CLINICAL STUDY

Comparative Analysis of Intranodal Lymphangiography with Percutaneous Intervention for Postsurgical Chylous Effusions

Michael Yannes, MD, Donghoon Shin, MS, Kevin McCluskey, MD, Rakesh Varma, MD, and Ernesto Santos, MD

ABSTRACT

Purpose: To evaluate clinical success and time to resolution of intranodal lymphangiography (INL) alone or with thoracic duct embolization (TDE) or thoracic duct disruption (TDD) based on initial effusion volume for postsurgical chylothorax.

Materials and Methods: Retrospective review was performed of 57 patients (mean age 63 y; 65% male) undergoing INL alone or in conjunction with other percutaneous techniques for postsurgical chylous effusions. INL alone was performed when chylothorax output was $\leq$ 500 mL/d and no leak was identified during fluoroscopy.

Results: INL was technically successful in all patients. There was 1 major and 2 minor complications. Clinical success rate was 71% (40/56). Clinical success rate meeting algorithmic inclusion criteria was 71.4% (5/7) for INL only, 41.7% (5/12) in INL with TDD, and 90.5% (19/21) in INL with TDE. Hazard ratio (HR) of clinical success of INL with TDE versus INL only was not statistically significant (HR 2.3, 95% confidence interval [CI], 0.70–5.87, $P = .19$). Median time to resolution was 14 days for INL only (95% CI, 0 days to not reached), 7 days for INL with TDD (95% CI, 4 days to not reached), and 3 days for INL with TDE (95% CI, 2 to 5 days) ($P = .007$). No statistically significant difference in median time to resolution existed between INL with TDE and INL only ($P = .04$).

Conclusion: In patients with postsurgical chylothorax, INL alone had similar rates of clinical success and time to resolution compared with INL with TDE when initial effusion volume was $\leq$ 500 mL/d and no leak was visualized during fluoroscopy.

ABBREVIATIONS

BPL = bipedal lymphangiography, CI = confidence interval, HR = hazard ratio, INL = intranodal lymphangiography, OR = odds ratio, TD = thoracic duct, TDD = thoracic duct disruption, TDE = thoracic duct embolization

Patients with postsurgical chylous effusions develop serious complications secondary to loss of fluids, fat, and lymphocytes; this can lead to dehydration, malnutrition, and immune depression (1,2). Conservative interventions for these effusions, including drainage, low-fat diet, octreotide, and supplementation with total parenteral nutrition, are often unsuccessful, with reported success rates of 16%–80% (2–5). Approximately 37%–72% of patients undergo corrective surgical intervention, but these interventions can result in significant morbidity (5,6). Minimally invasive percutaneous techniques can obviate the need for open surgical procedures in patients with chylous effusions, particularly chylothorax. First described in 1996 (7–9), thoracic duct embolization (TDE) or thoracic duct disruption (TDD) after bipedal lymphangiography (BPL) is a viable procedure to forestall open surgical correction. Multiple prior retrospective analyses (10–14) and case reports (15,16) confirm the high clinical success rate of BPL with TDE or TDD. Clinical success rates, usually defined as resolution of clinical symptoms and avoidance of subsequent surgical interventions, are 72%–74% for BPL with TDE and 55%

From the Department of Radiology (M.Y., K.M., R.V.), University of Pittsburgh Medical Center, 200 Lothrop Street, Presby East Wing, Suite E174, Pittsburgh, PA 15213; University of Pittsburgh School of Medicine (D.S.), Pittsburgh, Pennsylvania; and Department of Radiology (E.S.), Memorial Sloan Kettering Cancer Center, New York, New York. Received June 3, 2016; final revision received December 4, 2016; accepted December 7, 2016. **Address correspondence to** E.S.; E-mail: ernessantos@gmail.com

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for BPL with TDD (13,14). Technical success rates are 79%–85% (13,14). Clinical success rates of BPL without TDE or TDD are 70% for low-volume (< 500 mL/d) effusions and 35% for high-volume (> 500 mL/d) effusions (17). Nevertheless, many physicians attempt embolization or disruption of the thoracic duct (TD) with all chylothoraces, despite effusion volume.

