

# **PROGRAM & ABSTRACTS**

## ***9<sup>th</sup> European Conference on Perfusion Education and Training***

### ***"Strategies in Perfusion"***

**Saturday, 17<sup>th</sup> October 2009  
Vienna, Austria**

**Austria Centre  
[www.acv.at](http://www.acv.at)**

**Location :  
Blue Level U2  
Halls G/H**

## "Strategies in Perfusion"

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The word "strategy" is derived from the Greek word "stratos" – meaning army. In this way, a strategy teaches systematic positioning leading to triumph.

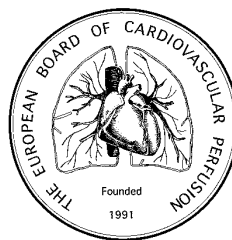
A strategy is considered an art to analyse and direct with "a style of thinking several moves ahead" to ensure future success.

It is a tool that may be used by practitioners to pursue challenges by creating a plan of action with specific objectives to achieve a particular goal.

So with strategic goals in mind, we welcome you to the 9<sup>th</sup> European Conference on Perfusion Education and Training.

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Carole Hamilton CCP, CPC, ECCP  
Perfusionist  
Organizing Committee  
Member Academic Committee EBCP



Organized by the European Board of Cardiovascular  
Perfusion [www.ebcp.org](http://www.ebcp.org)

## **ECoPEaT Organizing Committee:**

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Mr. Charlie Grima, (Malta)  
Delegate Malta  
Registration

Ms. Carole Hamilton, (Germany)  
Member Academic Committee

Mr. Frank Merkle (Germany)  
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Mr. Eddy Overdevest, (Netherlands)  
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Accreditation Sub-Committee  
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## **Moderators:**

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Adrian Bauer (Coswig, Germany)  
Carole Hamilton (Jettenburg, Germany)  
Ingo Kutschka (Hannover, Germany)  
Mark Kurusz (Galveston, USA)  
Frank Merkle (Berlin, Germany)  
Paul Murphy (Newmarket, Ontario, Canada)  
Eddy Overdevest (Eindhoven, Netherlands)  
John Toomasian (Ann Arbor, Michigan, USA)  
Alexander Wahba (Trondheim, Norway)

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**9:00-9:15**

Welcome to Vienna, Austria  
Wilhelm Hauer

**9:15-9:30**

Thomas Pezzella  
Global Aspects and Advances in Cardiothoracic Surgery

**9:30-9:45**

Gerdy Debeuckelaere  
National Perfusion Database Register in Belgium: Start and Progress  
of a Promising Project

**9:45-10:00**

Gerard J Myers  
In Vitro Investigation of 5 Integral Cardiotomy Reservoirs for  
Gaseous Microemboli Activity during Venting

**10:00-10:15**

Bill O'Reilly  
Assessment of Micro-Air Handling Capabilities of Several Arterial  
Line Filters Utilizing the EDAC Monitor: Roller vs. Centrifugal Pump  
systems

**10:15-10:35**

Mathias Perthel  
Arterial Filters – Their Potential and Their Limitations: An In-Vitro  
Study  
Medtronic Sponsored Session

**10:35-10:50**

Alberto Tripodi  
Lipid Microemboli and Leukocyte Filtration in Shed Mediastinal Blood  
during Extracorporeal Circulation

**10:50-11:20****COFFEE BREAK**

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**11:20-11:35**

Emmanuel Devolder

Hemolysis in ECMO; A Single Center Analysis

**11:35-11:50**

Maik Foltan

Long-term Function of Extracorporeal Lung Assist Oxygenators

**11:50-12:05**

Stephen Harwood

Expanding the Options in Lung Transplantation: The Ex-Vivo Program at Toronto General Hospital"

**12:05-12:25**

Thomas Müller

Protective ventilation in severe lung failure: present and future

Maquet Sponsored Session

**12:25-12:55**

Mihai Constantinescu

A New Application for the Extracorporeal Perfusion: the Expansion of Time Limits in Macroreplantation of Extremities

Medos Sponsored Session

**12:55-13:40 LUNCH**



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**13:40-13:55**

Judita Andrejaite

Cardiopulmonary Bypass Perfusion Pressure and Postoperative Renal Dysfunction in Elderly Patients

**13:55-14:10**

Sasha Agati

Strategies in Pediatric Cardiac Surgery Perfusion: Is it Possible to Use an Evidence Based Approach?

**14:10-14:30**

Philippe Pouard

Blood saving by perfusion optimization: general approach and pediatric application

Sorin Sponsored Session

**14:30-14:45**

Lazo Eremija

Benefits of Conventional and Modified Ultrafiltration in Pediatric Cardiac Surgery: A 7 Year Experience

**14:45-15:00**

Scott Beckmann

Radical Coagulation Changes Post Cardiac Surgery with the Hemobag without the use of Blood Products

**15:00-15:30 COFFEE BREAK**



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**15:30-16:00**

Prof. Serdar Gunaydin

Modular Cardiopulmonary Bypass: From Enthusiasm to Reason

Terumo Sponsored Session

**16:00-16:20**

Marc Wollenschläger

C5 - A Clinical Validation Report

Sorin Sponsored Session

**16:20-16:40**

James Ferguson

A Clinical Experience with the Resting Heart Mini-Extracorporeal System: A Strategy for Blood Conservation!

Medtronic Sponsored Session

**16:40-17:00**

Poster Session Review and Summary

**Poster Presentations:**

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**Mathias Aazami**

New Strategy for Right Atrial Isolation by Cannulation of the Innominate Vein in Adult Cardiac Surgery: Is it Safe and Reproducible? *F. Kargar, F. Kaleghi, M.H. Aazami*

*Rajaei Heart Center, Department of Cardiac Surgery*

**G. Faggian**

A new, "Industrial Standards", Miniaturized Hollow Fiber Oxygenator for experimental murine models of extracorporeal circulation (ECC).

*M. Tessari (1), B. Walpoth (2), G. Cresce (1), P. Balboni (3), F. Chinni (3), A. Kalangos (1), A. Mazzucco (1), G. Faggian (1) (1)Cardiac Surgery University of Verona, Verona, ITALY, (2)Cardiovascular Research, University Hospital of Geneva, Geneva, Switzerland, (3)Sorin Group, Mirandola, Modena, ITALY*

**Beaurich Groenewald** Perfusion: the South African experience.

Martin Lampacher, Viking Medical & Surgical (Pty) Ltd

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## **Moderators: 1<sup>st</sup> Session**

Mark Kurusz CCP  
Perfusionist  
Galveston, USA

Adrian Bauer ECCP; MCVT  
Cardiac Perfusionist  
Coswig Cardiac Center, Germany  
EBCP Delegate to Germany

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**9:00-9:15**

Welcome to Vienna, Austria

**Speaker: Wilhelm Hauer**  
**Perfusionist**  
**Klinikum Wels-Grieskirchen, Austria**

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**9:15-9:30**

**Speaker: A. Thomas Pezzella, M.D.**

**Founder/Director International Children's Heart Fund**

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## **GLOBAL ASPECTS AND ADVANCES IN CARDIOTHORACIC SURGERY**

Cardiothoracic surgery continues to grow globally, despite access and cost issues.

This growth favors the developing countries and emerging economies. The increase in incidence and prevalence of atherosclerotic coronary artery disease, rheumatic heart disease, congenital heart disease, trauma, and thoracic malignancies is more prevalent in these developing countries and emerging economies. The increase in quantity and quality of CT surgery in these countries has been enhanced by humanitarian/voluntary efforts.

