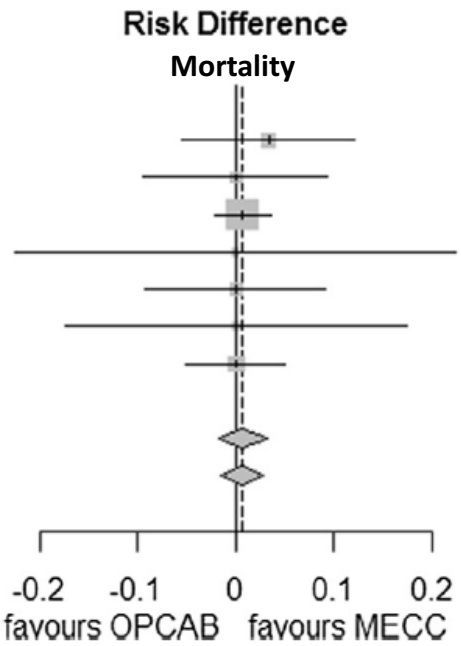
Minimal invasive ExtraCorporeal Circulation

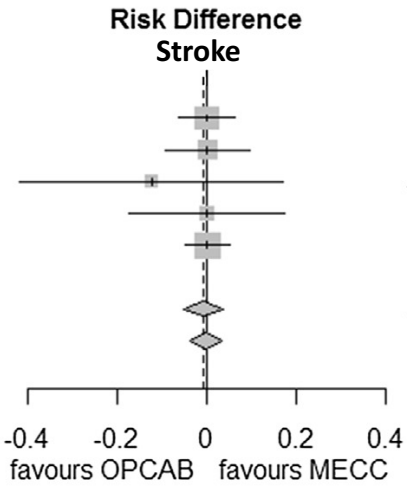
MiECC

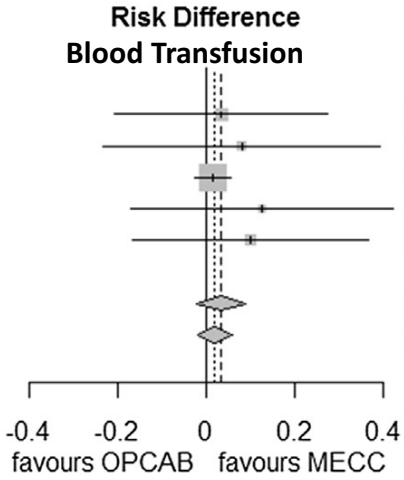
studies

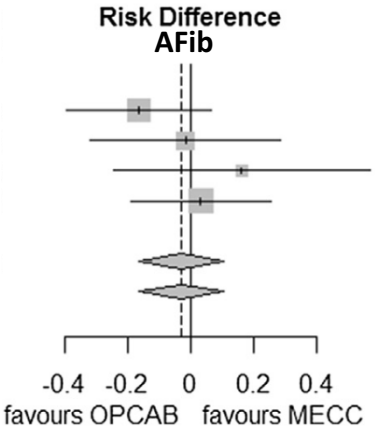
Miniaturized extracorporeal circulation versus off-pump coronary artery bypass grafting: A meta-analysis of randomized controlled trials

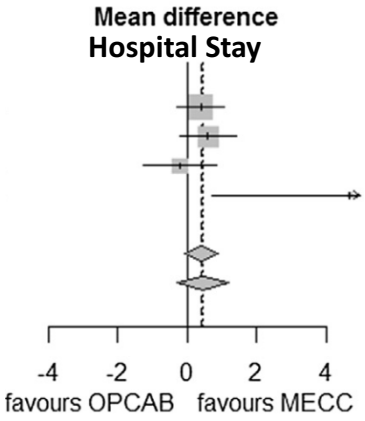
Umberto Benedetto [a,*], Colin Ng [a], Giacomo Frati [b,c], Giuseppe Biondi-Zoccai [b], Piergiusto Vitulli [b], Mohamed Zeinah [d], Shahzad G. Raja [a], on behalf of the Cardiac Outcomes METa-analysis (COMET) group





