DOPPLER TRANS CRANIEN
- EN TRAUMATOLOGIE
- MORT ENCÉPHALIQUE

TUSAR 2025-2026

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Plan

DTC et traumatisé crânien

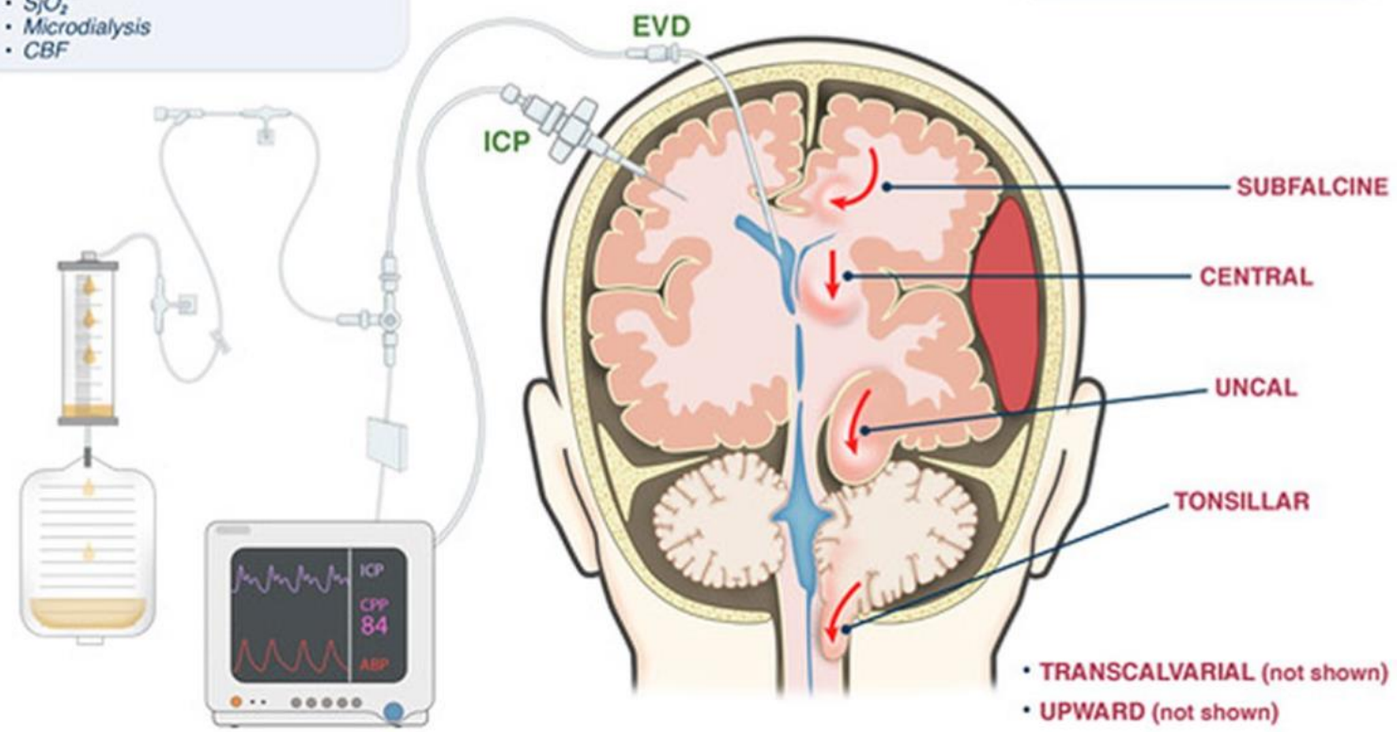
1. Rappels physiopathologiques traumatisme crânien
2. Facteurs confondants et limites
3. Apports du DTC dans la cas du traumatisé crânien
4. Conclusion

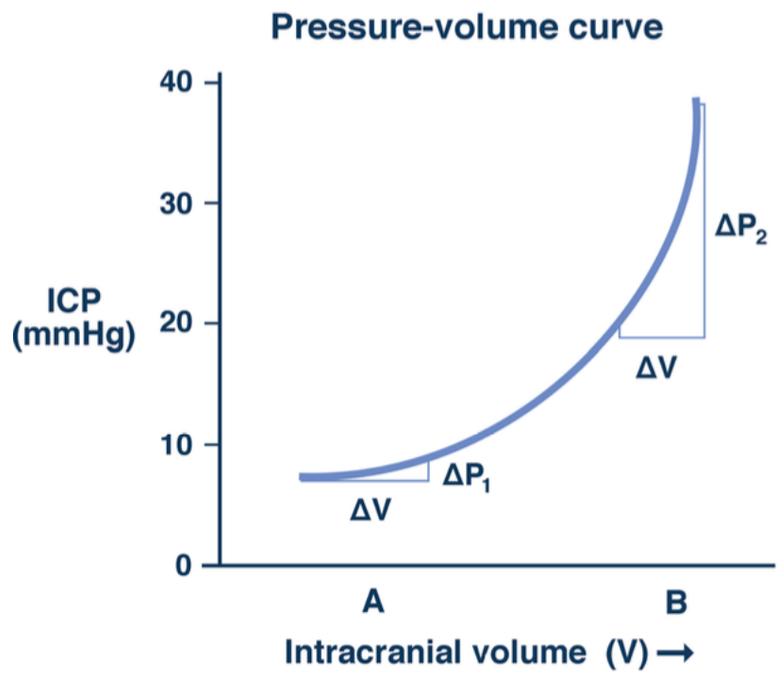
Hypoperfusion toxicity
ISCHEMIA

- Assess CPP = MAP-ICP
- Assess CO_2
- Consider cerebrovascular autoregulation
- Consider ancillary monitoring
  - EEG
  - $PbtO_2$
  - SjO_2
  - *Microdialysis*
  - *CBF*

