ORIGINAL ARTICLE

Efficiency of intranodal lymphangiography in the treatment of postoperative lymphatic leakage

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ABSTRACT

BACKGROUND: This study aimed to evaluate the safety and efficacy of intranodal lymphangiography (IL) for the treatment of postoperative chyle leakage (CL), chylothorax, and chylous ascites.

METHODS: Between April 2018 and July 2022, eight patients who underwent IL for CL following thyroid and thoraco-abdominal surgeries were included in this retrospective study. Among these eight patients, six underwent bilateral total thyroidectomy, one underwent lobectomy of the lung, and one underwent total abdominal hysterectomy with bilateral salpingo-oophorectomy. Prior to the procedure, thoracic duct ligation was attempted in one patient. Lymphangiographic findings, technical and clinical success rates, and complications were analyzed. Technical success was defined as the successful ultrasound-guided puncture of an inguinal lymph node and the opacification of the lymphatic system in the pelvis and abdomen by fluoroscopy. Clinical success was defined as a progressively decreasing drain output, culminating in the cessation of output within one week after the procedure.

RESULTS: Technical and clinical success was achieved in all patients. On lymphangiography, ethiodized oil leakage near the surgical bed was identified in seven of the eight patients. The median time from the procedure to drain removal was three days (range: 1-6 days) for patients who underwent surgical drainage. No recurrence of CL, chylothorax, or chylous ascites was observed during the follow-up period (range: 21-73 months; median: 38 months).

CONCLUSION: Intranodal lymphangiography appears to be a safe and effective minimally invasive treatment option for CL following thyroid and thoraco-abdominal surgeries, demonstrating acceptable technical and clinical success rates.

Keywords: Intranodal lymphangiography; chylous ascites; chylothorax; thyroidectomy; hysterectomy.

INTRODUCTION

Chyle leakage (CL) is a rare complication of thyroid surgery that may present clinically as postoperative neck swelling, chylous output in surgical drains, and chylothorax. The incidence of CL following thyroid surgery is reported to range from 0.5% to 2.0%.[1-3] However, some prospective studies have reported a much higher incidence, ranging from 4.7% to 8.3%, depending on the extent of the surgery.[4-6]

Postoperative lymphatic leakage after abdominal and pelvic surgery is a serious complication associated with significant morbidity and mortality.[7-10] Until recently, surgery was the only available option if conservative therapies, including drainage, diet modifications, and medication, failed.[9,10] However, surgery is associated with local complications and comorbidities.[11] Over the last two decades, transpedal or intranodal ethiodized oil-lymphangiography (L-LAG) has emerged as a minimally invasive diagnostic and therapeutic method to identify and treat persistent postsurgical pelvic and intra-abdominal lymphatic leaks.[12-17]

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MATERIALS AND METHODS

Patients

This retrospective study was approved by Istanbul University-Cerrahpaşa Rectorate Clinical Research Ethics Committee (Decision/Protocol No: 83045809/604.01-980860, Date: 08.05.2024,), and the requirement for informed consent was waived. The electronic medical records of all consecutive patients who underwent intranodal lymphangiography for CL following thyroid and thoraco-abdominal surgeries between April 2018 and July 2022 were reviewed. Demographic data, type of surgery, clinical presentation, CL output, technical details, complications, and clinical outcomes were evaluated. Intranodal lymphangiography was performed in patients with refractory CL that persisted for more than one week despite conservative management, including diet modification, fasting with total parenteral nutrition, and octreotide administration. All patients had low output (less than 500 cc per day) after at least one week of conservative treatment.

Procedure

Intranodal lymphangiography was performed by a board-certified interventional radiologist with 12 years of experience. Bilateral inguinal lymph nodes were accessed using a 25-gauge needle under sonographic guidance. Ethiodized oil (Lipiodol; Guerbet LLC) was manually injected into the lymph nodes until opacification of the lymphatic system in the abdomen was observed. Technical success was defined as the successful ultrasound-guided puncture of an inguinal lymph node and opacification of the lymphatic system in the pelvis and abdomen by fluoroscopy. Clinical success was determined by the resolution of chylous drainage output sufficient for surgical drainage or chest tube removal within one week after the procedure.

Statistical Analysis

The SPSS package program version 26.0 (IBM Corp., Armonk, NY) was used for statistical analysis. Pearson chi-square test or Fisher's exact test was used to compare categorical data. Kolmogorov-Smirnov test and Shapiro-Wilk test were employed to evaluate whether the distribution of continuous variables was normal. Nonparametric tests (Kruskal-Wallis or Mann-Whitney U test) were used to compare non-normally distributed data. For statistical significance, a p value of <0.05 was considered acceptable.