A paradigm shift to include preventive care strategies to the curative strategies will enhance access, and cost effective measures to meet the growing need and demand.

An overview of historical approaches and present approaches will be addressed.

[atpezzella@hotmail.com](mailto:atpezzella@hotmail.com)

[www.ichfund.org](http://www.ichfund.org)

9:30-9:45

**Speaker:** Gerdy Debeuckelaere

**Perfusionist** University Hospital Antwerp, Belgium

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## **NATIONAL PERFUSION DATABASE REGISTER IN BELGIUM: START AND PROGRESS OF A PROMISING PROJECT**

*G. Debeuckelaere, ECCP<sup>1</sup>, M. Lagny, ECCP<sup>2</sup>, N. Libert, ECCP<sup>2</sup>, L. Puis, ECCP<sup>3</sup>, D. Thiry, ECCP<sup>4</sup>* <sup>1</sup>University Hospital Antwerp, Belgium, <sup>2</sup>CHU Sart Tilman, Liège, Belgium, <sup>3</sup>University Hospital Brussels, Belgium, <sup>4</sup>Cliniques Universitaires Saint Luc, Brussels, Belgium for the BelSECT database committee.

**Objectives:** In 29 cardiac centers in Belgium, 13000 cardiac surgery procedures are performed yearly. Although cardiopulmonary bypass appears to be a safe technique, evidence-based medicine does not provide adequate practice guidelines. Wide variations of techniques and technology are associated with differences in outcome and cost. In order to register the variation in clinical activity, and employ the incorporation of evidence-based guidelines into clinical practice, a database project for the registry of perfusion activity in Belgium was introduced by the Belgian Society of ExtraCorporeal Technology.

**Methods:** The development of the perfusion database registry process included a registration of the data collection at the Belgian Privacy Commission, the setup of a 'Memory of understanding' and the development of an appropriate dataset with user manual.

**Results:** In Oct. 2008, a trial registry was started with 5 pilot centers. After the statistical processing of the collected data, the preliminary results were presented at the general assembly of BelSECT in February 2009. An adapted version of the dataset and datasheet has been developed for definitive launch in all voluntary centers.

**Conclusions:** A uniform, reliable registration and a safe, anonymous transmission of data is an important part of the process. Evaluation of the first dataset resulted in the creation of a new version. This first trial taught us that we can collect reliable data in a safe way, and that we can produce an overview of perfusion activity in Belgium, with benchmarks per center. This convinced BelSECT to hold on to this ambitious project.

[gerdy.debeuckelaere@uza.be](mailto:gerdy.debeuckelaere@uza.be)

9:45-10:00

**Speaker:** Gerard J Myers RRT, CCP

**Manager Cardiovascular Perfusion, Halifax, Nova Scotia, Cda**

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## **DOES TURNING ON THE VENT INCREASE MICROEMBOLI TRANSMISSION POST ARTERIAL FILTER?**

*G J Myers, C Voorhees, R Haynes and B Eke*

*QEII and IWK Health Science Centers, Halifax, Nova Scotia, Canada*

**Objective:** During our previously published investigation into gaseous microemboli (GME) and perfusionist's interventions, it was noted that emboli could be detected post arterial filter when blood/air challenges entered the membrane oxygenator's integral cardiectomy. This is the first know published report that connects the vent return to microemboli activity post arterial filter.

**Methods:** To investigate the air handling ability of the membranes integral cardiectomy, an in vitro study was conducted on 5 hard shell coated membrane oxygenators (Terumo Capiox SX25 - X coated, Sorin Synthesis - Phosphorylcholine coated, Gish Vision - GBS coated, Medtronic Affinity NT - Trillium coated and Maquet Quadrox - Bioline coated). The oxygenators were matched with their own manufacturers coated arterial filters. There were three arms to the study, and three separate oxygenator/filter combinations were used in each arm. The first arm consisted of only the arterial filter purge blood entering the integral cardiectomy. The second measured activity when vent blood was added, and the final arm added air to the vent blood to more closely simulate cardiopulmonary bypass. All GME activity in the oxygenator/filter combinations was examined using the Hatteland CMD20 Microemboli Counter.

**Results:** When vent blood flow was turned on, there was a significant increase in the microemboli activity detected between the reservoirs and the roller pumps. Post arterial filter, three of the oxygenator/filter combinations removed 98-99% of the venting GME, only one removed 84.3% and another removed only 55.5% of the GME coming out of the oxygenator's reservoir.

**Conclusions:** All oxygenators were found to have a dramatic increase in the reservoir GME activity when the vent was turned on. Depending on the oxygenator/filter combination, GME created by vent return into the integral cardiectomy resulted in the presence of significant amounts of microemboli post arterial filter.

[edit@ns.sympatico.ca](mailto:edit@ns.sympatico.ca)

10:00-10:15

**Speaker:** Bill O'Reilly RN,CCP,CPC

**Manager Cardiac Perfusion Department**

**New Brunswick Heart Centre, Saint John, NB, Canada**

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**ASSESSMENT OF MICRO-AIR HANDLING CAPABILITIES OF SEVERAL ARTERIAL LINE FILTERS UTILIZING THE EDAC MONITOR: ROLLER VS CENTRIFUGAL PUMP SYSTEMS**

*O'Reilly B., New Brunswick Health Center, Saint John, New Brunswick, Canada*

**Objective:** One of the primary uses of the arterial line filter in the bypass circuit is to protect the patient from gaseous micro-emboli during cardiopulmonary bypass (CPB). Currently most arterial line filters are between 20 micron and 40 micron in pore size.

**Method:** In an effort to assess the filter that provides the best line of defense against micro-air in the bypass circuit we undertook a review of performance of several filters of various sizes using the EDAC™ emboli detector (Luna Innovations Incorporated Blacksburg, VA , USA). An in-vitro test circuit was designed to test each filter's capability at handling gaseous micro-emboli.

The filters were then added to the test circuit with the Revolution™ centrifugal pump or the roller pump pvc tubing to assess the best outcomes. The measurement of performance of each filter was the volume and number of micro-air emboli detected by the EDAC™.

**Results:** Use of the Sentry® 21 ALF removes more GME in the bypass circuit than the other filters tested. The centrifugal pump does remove more GME at larger challenges of air and is safer at handling macro air in a circuit or complete emptying of the reservoir. However no difference between the Revolution® centrifugal pump and the roller pump with the amounts of introduced air (ns) was found in this study.

**Conclusion:** The EDAC™ emboli detector is very useful as a clinical device to assess the best circuit design for defense of gaseous micro-emboli in the bypass circuit. The smaller pore size of arterial line blood filters are more effective at removing micro-air in the bypass circuit whether using centrifugal or roller pump tubing.

[orebi@reg2.health.nb.ca](mailto:orebi@reg2.health.nb.ca)

10:15-10:35

Medtronic Sponsored Session

Speaker: Mathias Perthel M.D.

Cardiothoracic Surgery, HGZ Bad Bevensen, Germany

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## ARTERIAL FILTERS: THEIR POTENTIAL AND THEIR LIMITATIONS: AN IN-VITRO STUDY

**Background:** In many hospitals, arterial filters are used to eliminate air bubbles from extracorporeal circulation. This study uses defined, comparable measurements of arterial filters made by various manufacturers (*Medtronic, Maquet, Terumo*) to determine the extent to which an arterial filter can perform the task for which it is intended.

