

Crushed Muscle Tissue Graft: A Efficient Repair Technique for Intraoperative Chylous Fistulas

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ABSTRACT

Background/objectives: Chylous fistula is an uncommon but serious complication of radical neck dissections and is a complication which can be better avoided than treated. Presence of amber colored lymph in the postoperative closed wound suction drainage is defined as chylous fistula.

Materials and methods: The study was done over 18 months analyzing neck dissections done for 245 cases for complications of chyle leak. Six cases of chyle leak were identified during the course of the study.

Results: All the six cases were repaired with crushed muscle tissue graft harvested from the remaining portion of the sternocleidomastoid muscle was spread out and sealed. No chyle leak complications were seen in the drains after the repair.

Conclusion: The use of crushed local muscle tissue grafts offers better chances of success for closure of chylous fistulae in the neck, especially when the fistulous opening was difficult to ligate and the site of leak was only packed with sponge gel or Surgicel®. This complication should be better avoided than repaired.

Keywords: Chylous fistula, Thoracic duct, Crushed muscle, Surgicel.

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INTRODUCTION

Neck dissections are routine procedures in treatment of head and neck malignancies.¹⁻⁴ The various modifications of neck dissections are aimed at blocking tumor cell migration and metastasis into the lymphatic drainage system.⁵ Careful preservation of vital structures like carotid artery, vagus nerve, thoracic duct, and phrenic nerve takes the top priority in neck dissections.⁵

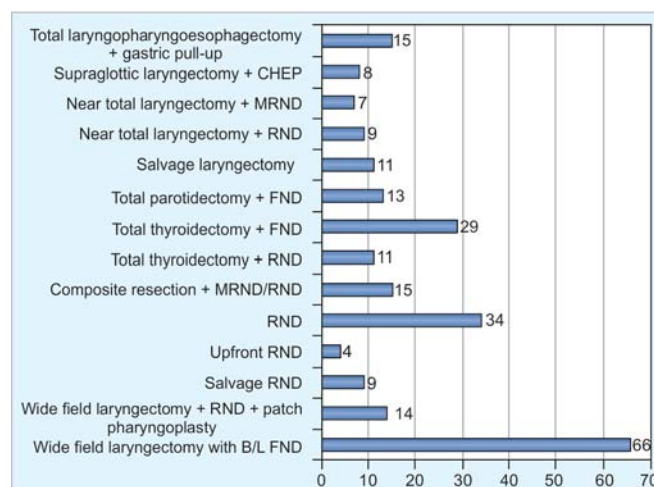
Chylous fistula is an uncommon but serious complication of radical neck dissections and is a complication which can be better avoided than treated.² Presence of amber colored lymph in the postoperative closed wound suction drainage is defined as chylous fistula.⁶ Incidence is seen in 1 to 2.5% of radical neck dissections, with the majority (75-92%) occurring on the left side.^{7,8} Mortality due to chylous fistula was as high as 12.5% in the initial years of neck dissections but with better

understanding of the anatomy and advances it is rare currently.⁹ Also complications like local cutaneous reactions, such as induration, edema, erythema and incisional problems occur due to the alkaline pH of the chyle or the vasoactive substances released by lymphocytes.¹⁰ Systemic imbalances of lipid, protein, or electrolyte metabolism were also observed.¹⁰

The accurate lymphatic anatomy and its variation are important to avoid injury to the thoracic duct and its tributaries and prevention of the leaks is better than any treatment.¹¹ Immediate repair of the leak encountered intraoperatively is the widely practised protocol.¹² Meticulous identification and ligation of the branches of the thoracic duct is necessary when an intraoperative chylous leak is recognized.¹² Immediate suture ligation should be done or hemoclips should be applied.¹² Intraoperatively under anesthesia leakproof ligation should be confirmed by manual hyperventilation.¹³ Postoperative chyle fistula will be manifested by increasing output of milky fluid and most of them are managed conservatively and rarely need reexploration.¹³ The purpose of this study was to treat chylous fistulae following neck surgery with crushed muscle tissue graft.¹³ We concluded that the use of crushed muscle tissue graft offers great chances of success for closure of chylous fistulae in the neck.

