FINAL PROGRAM – ABSTRACT BOOK

22nd European Conference on Perfusion Education and Training

Milan - Saturday October 08st, 2022
08.45 – 17.30

Milan Conference Center
Level 0, Space 2, Room Rafael

Organized by the

THE EUROPEAN BOARD OF CARDIOVASCULAR PERFUSION

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THE EUROPEAN BOARD OF CARDIOVASCULAR PERFUSION

OUTLINE ABSTRACT BOOK

THE EUROPEAN BOARD OF CARDIOVASCULAR PERFUSION

1991

WELCOME

The European Board of Cardiovascular Perfusion (EBCP) is pleased to welcome you to their annual European Conference on Perfusion Education and Training (ECoPEaT)

After the changes which took place over the past two years, during the "Covid-19 era", the annual EBCP congress is finally back as a physical meeting!
The Milan meeting consists of 4 scientific sessions & 1 "Meet the Industry" session, and we offer coffee & lunch during the breaks. The meeting will end around 5pm and we hope you will take some time to socialise with your international colleagues in the vibrant city of Milan.
Each scientific session will host a few invited speakers of high academic standing and will allow European perfusionists/researchers to present their perfusion related academic work.

The theme of this year's conference is:

"Improving the future by learning from the past".

The first scientific session accomodates a range of perfusion topics related to the impact of the pandemic on researchers, healthcare organisations and industry. We are proud to welcome our keynote speakers and key stakeholders that have been affected.

The second session will focus on ECMO and we will learn more about the need for an LV unloading strategy in each cardiac ECMO program now the past has proven the burden of VA ECMO on the LV

We will also discuss the ECMO support strategies in our Congenital Heart Disease (CHD) patients with an internationally renowned speaker carrying extensive clinical epxerience in this patient population.

During the 'Meet the Industry' session, our valued loyal sponsors (Medtronic - LivaNova - Eurosets – Terumo – HC Tronic) have the opportunity to speed-date with all of you; each supporting company sharing most important messages and developements. Of course, you are all encouraged to chat with them afterwards or visit their stand in the EACTS exhibition hall!

The third scientific session is dedicated to problem solving to achieve high standards of care in perfusion practice across Europe; we will address whether heat exchangers still are a problem, and whether there is an effectiveness of adsorptive therapies during extracoporeal circulation.

The fourth scientific session will address the challenges of education & training in healthcare, including the evolving field of telemedicine. We will discuss the role of the perfusionist in training, the development of simulation and simulation systems; all helping new perfusionists to get into the perfusion mindframe.

There will be free coffee before and during the meeting and we also offer a free lunch for all participants. We invite you to take the opportunity to socialise and participate in the discussions, but please return to the meeting room at the appropriate time out of respect for our speakers.

Last but not least, we acknowledge and appreciate our generous sponsors; without them it would be impossible to hold this perfusion training meeting!!!

Platinum sponsors: Medtronic - LivaNova

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We hope we will meet your expectations and hope you will enjoy the meeting!

Antonella Degani - EBCP Congress Organizer 2022

antonella.degani@unipv.it

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Christian Karagiannidis – Germany
Michael Van Driel - Switzerland
Roberto Lorusso – The Netherlands
Malaika Mendonca - Switzerland
Sergio Pillon – Italy
Andreas Lemmers - Belgium
Zaheer ud din Bahar - The Netherlands
Wouter de Wilde The Netherlands

Abstracts Oral Presenters:

Sergii Sudakevych – Ukraine
Fabio Zulaf – Switzerland
Ignazio Condello – Italy
Anna Corderfelt Keiller – Sweden
Rik Hendrix - The Netherlands
Anna Holmen – Sweden
Katerina Denysluk- Ukraine
Laurent Locquet – UK
Adrian Bauer- Germany

Session Moderators

Dominique Hella – Alexander Wahba
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PROGRAM AT A GLANCE

08.00 – 09.00 *"Welcome to Milan!"*

08.00 – 08.45 Welcome Coffee + Registration

08.45 – 09.00 Welcome Address: F. De Somer

09.00 – 10.30 Scientific Session I: "Lessons Learned from the past"
Moderators: Dominique Hella – Alexander Wahba

10.30 – 11.00 Coffee break

11.00 – 12.30 Scientific Session II: "ECLS Lessons learned from the past"
Moderators: Leen Vercaemst - Antonella Degani

12.30 – 13.30. Free Lunch

13.30 – 14.10 PECHA KUCHA SESSION "MEET THE INDUSTRY"
Moderators: Gerdy Debeuckelaere - John Campbell

14.10 – 15.00 Scientific Session III: Learning from the past: solving old problem & new needs"
Moderators: Gudrun Kunst - Adrian Bauer

15.00 – 15.30 Coffee break

15.30 – 16.45 Scientific Session IV: "Moving forward: Education and Digitation"
Moderators: Erminia Maria Mascitelli - Inês Figuera

16.45 – 17.00 Closing remarks

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DETAILED SCIENTIFIC PROGRAM

08.00 – 08.30 Coffee & Registration
08.45 – 09.00 Welcome by EBCP Chairman: F. De Somer

"Improving the future by learning from the past"

09.00 – 10.30: Scientific Session I

Lessons Learned from the past

Moderated by Dominique Hella – Alexander Wahba

09.00 - 09.15	Overview of perfusion related research: Highlights of 2021-2022	Filip De Somer *Belgium*
09.15 - 09.35	Lessons learned from the past: Impact of COVID-19 on healthcare	Christian Karagiannidis *Germany*
09.35 - 09.55	Lessons learned from the past: Impact of COVID-19 on the industry	Michael Van Driel *Switzerland*
09.55 - 10.10	Performing cardiopulmonary bypass at fragment heart wound with the right coronary artery lesion with using an oxygen concentrator as a source of oxygen	Sergii Sudakevych *Ukraine*
10.10 – 10.25	An evaluation of hard-shell venous reservoir integrated pressure relief valve pressure mitigation performance	Fabio Zulauf *Switzerland*

