

Pathway Purpose: To provide a standardized approach to CT removal so that we reduce the average postoperative CT duration to 48 hours or less (current average is 72 hours for less complex CHD surgery and 100 hours for more complex surgeries). In doing so we increase patient comfort and help lower postoperative hospital LOS.

Inclusion Criteria:

- Congenital heart disease patients in the immediate post-op period
- Located in CVICU, PICU, NICU, or PCU 200 & 500

Exclusion Criteria:

- Chest tubes placed for non-cardiac surgery
- Ventricular assist device
- Heart transplants
- Norwood stage I

Discuss chest tube management with surgeon

Two-ventricle patients & Bidirectional Glenn patients

Does patient have an atrial line?

No

Yes

Remove chest tube(s) (pleural or mediastinal) when*:

- Chest is closed
- Chest x-ray (CXR) shows no significant pneumothorax or effusion
- Fluid is serous (non/lightly bloody, non-chylous)
- Output is downtrending ($\leq 1\text{cc/kg/hour}$)

Note: Begin counting drainage AFTER the first 12 hours post-op (e.g. 10kg patient 3pm arrival to CVICU → start counting at 3am on POD 1. If $<10\text{cc/hr/tube}$ OK to remove that day)

Remove any remaining chest tubes*

- If you “opt out” of POD 2 removal, specify reason in progress note.
- “Opt-out POD 2” strategy: No volume criteria once POD 2 or later.

Remove PLEURAL chest tube(s) per guidelines on the left (goal POD 2).

Remove MEDIASTINAL chest tube prior to POD 5 if:

- Chest is closed AND
- 4 hours since atrial line has been removed

Remove any remaining chest tubes on POD 5 even if atrial line will remain in place.

Risk of bleeding after atrial line removal is less

*NO specific recommendations for fluids, diuretics, oxygen or diet

*NO REQUIREMENT to ambulate (fine to stand/walk but do not count output) or have diet restarted (unless indicated by provider) to pull chest tubes

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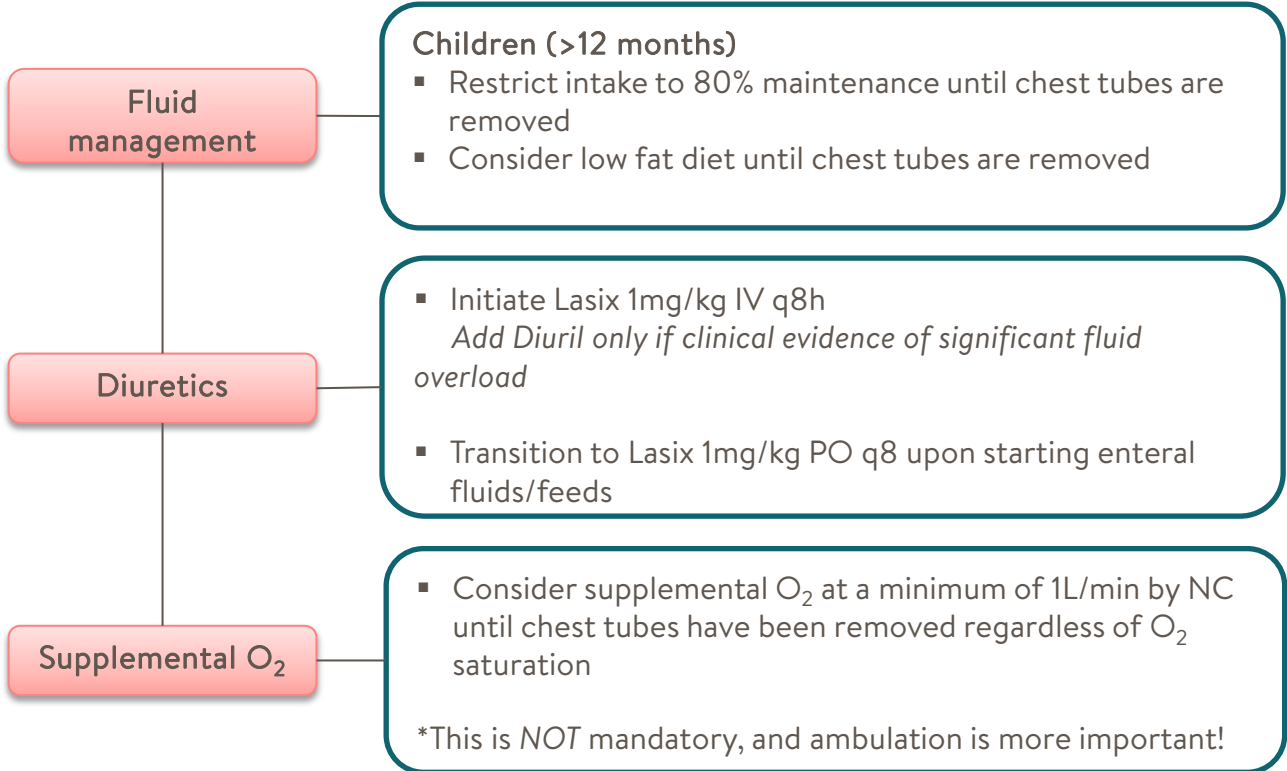
Last Updated: 10/21/2025

