



Case Report Describing Repair of Debakey Type II Dissection with Deep Hypothermic Circulatory Arrest in a Patient Presenting to Antenatal Clinic at 16 weeks Gestation

Louise Carlton

Senior Clinical Perfusionist - University Hospitals Birmingham NHS Foundation Trust

A 36 year old woman attending antenatal clinic at 16 weeks pregnant was found to have a murmur, alongside shortness of breath, and was therefore referred for echocardiography and subsequently CT imaging.

She was found to have a Debakey Type II dissection from the sinus of valsalva to the proximal arch at the level of the innominate artery, with severe aortic regurgitation. The aortic root measured 7cm. The patient was not in heart failure but had collapsing radial pulses and carotids.

Surgery was therefore necessary and a valve sparing root, ascending aorta and hemi-arch repair was performed using deep hypothermic circulatory arrest (DHCA).

The risk of surgery to the mother and foetus was 2-3% and 16-30%, respectively, depending on the extent of surgery and the need for deep hypothermic circulatory arrest.

Previous renal transplantation in 2011 also added to the risk of surgery and the risk of renal graft loss was <10% with a higher risk of temporary renal dysfunction.

Perfusion strategy involved using a blood prime, cardiac index of 3 L/min/m², gently cooling the patient down to 22°C, blood pressure maintenance between 65-75mmHg with a noradrenaline infusion running throughout, limited vasoconstrictor use, alpha stat PH management, and increased target haemoglobin levels.

The patient had good LV and RV function post operatively with mild aortic regurgitation and was extubated overnight. Her kidney function was also normal. The following day a foetal scan reported a viable foetus with normal liquor volume, and foetal movements were seen.

The baby was born at 34 weeks by Caesarean section for spontaneous onset of labour with mother and baby doing well.

This case highlights difficulties and potential strategies in a case of this kind requiring DHCA in complex surgery involving pregnant patients.



Title – High Pressure Excursions – Stressful trip abroad or a potentially fatal oxygenator emergency?

Emily Woods

Objectives – To look at literature and explore our own experiences surrounding high pressure excursions, to highlight causes and high risk patients and determine a strategy for management and prevention. Finally to consider a link between reported increase in HPEs and the Covid 19 pandemic

Methods –

Literature review

Case study review

Multi centre survey

Results / Discussions – HPE are the most commonly recorded adverse events involving membrane oxygenators. The phenomenon usually occurs upon initiation of CPB displaying as high pre membrane pressures, increasing trans membrane pressure drop and poor gas exchange. Common findings demonstrate a fibrin gel network with platelet activation which binds to the oxygenator fibres and heat exchanger. This significantly reduces the blood flow pathway leading to high membrane pressures and increases the distance for diffusive gas exchange leading to poor oxygenation.

There have been a number of documented common causes including patients with high platelet / fibrinogen levels, those who were previous smokers, and patients displaying heparin resistance. These incidents are most commonly occurring in patients undergoing CABG for coronary artery disease but most recently there seems to have been an increase potentially due to the COVID 19 virus.

Conclusions - Making practitioners aware of these highly stressful occurrences can only benefit clinical practice. Following a clear protocol to try and alleviate the HPE can reduce the number of potentially unnecessary oxygenator change outs and ultimately reduce patient risk.



Intraoperative anti-A/B immunoadsorption is associated with significantly reduced blood product utilisation with similar outcomes in paediatric ABO-incompatible heart transplantation

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BACKGROUND: Intraoperative anti-A/B immunoadsorption (ABO-IA) was recently introduced for ABO-incompatible heart transplantation. Here we report the first case series of patients transplanted with ABO-IA, and compare outcomes with those undergoing plasma exchange facilitated ABO-incompatible heart transplantation (ABO-PE).