**Methods:** The test circulatory system constructed for this purpose allowed researchers to set defined values for flow rate, pressure and volume of air. Tests were conducted with a large single dose of air (bolus), with continuous streams of air in which the size of the bubbles was defined, and with individual bubbles of various sizes. This corresponds most closely to the conditions found during ECC with blood-gas analyses, administration of medications, etc. The BCC200 Bubble Counter made by the GAMPT company (Zappendorf, Germany) was used to perform simultaneous measurements of the quantities of air flowing both into and out of the arterial filter. This unit allowed researchers to detect and measure individual bubbles with diameters of 5  $\mu\text{m}$  or more, as well as relatively large amounts of air.

Data was gathered on the number, volume and distribution of air bubbles with respect to their size upstream (IN) and downstream (OUT) from the filter. The resulting ratio can be used to determine the efficacy of the filter regarding its ability to block air under simulated circumstances that closely approximate clinical conditions.

**Results:** For individual bubbles ranging in size from 5-250  $\mu\text{m}$ , measurements showed a filter edge at approx. 50  $\mu\text{m}$ , i.e., in the range of the mesh size (approx. 40  $\mu\text{m}$ ), for all filters. Small amounts of small bubbles (<100  $\mu\text{m}$ ) were nearly unaffected.

In the cases of large individual amounts of air (>100  $\mu\text{L}$ ) or large numbers of large individual bubbles (>250  $\mu\text{m}$ ), the volume of air was indeed reduced (the magnitude of this effect varied for some filters, such as those made by Jostra Quart). The number of air bubbles

downstream from the filter actually increased, however. The filter significantly loses its efficacy.

Priming the filter represents yet another problem: altering the pressure (starting the pump, quickly changing the flow rate) can release large volumes of air from the filter, actually giving the filter a negative effect.

**Conclusions:** When preparing a set, all characteristics of the arterial filter should always be considered with respect to other components and to the method used by the OR team.

An arterial filter does not represent any kind of guarantee that air will not enter an infusion.

[m.perthel@herz-kreislauf-klinik-bevensen.de](mailto:m.perthel@herz-kreislauf-klinik-bevensen.de)

10:35-10:50

Speaker: Alberto Tripodi M.D.

Cardiac Surgeon, Cotignola, Italy

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## LIPID MICROEMBOLI AND LEUKOCYTE FILTRATION IN SHED MEDIASTINAL BLOOD DURING EXTRACORPOREAL CIRCULATION

A. Tripodi<sup>1</sup>, A. Petralia<sup>2</sup>, S. Calvi<sup>1</sup>, A. Cavallucci<sup>2</sup>, C. Goni<sup>2</sup>, F. Guerrini<sup>2</sup>, B. Ronchi<sup>2</sup>, M. Lamarra<sup>1</sup>. <sup>1</sup>Cardio Vascular Surgery Department Villa Maria Cecilia Hospital, Cotignola (RA), Italy. <sup>2</sup>Perfusion Service Villa Maria Cecilia Hospital, Cotignola (RA), Italy.

Objective: Neurological dysfunctions still remain a significant sequelae after cardiac surgery, with a reported incidence from 20% to 80% of cases. Shed mediastinal blood is the major source of lipid microemboli and one of the main activators of leucocytes during extracorporeal circulation (ECC). We evaluated the effectiveness of a new device for lipid particles and leukocyte removal from the pericardial suction blood

Methods: We enrolled 20 patients admitted to cardiac surgery operation in our department. We used the RemoweLL (Eurosets, Medolla, Italy) oxygenator with a cardiotomy unit, designed for leukocyte and lipid particle removal. The intrapleural blood is collected in this reservoir. Lipid particle removal is achieved by sedimentation, while filtration is used to deplete leukocytes.

Blood samples were taken before and after the filtration process to assess size and amount of lipid particles and leukocyte count.

Results: Mean lipid particles diameter was 15 microns. Pre and post-filtration lipid particles (n°/dl) were 2850 (range = 1200-6400) and 950 (range 400-2800) respectively, determining a 63% (SD 8.4%) removal percentage ( $p < 0,001$ ). Leukocytes ( $10^3/\mu\text{l}$ ) were 5.55 (range= 12.90 to 15.10) and 2.60 (range= 0.80 to 8.90) before and after filtration respectively, counting for a 52% (SD 9.0%) removal percentage ( $p < 0,001$ ).

Conclusions: While most filters use 40 micron pores, our data demonstrates that lipid particles have mean diameter of about 15 microns. The study shows the effectiveness of lipid particles and leukocytes removed. We need further studies in order to assess the clinical benefits of this device, regarding neuro, lung and renal outcomes.

[albertotripodi@hotmail.com](mailto:albertotripodi@hotmail.com)

10:50-11:20

COFFEE BREAK



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**Moderators: 2<sup>nd</sup> Session**

Mr. John Toomasian  
Perfusionist, Project Scientist  
Ann Arbor, Michigan, USA

Dipl.-Med. Päd. Frank Merkle  
Akademie für Kardiotechnik  
Steinbeis Transfer-Institut Kardiotechnik  
Berlin, Germany  
EBCP General Secretary

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11:20-11:35

**Speaker: Emmanuel Devolder RN, BCP**  
**University Hospital Leuven, Belgium**

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## **HEMOLYSIS IN ECMO: A SINGLE-CENTER ANALYSIS**

*Devolder E.\*; Rega F.°; Vercaemst L.\*; Vandezande E.\*; Meyns B°*  
*Perfusion Department\*, Department of Cardiac Surgery°; University*  
*Hospital Leuven, Herestraat 48, 3000 Leuven, Belgium*

**Background:** Till today the clinical importance of hemolysis remains poorly investigated.

**Aim:** To study the importance of hemolysis we performed a retrospective analysis on Extracorporeal Membrane Oxygenation (ECMO) run's performed in our centre over the past 12 years. Our first aim was to quantify hemolysis during ECMO in our study population. The second aim was to determine whether hemolysis influenced outcome and the third aim was to identify mechanical properties of the ECMO run that may impact the occurrence of hemolysis.

**Medthods:** Between July 1996 and July 2008, 231 ECMO runs were retrospectively reviewed. Prevalence of clot formation in the circuit and hemolysis were quantified together with circuit component exchange due to hemolysis. Free Plasma Hemoglobin (fHb) levels during ECMO were reviewed. In 64 cases fHb levels were compared with mechanical forces in ECMO.

**Results:** In 57 of 231 cases (24%), clot formation or plasma leakage was reported. In 33 of 231 (14%), at least one circuit component was exchanged. Free hemoglobin values reached 10 mg/dL in 62% of the cases in wich fHb values were retrieved. Free plasma hemoglobin levels in patients with combined continuous renal replacement therapy (CRRT) and ECMO treatment were significantly higher than in patients receiving ECMO treatment alone.

**Conclusions:** In conclusion, this study shows that hemolysis is a common problem in ECMO. There was no statistical difference in outcome between patients with peak fHb more or less as 40 mg/dL. We were not able to prove statistically that pre-pump pressure and pre-membrane pressure affected hemolysis. There was a trend for higher pre-membrane pressures before peak fHb were reached. CRRT negatively influenced fHb release.