Associated Order Set: CVICU Post-op order set

Associated Policies: n/a



Fontan patients



Chest tube removal ok when:

- No significant pleural effusion by CXR and fluid is serous (non-bloody, non-chylous)
AND
 - Chest tube output is:*
 - Less than 6cc/kg/tube over any 24h period or
 - Less than 3cc/kg/tube over any 12h period

Discharge from hospital:

- Observe overnight after chest tube removal
- Repeat CXR in am → if no significant re-accumulation, ok to discharge on PO Lasix
- Local patients: discharge home, follow-up with referring cardiologist with CXR in 2-3 days
- Non-local patients: stay locally, follow-up with LPCH cardiologist with CXR in 2-3 days → if no recurrence ok to return home

Chylous Effusions

*Triglyceride (TG) level >100mg/dL; cell count >1000 cells/mm³ with predominance (>80%) of lymphocytes if being fed; OR pleural TG > serum TG

Fluid management

Infants (≤12 months)

- If NPO: restrict to 80% maintenance while on IVF or TPN
- If taking PO/enteral feeds: liberalize to maintenance (or PO ad lib) to allow for adequate caloric intake

Children (>12 months)

- Restrict intake to 80% maintenance until chest tubes are removed (either NPO/TPN or enteral)

Diuretics

- Initiate Lasix 1mg/kg IV q8h
Add Diuril only if clinical evidence of significant fluid overload
- Transition to Lasix 1mg/kg PO q8-12h upon starting enteral fluids/feeds

Diet

MCT diet at current feeding rate for 24-36h

- *If chest tube output <20cc/kg/day*
 - Continue MCT diet x 2d and advance to full volume (at least 40cc/kg/day)
- *If chest tube output >20cc/kg/day*
 - Consider NPO/TPN
 - Consider propranolol 0.5-2mg/kg/day PO divided q8h
 - Consider octreotide
 - Discuss with IR for MR lymphangiogram

Chest tube removal

- Once fluid is clear/non-cloudy
- CXR shows no significant effusion
- Patient on full MCT/low fat diet and off octreotide (if applicable)
- Chest tube output is:
 - Less than 6cc/kg/tube over any 24h period or
 - Less than 3cc/kg/tube over any 12h period

Post-chest tube diet

Continue fat-modified diet for 2 weeks after chest tube removal (4 weeks if after Glenn or Fontan palliation) then resume normal diet.

References:

- Bates, K. E., Connelly, C., Khadr, L., Graupe, M., Hlavacek, A. M., Morell, E., Pasquali, S. K., Russell, J. L., Schachtner, S. K., Strohacker, C., Tanel, R. E., Ware, A. L., Wooton, S., Madsen, N. L., & Kipps, A. K. (2021). Successful Reduction of Postoperative Chest Tube Duration and Length of Stay After Congenital Heart Surgery: A Multicenter Collaborative Improvement Project. *Journal of the American Heart Association*, 10(21), e020730. <https://doi.org/10.1161/JAHA.121.020730>
- Lion, R. P., Winder, M. M., Amirnovin, R., Fogg, K., Bertrandt, R., Bhaskar, P., Kasmai, C., Holmes, K. W., Moza, R., Vichayavilas, P., Gordon, E. E., Trauth, A., Horsley, M., Frank, D. U., Stock, A., Adamson, G., Lyman, A., Raymond, T., Diaz, I., DeMarco, A., ... PC4 Chylothorax Work Group (2022). Development of consensus recommendations for the management of post-operative chylothorax in paediatric CHD. *Cardiology in the young*, 32(8), 1202–1209. <https://doi.org/10.1017/S1047951122001871>