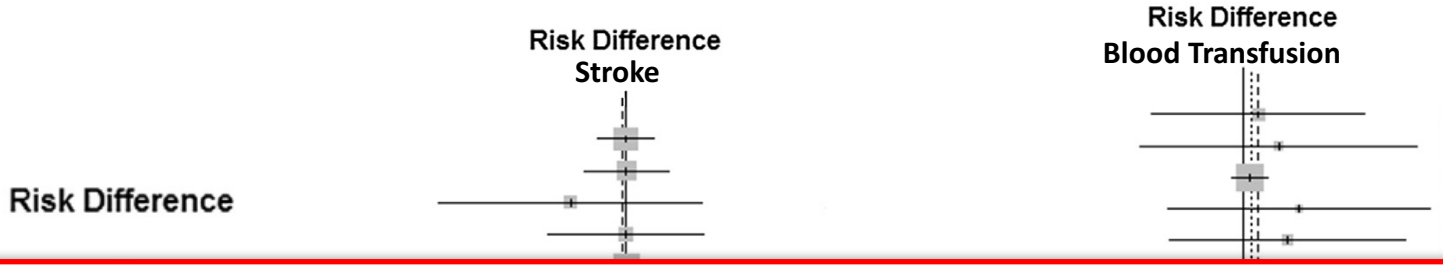




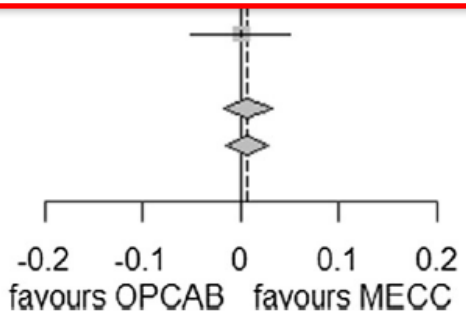


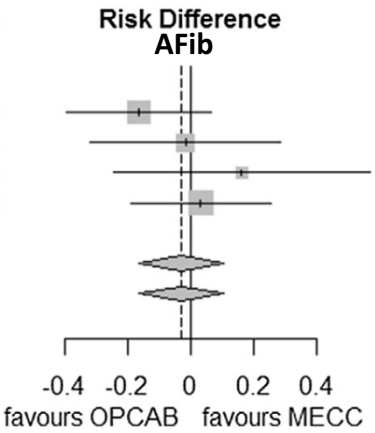
Miniaturized extracorporeal circulation versus off-pump coronary artery bypass grafting: A meta-analysis of randomized controlled trials

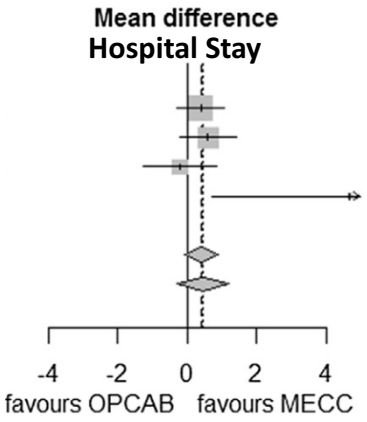
Umberto Benedetto [a,*], Colin Ng [a], Giacomo Frati [b,c], Giuseppe Biondi-Zoccai [b], Piergiusto Vitulli [b], Mohamed Zeinah [d], Shahzad G. Raja [a], on behalf of the Cardiac Outcomes METa-analysis (COMET) group



Conclusions: Using a meta-analytic approach, MECC achieves clinical results comparable to OPCAB including postoperative blood loss and blood transfusion requirement. On the basis of our findings, MECC should be considered as a valid alternative to OPCAB







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ORIGINAL ARTICLE

ADULT CARDIAC

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Safety and efficacy of miniaturized extracorporeal circulation when compared with off-pump and conventional coronary artery bypass grafting: evidence synthesis from a comprehensive Bayesian-framework network meta-analysis of 134 randomized controlled trials involving 22 778 patients

Mariusz Kowalewski[a,b,*], Wojciech Pawliszak[a], Giuseppe Maria Raffa[c], Pietro Giorgio Malvindi[d], Magdalena Ewa Kowalkowska[e], Katarzyna Zaborowska[a], Janusz Kowalewski[f], Giuseppe Tarelli[g], David Paul Taggart[h] and Lech Anisimowicz[a]

Outcome	MECC	OPCAB	CECC
All-cause mortality	1.20 (0.55–2.48)	1.94 (1.25–2.75)	2.59 (2.10–3.16)
Myocardial infarction	2.16 (0.54–7.27)	4.56 (3.18–6.42)	5.29 (4.59–6.05)
Cerebral stroke	0.65 (0.30–1.33)	0.92 (0.53–1.42)	1.24 (1.16–2.05)
Postoperative AF	12.82 (7.63–20.62)	13.55 (10.14–17.89)	17.66 (16.16–20.71)
Renal dysfunction	0.83 (0.40–1.64)	1.21 (0.76	75 (1.35–2.21)

? ???
Dominant Technique!

MiECC offers the potential for complete revascularization, whereas OPCAB pos ons

CONCLUSIONS: MECC and OPCAB both improve perioperative outcomes following coronary b s surgery when compared with conventional CABG performed with extracorporeal circulation. MECC may represent an attractive compromise between OPCAB and CECC.

Use of minimal extracorporeal circulation improves outcome after heart surgery; a systematic review and meta-analysis of randomized controlled trials

Kyriakos Anastasiadis [a], Polychronis Antonitsis [a,*], Anna-Bettina Haidich [b], Helena Argiriadou [a], Apostolos Deliopoulos [a], Christos Papakonstantinou [a]