CASE REPORT

This is a study of complications of neck dissections done for various procedures over a period of 18 months. A total



Graph 1: Neck dissections done for various procedures

of 245 neck dissections done for clearing the neck for different primary malignancies were considered under the study (Graph 1). Six cases that had chylous leak during neck dissection were managed and followed up successfully. Radical neck dissection was the surgery in all six cases and three cases had metastasis of unknown origin in the left neck and the other three were operated for salvaging the neck after radical chemoradiotherapy. All the leaks were identified on the table and were sutured by a conservative method. The leak continued and later crushed muscle tissue graft harvested from the remaining portion of the sternocleidomastoid muscle was spread out and sealed.

All the six patients were males with an average age group of 56.5 years, ranging from 52 to 64 years. All cases had left-sided chylous leak intraoperatively. The anesthesiologist was asked to apply prolonged positive pressure to identify the site of the leak. The creamy chyle was identified as it rises in the clear saline and the leaking point is identified. The leaking site was sutured continuously along with the fatty tissue present there and not extra fat was harvested (Fig. 1). A 2 × 2 cm muscle tissue of the clavicular head of the sternomastoid was harvested cleaned in normal saline thoroughly and was crushed in a vein graft crusher and spread over the repair site (Fig. 2). The tissue was sutured with 5-0 prolene and a later with a second layer of Surgicel® was put to reinforce it (Fig. 3). Immediate closure of the fistula occurred in all the cases and was observed for a week for further leaks in the drain.

