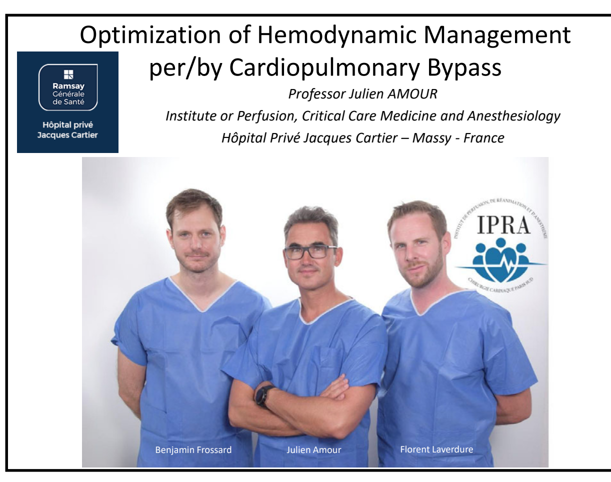
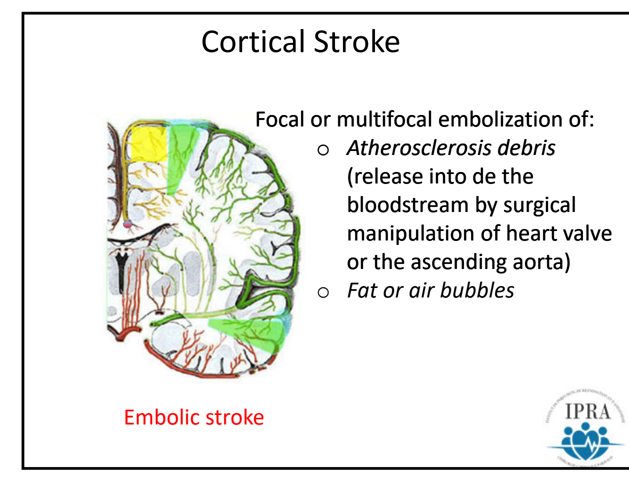
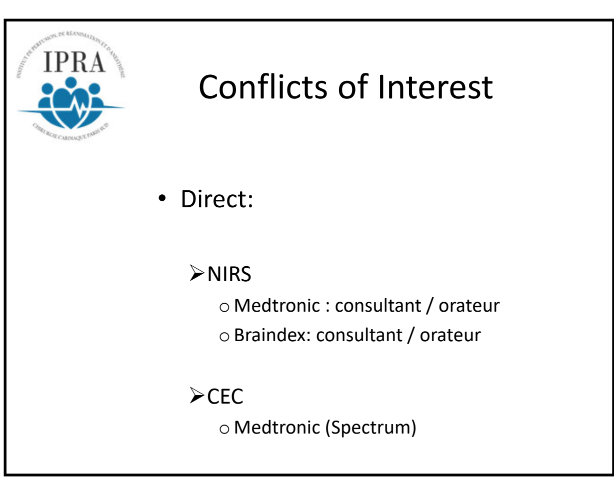
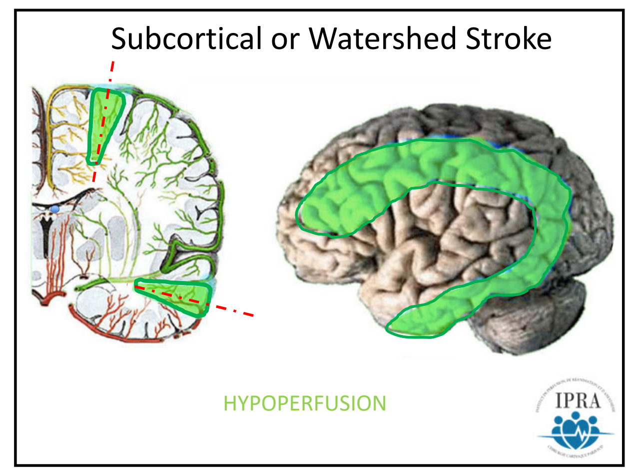








Stroke in Cardiac Surgery

Stroke:

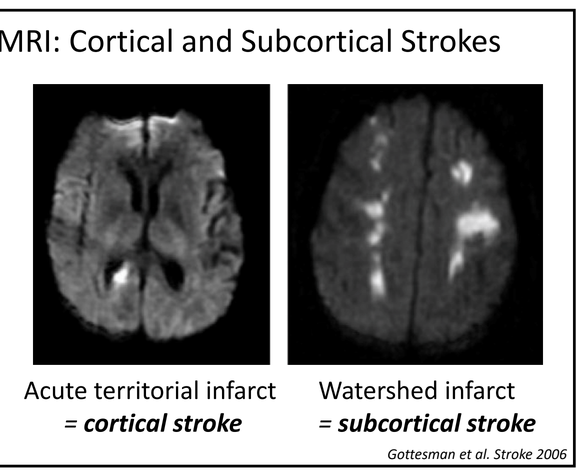
- ✓ affects 3% of patients
- ✓ 3-fold ↗ the in-hospital mortality
- ✓ 10-fold ↗ the global mortality

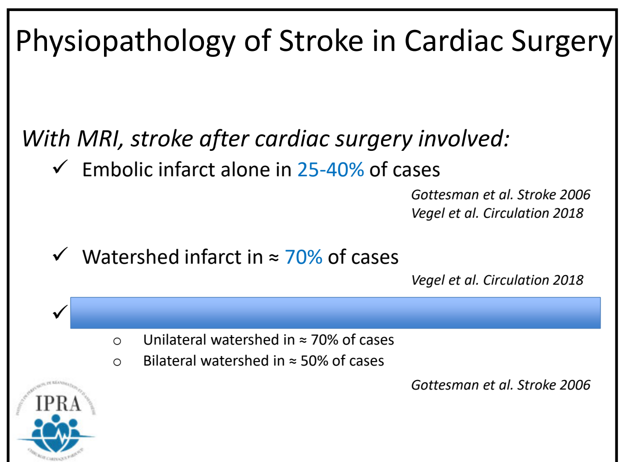
McKhann et al. Stroke 2006

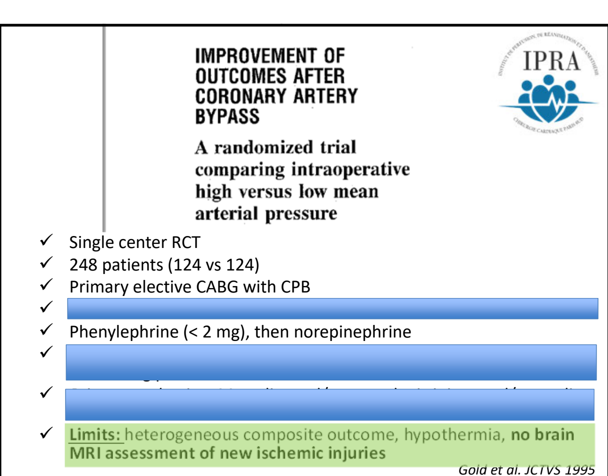
Silent stroke:

- ✓ affects > 50% of patients (detected by MRI)
- ✓ is involved in 1/3 of early POCD

Vedel et al. Circulation 2018

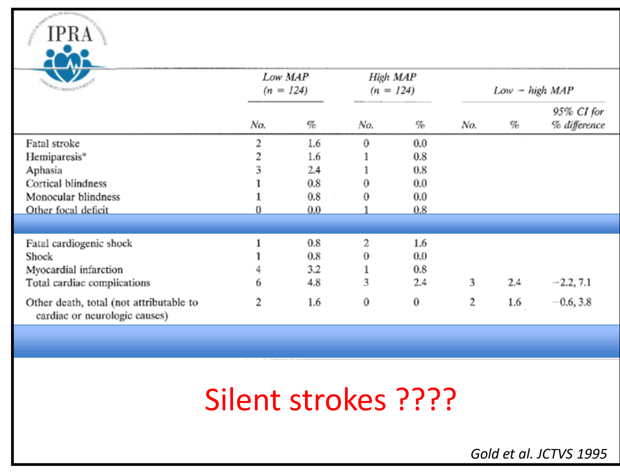




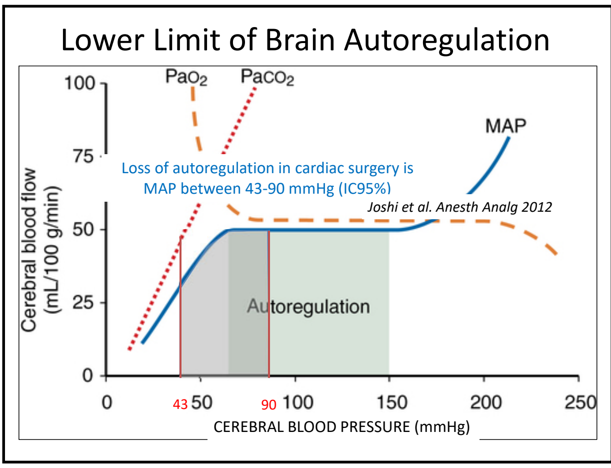


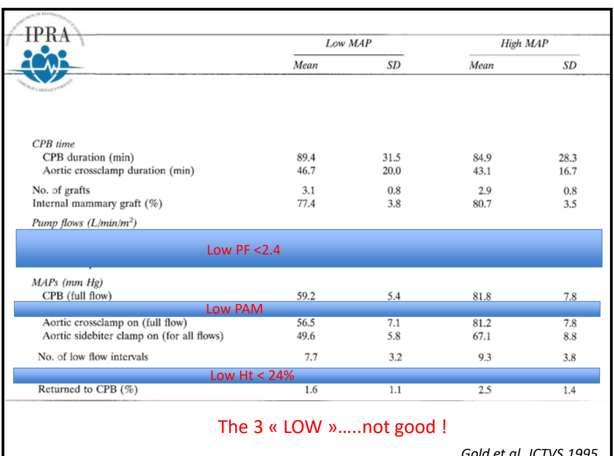
Is there a « GOOD » MAP in CPB to avoid hypoperfusion ?