Author	Year	Procedure	MECC	Control
Anastasiadis [62]	2010	CABG	50	49
Bauer [63]	2010	CABG	18	22
El-Essawi [64]	2010	CABG ± AVR / AVR	146	145
Gunaydin [65]	2009	CABG	20	20
Kutschka [66]	2009	CABG ± AVR/ aortic root	85	85
Castiglioni [67]	2009	AVR	60	60
Sakwa [68]	2009	CABG	102	97
Camboni [69]	2009	CABG	50	40
Formica [70]	2009	CABG	30	30
Ohata [71]	2008	CABG	34	64
Schöttler [72]	2008	CABG	30	30
Kofidis [73]	2008	CABG	50	30
Mazzei [74]	2007	CABG	150	150
Valtonen [75]	2007	CABG	20	20
Huybregts [76]	2007	CABG	25	24
Perthel [77]	2007	CABG	30	30
Skrabal [78]	2007	CABG	30	30
Beghi [79]	2006	CABG	30	30
Bical [80]	2006	AVR	20	20
Remadi [81]	2006	CABG	200	200
Abdel-Rahman [82]	2005	CABG	101	103
Remadi [83]	2004	AVR	50	50
Fromes [84]	2002	CABG	30	30
Abdel Aal [85]	2010	CABG	40	40
Ovcina [86]	2009	CABG	144	144
Zeitani [87]	2009	CABG	20	20

- mortality
- Ht
- PLT
- blood loss
- transfusion
- PMI
- myocardial protection
- inotropic support
- ARF
- arrhythmias
- mechanical ventilation
- ICU stay

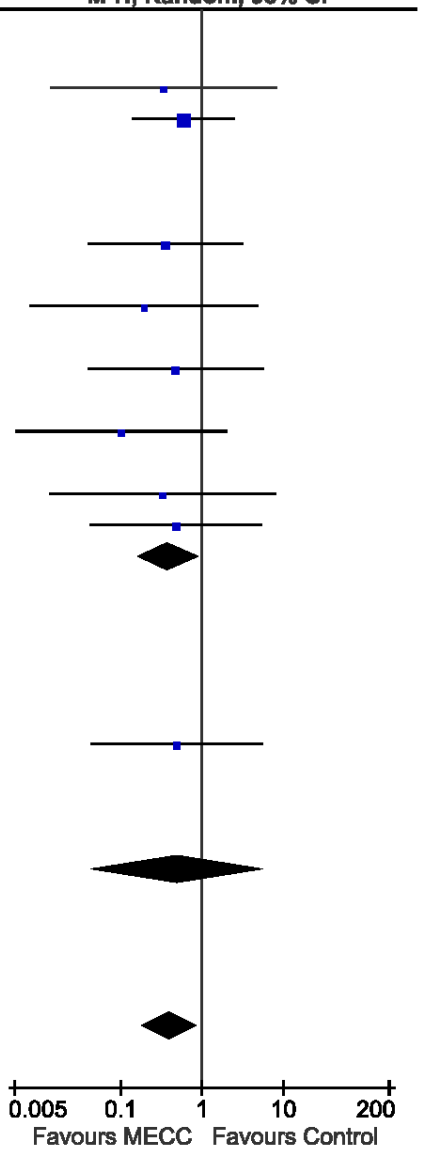
Conclusions: Use of MECC in heart surgery resulted in improved short-term outcome as reflected by reduced mortality and morbidity compared with conventional extracorporeal circulation.

1387 1383 patients

Int J Cardiol 2013;164:158-69.

OVERALL MORTALITY

Study or Subgroup	MECC Events	MECC Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
1.12.1 CABG							
Fromes 2002	0	30	0	30		Not estimable	2002
Abdel-Rahman 2005	0	101	1	103	6.1%	0.34 [0.01, 8.36]	2005
Remadi 2006	3	200	5	200	30.1%	0.59 [0.14, 2.52]	2006
Beghi 2006	0	30	0	30		Not estimable	2006
Skrabal 2007	0	30	0	30		Not estimable	2007
Huybregts 2007	0	25	0	24		Not estimable	2007
Ohata 2008	1	34	5	64	13.1%	0.36 [0.04, 3.19]	2008
Schottler 2008	0	30	0	30		Not estimable	2008
Kofidis 2008	0	50	1	30	6.0%	0.19 [0.01, 4.94]	2008
Ovcina I 2009	0	144	0	144		Not estimable	2009
Gunaydin 2009	1	20	2	20	10.2%	0.47 [0.04, 5.69]	2009
Sakwa 2009	0	102	0	97		Not estimable	2009
Camboni 2009	0	52	3	40	7.0%	0.10 [0.01, 2.03]	2009
Bauer 2010	0	18	0	22		Not estimable	2010
El-Essawi 2010	0	146	1	145	6.1%	0.33 [0.01, 8.14]	2010
Anastasiadis 2010	1	50	2	49	10.6%	0.48 [0.04, 5.47]	2010
Subtotal (95% CI)		**1062**		**1058**	**89.4%**	**0.39 [0.17, 0.90]**	
Total events	6		20				
Heterogeneity: Tau² = 0.00; Chi² = 1.37, df = 7 (P = 0.99); I² = 0%							
Test for overall effect: Z = 2.19 (P = 0.03)							
1.12.2 AVR							
Remadi 2004	1	50	2	50	10.6%	0.49 [0.04, 5.58]	2004
Bical 2006	0	20	0	20		Not estimable	2006
Castiglioni 2009	0	60	0	60		Not estimable	2009
Kutschka 2009	0	85	0	85		Not estimable	2009
Subtotal (95% CI)		**215**		**215**	**10.6%**	**0.49 [0.04, 5.58]**	
Total events	1		2				
Heterogeneity: Not applicable							
Test for overall effect: Z = 0.57 (P = 0.57)							
Total (95% CI)		**1277**		**1273**	**100.0%**	**0.40 [0.18, 0.88]**	
Total events	7		22				
Heterogeneity: Tau² = 0.00; Chi² = 1.40, df = 8 (P = 0.99); I² = 0%							
Test for overall effect: Z = 2.26 (P = 0.02)							
Test for subgroup differences: Chi² = 0.03, df = 1 (P = 0.86), I² = 0%							



Anastasiadis et al; Int J Cardiol 2013;164:158-69.

