Pediatric Intranodal CT Lymphangiography with Water-Soluble Contrast Media

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Purpose

To describe a novel lymphatic imaging technique: pediatric ultra-high resolution CT lymphangiography (UHR CTL) with water-soluble iodinated contrast via direct inguinal intranodal injection. UHR CTL is particularly beneficial in complex congenital heart disease patients with postoperative high-mortality continuous chylothorax and right-to-left shunt.1

Materials & Methods

Intranodal injection. US-guided direct inguinal intranodal injection was performed as previously described.2,3 Under fluoroscopic guidance, intermittent pulsed intra-nodal iodinated contrast injection (3.2 mL total, ~1 mL/kg body weight) continued until contrast was visualized in the upper abdominal lymphatics. Limited intermittent CT fluoroscopy confirmed contrast propagation to the upper mediastinum and lower neck.

UHR CTL technique. Non-contrast and intra-lymphatic contrast enhanced UHR CT images of the chest, abdomen, and pelvis were helically acquired with a 160 row x 0.25 mm detector element and thickness 0.25 mm, tube voltage 80-100 kVp, and iterative reconstruction. Immobility is vital to diagnostic quality; ICU managed intubation and sedation during image acquisition.

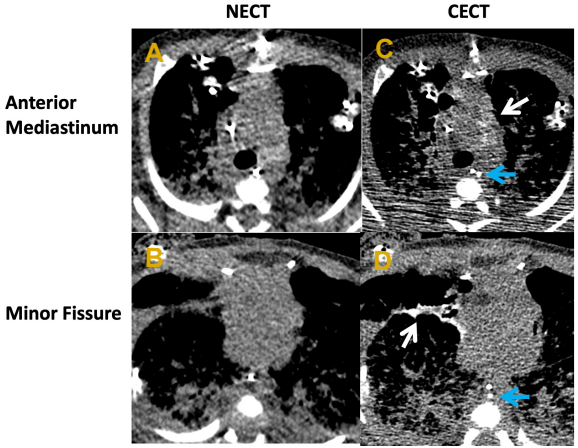
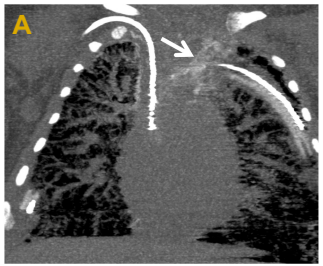
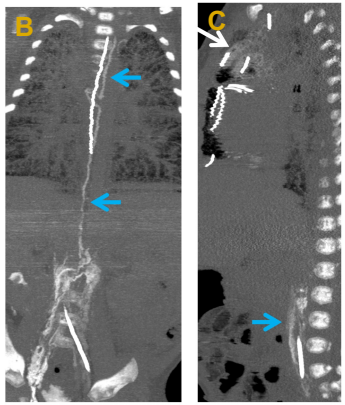


Figure 1. a,b) Noncontrast CT in the anterior mediastinum and minor fissure. c,d) Excellent opacification of the thoracic duct (blue arrow) with interstitial leakage into the anterior mediastinum and right minor fissure (white arrow).

Figure 2. Coronal (a,b) and sagittal (c) 10 mm MIP showing excellent thoracic duct opacification (blue arrow) and interstitial leakage into the anterior mediastinum (white arrow).





References

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Results

Water-soluble pediatric UHR CTL was successfully performed without complication. US-guided intra-nodal injection rapidly opacified the central lymphatic system. Intermittent fluoroscopy identified contrast progression along the abdominopelvic lymphatics, but was unable to delineate the thoracic duct. With UHR CTL, the thoracic duct and lymphovenous junction were visualized 10-15 minutes after injection, lymphatic leakage site(s) were identified, and the thoracic duct was void of contrast 30 minutes after injection. A typical case can be performed in 2 hours of room time. In infants, fluoroscopy was performed with 1-2 minutes of fluoro time (~ 1 mGy), and base, CT fluoroscopy, and CTL scans were performed with low radiation dose (CTDIvol 10-15 mGy and total DLP 100-200 mGy).

Conclusion

To the best of our knowledge, this is the first technical description of water-soluble pediatric UHR CTL. Water-soluble iodinated contrast offers superior diagnostic quality compared to lipiodol, is safe in patients with right-to-left shunting, and rapidly identifies the central lymphatic drainage pathways. CTL is a viable alternative to MR lymphangiography and likely provides superior spatial resolution in infants and small children. The procedures were safe and accurately delineated small lymphatic structures, which is a vital diagnostic capability for patients with high-mortality continuous chylothorax.

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