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Management of lymph fistulas in thyroid surgery

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Abstract
Purpose Postoperative lymphatic leakage following thyroid surgery represents a management problem with considerate potential morbidity, psychological, and economical impact. Conservative and surgical management strategies for high- and low-output lymph fistulas are inconsistent. Reliable criteria to predict outcome of conservative versus surgical treatment in clinically evident lymph fistula are lacking.
Material and methods A retrospective single-center chart review of consecutively quality-control-documented thyroid surgeries from January 1998 to December 2009 was performed to identify reported postoperative lymph fistulas. Documentation of surgical procedures, drainage, medical, and nutritional management was analyzed to identify risk factors for occurrence and criteria for management of evident lymph fistulas.
Results There were 29 patients identified with postoperative clinical evidence of lymph fistulas following thyroid surgery; incidence was 0.5%. Indication to surgery comprised benign nodular goiter, recurrent nodular goiter, and thyroid carcinoma or local and lymphonodal carcinoma recurrences. There were 12 (41%) primary and 17 (59%) redo surgeries performed. Surgical procedures performed included thyroidectomy, completion thyroidectomy, and primary and redo central and lateral systematic microdissection of lymphatic compartments. All patients were initially submitted to fasting diet and medical treatment, successfully in 19 (66%), whereas ten (34%) patients underwent surgical intervention for fistula closure after failure of conservative treatment. Complications were one wound infection and fistula recurrence in five (26%) patients in the conservative group and two (20%) in the surgical group. Hospital stay was exceedingly prolonged in both groups with a median of 21 and 11 versus 6 days in patients with regular postoperative course following thyroid surgery.
Conclusions Data of this series support definition of the two categories of high- and low-output fistulas according to drainage collection with >300 versus <200 ml/day. Fasting in low-output fistula facilitates conservative treatment with closed drainage, whereas in high-output fistulas surgical intervention should be sought. Attendant criteria for treatment stratification are equally important, like patient's compliance, nutritional, and general health status as well as evidence for wound infection. Surgical closure of lymph fistula may be demanding when identification of the secreting fistula is limited and even muscle flap fortification may fail. Ultimately, in unsuccessfully reoperated fistula recurrences, open drainage may become necessary. Lymph fistulas cause significantly prolonged hospital stay, possible critical clinical decay, and unfavorable cosmetic and oncologic outcome while the superior management remains to be defined.

Keywords Lymph fistula · Chyle leakage · Complication thyroid surgery · Management lymph fistula

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Introduction

Lymph fistula, synonymously chyle fistula or chylous leakage following thyroid surgery, is a infrequent, however most cumbersome, and potentially hazardous postoperative

complication. Incidence in the literature is reported to be less than 1%, with consideration of lymphonodal dissection up to 2.5% [1–4]. Recognized risk factors for development of lymph fistulas are lymphonodal neck dissection, particularly in the lateral compartment of the cervical neck and prior oncologic irradiation to the neck [5]. Surgical injuries to the dominant lymphatic vessels, the cervical thoracic duct, are the most frequently identified cause for this complication in thyroid and thyroid carcinoma surgery. Predominantly, the left thoracic duct is anatomically exposed to surgical injury. In close proximity to the posterior esophagus, the thoracic duct extends from the thorax posterior to the left common carotid and the subclavian artery to the neck, where it courses anterior-laterally, between the internal jugular vein and the anterior thyrocervical trunk, phrenic nerve, and scalene muscle fascia to arch towards the introduction of the venous system, close to the jugular-subclavian junction. Variations infrequently include multiple lymphatic vessels in the terminal course of the thoracic ducts, furthermore aggravating anticipatory identification and preservation of these vessels [6, 7]. Surgical lesions to the right lymphatic duct or central compartment on either side are less frequent [8, 9].