RESULTS

The baseline characteristics of the patients are summarized in Table 1. Technical and clinical success was achieved in all patients. The CL sites (Fig. 1) were identified by the presence

Table 1. Demographics and clinical details of included patients

Patient No	Chyle Leak	Age (Years)	Sex	Primary Diagnosis	Treatment History	Technical Success	Clinical Success	Duration of Follow-Up (Months)	Follow-Up	Comment
1	Chylous ascites	7	Male	Adrenal gland malignancy	Excision of lesion	Yes	Yes	28	No recurrence	
2	Chylous ascites	55	Male	Pancreatic carcinoma	Whipple procedure	Yes	Yes	50	No recurrence	
3	Chylous output in surgical drain	30	Male	Papillary thyroid carcinoma	Total thyroidectomy	Yes	Yes	34	No recurrence	Prior surgical ligation of the thoracic duct
4	Chylous output in surgical drain	44	Male	Papillary thyroid carcinoma	Total thyroidectomy	Yes	Yes	42	No recurrence	
5	Chylous output in surgical drain	57	Female	Papillary thyroid carcinoma	Total thyroidectomy	Yes	Yes	42	No recurrence	
6	Chylous output in surgical drain	59	Female	Medullary thyroid carcinoma	Total thyroidectomy with bilateral central compartment neck dissection	Yes	Yes	73	No recurrence	
7	Chylothorax	69	Male	Lung cancer	Lobectomy	Yes	Yes	21	No recurrence	
8	Chylous ascites	59	Female	Ovarian cancer	Total abdominal hysterectomy with bilateral salpingo-oophorectomy	Yes	Yes	21	No recurrence	A 1:4 ratio of n-butyl cyanoacrylate (n-BCA) to ethiodized oil was used for the pelvic leakage site

of ethiodized oil leakage on the surgical bed in all patients except one. Among the study population, surgical thoracic duct ligation (TDL) was performed in one patient prior to intranodal lymphangiography, and the CL site was not identified in this patient. In two post-thyroidectomy patients, thoracic duct embolization (TDE) attempts were performed after intranodal lymphangiography. Following unsuccessful TDE attempts, cisterna chyli disruptions were performed in both patients. A 1:4 ratio of n-butyl cyanoacrylate (n-BCA) to ethiodized oil was used for one patient whose leakage site was located in the pelvis (Fig. 2).

The median time from the procedure to drain removal was three days (range: 1-6 days) for the eight patients. No recurrence of CL was observed during the follow-up period, which ranged from 21 to 73 months (median: 38 months).

DISCUSSION

The treatment of chylothorax typically includes drainage of the fluid, addressing the underlying disease, and an initial attempt at conservative treatment. Conservative therapy aims to reduce lymphatic flow within the vessels, allowing the leakage to close spontaneously. This can be achieved by administering a medium-chain triglyceride diet via total parenteral nutrition, or through the additional administration of somatostatin or octreotide.[18-21]

When conservative therapy fails, surgical or interventional radiological treatment options can be considered.[22,23] The duration of conservative treatment is under debate.[24-26] An active approach in experienced centers involves initiating interventional radiological treatment for chylous drainage exceeding 300 mL within one week of diagnosis. However, immediate conversion to surgical or interventional radiological treatment is strongly recommended under the following circumstances:

- Drainage exceeding 300 to 1000 mL for five or more days,
- Low drainage rates (100-200 mL) persisting for more than two weeks,
- Unchanged drainage over two weeks, and
- Development of malnutrition or metabolic complications due to chylous fluid loss.

Clinical results of the theranostic effect of intralymphatic use of Lipiodol to treat lymphatic leaks demonstrate the disappearance of leaks in 50% to 80% of cases, with the highest success rates observed in cases of chyle leaks less than 1000 mL/day.[27] The therapeutic mechanism of Lipiodol for chyle leakage has not yet been fully clarified; however, several researchers suggest that Lipiodol accumulates near the leakage point and induces localized inflammatory reactions. Additionally, similar to its use in conventional transarterial chemoembolization, Lipiodol may also act as an embolic agent within the lymphatic vessels.[8,27-30]

In our study, CL was observed in all patients except one who underwent surgical TDL prior to intranodal lymphangiography. Postoperative CL resolved in all post-thyroid surgery cases following intranodal lymphangiography without successful TDE. This could be attributed to the therapeutic effects of intranodal lymphangiography or the disruption of the cisterna chyli during the TDE attempts.[18]

Matsumoto et al.[16] reported the therapeutic effect of lymphangiography with a high clinical success rate of 89% (7/9) for various types of CL. Matsumoto et al.[16] also reported a mean duration of 17 days from the procedure to CL resolution. Although the patient group in their study was heterogeneous and different from ours, the time to CL resolution was relatively longer than in our study, particularly given that the surgical drain was removed within a week in our study. The additional therapeutic effects of intranodal lymphangiography (IL) may explain this difference when compared to pedal lymphangiography.