Adaptation of MiECT at UHN??

"It can't handle air down the venous line"

Miniaturized Cardiopulmonary Bypass in Coronary Artery Bypass Surgery: Marginal Impact on Inflammation and Coagulation but Loss of Safety Margins

Georg Nollert, MD, Ina Schwabenland, MD, Deniz Maktav, MD, Felix Kur, MD, Frank Christ, MD, Peter Fraunberger, MD, Bruno Reichart, MD, and Calin Vicol, MD

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"You'll pump air to the patient!"

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ORIGINAL ARTICLE

Excessive negative venous line pressures and increased arterial air bubble counts during miniaturized cardiopulmonary bypass: an experimental study comparing miniaturized with conventional perfusion systems

Anas Aboud[a,*], Kai Liebing[b], Jochen Börgermann[a], Stephan Ensminger[a], Armin Zittermann[a], Andre Renner[a], Kavous Hakim-Meibodi[a] and Jan Gummert[a]

"It's too dangerous!"

UHN Toronto General Hospital

What's the air handling capability of MiECC vs. CCPB?

AIR HANDLING CAPABILITY OF A CONVENTIONAL CARDIOPULMONARY BYPASS CIRCUIT VS. MINIMALLY INVASIVE EXTRACORPOREAL CIRCUIT

Amanda Spriel BSc, CCP, CPC
May Nguyen-Vu BSc, CCP
Cyril Serrick MSc, CCP, CPC

UHN Toronto General Hospital

CCPB vs MiECC

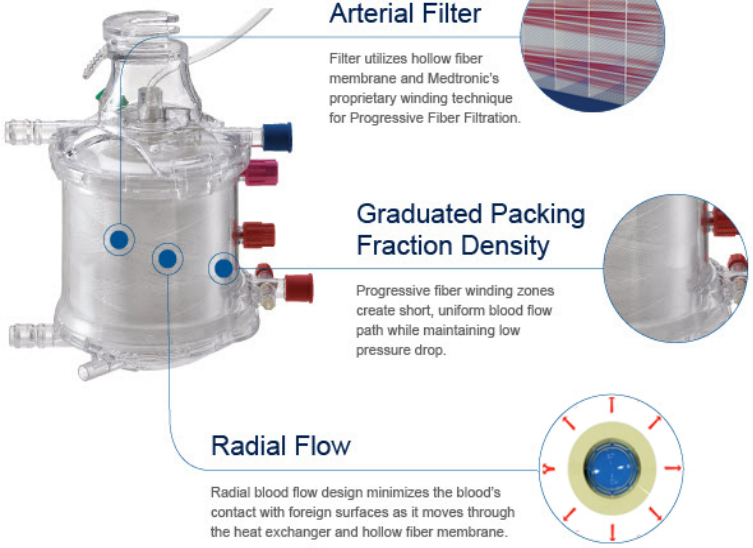
	CCPB	MiECC
Venous Reservoir	Medtronic	none
Oxygenator	Medtronic Affinity	Medtronic Affinity
Pump	Medtronic CP	Medtronic CP
Drainage	Gravity	Kinetic
Air Handling System	Venous Reservoir	VARD
In-line Monitoring System	Spectrum M4	Spectrum M4
Prime Volume (mL)	1000	650

CCPB vs MiECC

	CCPB	MiECC
Venous Reservoir	Medtronic	none
Oxygenator	Medtronic Affinity	Medtronic Affinity
Pump	Medtronic CP	Medtronic CP
Drainage	Gravity	Kinetic
Air Handling System	Venous Reservoir	VARD
In-line Monitoring System	Spectrum M4	Spectrum M4
Prime Volume (mL)	1000	650

