Minibypass Revisited?

Cyril Serrick MSc, CCP, CPC
Manager of Perfusion Service and ExVivo Therapies
University Health Network
Toronto General Hospital
Toronto, ON, Canada

UHN Toronto General Hospital

Trillium Health Centre first in Canada to use new heart bypass technology

MAY 1, 2004 12:00 AM VIEWS: 284 SHARE: TWITTER FACEBOOK

The very first cardiopulmonary bypass surgery in Canada, using the Sorin Biomedica Synergy Miniature Bypass System, was performed at Trillium Health Centre in March 2004.

"This device looks like a large blender as opposed to a small Volkswagen," explains Dr. Gopal Bhatnagar, chief of cardiac surgery at Trillium. "We're hoping this will certainly make a big difference in the amount of blood transfusions we require. The better patients do, the less resources are utilized to take care of them, which means perhaps less financial impact in the long run to health care institutions."

Cyril Serrick, Chief Perfusionist at Trillum Health Centre, monitors a patient undergoing cardiac surgery on the miniature bypass system, a compact version of the heart-lung machine. The new device is expected to dramatically improve patient outcomes.

POPULAR LATEST COMMENTS

The role of the nurse in health promotion
A hidden truth: Hostility in healthcare
Acupuncture for pain? No thanks
The Scarborough Hospital hosts innovative Oxford Knee surgery for surgeons
Humber River Regional Hospital's cutting-edge imaging procedure unlocking 'frozen shoulder'
North America's first fully digital hospital

18th World Congress - World Society of Cardio-Thoracic Surgeons Kos Island - Greece April 30 - May 3, 2008

INTEGRATED MINIMAL PRIME CIRCUITS FOR CORONARY ARTERY BYPASS SURGERY IMPROVES CLINICAL OUTCOMES

AUTHOR(S): CJ Serrick MSc, CCP and G Bhatnagar MD
AFFILIATION(S): Trillium Health Centre, Mississauga, Ontario, Canada

Background: Conventional Cardiopulmonary Bypass (CCPB) leads to a host of adverse systemic effects. It has been shown to be associated with neurologic, pulmonary, renal and myocardial injury, increased blood loss and transfusions, all resulting in an increased length of stay. The integration and miniaturization of adult CPB circuits is an attempt to overcome the drawbacks of CCPB. These closed circuit reservoir-less bypass systems (Minimal Prime Circuits – MPC) are an entirely new way of looking at circulatory support and its techniques for cardiac surgery patients. These circuits provide the safety and flexibility of CCPB while minimizing the most hazardous drawbacks, specifically hemodilution and blood-air/foreign surface-contact, by reducing prime volumes and improving the biocompatibility of surfaces. The purpose of this study was to retrospectively compare clinical outcomes of coronary artery bypass patients who have undergone cardiopulmonary bypass with either a MPC or CCPB circuit.
Methods: Between March 1, 2004 and August 31, 2005 1246 patients underwent coronary artery bypass surgery. 168 of these patients were not candidates for beating heart surgery and therefore underwent cardiopulmonary bypass utilizing CCPB in 71 patients and a MPC in 97 patients. Patient demographics, hospital length of stay (LOS), postoperative blood loss and homologous red blood cell usage was retrospectively collected for each patient.
Results: When comparing the two groups, there were no differences in patient demographics. As expected there was significantly less pump prime (557 $\pm$234 ml* vs 1331$\pm$287 ml, $p<0.05$) and fluid balance post CPB (735$\pm$645 ml* vs 1501$\pm$856 ml, $p<0.05$) when comparing MPC to CCPB. There were also significantly less blood loss (854$\pm$906 ml* vs 1301$\pm$1914 ml, $p<0.05$), blood transfusions (1.2$\pm$2.2* vs 2.5$\pm$4.2 units per patient, $p<0.05$) and average LOS (5.9$\pm$2.6* vs 9.0$\pm$7.9 days, $p<0.05$) favoring the MPC compared to CCPB.
Conclusion: The use of an integrated minimal prime circuit for CPB provides hemodynamic support and safety similar to traditional CPB with the advantage of improved patient outcomes.

