

Application of Ultrasound-Guided Intranodal Lymphangiography and Embolization in Cancer Patients With Postoperative Lymphatic Leakage

Xingwei Sun

Second Affiliated Hospital of Soochow University <https://orcid.org/0000-0002-6639-145X>

Feng Zhou

Affiliated Suzhou Science and Technology Town Hospital of Nanjing Medical University

Xuming Bai

Second Affiliated Hospital of Soochow University

Qiang Yuan

Second Affiliated Hospital of Soochow University

Mingqing Zhang

Second Affiliated Hospital of Soochow University

Liang Ma

The Forth Affiliated Hospital of Nantong University

Yong Jin (✉ 578898234@qq.com)

The Second Affiliated Hospital of Soochow University

Technical innovations

Keywords: Lymphatic leakage, Lymphangiography, Ultrasound-guided

Posted Date: September 14th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-73630/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published on January 30th, 2021. See the published version at <https://doi.org/10.1186/s12957-021-02144-2>.

Abstract

Background: Traumatic lymphatic leakage is a rare but potentially life-threatening complication. The purpose of this study was to introduce the technique of ultrasound-guided intranodal lymphangiography and embolization in the postoperative lymphatic leakage in patients with cancer.

Methods: During January 2018 and June 2020, seven cancer patients (three males, four females, aged 59-75 years [mean 67.57 ± 6.11 years]) developed lymphatic leakage after abdominal or pelvic surgery, with drainage volume ranging from 550 to 1200 mL per day. The procedure and follow-up of ultrasound-guided intranodal lymphangiography and embolization were recorded. This study retrospectively analysed the technical success rate, operation time, hospital stay, clinical efficacy, and complications.

Results: The operation was technically successful in all patients. Angiography revealed leakage and embolization was performed in all the seven patients (7/7, 100%). The operative time of angiography and embolization was 41 to 68 minutes, with an average time of 53.29 ± 10.27 minutes. The mean length of stay was 3.51 ± 1.13 days. Lymph node embolization was finally clinically successful in five patients (5/7, 71.43%), with a significant reduction in or disappearance of chylous ascites. The other two patients received surgical treatment 2 weeks later due to poor results after embolization. All patients were followed-up for 2 weeks. No serious complications or only minor complications were found in all the patients.

Conclusions: Ultrasound-guided intranodal lymphangiography and embolization are easy to tolerance, with a low incidence of complications. Early intervention is recommended for cancer patients with postoperative lymphatic leakage.

Background

Traumatic lymphatic leakage is a rare but potentially life-threatening complication for cancer patients [1,2]. Abdominal and pelvic surgery is the main cause of lymphatic leakage [3-5]. Lymphatic vessel ligation is the standard treatment for high-output lymphatic leakage; however, cancer patients often find this procedure difficult to tolerate [6-8].

Intranodal lymphangiography and lymphatic leakage embolization is a new technique that has emerged in recent years [9,10]. Here, we introduced the ultrasound-guided intranodal lymphangiography and embolization technique in cancer patients with postoperative lymphatic leakage. Seven cancer patients with lymphatic leakage after abdominal or pelvic surgery were treated with this new technique, the procedure and follow-up results are reported.

Materials And Methods

This study was approved by the ethics committee of our hospital. Informed consent was obtained from the patients.

Seven patients received interventional therapy for lymphatic leakage in our department from January 2018 and June 2020. We retrospectively analysed their clinical data (Table 1).

Table 1 Procedural data of all study patients.

Patient No.	Age(y) /Sex	Surgery	Procedure Times (min)	Preoperative Drainage mL/day	Postoperative Drainage mL/day	Complications	Treatment Measures
1	59/M	Subtotal gastrectomy	63	750	700		Surgical treatment
2	73/M	Radical prostatectomy	68	870	50		
3	67/F	Cystadenoma resection	51	1200	1100		Surgical treatment
4	61/F	Hysterectomy	48	550	None		
5	72/M	Radical gastrectomy	59	650	30	Infection	Anti-infective therapy
6	66/M	Kidney transplantation	43	1100	None	Chronic diarrhea	Symptomatic treatment
7	75/F	Hysterectomy	41	600	20		