IPRA

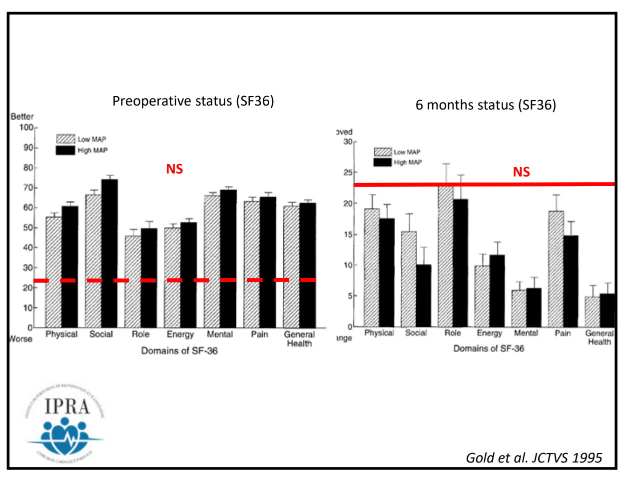


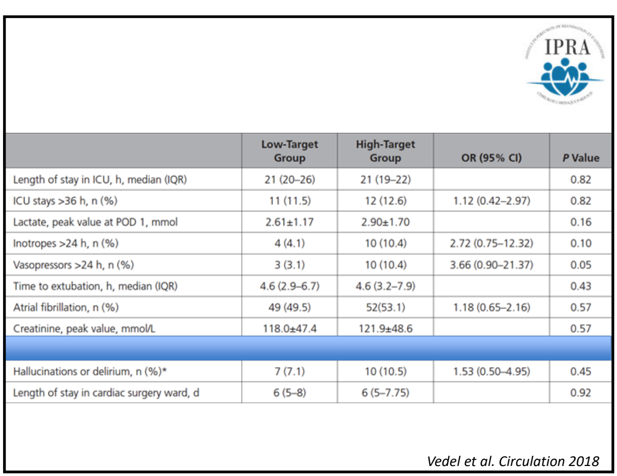
	Low MAP (n = 124)		High MAP (n = 124)		Low − high MAP		
	No.	%	No.	%	No.	%	95% CI for % difference
Fatal stroke	2	1.6	0	0.0			
Hemiparesis*	2	1.6	1	0.8			
Aphasia	3	2.4	1	0.8			
Cortical blindness	1	0.8	0	0.0			
Monocular blindness	1	0.8	0	0.0			
Other focal deficit	0	0.0	1	0.8			
Fatal cardiogenic shock	1	0.8	2	1.6			
Shock	1	0.8	0	0.0			
Myocardial infarction	4	3.2	1	0.8			
Total cardiac complications	6	4.8	3	2.4	3	2.4	−2.2, 7.1
Other death, total (not attributable to cardiac or neurologic causes)	2	1.6	0	0	2	1.6	−0.6, 3.8



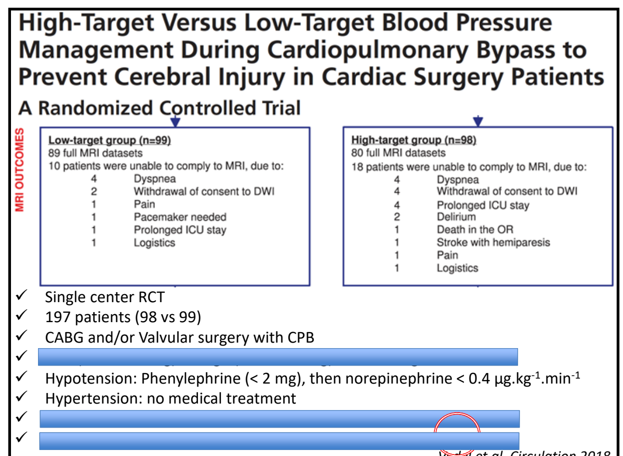


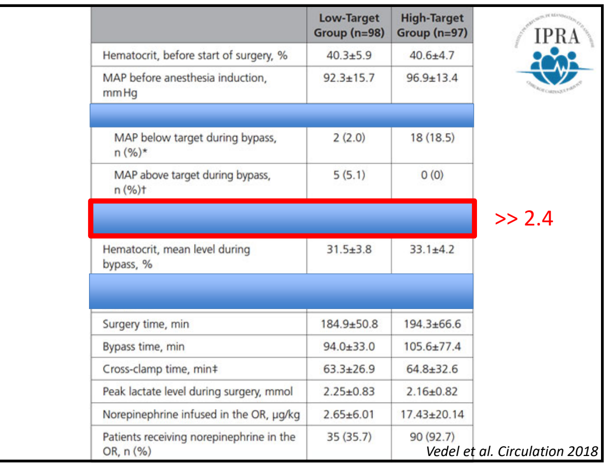
	Low MAP		High MAP	
	Mean	SD	Mean	SD
CPB time				
CPB duration (min)	89.4	31.5	84.9	28.3
Aortic crossclamp duration (min)	46.7	20.0	43.1	16.7
No. of grafts	3.1	0.8	2.9	0.8
Internal mammary graft (%)	77.4	3.8	80.7	3.5
Pump flows ($L/min/m^2$)				
MAPs (mm Hg)				
CPB (full flow)	59.2	5.4	81.8	7.8
Aortic crossclamp on (full flow)	56.5	7.1	81.2	7.8
Aortic sidebiter clamp on (for all flows)	49.6	5.8	67.1	8.8
No. of low flow intervals	7.7	3.2	9.3	3.8
Returned to CPB (%)	1.6	1.1	2.5	1.4



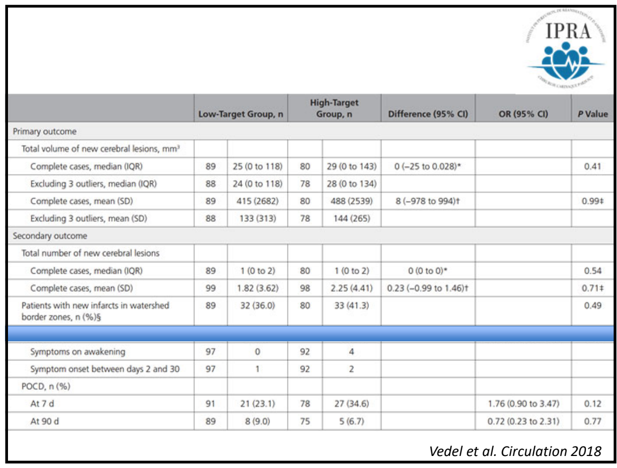


	Low-Target Group	High-Target Group	OR (95% CI)	P Value
Length of stay in ICU, h, median (IQR)	21 (20–26)	21 (19–22)		0.82
ICU stays >36 h, n (%)	11 (11.5)	12 (12.6)	1.12 (0.42–2.97)	0.82
Lactate, peak value at POD 1, mmol	2.61±1.17	2.90±1.70		0.16
Inotropes >24 h, n (%)	4 (4.1)	10 (10.4)	2.72 (0.75–12.32)	0.10
Vasopressors >24 h, n (%)	3 (3.1)	10 (10.4)	3.66 (0.90–21.37)	0.05
Time to extubation, h, median (IQR)	4.6 (2.9–6.7)	4.6 (3.2–7.9)		0.43
Atrial fibrillation, n (%)	49 (49.5)	52(53.1)	1.18 (0.65–2.16)	0.57
Creatinine, peak value, mmol/L	118.0±47.4	121.9±48.6		0.57
Hallucinations or delirium, n (%)*	7 (7.1)	10 (10.5)	1.53 (0.50–4.95)	0.45
Length of stay in cardiac surgery ward, d	6 (5–8)	6 (5–7.75)		0.92



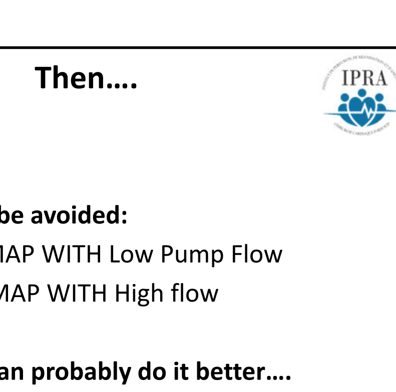


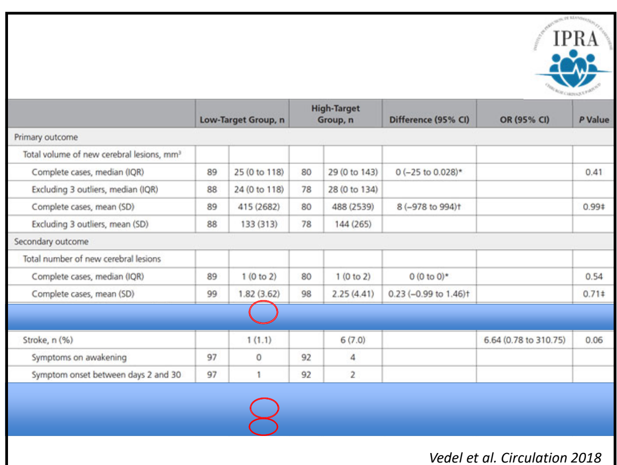
	Low-Target Group (n=98)	High-Target Group (n=97)
Hematocrit, before start of surgery, %	40.3±5.9	40.6±4.7
MAP before anesthesia induction, mm Hg	92.3±15.7	96.9±13.4
MAP below target during bypass, n (%)*	2 (2.0)	18 (18.5)
MAP above target during bypass, n (%)†	5 (5.1)	0 (0)
Hematocrit, mean level during bypass, %	31.5±3.8	33.1±4.2
Surgery time, min	184.9±50.8	194.3±66.6
Bypass time, min	94.0±33.0	105.6±77.4
Cross-clamp time, min‡	63.3±26.9	64.8±32.6
Peak lactate level during surgery, mmol	2.25±0.83	2.16±0.82
Norepinephrine infused in the OR, µg/kg	2.65±6.01	17.43±20.14
Patients receiving norepinephrine in the OR, n (%)	35 (35.7)	90 (92.7)



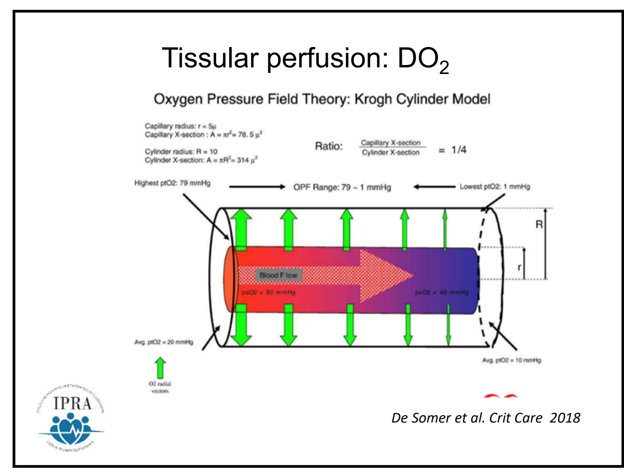
	Low-Target Group, n		High-Target Group, n		Difference (95% CI)	OR (95% CI)	P Value
Primary outcome							
Total volume of new cerebral lesions, mm³							
Complete cases, median (IQR)	89	25 (0 to 118)	80	29 (0 to 143)	0 (–25 to 0.028)*		0.41
Excluding 3 outliers, median (IQR)	88	24 (0 to 118)	78	28 (0 to 134)			
Complete cases, mean (SD)	89	415 (2682)	80	488 (2539)	8 (–978 to 994)†		0.99‡
Excluding 3 outliers, mean (SD)	88	133 (313)	78	144 (265)			
Secondary outcome							
Total number of new cerebral lesions							
Complete cases, median (IQR)	89	1 (0 to 2)	80	1 (0 to 2)	0 (0 to 0)*		0.54
Complete cases, mean (SD)	99	1.82 (3.62)	98	2.25 (4.41)	0.23 (–0.99 to 1.46)†		0.71‡
Patients with new infarcts in watershed border zones, n (%)§	89	32 (36.0)	80	33 (41.3)			0.49
Symptoms on awakening	97	0	92	4			
Symptom onset between days 2 and 30	97	1	92	2			
POCD, n (%)							
At 7 d	91	21 (23.1)	78	27 (34.6)		1.76 (0.90 to 3.47)	0.12
At 90 d	89	8 (9.0)	75	5 (6.7)		0.72 (0.23 to 2.31)	0.77

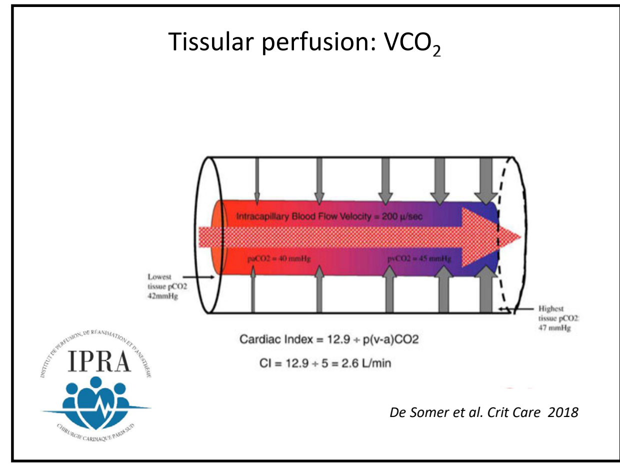
Then….