Minimally invasive ExtraCorporeal Technology

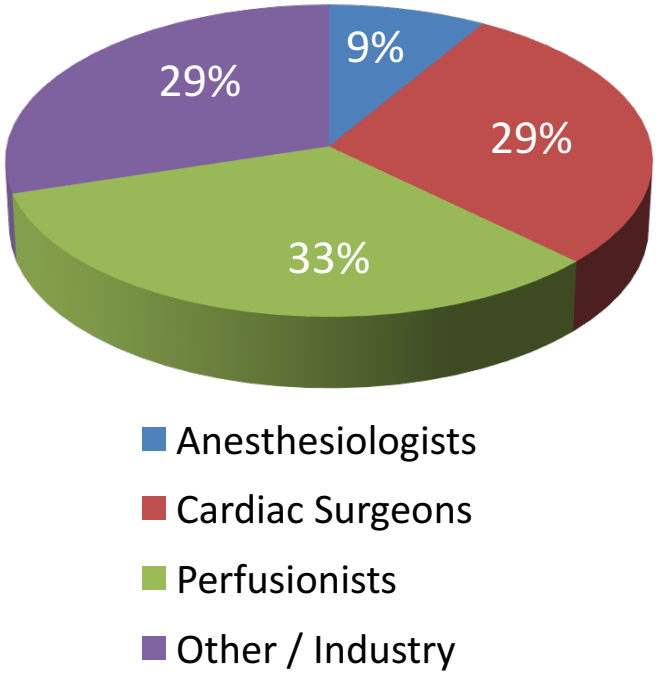
MiECT

UHN Toronto General Hospital

MiECTiS

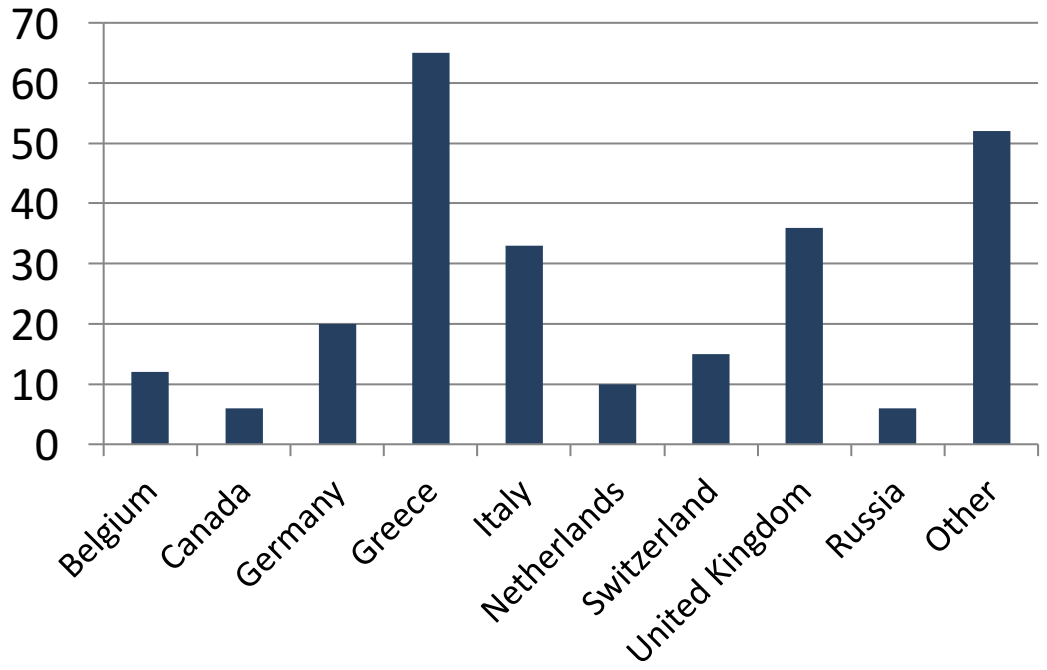
- June 2014: 120 Founding Members
- March 2017: **255 Members**

Members Profession



Country

29 Countries



Interactive CardioVascular and Thoracic Surgery Advance Access published January 26, 2016

Interactive CardioVascular and Thoracic Surgery (2016) 1–16
doi:10.1093/icvts/ivv380

Cite this article as: Anastasiadis K, Murkin J, Antonitsis P, Bauer A, Ranucci M, Gygax E *et al*. Use of minimal invasive extracorporeal circulation in cardiac surgery: principles, definitions and potential benefits. A position paper from the Minimal invasive Extra-Corporeal Technologies international Society (MiECTiS). Interact CardioVasc Thorac Surg 2016; doi:10.1093/icvts/ivv380.

Use of minimal invasive extracorporeal circulation in cardiac surgery: principles, definitions and potential benefits. A position paper from the Minimal invasive Extra-Corporeal Technologies international Society (MiECTiS)

Kyriakos Anastasiadis[a], John Murkin[b], Polychronis Antonitsis[a], Adrian Bauer[c], Marco Ranucci[d], Erich Gygax[e], Jan Schaarschmidt[c], Yves Fromes[f], Alois Philipp[g], Balthasar Eberle[h], Prakash Punjabi[i], Helena Argiriadou[a], Alexander Kadner[e], Hansjoerg Jenni[e], Guenter Albrecht[j], Wim van Boven[k], Andreas Liebold[j], Fillip de Somer[l], Harald Hausmann[c], Apostolos Deliopoulos[a], Aschraf El-Essawi[m], Valerio Mazzei[n], Fausto Biancari[o], Adam Fernandez[p], Patrick Weerwind[q], Thomas Puehler[r], Cyril Serrick[s], Frans Waanders[t], Serdar Gunaydin[u], Sunil Ohri[v], Jan Gummert[r], Gianni Angelini[i,w], Volkmar Falk[x] and Thierry Carrel[e,*]

