CPPopt without 'Cogitates'

can we manage patients?

teamwork

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CPPopt without 'Cogitates'

'cogitate'

think deeply about something
meditate or reflect

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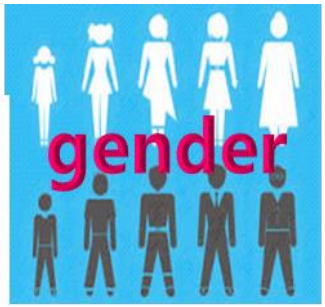
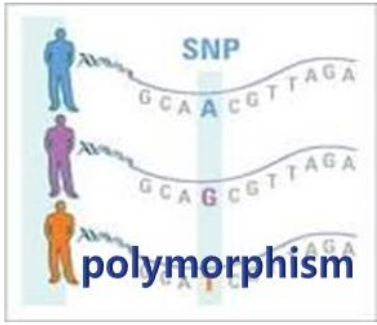
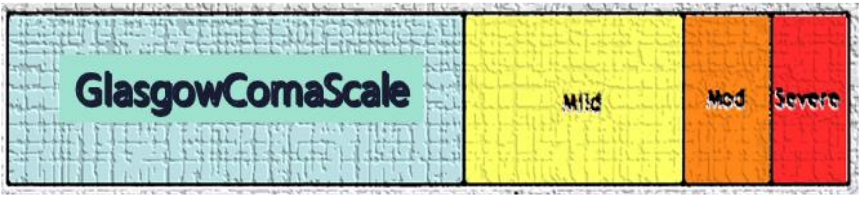
CPP one size fits all?

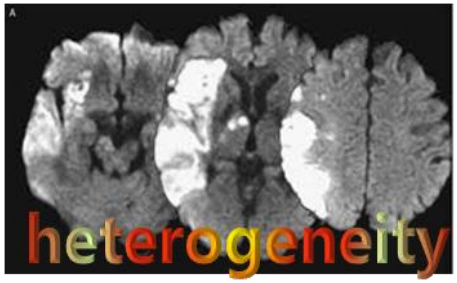
the driving force of cerebral blood flow across the microvascular capillary bed.

CPP = MAP-ICP









TBI ICH SAH STROKE

'cogitate'= think deeply about something; meditate or reflect.

CPP one size fits all?

the driving force of cerebral blood flow across the microvascular capillary bed.

CPP above : 70? ….65?…

J Neurosurg 83:949–962, 1995

Cerebral perfusion pressure: management protocol and clinical results

MICHAEL J. ROSNER, M.D., SHEILA D. ROSNER, R.N., M.S.N., AND ALICE H. JOHNSON, R.N., B.S.N.

Division of Neurological Surgery, Department of Surgery, University of Alabama at Birmingham, Birmingham, Alabama

CPP may be low; ICP<15 mmHg

Intensive Care Med (2006) 32:1475–1484
DOI 10.1007/s00134-006-0294-3

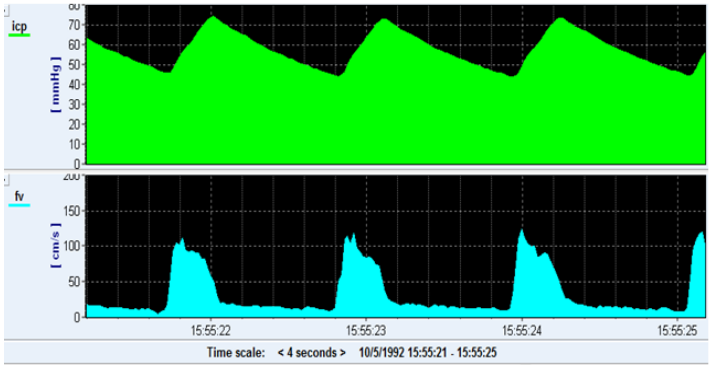
REVIEW

Per-Olof Grände

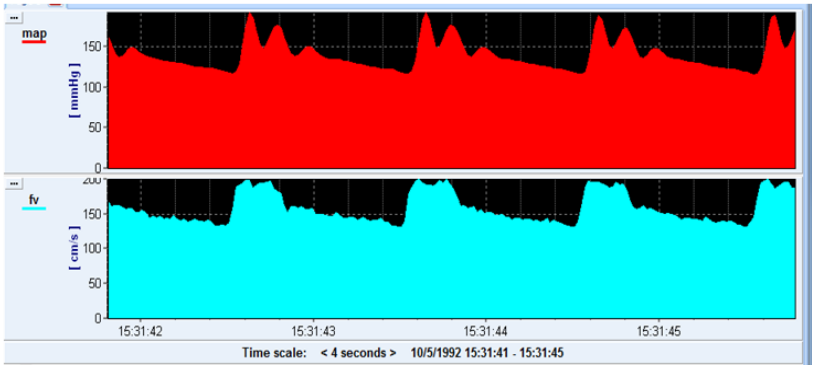
The "Lund Concept" for the treatment of severe head trauma – physiological principles and clinical application

CPP one size fits all?

Too low CPP: ischaemia



Too high CPP: hyperaemia



'cogitate'= think deeply about something; meditate or reflect.

CPP one size fits all?

the driving force of cerebral blood flow across the microvascular capillary bed.