Clinical identification of postoperative lymph fistula is mainly due to quantity and quality of drain fluid or fluid collection and swelling in the undrained neck. Typically milky-white appearance of drainage fluid correlates with nutritional composition and is enhanced with fatty components. Analysis of triglycerides content in drainage fluid or aspirate may differentiate seroma from lymph collection in the absence of visible fat content. Persistent lymph fistula can amount up to 2–4 l/day and is reportedly enhanced with fatty diet components. Contrarily, medium-chain triglycerides (MCT) and short-chain triglycerides are directly absorbed by the portal circulation, the rationale behind conservative management dietary protocols exclusively administering MCT [10–13]. Subsequent complications of persistent lymph fistula may involve infection, metabolic, and nutritional derangement as well as cosmetic and potentially oncologic disadvantages [2, 5, 14, 15]. Independent of conservative or surgical treatment, the incidence of lymph fistula considerably prolongs hospital stay, expenses, and efforts following thyroid surgery. Most importantly, lymph fistulas constitute a severe physical and mental burden to the patient.

Patients and methods

In a retrospective analysis, patients with postoperative lymph fistulas following thyroid surgery between January 1, 1998 and December 31, 2009 and were identified utilizing an established quality control documentation system for consecutive thyroid surgeries in a tertiary referral center. A comprehensive chart review was performed to identify surgical procedures, drainage output, and medical and nutritional management in lymph fistula. A total of 29 patients during the study period were identified with clinical evidence of postoperative lymph fistula. Management modalities of conservative and surgical treatment in regard to outcome were compared.

Results

There were 29 of 5,736 patients undergoing thyroid surgery reported to reveal postoperative lymph fistulas, representing an overall incidence of 0.5%. Total gender ratio in this series was 17:12 men to women. Indication to surgery included benign nodular goiter (n=2), recurrent goiter (n=1), thyroid carcinoma (n=10), and thyroid carcinoma recurrence (n=16). There were 13 (45%) primary and 16 (55%) remedial surgeries performed. Surgical procedures performed comprehended total thyroidectomy (n=2), redo thyroidectomy (n=1), completion thyroidectomy with systematic bilateral microdissection of central lymph node compartment (n=1), systematic redo microdissection of bilateral central and unilateral lateral lymph node compartment (n=9), systematic unilateral microdissection of lateral lymph node compartment (n=1), lateral systematic redo microdissection of bilateral central, and redo bilateral lateral lymph node compartments (n=14; Table 1). At initial surgery, lymphatic secretion was observed and attended to

Table 1 Indication to surgery and initial surgical procedures performed

Diagnosis	Conservative n=19	Surgical n=10
Benign goiter	1	1
Benign recurrent goiter	0	1
Thyroid carcinoma	5	5
Malignant recurrent goiter	13	3
Surgical procedure		
TT	1	1
Completion-TT	0	1
TT+K1	0	0
Completion-TT, K1	1	0
Redo-K1+K2	2	0
Redo-K1+K3	3	0
TT, K1–3	5	5
Redo K1–3	6	3
Selective K3	1	0

TT total thyroidectomy; *K1–3* cervical lymph node compartments according to Dralle [20]

by the surgeon with ligature, suture, and adjuncts like hemostyptic fleece or fibrin glue (Table 2).

Postoperative lymph fistulas were perceived through quantity and quality of drainage output in 27 patients with cervical drainages; in two patients without drainages, aspirate of cervical swelling postoperatively showed typical lymphatic fluid collection and elevated triglyceride content. Earliest evidence of lymph fistula was recognized on postoperative day 2 and latest on postoperative day 7. Initial conservative treatment was intended in all 29 patients. Conservative treatment included nutritional protocols with total fasting (nihil per os (NPO); $n=12$), parenteral alimentation except crystal liquid drink (partial parenteral nutrition, $n=7$), and no-fat diet (fat-free nutrition (FFN), $n=10$). Pressure dressings to assist fistula closure using a neck brace were applied in nine patients and repeat drainage and/or aspiration in 15.

Treatment groups were defined as conservative whenever therapeutic modalities did not include redo surgery and as surgical whenever remedial neck surgery for fistula closure was undertaken. Ultimately, 19 (65%) patients were stratified into the conservative and ten (34%) into the surgical treatment group. Review of the primary surgery reports revealed intraoperative identification of lymphatic fluid or recognition of lymph vessel lesion by the surgeon in eight patients. Consecutive primary countermeasures included ligation, suture, and application of fibrin glue or hemostyptical fleece.