[a] Cardiothoracic Department, AHEPA University Hospital, Thessaloniki, Greece
[b] Department of Anesthesiology and Perioperative Medicine, University of Western Ontario, London, Canada
[c] Department of Cardiothoracic Surgery, MediClin Heart Centre Coswig, Coswig, Germany
[d] Department of Anaesthesia and Intensive Care, Policlinico S. Donato, Milan, Italy
[e] Department of Cardiovascular Surgery, University of Bern, Bern, Switzerland
[f] University Pierre and Marie Curie (Paris 06), Paris, France
[g] Department of Cardiac Surgery, Regensburg, Germany
[h] Department of Anesthesiology and Pain Therapy, University of Bern, Bern, Switzerland
[i] Department of Cardiothoracic Surgery, Hammersmith Hospital, London, UK
[j] Department of Cardiothoracic and Vascular Surgery, Ulm University, Ulm, Germany
[k] Department of Cardiothoracic Surgery, Amsterdam Medical Center, Amsterdam, Netherlands
[l] Heart Centre, University Hospital Ghent, Gent, Belgium
[m] Department of Thoracic and Cardiovascular Surgery, Braunschweig, Germany
[n] Department of Adult Cardiac Surgery, Mater Dei Hospital, Bari, Italy
[o] Department of Cardiac Surgery, Oulu University Hospital, Oulu, Finland
[p] Department of Surgery, Sidra Medical & Research Centre, Doha, Qatar
[q] Department of Cardiothoracic Surgery, Maastricht University Medical Centre, Maastricht, Netherlands
[r] Department of Thoracic and Cardiovascular Surgery, University Hospital of the Rhine University Bochum, Bad Oeynhausen, Germany
[s] University Health Network, Toronto, Canada
[t] St Antonius Hospital, Nieuwegein, Netherlands
[u] Department of Cardiovascular Surgery, Medline Hospitals, Adana, Turkey
[v] Department of Cardiothoracic Surgery, Wessex Cardiac Centre, University Hospital Southampton, Hampshire, UK
[w] Department of Cardiac Surgery, Bristol Heart Institute, Bristol, UK
[x] Department of Cardiothoracic Surgery, German Heart Centre, Berlin, Germany

35 authors

24 departments

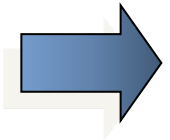
Experts Consensus Meeting, Bern, December 2014

MiECTiS

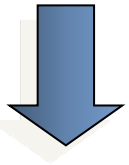
DEFINITION

Terminology

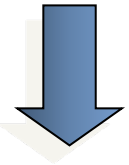
- miniaturized extraorporeal circulation (MECC)
- mini extraorporeal circulation (mECC)
- minimized extracorporeal circulation
- mini cardiopulmonary bypass (mCPB, mini-CPB)
- minimal invasive cardiopulmonary bypass (MICPB)
- miniaturized cardiopulmonary bypass (MCPB)
- venoarterial extracorporeal membrane oxygenation
- minimized perfusion circuit
- minimized extracorporeal life support system
- minimized cardiopulmonary bypass
- minimal invasive extracorporeal circulation



not mini



MINIMAL INVASIVE



MiECC

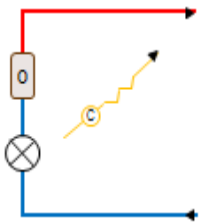
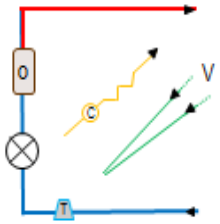
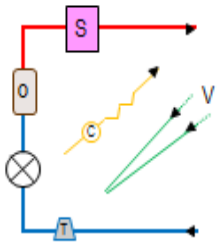
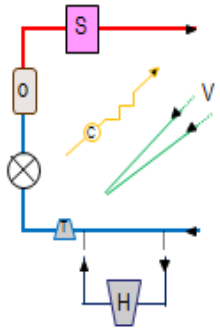
from chaos… to order

MiECTiS

In order to be characterized as MiECC

- the main components of the system must include:
  - a closed CPB circuit
  - biologically inert blood contact surfaces
  - reduced priming volume
  - a centrifugal pump
  - a membrane oxygenator
  - a heat exchanger
  - a cardioplegia system
  - a venous bubble trap / venous air removing device
  - a shed blood management system
- additional components to be integrated into system are:
  - pulmonary artery vent
  - aortic root vent
  - pulmonary vein vent
  - soft bag / soft-shell reservoir
  - hard-shell reservoir (modular systems)
  - regulated smart suction device
  - arterial line filtration

