

Deltex Medical Bibliography

Outcome Studies

- **Intraoperative: ODM RCT**

Mythen, M.G. and Webb, A.R., *Perioperative plasma volume expansion reduces the incidence of gut mucosal hypoperfusion during cardiac surgery*. Arch Surg, 1995. **130**(4): p. 423-9.

Sinclair, S., James, S., and Singer, M., *Intraoperative intravascular volume optimisation and length of hospital stay after repair of proximal femoral fracture: randomised controlled trial*. BMJ, 1997. **315**(7113): p. 909-12.

Gan, T.J., Soppitt, A., Maroof, M., el-Moalem, H., Robertson, K.M., Moretti, E., Dwane, P., and Glass, P.S., *Goal-directed intraoperative fluid administration reduces length of hospital stay after major surgery*. Anesthesiology, 2002. **97**(4): p. 820-6.

Venn, R., Steele, A., Richardson, P., Poloniecki, J., Grounds, M., and Newman, P., *Randomized controlled trial to investigate influence of the fluid challenge on duration of hospital stay and perioperative morbidity in patients with hip fractures*. Br J Anaesth, 2002. **88**(1): p. 65-71.

Wakeling, H.G., McFall, M.R., Jenkins, C.S., Woods, W.G., Miles, W.F., Barclay, G.R., and Fleming, S.C., *Intraoperative oesophageal Doppler guided fluid management shortens postoperative hospital stay after major bowel surgery*. Br J Anaesth, 2005. **95**(5): p. 634-42.

Noblett, S.E., Snowden, C.P., Shenton, B.K., and Horgan, A.F., *Randomized clinical trial assessing the effect of Doppler-optimized fluid management on outcome after elective colorectal resection*. The Br J Surg, 2006. **93**(9): p. 1069-76.

Senagore, A.J.E., Emery, T., Luchtefeld, M., Kim, D., Dujovny, N., Hoedema, R., *Fluid management for laparoscopic colectomy: a prospective, randomized assessment of goal-directed administration of balanced salt solution or hetastarch coupled with an enhanced recovery program*. Dis Colon Rectum, 2009. **52**(12): p. 1935-40.

Pillai, P.M., McEleavy, I., Gaughan, M., Snowden, C., Nesbitt, I., Durkan, G., Johnson, M., Cosgrove, J., Thorpe, A., *A double-blind randomized controlled clinical trial to assess the effect of Doppler optimized intraoperative fluid management on outcome following radical cystectomy*. J Urol, 2011. **186**(6): p. 2201-6.

Brandstrup, B., Svendsen, P.E., Rasmussen, M., Belhage, B., Rodt, S.A., Hansen, B., Moller, D.R., Lundbech, L.B., Andersen, N., Berg, V., Thomassen, N., Andersen, S.T., and Simonsen, L., *Which goal for fluid therapy during colorectal surgery is followed by the best outcome: near-maximal stroke volume or zero fluid balance?* Br J Anaesth, 2012. **109**(2): p. 191-9.

Challand, C.S., Struthers, R., Sneyd, J. R., Erasmus, P. D., Mellor, N., Hosie, K. B., Minto, G., *Randomized controlled trial of intraoperative goal-directed fluid therapy in aerobically fit and unfit patients having major colorectal surgery*. Br J Anaesth, 2012. **108**(1): p. 53-62.

Srinivasa, S., Taylor, M.H., Singh, P.P., Yu, T.C., Soop, M., and Hill, A.G., *Randomized clinical trial of goal-directed fluid therapy within an enhanced recovery protocol for elective colectomy*. Br J Surg, 2013. **100**(1): p. 66-74.

Zakhaleva, J., Tam, J., Denoya, P.I., Bishawi, M., and Bergamaschi, R., *The impact of intravenous fluid administration on complication rates in bowel surgery within an enhanced recovery protocol: a randomized controlled trial*. Colorectal Dis, 2013. **15**(7): p. 892-9.

McKenny, M., Conroy, P., Wong, A., Farren, M., Gleeson, N., Walsh, C., O'Malley, C., and Dowd, N., *A randomised prospective trial of intra-operative oesophageal Doppler-guided fluid administration in major gynaecological surgery*. *Anaesthesia*, 2013. **68**(12): p. 1224-31.

El Sharkawy, O.A., Refaat, E.K., Ibraheem, A.E.M., Mahdy, W.R., Fayed, N.A., Mourad, W.S., Abd Elhafez, H.S., and Yassen, K.A., *Transoesophageal Doppler compared to central venous pressure for perioperative hemodynamic monitoring and fluid guidance in liver resection*. *Saudi J Anaesth*, 2013. **7**(4): p. 378-86.