Mechanical toxicity
HERNIATION

Consider:
- Imaging
- Pupillometry
- Surgical lesions



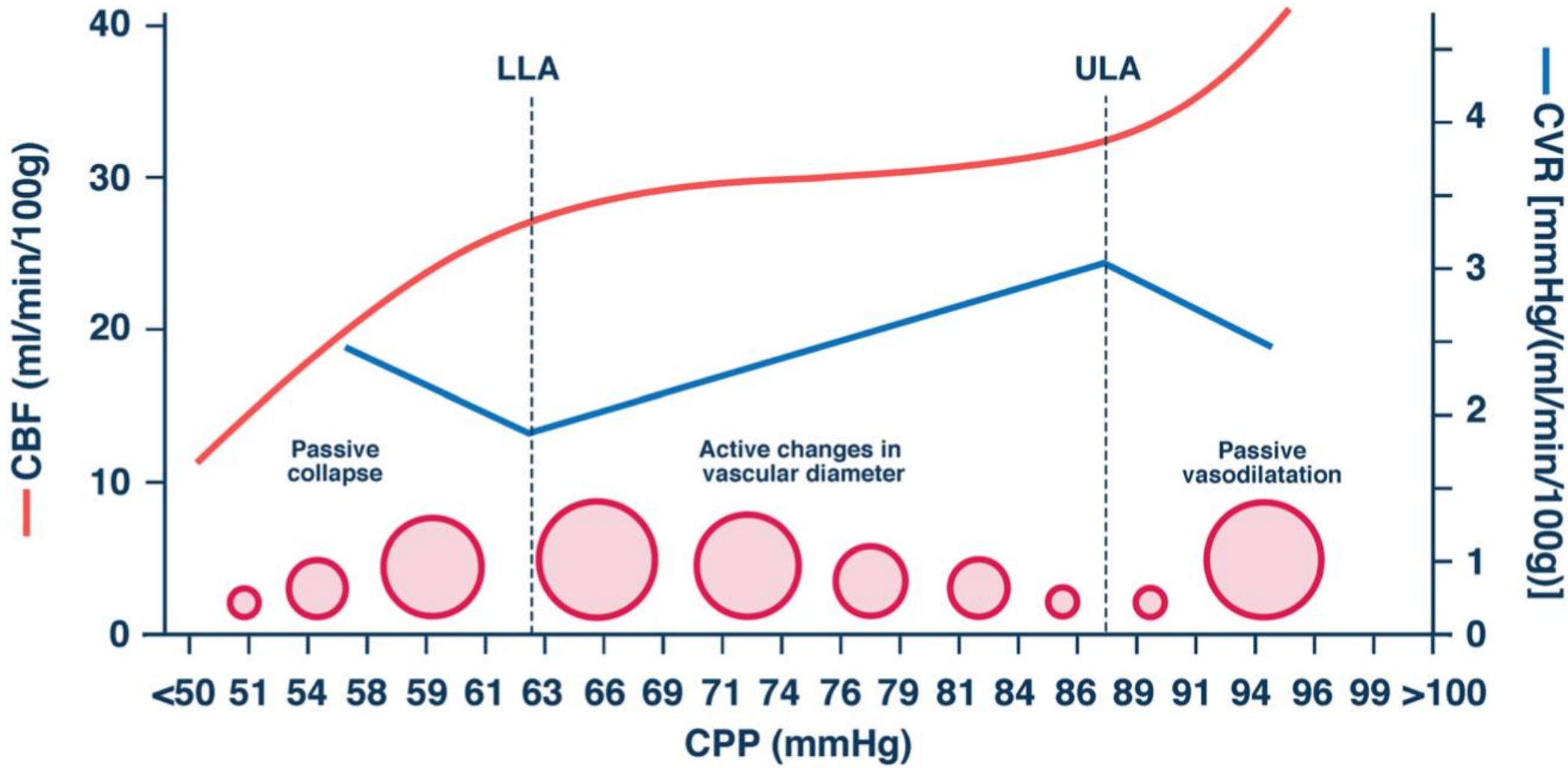


Sang (contenu dans les vx)
Parenchyme cérébral
LCR

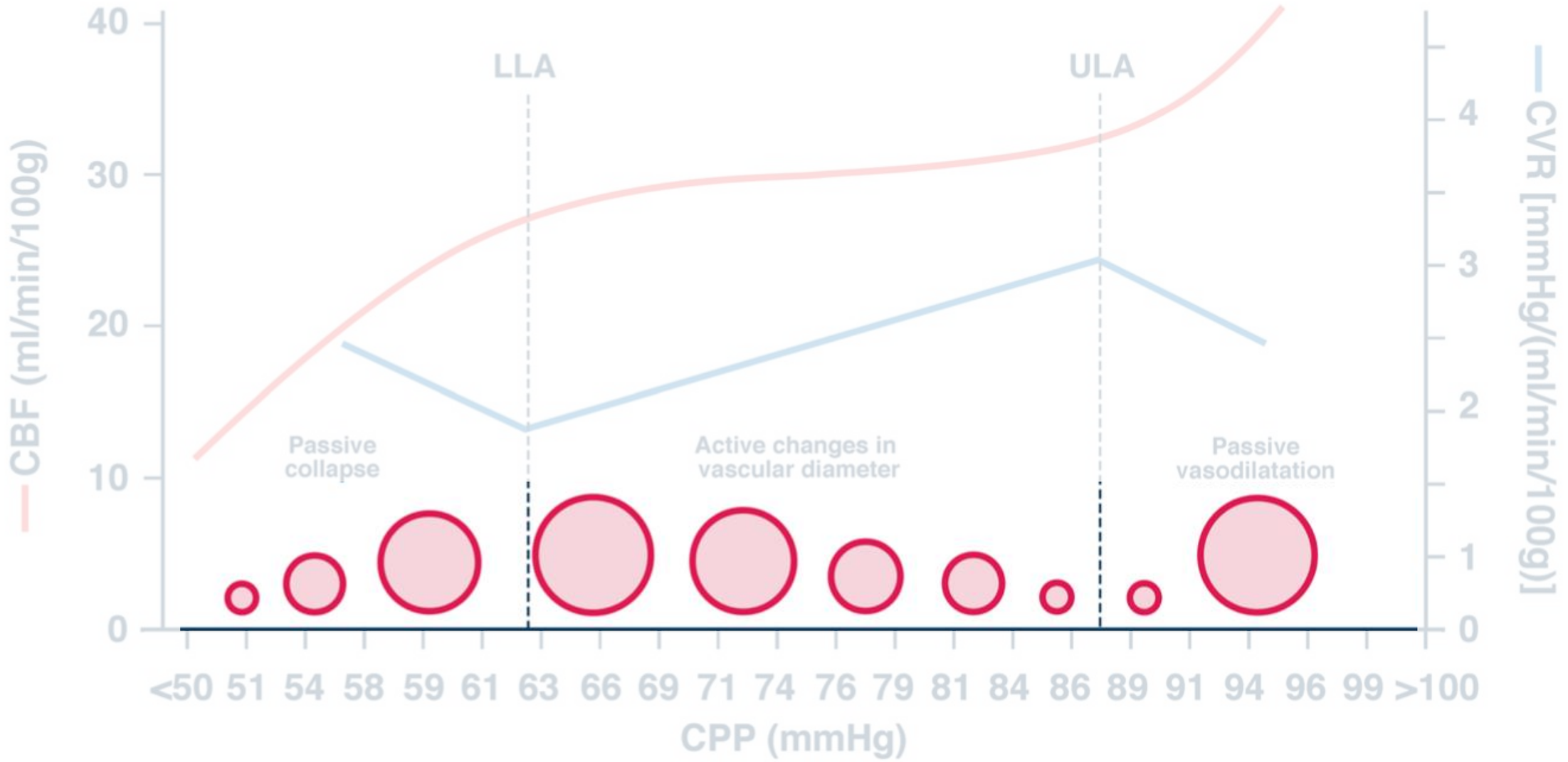
PIC = Pression intra-crânienne (Normale < 15 mmHg)
HTIC = Hyper Tension Intra-Cérébrale (PIC > 22 - 25 mmHg)
PPC = Pression de perfusion cérébrale