10.30 – 11.00 COFFEE

11.00 – 12.30: Scientific Session II

ECLS Lessons learned from the past

Moderated by Leen Vercaemst - Antonella Degani

11.00-11.20	Lessons learned from the past: Does each VA ECMO program require an unloading program?	Roberto Lorusso *The Netherlands*
11.20 - 11.40	ECMO in patients with CHD: Challenges for the perfusionist	Malaika Mendonca *Switzerland*
11.40 - 11.55	Micro Embolic Activity During Cavitation and type of Gas involved on ECMO and Minimal Invasive Extracorporeal Circulation	Ignazio Condello *Italy*
11.55 - 12.10	Non-invasive and invasive measurement of skeletal muscular oxygenation during isolated limb perfusion	Anna Corderfelt Keiller *Sweden*
12.10 – 12.25	Clinical evaluation of the novel Capiox NX19 adult oxygenator – a multicenter study	Rik Hendrix *The Netherlands*

12.30 – 13.30 ***LUNCH!***

13.30 – 14.10: PECHA KUCHA SESSION "MEET THE INDUSTRY"

Speed Date session with the Industry

Moderated by Gerdy Debeuckelaere – John Campbell

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14.10 – 15.00: Scientific Session III

"Learning from the past: solving old problem & new needs"

Moderated by Gudrun Kunst - Adrian Bauer

14.10 - 14.25	Our Heater Coolers: Did we manage to solve the problem?	Wouter de Wilde *The Netherlands*
14.25 - 14.40	Whole Blood Adsorber During CPB and Need for Vasoactive Treatment After Valve Surgery in Acute Endocarditis: A Randomized Controlled Study	Anna Holmen *Sweden*
14.40 - 14.55	Hemosorption in Complex Therapy of Arrhythmias in Patients with Heart Failure against a Background of Dilated Cardiomyopathy	Katerina Denysiuk *Ukraine*

15.00 – 15.30 ***COFFEE*** 

15.30 – 16.45: Scientific Session IV

"Moving forward: Education and Digitation"

Moderated by Erminia Maria Mascitelli – Inês Figuera

15.30 - 15.45	Telemedicine and digital health and a new health model. Perfusion and Digitation	Nicolò Persiani *Italy*
15.45 - 16.00	Role of the perfusionist in organ perfusion: Testimony from a perfusionist-trainee	Andreas Lemmers *Belgium*
16.00 - 16.15	Current non-experimental applications of the cardiopulmonary bypass in the dog and cat - A literature review	Laurent Locquet *UK*
16.15 - 16.30	Minimal invasive Extracorporeal circulation training and simulation	Adrian Bauer *Germany*
16.30 – 16.45	VR as perfusion training tool	Zaheer ud din Babar *The Netherlands*

16.45 – 17.00 Closing remarks

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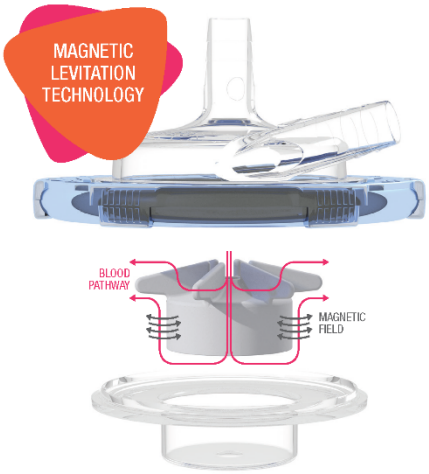

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INVITED TALK

09.00 - 09.15 Overview of perfusion related research: Highlights of 2021-2022

Filip De Somer

INVITED TALK

09.15 - 09.35 Lessons learned from the past: Impact of COVID-19 on healthcare

Christian Karagiannidis

INVITED TALK

09.35 – 09.55 Lessons learned from the past: Impact of COVID-19 on the industry

Michael van Driel, Medtronic International

The COVID 19 pandemic posed significant challenges for the entire field of cardiac surgery, from patient treatment to shared resources within the ICU and patient management post operatively. The consequences continue to be felt across the globe. The product producers, service suppliers and manufacturers behind the scenes had very similar issues through the multiple waves of COVID, including material sourcing, human resources and managing the constant stress of dealing with the regulations and rules associated with containing the pandemic.
During this presentation, the impact of the multiple waves of the pandemic on industry more broadly will be presented and discussed, as well as the lessons learned in terms of the new normal from the suppliers' perspective, "post COVID."

ABSTRACT

09.55 10.10 Performing cardiopulmonary bypass at fragment heart wound with the right coronary artery lesion with using an oxygen concentrator as a source of oxygen

Sergii Sudakevych

Introduction. We present a case of performing cardiopulmonary bypass (CPB) with the using of oxygen concentrator as a source of oxygen in a 35-year-old soldier with a fragment wound of the heart with the right coronary artery lession.

Clinical case. Patient K., aged 35, was brought from the battlefield to our clinic within an hour after injury with cardiac tamponade with high doses of adrenomimetics and signs of acute heart failure. The pericardial cavity was drained and symptomatic therapy was prescribed. Two weeks later, the patient underwent on-pump coronary artery bypass grafting (CABG) with removal of the fragment.

