



2018

*Федеральный центр высоких
медицинских технологий*

Минздрава России г. Калининград



Использование малоинвазивного искусственного кровообращения в комплексном подходе кровосбережения

ФГБУ ФЦВМТ МЗ РФ г. Калининград

Макаров А. А., Звягин Р. Ю., Несын В. В., Червяков И. В., Шнейдер Ю. А.

Калининград, 2018

Определение

- miniaturized extraorporeal circulation (МЕСС)
- mini extraorporeal circulation (mЕСС)
- 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



не мини



МИНИМАЛЬНО
ИНВАЗИВНОЕ



МИЕСС/МИЭКЦ

Классификация МІЕСС контуров

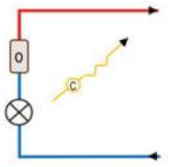
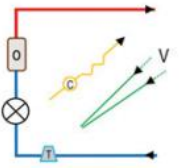
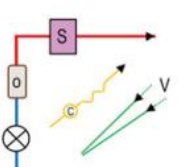
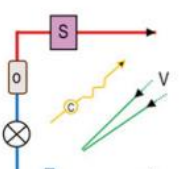
<p>Type I</p>		<p>Standard</p>	<p>This closed circuit comprises of an afferent tube (blue line) which drains blood from the right atrium to the pump (X), then to the oxygenator (O) and returns it to the arterial circulation with the efferent tube (red line). The oblique arrow indicates cardioplegia line with its pump (C).</p>
<p>Type II</p>		<p>Air handling</p>	<p>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.</p>
<p>Type III</p>		<p>Volume management</p>	<p>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.</p>
<p>Type IV</p>		<p>Blood management</p>	<p>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).</p>

Figure 1: Classification of MiECC circuits [12]. [Note that the modular type IV circuit is literally type III with a standing-by component, used only when necessary] (X: pump; O: oxygenator; C: cardioplegia; T: bubble trap/air-removing device; V: vent (aortic/pulmonary); S: soft-bag/reservoir; H: hard-shell/reservoir). MiECC: minimal invasive extracorporeal circulation.

СРВ

- Расчетная доза гепарина- 300 Ед/кг
- Целевое ABC- не менее 480 с
- Наличие резервуара
- Перфузионный индекс 2,4 л/мин/м²
- Роликовый насос
- Объем заполнения 1200-1600 мл

МІЕСС

- Расчетная доза гепарина- 150 Ед/кг
- Целевое ABC- не менее 350 с
- Объем контролирует перфузиолог
- Перфузионный индекс 2,0 л/мин/м²
- Центрифужный насос
- Объем заполнения 600 мл

Cite this article as: Anastasiadis K, Murkin J, Antonitsis P, Bauer A, Ranucci M, Gyga 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;22:647–62.

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 Gyga^e, Jan Schaarschmidt^c, Yves Fromes^f, Alois Philipp^g, Balthasar Eberle^h, Prakash Punjabiⁱ, Helena Argiriadou^a,

Использование минимально-инвазивного экстракорпорального кровообращения в кардиохирургии: принципы, определения и потенциальные выгоды. Позиционный документ международного общества минимально инвазивных экстракорпоральных технологий

- 35 авторов
- 24 КЛИНИКИ



Anastasiadis K, Murkin J, Antonitsis P, Bauer A, Ranucci M, Gygax E *et al.* Use of minimal invasive extracorporeal circulation in cardiac surgery: principles and potential benefits. A position paper from the Minimal invasive Extra-Corporeal Technologies international Society (MiECTiS). *Interact Cardiovasc Thorac Surg* 2016;22:647–62.

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^e, Yves Fromes^f, Alois Philipp^g, Balthasar Eberle^h, Prakash Punjabiⁱ, Helena Argiriadou^a,

STATE-OF-THE-ART
Downloaded from

References

Class I

MiECC systems reduce haemodilution and better preserve haematocrit as well as reduce postoperative bleeding and the need for RBC transfusion	A	[17, 19, 20]
MiECC systems reduce the incidence of postoperative atrial fibrillation	A	[13, 16, 19, 20]
MiECC systems preserve renal function	A	[20, 39]
MiECC is associated with improved myocardial protection	A	[20, 43–45]