PPC = PAM - PIC

Intensive Care Med (2022) 48:1471–1481



Intensive Care Med (2022) 48:1471–1481



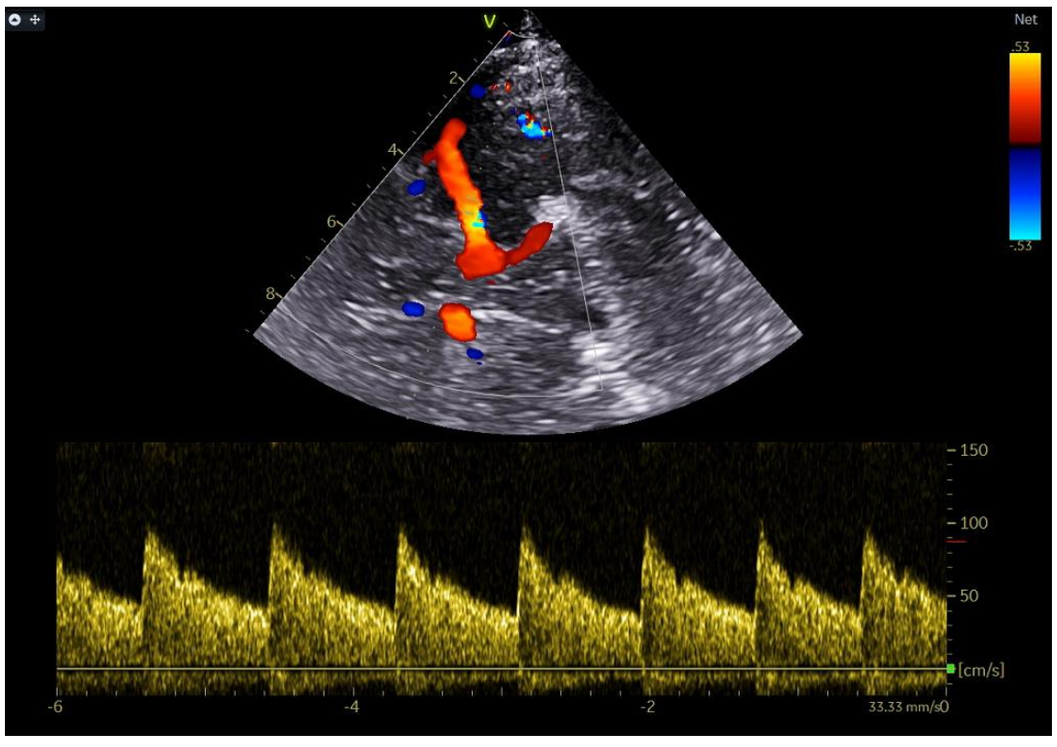
Variabilité du diamètre des artères cérébrales