	Low-Target Group, n		High-Target Group, n		Difference (95% CI)	OR (95% CI)	P Value
Primary outcome							
Total volume of new cerebral lesions, mm³							
Complete cases, median (IQR)	89	25 (0 to 118)	80	29 (0 to 143)	0 (−25 to 0.028)*		0.41
Excluding 3 outliers, median (IQR)	88	24 (0 to 118)	78	28 (0 to 134)			
Complete cases, mean (SD)	89	415 (2682)	80	488 (2539)	8 (−978 to 994)†		0.99‡
Excluding 3 outliers, mean (SD)	88	133 (313)	78	144 (265)			
Secondary outcome							
Total number of new cerebral lesions							
Complete cases, median (IQR)	89	1 (0 to 2)	80	1 (0 to 2)	0 (0 to 0)*		0.54
Complete cases, mean (SD)	99	1.82 (3.62)	98	2.25 (4.41)	0.23 (−0.99 to 1.46)†		0.71‡
Stroke, n (%)		1 (1.1)		6 (7.0)		6.64 (0.78 to 310.75)	0.06
Symptoms on awakening	97	0	92	4			
Symptom onset between days 2 and 30	97	1	92	2			

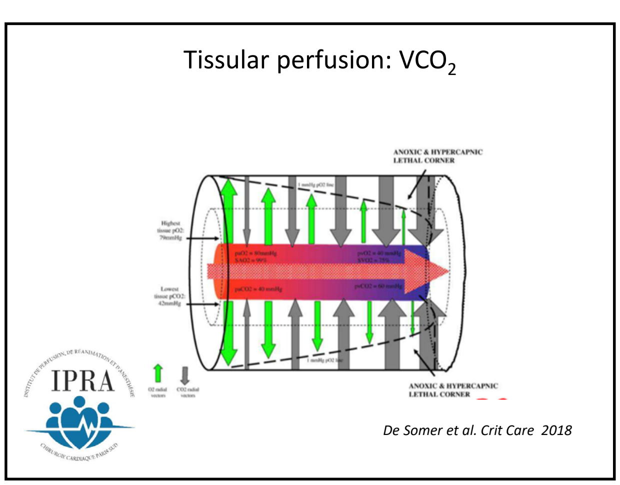




The « adapted » Pump Flow:

Role of the **G**oal **D**irected **P**erfusion

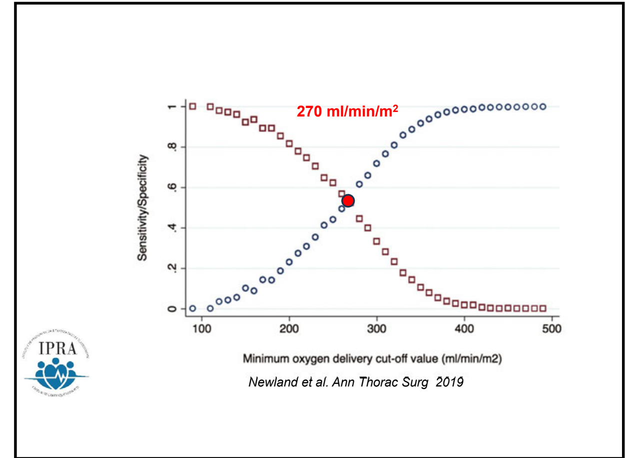
IPRA



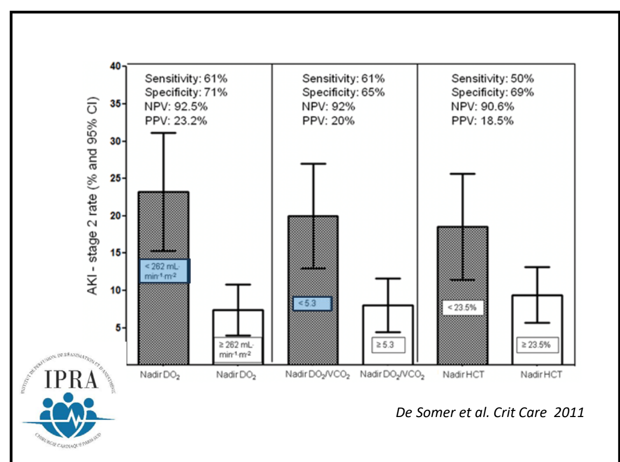
O2 delivery and CO2 production during cardiopulmonary bypass as determinants of acute kidney injury: time for a goal-directed perfusion management?

- Prospective study, retrospective analysis
- 359 patients
- DO_2 and DO_2/VCO_2
- IC 2.4-2.8 L/min/m^2
- T: 30-34°C
- CGR if <6-7g/dL
- Objective: Association DO_2 &DO_2/VCO_2 and AKI (AKI stages) for the first 48 hours after surgery
- Multivariable logistic regression models

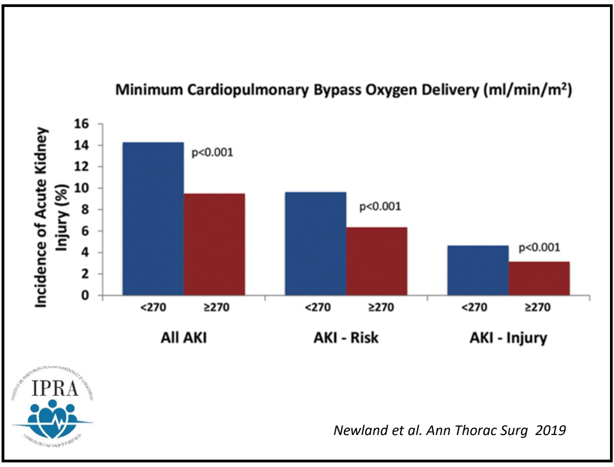
De Somer et al. Crit Care 2011



Newland et al. Ann Thorac Surg 2019



De Somer et al. Crit Care 2011



Newland et al. Ann Thorac Surg 2019

Predictive Capacity of Oxygen Delivery During Cardiopulmonary Bypass on Acute Kidney Injury

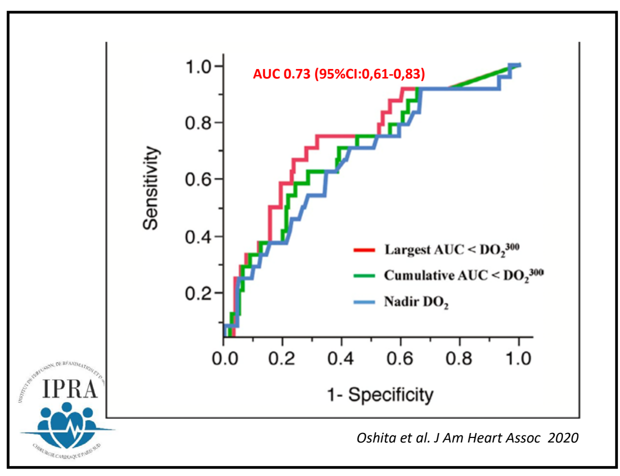
- Prospective database (9 Australia and New Zeland center)
- Retrospective analysis
- 19 410 patients with CPB
- For 2008 to 2016 in (9 Australia and New Zeland center)
- T°: ?
- Objective: Multivariate logistic regression for calculating the optimal minimal DO_2 value to predict postoperative AKI (RIFLE score)

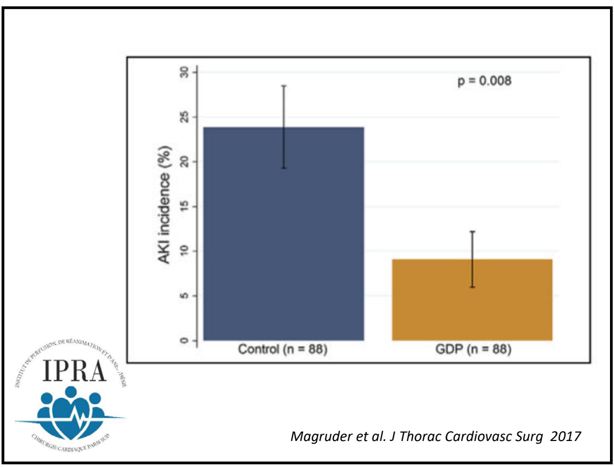
Newland et al. Ann Thorac Surg 2019

A Better Predictor of Acute Kidney Injury After Cardiac Surgery: The Largest Area Under the Curve Below the Oxygen Delivery Threshold During Cardiopulmonary Bypass

- Prospective study
- 202 patients between 2017 and 2019
- Threshold : 300 ml/min/m^2
- T = 34°C
- AKI (KDIGO)
- CI: 2.5 mL/min/m^2
- CGR: <8g/dL
- Objective: correlation between AUC < 300 ml/min/m^2 & AKI

Oshita et al. J Am Heart Assoc 2020





A pilot goal-directed perfusion initiative is associated with less acute kidney injury after cardiac surgery

- Before/After study
- 88 control patients (2010-2015) matched 1:1 to 88 patients with GDP (>2015) with propensity score analysis
- IC: for DO_2 > 300 ml/min/m² vs 1.8-2.2 L/min/m²
- T: 28-34°C
- CGR if Hb < 8g/dL
- Outcome: AKI (KDIGO) for the first 72 hours after surgery

Magruder et al. J Thorac Cardiovasc Surg 2017

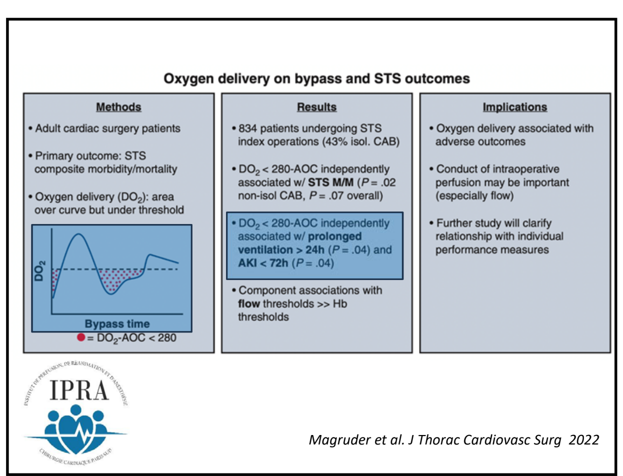
Correlating oxygen delivery on cardiopulmonary bypass with Society of Thoracic Surgeons outcomes following cardiac surgery

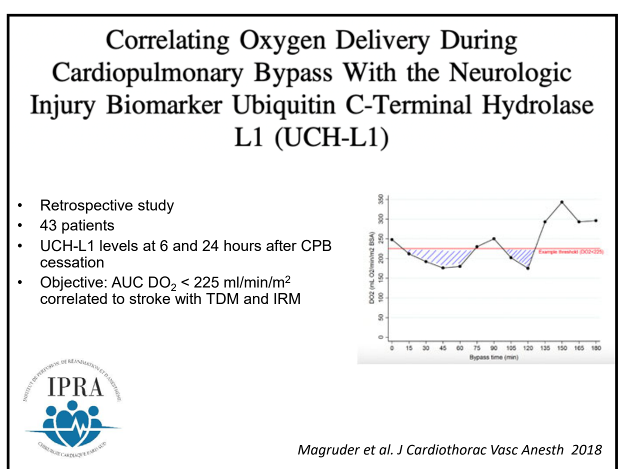
- Retrospective analysis study
- 834 patients between 2019 to 2020
- AUC DO_2 < 280 ml/min/m²
- Composite Outcome: correlation with mortality, renal failure, prolonged ventilation > 24h, stroke, Wound infection and reoperation