Patient's body weight was 89 kg, height – 183 cm, body surface area was 2.11 m2. The initial level of hemoglobin before surgery – 113 g/l. CPB was performed on a heart-lung machine MAQUET HL 20 using a disposable membrane oxygenator "Inspire 8F", Sorin group. Moderate hypothermia (+32 °C) was achieved using a Heater-Cooler Unit HCU 40, Maquet. Prior to the start of CPB, heparin was administered intravenously at a dose of 26,700 IU (300 IU/kg body weight). At the level of activated clotting time (ACT) was more than 460 s, cannulation of the ascending aorta (Arterial Cannulae DLPTM _ Straight Tip Arterial Cannulae 22 Fr, Medtronic) and right atrium (Venous Cannulae MC2TM Two Stage Venous Cannulae 34/46 Fr, Medtronic) were performed.

The priming solution (1100 ml) consisted of 500 ml 4% Gelaspan (B. Braun Medical SA. Switzerland.), 100 ml of 4.2% sodium bicarbonate solution, 300 ml of 0.9% sodium chloride solution and 100 ml of 15% mannitol solution. Heparin 5500 IU (500 IU per 100 ml of priming solution) was added to the priming solution.

After the start of CPB, the minimum hemoglobin level was 92 g/l. Oxygen delivery (DO2) during CPB was maintained at > 272 ml O2/min/m2 with the minimum blood flow 2.4 l/min/m2. Changes in mean blood pressure during CPB did not exceed 20% of baseline. Electrically induced ventricular fibrillation was used, which was performed by Fibrillator Fi 20 M, Stockert GmbH. Duration of CPB – 48 minutes, duration of electrically induced ventricular fibrillation – 25 minutes.

Given the possibility of missile fire on the clinic by russian troops, to prevent the detonation of oxygen storage tanks, which are commonly used in the our clinic as a source of oxygen during CPB, we used oxygen concentrator Plusmed PM - KN 01 (Trimpex ith ihr tur and tic a. s., Turkey). The maximum flow of oxygen in the oxygen concentrator was 5 l/min, and FiO2 reached 90%. FiO2 could be controlled by mixing oxygen from the oxygen concentrator and the air flow to the mixer. Thus, the supply of oxygen flow of 2 l/min and 1 l/min of air to the mixer allowed to provide FiO2 68%. An anesthesia gas analyzer was used to monitor the FiO2 of the resulting mixture.

The effectiveness of the use of oxygen concentrator during CPB was also confirmed by the results of the analysis of blood gases (saO2 ranged from 99% to 100%, svO2 – from 75% to 80%, pO2 – from 129 mm Hg to 215 mm Hg; ctO2 – from 19.3 ml/dl to 21.5 ml/dl) and cerebral saturation (not decrease below 10% of baseline).

The mean intraoperative lactate levels also did not exceed the reference values and were 1.61±0.2 mmol/l, which indicated a normal level of tissue perfusion and tissue gas exchange. Positive verbal contact was recorded eighteen minutes later after anesthesia, with positive dynamics on the ECG.

Conclusion. This case demonstrated the safety of using an oxygen concentrator during CPB, which makes it possible to perform cardiac surgery in the absence of centralized oxygen supply or its deficiency.
Key words: cardiopulmonary bypass; oxygen concentrator; fragment heart wound.

10.10 10.25 An evaluation of hard-shell venous reservoir integrated pressure relief valve pressure mitigation performance

Richard Fabio Zulauf[2] and Saverio Spada[1]

Introduction: Vacuum assisted venous drainage (VAVD) requires the sealing of the hard-shell venous reservoir, thereby creating circumstances where reservoir pressurization may occur. Manufacturers utilize integrated pressure relief valves (IPRV) to mitigate pressurization risk; however, accidents have been reported even with these devices. We have undertaken a performance evaluation of IPRV's in a large number of hard-shell venous reservoirs.
Methods: Reservoirs were sealed and gas insufflated while measuring reservoir internal pressure. Linear regression models were developed to depict the association between internal pressure and gas inflow rate. External secondary one-way valves (ESOV) were assessed for pressure mitigation performance. An assisted venous drainage survey was circulated to Canadian Clinical Perfusionists.
Results: The reservoirs tested were adult (n = 9, 64%) and pediatric (n = 5, 36%) designs. Significant variability ($p < 0.001$) in internal reservoir pressures (range: 0.04–161.41 mmHg) was observed across the titrated gas inflow rate (0.5–10.0 l/min). The regression models demonstrate excellent predictive performance (SE: 0.008–0.309). ESOV's reduce the reservoir pressure below that of the IPRV; however, they cannot eliminate reservoir pressurization. The survey showed a majority (91%) of respondents use VAVD, and reservoir pressurization events occur regularly (18%).
Conclusions: Significant variability among reservoir's IPRV to mitigate reservoir pressurization exists. The predictive models are extremely accurate at estimating the internal pressure. ESOV performance limitations moderate their utility as a backup pressure mitigation technique. A significant number of reservoir pressurization events are occurring with the use of VAVD. As a result, standardized communication from manufacturers on the purpose and performance of IPRV is recommended in order to delineate the limitations of these devices.