- **Intraoperative: ODM Audit**

Kuper, M., Gold, S.J., Callow, C., Quraishi, T., King, S., Mulreany, A., Bianchi, M., and Conway, D.H., *Intraoperative fluid management guided by oesophageal Doppler monitoring*. *BMJ*, 2011. **342**: p. d3016.

Feldheiser, A., Conroy, P., Bonomo, T., Cox, B., Ruiz Garces, T., and Spies, C., *Development and feasibility study of an algorithm for intraoperative goal-directed haemodynamic management in noncardiac surgery*. *J Int Med Res*, 2012. **40**(4): p. 1227-41.

Chattopadhyay, S., Mittal, S., Christian, S., Terblanche, A.L., Patel, A., Biliatis, I., Kucukmetin, A., Naik, R., and Galaal, K., *The role of intraoperative fluid optimization using the esophageal Doppler in advanced gynecological cancer: early postoperative recovery and fitness for discharge*. *Int J Gynecol Cancer*, 2013. **23**(1): p. 199-207.

Figus, A., Wade, R.G., Oakey, S., and Ramakrishnan, V.V., *Intraoperative esophageal Doppler hemodynamic monitoring in free perforator flap surgery*. *Ann Plast Surg*, 2013. **70**(3): p. 301-7.

McKenny, M., O'Malley, C., Mehigan, B., McCormick, P., and Dowd, N., *Introduction of oesophageal Doppler-guided fluid management in a laparoscopic colorectal surgery enhanced recovery programme: an audit of effect on patient outcome*. *Ir Med J*, 2014. **107**(5): p. 135-8.

- **Intraoperative: ODM Unpublished**

Shi, C., Morse, L.S., Downing, L.K., Chi, L., and Jessen, M.E. *Optimizing intraoperative volume management during coronary bypass surgery*. American Society of Anesthesiologists, 2000: p. A-347.

Dodd, T.E.M., McCormack, R.N., Dorman, F., Green, R., Bromilow, J. *Using the oesophageal Doppler monitor in elective colorectal surgery: is it worth it? [Poster]*. in *Annual Meeting of Wessex Anaesthetists in Training*. 2004. Poole, UK.

Munoz, C.A.F., Rojas, J.L.T., Bermudez, O.I.G., Rios, D.E.M., Escobar, E.M. *Intraoperative oesophageal Doppler during emergency abdominal surgery [Abstract #966]*. in *World Congress of Anaesthesiologists*. 2012. Buenos Aires.

- **Intraoperative: Other ODM**

Conway, D.H., Mayall, R., Abdul-Latif, M.S., Gilligan, S., Tackaberry, C., *Randomised controlled trial investigating the influence of intravenous fluid titration using oesophageal Doppler monitoring during bowel surgery*. *Anaesthesia*, 2002. **57**(9): p. 845-9.

Szturz, P.S., Maca, J.M., Tichy, J.T., Sukenik, P.S., Chylek, V.C., Skilienka, P.S., Jahoda, J.J., and Kula, R.K., *Maintenance of cardiac index within normal range is associated with mortality reduction in patients undergoing major urological surgery*. *Crit Care*, 2010. **14**(Suppl 1): p. P213.

Mannova, J.H., Silhart, Z., Sevcik, P., and Prokes, A., *Perioperative haemodynamic monitoring by oesophageal Doppler improves outcome of patients with abdominal aortic aneurysm repair*. Bratislavske lekarske listy, 2013. **114**(2): p. 78-83.

- **Postoperative/ICU: ODM RCT**

McKendry, M., McGloin, H., Saberi, D., Caudwell, L., Brady, A.R., and Singer, M., *Randomised controlled trial assessing the impact of a nurse delivered, flow monitored protocol for optimisation of circulatory status after cardiac surgery*. BMJ, 2004. **329**(7460): p. 258.

El Sharkawy, O.A., Refaat, E.K., Ibraheem, A.E.M., Mahdy, W.R., Fayed, N.A., Mourad, W.S., Abd Elhafez, H.S., and Yassen, K.A., *Transoesophageal Doppler compared to central venous pressure for perioperative hemodynamic monitoring and fluid guidance in liver resection*. Saudi J Anaesth, 2013. **7**(4): p. 378-86.

- **Postoperative/ICU: ODM Unpublished**

van Dellen, J., McCorkell, S., and Williams, A., *Randomised controlled trial of extended post-operative goal-directed fluid therapy using oesophageal doppler within an enhanced recovery programme for elective colorectal patients [Abstract P056]*. Colorectal Dis, 2013. **15**(Suppl 1): p. 30.

- **Postoperative/ICU: Other ODM**

Chytra, I., Pradl, R., Bosman, R., Pelnar, P., Kasal, E., Zidkova, A., *Esophageal Doppler-guided fluid management decreases blood lactate levels in multiple-trauma patients: a randomized controlled trial*. Crit Care, 2007. **11**(1): p. R24.