Conservative treatment group

In the conservative group, there was a gender ratio of 11:8 men to women, and mean age was 45 years (14–74). Mean hospital stay was 11 days. Daily drainage amounted to mean 198 ml during the first seven postoperative days. Conservative treatment lasted a mean 6.2 days in this group until closure of fistula with enteral nutrition was clinically assessed. In five (26%) patients, recurrences of lymph fistulas following restart of enteral nutrition in the conservative group again were treated conservatively with ultimately successful outcome. There was no wound infection in this group. In the conservative group, seven patients showed recurrence of lymph fistula after restart of enteral nutrition and NPO was reinitiated. Overall, there were no in-hospital mortalities observed and no posthospital death correlated to lymph fistula reported. In the conservative treatment group with respective individual dietary protocols and intravenous supplementation with fat content restricted to MCT, other adjuncts applied were neck braces. In this group, there were five recurrences following restart of enteral alimentation observed, and patients were again submitted to NPO.

Table 2 Intraoperative identification of lymph secretion and measures at initial surgery

Intraoperative	Conservative $n=19$	Surgical $n=10$
Lymph flow, diffuse	0	1
Ligature	9	7
Suture	1	2
Muscle flap	0	0
Hemostatic fleece/fribrin	7	7
Intraoperative fat stimulation	1	1

Surgical treatment group

In the surgical group, there were 6:4 men to women, and mean age was 52 years (37–73) with a mean hospital stay of 21 days. Daily drainage was a mean of 322 ml during the first seven postoperative days. Conservative treatment lasted mean 4.9 days in this group until surgical remedial intervention was sought. Reoperative procedures consisted of fistula closure with ligation in six, ligation and sutures in two patients, muscle flap in two, and exclusively oversuture with additional application of fibrin glue in one patient. Adjunctive application of hemostyptic fleece or fibrin glue was tried in seven patients within this group. In four patients at reoperation, the source of lymphatic secretion could not be identified and was intraoperatively provoked by administration of fatty liquid via nasogastral tube feeding, leading to fistula identification in two. In the surgical group, five patients revealed another recurrence of lymph fistula, four undergoing one more surgery, one undergoing unsuccessful surgery and conduction to open wound drainage, and one patient treated conservatively with NPO protocol and prolonged closed drainage. There was one wound infection (10%) in this group. Reoperation with intention to close fistula could identify five sources of lymph leakages; additionally, seven diffuse lymphatic secretions and no identifiable source was found in two patients. Surgical procedures included ligation, suture, hemostyptic adjuncts, and muscle flap. Drainages were placed in all reoperative cases. Postoperatively, these patients were again subjected to NPO with exception of crystal liquids for 1 to 2 days postoperatively before enteral alimentation was restarted. There were two clinical fistula recurrences observed following surgical fistula treatment with concurrent conservative treatment and open wound drainage in one patient due to wound infection; however, microbiological testing remained negative.

Drainage volume was significantly elevated in high-output fistulas with a median of 322 ml/day than in low-

output fistula with median 198 ml/day (p=0.026; Tables 3 and 4). Concomitant determinants to change management in favor of surgery were poor patient compliance with the dietary regimen, poor patients nutritional, and general health status as well as failure to decrease output volume at NPO and unchanged lipidous secretion.

Lymph fistulas caused significantly prolonged hospital stay. Median stay in the patient group who underwent surgery after failed conservative treatment was longest with mean 21 days, a mean of 11 days in the conservative group compared with 6 days in patients with uneventful postoperative course following thyroid surgery. The latter comparative group's rather long hospitalization resembles the predominance of thyroid cancer cases and a historical group with traditionally longer hospitalization (Fig. 1).

Discussion

Incidence of lymph fistulas in thyroid surgery is low, even though a higher incidence is observed when surgical procedures involve lymph node dissection of the neck. This rarity makes it difficult to derive at consistent recommendations of treatment regimen. Nevertheless, when present, lymph fistulas present a management challenge for the surgeon and a wearisome compliance challenge for the patient. Even in young and healthy patients, a rapid clinical decay subsequent to metabolic derangement may be observed. Therefore, prevention of lymph fistula must be given strict priority. Meticulous surgical technique and magnifying glasses are auxiliaries to prevent lymph fistulas. Recognition of lymphatic leakage intraoperatively is important, and these should be immediately attended to. Ligature seems superior to suture as lymphatic discharge will easily flow along suture canals of the finely walled lymph vessels. Nevertheless, reports of serial experience identify reproducible criteria for management stratification.