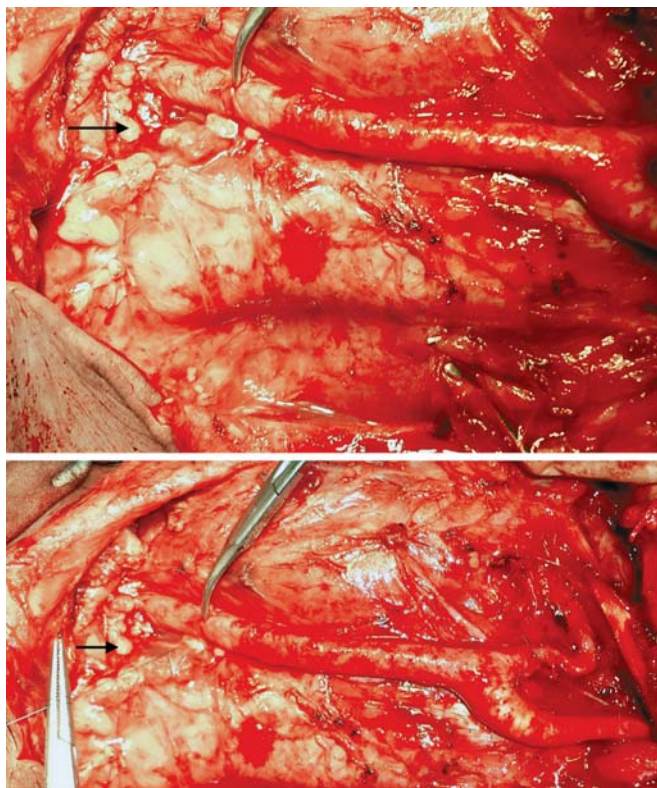


Fig. 1: Leak being visualized during radical neck dissection

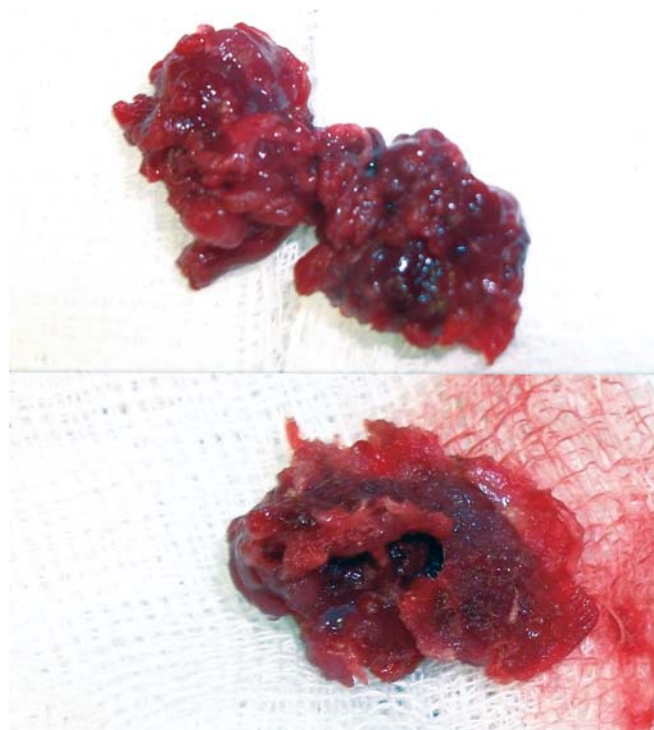


Fig. 2: Crushed muscle grafts being prepared

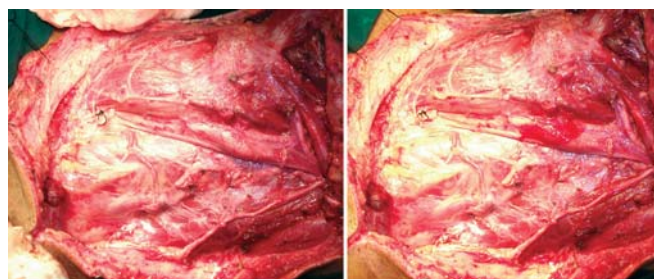


Fig. 3: The leak sealed with graft and sutured well

DISCUSSION

Chylous leakage after neck dissection is a rare complication which can be prevented intraoperatively with careful observation.^{14,15} The complications like delayed wound healing due to skin flap elevation later delaying the required adjuvant radiotherapy can lead onto fatal morbidity later on.⁴ Apart from complications like electrolyte imbalances, protein loss, and lymphocytopenia due to long-term chylous leakage major complications like myocutaneous flap failures, carotid blowout and rarely chylothorax have been reported.¹⁶⁻¹⁸

Cisterna chyli collects the lymph and chyle below the diaphragm and ascends through the thorax in the posterior mediastinum between the aorta and the azygos vein as the thoracic duct.⁵ Arising at the level of the second lumbar vertebra extending to the neck, it is 38 to 45 cm long duct arising from the confluence of various abdominal lymph

vessels.⁵ In the neck it forms an arch 3 to 5 cm above the clavicle passing anterior to the subclavian artery, the vertebral artery and vein and the thyrocervical trunk or its branches.⁵ It passes anterior to the phrenic nerve and medial border of the scalenus anterior muscle but separated from them by the prevertebral fascia.⁵

The duct runs anterior to the carotid artery, vagus nerve and internal jugular vein later arching upward, forward and laterally to open in the angle formed by the junction of the left subclavian vein with the left internal jugular vein.⁵ The right lymphatic duct which drains the right side of the head, neck, the right upper extremity, the right lung, the right side of the heart and the convex surface of the liver ends in the right subclavian vein at its junction with the right internal jugular vein.⁵ Both the thoracic duct and the right lymphatic duct have valves at their ends to prevent retrograde flow of blood into the lymphatic system.²

Anatomic variations at the terminal portions add up to the misery of the surgeons.⁵ Duct usually end in the left internal jugular vein as a single termination and rarely as multiple terminations.⁵ Rarely it may end in subclavian, innominate and external jugular veins and in 5% on to the right side.⁷ Dissection anatomy at the root of the neck may be destroyed by disease, infection, radiation or previous surgery.¹⁴ Preventing chyle includes meticulous dissection of the supraclavicular area and reducing more complex reconstruction to reinforce the carotid using the levator muscles.^{1,8,14}

As the duct is the largest lymphatic vessel having very thin walls, just tying it when damaged will not completely seal off the leak.² More than 50% of the patients exhibit more than one duct on termination and makes knowledge about anatomical variations important as prevention of chyle fistula is the rule.¹⁹ Seventy percent of the ingested fat takes the chylous (lymph + emulsified fat) route to the blood stream.²⁰ Chyle contains 2 to 4.5% protein and the electrolyte composition is similar to lymph and plasma with maximum flow rate of 2 to 4 l/day.²⁰ Large leaks cause dehydration, leading to hypoalbuminemia with edema.³