Systematic Reviews and Meta-analyses

Abbas, S.M., Hill, A. G., *Systematic review of the literature for the use of oesophageal Doppler monitor for fluid replacement in major abdominal surgery*. Anaesthesia, 2008. **63**(1): p. 44-51.

Phan, T.D., Ismail, H., Heriot, A. G., Ho, K. M., *Improving perioperative outcomes: fluid optimization with the esophageal Doppler monitor, a metaanalysis and review*. J Am Coll Surg, 2008. **207**(6): p. 935-41.

Walsh, S.R., Tang, T., Bass, S., and Gaunt, M.E., *Doppler-guided intra-operative fluid management during major abdominal surgery: systematic review and meta-analysis*. Int J Clin Pract, 2008. **62**(3): p. 466-70.

Giglio, M.T., Marucci, M., Testini, M., and Brienza, N., *Goal-directed haemodynamic therapy and gastrointestinal complications in major surgery: a meta-analysis of randomized controlled trials*. Br J Anaesth, 2009. **103**(5): p. 637-46.

Mowatt, G., Houston, G., Hernandez, R., de Verteuil, R., Fraser, C., Cuthbertson, B., Vale, L., *Systematic review of the clinical effectiveness and cost-effectiveness of oesophageal Doppler monitoring in critically ill and high-risk surgical patients*. Health Technol Assess, 2009. **13**(7): p. iii-iv, ix-xii, 1-95.

Dalfino, L., Giglio, M.T., Puntillo, F., Marucci, M., and Brienza, N., *Haemodynamic goal-directed therapy and postoperative infections: earlier is better. A systematic review and meta-analysis*. Crit Care, 2011. **15**(3): p. R154.

Hamilton, M.A., 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.* *Anesth Analg*, 2011. **112**(6): p. 1392-402.

Maeso, S., Callejo, D., Hernandez, R., Blasco, J.A., and Andradas, E., *Esophageal Doppler monitoring during colorectal resection offers cost-effective improvement of hemodynamic control.* *Value Health*, 2011. **14**(6): p. 818-26.

Giglio, M., Dalfino, L., Puntillo, F., Rubino, G., Marucci, M., and Brienza, N., *Haemodynamic goal-directed therapy in cardiac and vascular surgery. A systematic review and meta-analysis.* *Interact Cardiovas Thorac Surg*, 2012. **15**(5): p. 878-87.

Grocott, M.P., Dushianthan, A., Hamilton, M.A., Mythen, M.G., Harrison, D., and Rowan, K., *Perioperative increase in global blood flow to explicit defined goals and outcomes following surgery.* *Cochrane Database Syst Rev*, 2012. **11**: p. CD004082.

Validation

Singer, M., Clarke, J., Bennett, E. D., *Continuous hemodynamic monitoring by esophageal Doppler.* *Crit Care Med*, 1989. **17**(5): p. 447-52.

Singer, M. and Bennett, E.D., *Noninvasive optimization of left ventricular filling using esophageal Doppler.* *Crit Care Med*, 1991. **19**(9): p. 1132-7.

Klotz, K.F., Klingsiek, S., Singer, M., Wenk, H., Eleftheriadis, S., Kuppe, H., and Schmucker, P., *Continuous measurement of cardiac output during aortic cross-clamping by the oesophageal Doppler monitor ODM 1.* *Br J Anaesth*, 1995. **74**(6): p. 655-60.

Keyl, C., Rodig, G., Lemberger, P., and Hobbhahn, J., *A comparison of the use of transoesophageal Doppler and thermodilution techniques for cardiac output determination.* *Eur J Anaesthesiol*, 1996. **13**(2): p. 136-42.

Krishnamurthy, B., McMurray, T.J., and McClean, E., *The peri-operative use of the oesophageal Doppler monitor in patients undergoing coronary artery revascularisation. A comparison with the continuous cardiac output monitor.* *Anaesthesia*, 1997. **52**(7): p. 624-9.

Colbert, S., O'Hanlon, D.M., Duranteau, J., and Ecoffey, C., *Cardiac output during liver transplantation.* *Can J Anaesth*, 1998. **45**(2): p. 133-8.

Lefrant, J.Y., Bruelle, P., Aya, A.G., Saissi, G., Dauzat, M., de La Coussaye, J.E., and Eledjam, J.J., *Training is required to improve the reliability of esophageal Doppler to measure cardiac output in critically ill patients.* *Intensive Care Med*, 1998. **24**(4): p. 347-52.

Valtier, B., Cholley, B.P., Belot, J.P., de la Coussaye, J.E., Mateo, J., and Payen, D.M., *Noninvasive monitoring of cardiac output in critically ill patients using transesophageal Doppler.* *Am J Respir Crit Care Med*, 1998. **158**(1): p. 77-83.