With the patient supine appropriate inguinal lymph nodes were identified using ultrasound and prior CT or MRI images. A high-frequency probe (>7.5 MHz) was used to detect superficial lymph nodes. A 60 mm, 25 G Cathelin needle (Terumo Europe, Leuven, Belgium) could be used directly to puncture the inguinal lymph nodes under ultrasound guidance (Figure 1A). The ultrasound-guided needle tip was positioned into the inguinal lymph nodes at the junction of the hilum and the cortex, and iodized oil (Lipiodol; Guerbet, Roissy, France) was gently injected manually at a rate of approximately 1 to 2 ml every 5 minutes under intermittent fluoroscopy (dedicated lymphangiogram pump or, more commonly, an advanced anaesthesia injection pump was used at an injection rate of 0.2–0.4 mL/minute). The lymph nodes showed a small dark area that drained into the lymph vessels through its continuous branches (Figure 1B). The total dose of iodized oil should be limited to 0.25 mL/kg. The X-ray showed that the iodized oil accumulated in the abdomen. A large amount of iodized oil leaked from the lymphatic vessels into the abdominal cavity, consistent with the drainage site from where the lymphatic fluid leaked out (Figure 1C).

Approximately 2 ml 5% glucose water could be used to push the remaining iodine oil to the accumulation site. N-butyl cyanoacrylate (NBCA) (B. Braun Melsungen AG, Melsungen, Germany) and iodized oil mixed well (1:3-1:4), providing a long enough injection time; the mixture was injected manually at a rate of approximately 1 to 2 ml every 5 minutes under intermittent fluoroscopy by the puncture needle at the aggregation site for embolization of the lymphatic leakage, and 2 ml 5% glucose water could be used again to push the mixture out of the inguinal lymph nodes. The needles were then removed, and the wounds were sutured after the injection was completed.

Ultrasound or CT were used for postoperative follow-up. Clinical efficacy was defined as a significant reduction in daily leakage (over 80%) due to lymphatic drainage over 2 weeks.

Results

Ultrasound-guided inguinal lymph node puncture and lymph node angiography were technically successful (Table 1). Angiography revealed that all seven patients had leakage, and all patients underwent embolization. In five patients (5/7, 71.43%), embolization was clinically successful, and chylous ascites improved significantly in 3 patients and disappeared in 2 patients. The patients were hospitalized for 3 to 7 days, with an average of 5.2 days. One patient

developed chronic diarrhoea after the operation, one patient developed puncture point infection, and these conditions improved after symptomatic treatment. After a follow-up of 2 weeks, no serious complications were found in these patients.

Discussion

Lymphatic leakage seriously affects the prognosis of patients and delays further treatment [11-16]. Janco et al. described that surgical treatment is helpful in avoiding metabolic complications, and ligation or suture of the leakage site was recommended [17]. However, surgical treatment for lymphatic leakage is a more aggressive approach, and it is often difficult for patients with cancer to tolerate another operation after abdominal or pelvic surgery [18,19].

The technique of lymphatic embolization was originally proposed by Cope et al. [20]. The relevant literature notes that the effective rates of lymphangiography and embolization for postoperative lymphatic leakage are 56% and 86%, respectively, which can be used as alternatives to surgical treatment [21-23].

In this study, the clinical effective rate was 71.43% (5/7), which was consistent with the reports of Matsumoto et al. [21-23]. In the study, the drainage volume decreased significantly in three patients, drainage gradually disappeared in two patients, and the effect was not good in the other two patients. One of the patients was diagnosed with a giant abdominal cystadenoma and underwent surgical resection (Figure 2A). Abdominal distension occurred after the operation in this patient. Combined with the MRI examination results, lymphatic leakage was considered; hence, abdominal puncture drainage was performed, and the daily drainage volume was as high as approximately 1200 ml. Because the patient had high-flow leakage and had previously undergone surgery, there was a risk of reoperation. Ultrasound-guided intranodal lymphangiography and embolization were performed after interdisciplinary consultation. During the operation, iodized oil leakage accumulated on the right side of the abdomen (Figure 2B, C). After the contrast medium was flushed out of the iodized oil, a 1:3 iodized oil NBCA mixture was used for lymphatic leakage embolization. However, there was persistent lymphatic leakage after the operation, with a daily drainage volume of 700 mL, which was lower than before. The patient underwent further surgical treatment one week later.