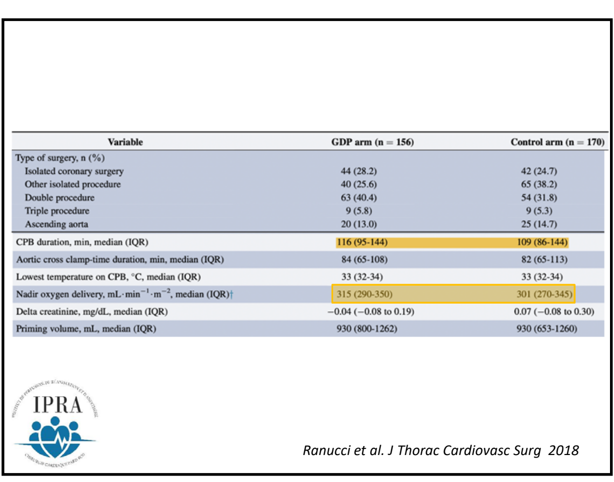
Magruder et al. J Thorac Cardiovasc Surg 2022

	Controls	Goal-directed perfusion patients	P value
Crystalloid prime volume (median mL, IQR)	650 (500–1000)	800 (500–1000)	.28
PRBC in prime (%, n)	9.5 (8)	14.8 (13)	.35
Received any mannitol in prime (%, n)	91.7 (77/84)	17.1 (15/88)	**<.001**
Total phenylephrine administered (median mg ± IQR)	1.5 (0.7–3.25)	0.65 (0.2–2.4)	**.001**
Heparin drip used in OR	0	50.6 (45/88)	**<.001**
Nadir temperature on CPB (°C ± SD)	32 ± 3	33 ± 3	**.02**
Hemoconcentrator used (%, n)	46.4 (39/84)	98.9 (87/88)	**<.001**
Volume exchanged with hemoconcentrator (median L ± IQR)	2.0 (1.2–3.0)	6.0 (4.3–9.0)	**<.001**
Nadir Hb on CPB (mg/dL ± SD)	9.0 ± 1.8	8.7 ± 2.0	.46
Nadir pump flow/m² (L/min/m² BSA ± SD)	1.9 ± 0.3	2.4 ± 0.4	**<.001**
Nadir DO2 (mL O_2/min/m² BSA ± SD)	240 ± 64	302 ± 62	**<.001**

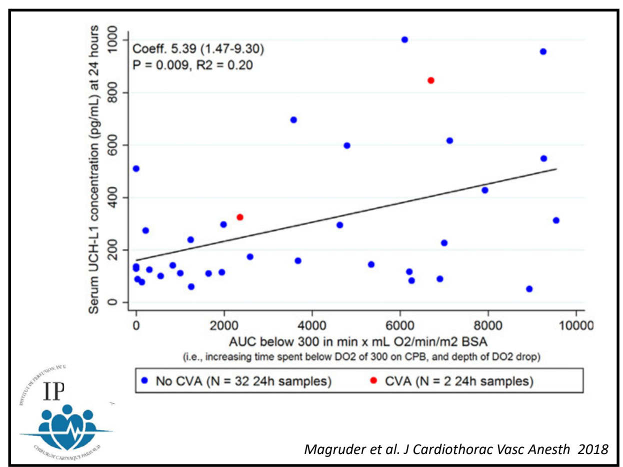
Magruder et al. J Thorac Cardiovasc Surg 2017

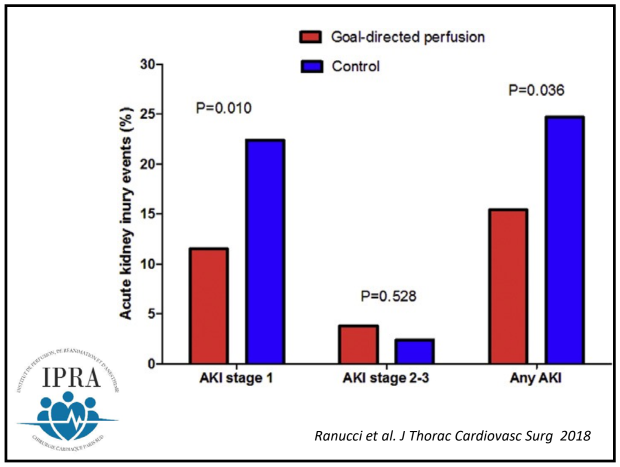






Variable	GDP arm (n = 156)	Control arm (n = 170)
Type of surgery, n (%)		
Isolated coronary surgery	44 (28.2)	42 (24.7)
Other isolated procedure	40 (25.6)	65 (38.2)
Double procedure	63 (40.4)	54 (31.8)
Triple procedure	9 (5.8)	9 (5.3)
Ascending aorta	20 (13.0)	25 (14.7)
CPB duration, min, median (IQR)	116 (95-144)	109 (86-144)
Aortic cross clamp-time duration, min, median (IQR)	84 (65-108)	82 (65-113)
Lowest temperature on CPB, °C, median (IQR)	33 (32-34)	33 (32-34)
Nadir oxygen delivery, $mL \cdot min^{-1} \cdot m^{-2}$, median (IQR)†	315 (290-350)	301 (270-345)
Delta creatinine, mg/dL, median (IQR)	−0.04 (−0.08 to 0.19)	0.07 (−0.08 to 0.30)
Priming volume, mL, median (IQR)	930 (800-1262)	930 (653-1260)





Goal-directed perfusion to reduce acute kidney injury: A randomized trial

- RCT (multicenter study)
- 326 patients
- DO_2 > 280 ml/min/m²
- IC 2.4-3.0 L/min/m² vs 2.4 L/min/m²
- T: 32-34°C
- CEC > 60 min or < 90th percentile of the CPB time distribution
- CGR if DO_2 < 280 ml/min/m² and Sv02 < 68 and/or Oxygen extraction rate > 40%
- Outcome: AKI (AKIN) for the first 48 hours after surgery

IPRA

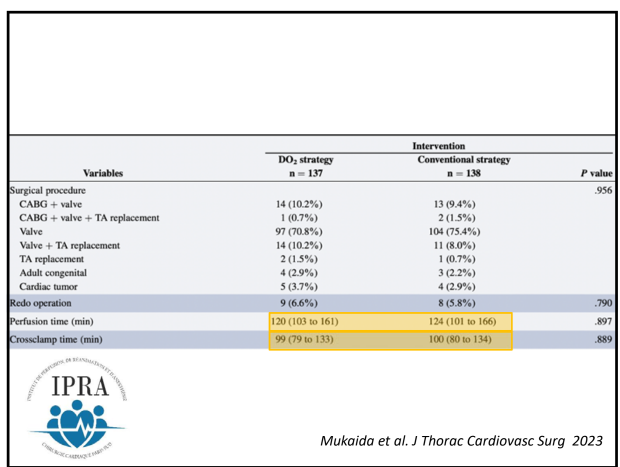
Ranucci et al. J Thorac Cardiovasc Surg 2018

Oxygen delivery-guided perfusion for the prevention of acute kidney injury: A randomized controlled trial

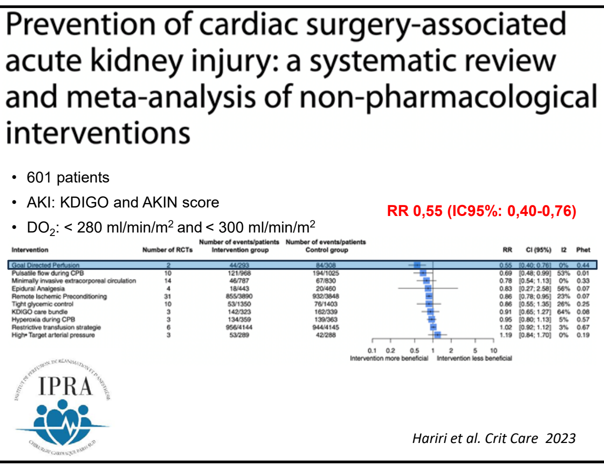
- RCT (1 center)
- 300 patients
- DO_2 > 300 ml/min/m²
- IC 2.6-3.0 L/min/m² vs 2.6 L/min/m²
- T >35°C
- CGR if <7g/dL
- Outcome: AKI (KDIGO) for the first 48 hours after surgery

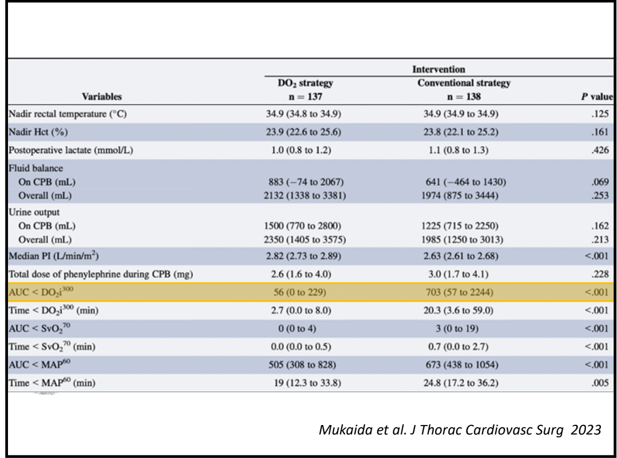
IPRA

Mukaida et al. J Thorac Cardiovasc Surg 2023

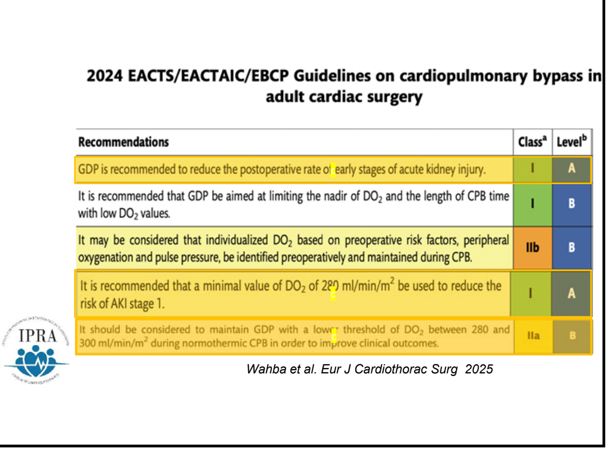


Variables	Intervention: DO_2 strategy n = 137	Intervention: Conventional strategy n = 138	*P* value
Surgical procedure			.956
CABG + valve	14 (10.2%)	13 (9.4%)	
CABG + valve + TA replacement	1 (0.7%)	2 (1.5%)	
Valve	97 (70.8%)	104 (75.4%)	
Valve + TA replacement	14 (10.2%)	11 (8.0%)	
TA replacement	2 (1.5%)	1 (0.7%)	
Adult congenital	4 (2.9%)	3 (2.2%)	
Cardiac tumor	5 (3.7%)	4 (2.9%)	
Redo operation	9 (6.6%)	8 (5.8%)	.790
Perfusion time (min)	120 (103 to 161)	124 (101 to 166)	.897
Crossclamp time (min)	99 (79 to 133)	100 (80 to 134)	.889