References

1. Durandy Y. Vacuum-assisted venous drainage, angel or demon: PRO? J Extra Corpor Technol 2013; 45(2):122–127.
2. Matte GS, Kussman BD, Wagner JW, et al. Massive air embolism in a Fontan patient. J Extra Corpor Technol 2011; 43(2): 79–83.
3. Davila RM, Rawles T, Mack MJ. Venoarterial air embolus: a complication of vacuum-assisted venous drainage. Ann Thorac Surg 2001; 71(4): 1369–1371.
4. Jahangiri M, Rayner A, Keogh B, et al. Cerebrovascularaccident after vacuum-assisted venous drainage in a Fontan patient: a cautionary tale. Ann Thorac Surg 2001;72(5): 1727–1728.
5. Burch TM, Locke AQ. Air lock and embolism upon attempted initiation of cardiopulmonary bypass while using vacuum-assisted venous drainage. J Cardiothorac Vasc Anesth 2012; 26(3): 468–470.
6. Almany DK, Sistino JJ. Laboratory evaluation of the limitations of positive pressure safety valves on hard-shell venous reservoirs. J Extra Corpor Technol 2002; 34(2): 115–117.
7. Kadane JB, Lazar NA. Methods and criteria for model selection. J Am Stat Assoc 2004; 99(465): 279–290.

8. Corno AF. Systemic venous drainage: can we help Newton? Eur J Cardiothorac Surg 2007; 31(6): 1044–1051.
9. Gambino R, Searles B, Darling EM. Vacuum-assisted venous drainage: a 2014 safety survey. J Extra Corpor Technol 2015; 47(3): 160–166.
Declaration of conflicting interests The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

10.30 -11.00: TIME FOR COFFEE

INVITED TALK

11.00 11.20 Lessons learned from the past: Does each VA ECMO program require an unloading program?

Roberto Lorusso

INVITED TALK

11.20 - 11.40 ECMO in patients with CHD: Challenges for the perfusionist

Malaika Mendonca

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Date of preparation: October 2021 **IM-7300433-CP**

ABSTRACT

11.40 – 11.55 Micro Embolic Activity During Cavitation and type of Gas involved on ECMO and Minimal Invasive Extracorporeal Circulation

Ignazio Condello1.
1 Department of Cardiac Surgery, Anthea Hospital, GVM Care & Research, Bari, Italy.
Competing interests: Livanova and Eurosets consultant.
Funding: None.

Corresponding Author
Ignazio Condello, PhD
GVM Care & Research, Perfusion Service, Anthea Hospital,
Via Camillo Rosalba 35/37, 70124 Bari, Italy.
Tel. +39 080 5644560
ignicondello@hotmail.it

Background: Distinct to industrial pumps, which are designed to work at a single pump speed, pumps for an extracorporeal circulation are required to cover a wide range of flow rates. Cavitation occurs in centrifugal pumps when the Nett Positive Suction Head Available (NPSHa) is lower than the Nett Positive Suction Head Required (NPSHr) causing the formation and accumulation of bubbles around the impeller eye that then collapse resulting in a series of mini implosions and significant damage to both the impeller and the casing. However, if the cavitation mechanism is widely described from a quantitative point of view, the qualitative aspect of the type of atom or gas molecule (Oxygen, Nitrogen, Carbon Dioxide) involved in the formation of the micro-emboli produced in cavitation remains obscured during Extracorporeal Membrane Oxygenation (ECMO) and Minimally Invasive Extracorporeal Circulation (MiECC). In this context we tried to highlight the role of the gases involved in relation to the type of cannula and the type of positioning during the procedures.

Materials and Methods: Preoperative data included patient demographic characteristics, baseline serum creatinine levels, ventricular ejection fraction, comorbidities (eg, chronic obstructive pulmonary disease or previous cerebrovascular accident), baseline Hb, logistic European System for Cardiac Operative Risk Evaluation II score and New York Heart Association functional class. Perioperative data included type of operation, Cardiopulmonary Bypass (CPB) duration, nadir body temperature during CPB, nadir Hct and Hb values (measured at the start of the CPB operation and every 20 minutes thereafter), RPM of the pump, Blood flow, negative pressure in the inlet of pump and central venous pressure. In this context were analyzed, ten patients with MIECC without bubble trap technique with constrained vortex pump and microporous polypropylene hollow fiber oxygenator (five patients with peripheral cannulation and five with central cannulation) for elective coronary arteries bypass grafting beating heart and for post cardiotomy patients with veno-arterial ECMO with magnetic levitation pump and Polymethylpentene (PMP) hollow fiber oxygenator (two patients with peripheral and two central cannulation). The Gampt BCC 300 was used during all time of extracorporeal procedures to record the

phenomena of micro embolic activity (Figure 1). Central venous Cannulation was made with 32/40 Fr atrio-caval Medtronic, and peripheral cannulation was made with 22-23/25 Fr with femoral venous cannula Livanova.

Results: All patients during the procedures had a means values from a minimum of one to a maximum of twelve cavitation phenomena during extracorporeal procedures, in particular the central cannulations contributed to increase the micro embolic activity in terms of volume and number of micro emboli in the artery in relation to cavitation greater than peripheral cannulation. Central Cannulation in closed circuit during cavitation reported : mean values for cavitation n° of bubbles was 336 ± 56, 4% reported a diameter >500 μm, GME volume was 5.9 ± 2 (μL) in the venous inlet line of the pump; n° of bubbles was 900 ± 33, 3.3% reported a diameter >500 μm; GME volume was 5.11 ± 0.3 (μL) in the outlet line of centrifugal pump; n° of bubbles was 330 ± 12, 1.5% reported a diameter >500 μm; GME volume was 1.51 ± 0.2 (μL) in the arterial line. (Categorization for each pumps and oxygenators models). Peripheral Cannulation in closed circuit during cavitation reported : mean values for cavitation n° of bubbles was 156 ± 16, 2.01% reported a diameter >500 μm, GME volume was 2.2 ± 2 (μL) in the venous inlet line of the pump; n° of bubbles was 290 ± 21, 2.3% reported a diameter >500 μm; GME volume was 2.13 ± 0.3 (μL) in the outlet line of centrifugal pump; n° of bubbles was 80 ± 13, 0% reported a diameter >500 μm; GME volume was 0.251 ± 0.2 (μL) in the arterial line. (Categorization for each pumps and oxygenators models). GME volume in arterial line for each cavitation phenomena Central cannulation vs Peripheral Cannulation p-value 0.0022.