For patients with poor clinical effects, preoperative lymphangiography can better determine the leakage site, provide an effective reference for surgical treatment, and facilitate the localization and ligation of the target lymphatic vessels during the operation [23].

It has been reported that the NBCA iodized oil diluent was mixed evenly at a ratio of 1:2 [24]. In our study, the NBCA iodized oil diluent was used and mixed evenly at a ratio of 1:3 to 1:4. We believe that this concentration can provide a long injection time, allowing sufficient advancement of the NBCA glue in the lymphatic networks. In addition, 5% glucose water was used to push the residual iodized oil to the aggregation site before embolization to prevent the mixture from accumulating rapidly in the lymph nodes.

Kim et al retrospectively evaluated the complications of 24 patients who underwent successful lymphatic embolism. Kim et al noted that in view of the well-known serious mortality and incidence of untreated chylothorax, lymphatic embolization may be a feasible option for the treatment of chylothorax [25].

In our study, ultrasound-guided puncture of inguinal lymph nodes was used. Good ultrasound guidance techniques are keys to the success of the operation. The incidence of complications in the study was 28.57% (2/7); all complications were mild symptoms that could be controlled, including one case of chronic diarrhoea and one case of puncture site infection, all of which improved after symptomatic treatment. Another case of diarrhoea in our study was considered to be caused by other factors. After a follow-up of 2 weeks, no serious complications were found in the patients.

In patients with pulmonary insufficiency (PaO₂ lower than 60 mmHg) or with a right-to-left cardiac shunt, iodized oil embolization risks aggravating a pulmonary embolism or causing a cerebral embolism. Although the incidence of such complications is low, these complications are fatal. Such patients were outside the scope of this study^[26].

Postoperative lymphatic leakage is a rare condition, and the number of cases in this study were limited. Since this technique has not yet been popularized, this group of cases included elderly patients with cancer who could not tolerate surgery again, but the technique itself has no age limitation. The efficacy and safety of ultrasound-guided lymph node angiography and lymphatic embolization need to be further verified in more studies.

Conclusion

Ultrasound-guided intranodal lymphangiography and embolization can be used as a supplement to surgical treatment. With the advantages of minimal trauma, easy tolerance and a low incidence of complications, this early intervention is recommended for cancer patients with postoperative lymphatic leakage.

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of The Second Affiliated Hospital of Soochow University and consent from the patient was available.

Consent for publication:

All authors approved the final manuscript for publication.

Availability of data and material:

Research data can be obtained from corresponding author upon reasonable request.

Competing interests:

All authors declare that they have no conflicts of interest.

Funding

The study was funded by the Pre-Research Project of the National Natural Science Foundation of China (SDFEYGJ1801) and the Young Talent Program of China National Nuclear Corporation (NO. CNNC51007).

Authors' contributions:

Xingwei Sun, Feng Zhou and Mingqing Zhang carried out the studies, participated in collecting data, and drafted the manuscript. Xuming Bai and Qiang Yuan analyzed data. Liang Ma and Yong Jin helped to revise the manuscript.

Acknowledgements:

None.