METHODS: Data were retrospectively analysed on all ABO-incompatible heart transplants undertaken at a single centre between January 1, 2000 and June 1, 2020. Data included all routine laboratory tests, demographics and pre-operative characteristics, intraoperative details and post-operative outcomes. Primary outcome measures were volume of blood product transfusions, maximum post-transplant isohaemagglutinin titres, occurrence of rejection and graft survival. Secondary outcome measures were length of intensive care and hospital stay. Demographic and survival data were also obtained for ABO-compatible transplants during the same time period for comparison.

RESULTS: Thirty-seven patients underwent ABO-incompatible heart transplantation, with 27 (73%) using ABO-PE and 10 (27%) using ABO-IA. ABO-IA patients were significantly older than ABO-PE patients ($p < 0.001$) and the total volume of blood products transfused during the hospital admission was significantly lower (164 [126-212] ml/kg vs 323 [268-379] ml/kg, $p < 0.001$). No significant differences were noted between methods in either pre or post-transplant maximum isohaemagglutinin titres, incidence of rejection, length of intensive care or total hospital stay. Survival comparison showed no significant difference between antibody reduction methods, or indeed ABO-compatible transplants ($p = 0.6$).

CONCLUSIONS: This novel technique appears to allow a significantly older population than typical to undergo ABO-incompatible heart transplantation, as well as significantly reducing blood product utilization. Furthermore, intraoperative anti-A/B immunoadsorption does not demonstrate increased early post-transplant isohaemagglutinin accumulation or rates of rejection compared to ABO-PE. Early survival is equivalent between ABO-IA, ABO-PE and ABO-compatible heart transplantation.



Safe ECMO reconfiguration from VV to VVV to support hypoxic patients with severe COVID 19, a single centre cohort.

Smith R, Doyle J, Passariello M, Garfield B, Querido Leal R, Begum L, Browning R, Jackson T, Ledot S, Bianchi P

Objective:

Veno-venous ECMO is a well-established support technique for patients with respiratory failure-induced hypoxia allowing for pulmonary recovery and implementation of lung-protective ventilatory settings. However, in severe respiratory failure cases, ECMO may be unable to provide full support, and patients remain hypoxic. In this case series, we describe the reconfiguration of VV ECMO to veno-veno-venous (VV-V) ECMO, a more complex “hybrid” cannulation strategy, where a third cannula is inserted to improve venous drainage to provide more ECMO blood flow and therefore increase systemic oxygenation in patients receiving ECMO for severe COVID-19.

Method:

Data from patients who received circuit reconfiguration from VV ECMO to VV-V ECMO at the Royal Brompton Hospital during the COVID-19 pandemic between March 2020 - February 2021 was collected from the ICU's Clinical Information System (ICCA, Philips Healthcare) and analysed. Endpoints included PaO₂, ECMO blood flow, arterial saturation and any complications relating to the reconfiguration.

Results:

17 patients (11/17 male) with an average BMI of 37.6 ± 10.4 received circuit configuration bedside with no recorded complications. A significant increase in ECMO blood flow (average increase 0.57 ± 0.69 LPM, $p < 0.01$), PaO₂ (average increase 4.7 ± 4.15 kPa, $p < 0.001$) and arterial saturation ($10 \pm 6\%$) were demonstrated over the cohort of patients. 13/17 patients survived their ECMO run, 5 patients died during their ECMO run. Patients spent an average of 36.4 days on ECMO.

Conclusions:

Reconfiguration of VV ECMO to a VV-V cannulation strategy is a safe procedure and increase ECMO blood flow and therefore, arterial oxygenation and saturation in hypoxic patients with severe COVID-19.



“Innovation in Perfusion Training and Education”

Jessie Wouter – Medtronic

Exactly 12 months ago, I wrote an abstract focused on “Perfusion training and education in ordinary and extraordinary times”. The ongoing COVID-19 pandemic impacted our normal way of living and challenged our way of teaching. The result is that a lot of organizations needed to emergent transition from face-to-face learning to online learning, which can be challenging.