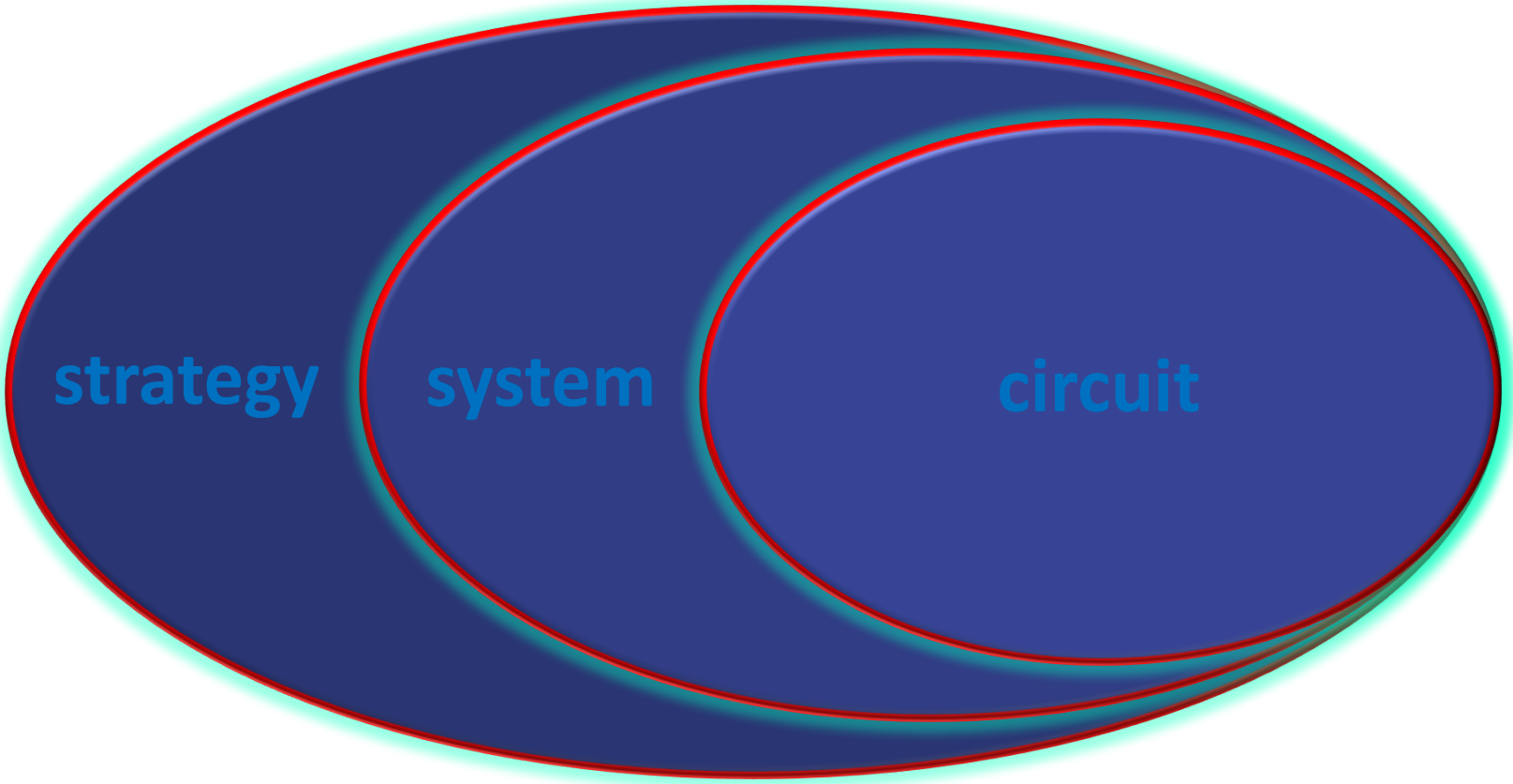
MiECC

type I		standard	This closed circuit comprises of an afferent tube (blue line) which drains blood from the right atrium to the pump (⊗), then to the oxygenator (O) and returns it to the arterial circulation with the efferent tube (red line). The oblique arrow indicates cardiopledgia line with its pump (©).
type II		air handling	A venous bubble trap/air removing device (T)is added to the standard MiECC circuit so as to facilitate air handling and avoid air entrainment to the venous line. Venting (green) lines (V) drain blood from the aortic root and/or pulmonary artery/vein.
type III		volume management	A soft shell reservoir (S) is added to the circuit to collect blood volume from the patient and return it back during perfusion according to the needs.
type IV		blood management	A hard shell reservoir (H) is added as an extra component integrated to the venous line, so as to convert the system to an open circuit that could facilitate blood management as well as overcome any other intraoperative issue (modular configuration).

Anastasiadis et al; Perfusion 2015;30:195-200.

MiECC

PROCEDURE



MiECTiS advocates this **strategy** to obtain the maximal benefits from this technology

UHN Toronto General Hospital

MiECTiS Minimal Invasive Extracorporeal Technologies International Society

Expert Consensus Meeting, Bern, December 2014

MiECC represents a strategy and not just a circuit.

For this reason a teamwork approach is mandatory for obtaining maximum clinical benefit.