References

1. Reyesfigueroa, A. , Pedro GilMartínez, Ángel BorqueFernando, Riojazuazu, J. , Ramiro GarcíaRuiz, & María Jesús GilSanz. Management of chylous fistulas, a rare complication after urologic surgery.[J]. Archivos Españoles De Urología, 2015, 68(2):183.
2. Kortés, N. , Radeleff, B. , Sommer, C. M. , Bellemann, N. , Ott, K. , & Richter, G. M. , et al. Therapeutic Lymphangiography and CT-guided Sclerotherapy for the Treatment of Refractory Lymphatic Leakage[J]. Journal of Vascular and Interventional Radiology, 2014, 25(1):127-132.
3. Frey, M. K. , Ward, N. M. , Caputo, T. A. , Taylor, J. , Worley, M. J. , & Slomovitz, B. M. Lymphatic ascites following pelvic and paraaortic lymphadenectomy procedures for gynecologic malignancies[J]. Gynecologic Oncology, 2012, 125(1):48-53.
4. Da-Li, W. , Wu, P. , Shen-Yang, C. , Hai-Long, L. , Shu-Rui, O. , & Wen-Duo, Z. , et al. The application of nutrition support in conservative treatment of chylous ascites after abdominal surgery[J]. Therapeutics and Clinical Risk Management, 2016:607-612
5. Aalami OO, Allen DB, Organ CH. Chylous ascites: a collective review. Surgery. 2000;128(5):761–778
6. Lu, H. W., Zhou, H., Peng, Y. P., Zhang, B. Z., Lu, X. M., & Wang, L. J., et al. Influences of lymphatic vessel ligation in pelvic lymphadenectomy on postoperative lymphocyst formation—a randomized controlled trial [J]. Surgery, 128(5):761-778
7. Tabchouri, N. , Frampas, E. , Marques, F. , Blanchard, C. , Jirka, A. , & Regenet, N. Chylous Ascites Management After Pancreatic Surgery[J]. World Journal of Surgery, 2017, 41(4):1054-1060.
8. Albaghdady, A. , El-Asmar, K. M. , Moussa, M. , & Abdelhay, S. Surgical management of congenital chylous ascites[J]. Annals of Pediatric Surgery, 2018, 14(2), 56-59.
9. Kim, S. W. , Hur, S. , Kim, S. Y. , Cho, J. Y. , Kwak, C. , & Kim, H. S. , et al. The Efficacy of Lymph Node Embolization Using N-Butyl Cyanoacrylate Compared to Ethanol Sclerotherapy in the Management of Symptomatic Lymphorrhea after Pelvic Surgery[J]. Journal of Vascular and Interventional Radiology, 2019, 30(2):195-202.e1.
10. Kuetting Daniel, Schild Hans H, Pieper Claus C. In Vitro Evaluation of the Polymerization Properties of N-Butyl Cyanoacrylate/Iodized Oil Mixtures for Lymphatic Interventions[J]. J Vasc Interv Radiol, 2019, 30: 110-117.
11. Kuboki, S. , Shimizu, H. , Yoshidome, H. , Ohtsuka, M. , Kato, A. , & Yoshitomi, H. , et al. Chylous ascites after hepatopancreatobiliary surgery[J]. British Journal of Surgery, 2013, 100(4):522-527.
12. Pascual M, Pa?Ella C , Pera M . Use of Indocyanine green in the surgical treatment of chylous ascites after laparoscopic colectomy[J]. Colorectal Disease, 2017.
13. Bhardwaj R, Vaziri H, Gautam A, Ballesteros E, Karimeddini D, Wu GY. Chylous Ascites: A Review of Pathogenesis, Diagnosis and Treatment[J]. Journal of Clinical & Translational Hepatology, 2018, 6(1):105-113.
14. Lizaola, A. Bonder, H. D. Trivedi, E. B. Tapper, & A. Cardenas. Review article: the diagnostic approach and current management of chylous ascites[J]. Alimentary Pharmacology & Therapeutics, 2017, 46(9):816-824.
15. Lv S, Wang Q, Zhao W, et al. A review of the postoperative lymphatic leakage. Oncotarget. 2017;8(40):69062-69075
16. Almakdisi T, Massoud S, Makdisi G. Lymphomas and Chylous Ascites: Review of the Literature[J]. Oncologist, 2005, 10(8):632-635.
17. Janco, J. M. T. , Gloviczki, P. , Friese, J. L. , & Cliby, W. A. Lymphatic mapping and ligation for persistent ascites after surgery for gynecologic malignancy[J]. Obstetrics & Gynecology, 2015, 125(2):434-437.
18. Kim E A, Park C T, Park H. Re: “Chylous ascites: Analysis of 24 patients”[J]. Gynecologic oncology, 2012, 127(2): 435-436..
19. Pio L, Boccardo F, Avanzini S, Paraboschi I, Granata C, Garaventa A, et al. Conservative management of chylous ascites after oncological surgery for peripheral neuroblastic tumors in pediatric patients[J]. Lymphology, 2019;52(1):25-34.