CPP = MAP-ICP

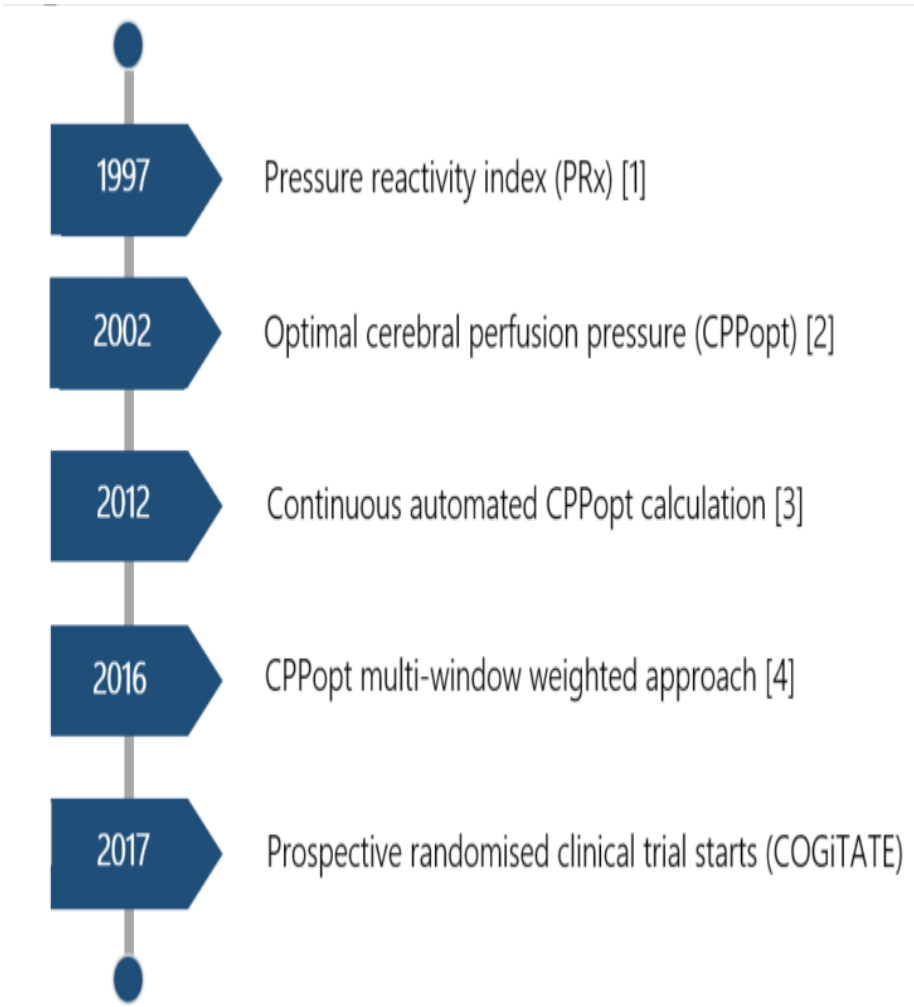
Rosner MJ et al. J Neurosurg (1995) 83:949-62

"the minimum level of CPP in this instance is greater than 70mmHg and frequently higher, defined by individual circunstances"

PRx = pMAP,ICP

Marek Czosnyka, Zofia Czosnyka, Peter Smielewski. Acta Neurochir (2017) 159:2063-65

"the most important advantage of PRx is the ability to guide the management of cerebral perfusion pressure"



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CPPopt

individualized CPP according to the autoregulation status

CPP = MAP-ICP

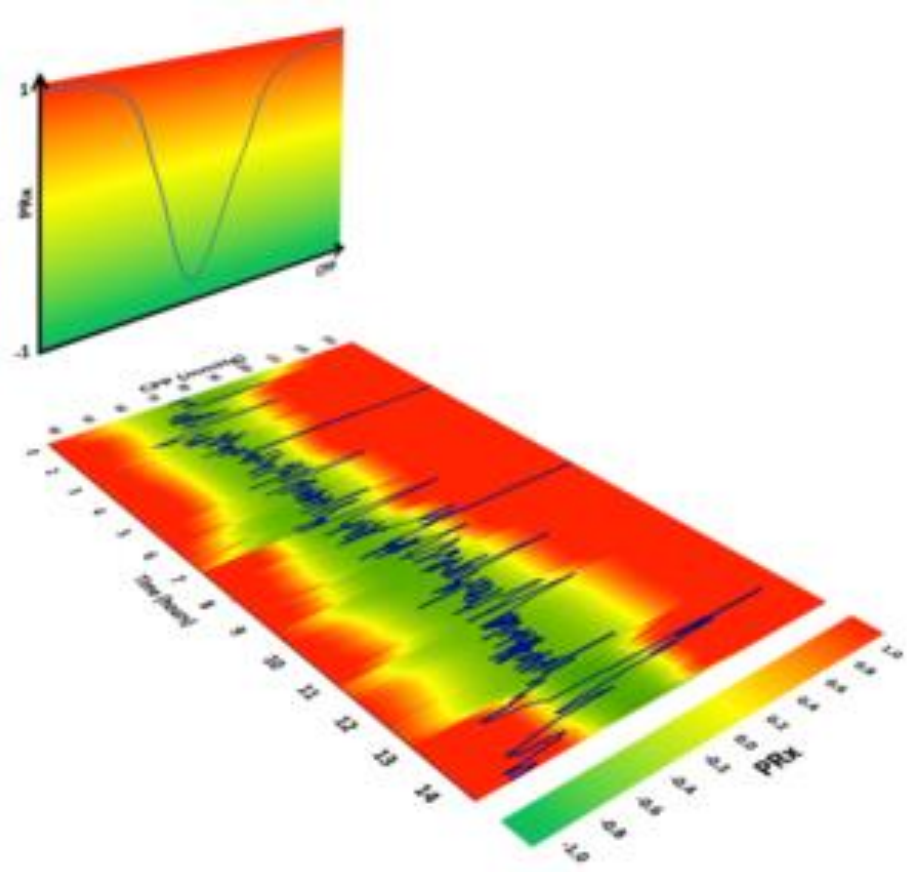
PRx = ρMAP,ICP

CPPopt = f (PRx)

Luzius Steiner

'The Cambridge Hypothesis'

