraoperative abdominal compression

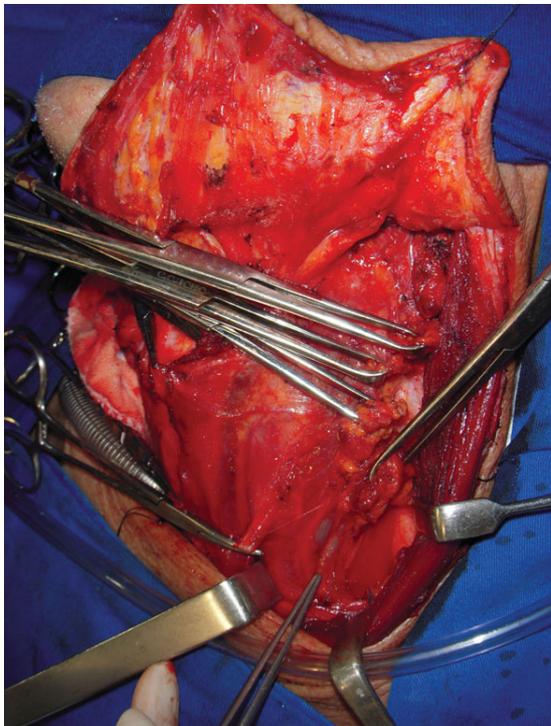


FIGURE 1. Left modified radical neck dissection indicated for an advanced laryngeal cancer. The forceps points to the thoracic duct, entering the internal jugular vein on an unusually high location.

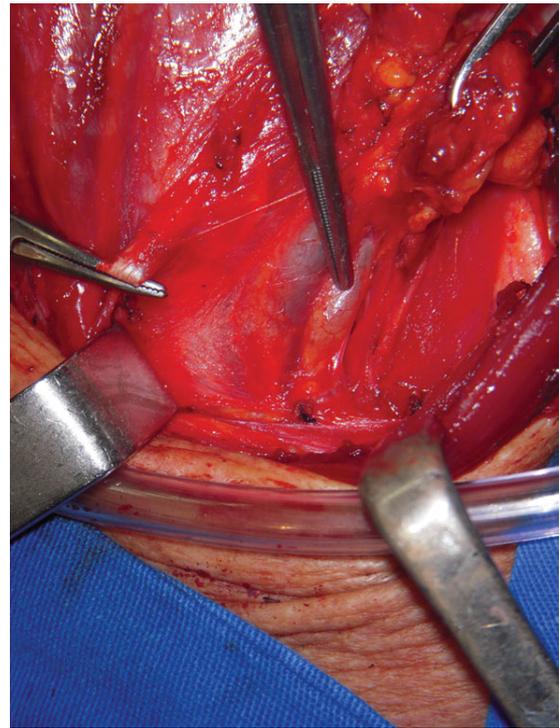


FIGURE 2. Close-up view of the operative field. The hemostat points to the ingurgitated thoracic duct, during intraoperative abdominal compression (IAC); to the left, the adjacent left internal jugular vein can be clearly seen.

was repeated to reassure complete occlusion of the lymphatic vessel. In all patients, a multiperforated suction drain was placed on the operative field before closure.

This study was approved by the institutional review board of our institution.

RESULTS

In 13 cases (6.3%), a chyle leak was detected after performing the intraoperative abdominal compression. All leaks, except for 2, were successfully controlled after 1 attempt. In these 2 patients, a patch of muscle and fat tissue was applied with fibrin glue on the top of it. In 1 of these patients, another chyle leak in a different location was detected only at the second intraoperative abdominal compression, and was also effectively closed. Postoperatively, considering the 206 patients, there were 2 (0.97%) chyle fistulas detected clinically, both among the 13 cases with positive intraoperative detection (15.3%), and all were successfully managed with clinical measures only. If we consider a positive result of the method, the efficient detection of the fistula at the end of the operation with no chyle fistula in the postoperative period, the positive predictive value of intraoperative abdominal compression was 84.6% (11/13). No fistulas occurred among the remaining 193 patients in whom intraoperative abdominal compression did not demonstrate lymphatic leak. Thus, the negative predictive value was 100%.