Baillard, C., Cohen, Y., Fosse, J.P., Karoubi, P., Hoang, P., and Cupa, M., *Haemodynamic measurements (continuous cardiac output and systemic vascular resistance) in critically ill patients: transoesophageal Doppler versus continuous thermodilution.* *Anaesth Intensive Care*, 1999. **27**(1): p. 33-7.

Madan, A.K., UyBarreta, V.V., Aliabadi-Wahle, S., Jespersen, R., Hartz, R.S., Flint, L.M., and Steinberg, S.M., *Esophageal Doppler ultrasound monitor versus pulmonary artery catheter in the hemodynamic management of critically ill surgical patients.* *J Trauma*, 1999. **46**(4): p. 607-11; discussion 11-2.

DiCorte, C.J., Latham, P., Greilich, P.E., Cooley, M.V., Grayburn, P.A., and Jessen, M.E., *Esophageal Doppler monitor determinations of cardiac output and preload during cardiac operations*. Ann Thorac Surg, 2000. **69**(6): p. 1782-6.

Penny, J.A., Anthony, J., Shennan, A.H., De Swiet, M., and Singer, M., *A comparison of hemodynamic data derived by pulmonary artery flotation catheter and the esophageal Doppler monitor in preeclampsia*. Am J Obstet Gynecol, 2000. **183**(3): p. 658-61.

Leather, H.A. and Wouters, P.F., *Oesophageal Doppler monitoring overestimates cardiac output during lumbar epidural anaesthesia*. Br J Anaesth, 2001. **86**(6): p. 794-7.

Su, N.Y., Huang, C.J., Tsai, P., Hsu, Y.W., Hung, Y.C., Cheng, C.R., *Cardiac output measurement during cardiac surgery: esophageal Doppler versus pulmonary artery catheter*. Acta Anaesthesiol Sin, 2002. **40**(3): p. 127-33.

Jaeggi, P., Hofer, C.K., Klaghofer, R., Fodor, P., Genoni, M., and Zollinger, A., *Measurement of cardiac output after cardiac surgery by a new transesophageal Doppler device*. J Cardiothorac Vasc Anesth, 2003. **17**(2): p. 217-20.

Roeck, M., Jakob, S.M., Boehlen, T., Brander, L., Knuesel, R., and Takala, J., *Change in stroke volume in response to fluid challenge: assessment using esophageal Doppler*. Intensive Care Med, 2003. **29**(10): p. 1729-35.

Seoudi, H.M., Perkal, M.F., Hanrahan, A., and Angood, P.B., *The esophageal Doppler monitor in mechanically ventilated surgical patients: does it work?* J Trauma, 2003. **55**(4): p. 720-5; discussion 5-6.

Dark, P.M., Singer, M., *The validity of trans-esophageal Doppler ultrasonography as a measure of cardiac output in critically ill adults*. Intensive Care Med, 2004. **30**(11): p. 2060-6.

Monnet, X., Rienzo, M., Osman, D., Anguel, N., Richard, C., Pinsky, M.R., and Teboul, J.L., *Esophageal Doppler monitoring predicts fluid responsiveness in critically ill ventilated patients*. Intensive Care Med, 2005. **31**(9): p. 1195-201.

Chew, H.C., Devanand, A., Phua, G.C., and Loo, C.M., *Oesophageal Doppler ultrasound in the assessment of haemodynamic status of patients admitted to the medical intensive care unit with septic shock*. Ann Acad Med Singapore, 2009. **38**(8): p. 699-703.

Phan, T.D., Kluger, R., Wan, C., Wong, D., and Padayachee, A., *A comparison of three minimally invasive cardiac output devices with thermodilution in elective cardiac surgery*. Anaesth Intensive Care, 2011. **39**(6): p. 1014-21.

Guinot, P.G., de Broca, B., Abou Arab, O., Diouf, M., Badoux, L., Bernard, E., Lorne, E., and Dupont, H., *Ability of stroke volume variation measured by oesophageal Doppler monitoring to predict fluid responsiveness during surgery*. Br J Anaesth, 2013. **110**(1): p. 28-33.

Monnet, X., Robert, J.M., Jozwiak, M., Richard, C., and Teboul, J.L., *Assessment of changes in left ventricular systolic function with oesophageal Doppler*. Br J Anaesth, 2013.

Paediatrics

Note: The items in blue are papers where ODM was used or reviewed. Items in black either mention ODM or are documents Deltex Medical are working with to refine the system and develop an understanding of its place in the clinical setting.