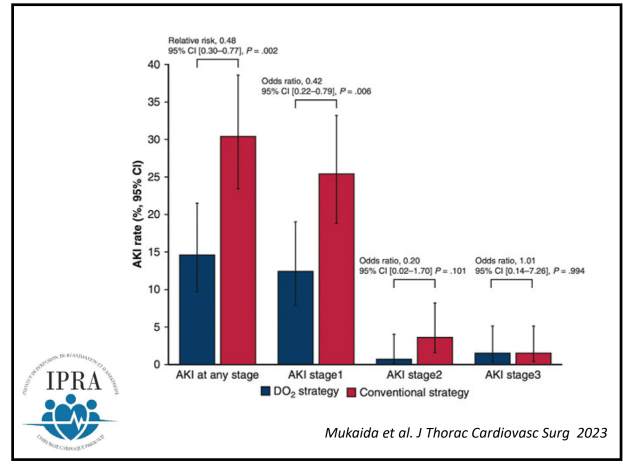


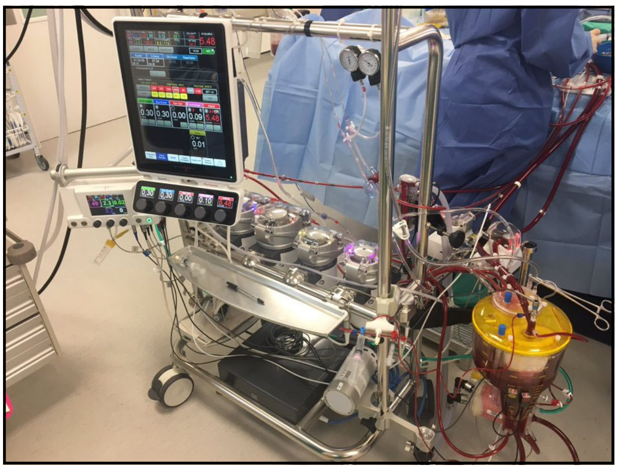
Variables	Intervention: DO_2 strategy n = 137	Intervention: Conventional strategy n = 138	*P* value
Nadir rectal temperature (°C)	34.9 (34.8 to 34.9)	34.9 (34.9 to 34.9)	.125
Nadir Hct (%)	23.9 (22.6 to 25.6)	23.8 (22.1 to 25.2)	.161
Postoperative lactate (mmol/L)	1.0 (0.8 to 1.2)	1.1 (0.8 to 1.3)	.426
Fluid balance			
On CPB (mL)	883 (−74 to 2067)	641 (−464 to 1430)	.069
Overall (mL)	2132 (1338 to 3381)	1974 (875 to 3444)	.253
Urine output			
On CPB (mL)	1500 (770 to 2800)	1225 (715 to 2250)	.162
Overall (mL)	2350 (1405 to 3575)	1985 (1250 to 3013)	.213
Median PI (L/min/m^2)	2.82 (2.73 to 2.89)	2.63 (2.61 to 2.68)	<.001
Total dose of phenylephrine during CPB (mg)	2.6 (1.6 to 4.0)	3.0 (1.7 to 4.1)	.228
AUC < DO_2i^{300}	56 (0 to 229)	703 (57 to 2244)	<.001
Time < DO_2i^{300} (min)	2.7 (0.0 to 8.0)	20.3 (3.6 to 59.0)	<.001
AUC < SvO_2^{70}	0 (0 to 4)	3 (0 to 19)	<.001
Time < SvO_2^{70} (min)	0.0 (0.0 to 0.5)	0.7 (0.0 to 2.7)	<.001
AUC < MAP^{60}	505 (308 to 828)	673 (438 to 1054)	<.001
Time < MAP^{60} (min)	19 (12.3 to 33.8)	24.8 (17.2 to 36.2)	.005

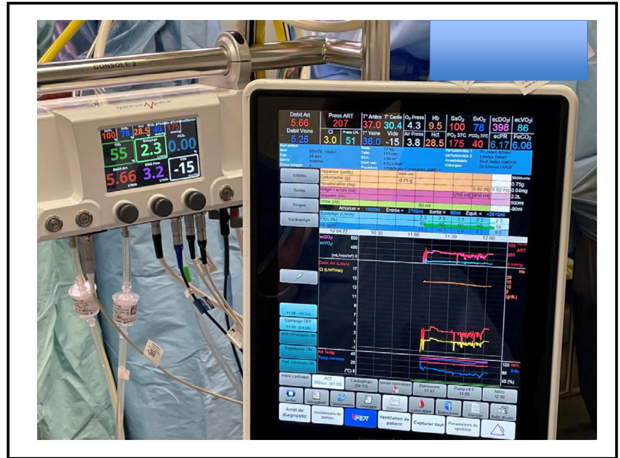


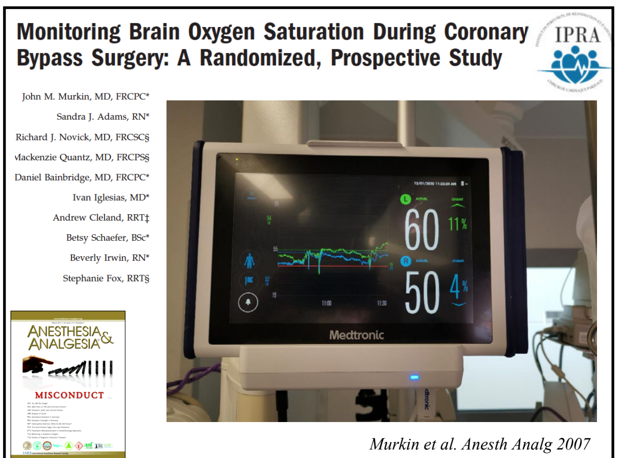
2024 EACTS/EACTAIC/EBCP Guidelines on cardiopulmonary bypass in adult cardiac surgery

Recommendations	Class[a]	Level[b]
GDP is recommended to reduce the postoperative rate of early stages of acute kidney injury.	I	A
It is recommended that GDP be aimed at limiting the nadir of DO_2 and the length of CPB time with low DO_2 values.	I	B
It may be considered that individualized DO_2 based on preoperative risk factors, peripheral oxygenation and pulse pressure, be identified preoperatively and maintained during CPB.	IIb	B
It is recommended that a minimal value of DO_2 of 280 ml/min/m^2 be used to reduce the risk of AKI stage 1.	I	A
It should be considered to maintain GDP with a lower threshold of DO_2 between 280 and 300 ml/min/m^2 during normothermic CPB in order to improve clinical outcomes.	IIa	B









The « adapted » cerebral perfusion:

NIRS to detect loss of autoregulation ?

Cerebral Oxygen Desaturation Predicts Cognitive Decline and Longer Hospital Stay After Cardiac Surgery

James P. Slater, MD, Theresa Guarino, RN, Jessica Stack, BS, Kateki Vinod, BA, Rami T. Bustami, PhD, John M. Brown III, MD, Alejandro L. Rodriguez, MD, Christopher J. Magovern, MD, Thomas Zaubler, MD, Kenneth Freundlich, PhD, and Grant V.S. Parr, MD