DISCUSSION

The thoracic duct carries lymph from the inferior limbs, the abdomen, the left hemithorax, the left arm, the left side of the neck, face, and skull to the circulatory system. The duct usually ends in the left subclavian vein, in the left internal jugular vein, or at the junction of both vessels. Due to this anatomic relationship, the thoracic duct and/or its major affluents are at risk during neck dissections involving the left level IV. In fact, there are reports in the literature of chyle fistulas even after central compartment dissection for thyroid cancer. Roh et al⁸ found this complication in 1.4% of 283 patients who underwent total thyroidectomy with central compartment dissection for thyroid cancer. The same group reported their experience with chyle fistula after lateral neck dissections in patients with thyroid cancer.⁹ In a series of 96 neck dissections, they noted 8.3% of postoperative chyle fistulas; curiously, 3 were located on the left neck, but 5 appeared on the right side. They attributed this right-sided chyle fistula to intraoperative injury of the right lymphatic duct, which drains lymph from the right upper limb, right hemithorax and right side of the neck.

The frequency of chyle fistula after neck dissection is variable. Havas et al¹⁰ observed fistulas in 3% of 200 neck dissections. Spiro et al² reported 1.9% chyle fistulas in 823 neck dissections. Interestingly, they also found this complication after 2 gastric pull-up operations and after 1 scalene lymph node open biopsy. Erisen et al¹¹ prospectively studied 106 patients who underwent neck dissections; chyle fistulas occurred in 5.8% of the patients in their series.

The impact of the chyle fistula is variable. Most reported cases have been managed conservatively, with compression dressings, low-fat oral diets, or even parenteral nutrition. In the study by Lucente et al,¹ they were able to control all 6 chyle fistulas they experienced in their series of patients with conservative treatment. On the other hand, in some reports, chyle fistulas were associated with considerable morbidity or even mortality. There are at least 3 case reports of bilateral chylothorax after neck dissection.¹²⁻¹⁴ Zhengjiang et al¹⁵ proposed the use of an inferiorly based supraomohyoid muscle flap for the treatment of chyle fistula discovered intraoperatively using the Valsalva maneuver and Trendelenburg positioning in 14 patients submitted to neck dissections. The flap was plugged in the chyle fistula and sutured with absorbable sutures, and no patient had clinical evidence of chyle fistula postoperatively.

Despite the relevance of this complication, to our knowledge, no specific intraoperative maneuver has been described to identify a chyle leak at the end of a neck dissection. The usual check under pulmonary hyperpressure, in fact, collapses the thoracic duct and fails to disclose lymph fistulas. In a recent paper Santaolalla et al¹⁶ reported a retrospective review of 304 patients who underwent neck dissection. Chyle fistulas occurred in 4 cases (1.31%), but the authors did not mention the percentage of this complication when only left-sided neck dissections were considered. This frequency was not influenced by N classification, but the chyle fistula was more common after radiotherapy, although not statisti-

cally significant. They identified and treated 7 cases of thoracic duct injury at the operation, detected after asking the anesthesiologist to increase pulmonary pressure and to change the patient's position to the Trendelenburg. Among these 7 patients, 2 developed chyle fistula postoperatively, as well as 2 individuals in whom the fistula was not discovered intraoperatively. The presence of chyle fistula significantly increased the length of hospital stay ($p = .01$), and 1 of their patients died due to the chyle fistula.

More than 20 years ago, we developed a simple maneuver to discover a major lymphatic vessel opening at the end of neck dissections involving left level IV. The principle of intraoperative abdominal compression is very simple: after disconnecting the ventilator, when pressure is exerted on the abdominal wall, it is transmitted to the lymphatic network and, ultimately, to the thoracic duct. In fact, we could demonstrate in several instances an ingurgitation of the intact thoracic duct, as can be observed in Figures 1 and 2. In our prospective nonrandomized study involving 206 patients who underwent neck dissections involving left level IV, in 13 cases (6.3%) a chyle leak was detected after performing the intraoperative abdominal compression. Interestingly, this percentage was very similar to the 5.8% reported by another prospective study.¹¹ In the present study, all leaks, except for 2 cases, were successfully controlled intraoperatively after 1 attempt. In these 2 patients, a patch of muscle and fat tissue was applied with fibrin glue on the top. In 1 of these patients, another chyle leak in a different location was detected only at the second intraoperative abdominal compression, and was also effectively closed. Postoperatively, there were 2 (1%) chyle fistulas, both among these 13 cases, and all were successfully managed with clinical measures only (compression dressings and a low-fat oral diet), experiencing closure of the fistulas within 3 and 6 days after the operation, respectively. It is important to emphasize that no fistulas occurred among the remaining 193 patients in whom intraoperative abdominal compression did not demonstrate lymphatic leak. Therefore, positive predictive value and negative predictive value were 84.6% and 100%, respectively. Furthermore, no additional morbidity or mortality related to chyle fistulas was observed in our series of patients.