Krovetz LJ, McLoughlin TG, Mitchell MB and Schiebler GL. Hemodynamic Findings in Normal Children. *Pediat. Res.* 1967. 1: 122-130

- Grenadier E, Oliveira C, Allen HD, Sahn DJ, Barron JV, Vales-Cruz LM and Goldberg SJ. Normal Intracardiac and Great Vessel Doppler Flow Velocities in Infants and Children. *JACC*. 1984. 4(2): 343-350
- Hanseus K, Björkhem G and Lundröm NR. Cardiac Function in Healthy Infants and Children: Doppler Echocardiographic Evaluation. *Pediatr Cardiol*. 1994. 15:211-218
- Murdoch IA, Marsh MJ, Tibby SM, McLuckie A. Continuous haemodynamic monitoring in children: use of transoesophageal Doppler. *Acta Paediatr*. 1995. 84: 761-764
- Tibby S, Hatherill M, Marsh MJ and Murdoch IA. Clinicians' ability to estimate cardiac index in ventilated children and infants. *Archives of Disease in Childhood*. 1997. 77:516-518
- Childs C, Goldring S, Tann W and Hillier VF. Suprasternal Doppler ultrasound for assessment of stroke distance. *Arch Dis Child*. 1998. 79:251-255
- Tibby SM, Hatherill M, Murdoch IA. Use of transoesophageal Doppler ultrasonography in ventilated pediatric patients: Derivation of cardiac output. *Crit Care Med*. 2000. 28:2045-2050
- Wodey E, Carre F, Beneux X, Schaffuser A and Ecoffey C. Limits of Corrected Flow Time to Monitor Hemodynamic status in Children. *Journal of Clinical Monitoring and Computing*. 2000. 16: 223-228
- Sohn S and Kim HS. Doppler Aortic Flow velocity Measurement in Healthy Children. *J Korean Med*. 2001. 16: 140-4
- Tibby SM, Hatherill M, Durward A, Murdoch IA. Are transoesophageal Doppler parameters a reliable guide to paediatric haemodynamic status and fluid management? *Intensive Care Med*. 2001. 27:201-205
- Carcillo JA and Fields AI. Clinical practice parameters for hemodynamic support of pediatric and neonatal patients in septic shock. *Jornal de Pediatria*. 2002. 78(6): 449-466
- Larousse E, Asehnoune K, Datayet B, Albaladejo P, Dubousset AM, Gauthier F and Benhamou D. The hemodynamic effects of pediatric caudal anesthesia assessed by esophageal Doppler. *Anesth Analg*. 2002 May; 94(5): 1165-8
- Mohan UR, Britto J, Habibi P, Munter C, Nadel S. Noninvasive Measurement of Cardiac Output in Critically Ill Children. *Journal Pediatric Cardiology*. 2002. 23(1): 58-61
- Tibby SM and Murdoch IA. Measurement of cardiac output and tissue perfusion. *Curr Opin Pediatr* 2002, 14:303-309
- Chew MS and Poelaert J. Accuracy and repeatability of pediatric cardiac output measurement using Doppler: 20-year review of the literature. *Intensive Care Medicine*. 2003. 29(11): 1889-894
- Tibby SM, Murdoch IA. Monitoring cardiac function in intensive care. *Arch Dis Child*. 2003. 88:46-52
- King SL and Lim MS. The Use of the Oesophageal Doppler Monitor in the Intensive Care Unit. *Critical Care and Resuscitation*. 2004. 6: 113-122
- Raux O, Rochette A, Morau E, Dadure C, Vergnes C and Capdevila X. The effects of spread of block and adrenaline on cardiac output after epidural anesthesia in young children: a randomized, double-blind, prospective study. *Anesth Analg*. 2004. 98(4): 948-55
- Hack H. Case report. Use of the Esophageal Doppler Machine to help guide the intraoperative management of two children with pheochromocytoma. *Pediatric Anesthesia*. 2006. 16:867-87

Monsel A, Salvat-Toussaint A, Durand P, Haas V, Baujard C, Rouleau P, El Aouadi S, Benhamou D and Asehnoune K. The Transesophageal Doppler and Hemodynamic Effects of Epidural Anesthesia in Infants Anesthetized with Sevoflurane and Sufentanil. *International Anesthesia Research Society*. 2007. 105(7): 46-50

Rowlands H, Bagshaw O and Duncan H. Does Trans-Oesophageal Doppler Cardiac Output Measurement Change Clinical Management Strategy? 2007 Poster

Knirsch W, Kretschmar O, Tomaske M, Stutz K, Nagdyman N, Balmer C, Schmitz A, Bettex D, Berger F, Bauersfeld U and Weiss M. Cardiac output measurement in children: comparison of the Ultrasound Cardiac Output Monitor with thermodilution cardiac output measurement. *Intensive Care Med*. 2008. 34(6): 1060-4

Mukhtar AM and Obayah G. Esophageal Doppler Monitor: A New Tool in Monitoring Video Assisted Thorascopic Surgery for Ligation of Patent Ductus Arteriosus. *Anesthesia & Analgesia*. 2008. 107(1) 346-347