UHN Toronto General Hospital

Minimal invasive ExtraCorporeal Circulation

MiECC

evidence

Use of minimal invasive extracorporeal circulation in cardiac surgery: principles, definitions and potential benefits. A position paper from the Minimal invasive Extra-Corporeal Technologies international Society (MiECTiS)

Kyriakos Anastasiadis[a], John Murkin[b], Polychronis Antonitsis[a], Adrian Bauer[c], Marco Ranucci[d], Erich Gygax[e], Jan Schaarschmidt[c], Yves Fromes[f], Alois Philipp[g], Balthasar Eberle[h], Prakash Punjabi[i], Helena Argiriadou[a], Alexander Kadner[e], Hansjoerg Jenni[e], Guenter Albrecht[j], Wim van Boven[k], Andreas Liebold[j], Fillip de Somer[l], Harald Hausmann[c], Apostolos Deliopoulos[a], Aschraf El-Essawi[m], Valerio Mazzei[n], Fausto Biancari[o], Adam Fernandez[p], Patrick Weerwind[q], Thomas Puehler[r], Cyril Serrick[s], Frans Waanders[t], Serdar Gunaydin[u], Sunil Ohri[v], Jan Gummert[r], Gianni Angelini[i,w], Volkmar Falk[x] and Thierry Carrel[e,*]

Recommendation	Level of evidence
Class I	
MiECC systems reduce haemodilution and better preserve haematocrit as well as reduce postoperative bleeding and the need for RBC transfusion	A
MiECC systems reduce the incidence of postoperative atrial fibrillation	A
MiECC systems preserve renal function	A
MiECC is associated with improved myocardial protection	A
Class IIA	
Inflammatory response assessed by specific inflammatory markers is attenuated with use of MiECC	B
MiECC systems can reduce cerebral gaseous microembolism and preserve neurocognitive function	B
MiECC exerts a subclinical protective effect on end-organ function (lung, liver, intestine) which is related to enhanced recovery of microvascular organ perfusion	B
Class IIB	
Within a MiECC strategy, less thrombin generation may permit reduced heparin dose targeted to shorter ACT times. When such a strategy is followed, individual heparin dose should be determined using heparin dose–response monitoring systems	B
MiECC appears to offer survival benefit in terms of lower 30-day mortality after CABG procedures	B
The use of short-acting opioids in combination with propofol or volatile anaesthetics, and hypnotic effect monitoring by processed EEG, is recommended for induction and maintenance of anaesthesia for MiECC-based surgery. TOE findings pertinent to institutional management of MiECC should be communicated during the preoperative surgical safety time out	C

Use of minimal invasive extracorporeal circulation in cardiac surgery: principles, definitions and potential benefits. A position paper from the Minimal invasive Extra-Corporeal Technologies international Society (MiECTiS)

Kyriakos Anastasiadis[a], John Murkin[b], Polychronis Antonitsis[a], Adrian Bauer[c], Marco Ranucci[d], Erich Gygax[e], Jan Schaarschmidt[c], Yves Fromes[f], Alois Philipp[g], Balthasar Eberle[h], Prakash Punjabi[i], Helena Argiriadou[a], Alexander Kadner[e], Hansjoerg Jenni[e], Guenter Albrecht[j], Wim van Boven[k], Andreas Liebold[j], Fillip de Somer[l], Harald Hausmann[c], Apostolos Deliopoulos[a], Aschraf El-Essawi[m], Valerio Mazzei[n], Fausto Biancari[o], Adam Fernandez[p], Patrick Weerwind[q], Thomas Puehler[r], Cyril Serrick[s], Frans Waanders[t], Serdar Gunaydin[u], Sunil Ohri[v], Jan Gummert[r], Gianni Angelini[i,w], Volkmar Falk[x] and Thierry Carrel[e,*]

Recommendation	Level of evidence
Class I	
MiECC systems reduce haemodilution and better preserve haematocrit as well as reduce postoperative bleeding and the need for RBC transfusion	A
MiECC systems reduce the incidence of postoperative atrial fibrillation	A
MiECC systems preserve renal function	A
MiECC is associated with improved myocardial protection	A
Class IIA	
Inflammatory response assessed by specific inflammatory markers is attenuated with use of MiECC	B
MiECC systems can reduce cerebral gaseous microembolism and preserve neurocognitive function	B
MiECC exerts a subclinical protective effect on end-organ function (lung, liver, intestine) which is related to enhanced recovery of microvascular organ perfusion	B
Class IIB	
Within a MiECC strategy, less thrombin generation may permit reduced heparin dose targeted to shorter ACT times. When such a strategy is followed, individual heparin dose should be determined using heparin dose–response monitoring systems	B
MiECC appears to offer survival benefit in terms of lower 30-day mortality after CABG procedures	B
The use of short-acting opioids in combination with propofol or volatile anaesthetics, and hypnotic effect monitoring by processed EEG, is recommended for induction and maintenance of anaesthesia for MiECC-based surgery. TOE findings pertinent to institutional management of MiECC should be communicated during the preoperative surgical safety time out	C