Intensive Care Med (2022) 48:1471–1481

DTC et Débit Sanguin Cerebral

En théorie

DSC = FC x ITV x surface du vaisseau



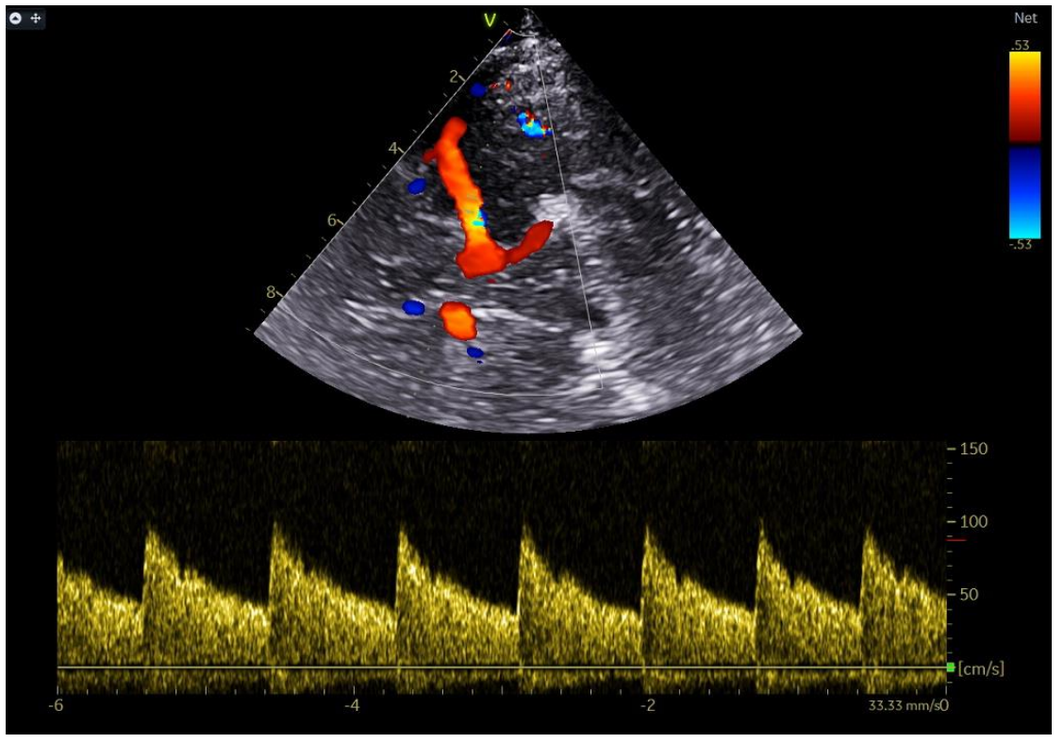
DTC et Débit Sanguin Cerebral

En théorie DSC = Fc x ITV x surface du vaisseau

Limite pratique :

Résolution spatiale et erreur de mesure

Variabilité du diamètre des vaisseaux
Variabilité augmente avec la distalité

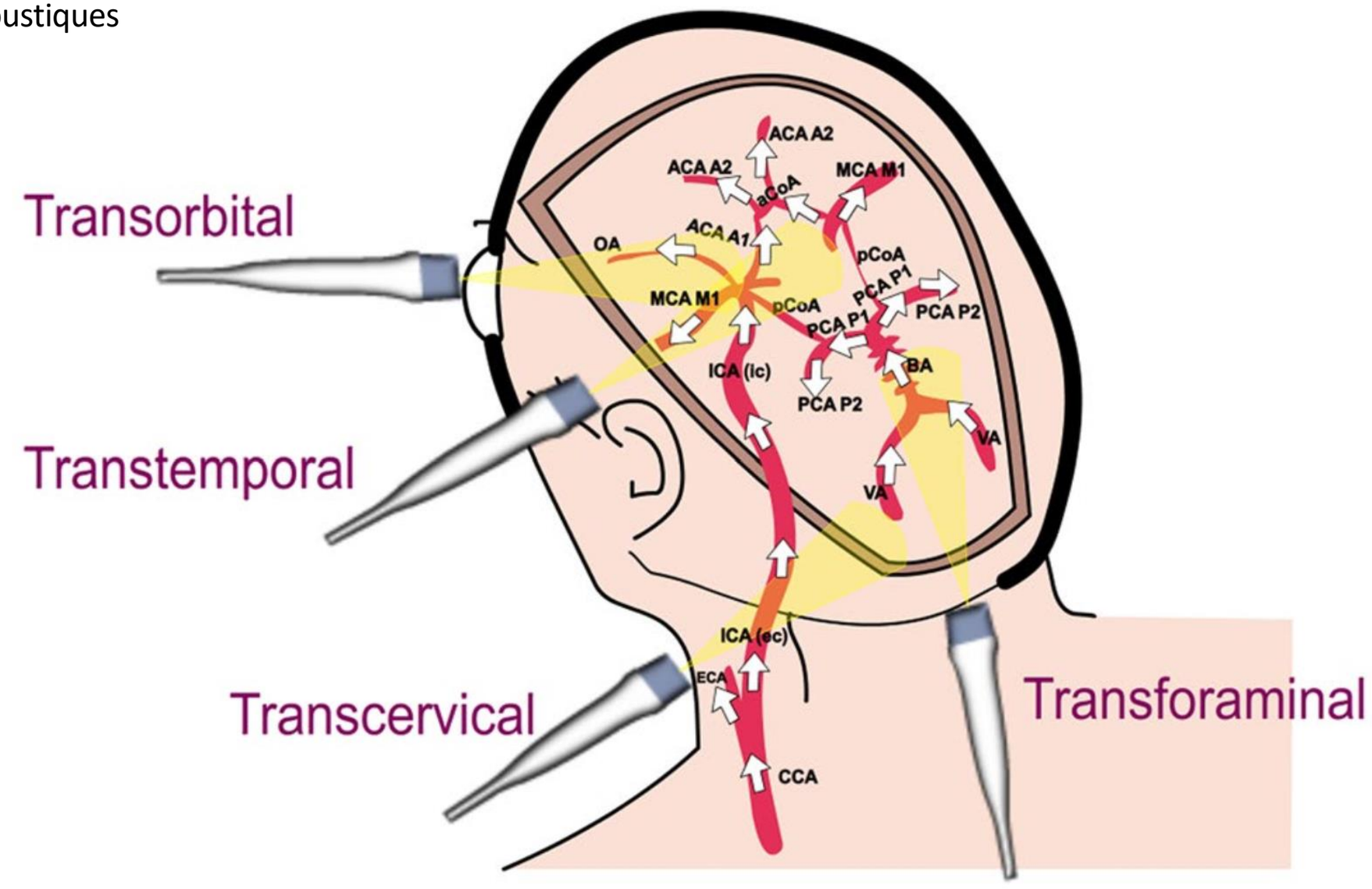


-> mesure précise impossible en pratique courante

-> mesure sur une artère ne reflétant
pas l'hétérogénéité de la circulation cérébrale

DTC et Débit Sanguin Cérébral : exploration régionale

Fenêtres acoustiques



Journal of Ultrasound (2018) 21:1–16
https://doi.org/10.1007/s40477-018-0282-9

DTC et Débit Sanguin Cerebral : exploration régionale

Valeurs « Normales »

Artère	Voie	Sens du flux	Profondeur (mm)	Vm ($cm.s^{-1}$)
Artère cérébrale moyenne	temporale	+	45 à 60	62 ± 12
Artère cérébrale antérieure	temporale	-	60 à 75	51 ± 12
Artère cérébrale postérieure	temporale	+	70 à 90	44 ± 11
Siphon carotidien	transorbitaire	+	50 à 75	42 ± 10
Tronc basilaire	sous-occipitale	-	70 à 110	40 ± 8

-> exploration REGIONALE

Chan KH, J Neurosurg 1992

Utility of Transcranial Doppler in Moderate and Severe Traumatic Brain Injury: A Narrative Review of Cerebral Physiologic Metrics