Intranodal lymphangiography (INL) with TDE or TDD is a technique with less analysis (18–21), in which ethiodized oil (Lipiodol; Guerbet, Villepinte, France) is directly injected into the groin lymphatic system under ultrasound guidance (18–21). Advantages of INL include lack of a skin incision, decreased contrast volume, and decreased procedure time. The purpose of this study is to evaluate the clinical success of INL alone or with TDE or TDD based on initial effusion volume and to evaluate factors that may influence clinical success.

MATERIALS AND METHODS

Study Cohort

This retrospective, institutional review board–approved, Health Insurance Portability and Accountability Act–compliant study was conducted with a study cohort of 57 patients (26 women, 31 men; mean age, 63 y, age range, 11–84 y) (Table 1). Informed consent was waived per institutional review board protocol. Ten patients underwent lymphatic intervention apart from INL only, INL with TDE, or INL with TDD. One patient was immediately lost to follow-up. Seven patients did not meet algorithmic inclusion criteria and were excluded from comparative analysis. There were 40 patients (18 women, 22 men) who underwent INL only, INL with TDE, or INL with TDD for postsurgical chylothorax. Of 40 patients, 5 underwent multiple separate percutaneous procedures (12 procedures total). The initial intervention was used for analysis for these 5 patients, and time to failure was calculated as the duration between the first and second intervention with censure of subsequent procedures. The remaining 35 of 40 patients underwent 1 percutaneous procedure for postsurgical chylothorax.

An interventional radiologist with 19 years of experience (E.S.) performed all procedures. All consecutive INL studies were included from April 2011 to October 2015. All patients had laboratory-proven chylous leaks (defined as triglycerides > 110 mg/dL and chylomicrons in the effusion) and met remaining inclusion criteria (Table 2).

Data Collection

Patient age, sex, treatment type, original surgery causing effusion, previous unsuccessful corrective surgical intervention (if attempted), duration of conservative therapy, initial daily drain output, clinical success, time to resolution, and any complications were recorded (Table 1). Prior administration of a low-fat diet, octreotide, or total parenteral nutrition was also recorded. Technical success of INL was defined as contrast extension from accessed groin lymph nodes to an opacified TD, similar to prior studies (18). Bilateral or unilateral groin injection, number of lymph nodes injected, and volume of Lipiodol were recorded. Identification of the TD was attempted in all patients with chylothorax under fluoroscopy, and time to visualization was recorded.

Clinical success was defined as avoidance of a subsequent surgical (open or minimally invasive) procedure and removal of a previously placed draining catheter or documented effusion resolution. Resolution of the effusion within 60 days from the intervention defined clinical success. Time to resolution was defined as the duration from the procedure until a draining catheter placed before the procedure was removed. If the procedure was unsuccessful, time to surgical correction was recorded. Major and minor complications were queried, as defined by the Society of Interventional Radiology (SIR) Clinical Practice Guidelines (22), through the home institution's electronic medical record (PowerChart; Cerner Corporation, Kansas City, Missouri).

Procedural Technique

Patients with postsurgical chylothorax with a daily effusion volume of ≤ 500 mL/d and in whom a leak was not identified during fluoroscopy were treated with INL only. Five patients with a daily effusion output of > 500 mL/d were also treated with INL only, and 1 patient with a daily effusion output of < 500 mL/d was treated with INL with TDE; this was done before the implementation of the treatment algorithm, and these patients were excluded from comparative analysis. Patients with postsurgical chylothorax with a documented daily effusion volume of > 500 mL/d or ≤ 500 mL/d with a leak identified on fluoroscopy underwent INL with TDE. If TDE was not technically feasible because of failed TD cannulation (often secondary to either patient body habitus or small diameter of the TD), TDD was performed (Fig 1).

INL was performed similarly to previously described reports (18–20,23). Bilateral inguinal lymph node injection was attempted in all cases. Unilateral INL was performed in 6 patients owing to the inability to fill the contralateral side despite needle repositioning. TDE was performed in a similar fashion as prior reports (13). No guiding tool was used. Embolization of the TD cranial to the carinal bifurcation was performed with 2 6 mm × 7 cm microcoils (Cook, Inc, Bloomington, Indiana), followed by a 1:1 mixture of Lipiodol and *N*-butyl cyanoacrylate (TRUFILL n-BCA Liquid Embolic; Codman Neuro, Raynham, Massachusetts) from the site of microcoil placement to the entry site of the TD. TDD was performed in a similar technique as described