Intention to treat postoperative lymph fistula should primarily be sought to be conservative. Medical and conservative non-operative armamentarium comprehends sufficient closed drainage, closed vacuum drainage, optional pressure dressing, sequential aspiration, and dietary protocols with monitoring of electrolyte and fluid balance [16–23]. In case of preferred continuation of enteral alimentation, administration of MCT was successful [14]. Alternatively, NPO regimen leads to more rapid cessation or reduction of lymphatic output, however, requires full intravenous supplementation [10, 12, 24]. Several reports observed prompt reduction of fistula output with commencement of diet and return to clear fluid in typical milky-white lymph fistula. Although, in the present series, this effect was initially found in the majority of patients, amount of fluid was inconsistent from day 2 of NPO or FFN regimen, therefore, offering no clear criteria for definite treatment. Boschin et al. found no effect of pressure dressing, low-fat diet, octreotide, etilefrine, and local tetracycline sclerothyerapy, however, proposed fasting with total intravenous nutrition to be the most successful treatment in cervical lymphatic leakage and discourage neck reoperation [10, 13]. In the present series, dietary restriction was less successful compared with strict NPO; however, even in the NPO group, fistula recurrence at restarting enteral nutrition could neither be excluded nor predicted.

Adjunctive pressure dressing aims at mechanically supporting reduction of fistula output in conservative treatment and assist adherence of tissues with consecutive fistula closure [2, 4, 14]. Effective placement of pressure dressing and patient's tolerance are difficult. This measure may be helpful, however, remains impossible to estimate in effect. In the present series, this was performed in nine patients with unclear durable effect on fistula output.

Contrary to several reports, there was no compromise of skin flap or wound necrosis and only one wound infection observed in this series [24]. Topical application of tetracycline aimed at closure of persistent lymph fistula by inducing adherent tissue reaction [25]. In another report, local administration of doxycycline via drainages aimed at sclerosing therapy of lymph fistula; however, consecutive phrenic nerve palsy was described [26]. None of these measures was applied. However, in the present series. A systemic approach to decrease lymphatic output is the application of somatostatin analoga that has not been described in larger number of patients [27].

In surgical interventions described in the literature, following unsuccessful conservative treatment most procedures performed were ligation of identified leak or suturing [1, 9, 15, 16, 18–22]. In cases were leakage was present, however, fistula origin could not be identified; hemostyptic devices and fibrin glue were administered with inconsistent success [1, 9, 16]. Supplementary application of local fibrin glue and fleece was utilized generously in the present series and thought to be helpful; however, effectiveness cannot be

Table 3 Patient characteristics and management groups

Patient characteristics	Conservative n=19	Surgical n=10
Age (mean; range)	45 years (14–74)	52 years (37–73)
Gender (m/f)	11:8	6:4
Hospitalization (median)	11 days	21 days
Initial conservative therapy	6.2 days	4.9 days
Drainage (mean; standard deviation, CI 95%)	198 ml/day (51.74; CI 95% 160–236)	322 ml/day (70.70; CI 95% 269–374)

Table 4 Characteristics of patient group with surgically treated lymph fistulas and initial surgical procedures performed