Minimal invasive ExtraCorporeal Circulation

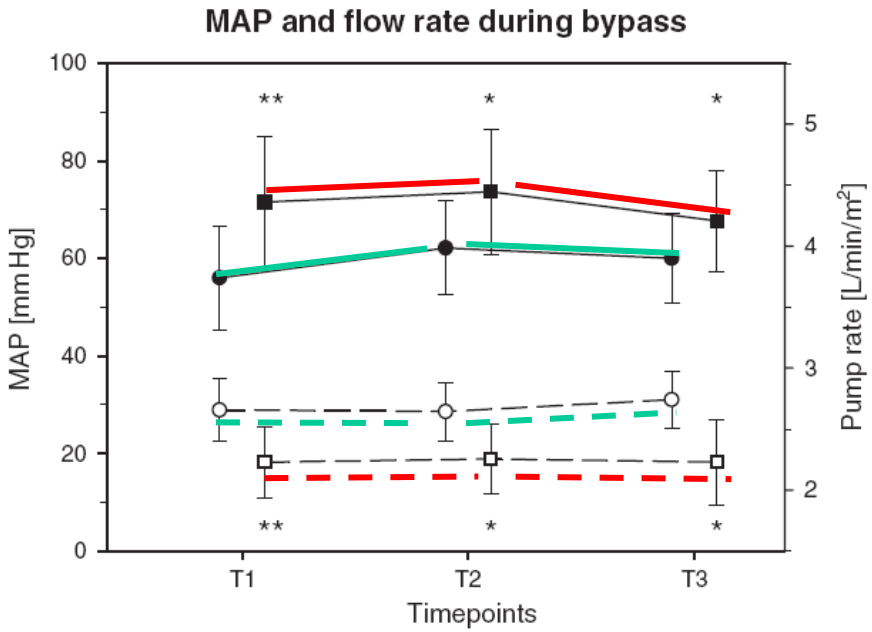
MiECC

rationale

Artificial Organs
28(12):1082–1088, Blackwell Publishing, Inc.

Four Years' Experience With a Miniaturized Extracorporeal Circulation System and Its Influence on Clinical Outcome

*Christoph Wiesenack, †Andreas Liebold, ‡Alois Philipp, *Markus Ritzka, *Joachim Koppenberg, ‡Dietrich E. Birnbaum, and §Cornelius Keyl



cCPB

MiECC

*$p <$ 0.05

T1 = following cardioplegia
T2 = in the middle of bypass time
T3 = end of aortic cross clamping time

UHN Toronto General Hospital

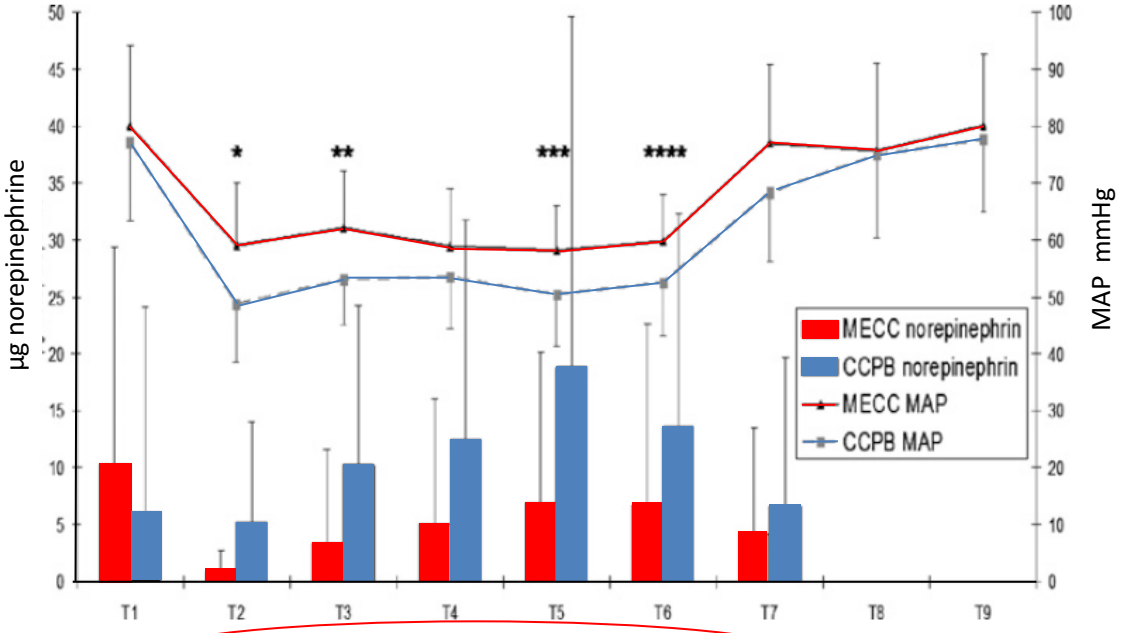
JECT. 2010;42:30–39
The Journal of ExtraCorporeal Technology