Medtronic explored alternative and complementary ways to provide high quality trainings and Virtual Reality (VR) is one of these alternative ways that can contribute as a next-generation option in training healthcare professionals from distance or onsite. Exactly 12 months ago, Medtronic created the European Experience Center (EECK), which is located in The Netherlands, entirely virtual. In this way, we could bring the flow physiology course back to live and bring many healthcare professionals back to the EECK to experience this course, and its experiments, virtually in an engaging way.

During the past months, Medtronic worked hard on developing more innovative learning solutions, which are even more innovative compared to last year’s update at the AGM. We’ve focused on developing two VR product trainings, which take place in a virtual operating theatre. These VR product trainings, focused on Quantum Thermal Technology and AutoLog IQ, will not replace any onsite hands-on trainings in the future. On the contrary, these VR trainings will prepare you better to actual hands-on training and are therefore now part of a complete perfusion product training.

Medtronic’s beliefs are that combining these new innovative technologies with onsite training, that this leads to training and education programs better adapted to the needs of our customers, which will also reach more health care professionals.

Medtronic is looking to be further connected with all health care professionals. Stay tuned for next year’s edition, there is more to come.



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Neurological outcomes and congenital heart disease: The role glial fibrillary acidic protein biomarker

[Kalyne Royds](#)



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Invited Speaker

Christopher Lemons



Efficiency of Global Oxygen Delivery during Paediatric Cardiopulmonary Bypass predicts Postoperative Acute Kidney Injury

Alice Hayward

Trainee Clinical Perfusionist – Great Ormond Street Hospital for Children

Abstract

Objective: Acute kidney injury (AKI) following paediatric cardiac surgery with cardiopulmonary bypass is a frequently reported complication. This study aims to determine the critical oxygen delivery (DO_{2i}) threshold for predicting postoperative AKI in paediatric patients during cardiopulmonary bypass, and whether it remains clinically important in the context of other known independent risk factors.

Methods: A single institution, retrospective study, encompassing 396 paediatric patients, who underwent heart surgery between April 2019 and April 2021 was undertaken. Time spent below DO_{2i} thresholds was compared to determine the critical value for predicting AKI within 48 hours of surgery. DO_{2i} threshold was then included in a classification analysis with known risk factors including nephrotoxic drug usage, bypass and aortic cross clamp times, comorbidities and ventricular function data, and vasoactive inotrope requirement to determine DO_{2i} predictive importance.

Results: Logistic regression models demonstrated cumulative time spent below a DO_{2i} value of 350ml/min/m² was associated with AKI. Random forest models, incorporating established risk factors, demonstrated DO_{2i} threshold still displayed predictive importance. Patients who developed post-CPB AKI were significantly younger, had significantly longer CPB and ischemic times, and required significantly higher inotrope support post-surgery.

Conclusions: The present data supports previous findings that DO_{2i} during CPB is an independent risk factor for AKI development in paediatric patients. Furthermore, the data support previous suggestions of a higher threshold value in children compared to adults and indicate that adjustments in DO_{2i} management may reduce incidence of postoperative AKI in the paediatric cardiac surgery population.

Graphical Abstract

Context



Cardiac surgery-associated AKI is a significant problem



Poor O₂ delivery is a key cause of AKI



Setting DO₂ goals can help reduce AKI; however, evidence comes from adult studies



396 Paediatric patients

Methodology



Predictive modelling



AKI
Defined according to KDIGO criteria

Outcomes

- DO₂ indexed to BSA** provides best predictive model
- DO_{2i} < 350ml/min/m²** is predictive of postoperative AKI in paediatric patients
- DO₂** was identified within the top 10 risk factors for predicting AKI



Extracorporeal membrane oxygenation following paediatric cardiopulmonary bypass: A retrospective review on predictors and outcomes at Birmingham Children's Hospital

Holly Farrell

Trainee Clinical Perfusionist – Birmingham Children's Hospital

Abstract

Introduction: Considering the vast increase in post-operative paediatric ECMO, defined indicators for initiating ECMO still remain controversial, with limited research into perfusion parameters. This study aimed to assess whether perfusion parameters can indicate the necessity for post-operative ECMO and whether patient outcomes are determined by ECMO duration and the reasons for requiring post-operative ECMO.

