



# Prophylactic Peritoneal Dialysis in Pediatric Patients Undergoing Cardiopulmonary Bypass and the Effects on Fluid Overload



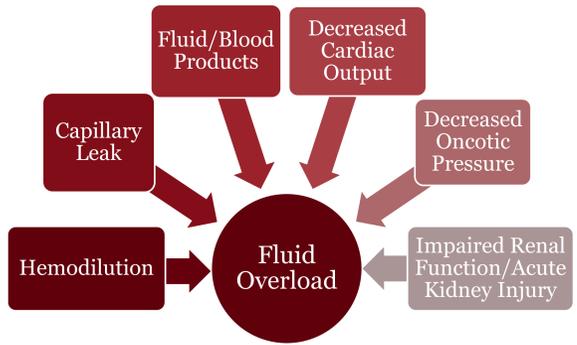
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## Background

- Congenital heart disease is the number one congenital birth defect, 25% of which likely require surgical intervention<sup>1</sup>.
- Fluid overload represents one of the most common complications seen in pediatric patients undergoing cardiac surgery with cardiopulmonary bypass<sup>2</sup>.



- Post-operative fluid overload can lead to multiple complications such as, systemic and pulmonary edema, systemic inflammatory response syndrome, low cardiac output syndrome, ECMO requirement, prolonged mechanical ventilation, cardiac arrest, and death<sup>3,4,5,6</sup>.
- Fluid offloading is used to prevent fluid overload and subsequent complications<sup>6</sup>.

## Rationale

- Diuretics are the current standard of care is for fluid offloading<sup>3</sup>.
- Peritoneal dialysis is not typically considered until the patient is severely fluid overloaded or if the patient is high risk for fluid overload<sup>3</sup>.
- There is evidence to suggest early peritoneal dialysis may decrease the risk of fluid overload as well as other post-operative adverse outcomes<sup>6</sup>.
- The use of peritoneal dialysis is a regular practice and is considered an easy and safe procedure as well as cost effective<sup>2</sup>.

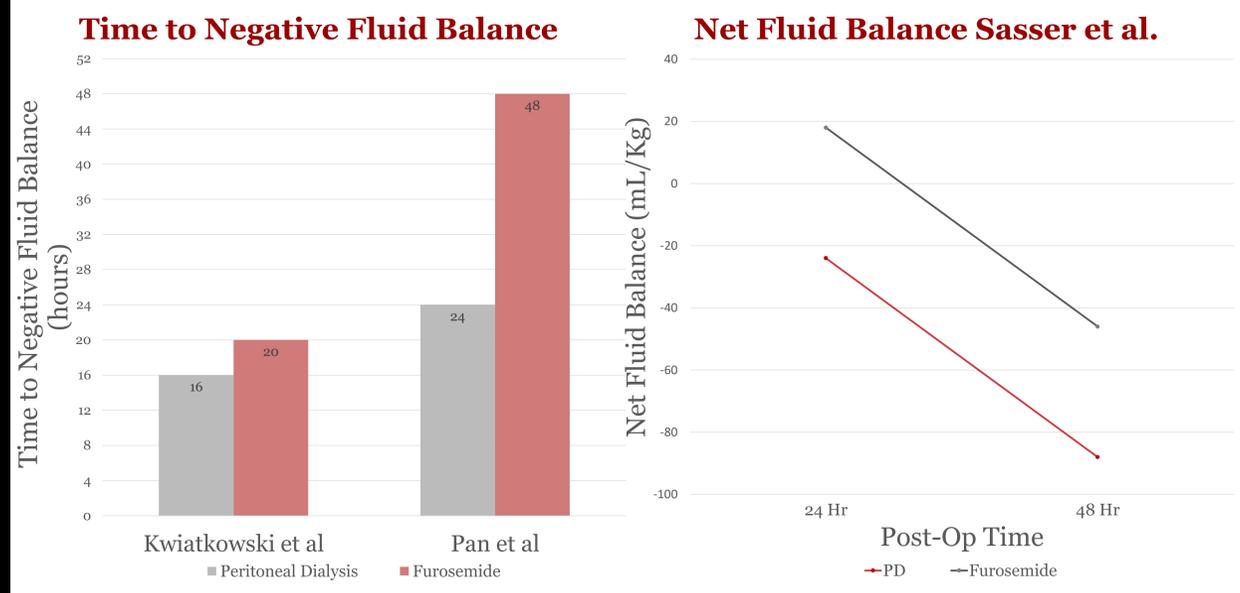
## Methods

- PubMed Mesh was used to search the use of peritoneal dialysis versus diuretics in cardiac surgery.
- Results were filtered by pediatric patient population
- Exclusion criteria included patients requiring ECMO or with pre-existing kidney disease.
- Study designs included randomized clinical trial, retrospective and prospective observational cohort studies.
- Limitations: Sample size and lack of randomization