Alwyn Gomez,[1,2] Carleen Batson,[2] Logan Froese,[3]
Amanjyot Singh Sainbhi,[3] and Frederick Adam Zeiler[1–5]

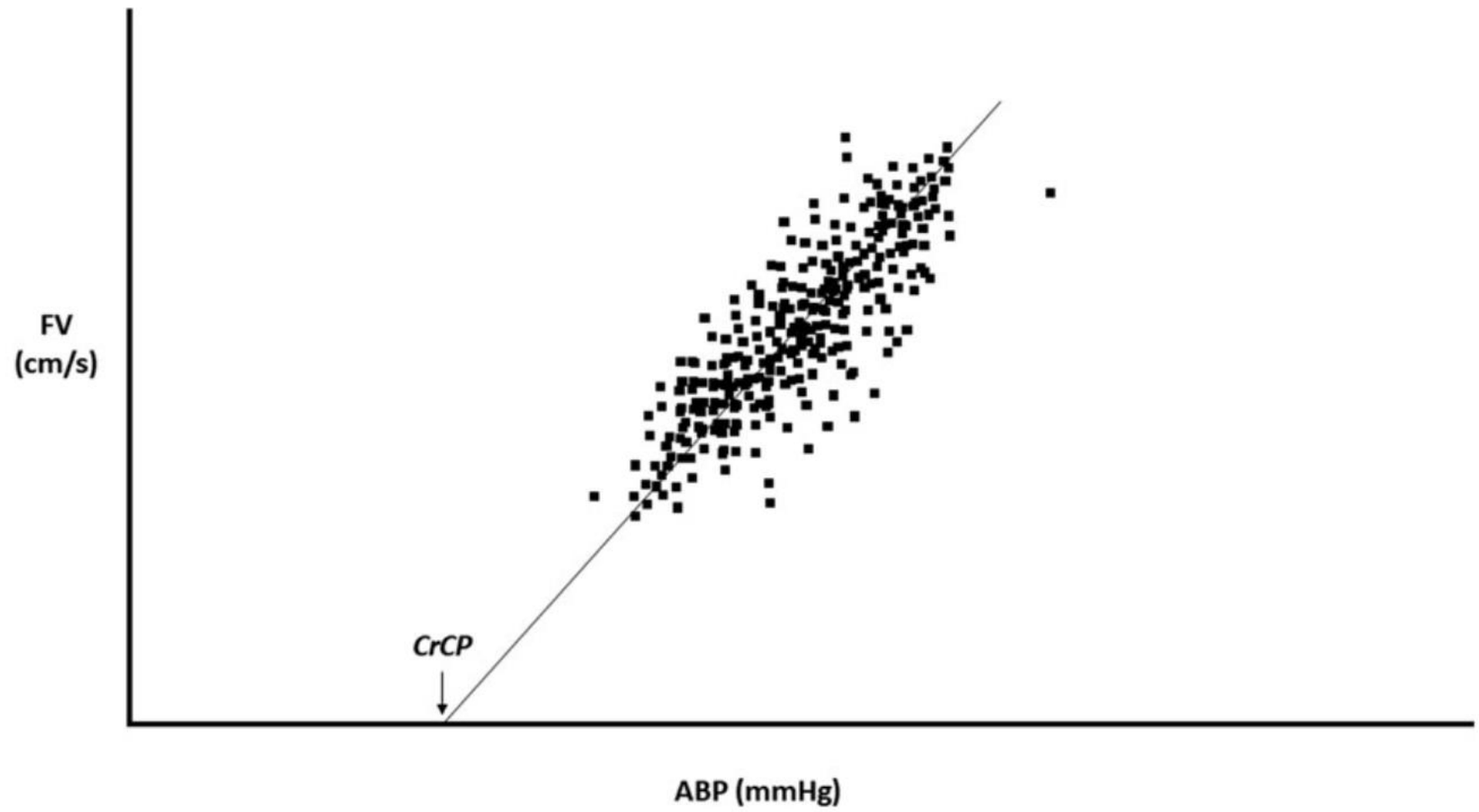


FIG. 3. A schematic representation of the derivation of critical closing pressure (CrCP). Flow velocity (FV) is plotted against arterial blood pressure (ABP) and the x intercept, which the ABP at which FV is zero, represents the CrCP.

Transcranial Doppler Measurements of the Middle Cerebral Artery

Effect of Hematocrit

L.M. Brass, MD, S.G. Pavlakis, MD, D. DeVivo, MD,
S. Piomelli, MD, and J.P. Mohr, MD

n = 45
Pas d'exploration de l'hémodynamique systémique
Patients stables d'hématologie

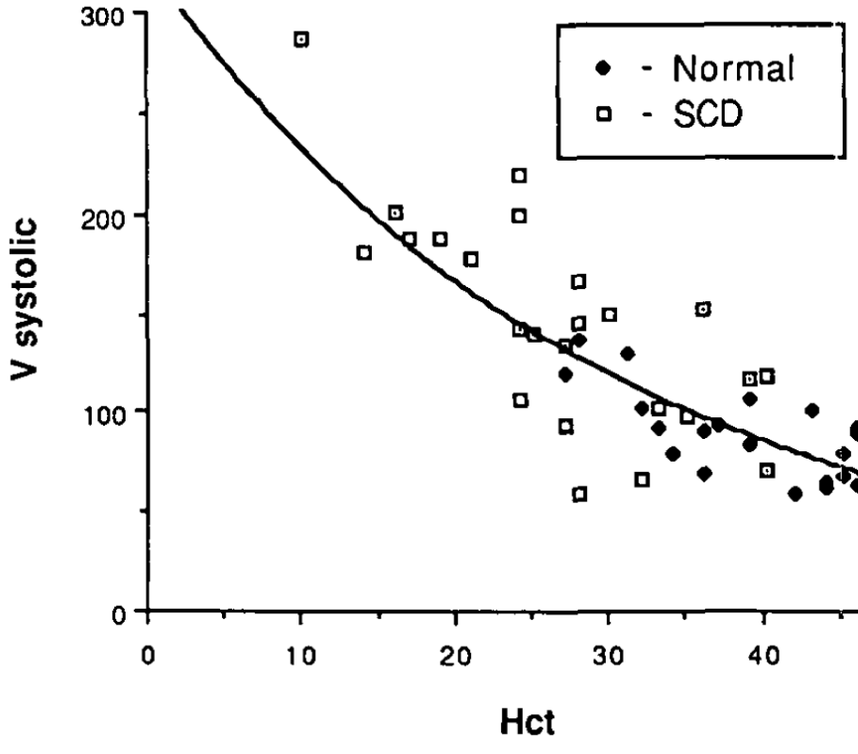


FIGURE 1. *Relation between hematocrit as percent (Hct) and peak systolic blood velocity as centimeters per second (V systolic) in normal patients and in those with sickle cell disease (SCD) examined with transcranial Doppler ultrasonography. Equation for regression curve is V systolic=326* $e^{-0.033 \times Hct}$*, with correlation coefficient of 0.79 (*$p<0.001$*).*