Blood collection in the drains and flap swelling delay the identification of chyle leak, while milky-like collection raise the suspicion.⁵ The content of the drainage can be tested by switching the patient to a low-fat diet where in chyle leakage rapid clearance is seen.⁵ Crumley and Smith first classified fistula into high output (>500 ml/24 h) and low output (<500 ml/24 h) for 4 days.²¹ They suggested conservative measures for low output and reexploration for high output as they were refractory.²¹ Others advice

exploration for low output also as delayed repair obscures the anatomy with progressive granulation tissue.²²

Meticulous methods of identification intraoperatively include placing the patient in the Trendelenburg position and forced Valsalva maneuver.¹⁹ If the leak is established it can be treated with nutritional, surgical and pharmacological therapy.¹⁹ Consolidated evidence of superiority of one mode of treatment over the other is not proven yet as the incidences of chyle leak are reducing due to meticulous surgical techniques.²³ If the volume of drainage is low or is decreasing overtime the leak can be conservatively managed keeping a watch on the skin flaps.²⁴ Also injection of tetracycline into the flaps was tried by some surgeons but potential neural toxicity had made its use obsolete.²⁵ Applying fibrin glue with a muscle pedicle flap are also tried with good results.⁷ Total parenteral feeding should be begun when the total volume of the chylous leakage exceeds 1,000 ml on postoperative day 3 dramatically decreases the chyle volume.^{1-3,8} Serum albumin and electrolytes should be regularly followed up.⁵ The TPN can be discontinued after the closed drainage volume decreases to <10 ml/day.⁵

Pressure dressing of the supraclavicular region is not effective as it has no solid base support.¹⁴ These pressure dressings cannot be applied if the pedicled vessels of pectoralis major myocutaneous flap or scapular flaps are crossing the regions.¹⁴ Reexploration should be decided on the operative findings, and postoperative drainage volume and content.⁵ Postoperative 3 days are critical for evaluation.⁵ Patients should be prepared with bed rest with head elevation, continuation of closed drainage, parenteral nutrition, pressure dressings and repeated aspirations before reexploration, dietary management to decrease the rate of chyle formation either through the use of total parenteral nutrition or enteral feeding using medium-chain triglycerides as the only fat source.^{1,2,8} The fistula should be explored and sutured with Surgicel[®] and with free fat graft and can be reinforced with local muscle flaps if available.⁶ We used crushed muscle patch graft as a sealant. Vacuum suction drains should be placed away from the repair site and patient advised not to change position often.¹⁴

Graunlaugsson et al laid down criteria for re-exploration: (1) Chyle output exceeding 500 ml/day, with previous intraoperative ligature failure; (2) severe metabolic and nutritional complications; (3) coexisting chylothorax with respiratory compromise; or (4) low-output fistulas of long duration (>14 days).⁴ Chylothorax is a rare

complication where the and metabolic conditions should be closely monitored.⁵

Casler and Brietzke advocated free fat graft from the submental area while Nouwen et al tried abdominal fat with varying results.²² No molecular level analysis confirm the relation between lipids, adipose tissue and chyle coagulation and the nature of the fat tissue success is not revealed.²² Casler and Brietzke also tried sternohyoid muscle flap successfully treating high output chylous fistula.²² Nouwen et al repaired the fistula with sternomastoid muscle when the straps were sacrificed for functional neck dissection in papillary carcinoma of the thyroid.²²

Gacek and Zonis described superiorly based pedicled flap of levator scapulae muscle was used in some cases of laryngectomy with chyle leak.²⁶ Staley's modified it by freeing the muscle posteriorly and inferiorly then anterior rotation over the artery based on the belief that the blood supply comes from the anterior edge of the muscle.²⁷ Pectoralis major flap with fibrin glue were also used but time consumption and available local flaps discouraged it but were reserved where local muscle flaps failed to repair fistula.³ Chylous leakage is a controllable complication after neck dissection and early intraoperative observation reduces the cost of hospital stay.⁵

CONCLUSION

The use of crushed local muscle tissue grafts offers better chances of success for closure of chylous fistulae in the neck, especially when the fistulous opening was difficult to ligate and the site of leak was only packed with sponge gel or Surgicel®. This complication should be better avoided than repaired.

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