Hemodynamic Optimization Solutions

Evidence-Based Medicine

Clinical Evidence for Hemodynamic Optimization through Perioperative Goal-Directed Therapy

When applied intraoperatively, hemodynamic optimization through PGDT has been shown to reduce post-surgical complications, hospital length of stay and associated costs across a wide range of moderate to high-risk surgical populations.

30+ randomized controlled trials demonstrate benefit

14+ meta-analyses confirm benefit

Reduction in Post-Surgical Morbidity

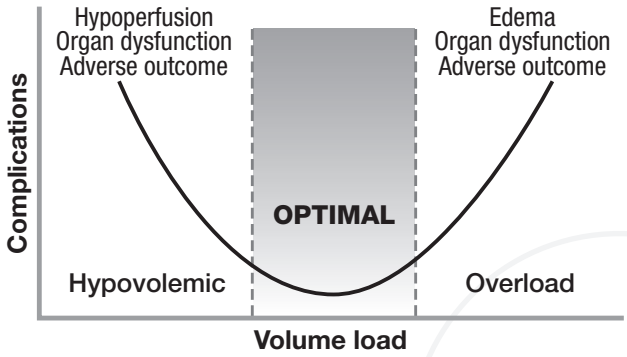
1. Hamilton MA, Cecconi M, Rhodes A. A systematic review and meta-analysis on the use of preemptive hemodynamic intervention to improve postoperative outcomes in moderate and high risk surgical patients. *Anesthesia & Analgesia* 2011;112: 1392–402.
2. Pearse M, Harrison D, MacDonald N, et al. for the OPTIMISE Study Group. Effect of a Perioperative, Cardiac Output-Guided Hemodynamic Therapy Algorithm on Outcomes Following Major Gastrointestinal Surgery: A Randomized Clinical Trial and Systematic Review. *JAMA 2014* doi:10.1001/jama.2014.5305.

Reduction in Hospital Length of Stay

1. Corcoran T, Rhodes JE, Clarke S, et al. Perioperative Fluid Management Strategies in Major Surgery: A Stratified Meta-Analysis. *Anesthesia & Analgesia* 2012; 114(3): 640-651.
2. Grocott MP, Dushianthan A, Hamiltom MA. et al. Perioperative increase in global blood flow to explicit defined goals and outcomes after surgery: a Cochrane systematic review. *Br J Anaesth* 2013; 111(4):535-548.

Advanced Hemodynamic Parameters when used in Perioperative Goal-Directed Therapy are Key to Optimize Volume Administration

Advance hemodynamic parameters – such as stroke volume, SV; stroke volume variation, SVV; and cardiac output, CO – when combined with a PGDT protocol, can more effectively guide volume administration than conventional care.[1] Edwards provides a range of monitoring options, including the ClearSight and FloTrac systems, that can be used in PGDT protocols to hemodynamically optimize patients.



FloTrac Minimally-Invasive System

PGDT outcome

1. Scheeren T, Wiesenack CH, Gerlach H, et al. Goal-directed intraoperative fluid therapy guided by stroke volume and its variation in high-risk surgical patients: a prospective randomized multicentre study. *J Clin Monit Comput*, 2013.
2. Ghneim M, Regner J, Jupiter D, et al. Goal-directed fluid resuscitation decreases time for lactate clearance and facilitates early fascial closure in damage control surgery, *The American Journal of Surgery*, Vol 206, No 6, December 2013.

ccNexfin/ClearSight Noninvasive System†

PGDT outcome

1. Garson L, Schwarzkopf R, Vakharia S, et al. Implementation of a total joint replacement-focused perioperative surgical home: a management case report, *Anesthesia & Analgesia* May 2014, Vol 118(5):1081-1089.
2. Chen G, Chung E, Meng L, et al. Impact of non invasive and beat-to-beat arterial pressure monitoring on intraoperative hemodynamic management. J.Clin.Monit.Comput. 2012 Apr;26(2):133-40.

† All studies listed were conducted using the ccNexfin system. The ccNexfin system technology – including the algorithm, Physiocal, volume clamp method, and brachial BP reconstruction for BP – are also included in the ClearSight system.