Conclusion: In this preliminary report, patients with central cannulation reported for each cavitation phenomena a statistically significant difference for increased micro-embolic activity in the arterial line, probably related to nitrogen (N) production less than carbon dioxide (CO_2) in relation to the position of the model cannula and surgical tobacco bags, compared to peripheral cannulations where probably the reduced micro-embolic activity is caused by a low concentration of nitrogen (N) and a raise of carbon dioxide (CO_2) on the transition from dissolved to gaseous state due to negative pressure. However, further studies are needed to understand this mechanism.

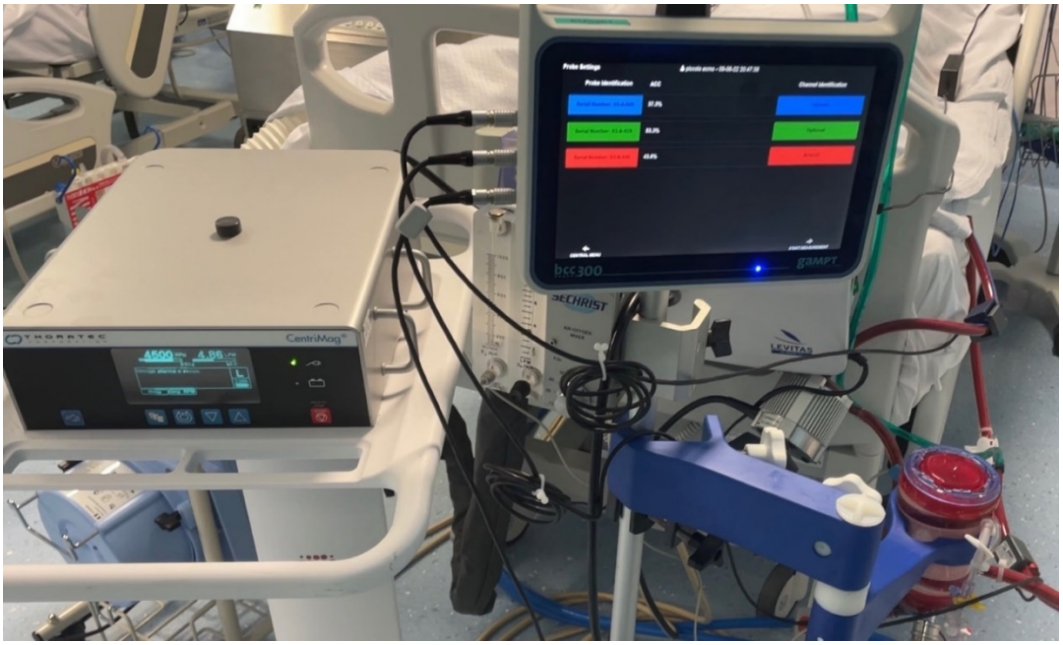

Figure 1. Micro Embolic Activity Evaluation During ECMO Procedure.

ABSTRACT

11.55 - 12.10 Non-invasive and invasive measurement of skeletal muscular oxygenation during isolated limb perfusion

Anna Corderfeldt Keiller [1 2 3], Anna Holmén [1], Christoffer Hansson [1], Sven-Erik Ricksten Gudrun Bragadottir [1 4], Roger Olofsson Bagge [2 5]

1 Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden.

2 Department of Surgery, Institute of Clinical Sciences, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden.

3 Wallenberg Centre for Molecular and Translational Medicine, University of Gothenburg, Gothenburg, Sweden.

4 Department of Anesthesiology and Intensive Care Medicine, Sahlgrenska Academy, University of Gothenburg, Sahlgrenska University Hospital, Gothenburg, Sweden.

5 Department of Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden.

Background: Isolated limb perfusion (ILP) is a regional surgical treatment for localized metastatic disease. High doses of chemotherapeutic agents are administered within an extracorporeal circulated isolated extremity, treating the metastasis, while systemic toxicity is avoided. To our knowledge the oxygen supply/demand relationship during ILP has not previously been described. Our aim was to measure and describe oxygen delivery, consumption and extraction, in an isolated leg/arm during ILP. Also investigate whether invasive oxygenation measurement during ILP correlates and can be used interchangeable with the non-invasive method, near infrared spectroscopy (NIRS).

Methods: Data from 40 patients scheduled for ILP were included. At six timepoints blood was sampled during the procedure. DO2, VO2 and O2ER was calculated according to standard formulas. NIRS and hemodynamics was recorded every 10 minutes.

Results: For all observations the mean of DO2 was 190±59 ml/min/m2, VO2 was 35±8 ml/min/m2 and O2ER was 21±8%. Repeated measures showed a significant decrease in DO2 in legs (209±65 to 180±66 ml/min/m2, p=<0.01) and in arms (252±72 to 150±57 ml/min/m2, p=<0.01). Significant correlation was detected between NIRS and SveO2 (rrm=0.568, p=<0.001, 95% CI 0.397 – 0.701). When comparing venous extremity oxygen saturation (SveO2) and NIRS using a Bland-Altman analysis, the mean difference (bias) was 8.26±13.03 (p=<0.001), the limit of agreement was -17.28 – 33.09, with an error of 32.5%.