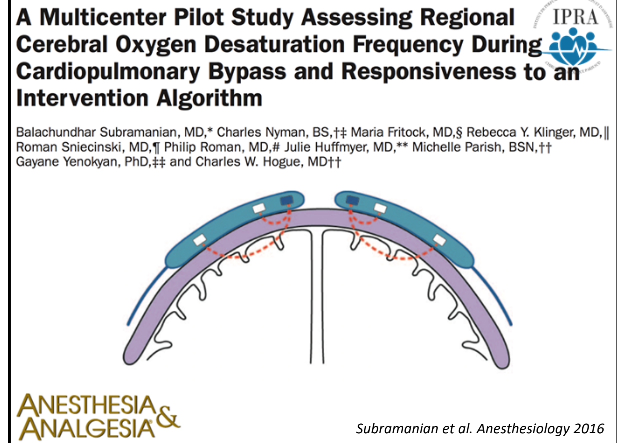
67 6%

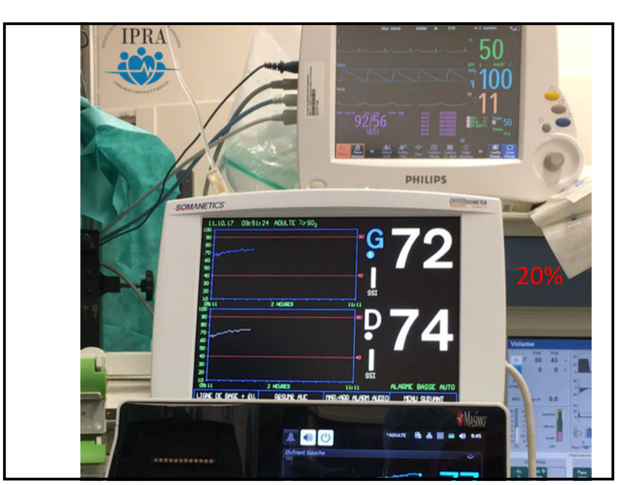
69 3%

Medtronic

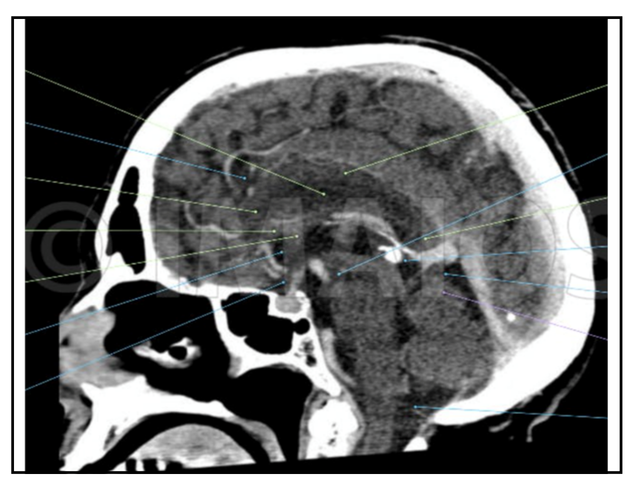
IPRA

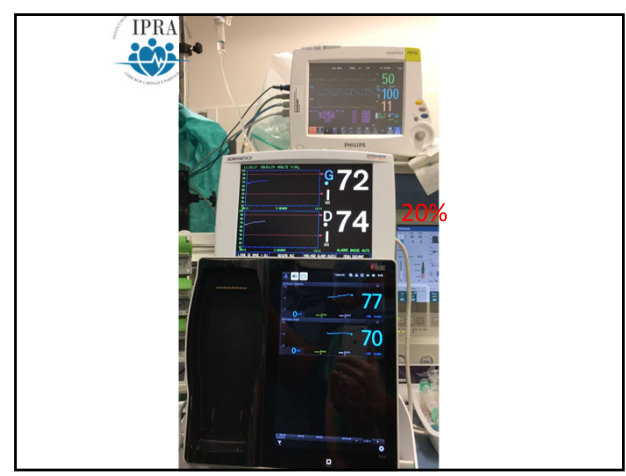
Slater et al. Ann thorac Surg 2009

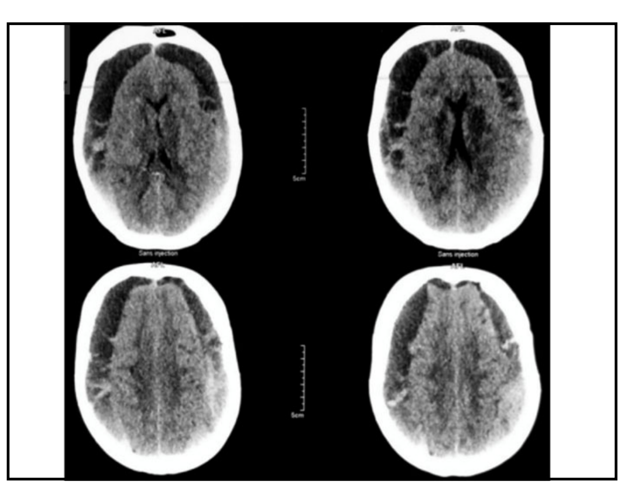




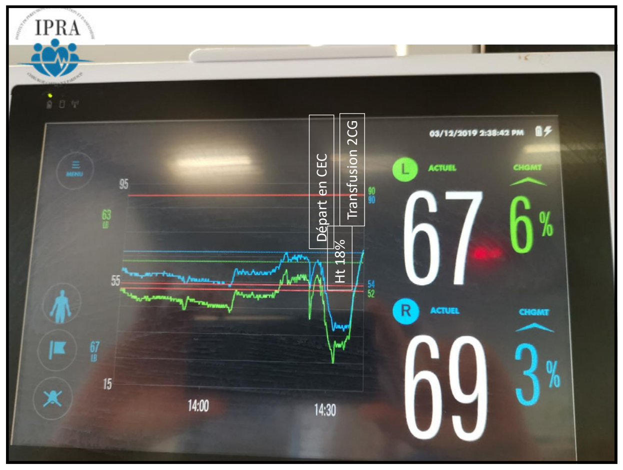
58
63
Medtronic




IPRA
50
100
11
PHILIPS
72
74
20%
77
70



03/15/2022 9:39:56 AM
MENU
95
59
55
63
15
09:00
09:30
L
CURRENT
CHANGE
59
0%
R
CURRENT
CHANGE
58
8%
Medtronic



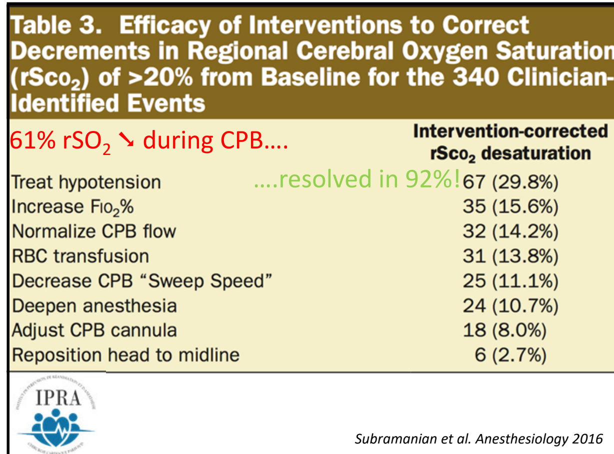


Table 3. Efficacy of Interventions to Correct Decrements in Regional Cerebral Oxygen Saturation ($rSco_2$) of >20% from Baseline for the 340 Clinician-Identified Events

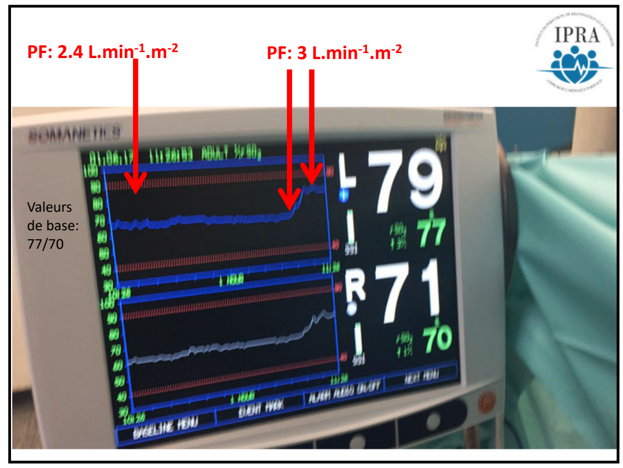
61% rSO_2 ↘ during CPB….

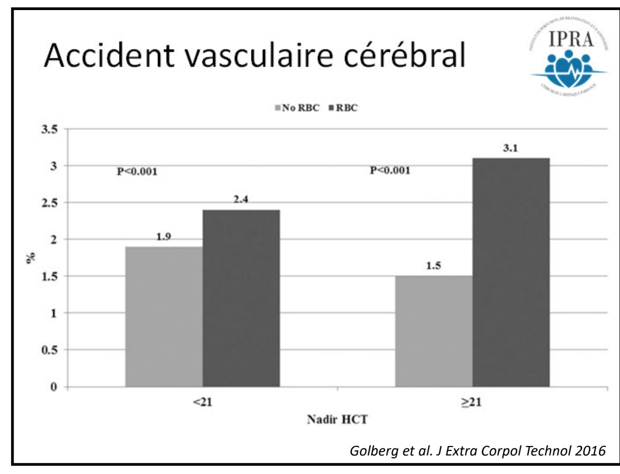
….resolved in 92%!

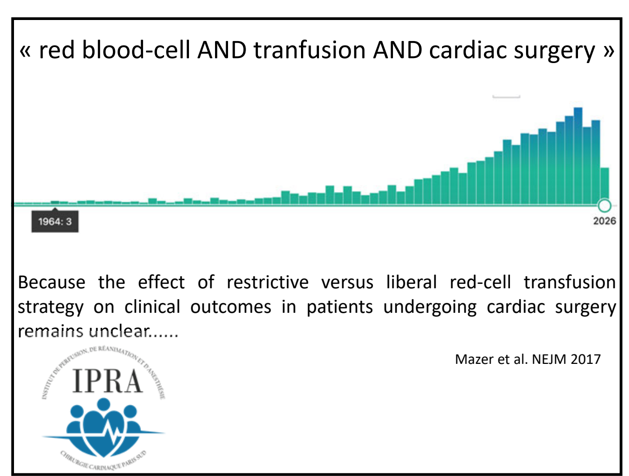
	Intervention-corrected $rSco_2$ desaturation
Treat hypotension	67 (29.8%)
Increase Fio_2%	35 (15.6%)
Normalize CPB flow	32 (14.2%)
RBC transfusion	31 (13.8%)
Decrease CPB "Sweep Speed"	25 (11.1%)
Deepen anesthesia	24 (10.7%)
Adjust CPB cannula	18 (8.0%)
Reposition head to midline	6 (2.7%)

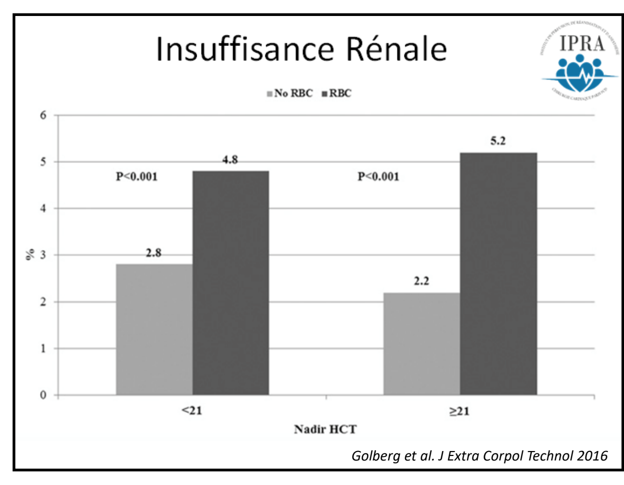
Subramanian et al. Anesthesiology 2016

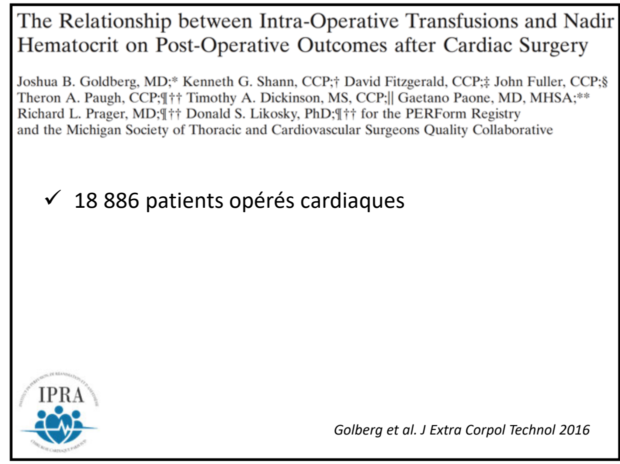
The « GOOD » strategy:
GDP & **NIRS** ?









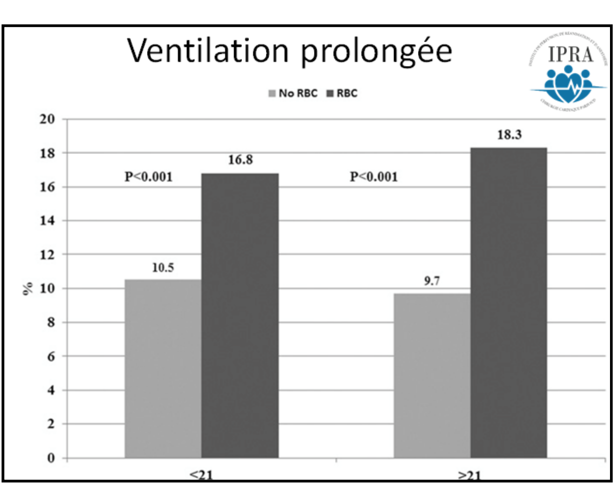

The Relationship between Intra-Operative Transfusions and Nadir Hematocrit on Post-Operative Outcomes after Cardiac Surgery

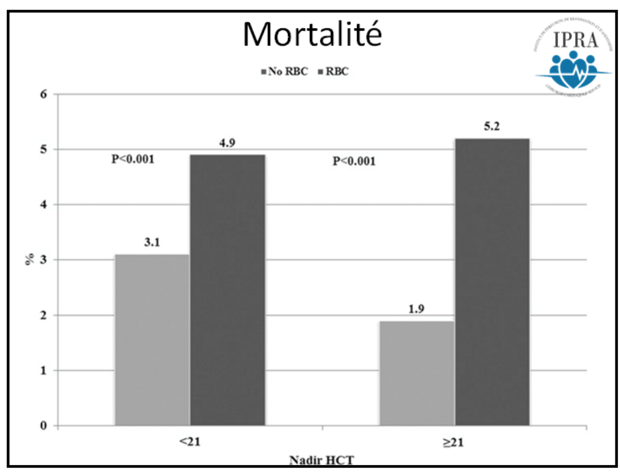
Joshua B. Goldberg, MD;* Kenneth G. Shann, CCP;† David Fitzgerald, CCP;‡ John Fuller, CCP;§ Theron A. Paugh, CCP;¶†† Timothy A. Dickinson, MS, CCP;|| Gaetano Paone, MD, MHSA;** Richard L. Prager, MD;¶†† Donald S. Likosky, PhD;¶†† for the PERForm Registry and the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative