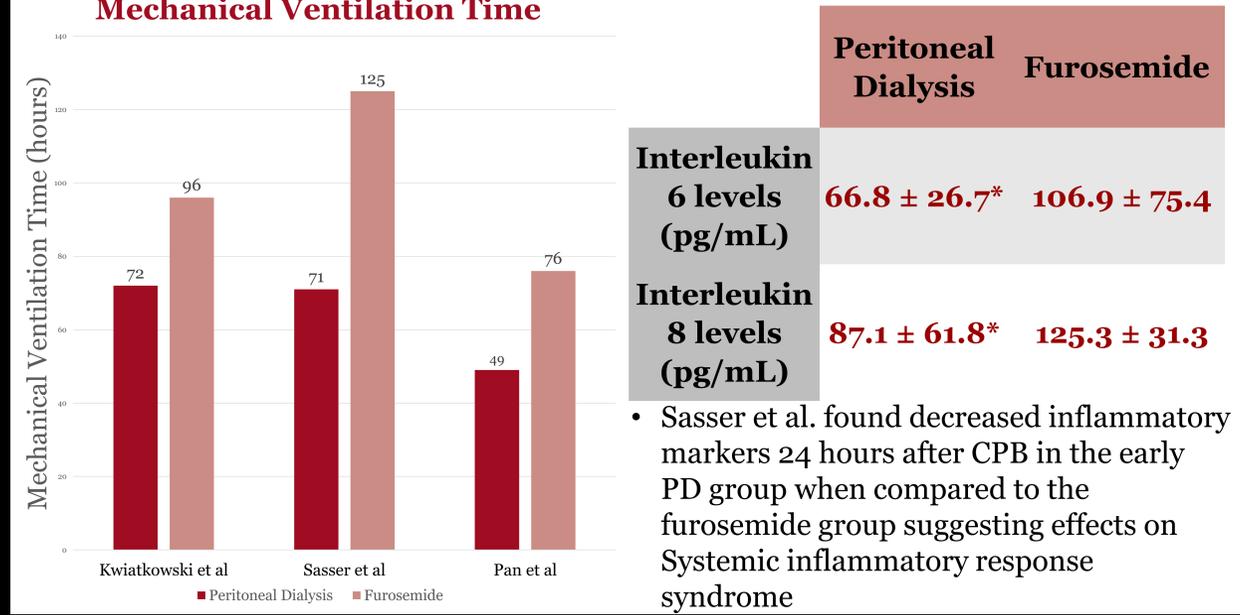
## PICO Question

- Does early initiation of peritoneal dialysis in pediatric patients undergoing cardiopulmonary bypass surgery improve outcomes when compared to using diuretics for fluid overload?
- P- Pediatric patients undergoing cardiac surgery requiring cardiopulmonary bypass
- I- Early initiation of peritoneal dialysis
- C- Furosemide diuretics
- O- Effects on morbidity and mortality

## Results



- All three studies found a more negative fluid balance on post-op day one in the early PD group (above) and reduced time being mechanically ventilated (below).
- Pan et al. and Kwiatkowski et al. found a shorter time to negative fluid balance in the early PD group



## Conclusions

- The results demonstrate morbidities secondary to the use of cardiopulmonary bypass can be improved with the use of early peritoneal dialysis.
- Since adverse events following cardiopulmonary bypass tend to follow a specific pattern and timing (48 hours following surgery), initiating peritoneal dialysis early may decrease these events<sup>4</sup>.
- Improving fluid overload and the systemic inflammatory response allows for a safer recovery and greater potential for survival.

## Future Directions

- Conduct studies with larger cohorts to evaluate effects on mortality
- Initiate peritoneal dialysis at different time points to determine optimal timing
- Evaluate peritoneal dialysis fluid to determine concentration of interleukin removal
- Investigate biomarkers that may predict risk for fluid overload and kidney injury<sup>6</sup>

## Acknowledgements

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## References

- Centers for Disease Control and Prevention. 2020. *Data and statistics on congenital heart defects* | CDC. [online] Available at: <<https://www.cdc.gov/ncbddd/heartdefects/data.html#References>> [Accessed 28 November 2020].
- Sasser WC, Dabal RJ, Askenazi DJ, et al. Prophylactic peritoneal dialysis following cardiopulmonary bypass in children is associated with decreased inflammation and improved clinical outcomes. *Congenit Heart Dis.* 2014;9(2):106-115.
- Pan T, Li D, Li S, Yan J, Wang X. Early initiation of peritoneal dialysis improves postoperative recovery in children with right ventricular outflow tract obstructive lesions at high risk of fluid overload: a propensity score-matched analysis. *Interact Cardiovasc Thorac Surg.* 2018;27(2):250-256.
- Namachivayam SP, Butt W, Millar J, Konstantinov IE, Nguyen C, d'Udekem Y. Early Peritoneal Dialysis and Major Adverse Events After Pediatric Cardiac Surgery: A Propensity Score Analysis. *Pediatr Crit Care Med.* 2019;20(2):158-165.
- Delpachitra MR, Namachivayam SP, Millar J, Delzoppo C, Butt WW. A Case-Control Analysis of Postoperative Fluid Balance and Mortality After Pediatric Cardiac Surgery. *Pediatr Crit Care Med.* 2017;18(7):614-622.
- Kwiatkowski DM, Goldstein SL, Cooper DS, Nelson DP, Morales DL, Krawczeski CD. Peritoneal Dialysis vs Furosemide for Prevention of Fluid Overload in Infants After Cardiac Surgery: A Randomized Clinical Trial. *JAMA Pediatr.* 2017;171(4):357-364.
- Gist KM, Henry BM, Borasino S, et al. Prophylactic Peritoneal Dialysis After the Arterial Switch Operation: A Retrospective Cohort Study. *The Annals of Thoracic Surgery.* 2020.