[Emmanuel.devolder@uzleuven.be](mailto:Emmanuel.devolder@uzleuven.be)

11:35-11:50

**Speaker: Maik Foltan**

**Perfusionist, University of Regensburg, Germany**

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**LONG-TERM FUNCTION OF EXTRACORPOREAL LUNG ASSIST OXYGENATORS** *Foltan M., Philipp A., Thrum A., Gietl M., Schettler F., Schmidt S., Holzamer A., Müller T., Lehle K., Schmid C.* *Department of Cardiothoracic Surgery, University Hospital Regensburg, Germany*

**Background:** Every extracorporeal gas exchange method requires a membrane oxygenator (MO). The long-term functioning of these artificial gas exchange systems depends not only on the coating but also on the material of the layer separating the blood and gas. The material being either microporous polypropylene (PP) or a nonmicroporous poly(4-methyl-1-pentene) (PMP) membrane. Furthermore long-term durability is limited by fibrous and cellular accumulations on the gas exchange surface.

**Method:** After the termination of the lung assist system or the exchange of the oxygenator based on an insufficient gas transfer rate, the membrane oxygenator was opened and surface deposits were studied using scanning electron, fluorescence microscopy and angiographic techniques.

**Results:** Eighty patients with severe refractory lung failure were provided with a VV-ECMO during the period of 2006 to May 2009. The cumulative support time was 352 days and the average support duration was 8 [1-33] days. Fifteen of these patients (19%) required replacement of the oxygenator due to a decrease in gas exchange capacity or an increased flow resistance  $\Delta p$  MO. The membrane surface of the MO was covered with a fibrous network of imbedded platelets and red blood cells

**Conclusion:** For the dysfunction of PMP- membrane oxygenators in an ECMO setting two essential mechanisms require attention. Firstly, contact of blood with foreign surfaces always activates the coagulation cascade. The accumulation of thrombocytes in fibrin formations on the membrane surface of the MO induces an increased flow resistance ( $\Delta p$ ) across the MO. With increased pump flows generated a further destruction of blood cells.

Secondly, cellular accumulations on the gas exchange surface of the PMP capillaries increase the diffusion distance of the gas exchange fibres. These lead to the impairment of the gas exchange efficiency and require the replacement of the membrane oxygenator without a significant increase in flow resistance  $\Delta p_{MO}$ .

[maik.foltan@klinik.uni-regensburg.de](mailto:maik.foltan@klinik.uni-regensburg.de)

11:50-12:05

**Speaker: Stephen Harwood CCP, CPC, BA**

**Manager, Cardiopulmonary Specialties**

**Coordinator, Mechanical Circulatory Assistance**

**Toronto General Hospital, Toronto, Ontario, Canada**

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## **EXPANDING THE OPTIONS IN LUNG TRANSPLANTATION: THE EX-VIVO PROGRAM AT TORONTO GENERAL HOSPITAL**

**OBJECTIVE:** The supply of organs for donation remains excessively small to meet the needs of patients awaiting solid organ transplants worldwide. To worsen an already short supply, only 15 – 20% of donated lungs meet strict criteria and are subsequently implanted. This leaves a large number of lungs that are rejected for a variety of reasons that may include infiltrates, prolonged ischemia, and poor function. Our program has developed an external perfusion circuit that has the ability to reverse some of these conditions, allowing us to implant lungs that would otherwise be rejected by other programs.

**METHODS:** Lungs that are assessed as 'borderline' according to standards set out by International Society for Heart and Lung Transplant (ISHLT) are harvested and brought to our centre and are placed on an extracorporeal circuit and perfused for up to 4 hours. During this time the organs are assessed for gas exchange capabilities, edema and vascular resistance. At the termination of the perfusion period, lungs that meet acceptable criteria are then transplanted into recipients.

**RESULTS:** We have performed 20 ex-vivo perfusions, and successfully transplanted these lungs in all cases. There has been an increase in lung function, decrease in resistance, edema and PCWP. In all cases the post-operative course was unremarkable.

**CONCLUSIONS:** Ex-vivo lung perfusion (EVLP) is an effective method for increasing the numbers of available donated lungs for transplantation. Damaged lungs with marginal function can be improved dramatically, and we are now accepting organs that previous to this treatment modality, would have been rejected. EVLP is an effective means of attenuating the effects of ischemia-reperfusion injury.

[Stephen.Harwood@uhn.on.ca](mailto:Stephen.Harwood@uhn.on.ca)

12:05-12:25

Maquet Sponsored Session

Speaker: Thomas Müller, Dr. med.

Pneumologie/Intensivmedizin, Universitätsklinikum Regensburg,  
Germany

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## **PROTECTIVE VENTILATION in SEVERE LUNG FAILURE: PRESENT and FUTURE**

Acute respiratory failure, and in particular its most severe form, acute respiratory distress syndrome (ARDS), still has an unacceptable high mortality rate of about 40% (1). Not unexpectedly survival is even more dismal in ARDS with a poor oxygenation index and a high lung-injury-score. The estimated number of ARDS amounts to more than 140.000 annual cases for the US (2). From animal experiments and human studies it is well known that the severe damage to the lungs occurring in ARDS can be aggravated by mechanical ventilation. Therefore, mechanical ventilation must be as protective as possible. Low tidal volume ventilation is the standard of care in acute lung failure (3), and volutrauma, barotrauma and atelectrauma must be kept at a minimum to reduce ventilator induced lung injury (VILI) and consecutively mortality.

Extracorporeal lung support is a promising option to ensure vital gas exchange in severe lung injury and to enable a highly protective ventilation. Important technical developments and miniaturisation of devices have largely reduced complication rates, which had led to very restricted use of extracorporeal membrane oxygenation (ECMO) in adults in the past. Nowadays two systems for extracorporeal support of severe lung failure are currently used in our institution in Regensburg: interventional lung assist (iLA) in selected cases of isolated hypercapnia and veno-venous ECMO with the permanent life support system (PLS).

ILA is a pumpless arterio-venous shunt with an interposed low-resistance oxygenator. As the heart is the driving force, left ventricular function must be sustained. It has an excellent capacity for extracorporeal carbon dioxide elimination of about 50% of production (4). However, oxygen transfer is restricted, and atherosclerosis is considered a contraindication.

Veno-venous ECMO can transfer more than 150 ml of oxygen per minute, which is more than 50% of total oxygen consumption. Carbon dioxide elimination depends on blood flow and sweep gas

flow and is highly effective and can amount to more than 200 ml/min. Due to the small foreign surface area the new PLS system can be operated with low-grade anticoagulation even in long-term use, which makes application possible also in patients with thrombocytopenia and disseminated intravascular coagulopathy. Tidal volume, end-inspiratory pressure, minute ventilation and fraction of inspired oxygen can be diminished rapidly allowing for a significantly more protective ventilation with a low rate of device-associated complications (data submitted).

For the future combination of extracorporeal gas transfer and physiologic autoregulation of ventilation with neurally adjusted ventilatory assist (NAVA) may be a promising concept for optimized protection. A further interesting option is the use of extracorporeal lung support with a dual-lumen catheter in patients who are awake and partly mobile to avoid complications of long term ventilation like muscle atrophy.

In summary modern miniaturised extracorporeal lung support allows interhospital transport of patients with severe ARDS and has a low rate of complications. It can buy time for the diseased lungs to heal and makes a more protective ventilation possible, thereby reducing ventilator-induced lung injury.