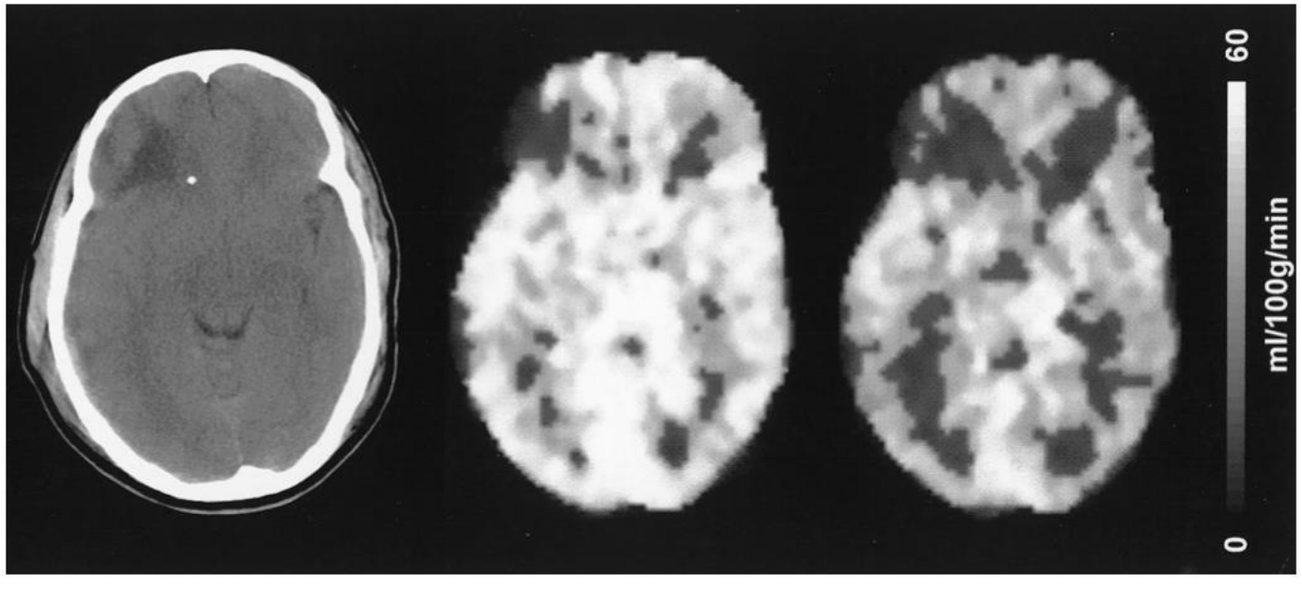
L M Brass, S G Pavlakis, D DeVivo, S Piomelli, and **J P Mohr**

Originally published 1 Dec 1988 | https://doi.org/10.1161/01.STR.19.12.1466 | Stroke. 1988;19:1466–1469 |

Effect of hyperventilation on cerebral blood flow in traumatic head injury: Clinical relevance and monitoring correlates*

Jonathan P. Coles, FRCA; Pawan S. Minhas, FRCS; Tim D. Fryer, PhD; Peter Smielewski, PhD; Franklin Aigbirihio, PhD; Tim Donovan, BSc; Stephen P. M. J. Downey, MSc; Guy Williams, PhD; Dot Chatfield, BSc; Julian C. Matthews, PhD; Arun K. Gupta, FRCA; T. Adrian Carpenter, PhD; John C. Clark, DSc; John D. Pickard, FRCS; David K. Menon, PhD

	PaCO2 35 mmHg	PaCO2 26 mmHg
	PIC 21 mmHg CPP 74 mmHg	PIC 17 mmHg CPP 76 mmHg
volume ischémique	141 ml	428 ml



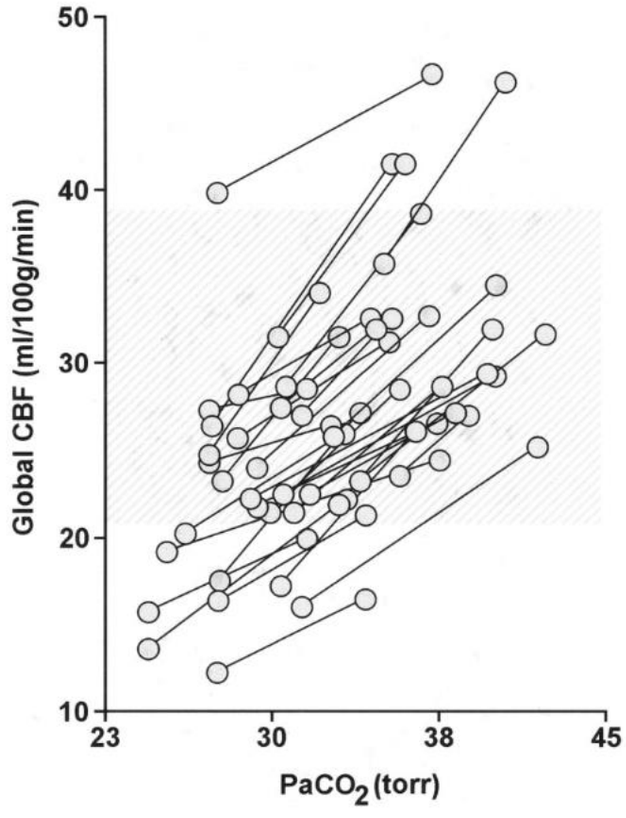


Figure 5. Relationship of positron emission tomographic–derived global cerebral blood flow (*CBF*) to $Paco_2$ in patients imaged at baseline and following hyperventilation. The 95% confidence interval for global CBF in healthy volunteers is shown in *hatched gray*.