20. Cope C, Salem R, Kaiser LR. Management of chylothorax by percutaneous catheterization and embolization of the thoracic duct: prospective trial[J]. *Journal of Vascular and Interventional Radiology*, 1999; 10:1248–1254.
21. Matsumoto, T., Yamagami, T., Kato, T., Hirota, T., Yoshimatsu, R., & Masunami, T., et al. The effectiveness of lymphangiography as a treatment method for various chyle leakages[J]. *The British Journal of Radiology*, 2009, 82(976):286-290.
22. Ryota, K., Koji, S., Masahiko, F., Naokazu, M., Takuya, O., & Masato, Y., et al. Therapeutic effectiveness of diagnostic lymphangiography for refractory postoperative chylothorax and chylous ascites: correlation with radiologic findings and preceding medical treatment[J]. *Ajr American Journal of Roentgenology*, 2013, 201(3):659-666.
23. Hur, S., Shin, J. H., Lee, I. J., Min, S. K., Min, S. I., & Ahn, S., et al. Early Experience in the Management of Postoperative Lymphatic Leakage Using Lipiodol Lymphangiography and Adjunctive Glue Embolization[J]. *Journal of Vascular and Interventional Radiology*, 2016, 27(8):1177-1186.e1.
24. Cuong NN, Binh NT, Hien PN, Hoang N, Linh LT, & Luu DT, et al. Interventional Treatment of Lymphatic Leakage Post Appendectomy: Case Report[J]. *Open Access Maced J Med Sci*, 2019, 7: 1512-1515.
25. Kim SW, Hur S, Kim SY, Cho JY, Kwak C, & Kim HS, et al. The Efficacy of Lymph Node Embolization Using N-Butyl Cyanoacrylate Compared to Ethanol Sclerotherapy in the Management of Symptomatic Lymphorrhea after Pelvic Surgery[J]. *Journal of Vascular and Interventional Radiology*, 2019, 30(2):195-202.e1.
26. Kusumoto S, Imamura A, Watanabe K. Case report: the incidental lipid embolization to the brain and kidney after lymphography in a patient with malignant lymphoma: CT findings[J]. *Clinical Radiology*, 1991;44:279-280