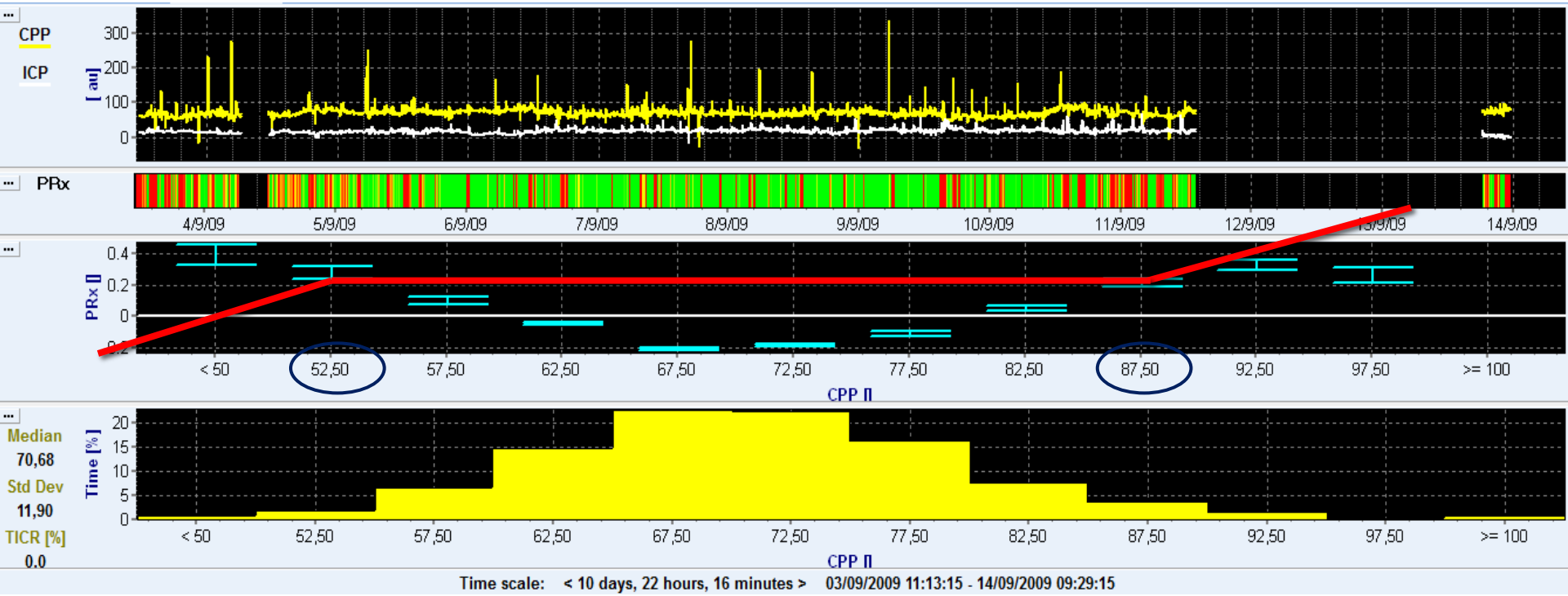
CPP should be kept at the CPP where an individual patient autoregulates most efficiently



from http://cppopt.org/cppopt-calculation-visualisation/

'cogitate'= think deeply about something; meditate or reflect.

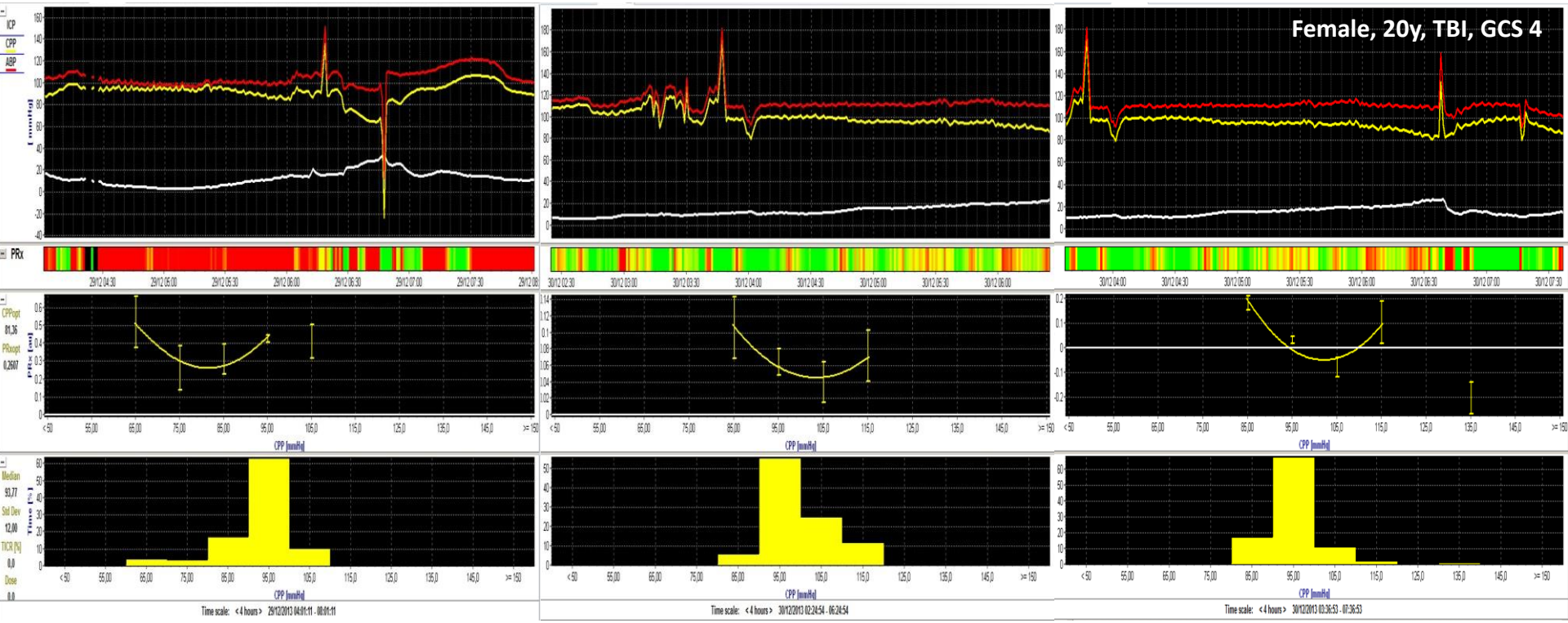
CPPopt: visual analysis and decision steps



Clinical Decision Support System approach:

- CPPopt value and curve, updated every minute, in a 4 hr calculation window
- at least 75% of time good recordings of CPP and ICP values had to be available in the 4hr calculation window
- average PRx values had to be < 0.25 the past 4hrs
- select the CPP value with most negative PRx value covered by the curve.
- U-shaped, ascending and descending curves were accepted in case the overall PRx<0.25.