Vélocités mesurées?

Intracranial blood flow velocity after head injury: relationship to severity of injury, time, neurological status and outcome

Kwan-Hon Chan, J Douglas Miller, N Mark Dearden

N = 121 TC (sévère 50, modéré 16, léger 55)

Comparaison des Vs en fonction des groupes

- Association entre Vs basse et sévérité
- Persistance de la Vs basse jusqu'à la sortie
- Association Vs basse et évolution neurologique défavorable à 6 mois

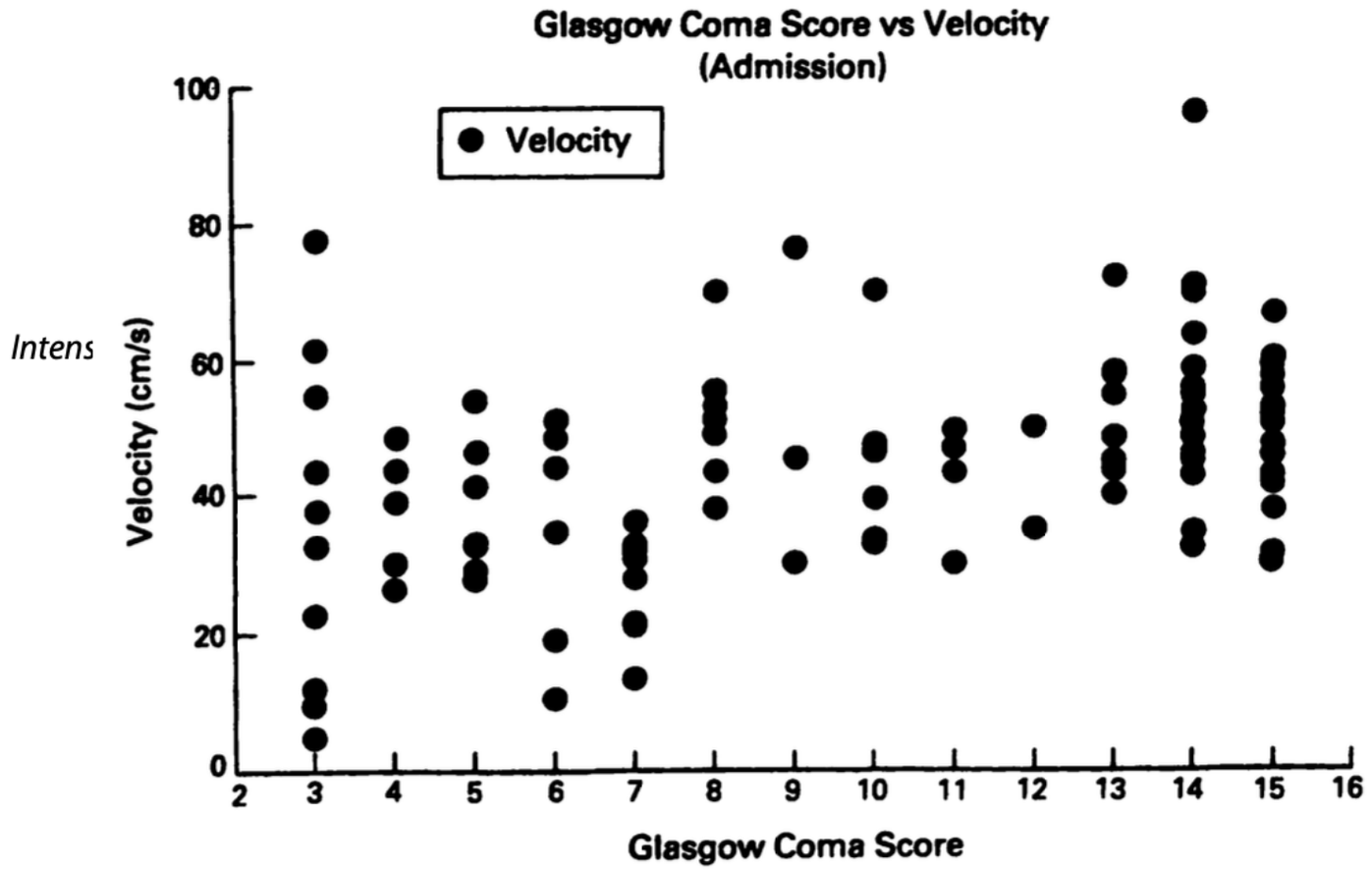


Figure 2 Plot of velocity against Glasgow Coma Score on admission in 121 patients studied.

Dispersion

Journal of Neurology, Neurosurgery, and Psychiatry 1992;55:787–791

Comparative Analysis of Simultaneous Transcranial Doppler and Perfusion Computed Tomography for Cerebral Perfusion Evaluation in Patients with Traumatic Brain Injury

Alex Trofimov,
Department of Neurosurgery, Privolzhsky Research Medical University, Nizhny Novgorod, Russia

n=170 patients
Groupe 1 TCG diffus (n=75)
Groupe 2 TCG hématome intracrânien (n=95)

Réalisation de TDM perfusion et DTC

Entre J2 et J15 post traumatisme

Fig. 1.
The Neuromonitoring System: white arrow, CT; blue arrow, TCD; red arrow, ECG-ABP monitor; black arrow, syringe injector; and green arrow, cerebral oximeter

Adv Exp Med Biol. 2020 ; 1232: 55–62.