[thomas.mueller@klinik.uni-regensburg.de](mailto:thomas.mueller@klinik.uni-regensburg.de)

#### **Literature:**

- 1) Phua J, Badia JR, Adhikari NKJ, et al. Has mortality from acute respiratory distress syndrome decreased over time? A systematic review. *Am J Respir Crit Care Med* 2009; 179:220-227
- 2) Rubenfeld GD, Caldwell E, Peabody E, et al. Incidence and outcomes of acute lung injury. *N Engl J Med* 05; 353:1685-1693
- 3) The Acute Respiratory Distress Syndrome Network. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *N Engl J Med* 2000; 342:1301-1308
- 4) Müller T, Lubnow M, Philipp A, et al. Extracorporeal pumpless interventional lung assist in clinical practice: determinants of efficacy. *Eur Respir J* 2009; 33:551-558

12:25-12:55

Medos Sponsored Session

Speaker : Mihai Constantinescu M.D.

Plastic Surgeon

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## **A NEW APPLICATION FOR THE EXTRACORPOREAL PERFUSION SYSTEM: THE EXPANSION OF TIME LIMITS IN MACROREPLANTATION OF EXTREMITIES**

*Hj. Jenni, Erich Gygax, Mihai A. Constantinescu, David Kiermeir, Esther Vögelin, Thierry Carrel, Department of Cardiovascular Surgery; Department of Plastic- and Hand Surgery; University Hospital, Berne, Switzerland*

**Background:** Macroreplantations have to be performed within six hours from amputation, to avoid reperfusion injury and irreversible tissue loss. We developed an extracorporeal perfusion system with the goal of lengthening this replantation window. Following proof of feasibility in a pilot study, the maximal potential of this technique was investigated in the current study.

**Material and Methods:** Twelve forelimbs of six large white pigs were divided into two groups: I perfusion group, II contralateral cold ischemia group controls.

In group I the axillary artery and two axillary veins were cannulated and extracorporeal perfusion started after 6 hours of cold ischemia. Autologous blood was anticoagulated with heparin and used for perfusion. The new extracorporeal perfusion system is a half- open setup with diagonal rotary pump, oxygenator and a 165 ml venous softbag. Extracorporeal perfusion was performed for 12 hours. Multiple variables including pO<sub>2</sub>, pCO<sub>2</sub>, lactate, potassium, and pH were monitored by blood gas analysis. Muscular and subcutaneous pO<sub>2</sub>, lactate and temperature were measured by Lycox probes. Neurostimulation was used to assess the motor response. The quality of the perfusion at intracellular level was assessed semi-quantitatively by morphological analysis of muscle fiber mitochondria using electron microscopy.

**Results:** Limb perfusion could be performed continuously for the entire period of 12 hours in all extremities of group I starting after six hours of cold ischemia. pH could be maintained stable (mean 7.56). Potassium was well controlled with insulin and glucose (mean 6.7

mmol/l). Lactate levels remained high during the perfusion (mean 20.1 mmol/l) due to the lack of the liver in this extracorporeal system. pO<sub>2</sub> was continuously higher in arterial than in venous blood indicating a functioning cellular metabolism. Muscular and subcutaneous temperature was constant after initial warming. Muscle response to stimulation was observed following a warm-up period of 40 minutes and was reproducible throughout the entire perfusion duration in all extremities after six hours of cold ischemia. In contrast we found a complete loss of muscle response to stimulation after 30 minutes of cold ischemia in the unperfused control group. The ultrastructural analysis paralleled the significant differences between the perfused and the non-perfused extremities.

**Conclusions:** The extracorporeal perfusion of amputated extremities demonstrated stable tissue effects at macroscopical, biochemical and histological level. This ex-vivo extracorporeal perfusion system successfully maximized the potential replantation period of amputated extremities from 6 to 18 hours. The in-vivo effects are currently under investigation.



**12:55-13:40    LUNCH**



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**Moderators: 3<sup>rd</sup> Session**

Dr: Alexander Wahba M.D., Ph. D  
Cardiac Surgeon, Trondheim, Norway  
EBCP Chairman

Mr. Eddy Overdevest  
Perfusionist  
Eindhoven, Netherlands  
EBCP Delegate to the Netherlands

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13:40-13:55

**Speaker: Judita Andrejaitiene**  
**Anesthesia, Kaunas, Lithuania**

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## **CARDIOPULMONARY BYPASS PERFUSION PRESSURE AND POSTOPERATIVE RENAL DYSFUNCTION IN ELDERLY PATIENTS**

*J. Andrejaitiene, L. Raliene, E. Sirvinskas, Institute for Biomedical Research, Kaunas University of Medicine, Kaunas, Lithuania*

**OBJECTIVE:** Low-risk patients tolerate mean arterial blood pressures (MABP) of 50–60 mmHg without apparent complications, although limited data suggest that higher-risk patients may benefit from MABP >70 mm Hg. The aim of study was to evaluate the "optimal" MABP during cardiopulmonary bypass (CPB) on renal function in elderly patients during the early postoperative period.

**METHODS:** We have analyzed the data of 99 pts > 70 yr with normal preoperative renal function who had been subjected to coronary artery bypass grafting (CABG) procedures on CPB. Patients were divided in 3 groups according to mean perfusion pressure (PP) during CPB: group I (n=42) included patients who PP was maintained 60–70, group II (n=27) – PP was 50–60 and group III (n=30) – PP was >70 mmHg. Patients clinical data were evaluated during the three postoperative days.

**RESULTS:** The rate of renal impairment (urine output <50ml/h) in the early postoperative period after cardiac surgery didn't differ among the groups. Evaluation of PP on renal excretion showed that urine output did not differ among the groups. It was established that volume balance at the end of surgery and early postoperative period didn't differ among the groups. The need for furosemide was similar in all groups. Length of postoperative hospital stay was not significantly different among the groups.

**CONCLUSION:** CPB perfusion pressure of 50 – 80 mmHg is not a cause for developing postoperative renal dysfunction in elderly patients after CABG surgery.

[andrejaitiene@yahoo.com](mailto:andrejaitiene@yahoo.com)

13:55-14:10

**Speaker: Sasha Agati**

**Pediatric Cardiac Surgeon**

**San Vincenzo Hospital – Taormina – Italy**

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## **STRATEGIES IN PEDIATRIC CARDIAC SURGERY PERFUSION: IS IT POSSIBLE TO USE AN EVIDENCE BASED APPROACH?**

**Objective:** The damaging effects of cardiopulmonary bypass and subsequent inflammatory response are the result of extreme conditions encountered during extracorporeal support, including (1) cell activation on contact with the foreign surfaces of the bypass circuit, (2) mechanical shear stress, (3) tissue ischemia and reperfusion, (4) hypotension, (5) nonpulsatile perfusion, (6) hemodilution with relative anemia, (7) blood product administration, (8) heparin and protamine administration, and (9) hypothermia.

**Methods:** A global inflammatory response ensues with the activation of cellular and humoral cascades. These inflammatory cascades result in a capillary leak syndrome and multiorgan dysfunction. Pediatric population of patients are more susceptible to the inflammatory response to cardiopulmonary bypass for several reasons such as higher metabolic demands, reactive pulmonary vasculature, immune organ systems and altered homeostasis. Infants and newborns, are also at increased risk because of tremendous disparity between CPB circuit size and the patient, greater metabolic demand of infants requiring higher pump flow rates. Immature and developing organ systems place the youngest patients at greatest risk.

**Conclusion:** Review and analysis of the literature is proposed in order to understand if an evidence based approach for cardiopulmonary bypass management is possible in such a delicate population of patients.