Class IIA

Inflammatory response assessed by specific inflammatory markers is attenuated with use of MiECC	B	[23–26]
MiECC systems can reduce cerebral gaseous microembolism and preserve neurocognitive function	B	[20, 29–33]
MiECC exerts a subclinical protective effect on end-organ function (lung, liver, intestine) which is related to enhanced recovery of microvascular organ perfusion	B	[39, 46–48]

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	[14, 15, 56, 57]
MiECC appears to offer survival benefit in terms of lower 30-day mortality after CABG procedures	B	[20, 49, 50, 51]
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	[16, 58–61]



Enhanced Recovery After Elective Coronary Revascularization Surgery With Minimal Versus Conventional Extracorporeal Circulation: A Prospective Randomized Study

Kyriakos Anastasiadis, MD, FETCS, Christos Asteriou, MD, Polychronis Antonitsis, MD, Helena Argiriadou, MD, Vassilios Grosomanidis, MD, Magdalena Kyparissa, MD, Apostolos Deliopoulos, ECCP, Dimitrios Konstantinou, MD, and Paschalis Tossios, MD

Objective: A minimal extracorporeal circulation (MECC) circuit integrates the advances in cardiopulmonary bypass (CPB) technology into a single circuit and is associated with improved short-term outcome. The aim of this study was to prospectively evaluate MECC compared with conventional CPB in facilitating fast-track recovery after elective coronary

Interventions: Group A included patients who were operated on using the MECC circuit, whereas patients in Group B underwent surgery on conventional CPB.

Measurements and Main Results: Incidence of fast-track recovery was significantly higher in patients undergoing MECC (25% v 6.7%, $p = 0.006$). MECC also was recognized as a strong

Улучшенное восстановление после коронарной хирургии с минимальной и обычной экстракорпоральная циркуляция: проспективное рандомизированное исследование

Number of bypass grafts	2.9 ± 0.7	3.1 ± 0.9	0.26
Cardiopulmonary bypass time (min)	102.9 ± 25.4	124.9 ± 33	<0.001
Aortic cross-clamp time (min)	65.2 ± 17.6	70.9 ± 16	0.07
Cardiac recovery unit stay (d)	2 ± 0.6	2.3 ± 0.7	0.02
In-hospital stay (d)	10.8 ± 2.6	11.5 ± 2.8	0.13
Mechanical ventilation (h)	11.6 ± 5.5	16.6 ± 5.1	<0.001
Chest tube drainage (mL)	731.7 ± 238.2	739 ± 323.6	0.89
Intraoperative blood transfusion (units)	0.5 ± 0.7	1.5 ± 1.1	<0.001
Postoperative blood transfusion (units)	2 ± 1.7	3 ± 2.4	0.009
Need for IABP (%)	2 (3.3)	5 (8.3)	0.03
Duration of inotropic support (h)	20.4 ± 5.4	35.2 ± 6.3	<0.001
Stroke (%)	2 (3.3)	3 (5)	0.4
Acute kidney injury (%)	1 (1.7)	5 (8.3)	0.02
Postoperative atrial fibrillation (%)	20 (33.3)	32 (53.3)	0.03

Cite this article as: Anastasiadis K, Antonitsis P, Kostarellou G, Kleontas A, Deliopoulos A, Grosomanidis V *et al.* Minimally invasive extracorporeal circulation improves quality of life after coronary artery bypass grafting. *Eur J Cardiothorac Surg* 2016; doi:10.1093/ejcts/ezw210.

Minimally invasive extracorporeal circulation improves quality of life after coronary artery bypass grafting

Kyriakos Anastasiadis, Polychronis Antonitsis*, Georgia Kostarellou, Athanassios Kleontas, Apostolos Deliopoulos, Vassilios Grosomanidis and Helena Argiriadou

Cardiothoracic Department, AHEPA University Hospital, Thessaloniki, Greece

* Corresponding author. Cardiothoracic Department, AHEPA University Hospital, S. Kyriakidi 1, 54636 Thessaloniki, Greece. Tel: +30-2310-994845; fax: +30-2310-994814; e-mail: antonits@auth.gr; antonits@otenet.gr (P. Antonitsis).