Schubert S, Schmitz T, Weiss M, Nagdyman N, Huebler M, Alexi-Meskishvili V, Berger F and Stiller B. Continuous, non-invasive techniques to determine cardiac output in children after cardiac surgery: evaluation of transesophageal Doppler and electric velocimetry. *J Clin Monit Comput*. 2008. 22(4): 299-307

Brierley J et al. Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine. *Crit Care Med*. 2009. 37(2) 666-688

Fleck T, Schubert S, Stiller B, Redlin M, Ewert P, Nagdyman N and Berger F, Capability of a new paediatric oesophageal Doppler monitor to detect changes in cardiac output during testing of external pacemakers after cardiac surgery. *J Clin Monit Comput*. 2011. 25(6): 419-25

Absi MA, Lutterman J and Wetzel GT. Noninvasive cardiac output monitoring in the pediatric intensive care unit. *Current Opinion in Cardiology*. 2010. 25: 77-79

Lemson J, Nusmeier A and van de Hoeven JG. Advanced Hemodynamic Monitoring in Critically Ill Children. *Pediatrics*. 2011. 128: 560-571

Lechner E, Hofer A, Leitner-Peneder G, Freynschlag R, Mair R, Weinzettel R, Rehak P and Gombotz H. Levosimendan versus milrinone in neonates and infants after corrective open-heart surgery: a pilot study. *Pediatr Crit Care Med*. 2012 Sep;13(5):542-8.

Brown Z, Gorges M, Cooke E, Malberbe S, Dumont G and Ansermino J. Changes in cardiac index and blood pressure on positioning children prone for scoliosis surgery. *Anaesthesia*. 2013. 68: 742-746

Galante D and Melchionda M. Transesophageal Doppler ultrasound and hemodynamic monitoring using regional anesthesia in pediatrics. *Ultrasounds Anesthesia Journal*. 2013. 1: 1-5

Gan H, Cannesson M, Chandler JR and Ansermino JM. Predicting Fluid Responsiveness in Children: A Systematic Review. *Anesthesia & Analgesia*. 2013. 117(6): 1380- 1392

Dubost C, Bouglé A, Hallynck C, Le Dorze M, Roulleau P, Baujard C and Benhamou D. Comparison of monitoring performance of bioreactance versus esophageal Doppler in pediatric patients. *Indian Journal of Crit Care Med*. 2015 19(1): 3-8

Weber T, Wagner T, Neuman K and Deusch E. Low Predictability of Three Different Noninvasive Methods to determine Fluid responsiveness in Critically Ill Children. *Pediatric Critical Care*. 2015. 16(3): 89-94

Desgranges F P, Desebbe O, Pereira de Souza Neto E, Raphael D, Chassard D. Respiratory

variation in aortic blood flow peak velocity to predict fluid responsiveness in mechanically ventilated children: a systematic review and meta-analysis. *Paediatr Anaesth*. 2016 Jan;26(1):37-47

Ibrahim ES, Yassein TA and Morad WS. The beneficial values of transoesophageal Doppler in intraoperative fluid guidance versus standard clinical monitoring parameters in infants undergoing Kasai operation. *MEJ Anesth*. 2015. 23(2) 205-211

Comparison with other technologies

Meng, L., Tran, N.P., Alexander, B.S., Laning, K., Chen, G., Kain, Z.N., Cannesson, M., *The impact of phenylephrine, ephedrine, and increased preload on third-generation Vigileo-FloTrac and esophageal doppler cardiac output measurements*. *Anesth Analg*, 2011. **113**(4): p. 751-7.

Conway, D.H., Hussain, O.A., and Gall, I., *A comparison of noninvasive bioreactance with oesophageal Doppler estimation of stroke volume during open abdominal surgery: An observational study*. *Eur J Anaesthesiol*, 2013. **30**(8): p. 501-8.

Nordstrom, J., Hallsjo-Sander, C., Shore, R., and Bjorne, H., *Stroke volume optimization in elective bowel surgery: a comparison between pulse power wave analysis (LiDCOrapid) and oesophageal Doppler (CardioQ)*. *Br J Anaesth*, 2013. **110**(3): p. 374-80.

Davies, S.J., Minhas, S., Wilson, R.J., Yates, D., and Howell, S.J., *Comparison of stroke volume and fluid responsiveness measurements in commonly used technologies for goal-directed therapy*. *J Clin Anesth*, 2013.

Waldron, N.H., Miller, T.E., Thacker, J.K., Manchester, A.K., White, W.D., Nardiello, J., Elgasim, M.A., Moon, R.E., and Gan, T.J., *A prospective comparison of a noninvasive cardiac output monitor versus esophageal Doppler monitor for goal-directed fluid therapy in colorectal surgery patients*. *Anesth Analg*, 2014. **118**(5): p. 966-75.

Relevant Review Studies

Laupland, K.B. and Bands, C.J., *Utility of esophageal Doppler as a minimally invasive hemodynamic monitor: a review*. *Can J Anaesth*, 2002. **49**(4): p. 393-401.