[sasha.agati@tiscali.it](mailto:sasha.agati@tiscali.it)

14:10-14:30

Sorin Sponsored Session

Speaker: Philippe Pouard

Pediatric Intensivist, Paris, France

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### **BLOOD SAVING BY PERFUSION OPTIMIZATION: GENERAL APPROACH AND PEDIATRIC APPLICATION**

*Dr Ph Pouard; Paediatric Intensive Care, Anaesthesia and CPB Unit  
Departments of Anesthesiology and Pediatric Cardiac Surgery;  
Hôpital Necker Enfants-Malades, Paris , France*

Blood conservation remains an ongoing quest since the early times of cardiac surgery. Many improvements occurred during last decades and allowed to move towards bloodless surgery. Moreover, blood transfusion has been associated with increased mortality rate and it remains unclear if blood transfusion improves survival. In adults, low haematocrit during CPB has been shown as an independent predictor of operative mortality, prolonged ICU stay, postoperative hospital stay and worse 0 to 6 year survival. A large part of paediatric cardiac surgery is performed during the neonatal period, homologous blood components are essential and blood conservation is a main concern. In this population, low haematocrit level, showed a worth immediate outcome (cardiac index, serum lactate levels, and increased total body water) and was associated with adverse developmental outcome. Blood conservation has to be considered in a benefits and risks strategy and not as an ultimate end point. Perfusion plays an important role in blood saving.

**Methods:** Blood conservation usually associates methods to limit haemodilution and to limit blood loss.

1) Methods to limit haemodilution include low prime circuits, remote pump head system, ultrafiltration and red cells salvage. With safety measures and moderate negative pressure (minus 20 mmHg), assisted venous drainage improves the venous return. To reduce haemodilution allows to decrease blood transfusion and to improve coagulation.

2) Methods to limit blood loss include surface modifying additives, accuracy of heparin therapy during CPB, pharmacologic modulation of coagulation and fibrinolysis.

**Results:**

Small circuits with remote pump head allow to reduce the priming volume down to less than 200 ml with a 3/16" tubing for neonates. With these devices, it has been possible to decrease the priming volume in piglets to 107 ml and to 140 ml in neonates. During the last 20 years the priming volume of paediatric oxygenators has been reduced by 70 % down to 32 ml (KIDS®) with a 14 ml arterial filter. This neonatal open circuit including 3/16" tubing can be primed with 135 ml, allowing to go on bypass with 150 ml. Many factors are involved in the results of surgery, nevertheless in the most common neonatal cardiac procedure, the arterial switch for transposition of the great arteries, with and without VSD, these techniques lead to a median ICU LOS of 4 days including a ventilation time of 22h for the simple TGA and 34 hours for the TGA+ VSD.

**Conclusions:** Rising costs for safer blood components, and remaining side effects of blood transfusion justify blood conservation in PCS. Nevertheless, devices and way of working do not allow yet safe bloodless CPB for complex repairs in very young and low weight children. Blood conservation requires the use of many methods, to decrease haemodilution, reduce blood loss and monitor haemostasis. Blood conservation fixes predetermined strategies involving the whole team and includes cardiologists, anaesthesiologists, surgeons, perfusionists and intensivists.

[pp@invivo.edu](mailto:pp@invivo.edu)

14:30-14:45

**Speaker: Lazo Eremija**

**Perfusionist, New Belgrade, Serbia**

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## **BENEFITS OF CONVENTIONAL AND MODIFIED ULTRAFILTRATION IN PEDIATRIC CARDIAC SURGERY: A SEVEN YEAR EXPERIENCE**

*Mila Stajevic, Lazo Eremija, Igor Sehic, Snezana Jelovac*

*Mother and child health institute – New Belgrade, Serbia*

**Objective:** The main characteristic of the pediatric extracorporeal circulation is balancing the volume between the pediatric patient and the volume of the prime in the heart lung machine. Extra tissue volume in the pediatric group is the result from the replacement of the intraoperative blood loss. The main objective is to show the use of ultrafiltration in pediatric centre which worked in suboptimal conditions and the benefits on this group of patients.

**Methods:** Conventional UF was instituted in our department in 1998 and modified UF since 1999. We have compared 90 patients operated on isolated ventricular septal defects below one year of age. The patients were divided into three groups:

1) 30 patients operated on before 1997 where ultrafiltration was NOT used.

2) 30 patients operated on after 1997 filtered only by conventional ultrafiltration, and,

3) 30 patients where both conventional and modified UF were used.

The first comparison group was based on results immediately post CPB and post filtration. The other compared values were clinical findings in the postoperative course

### **Results:**

Significant rise in systolic and mean blood pressure, decrease in serum glucose levels, decrease amount of blood transfusion, improved hematological status of patient, reduced postoperative use of diuretics and shorter ICU stay.

**Conclusion:** Ultrafiltration is a well known method used in operative procedures in pediatric patients which reduces the adverse effects of cardiopulmonary bypass. The cost/benefit ratio is positive as the price of the filtering device is 1:5 of the oxygenator price. The most important effects of ultrafiltration in our centre are elimination of excess body water after bypass, better hemodynamical parameters.

[lazoeremija@beotel.yu](mailto:lazoeremija@beotel.yu)

14:45-15:00

**Speaker: Scott R. Beckmann, B.S., C.C.P.**

**Cardiovascular Perfusionist, Salem, Oregon, USA**

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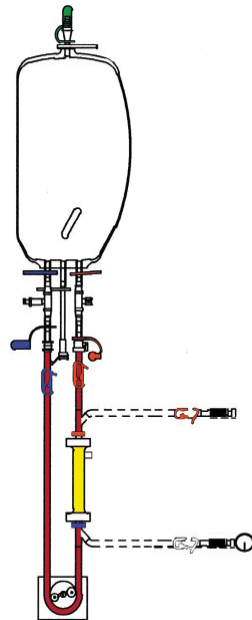
## **DRASTIC COAGULATION IMPROVEMENTS POST CARDIAC SURGERY WITHOUT THE USE OF BLOOD PRODUCTS USING THE HEMOBAG**

*W. Shely<sup>1</sup>, T. Winkler<sup>1</sup>, J. Ross<sup>3</sup>, B. Miller<sup>3</sup>, R. Bissinger<sup>3</sup>, J. Opton<sup>3</sup>, A. Anderson<sup>3</sup>, A. Ianus<sup>3</sup>, L. Priollaud<sup>3</sup>, D. Carlile<sup>2</sup>, M. Haycock<sup>2</sup>, K. Engstad<sup>1</sup>, S. Beckmann<sup>2</sup>*

Institutions: <sup>1</sup>Northwest Surgical Associates Division of The Oregon Clinic, <sup>2</sup>Hospital Clinical Services Group, <sup>3</sup>Oregon Anesthesia Group, Salem, OR, USA

**OBJECTIVE:** Optimal coagulation continues to be a challenge in the immediate postoperative period for the cardiac surgical patient. Exposure to red blood cell transfusions, fresh frozen plasma, platelet transfusions and cryoprecipitate has been associated with postoperative sequelae and increased morbidity and mortality. The impact of highly concentrated autologous whole blood on coagulation is less well understood.