Patient	Age	Gender	Previous surgery	Hospitalization (days)	Diagnosis	Surgical procedure 1st surgery	1st surgery: intraoperative lymph flow, pointed	1st surgery: intraoperative lymph flow, diffuse	Clinical evidence lymph fistula[a]	Initial conservative therapy (d)	Lf surgery: ligature	Lf surgery: suture	Lf surgery: muscle flap	Lf surgery: haemostasis	Max. mean drain volume (ml/day)	Drain duration (d)	Second lymph fistula	Conservative therapy 2. lymph fistula	Surgical therapy 2. lymph fistula
1	38	M	N	21	sMTC	TT, K1–3	N	N	1	5	Y	N	N	N	200*	5	Y	Y	N
2	48	F	Y	10	hMTC	redo-K1–3	N	N	2	4	Y	N	N	Y	60*	5	N	N	N
2	37	F	Y	21	hMTC	TT, K1–3	N	Y	2	9	Y	Y	N	Y	250*	10	Y	Y	Y
4	37	M	N	16	sMTC	TT, K1–3	N	N	4	6	Y	N	N	Y	100*	9	N	N	N
5	73	M	Y	20	MNG	Compl.-TT	N	N	2	4	N	N	N	Y	100*	3	N	N	N
6	54	F	Y	16	sMTC	Compl.-TT, K1–3	N	N	1	7	Y	N	N	Y	2050	8	N	N	N
7	67	M	N	24	sMTC	TT, K1–3	N	N	1	5	Y	N	N	Y	450	6	N	N	N
8	44	F	N	24	sMTC	TT, K1–3	N	N	5	6	Y	Y	Y	Y	450	18	Y	N	N
9	70	M	N	19	Thyroiditis	TT	N	N	2	3	N	N	Y	N	60[b]	7	N	N	N
10	55	M	Y	26	FTC	Compl.-TT, K1–3	N	N	1	0	1	0	N	Y	0	0	Y	N	Y

sMTC sporadic medullary thyroid carcinoma, *hMTC* hereditary medullary thyroid carcinoma, *MNG* multinodulary goiter, *FTC* follicular thyroid cancer, *TT* total thyroidectomy, *K1–3* cervical lymph node compartments according to Dralle, *N* no, *Y* yes

[a] Number of postoperative day

[b] Major content lost to measurement due to paradrain leakage

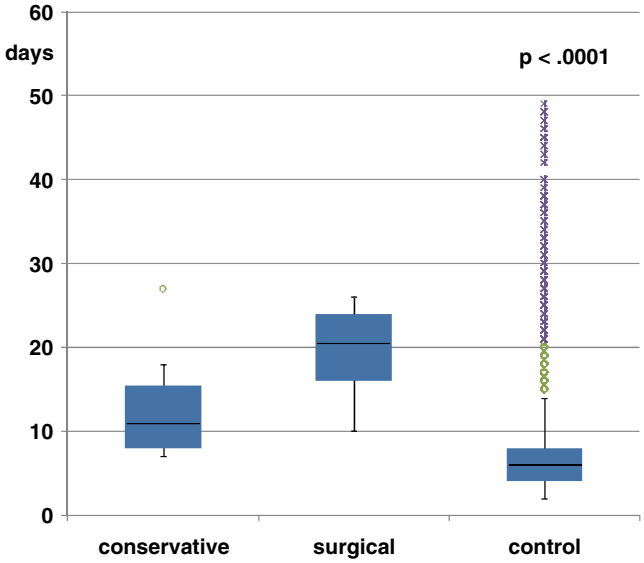

Fig. 1 Duration of hospital stay

verified as quantitative differences were not evident and success as well as unsuccessful fistula treatment resulted with or without application of fibrin glue.

In the recent reports investigating cervical lymph fistulas, incidence is reported to range between <1% to and up to 5.8% [1, 2, 24]. Contrary to historical reports, lethal outcome was not observed in series published in the past decade. The present series similarly demonstrates a low incidence of lymph fistula following thyroid surgery despite predominance of radical procedures with extensive lymph node dissection in this cohort, and there was no death. Efficient and immediate medical treatment with sufficient intravenous supplementation administering MTC, proteins, and balanced electrolytes assumedly influence today's improved outcome in the event of postoperative lymph fistula.