Cholley, B.P. and Singer, M., *Esophageal Doppler: noninvasive cardiac output monitor*. *Echocardiography*, 2003. **20**(8): p. 763-9.

King, S.L. and Lim, M.S., *The use of the oesophageal Doppler monitor in the intensive care unit*. *Crit Care Resusc*, 2004. **6**(2): p. 113-22.

Grocott, M.P., Mythen, M.G., and Gan, T.J., *Perioperative fluid management and clinical outcomes in adults*. *Anesth Analg*, 2005. **100**(4): p. 1093-106.

Roche, A.M., Miller, T.E., and Gan, T.J., *Goal-directed fluid management with trans-oesophageal Doppler*. *Best Pract Res Clin Anaesthesiol*, 2009. **23**(3): p. 327-34.

Schober, P., Loer, S.A., and Schwarte, L.A., *Perioperative hemodynamic monitoring with transesophageal Doppler technology*. *Anesth Analg*, 2009. **109**(2): p. 340-53.

Schober, P., Loer, S.A., and Schwarte, L.A., *Transesophageal Doppler devices: A technical review*. *J Clin Mon Comput*, 2009. **23**(6): p. 391-401.

Singer, M., *Oesophageal Doppler*. *Curr Opin Crit Care*, 2009. **15**(3): p. 244-8.

Singer, M., *Oesophageal Doppler monitoring: should it be routine for high-risk surgical patients?* *Curr Opin Anaesthesiol*, 2011. **24**(2): p. 171-6.

Marik, P.E., *Noninvasive cardiac output monitors: a state-of-the-art review*. J Cardiothorac Vasc Anesth, 2013. **27**(1): p. 121-34.

ODM+

Sun, J.X., Reisner, A.T., Saeed, M., and Mark, R.G., *Estimating Cardiac Output from Arterial Blood Pressure Waveforms: a Critical Evaluation using the MIMIC II Database*, Harvard-MIT Division of Health Sciences and Technology, MIT: Cambridge, MA, USA.

Sun, J.X., *Cardiac output estimation using arterial blood pressure waveforms*, in *Electrical Engineering and Computer Science 2006*, Massachusetts Institute of Technology.

Sun, J.X., Reisner, A.T., Saeed, M., Heldt, T., and Mark, R.G., *The cardiac output from blood pressure algorithms trial*. Crit Care Med, 2009. **37**(1): p. 72-80.

Monge Garcia, M.I., Gracia Romero, M., Gil Cano, A., Rhodes, A., Grounds, R.M., and Cecconi, M., *Impact of arterial load on the agreement between pulse pressure analysis and esophageal Doppler*. Crit Care, 2013. **17**(3): p. R113.

Caillard, A., Gayat, E., Tantot, A., Dubreuil, G., M'Bakulu, E., Madadaki, C., Bart, F., Bresson, D., Froelich, S., Mebazaa, A., and Vallee, F., *Comparison of cardiac output measured by oesophageal Doppler ultrasonography or pulse pressure contour wave analysis*. Br J Anaesth, 2015. **114**(6): p. 893-900.

Feasibility/Applicability/Ease-of-use

Urrunaga, J.J.R., Emanuel P; Karriem-Norwood, Varnada A; Mullen, Marie T; Nguyen, H Bryant, *Hemodynamic Evaluation of the Critically Ill in the Emergency Department: A Comparison of Clinical Impression Versus Transesophageal Doppler Measurement (EDM)*. Crit Care Med, 1999. **27**(12): p. A89.

Atlas, G., Mort, T., *Placement of the esophageal Doppler ultrasound monitor probe in awake patients*. Chest, 2001. **119**(1): p. 319.

Walker, D., Usher, S., Hartin, J., Adam, S., Brandner, B., and Chieveley-Williams, S., *Early experiences with the new awake esophageal Doppler probe*. Br J Anaesth, 2004. **93**(3): p. 471.

Levy, B.F., Scott, M.J., Fawcett, W.J., and Rockall, T.A., *23-hour-stay laparoscopic colectomy*. Dis Colon Rectum, 2009. **52**(7): p. 1239-43.

Bevir, T.J., Helm, D.R., Wakeling, H.G., *Oesophageal Doppler using the CardioQ-ODM™ is not a time consuming intervention [abstract]*, in *Royal College of Anaesthetists Annual Congress 2011*: London, UK.

Editorials/Letters

Ghosh, S., Arthur, B., and Klein, A.A., *NICE guidance on CardioQ(TM) oesophageal Doppler monitoring*. Anaesthesia, 2011. **66**(12): p. 1081-3. [and responses]

Campbell, B., *Innovation, NICE, and CardioQ*. Br J Anaesth, 2012. **108**(5): p. 726-9.