**METHODS:** 12 patients undergoing coronary artery bypass graft, or redo coronary artery bypass graft surgery were evaluated for the effective change in the coagulation parameters of prothrombin time (PT), activated partial thromboplastin time (PTT), International normalized ratio (INR), fibrinogen concentration (FIB) as well as hematocrit, (HCT) and platelet (PLT) count. After cardiopulmonary bypass (CPB) termination and neutralization of sodium heparin with protamine sulfate, these coagulation tests were collected before and after the infusion of "multipass" hemoconcentrated autologous whole blood via the Hemobag® technology for ultrafiltration (HBV).



**RESULTS:** The range and mean difference in PT was 19.9-17.3 seconds, -2.57 ( $p<.0001$ ), PTT was 34.5-32.7 seconds, mean difference -1.75 ( $p<.1011$ ), INR 1.7-1.4, mean difference -0.266 ( $p<.0001$ ), FBG 224-284mg/dl, mean difference +60.16 ( $p<.0001$ ), PLT 116-150K/mm<sup>3</sup> mean difference +33.83 ( $p<.0012$ ), HCT 26.4-34.5% mean difference +8.1 ( $p<.0001$ ). The average HBV infused was 1045ml. Zero percent of patients ( $n = 12$ ) were exposed to allogeneic blood or blood product transfusions immediately post CPB to achieve these drastic changes.

**CONCLUSIONS:** Overall improvements were seen in all measured parameters. Statistically significant improvements in coagulation studies, PLT count and HCT levels were observed. PTT although reduced, was not statistically significant. The administration of concentrated autologous whole blood using this technique following CPB, significantly improved the coagulation state in these patients. Optimizing coagulation can be achieved with this technology minimizing the risks and hazards of exposure to precarious donated blood products after coronary bypass surgery.

<b>Results Table:</b> Results of coagulation parameter changes after administration of concentrated whole blood using the Hemobag®						
<b>Parameter</b>	<b>Pre</b>	<b>Post</b>	<b>Change</b>	<b>Std Err</b>	<b>t-value</b>	<b>p-value</b>
Hematocrit	26.4%	34.5 %	+ 8.2	0.7	11.24	<0.0001
Platelet count	116 K/ $\mu$ l	150 K/ $\mu$ l	+ 34	7.8	4.33	0.0012
Fibrinogen	224mg/dl	284 mg/dl	+ 60	9.5	6.37	<0.0001
aPTT	34.5 sec	32.8 sec	- 1.8	0.98	-1.79	0.1011
PT	19.9 sec	17.3 sec	-2.6	0.32	-8.03	<0.0001
INR	1.7	1.4	- 0.2	0.03	-8.00	<0.0001
<b>Legend:</b> Coagulation parameter values for 12 patients receiving an average of 1046 ml of concentrated whole blood are listed with the results of t-test analysis between pre and post-administration.						

[scott.beckmann@hospitalclinicalsg.com](mailto:scott.beckmann@hospitalclinicalsg.com)



**15:00-15:30    COFFEE BREAK**



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**Moderators: 4<sup>th</sup> Session**

Priv. Doz. Dr. med. Ingo Kutschka (Hannover, Germany)  
Oberarzt, Cardiac Surgeon  
Herz-, Thorax-, Transplantations- und Gefäßchirurgie  
Medizinische Hochschule Hannover

Mr. Paul Murphy CCP  
Manager Cardiovascular Perfusion  
Southlake Regional Center, Newmarket, Ontario, Canada

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**15:30-16:00**

**Terumo Sponsored Session**

**Prof. Serdar Gunaydin, MD, PhD**

**Chair, Department of Cardiovascular Surgery,**

**University of Kirikkale-Turkey**

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## **MODULAR CARDIOPULMONARY BYPASS FROM ENTHUSIASM to REASON**

### **OBJECTIVES:**

There is a trend in modern practice of CPB towards reducing the biomaterial surface area exposed to blood and to reducing circuit priming volume. This trend stems from improvements in perfusion technology and a desire to minimize the negative effects of hemodilution and blood/biomaterial contact-mediated inflammatory processes. Minimized cardiopulmonary bypass systems have been developed to reduce these negative effects of extracorporeal support and to improve clinical outcomes. The latest generation of these circuits have become modular (modular-CBP). They use extra safety features for optimized air-handling and auxiliary circuit modules for adaptation to any type of operation. The aim of this study was to compare modular-CPB with conventional system (CECC).

### **METHODS:**

In a series of clinical studies complemented with biomaterial analysis, we compared outcome, intraoperative microembolic signal intensity, inflammatory response, hemolysis, perioperative regional cerebral oxygen saturation (rSO<sub>2</sub>) and myocardial protection in high-risk patients undergoing coronary revascularization and/or valve surgery with modular-CPB or CECC. In the second step, we evaluated modular-CPB versus off-pump surgery and studied the differences in cerebral protection compared to CECC consequently. The primary endpoints of these studies were to evaluate the air handling capacity and to qualify comfort and safety level of modular circuits. Secondary endpoints were to document any differences in contact activation- inflammatory response, free hemoglobin levels, hemodilution, CK-MB levels and clinical outcome.

### **RESULTS:**

Our data of three different studies will be summarized. Serum IL-6, C3a, percentage expression of neutrophil CD11b/CD18 levels were significantly lower in modular-CPB (Rocsafe, Terumo-Europe) vs.

CECC (Capiiox SX18, Terumo-Europe). CKMB levels in coronary sinus blood demonstrated well preserved myocardium in modular-CPB group. There were not any significant differences in air handling characteristics and free plasma hemoglobin levels in both circuits. rSO<sub>2</sub> measurements were significantly better in modular-CPB during follow-up. Inflammatory status during modular-CPB was very well comparable to off-pump surgery. Gaseous microemboli intensity was well correlated with postoperative neurocognitive outcome which was significantly better in modular-CPB vs. CECC. Blood protein adsorption analysis of oxygenator membranes demonstrated a significantly increased amount of microalbumin on CECC fibers

### **CONCLUSION:**

Modular-CPB provided a comfort and safety level similar to CECC via satisfactory air handling, attenuated inflammatory response and hemodilution with a better clinical outcome in patients undergoing high-risk cardiac surgery. We believe it is a step towards more physiological extracorporeal support, combining individually proven modifications.

[sgunaydin@isnet.net.tr](mailto:sgunaydin@isnet.net.tr)

16:00-16:20

Sorin Sponsored Session

Speaker: Marc Wollenschläger

Perfusionist, Bad Nauheim, Germany

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**FIRST CLINICAL EVALUATION OF THE NEW SORIN C5 HEART-LUNG-MACHINE** M. Wollenschläger<sup>1</sup>, H. Jung<sup>1</sup>, F. Sieburg<sup>2</sup>  
<sup>1</sup>Kerckhoff – Klinik, Bad Nauheim, Germany, <sup>2</sup>Sorin Group Deutschland GmbH, München, Germany

**Objective:** The confirmatory validation of the newly developed Sorin C5 Heart-lung-machine (HLM) shall provide evidence for the fulfilment of the user's expectations. Subject of this study is the usage of the Sorin C5 in a clinical setting with our first clinical experiences.

**Methods:** 20 patients, who had an elective operation procedure in our hospital, served for this clinical evaluation.

We observed the Sorin C5 in respect of ease of use, ergonomics and technical features during extracorporeal blood circulation.

We also compared the new Sorin C5 to previous Stöckert HLM models to understand if there are significant differences.

**Results:** During the 20 cardiac operations, no technical problems occurred. The C5 stands out with its well thought-out, logical structure, functional ergonomic design and reliable safety system. C5's flexibility and technical features provided us more possibilities to improve our perfusion standard.