Methods: A retrospective study of Birmingham Children's hospital data was undertaken between 2008-2020. Data was collected for 101 ECMO patients, and 3 appropriate control patients were selected who did not require post-operative ECMO. Comparison was undertaken for all ECMO vs. control patients, and between surgical procedure sub-groups. ECMO patients were also divided into the reason for requiring ECMO including low cardiac output syndrome, extracorporeal cardiopulmonary resuscitation, failure to separate from bypass, and respiratory failure to assess short- and long-term outcomes. Duration of ECMO was assessed with short-term outcomes.

Results: The post-operative ECMO rate was 2.3% with a survival rate of 51.5% within the study. Bypass time was significantly longer for ECMO patient's vs control patients (162.59 and 105.01 minutes respectively, $p < 0.001$), as well as arrest and x-clamp time (24.33 and 17.61 minutes respectively $p = 0.012$, and 80.09 and 64.61 minutes respectively, $p = 0.002$). The initial and final lactate on bypass were significantly increased in ECMO patient's vs control patients (3.25mmol/L and 2.44mmol/L respectively, $p < 0.001$, and 6.55mmol/L and 4.51mmol/L respectively, $p < 0.001$). Final base excess was more negative in ECMO patients than control patients at -4.88mmol/L and -3.62mmol/L respectively ($p = 0.002$). Similar results were seen for surgical procedure sub-groups. Duration of ECMO increased mortality after 151 hours. ECPR had poorer survival rates compared to LCOS and FTSB however; there was no difference between long-term survivals.

Conclusion: Overall, perfusion parameters can significantly indicate ECMO requirement. Duration and circumstances for requiring ECMO can impact on short-term outcomes, however, do not affect long-term outcomes.



Histidine Tryptophan Ketoglutarate vs Extracellular Crystalloid cardioplegia in endoscopic minimally invasive mitral valve surgery using endoaortic clamping: a proposal for a prospective randomised study comparing neurological outcomes, efficacy, and safety.

Alice Polkinghorne

Trainee Clinical Perfusionist

Minimally invasive mitral valve surgery (MIMVS) provides benefits including a shorter recovery time and more aesthetically pleasing scar, whilst resulting in similar valve repair quality to sternotomy. MIMVS can be performed endoscopically using a thoracoscope and endoaortic clamping (EAC). EAC is not currently a widely used method of cross clamping. However, it can confer advantages when used by a well-trained team, especially in the setting of a calcified aorta or redo procedure.

The EAC occludes the aorta by balloon inflation and cardioplegia is delivered down a central lumen. This central lumen requires a crystalloid cardioplegia solution. Histidine-tryptophan-ketoglutarate (HTK) is a form of single-dose intracellular crystalloid cardioplegia, which could shorten surgery time. However, it is a low sodium solution and causes systemic hyponatraemia. Hyponatraemia is known to cause cerebral swelling and can cause cognitive decline, although the hyponatraemia has been shown to be isotonic, a less dangerous form.

To test this, 334 endoscopic MIMVS patients will be randomised to receive HTK or multi-dose extracellular crystalloid cardioplegia (EC). The study will examine the change in cognitive function before and after HTK compared to EC. The tonicity of the hyponatraemia will also be determined. The secondary outcome of the study is to determine if HTK provides a similar level of cardio-protection to EC by testing levels of ischaemic markers following surgery. of surgery will also be compared.

Previous HTK studies have not investigated a change from baseline cognitive function, and no randomised studies using HTK with EAC exist. The aim of this research is to elucidate the safest, most efficacious cardioplegia to use in MIMVS with EAC.