TBI: CPPopt and CPP management



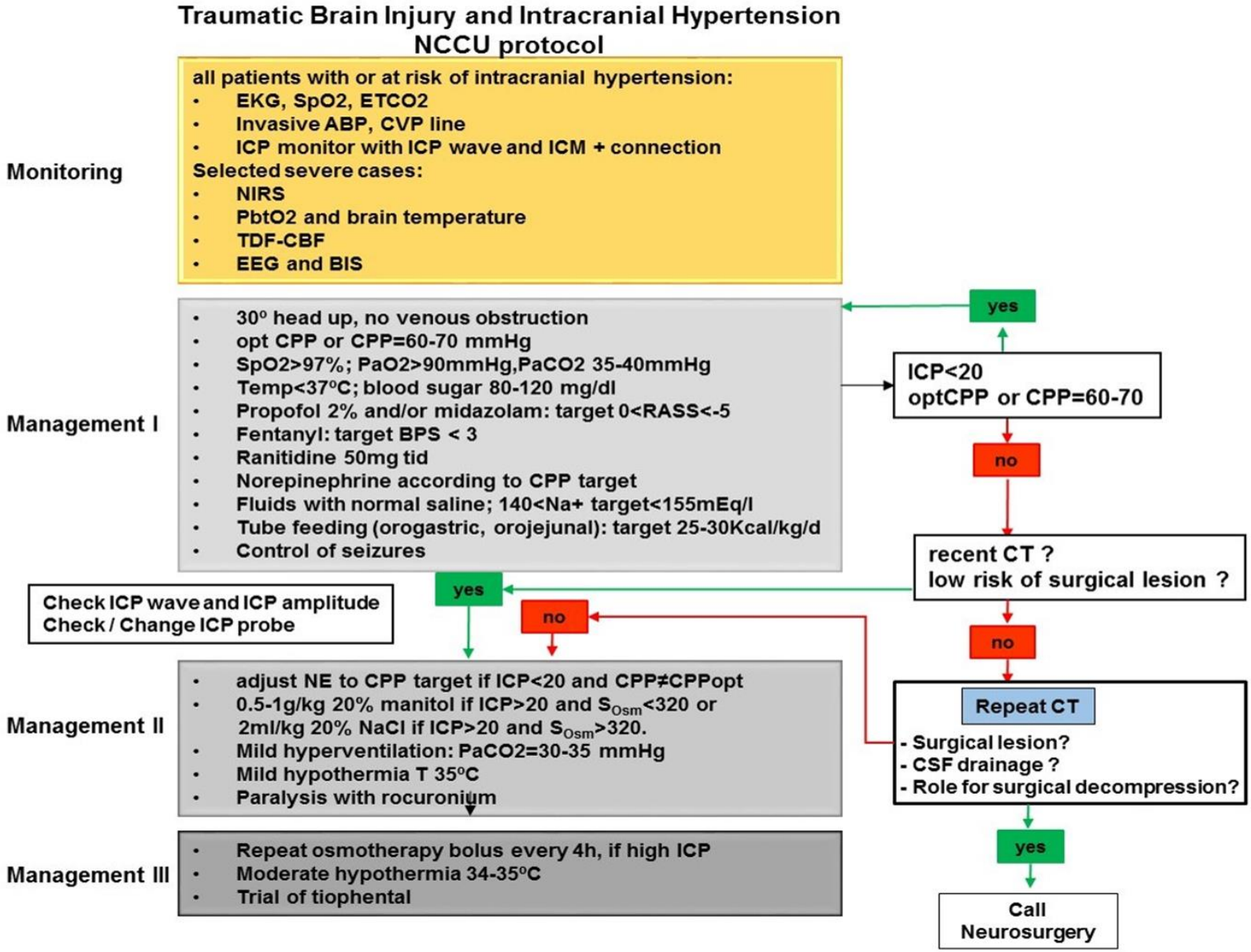
CPP management with PRx and CPPopt:

a) When possible, we guide CPP management using the bedside CPPopt values.

