

# LifeFlow®

## Publications

**Sai Surapa Raju, Judy Fuller; Stacy L. Gaither, Hui-Chien Kuo, Inmaculada Aban, Nancy M. Tofil. The Use of a Rapid Fluid Infusion System in Children. International Journal of Pediatric Research and Reviews, 2020, 3:26.**

A retrospective evaluation of pediatric patients presenting to the Emergency Department between May 2017 and November 2018 who had one or more fluid boluses administered with LifeFlow. For the 191 patients ultimately included, the most common diagnoses were sepsis/fever (36%), hypoxia/respiratory failure (21%), and trauma (16%). On average each patient received 35mL/kg (+/- 17mL/kg) of fluids with LifeFlow. No complications were noted in any patient with LifeFlow when using the IV or IO route of administration.

**Chang T, Ringold S, Lichtenfeld N, Nguyen P, Paz D, Festekjian A. The Effect of Rapid Fluid Infusions on Transabdominal Pelvic Ultrasound Timing Among Female Pediatric Patients: A Randomized Controlled Pilot Trial. Acad Emerg Med. Advanced online publication. 2020 Feb 19.**

Randomized controlled trial (n=30) in a large urban pediatric ED comparing standard care IV infusion versus LifeFlow® handheld infuser. LifeFlow was safe and effective and enabled faster bladder filling time (26.9 vs 61.9 mins) and time to ultrasound order completion (114.8 vs 154.4 mins).

**Piehl M, Smith-Ramsey C, Teeter W. Improving Fluid Resuscitation in Pediatric Shock with LifeFlow®: a Retrospective Case Series and Review of the Literature. Open Access Emergency Medicine. 2019; 11; 87-93.**

Four diverse cases of children with shock are presented, each of whom experienced immediate clinical benefit following receipt of an early fluid bolus. Current pediatric guidelines and literature review of fluid bolus therapy are also discussed.

**Piehl M, Griffin A, Blaivas M. Case Reports : Rapid Fluid Delivery for Hypotension via a Novel Device (LifeFlow®) Leads to Improved Patient Outcome. Journal of Emergency Medicine and Critical Care. 2019; 5(1), 3-5.**

Five patients with shock and hypotension are presented, each of whom experienced rapid reversal of hypotension from early fluid resuscitation. A brief literature review of fluid therapy for shock and hypotension is also presented.

**Robertson G, Hoff H, Spangler H, Piehl M. High Occurrence of Potential Contamination Risks Observed for Pediatric Patients Receiving Rapid Fluid Boluses with Single-use Syringes. American Journal of Infection Control. 2019 Jun 1;47(6):S5.**

The disconnect-reconnect technique (DRT) and push-pull technique (PPT) were used by critical care nurses to deliver 500ml of saline to a simulated pediatric patient. Nurses were instructed to follow aseptic technique and deliver the fluid boluses rapidly. An independent observer recorded the number and type of aseptic violations. Both DRT and PPT had high rates of contamination events due to either hand contact with the plunger or the syringe tip. Greater awareness of these risks and alternative rapid infusion methods are needed.

**Spangler H, Piehl M, Lane A, Robertson G. Improving Aseptic Technique During the Treatment of Pediatric Septic Shock. Journal of Infusion Nursing. 2019; 42(1): 23-28.**

The risk of aseptic technique violations with push-pull technique (PPT) and LifeFlow was compared by directly observing nurses administer fluids to a simulated patient model. Using PPT, participants came in contact with sterile portions of the syringe up to 23 times for each 500ml infusion. This study confirms the risk of PPT-associated syringe contamination and suggests that this risk could be mitigated with the use of a protected syringe system, such as LifeFlow.

**Brooks E, Piehl M. Potential mortality and cost reduction in adult severe sepsis and septic shock through the use of an innovative fluid delivery device. Open Access Emergency Medicine. 2018 October 26; 10:165-170.**

Based on a large study of adults with septic shock showing improved patient outcomes and reduced mortality with earlier initiation of fluid resuscitation, this decision analytic model showed that use of LifeFlow as the fluid delivery technique could result in less mechanical ventilation, shorter length of stay, less use of vasopressors, lower hospital cost, and lower mortality compared to standard care.

**Kline M, Crispino L, Bhatnagar A, Panchal R, Auerbach M. A Randomized Single-Blinded Simulation-Based Trial of a Novel Method for Fluid Administration to a Septic Infant. Pediatric Emergency Care. 2018, Aug 25.**

In this simulation study emergency providers were asked to care for a 10 kg patient with septic shock in the Yale emergency department. Twenty-seven teams of two participants each were randomized to one of three fluid administration methods: push-pull, pressure bag, or LifeFlow. During the 20-minute scenario, teams delivered three 20ml/kg boluses of fluid through a 22G IV. LifeFlow resulted in the fastest administration and the lowest task complexity rating use the NASA-TLX scale.

**Robertson G, Lane A, Piehl M, Whitfill T, Spangler H. Comparison of a novel rapid fluid delivery device to traditional methods. [White paper] (2018).**

This simulation study compared speed of infusion of 1 liter of saline using LifeFlow, pressure bag, and the push-pull technique (PPT). Across a range of catheter sizes from 22G to 16G, LifeFlow resulted in significantly faster delivery of a 1 liter fluid bolus.

**Piehl M, Spangler H, Robertson G, Chenet K. (2017). 383 A Novel Technique for Improving Fluid Resuscitation in Septic Shock. Annals of Emergency Medicine. 70(4), S150.**

In this septic shock scenario, individual emergency providers were asked to perform all elements of care of a simulated adult patient with septic shock, including physical examination, charting, oxygen and medication administration, and fluid resuscitation. Participants were randomized to pressure bag or LifeFlow as the fluid administration technique. Three 500ml saline boluses were given through a 20g IV to achieve a systolic BP of greater than 90. Providers in the LifeFlow group were able to deliver 1500ml of fluid in an average of 7.8 minutes, compared to 20 minutes in the PB group, and completed all required elements of patient care in 22.8 minutes compared to 36.3 minutes in the PB group.

**Piehl, M. A Novel Rapid Infusion Device for Pediatric Resuscitation. Poster session presented at 8th World Congress on Pediatric Intensive and Critical Care; 2016 June 5-8; Toronto.**

Pediatric emergency providers were asked to infused 1 liter of saline through a 22G IV in a simulated 20kg patient using each of three methods: push-pull technique, a pressure bag, and the LifeFlow device. LifeFlow resulted in completion of the fluid bolus in an average of 5.3 minutes, compared with 12 minutes for push-pull and 22 minutes with pressure bag.