Received 27 December 2015; received in revised form 2 May 2016; accepted 8 May 2016

Table 2: Operative and postoperative characteristics

Parameter	MI-ECC (n = 30)	cCPB (n = 30)	P-value
CPB time (min)	86.8 ± 45.1	96.6 ± 25.2	0.7
Cross-clamp time (min)	55.2 ± 29.6	61.2 ± 14.3	0.6
Number of grafts	3.2 ± 0.9	3 ± 0.8	0.9
RBC transfusion (units)	2.1 ± 2.2	3.1 ± 2.9	0.3
Haematocrit post-CPB (%)	30.4 ± 3.8	24.9 ± 3.9	<0.001
Mechanical ventilation (h)	5.8 ± 4.1	8.9 ± 6.7	0.3
ICU stay (days)	2.3 ± 0.4	2.6 ± 0.7	0.2
Hospital stay (days)	7.8 ± 1.1	8.1 ± 1.8	0.5
Major adverse events			0.2
Acute renal failure	1 (3%)	2 (7%)	
Mortality	0	1 (3%)	

- Минимально инвазивное экстракорпоральное кровообращение улучшает качество жизни после шунтирования коронарной артерии

Опросник SF-36

Established in 1871

Swiss Medical Weekly

Formerly: Schweizerische Medizinische Wochenschrift

An open access, online journal • www.smw.ch

Original article | Published 10 July 2017 | doi:10.4414/smw.2017.14474

Cite this as: Swiss Med Wkly. 2017;147:w14474

Minimally invasive extracorporeal circulation: excellent outcome and life expectancy after coronary artery bypass grafting surgery

Winkler Bernhard^a, Heinisch Paul Philipp^a, Zuk Grzegorz^a, Zuk Katarzyna^a, Gahl Brigitta^a, Jenni Hans Jörg^a, Kadner Alexander^a, Huber Christoph^b, Carrel Thierry^a

^a Department of Cardiovascular Surgery, Inselspital, University of Bern, Switzerland

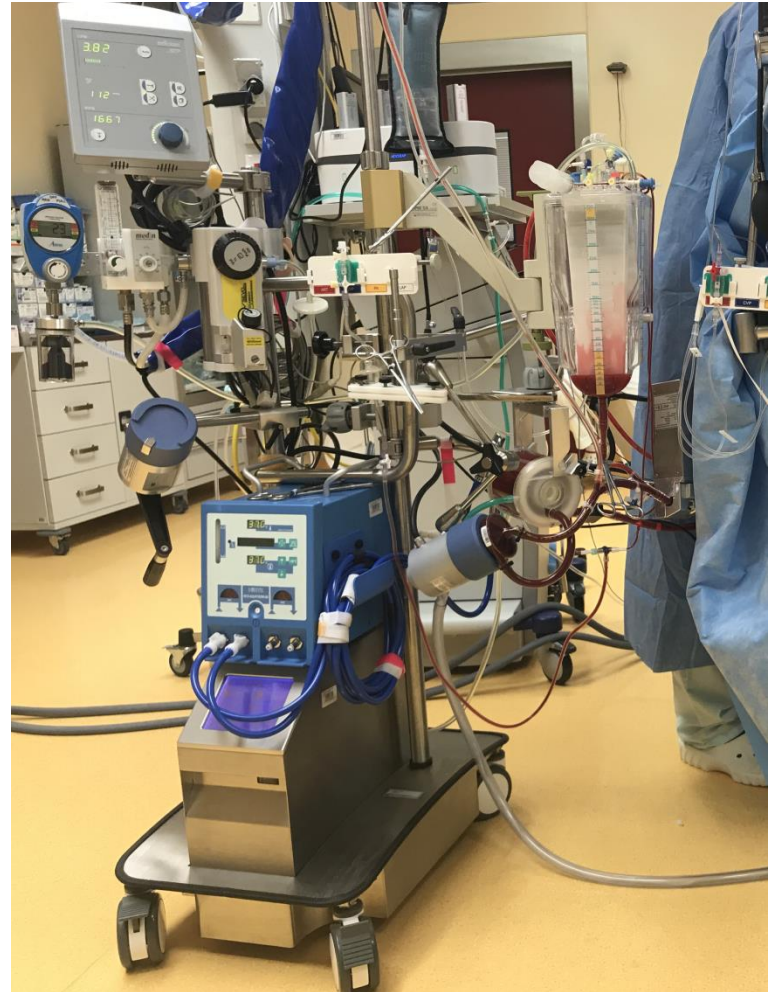
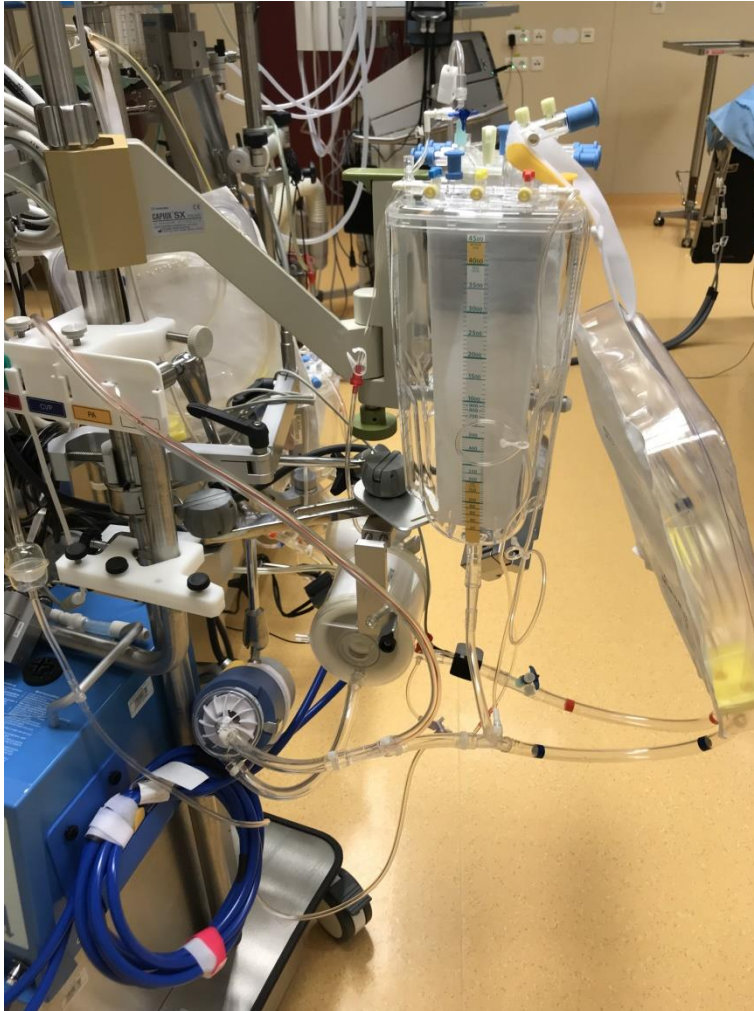
^b Department of Cardiac and Vascular Surgery, HUG, University of Geneva, Switzerland