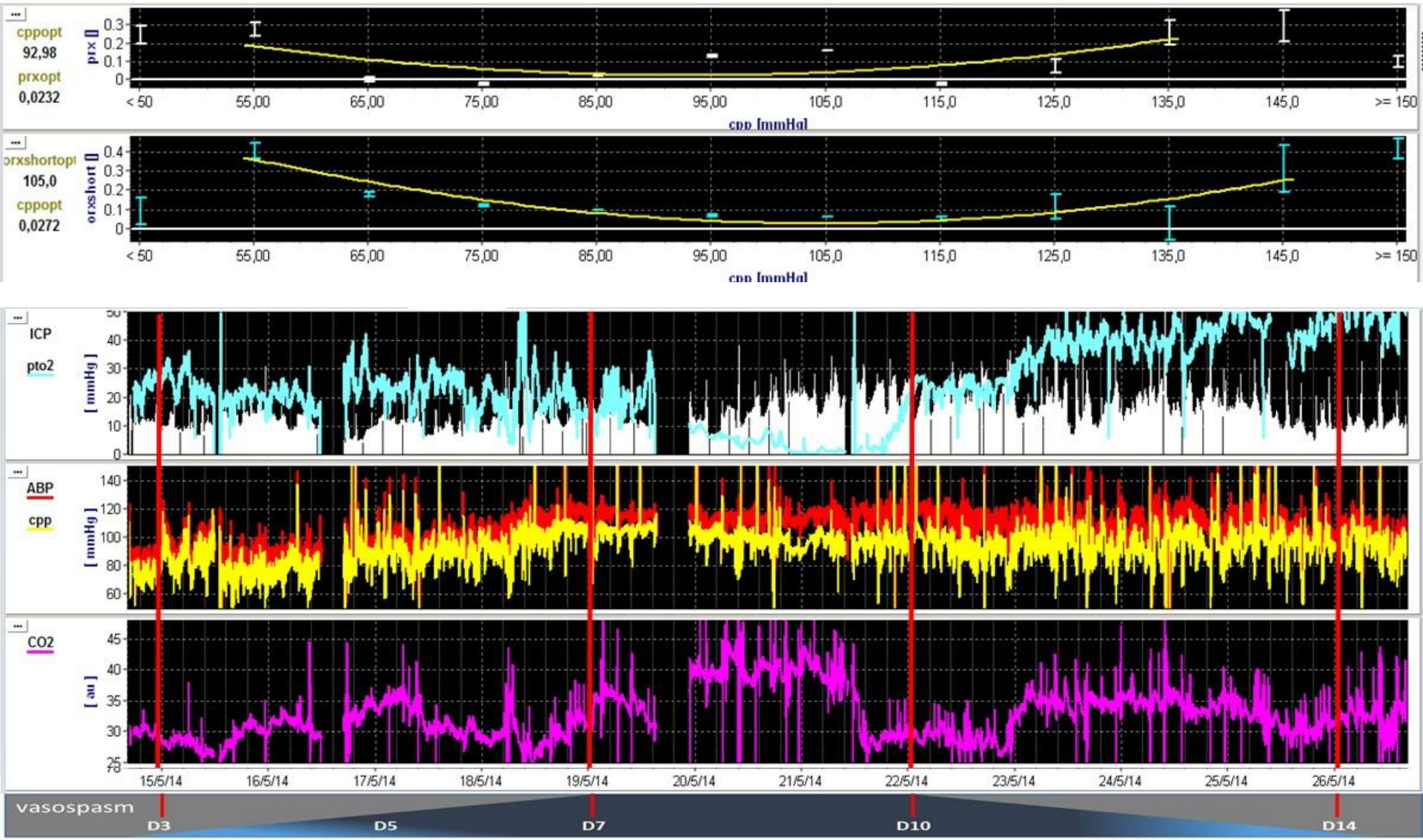
b) Management of CPPopt values with: adequate sedoanalgesia, oxygenation, ventilation, control of temperature, vasopressor therapy, fluid balance and treat intracranial hypertension.

c) When CPPopt is not available, we keep CPP between 60-70 mmHg in accordance to BFT Guidelines.

TBI management protocol



CPPopt, pbtO2 and vasospasm management

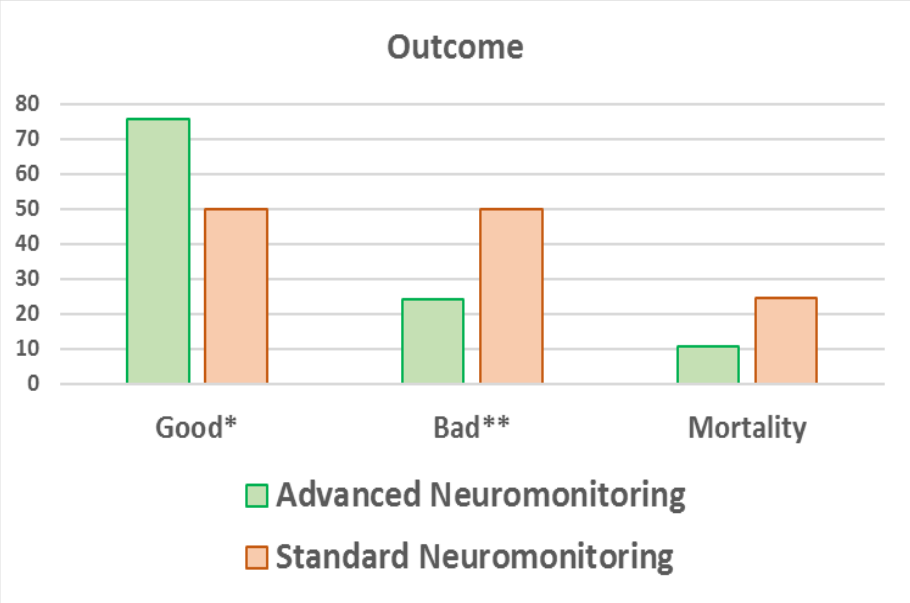


'CPPopt' in clinical practice at the NCCU: how do we do it with ICM+ in Porto

CPPopt, outcome and advanced neuromonitoring, 2019

severe TBI and spontaneous SAH with advanced vs standard neuromonitoring

- **3 and 6M outcome** of the 2 groups of patients
- except for age there was no difference between the two groups at baseline, namely for GCS and SAPS II.
- **Advanced neuromonitoring group had a significantly better outcome (GOS) at 3 and 6 months and lower mortality.** Adjusting outcome for age, patients with advanced neuromonitoring had a lower risk of bad outcome.