This study has several limitations. First, due to the relatively rare incidence of refractory postoperative CL following thyroid and thoraco-abdominal surgeries, the study included a small number of patients and was conducted retrospectively. Second, postoperative chyle CL, chylothorax, and chylous ascites were included. Although different types of leaks have distinct pathophysiologic origins, they are treated with the same interventional techniques. Finally, although no clinically relevant adverse events were identified in this study, potential subclinical damage to the lung parenchyma might have oc-

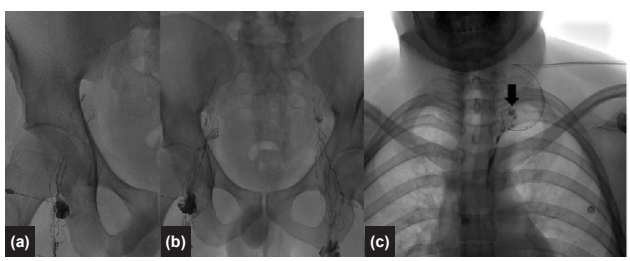

Figure 1. A 66-year-old woman underwent bilateral thyroidectomy for thyroid cancer. Bilateral intranodal lymphangiography **(a,b)** demonstrates ethiodized oil leakage (arrow) near the surgical site on the left side of the neck **(c)**.

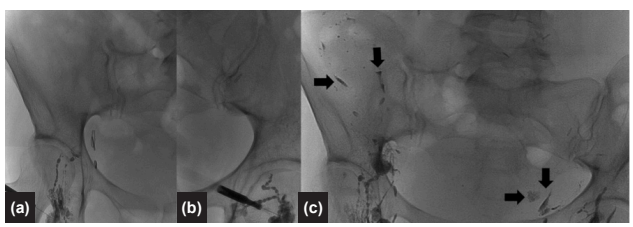

Figure 2. A 57-year-old woman presented with chylous ascites shortly after undergoing total abdominal hysterectomy with bilateral salpingo-oophorectomy. Bilateral intranodal lymphangiography **(a,b)** reveals bilateral pelvic leakage **(c)** of ethiodized oil (arrows), associated with bilateral iliac lymph vessel injury.

curred, as no lung function tests were performed following lymphangiography.

The current institutional approach involves at least a one-week trial of conservative measures before attempting intranodal lymphangiography. Based on the promising results of our study, we propose an earlier trial of intranodal lymphangiography. This approach may enhance the effectiveness of embolization due to higher lymphatic flow. Furthermore, early engagement of IL may mitigate the loss of nutrients, immune cells, and proteins, which can lead to high morbidity and mortality if not addressed promptly.

CONCLUSION

In conclusion, TDE appears to be a safe, effective, and minimally invasive treatment option for postoperative CL, chylothorax, and chylous ascites. Our findings align with previous studies, underscoring the efficacy of IL as a safe and effective alternative to more invasive surgical options. However, further research with larger patient cohorts is warranted to confirm these findings and investigate the potential long-term effects and subclinical implications of the procedure.

Ethics Committee Approval: This study was approved by the Istanbul University-Cerrahpaşa Rectorate Clinical Research Ethics Committee (Date: 08.05.2024, Decision No: 83045809/604.01-980860).

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Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

İntranodal lenfanjiografinin postoperatif lenfatik kaçakların tedavisindeki etkinliği

AMAÇ: Bu çalışmada intranodal lenfanjiografinin (İL) postoperatif lenf kaçağı (LK), şilotoraks ve şilöz asit tedavisindeki yerini değerlendirdik.
GEREÇ VE YÖNTEM: Nisan 2018 ile Temmuz 2022 tarihleri arasında cerrahi sonrası LK gelişen ve İL ile tedavi edilen 8 hasta geriye dönük olarak tespit edilip çalışmaya dahil edilmiştir. Sekiz hastanın altısı bilateral total tiroidektomi, birisi akciğer lobektomi ve birisi total abdominal histerektomi bilateral salfingooferektomilidir. İL öncesi bir hastada cerrahi torasik duktus ligasyonu denenmiştir. Lenfanjiografi bulguları, teknik ve klinik başarı ve komplikasyonlar analiz edilmiştir. Teknik başarı ultrason eşliğinde lenf nodu ponksiyonu ve pelvik ve abdominal lenfatik sistemin floroskopi ile görüntülenmesi olarak tariflenmiştir. Klinik başarı ise cerrahi drenlerden gelenin hızlı bir şekilde azalarak işlemden 1 hafta içinde gelenin durması olarak tariflenmiştir.
BULGULAR: Teknik ve klinik başarı hastaların tümünde elde edilmiştir. Lenfanjiografik incelemede; yağ bazlı iyotlu kontrast madde kaçağı sekiz hastanın yedisinde tespit edilebilmiştir. İşlem ile cerrahi drenin çekilmesi arasında geçen süre medianı 3 gündür (1-6 gün). Takip sürecindeki hiçbir hastada LK, şilotraks ve şilöz asit izlenmemiştir (21-73 ay, median 38).
SONUÇ: İL; kabul edilebilir teknik ve klinik başarı oranlarıyla, tiroid ve torakoabdominal cerrahi sonrasında gelişen LK için güvenli ve etkin bir yöntem olarak ön plana çıkmaktadır.

Anahtar sözcükler: Histerektomi; intranodal lenfanjiografi; şilöz asit; şilotoraks; tiroidektomi.

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