Parameters measured	Extremity	After induction	Before isolation	ECC start	After chemo infusion	Before rinse	System circulation resumed	ANOVA p - value
pO_2 (kPa)	Leg	22±15	17±4	35±3***	33±3***	32±4***	18±5	<0.001***
	Arm	35±31	17±3	33±3**	29±6**	28±7*	17±3	0.001***
SaO_2 (%)	Leg	98±2	98±1	99±1*	99±1***	99±1**	98±2	<0.01**
	Arm	98±1	98±1	98±1	99±2	99±1	98±1	0.26
Hb (g/L)	Leg	125±11	127±11	67±18***	64±16***	70±16***	117±12***	<0.001***
	Arm	113±8	111±7	74±9**	67±18**	68±20**	109±9	<0.01**
Lactate (mmol/L)	Leg	1.0±0.2	1.1±0.2	2.0±1.6*	2.6±1.1***	2.9±1.0***	1.8±0.6***	<0.001***
	Arm	1.0±0.3	1.1±0.3	5.0±0.7***	4.0±1.0**	3.9±1.6**	1.7±0.5*	<0.001***
Pump flow (L/min)	Leg	-	-	0.72±0.1	0.61±0.1**	0.58±0.2**	-	<0.001***
	Arm	-	-	0.36±0.1	0.26±0.1*	0.22±0.1*	-	<0.01**
CaO_2 (mL/dL)	Leg	-	17±2	10±2***	10±2***	10±2***	16±2**	<0.001***
	Arm	-	15±1	11±2**	10±2**	10±3*	15±1	<0.01**
CvO_2 (mL/dL)	Leg	-	12±3	8±2**	7±2**	8±2***	13±2	<0.001***
	Arm	-	13±1	9±1**	8±2*	8±2*	13±2	<0.01**
DO_2 (mL/min/m^2)	Leg	-	-	209±65	178±67**	180±66*	-	<0.01**
	Arm	-	-	252±72	174±62*	150±57**	-	<0.01**
VO_2 (mL/min/m^2)	Leg	-	-	39±10	38±9	38±7	-	0.79
	Arm	-	-	33±6	28±9	26±10	-	0.12
O_2ER (%)	Leg	-	30±14	20±7	24±10	24±9	22±12	0.21
	Arm	-	13±7	14±4*	16±6	18±6	11±6*	0.03*
$SveO_2$ (%)	Leg	-	71±13	86±6**	82±10*	82±10*	80±12	0.01*
	Arm	-	88±6	90±4	89±6	86±6	89±5	0.30
NIRS treated (%)	Leg	65±13	64±13	72±11	73±11	75±11	72±12	0.21
	Arm	77±10	76±10	87±9	83±10	81±10	80±16	0.19
NIRS not treated (%)	Leg	66±14	67±14	67±12	68±13	68±14	66±11	0.12
	Arm	70±11	71±11	72±8	73±8	74±9	70±8	0.41

Table 3. Characteristics during ILP. One way ANOVA repeated measure ("Before isolation" through "System circulation resumed"

Conclusion: DO2 above 170 ml/min/m2 during ILP kept O2ER below 30% for all observations. NIRS correlates significant to SveO2, however, the two methods do not agree sufficiently to work interchangeable.

12.10 - 12.25 Clinical evaluation of the novel Capiox NX19 adult oxygenator–a multicenter study

Rik H J Hendrix[1], Gerdy Debeuckelaere[2], Karlien Degezelle[3], Lieven Lenaerts[3], Tom Verbelen[4] and Patrick W Weerwind[1]

Introduction: The novel Capiox NX19 adult oxygenator is, compared to its predecessors, improved with enhanced air removal technology, a polymer heat exchanger and smaller, innovative hollow fibers resulting in a surface area reduction and a lower priming volume. The aim of this study was to evaluate the NX19 oxygenator performance in a clinical setting.

Methods: A prospective multicenter study was performed involving three large European university hospitals. The Capiox NX19 (n = 150) performance was assessed during adult cardiopulmonary bypass and involved gaseous microemboli handling and gas transfer efficiency. The heat exchanger performance was evaluated separately in vitro.

Results: The heat exchanger performance factors were 0.80 ± 0.03 and 0.58 ± 0.04 at pump flow rates of 3 L/min and 6 L/min, respectively. After priming, residual post-oxygenator gaseous microemboli count and volume were decreased by 91% and 93.7%, respectively. The gas compartment pressure was 6.0 ± 2.5 mmHg, while theO2 transfer was 69 ± 30 mL/min/m2 and the CO2 transfer 73 ± 34 mL/min/m2. The O2 gradient was 44 ± 19 mmHg/LPM and the O2 diffusing capacity 0.38 ± 0.14 mL/min/mmHg. The shunt fraction was 0.19 ± 0.13, whereas oxygenator resistance and shear stress were 10.5 ± 3.7 mmHg/LPM and 5.1 ± 3.1 dyn/cm2, respectively.

Conclusion: This multicenter study displayed good clinical safety and performance of the NX19 oxygenator.

1Department of Cardiothoraxic Surgery, Maastricht University Medical Centre, Maastricht, Netherlands
2Department of Extra-corporeal Circulation, University Hospital Antwerp, Edegem, Belgium
3Department of Perfusion Technology, University Hospitals Leuven, Leuven, Belgium
4Department of Cardiac Surgery, University Hospitals Leuven, Leuven, Belgium

12.30 -13.30

PECHA KUCHA SESSION

MEET THE INDUSTRY

13:30 – 13:35 Sevada Avaksoumbatian	Medtronic Further, Together
13:35 – 13:40 Chiara Orsini	LivaNova Health innovation that matters
13:40 – 13:45 Carlo Alberto Tassi	EUROSETS™ MEDICAL DEVICES
13:45 – 13:50 Andreas Becker	TERUMO
13:50 – 13:55 Eelke Krijnen	HC TRONIC

INVITED TALK

14.10 - 14.25 Our Heater Coolers: Did we manage to solve the problem?