Pinsky, M.R., O'Brien, T., Green, D., and Jonas, M., *Technology comparison studies require precise reference controls to be valid [Letter]*. Br J Anaesth, 2012. [and response]

Morris, C., *Oesophageal Doppler monitoring, doubt and equipoise: evidence based medicine means change*. Anaesthesia, 2013.

Physiology and the need for IOFM

Fiddian-Green, R.G., *Splanchnic ischaemia and multiple organ failure in the critically ill*. Ann R Coll Surg Engl, 1988. **70**(3): p. 128-34.

Deitch, E.A., *The role of intestinal barrier failure and bacterial translocation in the development of systemic infection and multiple organ failure*. Arch Surg, 1990. **125**(3): p. 403-4.

Shoemaker, W.C.A., P. L.; Kram, H. B., *Role of oxygen debt in the development of organ failure sepsis, and death in high-risk surgical patients*. Chest, 1992. **102**(1): p. 208-15.

Hamilton-Davies, C., Mythen, M.G., Salmon, J.B., Jacobson, D., Shukla, A., and Webb, A.R., *Comparison of commonly used clinical indicators of hypovolaemia with gastrointestinal tonometry*. Intensive Care Med, 1997. **23**(3): p. 276-81.

Khuri, S.F.H., W. G.; DePalma, R. G.; Mosca, C.; Healey, N. A.; Kumbhani, D. J., *Determinants of long-term survival after major surgery and the adverse effect of postoperative complications*. Ann Surg, 2005. **242**(3): p. 326-41; discussion 41-3.

Kimberger, O., Arnberger, M., Brandt, S., Plock, J., Sigurdsson, G.H., Kurz, A., and Hildebrand, L., *Goal-directed colloid administration improves the microcirculation of healthy and perianastomotic colon*. Anesthesiology, 2009. **110**(3): p. 496-504.

Bundgaard-Nielsen, M.J., C. C.; Secher, N. H.; Kehlet, H., *Functional intravascular volume deficit in patients before surgery*. Acta Anaesthesiol Scand, 2010. **54**(4): p. 464-9.

Enhanced Recovery

Kehlet, H., *Multimodal approach to control postoperative pathophysiology and rehabilitation*. British journal of anaesthesia, 1997. **78**(5): p. 606-17.

Fearon, K.C., Ljungqvist, O., Von Meyenfeldt, M., Revhaug, A., Dejong, C.H., Lassen, K., Nygren, J., Hausel, J., Soop, M., Andersen, J., Kehlet, H., *Enhanced recovery after surgery: a consensus review of clinical care for patients undergoing colonic resection*. Clin Nutr, 2005. **24**(3): p. 466-77.

Lassen, K., Soop, M., Nygren, J., Cox, P.B., Hendry, P.O., Spies, C., von Meyenfeldt, M.F., Fearon, K.C., Revhaug, A., Norderval, S., Ljungqvist, O., Lobo, D.N., and Dejong, C.H., *Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations*. Arch Surg, 2009. **144**(10): p. 961-9.

Ramirez, J.M., Blasco, J.A., Roig, J. V., Maeso-Martinez, S., Casal, J.E., Esteban, F., Lic, D.C., *Enhanced recovery in colorectal surgery: a multicentre study*. BMC Surg, 2011. **11**: p. 9.

Mythen, M.G., Swart, M., Acheson, N., Crawford, R., Jones, K., Kuper, M., McGrath, J. S., Horgan, A.F., *Perioperative fluid management: Consensus statement from the enhanced recovery partnership*. Perioperative Medicine, 2012. **1**(2).

NHS Enhanced Recovery Partnership Programme. *Fulfilling the potential: A better journey for patients and a better deal for the NHS*.

<http://www.improvement.nhs.uk/enhancedrecovery2/Anaesthetics.aspx>, 2012.

Miller, T.E., Roche, A.M., and Mythen, M., *Fluid management and goal-directed therapy as an adjunct to Enhanced Recovery After Surgery (ERAS)*. Can J Anaesth, 2015. **62**(2): p. 158-68.

Other

NHS Technology and Adoption Centre (NTAC). *'How to why to' guide - Doppler Guided Intraoperative Fluid Management*. <http://www.ntac.nhs.uk/HowToWhyToGuides/How-to-Why-to-Guides.aspx>.

Powell-Tuck, J., Gosling, P., Lobo, D. N., Allison, S.P., Carlson, G.L., Gore, M., Lewington, A.J., Pearse, R.M., Mythen, M.G., *British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients*.

National Institute for Health and Clinical Excellence (NICE). *CardioQ-ODM Oesophageal Doppler Monitor*. <http://guidance.nice.org.uk/MTG3>, 2011.

Innovation Health and Wealth: Accelerating Adoption and Diffusion in the NHS.
<http://www.dh.gov.uk/publications>, 2011.

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