MIMVS is offered at few cardiac centres in the UK, meaning patients miss out. Results of this study will give surgeons a proven myocardial protection method to use and encourage more centres to begin MIMVS



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Student Presentation 4 – TBC



Deep hypothermic circulatory arrest and neuromonitoring in paediatric cardiac surgery: A survey of practice across the UK and Ireland

Shannon Waterfield

Trainee Clinical Perfusionist – Birmingham Children's Hospital

Introduction:

It is estimated that 80-95% of patients who undergo cardiac surgery during the paediatric period survive into adulthood. This has highlighted the issue of long-term morbidities associated with cardiopulmonary bypass-dependant cardiac surgery such as neurological dysfunction which affects 2-25% of patients postoperatively. Several perioperative factors increase the risk of neurological dysfunction, including deep hypothermic circulatory arrest (DHCA) which is necessary for repair/palliation of certain complex lesions. Several perioperative neuromonitoring modalities are available to detect dangerous events and guide interventions to reduce risk.

Survey:

A survey of 33 questions on temperature management, DHCA and neuromonitoring during CPB was sent to perfusionists at all 12 paediatric centres across the UK and Ireland. 100% of centres responded. A great deal of heterogeneity across centres was identified in temperature definitions. 92% of centres use a nasopharyngeal probe and 8% use rectal and bladder probes. 100% of centres use DHCA, totalling 9.7% of all annual paediatric bypass cases. 100% of centres use temperature to initiate DHCA, from 18-24°C or variable. 92% of centres use near-infrared spectroscopy for neuromonitoring.

Discussion:

This is the first survey to be done across the paediatric centres in the UK and Ireland looking specifically at temperature management, DHCA and neuromonitoring. There were similarities in this survey with similar international surveys, specifically in temperature definitions which could suggest different average bypass times for similar surgeries across countries and centres.



Routine admission markers of inflammation may aid in risk stratification of Type A aortic dissection patients.

Authors

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Type A aortic dissection (TAAD) is a life-threatening condition which requires emergency surgery. Surgical intervention is high risk and complex with significant risk of mortality and morbidity.

TAAD patients frequently experience both a local and systemic inflammatory response. Bedside risk assessment using routinely acquired laboratory biomarkers could facilitate rapid diagnosis and risk prediction to inform clinical decision making. There is growing evidence that inflammatory markers can predict prognosis with the neutrophil to lymphocyte ratio (NLR) appearing to have particularly good predictive power.

This study aimed to investigate the relationship between admission markers of inflammation and prognosis in TAAD. The study was a retrospective cohort design which used prospectively collected anonymised clinical data extracted from the patient's electronic patient record (EPR). Exclusions included patients with iatrogenic or traumatic dissection or those with a concomitant infection or known acute inflammatory disorder. Inflammatory markers were compared between survivors and non-survivors (in-hospital mortality). A receiver operating characteristic (ROC) curve analysis to identify the ideal NLR cut-off value and a Kaplan Meier curve analysis were performed.

183 patients were included in the analysis. There were significant differences in white blood cell count (WBCc) (11.3 [8.6, 14.9] versus 14.6 [10.9, 18.1], $p=0.01$), neutrophil count (8.9 [6.6, 13.0] versus 12.5 [9.3, 15.6], $p=0.003$), and NLR (8.1 [5.0, 13.1] versus 12.5 [8.4, 18.8], $p=0.003$) between survivors ($n=160$) and non-survivors ($n=23$). The ROC curve analysis identified an NLR cut-off value of 8.2. Patients grouped by $NLR < 8.2$ or > 8.2 had significantly different in-hospital mortality ($NLR < 8.2$ 3/83 versus $NLR > 8.2$ 20/100, $p < 0.001$).

These findings suggest that use of NLR pre-operatively may help identify higher risk patients which may enable more targeted management of these patients.