Wouter de Wilde *The Netherlands*

ABSTRACT

14.25 – 14.40 Whole Blood Adsorber During CPB and Need for Vasoactive Treatment After Valve Surgery in Acute Endocarditis: A Randomized Controlled Study

Anna Holmen, Anna Corderfeldt [1], Lukas Lannemyr [2], Göran Dellgren [3], Emma C Hansson [4]

1 Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Sahlgrenska University Hospital, Gothenburg, Sweden.

2 Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Sahlgrenska University Hospital, Gothenburg, Sweden; Department of Anesthesia and Intensive Care, Institution of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.

3 The Transplant Institute, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; Department of Molecular and Clinical Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.

4 Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, Sahlgrenska University Hospital, Gothenburg, Sweden; Department of Molecular and Clinical Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.

Objectives: Patients with endocarditis requiring urgent valvular surgery with cardiopulmonary bypass are at a high risk of developing systemic inflammatory response syndrome and septic shock, necessitating intensive use of vasopressors after surgery. The use of a cytokine hemoadsorber (CytoSorb, CytoSorbents Europe GmbH, Germany) during cardiac surgery has been suggested to reduce the risk of inflammatory activation. The study authors hypothesized that adding a cytokine adsorber would reduce cytokine burden, which would translate into improved hemodynamic stability.
Design: A randomized, controlled, nonblinded clinical trial.
Setting: At a university hospital, tertiary referral center.
Participants: Nineteen patients with endocarditis undergoing valve surgery.
Intervention: A cytokine hemoadsorber integrated into the cardiopulmonary bypass circuit.

Measurements and Main Results: The accumulated norepinephrine dose in the intervention group was half or less at all postoperative time points compared to the control group, although it did not reach statistical significance; at 24 and 48 hours (median 36 [25–75 percentiles; 12–57] mg v 114 [25–559] mg, p = 0.11 and 36 [12–99] mg v 261 [25–689] mg, p = 0.09). There was no significant difference in chest tube output, but there was a significantly lower need for the transfusion of red blood cells (285 [0–657] mL v 1,940 [883–2,148] mL, p = 0.03).
Conclusions: There was no statistically significant difference between the groups with regard to vasopressor use after surgery for endocarditis with the use of a cytokine hemoadsorber during cardiopulmonary bypass. Additional, larger randomized controlled trials are needed to definitely assess the potential effect.

Key Words: infective endocarditis; cardiac surgery; cytokine adsorber; hemoadsorbtion; systemic inflammatory response syndrome; blood transfusion

14.40 – 14.55 Hemosorption in Complex Therapy of Arrhythmias in Patients with Heart Failure against a Background of Dilated Cardiomyopathy

K. DENYSIUK, O. LOSKUTOV, O. DRUZHYNA

(Shupyk National Healthcare University of Ukraine, Kyiv, Ukraine)

Background and Goal of Study: Globally, one of the main causes of heart failure (HF) with low left ventricular ejection fraction (LVEF) is dilated cardiomyopathy (DCMP). The prevalence of DCMP is 40 per 100,000 population with an annual incidence of 7 per 100,000.

Terminal HF due to DCMP is the most frequent indication for heart transplantation (HT). The main role in the progressive dilatation and remodeling of heart chambers, and registration of first arrhythmias, is played by the formation of autoantibodies to structural and functional myocyte proteins. The pathophysiology of DCMP is based on a viral infection followed by autoimmune activation. Pro-inflammatory cytokines and autoantibodies determined in serum of patients play an important role in mediating myocardial damage and development of arrhythmias. According to Tsutomu Yoshikawa and co-authors, the study immunosorption method showed effectiveness in the treatment of patients with DCMP refractory to standard therapy, and can also be an alternative "bridge" to HT in the future.

The work aims to evaluate the effectiveness of hemosorption (HS) with granulated deligandizing hemosorbent (GSGD) in the complex of conservative treatment of patients with rhythm disturbances against the background of HF in DCMP.

Materials and Methods: The retrospective analysis of treatment outcomes in 30 patients (93.3% men, 6.67% women; mean age 44.3±12.68 years; disease duration 16±6,2 months; NYHA III-IV (3,57±0,5), baseline LV EF 21±4.71%, LV end-systolic volume (ESV LV) 208.15±74.1 ml, LV end-diastolic volume (EDV LV) 260±72.34 ml), who were treated for HF in patients with DCMP was performed. At the time of hospitalization, all patients had arrhythmias refractory to standard therapy: sinus tachycardia in 100%, paroxysms in 56.67% (including atrial fibrillation - 46.67%, atrial flutter - 6.67%); extrasystoles in 30% of patients, and conduction disorders (AV block in 10%, intraventricular block in 40% of patients).

Conservative therapy was carried out by international recommendations and was supplemented by a course of 3 HS procedures, for which GSHD was used. The average procedure time was 130±9.4 min with an average blood flow rate in the extracorporeal circuit of 44.36±7.3 ml/min.

The Student's-t-test and Pearson's $\chi 2$ test were used to analyze the basic clinical, laboratory, and instrumental data (NYHA class, electrocardiography, LV EF, ESV LV, EDV LV and arrhythmias).