Outcome Mortality and GOS		Advanced Monitoring n (%)	Standard Monitoring n (%)	*p* value	Odds ratio (adjusted for age)
at 3 months	Good*	50 (75.8)	110 (50.0)	0.01	
	Bad**	16 (24.2)	110 (50.0)		0.485(0.248-0.950)
	Mortality	7 (10.6)	54 (24.5)	0.015	0.579(0.238-1.404)
at 6 months	Good*	50 (76.9)	119 (58.0)	0.006	
	Bad**	15 (23.1)	86 (42.0)		0.632(0.316-1.263)
	Mortality	9 (13.8)	52 (25.4)	0.053	0.798(0.346-1.838)

*Good = GOS 4+5 **Bad= GOS1+2+3

CPPopt, the first published results, 2015

neurocritical care society Neurocrit Care
DOI 10.1007/s12028-014-0103-8

Published online: 08 January 2015

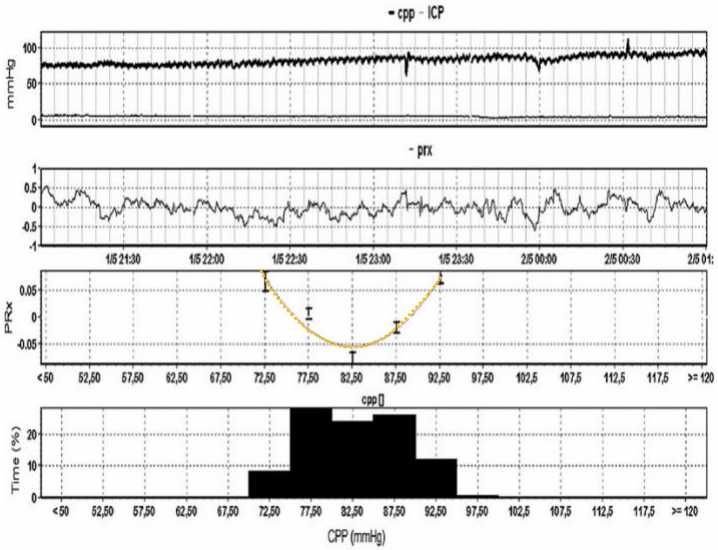
ORIGINAL ARTICLE

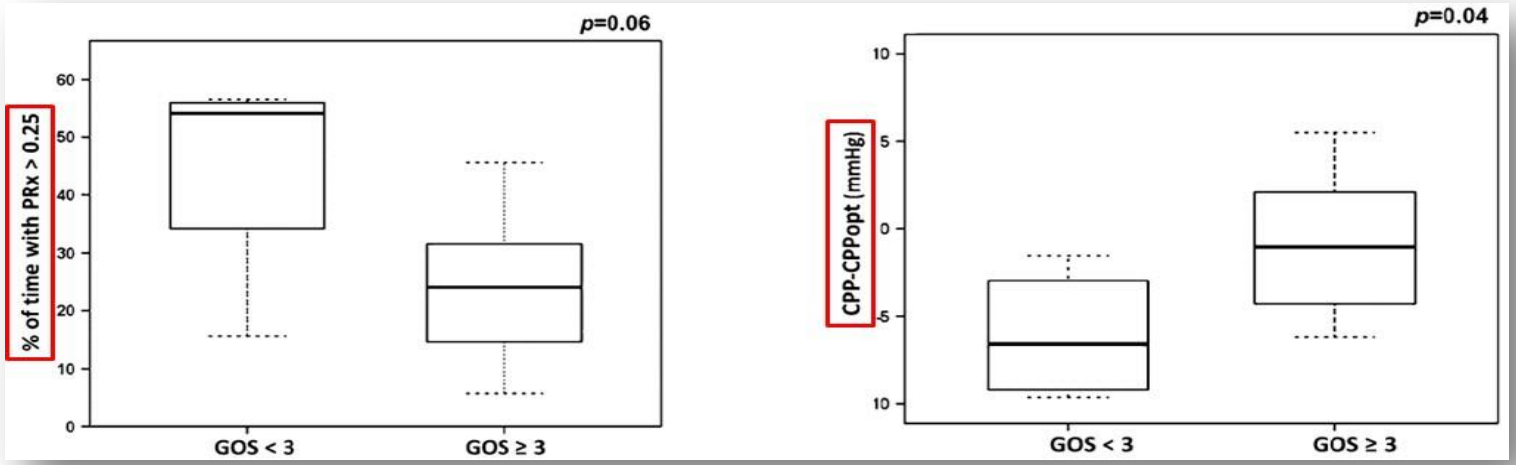
Optimal Cerebral Perfusion Pressure Management at Bedside: A Single-Center Pilot Study

Celeste Dias · Maria João Silva · Eduarda Pereira · Elisabete Monteiro · Isabel Maia · Silvina Barbosa · Sofia Silva · Teresa Honrado · António Cerejo · Marcel J. H. Aries · Peter Smielewski · José-Artur Paiva · Marek Czosnyka

CV reactivity preserved (PRx < 0.25) *(n=15)*
- mean PRx = -0.04 (SD 0.13)

CV reactivity impaired (PRx > 0.25) *(n=3)*
- mean PRx = 0.29 (SD 0.04)





There were no differences in age, SAPSII, and Marshall scores, but patients with overall preserved autoregulation presented significantly higher GCS at admission.

CPPopt vs CPP and outcome at 6M, 2018

severe TBI and spontaneous SAH

- **6M outcome** of patients at NCCU managed according to CPPopt
- Patients at the general ICU are managed according to guidelines
- No difference between age, gender and severity scores between groups

$p<0{,}001$

	NCCU n, (%)	**General ICU** n, (%)	**Surgical ICU** n, (%)
Bad outcome (GOS 1, 2, 3)	15 (14%)	41 (38%)	52 (33%)
Good outcome (GOS 4,5)	50 (47%)	35 (33%)	22 (21%)
	65	76	74