CCPB

- Medtronic Affinity Fusion Oxygenation System
- Affinity CP centrifugal pump



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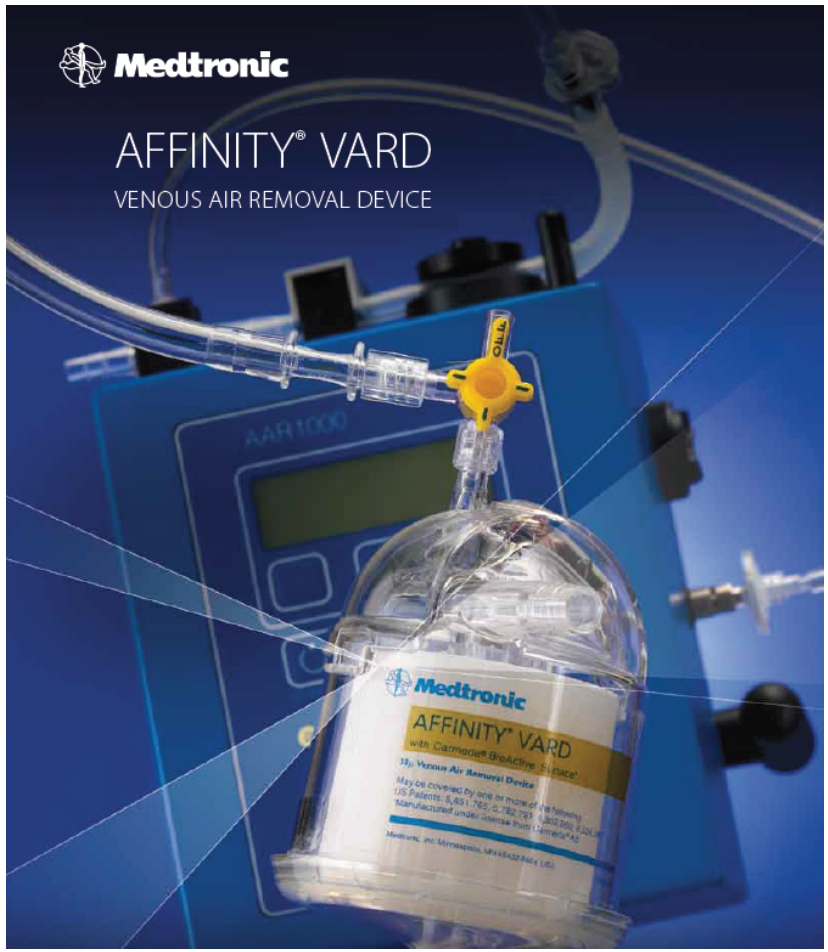
MiECC

- Medtronic Fusion Oxygenator
- Affinity CP centrifugal pump
- Medtronic Affinity Venous Air Removal Device
  - Ultrasonic air sensors automatically detect air at the inlet of the system and engages the controller opening the pinch valve to the vacuum source for air removal



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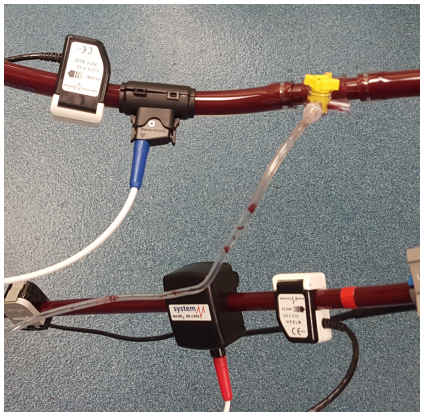
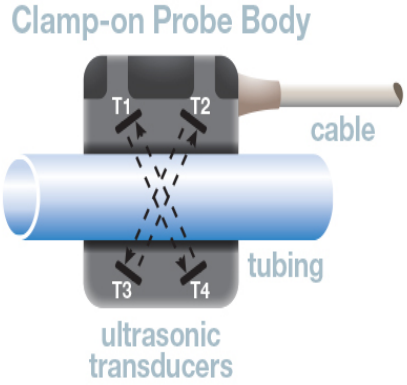
CCPB vs MiECC

- Air emboli counts measured over 5 minutes
- Locations measured:
  - Pre-oxygenator & Post-oxygenator
- M4 Spectrum Monitoring System (emboli detection level 1.3%) ~10-15 microns
  - Gross Emboli (bubbles) is measured by detecting reductions in Ultrasonic signal strength