One of the flaws of this study was the absence of a control group of patients in whom no intraoperative abdominal compression was used at the end of the neck dissection. As an alternative, a control group could include patients submitted only to Valsalva maneuvers and/or Trendelenburg. However, at least in our experience, pulmonary hyperpressure failed to detect chyle fistulas that were demonstrated a few moments later by the abdominal compression. Evidently, the findings described in the present study should be duplicated by other centers and, furthermore, a prospective randomized trial would be advisable to prove its usefulness with a reasonable evidence level. Nevertheless, in our opinion, the simplicity of the maneuver and the potential benefit that it offers supports its indication at the end of all neck dissections involving the left level IV.

In conclusion, in this study, intraoperative abdominal compression was able to detect an open lymphatic vessel in 6.3% of the cases, as well as to effectively assure its

absence in the remaining 93.7% of the patients. Moreover, no life-threatening high-volume fistula was noted in this study. To our knowledge, this is the first description of a specific maneuver designed to actively detect a lymphatic fistula at the end of a left neck dissection involving left level IV. We strongly believe that the best way to deal with a surgical complication is to prevent it or, at least, to be able to efficiently detect it and to correct it before the end of the operation.

REFERENCES

1. Lucente FE, Diktaban T, Lawson W, Biller HF. Chyle fistula management. *Otolaryngol Head Neck Surg* 1981;89:575–578.
2. Spiro JD, Spiro RH, Strong EW. The management of chyle fistula. *Laryngoscope* 1990;100:771–774.
3. Nussenbaum B, Liu JH, Sinard RJ. Systematic management of chyle fistula: the Southwestern experience and review of the literature. *Otolaryngol Head Neck Surg* 2000;122:31–38.
4. Eufinger H, Lehmbrock J. Life threatening and fatal complications of radical neck dissection. *Mund Kiefer Gesichtschir* 2001;5:193–197.
5. Gregor RT. Management of chyle fistulization in association with neck dissection. *Otolaryngol Head Neck Surg* 2000;122:434–439.
6. Scorza LB, Goldstein BJ, Mahraj RP. Modern management of chylous leak following head and neck surgery: a discussion of percutaneous lymphangiography-guided cannulation and embolization of the thoracic duct. *Otolaryngol Clin North Am* 2008;41:1231–1240.
7. Van Natta TL, Nguyen AT, Benharash P, French SW. Thoracoscopic thoracic duct ligation for persistent cervical chyle leak: utility of immediate pathologic confirmation. *JSLS* 2009;13:430–432.
8. Roh JL, Yoon YH, Park CI. Chyle leakage in patients undergoing thyroidectomy plus central neck dissection for differentiated papillary thyroid carcinoma. *Ann Surg Oncol* 2008;15:2576–2580.
9. Roh JL, Kim DH, Park CI. Prospective identification of chyle leakage in patients undergoing lateral neck dissection for metastatic thyroid cancer. *Ann Surg Oncol* 2008;15:424–429.
10. Havas TE, Gullane PJ, Kassel RN. The incidence and management of chylous fistulae. *Aust N Z J Surg* 1987;57:851–854.
11. Erisen L, Coskun H, Basut O. Objective and early diagnosis of chylous fistula in the postoperative period. *Otolaryngol Head Neck Surg* 2002;126:172–175.
12. Har-El G, Segal K, Sidi J. Bilateral chylothorax complicating radical neck dissection: report of a case with no concurrent external chylous leakage. *Head Neck Surg* 1985;7:225–230.
13. Jabbar AS, al-Abdulkareem A. Bilateral chylothorax following neck dissection. *Head Neck* 1995;17:69–72.
14. Jortay A, Bisschop P. Bilateral chylothorax after left radical neck dissection. *Acta Otorhinolaryngol Belg* 2001;55:285–289.
15. Zhengjiang L, Sabesan T, Pingzhang T, Ilankovan V. Omohyoid muscle flap in prevention of chyle fistula. *J Oral Maxillofac Surg* 2007;65:1430–1432.
16. Santaolalla F, Anta JA, Zabala A, Del Rey Sanchez A, Martinez A, Sanchez JM. Management of chylous fistula as a complication of neck dissection: a 10-year retrospective review. *Eur J Cancer Care (Engl)* 2010;19:510–515.