Results and Discussion: After the performed HS procedures, the clinical condition of all patients improved by at least one NYHA class (2,83±0,38) ($p<0,05$). Chronic rhythm disturbances were registered only in 46.67% of patients and did not affect hemodynamics in general: sinus tachycardia in 26,67% patients ($p<0,01$), paroxysms in 6,67% ($p<0,01$) (incl. atrial fibrillation – 30% ($p<0,05$)); extrasystoles in 30% patients ($p<0,05$), AV block – in 6,67% ($p>0,05$), intraventricular block in 33,3% patients ($p>0,05$). LV EF increased up to 30.1±3.38% (by 33%) ($p<0,01$). ESV LV decreased to 150.14±28.5 ml (by 28%), EDV LV decreased to 220.9±81.5 ml (by 15%) ($p<0,05$).

Conclusion: The use of HS with GSHD against the background of conservative treatment of HF in DCMP allows to correct rhythm disturbances and improves cardiac contractile function and general clinical condition of patients.

15.00 -15.30: BREAK

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1.Bronson, S., et al. Prescriptive Patient Extracorporeal Circuit and Oxygenator Sizing Reduces Hemodilution and Allogeneic Blood Product Transfusion during Adult Cardiac Surgery. JECT. 2013; 45:167-172.

INVITED TALK

15.30 - 15.45 Telemedicine and digital health and new health model: Perfusion and Digitation

Nicolò Persiani

INVATED TALK

15.45 16.00 Role of the perfusionist in organ perfusion: Testimony from a perfusionist-trainee

Andreas Lemmers

ABSTRACT

16.00 16.15 Current non-experimental applications of the cardiopulmonary bypass in the dog and cat - A literature review

Laurent Locquet

Introduction: In 1922, the first extracorporeal life support device was developed with tests proving its ability to perfuse a separated canine head. Although animal experiments have certainly become less sinister, more structured and strictly regulated over the course of the last century, dogs and cats are still used regularly in scientific research. Although cardiac-related morbidity and mortality is very common in both client-owned dogs and cats, the veterinary literature on the non-experimental applications in both dogs and cats is scarse and often vague. The goal of this review was to describre the currently available literature, any consistency of protocol or the lack thereof.

Material & Methods: Electronic searches were undertaken until May 2022 without date restriction though restricted to papers published in dutch, english, german and french. A PICO framework to develop the literature search strategy was applied. Experimental studies were excluded and search results were assessed and graded for the level of evidence.

Results: This search strategy eventually resulted in 31 papers, including 29 publications on dogs and 2 on cats, which are the base of this literature review[1,2].

Conclusion: Reported data on surgical approach, cannulation strategies, flow, perfusion pressure, value and management of body temperature, hematocrit, anti-coagulation and its monitoring and reversal are very divergent with a lack of consistency, protocols and guidelines. Further research is required which will benefit both client-owned dogs and cats and dogs and cats in experimental settings undergoing a cardiopulmonary bypass procedure.

References:

1. Pelosi A., Anderson L.K., Paugh J. Robinson S., Eyster G.E. (2013). Challenges of Cardiopulmonary Bypass- A review of the Veterinary Literature. Veterinary Surgery 42, 119-136.
2. Kanemoto I., Mihara K., Sato K. (2020). Open-heart techniques and mitral valve plasty for mitral regurgitation in toy- and small-breed dogs: A review. Open Veterinary Journal 11(1), 14-26.

Permission

This work has not been submitted for publication or presentation elsewhere.

Conflict of interest

None.

ABSTRACT

16.15 16.30 Minimal invasive Extracorporeal circulation training and simulation

Adrian Bauer

Background
Minimal Invasive Extracorporeal Circulation (MiECC) is a complex technique for cardiac procedures requiring cardiopulmonary bypass (CPB). Although MiECC has a IIa recommendation in Europe (1) and has been in use for over 20 years, its use in daily routine is limited (2). While conventional CPB techniques are routinely taught in both perfusion schools and practical work environment, the implementation of MiECC requires new competencies in routine application and management of critical incidents. A dedicated workshop was designed with the aim of facilitating implementation of MiECC into clinical practice and enabling future certification in a structured way.
Methods
A two-day workshop, consisting of theoretical background and hands-on training, was offered to first-time users of MiECC technology to cover all aspects of routine and emergency management of MiECC. The theoretical part consisted of lectures in biocompatibility, circuitry, anaesthesia and surgical management. A dedicated simulation operation room, a Califia high fidelity simulator, and a LivaNova C5 CPB console in MiECC configuration were used. Management of all bypass periods and of critical incidents during MiECC was demonstrated by an expert trainer and then practiced individually by the participants under supervision. The simulation session was ended with a debriefing phase.
Results
All participants successfully managed to complete the relevant MiECC scenarios. Evaluation of the workshop revealed that all participants were satisfied with the workshop. It was also stated that hands-on training with the use of high-fidelity simulation should be made mandatory for those starting to use MiECC technology.
Discussion
The training of MiECC techniques should be formalized to meet the requirements of individual perfusionists, hospital departments, and medical societies.
References
1. Wahba A, Milojevic M, Boer C, De Somer FMJJ, Gudbjartsson T, van den Goor J, u. a. 2019 EACTS/EACTA/EBCP guidelines on cardiopulmonary bypass in adult cardiac surgery. Eur J Cardiothorac Surg. 2. Oktober 2019;ezz267.
2. Anastasiadis K, Antonitsis P, Haidich AB, Argiriadou H, Deliopoulos A, Papakonstantinou C. Use of minimal extracorporeal circulation improves outcome after heart surgery; a systematic review and meta-analysis of randomized controlled trials. Int J Cardiol. April 2013;164(2):158–69.

INVATED TALK

16.30 -16.45 VR as perfusion training tool

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Notes

Notes

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