Spectrum Medical®



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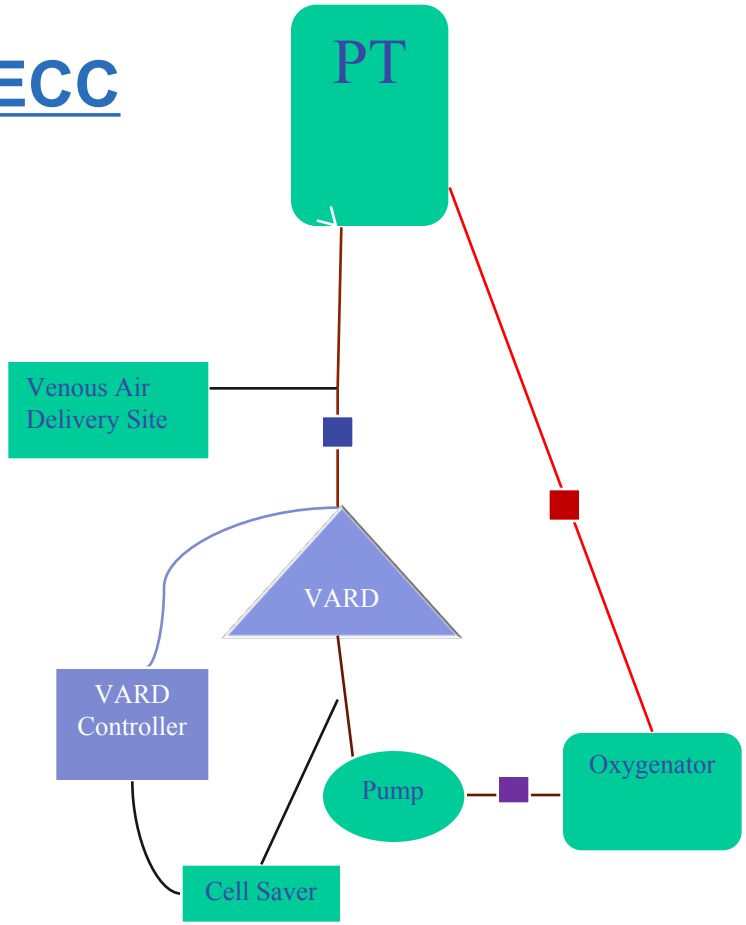
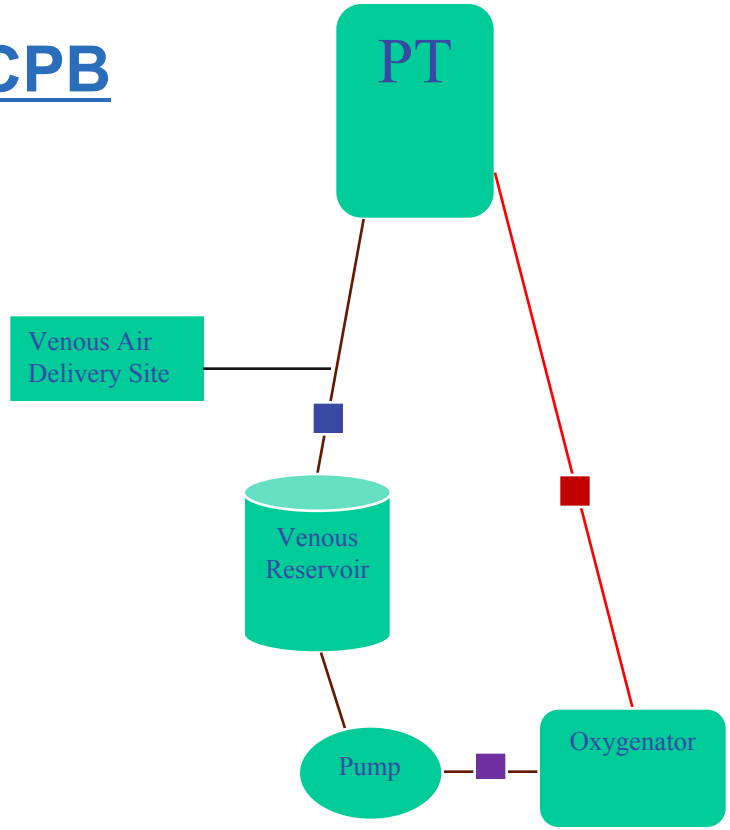
Circuit Schematic

MiECC



CCPB



Spectrum emboli detection probes

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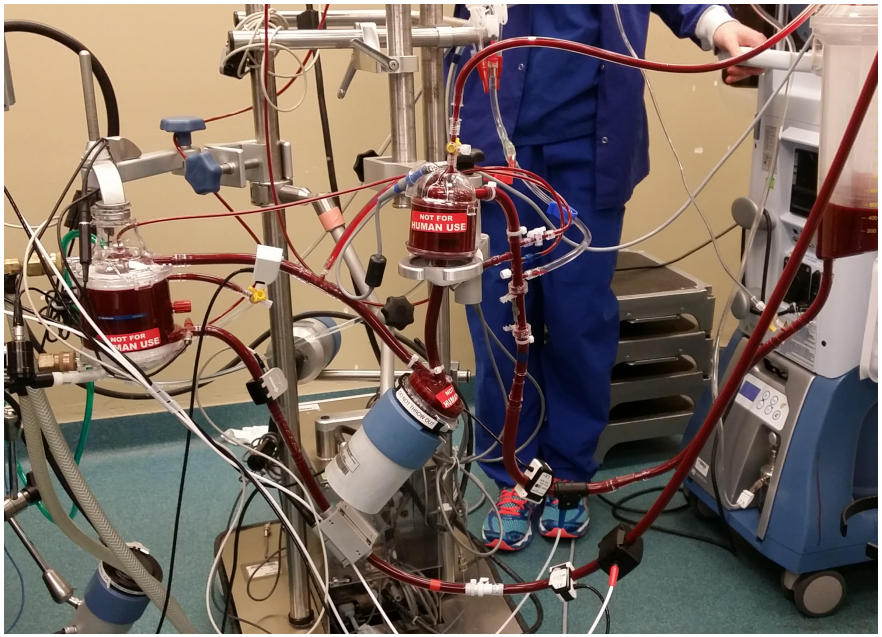
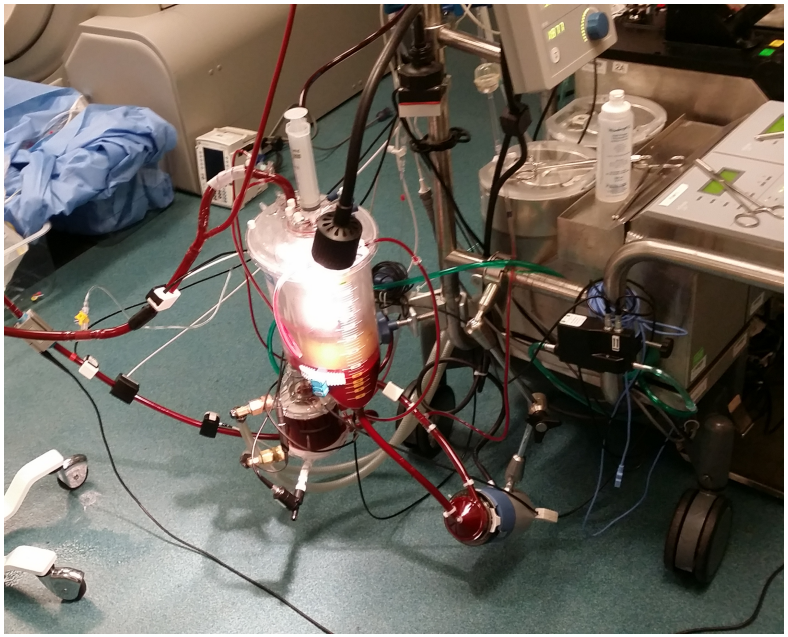
Circuits