Risk factors reported in the literature identify lymph node dissection with lesion to the left thoracic duct and previous neck irradiation. A predominance of left-sided leakage origin due to injury of the main thoracic duct is stated by several authors; however, in a recent retrospective study investigating lymph fistula in metastatic thyroid cancer, Roh et al. observed an overall incidence of 8.3% of postoperative lymph fistulas. In 8.9% of these this occurred after neck dissection on the right side and in 7.5% after left-sided lymphadenectomy. Clinical onset of lymph fistula lay between the day of surgery and postoperative day 3. Maximum output into drainages ranged from 152 to 1,720 ml/day with a duration of 5–62 days [1]. The authors imply that possibly overall incidence of lymph fistula may even higher when systematically analyzing drain content. They found the elevated triglyceride concentration above serum level to be superior in definitive identification of lymph leakage than the color of secretion itself. In the present series, this was also, however, infrequently used when volume and quality of drainage secretion were disparate. Erisen et al. also found a considerate 5.8% incidence of right-sided fistulas in a prospective study, which may until now have been underestimated [18]. In the present series, we also found two of 29 (6.8%) fistula originating from the right side. The present series shows comparable results to the report of Roh et al. Evidence of lymph leak was first recognized on postoperative day 2, latest on day 7. Considerate drainage volume or sudden increase was thereby registered as indicative of lymph leakage irrespective of absence of milky-white quality. Fistula output may be variable and ranged from 65 to 2,000 ml/day, and duration of primary fistula was 3–18 days [7, 18, 24].

Management of postoperative lymph fistula reveals a spectrum of conservative and surgical measures. The majority will preferably be treated conservatively with diets omitting long-chain triglyceride and prolonged closed drainage. Besides volume of output, several criteria will influence choice of management in the individual patient. Arguments against a prolonged conservative approach are the duration necessary for successful fistula closure which clearly presents a considerate compliance problem to the patient and poor general as well as compromising the nutritional health status which will further deteriorate with these strict protocols. Nonsurgical management in postoperative lymph fistulas is reported to be successful in 58–100% [2–4, 14, 19, 21, 24, 25]. Initiating fasting regimen should be followed by clearing of lymphatic secretion and measurable reduction in volume output within 4 days.

In the event of persistence, surgical intervention should be evaluated. Regarding the specific measures, medication alimentation clearly showed that additional aspirates, drainages, and open wound dressing are frequently necessary. Therefore, in view of the duration of hospital stay and comparable results of surgical and conservative management, arguments against surgical review seem less convincing. In the present series, surgical success was best whenever a solitary source of lymph leakage was identified and ligated, representing the strongest determinant of surgical success. Volume output in the surgically treated patients of this series was lower compared with Nussenbaum et al. illustrating the multifactorial determination of management in the course [9].

Unanimously, all authors regarding lymph fistula management report significantly prolonged hospital stay. This series showed the longest duration in hospital for the group of patients with surgical management. This is indebted to the fact that first-line conservative treatment failed and consecutively surgery with another period of dietary protocol and drainages in the historical group followed. In the intention to shortcut this prolonged hospitalization, today, early stratification on day 4 after initiating fasting

protocol towards continued conservative or changing in favor for surgery is preferred.

Conclusions

Lymph fistulas following thyroid surgery present a management challenge as no clear criteria for stratification into conservative or surgical treatment option exist. While the majority of lymph fistulas may ultimately be successfully managed conservatively, consideration of prolonged hospital stay, patient's tolerance, and compliance to trying fasting protocols and evidence of impairing health status are arguments for surgical intervention.

Success of surgical review of lymph fistulas is strongly correlated with identification of the responsible lymphatic outlet and safe ligature. In case of diffuse lymphatic leakage, failure of surgical intervention is likely and adjunct measures as well as extended procedures do not prove to positively influence outcome and should be discouraged.

Determinants for conservative treatment derived from this series were low-output fistula and prompt reduction of output after initiation of fasting as well as good general and nutritional health status but not less importantly good patient's compliance. Contrarily, criteria for surgical intervention in evidence of lymph fistula are high-output fistula and failure to promptly reduce output with fasting, poor general and nutritional health, as well as poor patient compliance to dietary regimen. In order to reduce severely prolonged hospitalization, decision towards definitive treatment modality should be met within 4 days of fistula evidence and initial conservative measures.

The considerate impact of postoperative lymph fistula regarding effort, economy, and patient's emotional stress as well as potential impairing effect on oncological outcome pronounce the importance to prevent lymph fistulas as best as possible utilizing magnifying loops and meticulous preparation.

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