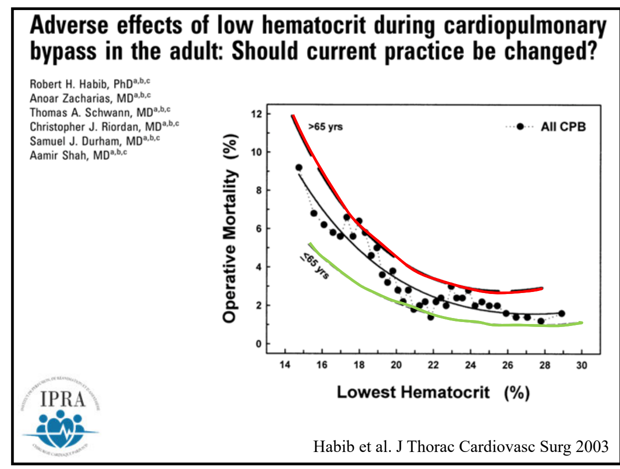
- ✓ 18 886 patients opérés cardiaques

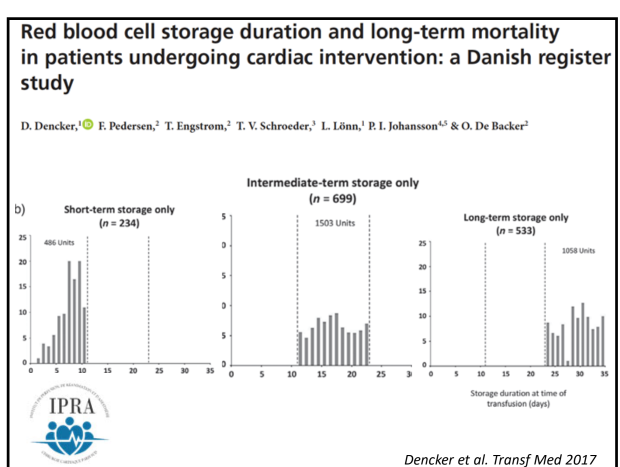
IPRA

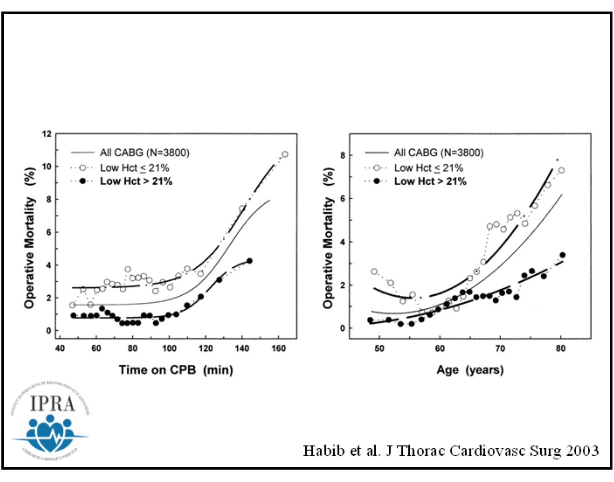
Golberg et al. J Extra Corpol Technol 2016

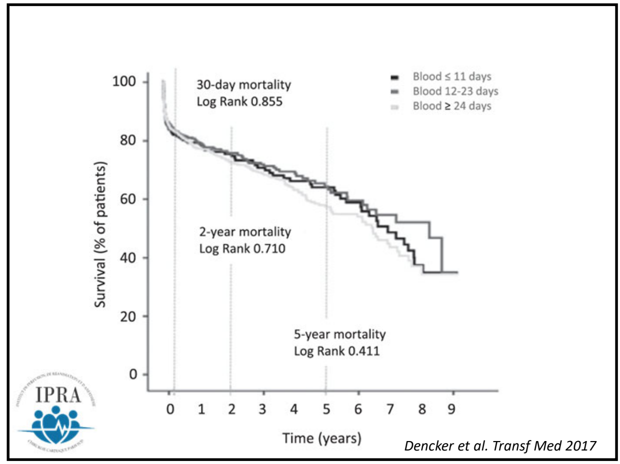


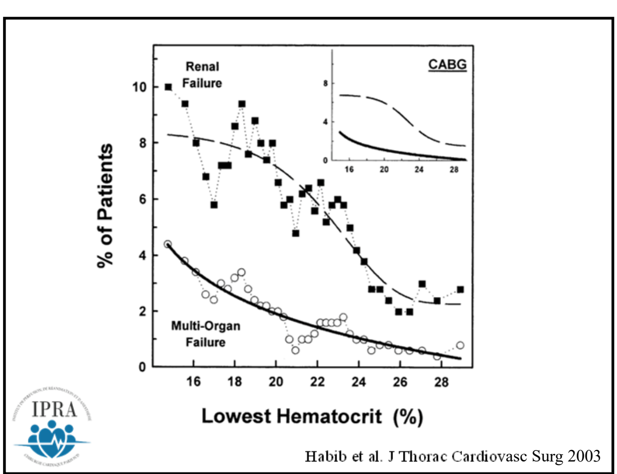

Mortalité
IPRA
No RBC
RBC
P<0.001
P<0.001
3.1
4.9
1.9
5.2
%
<21
≥21
Nadir HCT

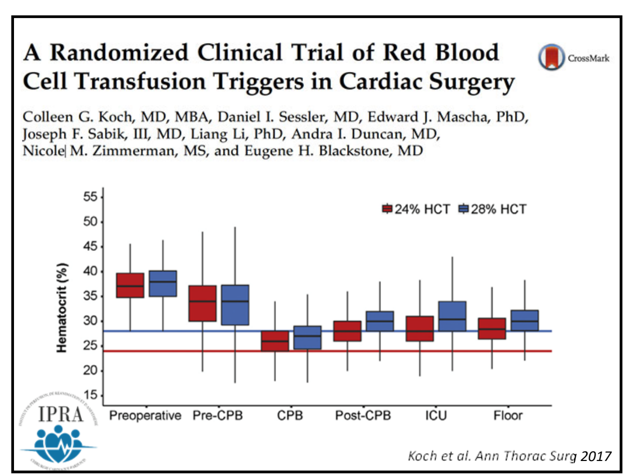

Adverse effects of low hematocrit during cardiopulmonary bypass in the adult: Should current practice be changed?
Robert H. Habib, PhD
Anoar Zacharias, MD
Thomas A. Schwann, MD
Christopher J. Riordan, MD
Samuel J. Durham, MD
Aamir Shah, MD
>65 yrs
<65 yrs
All CPB
Operative Mortality (%)
Lowest Hematocrit (%)
IPRA
Habib et al. J Thorac Cardiovasc Surg 2003

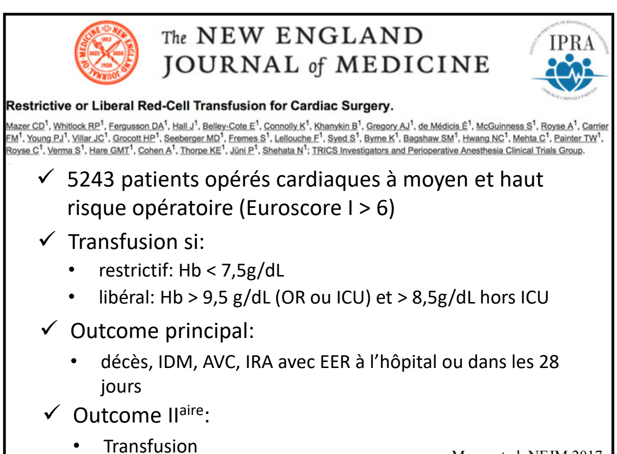

Red blood cell storage duration and long-term mortality in patients undergoing cardiac intervention: a Danish register study
D. Dencker, F. Pedersen, T. Engstrøm, T. V. Schroeder, L. Lönn, P. I. Johansson & O. De Backer
Short-term storage only (n = 234)
Intermediate-term storage only (n = 699)
Long-term storage only (n = 533)
486 Units
1503 Units
1058 Units
Storage duration at time of transfusion (days)
IPRA
Dencker et al. Transf Med 2017

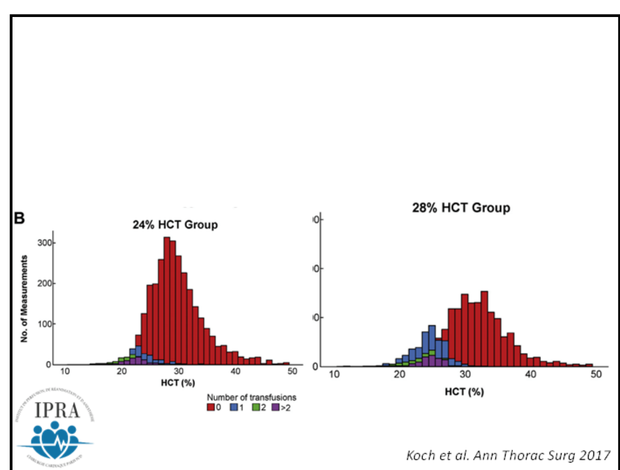

All CABG (N=3800)
Low Hct ≤ 21%
Low Hct > 21%
Operative Mortality (%)
Time on CPB (min)
Age (years)
IPRA
Habib et al. J Thorac Cardiovasc Surg 2003

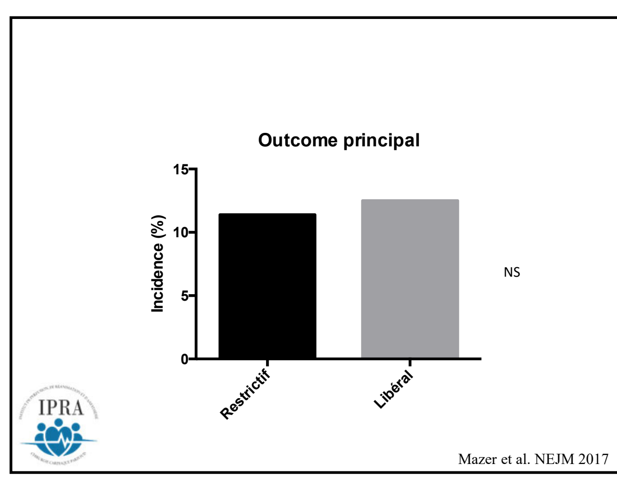

30-day mortality
Log Rank 0.855
Blood ≤ 11 days
Blood 12-23 days
Blood ≥ 24 days
2-year mortality
Log Rank 0.710
5-year mortality
Log Rank 0.411
Survival (% of patients)
Time (years)
IPRA
Dencker et al. Transf Med 2017


Renal Failure
CABG
Multi-Organ Failure
% of Patients
Lowest Hematocrit (%)
IPRA
Habib et al. J Thorac Cardiovasc Surg 2003