MiECC

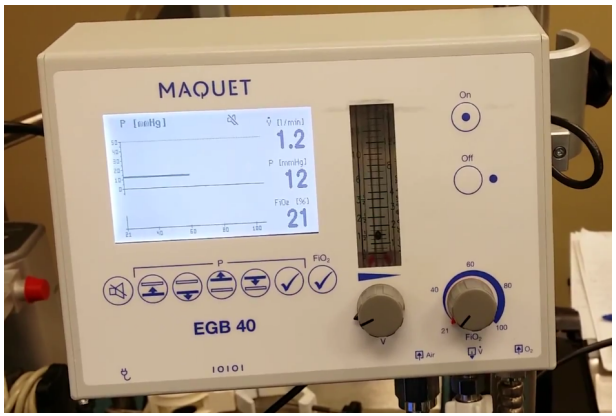


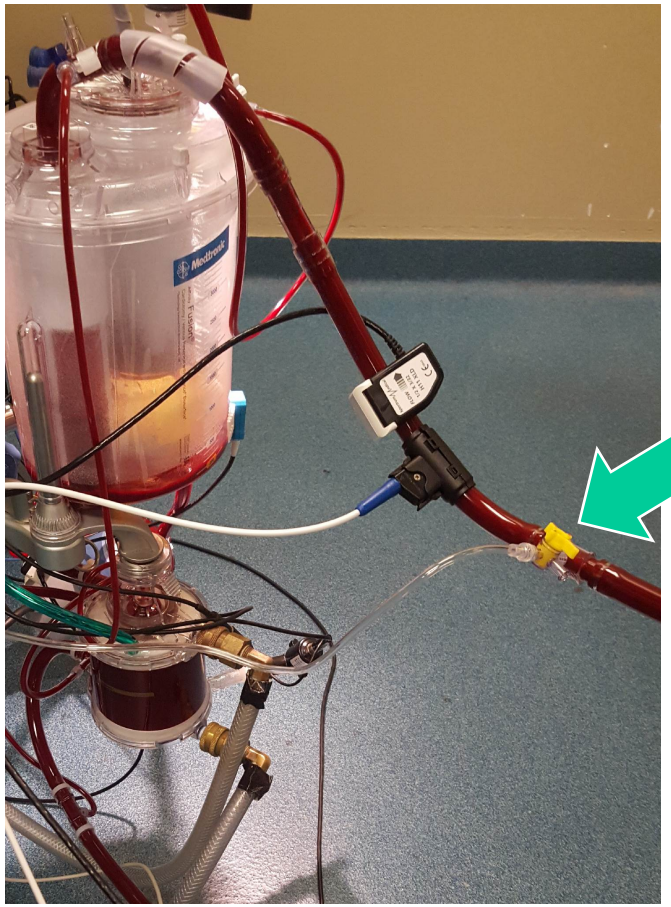
CCPB



CCPB vs MiECC

- Room air delivered down the venous line
- Gas Blender set @
  - 0.4, 1.2 LPM (clinically relevant)
  - 5LPM (extreme)