Original Articles

Evaluation of Hemodynamic and Regional Tissue Perfusion Effects of Minimized Extracorporeal Circulation (MECC®)

Adrian Bauer, ECCP, MCVT;* Claudius Diez, MD, PhD;† Jens Schubel, MD, PhD;‡
Nagi El-Shouki, MD, PhD;‡ Dietrich Metz, MD;‡ T. Eberle, MD, PhD;§ Harald Hausmann, MD, PhD‡

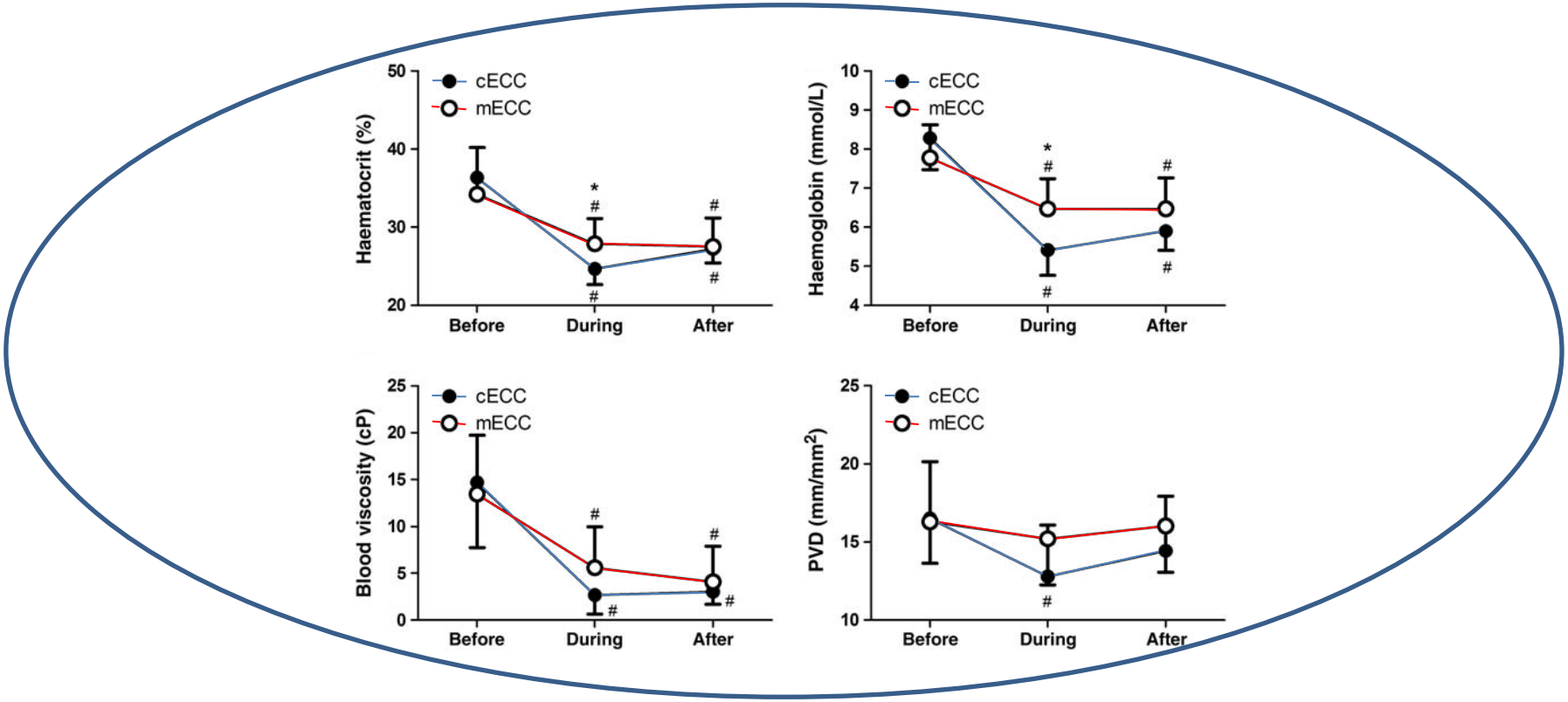
*Department of Cardiovascular Technology, MediClin Heart Centre Coswig, Sachsen Anhalt, Germany;
†Department of Cardiothoracic and Vascular Surgery, University Hospital of Regensburg, Regensburg, Germany;
‡Department of Cardiovascular Surgery, MediClin Heart Centre Coswig, Sachsen Anhalt, Germany; and
§Department of Cardio - Anesthesiology, MediClin Heart Centre Coswig, Sachsen Anhalt, Germany



MAP and norepinephrine consumption. Data are shown as mean ± SD (*p = .002; **p = .01; ***p = .015; ****p = .021). T1: preCPB; T2: after start of CPB; T3: after cardioplegia; T4: 15 minutes after cardioplegia; T5: after X-clamp opening; T6: before termination of CPB; T7: 15 minutes after CPB; T8: 1 hour after CPB; T9: 4 hours after CPB.