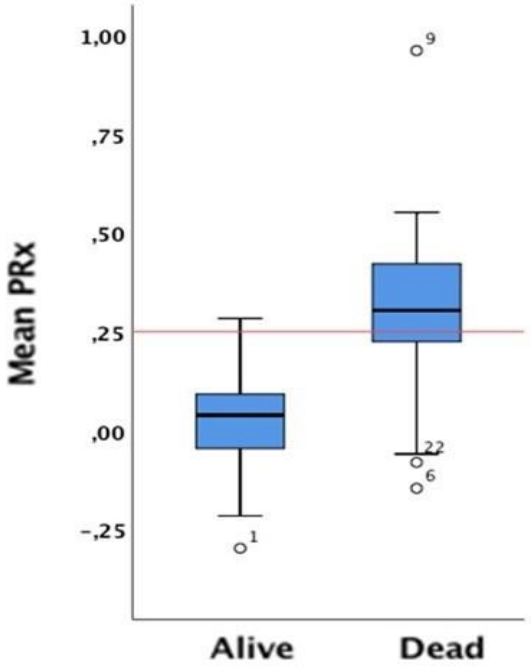
CPPopt, outcome and ICH, 2019

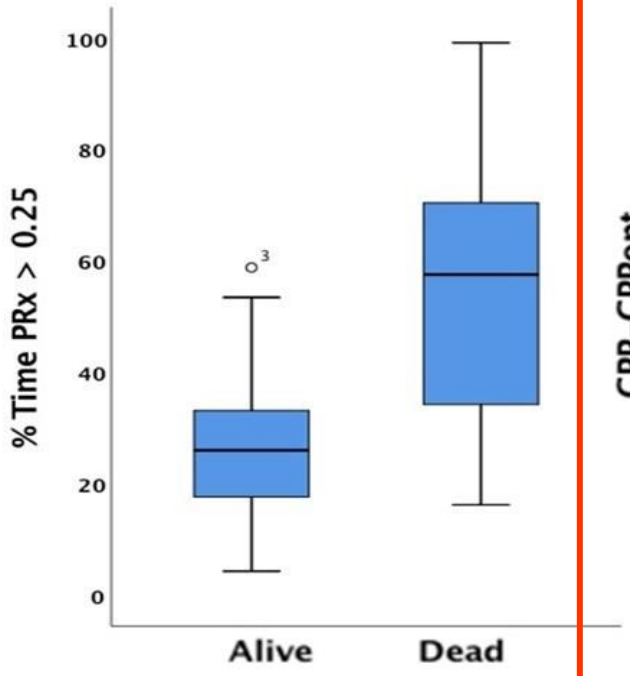
Spontaneous Intracerebral Hemorrhage

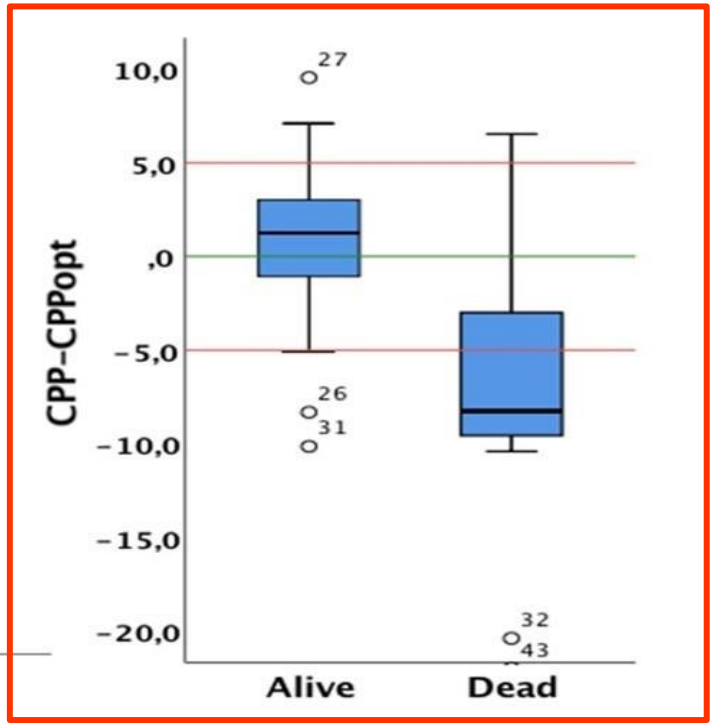
28-day mortality and PRx, % of time of PRx > 0.25 and CPP-CPPopt

We analyzed data from 46 patients, representing a mean duration of 263±173 hours of signal records, with a median length of stay in ICU of 22 (IQR 13) days. The mean age was 62.6±11.8 years old and 24(52%) were male. EVD drainage was applied in 50% of patients and 32.6% were submitted to surgery.

	Alive (29)	Dead (17)	*p*
ICP dose	1.24 (2.33)	8.90 (21.25)	0.001
PRx	0.026±0.147	0.3±0.264	0.001
% time PRx > 0.25	26 (17.8)	57.6 (40)	<0.001
CPP-CPPopt	0.67±4.32	-6.57±7.50	0.037