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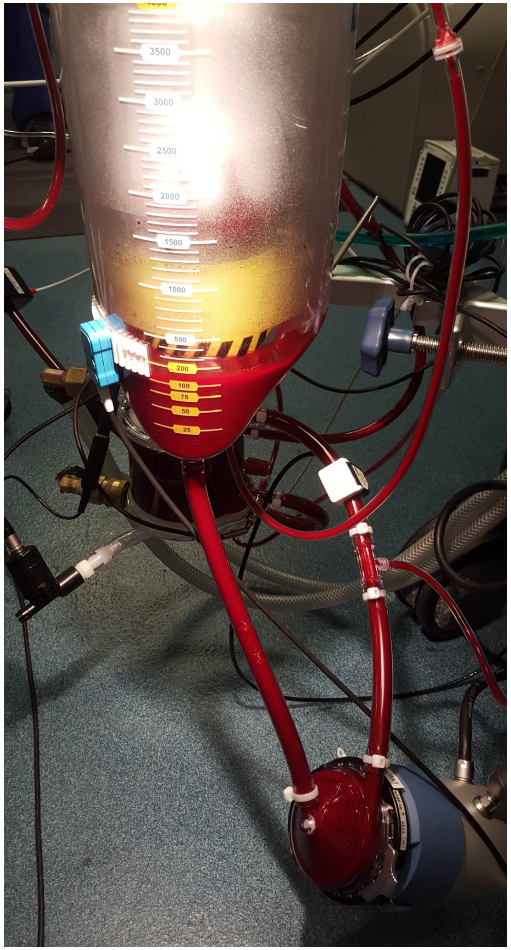
CCPB vs MiECC

- Controlled lab set up
- Blood Flow 5 LPM
- HCT 26%
- Sweep 2 LPM @ FiO2 1.0
- Blood Temperature 36 ˚C
- 200ml in CCPB reservoir
- N = 3



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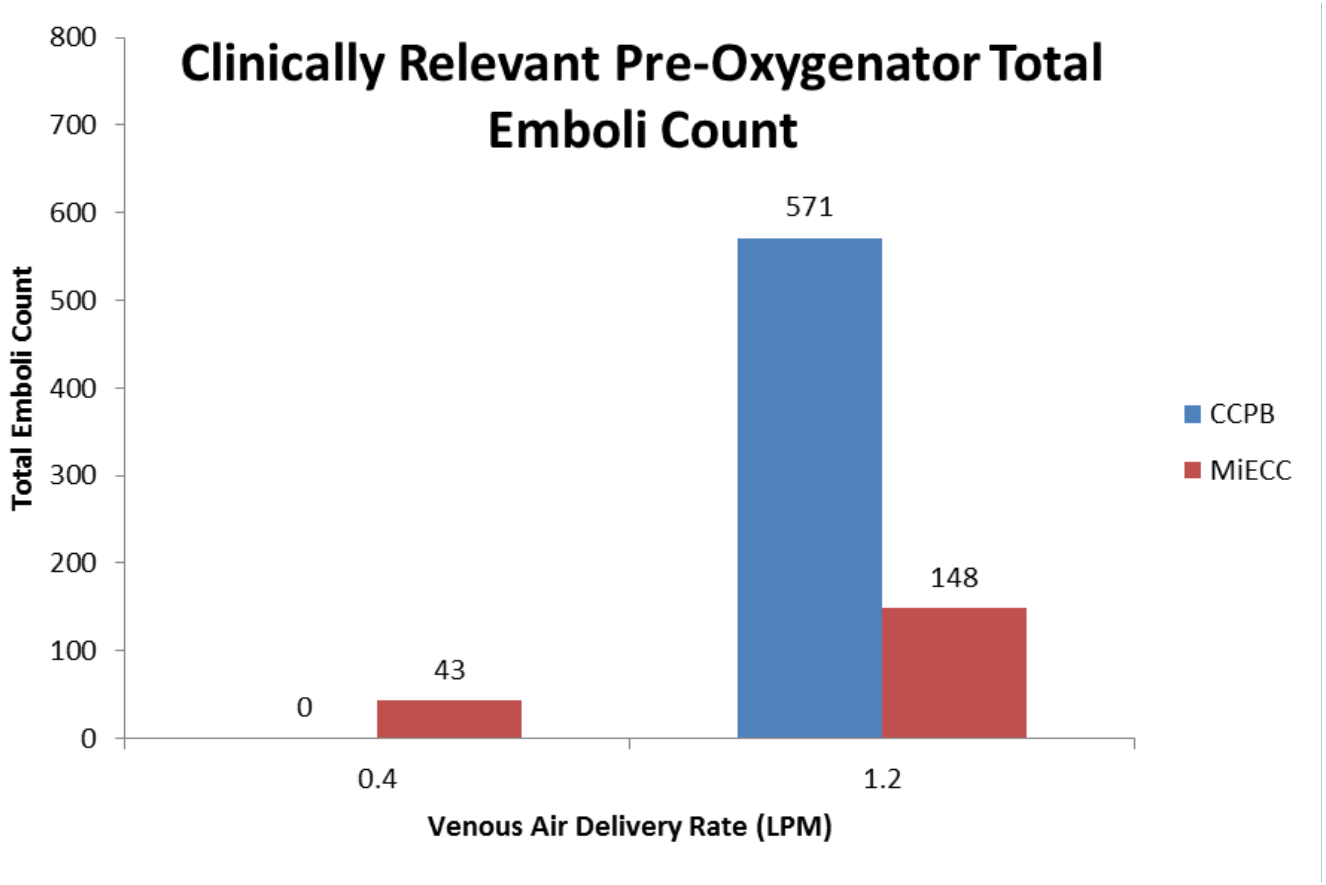
Results



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