**Conclusion:** C5 with its state-of-the-art technology and proven user interface delivers greater ergonomics for the operator. It's a well designed, easy to use HLM from Sorin Group.

[kardiotechnik@kerckhoff-klinik.de](mailto:kardiotechnik@kerckhoff-klinik.de)



16:20-16:40

Medtronic

Sponsored

Session

Speaker: James Ferguson B.S., MT (ASCP), CCP

Perfusionist, Phoenix Perfusion, Scottsdale, Arizona

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## **A CLINICAL EXPERIENCE WITH THE RESETTING HEART MINI-EXTRACORPOREAL SYSTEM: A STRATEGY FOR BLOOD CONSERVATION**

**Objective:** We studied a cohort of 515 patients operated with the Resting Heart cardiopulmonary bypass (CPB) system. The study was designed to determine the reduction in blood product utilization of patients undergoing bypass surgery with the Resting Heart mini-extracorporeal circuit (MECC). The Resting Heart is a MECC system and it uses a compilation of currently available equipment and techniques to improve on the conventional circuit in use today.

**Description:** The Resting Heart MECC is a tip-to-tip Carmeda coated closed circuit CPB system. The system includes a centrifugal pump and has a prime volume of 1100 mL. Between January 2005 and July 2009, 513 patients were operated on using the Resting Heart MECC system. This includes patients that underwent coronary artery bypass grafting (CABG), aortic valve replacement, mitral valve replacement, CABG – valve procedures, or Aortic Root replacements.

**Results:** In our current practice 85% of patients receive blood during their hospital stay while undergoing open heart surgery. The use of packed red blood cells (PRBC's) in the operating room (O.R.) at the initiation of the study (2004) was 58% for patients. The percentage of PRBC's used in 2007 was 21% with a decrease of 37% of patients no longer receiving PRBC's in the O.R. The time to extubation was shorter in these patients and the length of stay was reduced by one day.

**Conclusions:** In our experience, the Resting Heart system is a safe and reliable system for CPB with good clinical results. The results indicate that use of the Resting Heart circuit substantially reduces the amount of blood products patients receive undergoing cardiopulmonary bypass compared to the conventional circuit.

[Fergy2ccp@Q.com](mailto:Fergy2ccp@Q.com)

**16:40-17:00**

**Poster Session Review**

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**PERFUSION: THE SOUTH AFRICAN EXPERIENCE.**

**Beaurich Groenewald**, Martin Lampacher,

Beaurich Groenewald current Chairman of PERFMED.

The first bypass in South Africa was performed in 1959.

Perfusion performed by Anaesthetists.

Dedicated perfusion staff early 1960's

Medical technology training 1970's.

Perfusionist registration with the SAMDC (South African Medical & Dental Council).

Formal perfusion Diploma course 1981.

Local perfusion publication "Reperfusion"

Private practice perfusion 1986.

BTech Perfusion Degree 1990.

Formed Perfmmed Society 1997.

## **NEW STRATEGY FOR RIGHT ATRIAL ISOLATION BY CANNULATION OF THE INNOMINATE VEIN IN ADULT CARDIAC SURGERY: IS IT SAFE AND REPRODUCIBLE?**

*F. Kargar, F. Kaleghi, M.H. Aazami*

*Rajaei Heart Center, Department of Cardiac Surgery*

**Objective:** Innominate vein cannulation is generally used as venous access in congenital heart surgery or to assist drainage for minimally invasive valve surgery. We report on our experience with innominate vein cannulation as part of bicaval drainage in the setting of adult cardiac surgery.

**Methods:** After obtaining adequate exposure of the innominate vein, a purse is performed on its anterior aspect with a monofilament 5/0. A vertical veinotomy within the purse is performed that is enlarged subsequently. Usually, a French 22F malleable cannula is passed through the veinotomy heading toward the superior vena cava. The cardiopulmonary bypass is then instituted and the maximum flow provided by the innominate vein is noticed. Once the flow reaches up to 50%, the inferior caval venous cannula is placed achieving the total venous drainage.

**Results:** Since 2008 to present, 107 patients (mean age  $50.6 \pm 14.4$ , female 48.60%) underwent various types of adult open cardiac surgery using current bicaval cannulation. The mean body surface area was  $1.7 \pm 0.18$  m<sup>2</sup>. The mean theoretical perfusion flow and mean flow provided by innominate vein were 4081 and 2615 ml/min (64.27% of the theoretical flow) respectively. The mean central venous pressure was  $4.47 \pm 1.54$  mmHg during cardiac arrest. There was one hospital death due to delayed stroke. Three patients underwent reoperation for bleeding unrelated to innominate vein cannulation procedure.

**Conclusions:** Innominate vein cannulation is a safe and reproducible method for right atrial isolation in adult cardiac surgery. It provides an unfolded surgical field with enhanced superior vena cava and atrial exposure.

## **A NEW, “INDUSTRIAL STANDARD” , MINIATURIZED HOLLOW FIBER OXYGENATOR FOR EXPERIMENTAL MURINE MODELS OF EXTRACORPOREAL CIRCULATION (ECC).**

*M. Tessari MSc.(1), B. Walpoth M.D.(2), G. Cresce M.D (1), D. Mugnai M.D.(2), F. Innocente M.D.(2), P. Balboni Dr.(3) A. Rungatscher M.D.(1) F. Chinni Dr.(3), A. Kalangos M.D.(1), A. Mazzucco M.D.(1), G. Faggian M.D. (1) (1) Cardiac Surgery University of Verona, Verona , ITALY(2) Cardiovascular Research, University Hospital of Geneva, Geneva, Switzerland,(3) Sorin Group, Mirandola, Modena, Italy*

Extracorporeal circulation (ECC) is an essential component for open-heart surgery. The pathophysiological mechanisms of interaction between ECC and the body are only partially known and in many cases its use may represent a risk for serious events that usually occur post-operatively.

The evaluation in the laboratory, especially in animal models such as rodents (mice or rats) are widely known aspects of molecular biology related to the complete knowledge of the genome and other important biochemical parameters could provide experimental models for studying the inflammatory response, the behavior of the different parenchyma (lung, liver, kidney, brain etc), thermo-interactions and more. Currently there are not any micro-oxygenators available in the market that can be applied to this specific use.

We developed, in collaboration with SORIN-Group, a micro hollow-fiber oxygenator with a priming volume of 6.3 ml, gas exchange surface of 450 cm<sup>2</sup>, and heat exchanger surface area of 16 cm<sup>2</sup>. The oxygenator was tested in vitro and in vivo in five anesthetized and ventilated rats, using an ECC central chest cannulation with a miniaturized roller pump.

In vitro: blood oxygenation increased 10 times (from room air to 100% O<sub>2</sub>) , removal of PCO<sub>2</sub> was 2.5 times.

In vivo: ECC was performed without blood (asanguineous prime) for 90 minutes (no ventilation) maintaining stable hemodynamics during the procedure. A maximum blood flow of 124 ml/min was obtained. Arterio-venous PO<sub>2</sub> gradients were 10 times (O<sub>2</sub> to 100%), with only small variations when changing the rates of blood flow.

Conclusion: This new standardized miniaturized hollow fiber oxygenator reached optimal gas transfer with small volumes of asanguineous prime. This study opens new possibilities for ECC studies of various protocols, applicable end reproducible in small rodents.



## NOTES

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In recognition and appreciation of our Educational Supporters

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# MAQUET

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