Physiologic Effects Of Thoracic Duct Lymphovenous Bypass

Yoshiko Toyoda, MD[1], Cody C. Fowler, MD[2], Sammy Othman, MD[3], Daniel Mazzaferro, MD[1], Reed McGraw, BS[1], Said Azoury, MD[1], Maxim Itkin, MD[1], Stephen Kovach, MD[1]

[1]University of Pennsylvania, Philadelphia, PA; [2]University of Rochester, Rochester, NY; [3]Northwell Health, New Hyde Park, NY

Introduction

- Surgical intervention for lymphatic pathology remains largely unexplored, but thoracic duct mechanical obstruction is an exception which may be addressed with microsurgery.
- Patients who failed conservative treatment and minimally invasive therapies may be candidates for microsurgical lymphovenous bypass. We have developed a multidisciplinary, collaborative intraoperative protocol with interventional radiologists.
- Postoperatively, lymphovenous bypass is thought to cause physiological derangements as a result of the increased venous return, but no data exist on specifically what changes can be expected.

Purpose

We herein report on a case series of thoracic duct lymphovenous bypass patients and their postoperative physiologic changes.

Methods

- Retrospective review of all nonsyndromic adult patients who underwent thoracic duct lymphovenous bypass by the senior authors from 2016-2022
- Demographic and perioperative data; postoperative changes in vital signs including oxygen requirements, heart rate (HR), and blood pressure were collected.

Table 1. Patient demographics

Characteristic	
Women (%)	4 (44%)
Age (yr)	
Mean (Range)	46.8 (23 – 66)
BMI (kg/m^2)	
Mean (Range)	28.9 (19.3 – 42.4)
Comorbidities	Diabetes HLD HTN DVT/PE Pulmonary hypertension Lung adenocarcinoma + XRT Liver transplantation Thyroid disorder

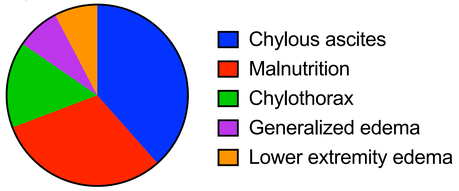


Figure 1. Presenting symptoms

Table 2. Prior interventions

Medical Therapies		**Procedural Therapies**	
TPN	2	Paracentesis	4
Compression	1	Thoracentesis	2
Diuresis	1	Lymphangiogram	5
Octreotide	1	Embolization	2
Sirolimus	1	Angioplasty	4
		Surgical resection	1

Results

- Nine patients with symptoms refractory to medical and procedural therapies were included in the study (**Table 1, Figure 1, Table 2**).
- The operative technique is described (**Figure 2**). Clinical outcomes varied based on location of the lesion. Those with isolated, proximal lesions benefited most from the lymphovenous bypass with less chance of clinical recurrence.
- Immediate postoperative HR increased significantly among this heterogeneous patient population, but within 4 - 6 hours the change in HR was no longer significant. Mean arterial pressure and oxygen requirement were not significantly different before and after bypass (**Figure 3**).

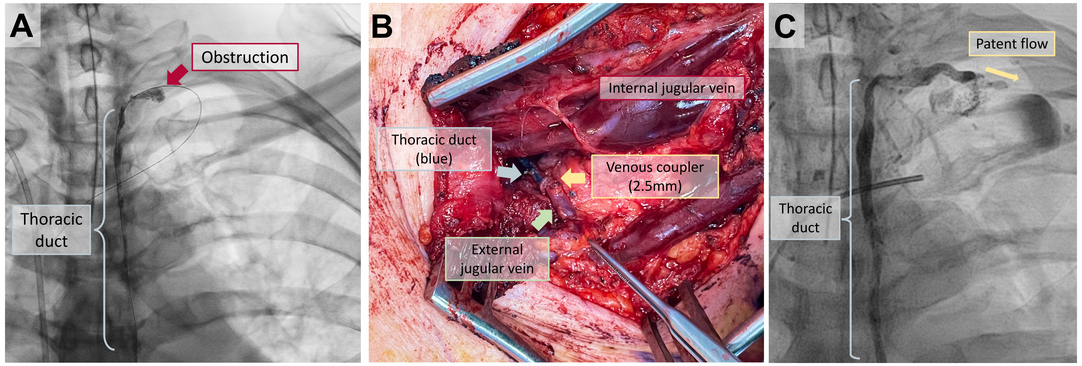
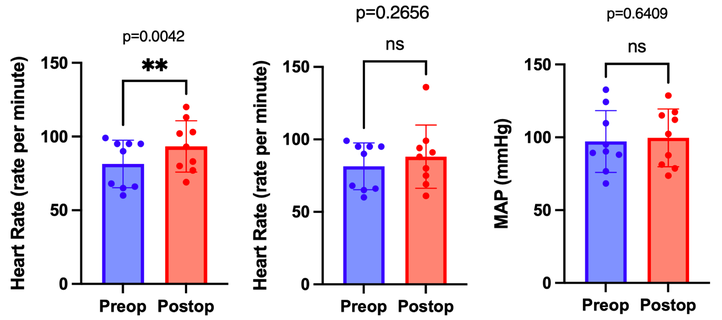


Figure 2. Operative technique. (A) Intraoperative lymphangiogram demonstrates thoracic duct outlet obstruction superior to the clavicle. (B) The internal jugular vein is followed to the junction of the subclavian vein where the the thoracic duct is typically identified with both isosulfan blue and contrast injection. This thoracic duct was anastomosed end-to-end with a venous coupler to the external jugular vein. (C) Post-anastomosis flow is confirmed in real-time prior to closing.



	Heart rate (immediate)	Heart rate (4-6hours)	MAP
Preop (avg)	81.4	81.4	97.1
Postop (avg)	93.3	88.1	99.6
Mean of differences	11.89	6.67	2.489
P-value	0.0042	0.2656	0.6409

Figure 3. Postoperative physiologic changes immediately and 4 – 6 hours later.

Conclusions

- Thoracic duct lymphovenous bypass appears to be well tolerated in the short-term even in patients with cardiopulmonary comorbidities.
- Further data are necessary to continue to better understand the resulting physiologic changes and to optimize patient outcomes. We have begun collaboration with cardiac anesthesiologists to gather more perioperative data on left and right ventricle function using echocardiograms.

References

Bhardwaj R, et al. Chylous ascites: A review of pathogenesis, diagnosis and treatment. *J Clin Transl Hepatol*. 2018;6(1):105-113.

Itkin M, et al. Research Priorities in Lymphatic Interventions: Recommendations from a Multidisciplinary Research Consensus Panel. *J Vasc Interv Radiol*. 2021;32(5):762.e1-762.e7.

Oliver G, Alitalo K. The Lymphatic Vasculature : Recent Progress and Paradigms. *Annu Rev Cell Dev Biol*. 2005:457-483.

Othman S, et al. Microsurgical Thoracic Duct Lymphovenous Bypass in the Adult Population. *Plast Reconstr Surg - Glob Open*. 2021;9(10):e3875.