Blood Conservation Update

Dr Andrew Klein

Abstract to be finished

Professor Andrew Klein is a Consultant Anaesthetist at Papworth Hospital in Cambridge. He is the Editor-in-Chief of the highly respected journal *Anaesthesia*, which has an Impact Factor of 6.95. He is on the Board and Council of the Association of Anaesthetists, the membership organisation for > 11,000 anaesthetists in Great Britain and Ireland. He also sits on the Board and Council of the National Institute of Academic Anaesthesia (NIAA), which manages research grant funding in the UK.

Professor Klein's main research area is pre-operative anaemia and the effects of iron replacement therapy. He is one of the Principal Investigators of the ITACS trial (Intravenous Iron for the Treatment of Anaemia before Cardiac Surgery). He has chaired two Working Parties updating the national Guidelines for Cell Salvage and for the Management of Jehovah's Witnesses patients undergoing surgery. His current research interests include....

Professor Klein will be updating the membership on current recommendations on blood conservation and highlighting upcoming research on the subject.



The role of electroencephalography in cardiac surgery with hypothermic circulatory arrest.

Will McDevitt

Clinical Scientist (Neurophysiology), Department of Clinical Neurophysiology - Birmingham Children's Hospital

Abstract: Although hypothermic circulatory arrest (HCA) is an essential technique to protect the brain during cardiac surgery, neurological morbidity is not uncommon. Electroencephalography (EEG) can be used to guide anaesthetic and HCA strategy, detect neurological abnormalities and prognose outcome. My department, in conjunction with cardiac surgery, the intensive care unit, and University of Birmingham performed a systematic review to explore the role of perioperative EEG in adults and children undergoing cardiac surgery with HCA. We did not find any study that compared detailed outcome in those monitored with EEG to those not monitored with EEG. We concluded that more evidence demonstrating EEG utility is required, and instead, I will present a narrative review of ways in which specialist centres utilise perioperative EEG. I will provide theory as to why the EEG may be useful in the setting of cardiac surgery and suggest ways in which the EEG could be prospectively researched.



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Case Report – Andrew Nichols

Title and abstract TBC



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Werfen – Title and abstract TBC



Innovation and the Future of Perfusion

Michael van Driel, Business Director Medtronic Extracorporeal Therapies

As we look towards the future of the role of the perfusionist, Medtronic is of the opinion that the perfusionist's role and the accompanying technology need to develop along with the therapies outside cardiac surgery to enable the perfusionist in the current role to become more of an extracorporeal specialist beyond support in the cardiac theatre. We will present our view of the future and the role innovation has had thus far within the Medtronic portfolio as well as where technology development might take us in the future, looking at the needs of the patient and the needs of the clinician in terms of safety, data management, patient monitoring, and of course from a regulatory perspective. The latter cannot be understated as the regulations continue to evolve locally in the UK in a manner somewhat in parallel with the Medical Device Requirements in the European Union.



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Title and abstract TBC – Kyrie Wheeler



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National ECMO Network activity for wave 2/3 and follow up – Rosie Smith

Abstract TBC



Iron, Nutrition and Long COVID

Professor Andrew Klein – Consultant Anaesthetist, Royal Papworth Hospital

Nutrition is a hugely important scientific determinant of health and wellbeing. Iron and B12 deficiency are increasingly common, mostly related to dietary choices and nutritional diseases like auto-immune gastritis. They cause fatigue, brain fog, palpitations, shortness of breath and impaired exercise tolerance. They are also related to long COVID and other causes of chronic fatigue or ME and can be treatable causes. Investigation and management, often using parental therapy with iron infusion and/or B12 injections can lead to marked improvements but this is limited in the NHS, especially recently due to resource constraint post-austerity and COVID.

This lecture will discuss physical fitness and high-performance athletes, plant-based diets and veganism, screening and testing for iron and B12 deficiency, novel treatments for long COVID and the role of nutrition in health and wellbeing. It may not be part of perfusion management but relates more to looking after ourselves and long-term physical and mental health.