Figures

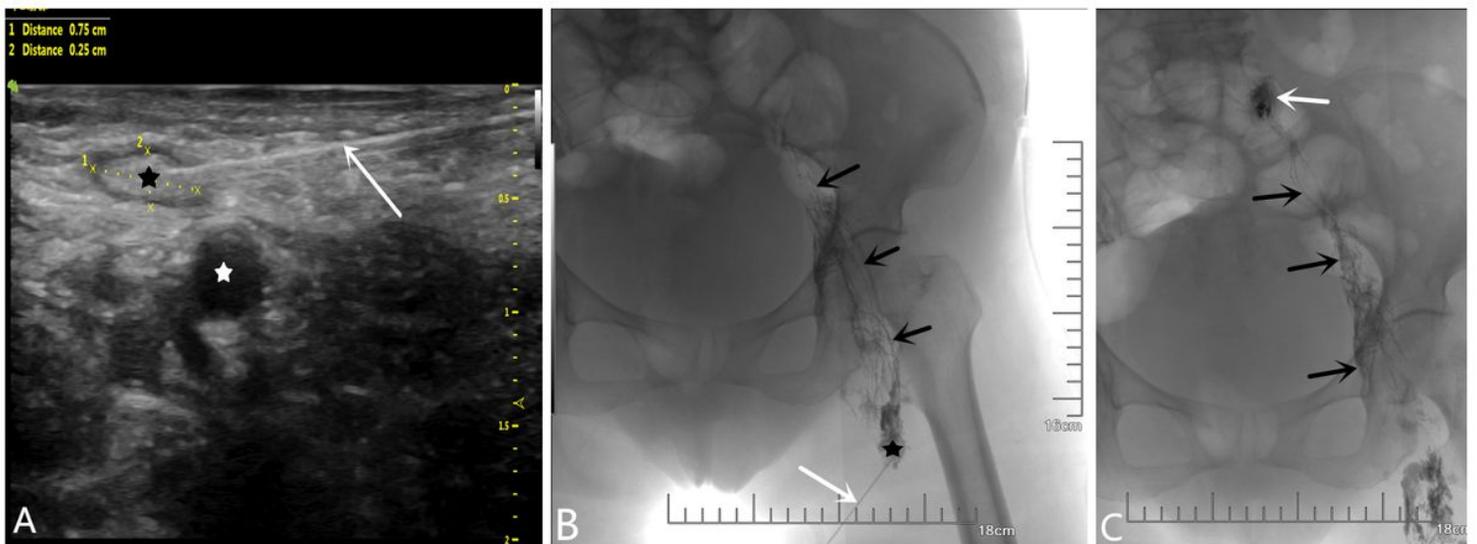


Figure 1

(A) Ultrasound-guided inguinal lymph node puncture. A 22G puncture needle (white arrow) was guided by ultrasound to puncture the inguinal lymph nodes (black star). The circular hypoechoic area on the lower right is the femoral artery (white star). (B) Intranodal lymphangiography. The 22G puncture needle (white arrow) punctured the inguinal lymph node (black star) and slowly injected iodized oil under fluoroscopy to show the lymphatic vessel path (black arrows). (C) Lymphatic leakage embolization. White arrow showing the location of the lymphatic leakage. Under fluoroscopy, the mixture of NBCA and iodized oil was injected at the aggregation site through the puncture needle to embolize the lymphatic leakage. The black arrows indicate the path of the lymphatic vessel.

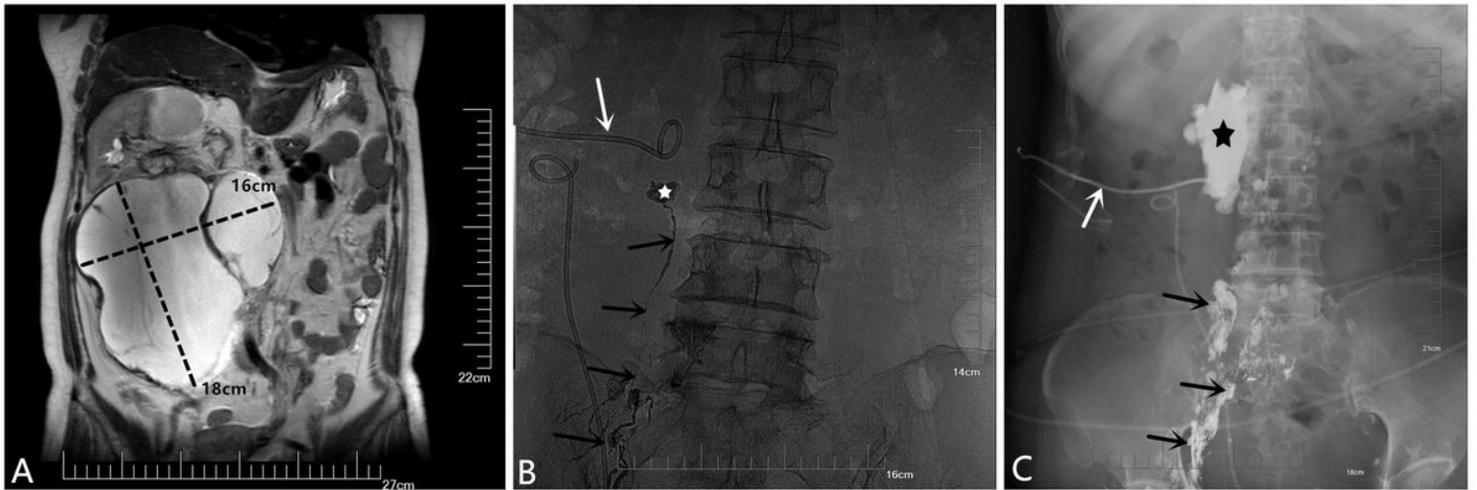


Figure 2

Intranodal lymphangiography and embolization to treat lymphatic leakage after abdominal surgery (patient 3). (A) Preoperative MRI in patients showed a large space in the right abdomen with a maximum diameter of 16 to 18 cm. Cystadenoma was considered. (B) Lymphatic leakage occurred after resection of the cystadenoma, with a daily drainage volume of 1200 mL of milky liquid. The white arrow is a drainage tube placed at the time of surgery. Ultrasound-guided intranodal angiography showed leakage of iodized oil and aggregation on the right side of the spine (white star). (C) The NBCA iodized oil diluent was mixed evenly at a ratio of 1:3, and the mixture was slowly injected at the site (black star) under fluoroscopy to embolize the lymphatic leakage.