Edwards

FloTrac Minimally-Invasive System

PGDT outcome *(continued)*

3. Davinder S, Ramsingh DS, Sanghvi C, et al. Outcome impact of goal-directed fluid therapy during high risk abdominal surgery in low to moderate risk patients: a randomized controlled trial. *The Journal of Clinical Monitoring and Computing* (online) 2012.
4. Cecconi M, Fasano N, Langiano N, Divella M, et al. Goal-Directed Haemodynamic Therapy during elective total hip arthroplasty under regional anaesthesia. *Society of Critical Care Medicine.* 2011;15(3):R132.
5. Benes J, Chytra I, Altmann P, et al. Intraoperative fluid optimization using stroke volume variation in high risk surgical patients: results of prospective randomized study. *Critical Care.* 2010;14:1-15.
6. Mayer J, Boldt J, Poland R, et al. Continuous Arterial Pressure Waveform–Based Cardiac Output Using the FloTrac/Vigileo: A Review and Meta-analysis. *Journal of Cardiothoracic and Vascular Anesthesia,* Vol 23, No 3 (June), 2009:pp 401-406.

Application*

1. Biais M, Nouette-Gaulain K, Roullet S, et al. A comparison of stroke volume variation measured by Vigileo FloTrac system and aortic Doppler echocardiography. *Anesthesia & Analgesia* 2009;109:466-469.
2. Cannesson M, Musard H, Desebbe O, et al. Ability of stroke volume variations obtained with Vigileo/FloTrac to monitor fluid responsiveness in mechanically ventilated patients. *Anesthesia & Analgesia* 2009;108:513-517.

Validation**

Cardiac Output / Stroke Volume Variation

1. Slagt C, Malagon I, Groeneveld AB. Systematic review of uncalibrated arterial pressure waveform analysis to determine cardiac output and stroke volume variation. *Br J Anaesth.* 2014 Jan 27. [Epub ahead of print]

Stroke Volume Variation

1. Cannesson M, Musard H, Desebbe O, et al. The ability of stroke volume variations obtained with Vigileo/FloTrac system to monitor fluid responsiveness in mechanically ventilated patients. *Anesth Analg.* 2009 Feb;108(2):513-7.

Cardiac Output

1. De Backer B, Marx G, Tan A, et al. Arterial pressure-based cardiac output monitoring: a multicenter validation of the third-generation software in septic Patients. *Intensive Care Med* 2011 Feb;37(2):233-40.***

ccNexfin / ClearSight Noninvasive System†

Application*

1. Kurup V, Ostroff R. When cardiac patients need ECT – challenges for the anesthesiologist. *Int.Anesthesiol.Clin* 2012;50(2):128-40.
2. Martini CH, Boon M, Bevers RF, et al. Evaluation of surgical conditions during laparoscopic surgery in patients with moderate vs deep neuromuscular block. *Br.J Anaesth.* 2013 Nov 15.
3. Nowak RM, Sen A, Garcia AJ, et al. The inability of emergency physicians to adequately clinically estimate the underlying hemodynamic profiles of acutely ill patients. *Am.J.Emerg.Med.* 2011 Jul 28.

Validation**

Cardiac Output

1. Bubenek-Turconi SI, Craciun M, Miclea I, et al. Noninvasive Continuous Cardiac Output by the Nexfin Before and After Preload-Modifying Maneuvers: A Comparison with Intermittent Thermodilution Cardiac Output. *Anesth Analg.* 2013 Jun 11.
2. Broch O, Renner J, Gruenewald M, et al. A comparison of the Nexfin and transcardiopulmonary thermodilution to estimate cardiac output during coronary artery surgery. *Anaesthesia* 2012 Apr;67(4):377-83.

Blood Pressure

1. Martina JR, Westerhof BE, van GJ, et al. Noninvasive continuous arterial blood pressure monitoring with Nexfin. *Anesthesiology* 2012 May;116(5):1092-103.
2. Vos JJ, Poterman M, Mooyaart EAQ, et al. Comparison of continuous non-invasive finger arterial pressure monitoring with conventional intermittent automated arm arterial pressure measurement in patients under general anaesthesia. *Br J Anaesth.* 2014 Apr15. [Epub ahead of print]

† All studies listed were conducted using the ccNexfin system. The ccNexfin system technology – including the CO algorithm, Physiocal, volume clamp method, and brachial BP reconstruction – are also included in the ClearSight system.

* Application: The performance characteristics of the method are considered acceptable and the measured data are applied for e.g. clinical purposes.

** Validation: With a validation study, different measurements are made on the same item to investigate the level of agreement. Usually, one of the measurements is believed to be a 'gold standard' (ie. the true value/ outcome) and the aim is to determine whether the other measurement can replicate this information.

*** This study assesses the 3rd generation FloTrac algorithm.

References

1. Michard & Biais. Rational fluid management: dissecting facts from fiction. *Br J Anaesth* 2012.

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