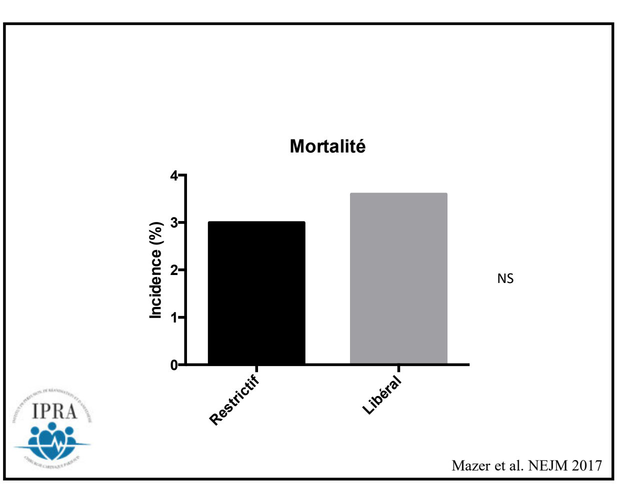


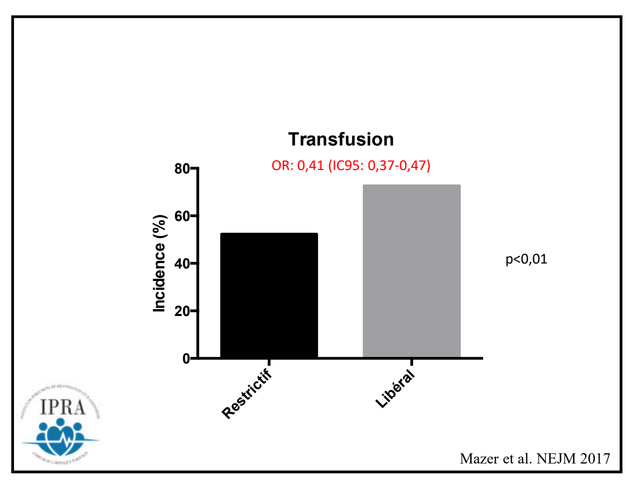


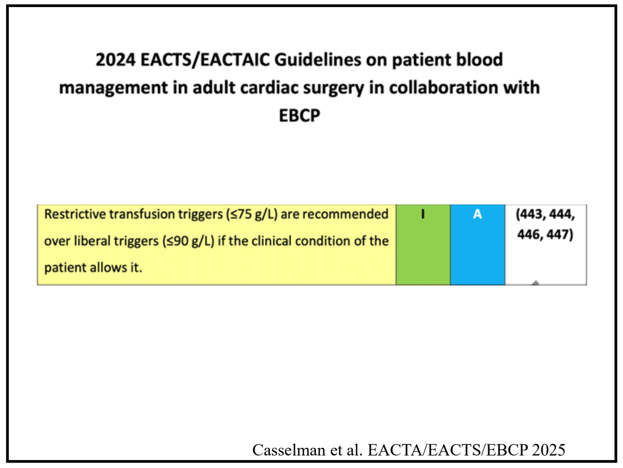
Morbidity	HCT Trigger 24% (n = 363)	HCT Trigger 28% (n = 354)	
Composite	59 (16)	68 (19)	
Mortality or multisystem organ failure	3 (0.8)	6 (1.7)	
Neurologic morbidity	1 (0.3)	3 (0.8)	
Pulmonary morbidity	23 (6.3)	19 (5.4)	
Renal morbidity	6 (1.6)	7 (2.0)	**NS**
Infectious morbidity	1 (0.3)	1 (0.3)	
Cardiac arrhythmia	36 (10)	50 (14)	
Asystole	2 (0.6)	1 (0.3)	
Gastrointestinal morbidity	5 (1.4)	2 (0.6)	
Reoperative morbidity	9 (2.5)	10 (2.8)	
Vascular morbidity	0 (0)	3 (0.8)	

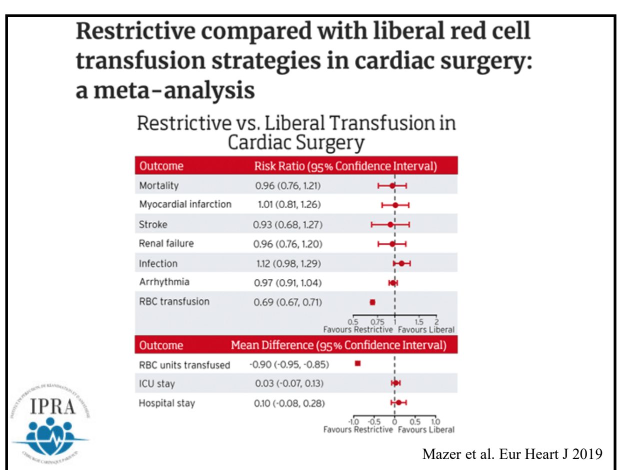
IPRA

Koch et al. Ann Thorac Surg 2017

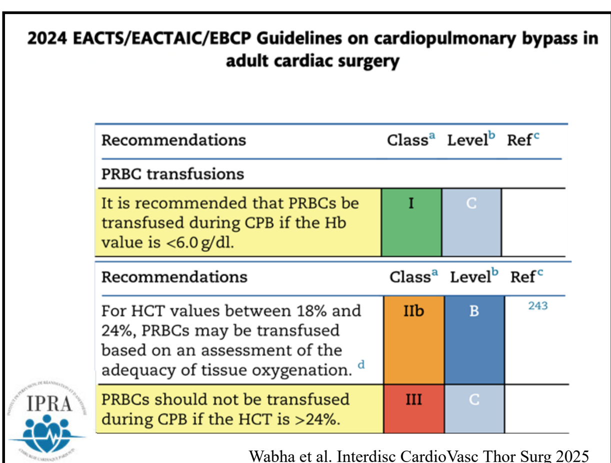


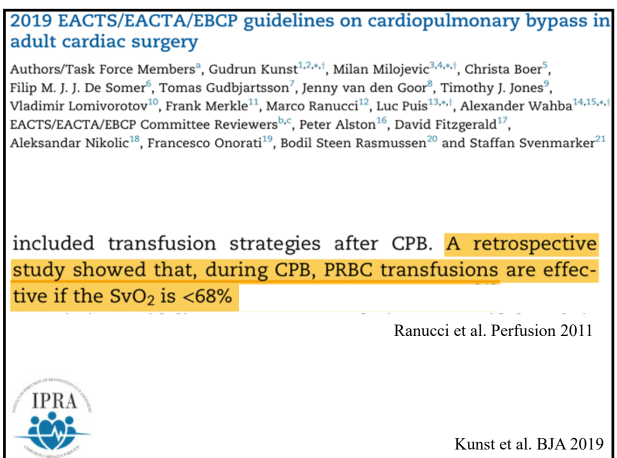

Transfusion
OR: 0,41 (IC95: 0,37-0,47)
Incidence (%)
80
60
40
20
0
p<0,01
Restrictif
Libéral
IPRA
Mazer et al. NEJM 2017


2024 EACTS/EACTAIC Guidelines on patient blood management in adult cardiac surgery in collaboration with EBCP
Restrictive transfusion triggers (≤75 g/L) are recommended over liberal triggers (≤90 g/L) if the clinical condition of the patient allows it.
I
A
(443, 444, 446, 447)
Casselman et al. EACTA/EACTS/EBCP 2025


Restrictive compared with liberal red cell transfusion strategies in cardiac surgery: a meta-analysis
Restrictive vs. Liberal Transfusion in Cardiac Surgery
Outcome | Risk Ratio (95% Confidence Interval)
Mortality 0.96 (0.76, 1.21)
Myocardial infarction 1.01 (0.81, 1.26)
Stroke 0.93 (0.68, 1.27)
Renal failure 0.96 (0.76, 1.20)
Infection 1.12 (0.98, 1.29)
Arrhythmia 0.97 (0.91, 1.04)
RBC transfusion 0.69 (0.67, 0.71)
Favours Restrictive Favours Liberal
Outcome | Mean Difference (95% Confidence Interval)
RBC units transfused -0.90 (-0.95, -0.85)
ICU stay 0.03 (-0.07, 0.13)
Hospital stay 0.10 (-0.08, 0.28)
Favours Restrictive Favours Liberal
IPRA
Mazer et al. Eur Heart J 2019

IPRA


2024 EACTS/EACTAIC/EBCP Guidelines on cardiopulmonary bypass in adult cardiac surgery
Recommendations | Class[a] | Level[b] | Ref[c]
PRBC transfusions
It is recommended that PRBCs be transfused during CPB if the Hb value is <6.0 g/dl. | I | C
Recommendations | Class[a] | Level[b] | Ref[c]
For HCT values between 18% and 24%, PRBCs may be transfused based on an assessment of the adequacy of tissue oxygenation.[d] | IIb | B | 243
PRBCs should not be transfused during CPB if the HCT is >24%. | III | C
IPRA
Wabha et al. Interdisc CardioVasc Thor Surg 2025


2019 EACTS/EACTA/EBCP guidelines on cardiopulmonary bypass in adult cardiac surgery
Authors/Task Force Members[a], Gudrun Kunst[1,2,*,†], Milan Milojevic[3,4,*,†], Christa Boer[5], Filip M. J. J. De Somer[6], Tomas Gudbjartsson[7], Jenny van den Goor[8], Timothy J. Jones[9], Vladimir Lomivorotov[10], Frank Merkle[11], Marco Ranucci[12], Luc Puis[13,*,†], Alexander Wahba[14,15,*,†]
EACTS/EACTA/EBCP Committee Reviewers[b,c], Peter Alston[16], David Fitzgerald[17], Aleksandar Nikolic[18], Francesco Onorati[19], Bodil Steen Rasmussen[20] and Staffan Svenmarker[21]
included transfusion strategies after CPB. A retrospective study showed that, during CPB, PRBC transfusions are effective if the SvO2 is <68%
Ranucci et al. Perfusion 2011
IPRA
Kunst et al. BJA 2019

2017 EACTS/EACTA Guidelines on patient blood management for adult cardiac surgery

The Task Force on Patient Blood Management for Adult Cardiac Surgery of the European Association for Cardio-Thoracic Surgery (EACTS) and the European Association of Cardiothoracic Anaesthesiology (EACTA)

Existing guidelines suggest transfusing PRBCs if the Hb is <6.0 g/dl[244] and an acceptable HCT value between 21% and 24% if the DO_2 is maintained above 273 ml/min/m^2.[2]

Pagano et al. Eur J Cardiothor Surg 2018

liberal transfusion trigger during CPB; however, in the presence of a low Hb value, the DO_2 is preserved by increasing the pump flow.[203] FFP has been used during CPB as a source of

De Somer et al. Crit Care 2011

IPRA

Table 3. Efficacy of Interventions to Correct Decrements in Regional Cerebral Oxygen Saturation ($rSco_2$) of >20% from Baseline for the 340 Clinician-Identified Events

61% rSO_2 ↘ during CPB....

....resolved in 92%!

	Intervention-corrected $rSco_2$ desaturation
Treat hypotension	67 (29.8%)
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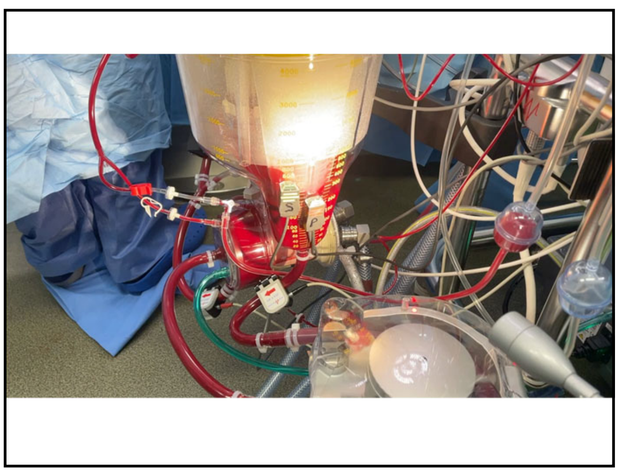
Reposition head to midline	6 (2.7%)

IPRA

Subramanian et al. Anesthesiology 2016



Take Home Messages

A « good» hemodynamic management during CPB is a “case by case” strategy :

- ✓adapted to the patient (not to the physician)
- ✓Pump flow ++++
- ✓DO_2, $D0_2/VC0_2$, Ht….
- ✓MAP is the last step (MAP ≈ 50 mmhg)
- ✓Adapted transfusion

Crucial and modern tools are:

- ✓GDP
- ✓NIRS