The effects of conventional extracorporeal circulation versus miniaturized extracorporeal circulation on microcirculation during cardiopulmonary bypass-assisted coronary artery bypass graft surgery

Koray Yuruk[a,b], Rick Bezemer[a,*], Mariska Euser[a], Dan M.J. Milstein[a], Hilde H.R. de Geus[c], Evert W. Scholten[b], Bas A.J.M. de Mol[b] and Can Ince[a]

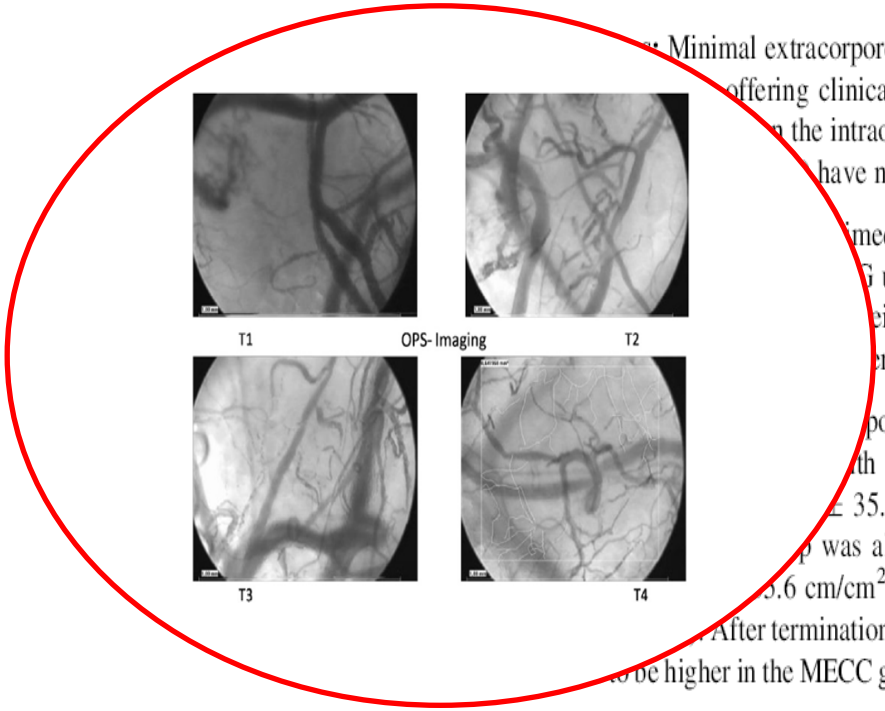


CONCLUSIONS: The results from this relatively small study suggest that the use of the miniaturized extracorporeal circulation system is associated with a statistically significant (but clinically insignificant) reduction in haemodilution and microcirculatory hypoperfusion compared with the use of the conventional extracorporeal circulation system.

Interactive CardioVascular and Thoracic Surgery 15 (2012) 364–370

Comparing microvascular alterations during minimal extracorporeal circulation and conventional cardiopulmonary bypass in coronary artery bypass graft surgery: A prospective, randomized study

Peter Donndorf, MD,[a] Franziska Kühn, MD,[a] Brigitte Vollmar, MD, PhD,[b] Jan Rösner, MD, PhD,[c] Andreas Liebold, MD, PhD,[d] Philipp Gierer, MD, PhD,[e] Gustav Steinhoff, MD, PhD,[a] and Alexander Kaminski, MD, PhD[a]



: Minimal extracorporeal circulation (MECC) has been introduced in coronary artery bypass graft offering clinical benefits owing to reduced hemodilution and no blood–air interface. Yet, the intraoperative microvascular perfusion in comparison with conventional extracor- have not been studied so far.

med to analyze alterations in microvascular perfusion at 4 predefined time points G using orthogonal polarization spectral imaging. Forty patients were random- either MECC or CECC. Changes in functional capillary density (FCD), blood r were analyzed by a blinded investigator.

poreal circulation (ECC) and aortic crossclamping (T2), both groups showed th a significantly higher FCD in the MECC group (206.8 ± 33.6 cm/cm^2 in ± 35.3 cm/cm^2 in MECC group; $P = .034$). In the late phase of the ECC (T3), was already recovered, whereas FCD in the CECC group was still significantly .6 cm/cm^2 in MECC group; $P = .100$ vs T1; 211.1 ± 36.9 cm/cm^2 in CECC group; After termination of ECC (T4), FCD recovered in both groups to baseline. Blood flow velocity be higher in the MECC group, with a significant intergroup difference after aortic crossclamping (T2).

Conclusions: Orthogonal polarization spectral imaging data reveal an impairment of microvascular perfusion during on-pump CABG. Changes in FCD indicate a faster recovery of the microvascular perfusion in MECC during the reperfusion period. Beneficial recovery of microvascular organ perfusion could partly explain the perioperative advantages reported for MECC.

J Thorac Cardiovasc Surg 2012;144:677-683.