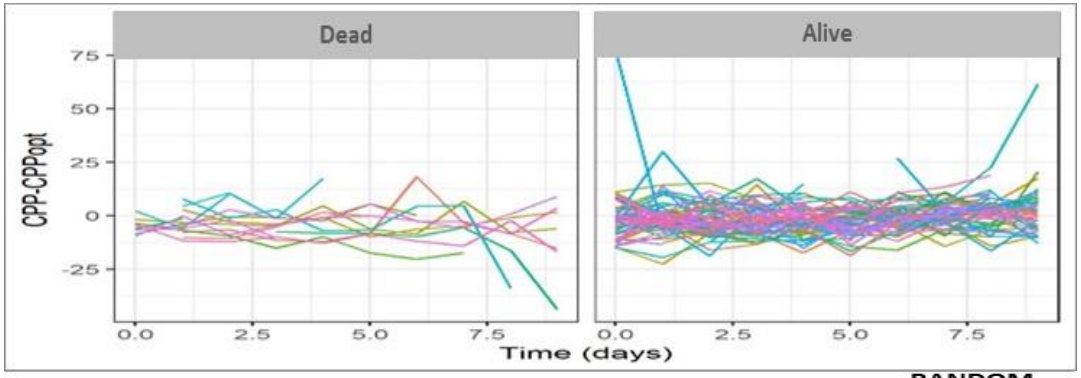




CPP-CPPopt along time and outcome at 3M, 2019

Demographic Data		Mean/Median (+/-sd or IQR)
Number of Patients		92
Age (Years)		53 ± 21
Gender	Male	79 (86%)
	Female	13 (14%)
GCS at admission		7 (IQR 5)
APACHE II		19 ± 6
Apache II mortality (%)		33 ± 17%
CT Marshall score		3 (IQR 2)
Outcome Data		
LOS ICU (days)		22 ± 26
LOS Hosp (days)		48 ± 48
Mortality		14 (15.2%)
GOS at 3 months		3 (IQR 2)
Monitoring Data		
ICP (mmHg)		11,19 ± 5,79
CPP (mmHg)		85,91 ± 7,37
PRx		0,03 ± 0,19
CPPopt (mmHg)		88,74 ± 8,54
CPP-CPPopt (mmHg)		-2,83 ± 10,23

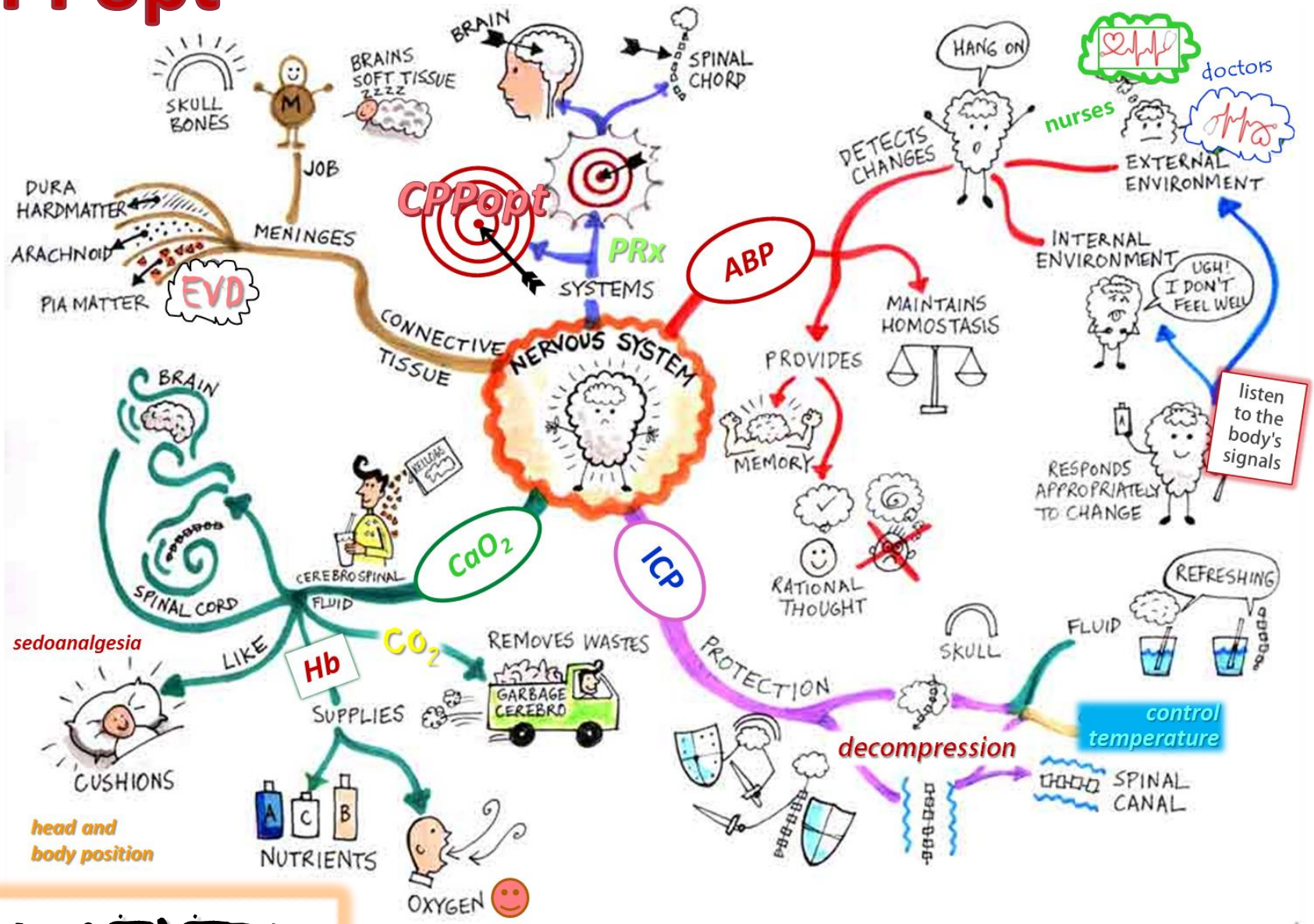
Model for time-effect on outcome of CPP-CPPopt



	FIXED EFFECTS			RANDOM EFFECT
Variables	Coefficient	Standard Error	*p*-value	sd
Intercept	-2.370	1.575	**0.133**	2.947
Dead	-0.788	1.715	0.647	
Day	-0.561	0.283	0.048	
Time*Dead	1.104	0.305	**<0.001**	

While, **at day 0 CPP-CPPopt is not significantly different between dead and alive**, **as time evolves during the first 10 days** of the study, the model expects: (1) **alive individuals to significantly increase CPP-CPPopt within positive range** on average by 0.5 each day; (2) **dead individuals to progressively lower their CPP-CPPopt values within negative range**, at a rate of 0.6 per day (p=0.048).

CPPopt



CoGiTATES

Thanks for your attention