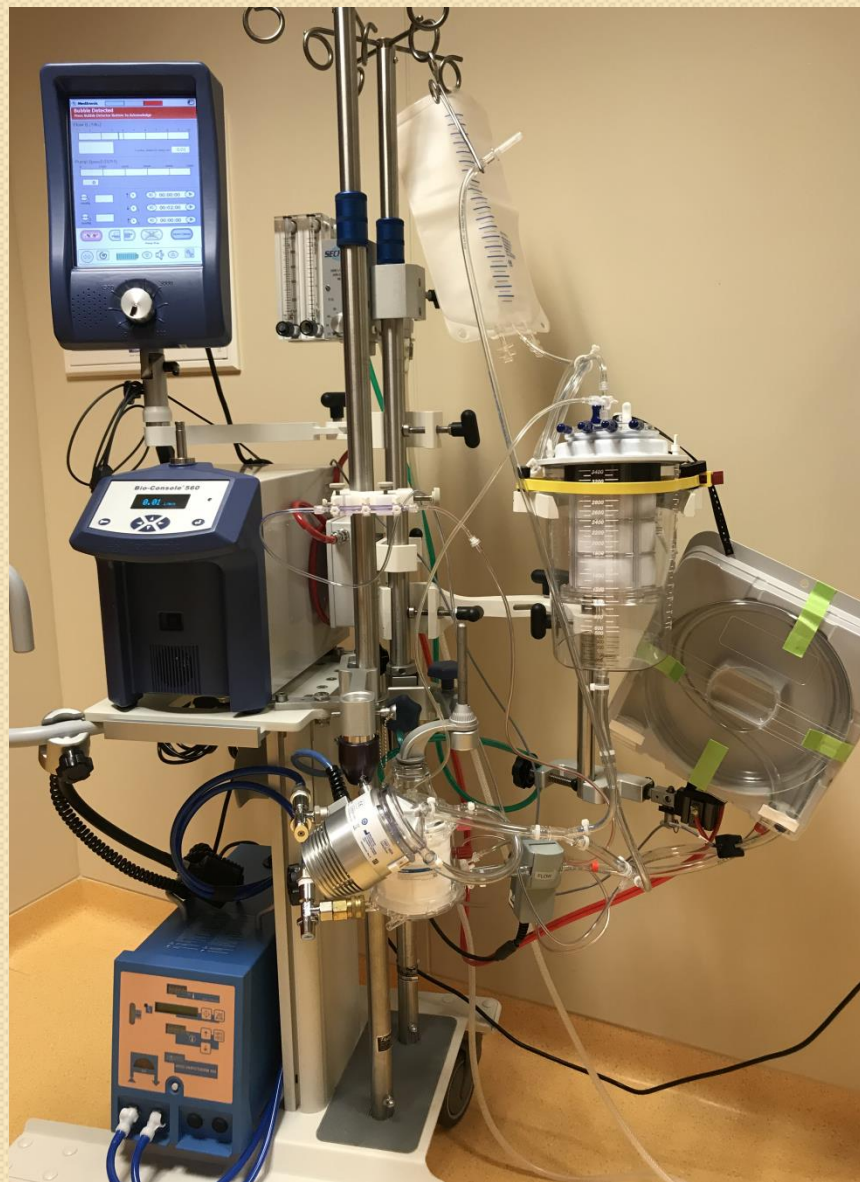
N=2130

MiECC показывает очень многообещающие результаты в нашей группе пациентов. Таким образом, мы считаем, что MiECC следует использовать в каждом случае АКШ, когда это технически выполнимо.



ФЦВМТ
ФГБУ «Федеральный центр высоких медицинских технологий»
Минздрава России г. Калининград





Динамика обучения

- Май-декабрь 2017 год- 8 пациентов
- 2018 год- 36 пациентов
- 2 перфузиолога
- 2 хирурга

- 72 пациента
- Группа МІЕСС n=36
- Группа СРВ =36
- Интраоперационный аутозабор крови
40-800 мл
- Ретроградное заполнение по аортальной
магистрале МІЕСС 600→300 мл
СРВ 1400→1100 мл

	МИЕСС	СРВ
Количество	n=36	n=36
Возраст, лет	67,3±5	66,6±5
Мужчины/женщины	25/11	20/16
ФВ, %	46±5	49±6
Время ИК, мин	61±14	71±9
Время ишемии	45±9	49±12

	МИЕСС	СРВ
Нв до операции, г/л	114±15	125±18
Нт до операции, г/л	36±5	37±3
Min Нв на ИК, г/л	88±12	71±5
Min Нт на ИК	27±5	23±3
Min Нв в ОАР , г/л	101±14	91±9
Нв при переводе из ОАР, г/л	111±15	101±12
Проведение гемотрансфузии	0	7



ФЦВМТ
ФГБУ «Федеральный центр высоких медицинских технологий»
Минздрава России г. Калининград

		МІЕСС	СРВ
	Мах лактат на ИК	1,5±0,3	1,7±0,7
Нв до опер	Мах лактат на конец операции	1,89±0,6	1,94±0,4
Нт до опер			
Min Нв на ИК, г/л	88±12	71±5	
Min Нт на ИК	27±5	23±3	
Min Нв в ОАР, г/л	101±14	91±9	
Нв при переводе из ОАР, г/л	111±15	108±12	
Проведение гемотрансфузии	0	7	

		МИЕСС		СРВ	
Hb до операции	Мах лактат на ИК	1,5±0,3		1,7±0,7	
	Мах лактат на конец операции	1,89±0,6		1,94±0,4	
Min Hb на ИК, г/л	88±12	71±5			
Min Ht на ИК	37±5	32±3			

		МИЕСС		СРВ	
Время ИВЛ, ч		5,7±2		8,3±3	
Применение инотропных препаратов, n		0		6	
гемотрансфузии					

Выводы

- Применение миниконтура возможно и нужно применять, как один из методов кровосбережения в кардиохирургии
- MiECC представляет собой стратегию, а не только схему.
- По этой причине подход к совместной работе является обязательным для получения максимального клинического эффекта.