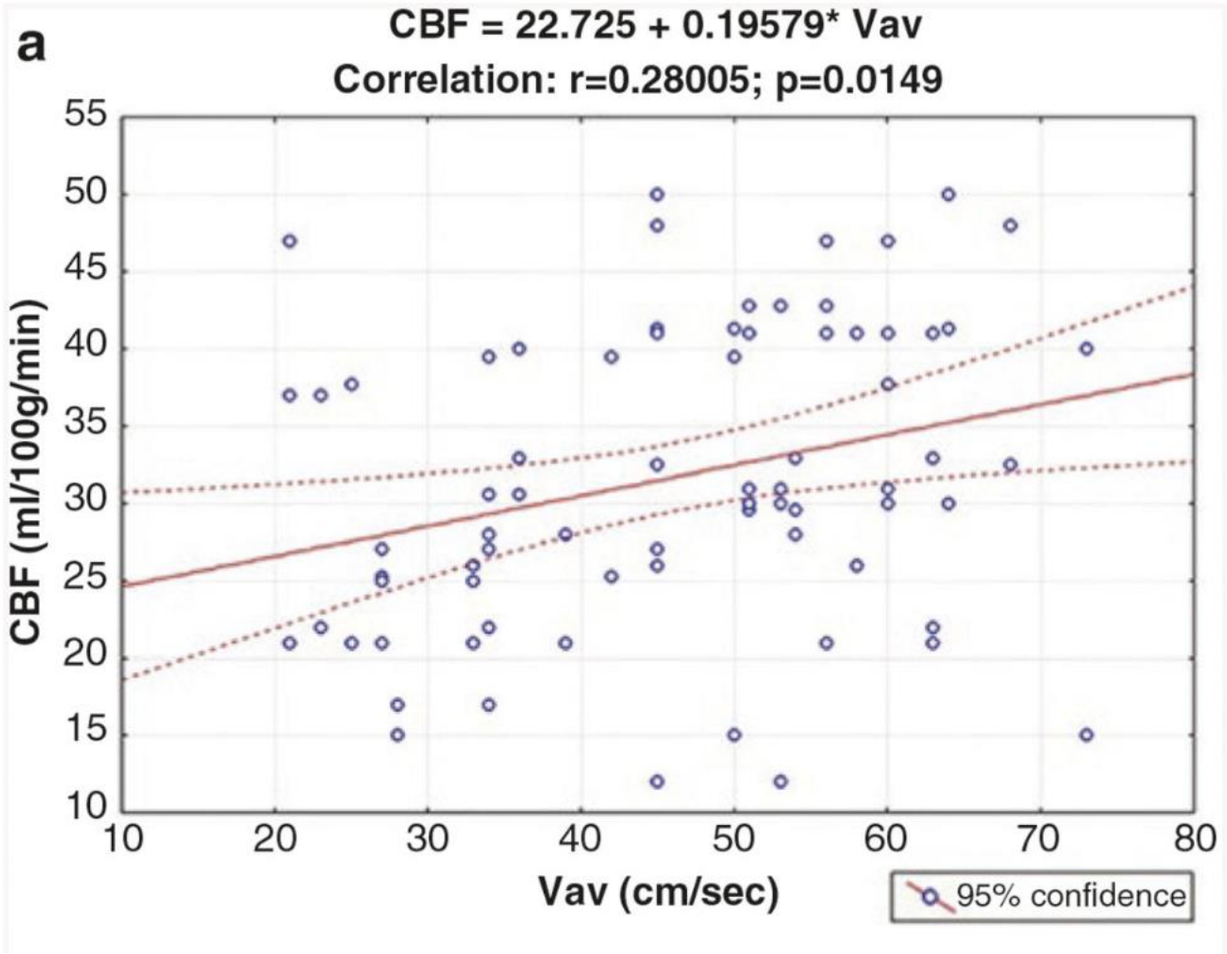


Fig. 2.
Volumetric CBF plotted against Vav (CBFV) on the left side (**a**) and right side (**b**) in Group 1 with diffuse TBI. Dashed red lines represent 95% confidence intervals for the regression (solid red line)

Evaluating the outcome of severe head injury with transcranial Doppler ultrasonography

José A. Moreno, M.D., Eduard Mesalles, M.D., Juan Gener, M.D., Antonio Tomasa, M.D., Adolfo Ley, M.D., Josep Roca, M.D., and Jaime Fernández-Llamazares, M.D.

Departments of Intensive Care and Neurosurgery, and Surgery, and Epidemiology Unit, Hospital Universitario "Germans Trias i Pujol," Badalona; and Universidad Autónoma de Barcelona, Barcelona, Spain

Rappel :
Index de pulsatilité (IP) = (Vs-Vd)/Vm

n=125 patients avec TC
Monitorage PIC et DTC

Evaluation neurologique à 6 mois (GOS)

TABLE 1

General description of study variables obtained in 125 severely head injured patients*

Characteristic	No. of Cases (%)
sex	
male	96 (77)
female	29 (23)
associated lesion	92 (74)
pupillary anomalies	36 (29)
focal injury	17 (14)
convulsion	7 (6)
otorrhagia	37 (30)
cranial fracture	52 (41)
shock	35 (28)
CT classification	
Type II lesion	82 (66)
Type III lesion	18 (14)
SAH	65 (52)
exitus	46 (37)

* Classification based on that reported in TCDB.

TABLE 2

Mean values obtained of the quantitative variables studied

Variable	Mean Value	Standard Deviation
age (yrs)	34.14	19.16
pH	7.37	0.08
$PaCO_2$ (mm Hg)	35.9	9.75
PaO_2 (mm Hg)	173	113.5
hemoglobin (g/l)	11.49	2.48
glucose level (mg/dl)	161.76	62.52
MAP* (mm Hg)	85.86	11.45
GCS score	6.02	1.81
APACHE II	13.68	4.34
ICP (mm Hg)	22.07	17.29
CPP (mm Hg)	63	19.70
blood flow velocity (cm/s)	40.75	17.86
PI	1.26	0.73

* MAP = mean arterial blood pressure.

Neurosurg Focus 8 (1): Article 8, 2000

Evaluating the outcome of severe head injury with transcranial Doppler ultrasonography

Association IP et pronostic

TABLE 5

RESULTS OF MULTIVARIATE ANALYSIS OF DATA OBTAINED AT 6 MONTHS*

Variable	Odds Ratio	95% Confidence Interval	p Value
GCS score	0.24	0.11–0.42	0.0001
pupillary anomalies	3.86	0.59–27	0.04
presence of shock	0.13	0.02–0.63	0.013
PI	21.42	3.81–183.08	0.001

* Hosmer–Lemeshow best-of-fit test of reliability of statistical adjustment, p = 0.9952. Area below ROC curve 95%.

Bon pronostic

IP = 1 (moy)

Mauvais pronostic

IP = 1,56 (moy)

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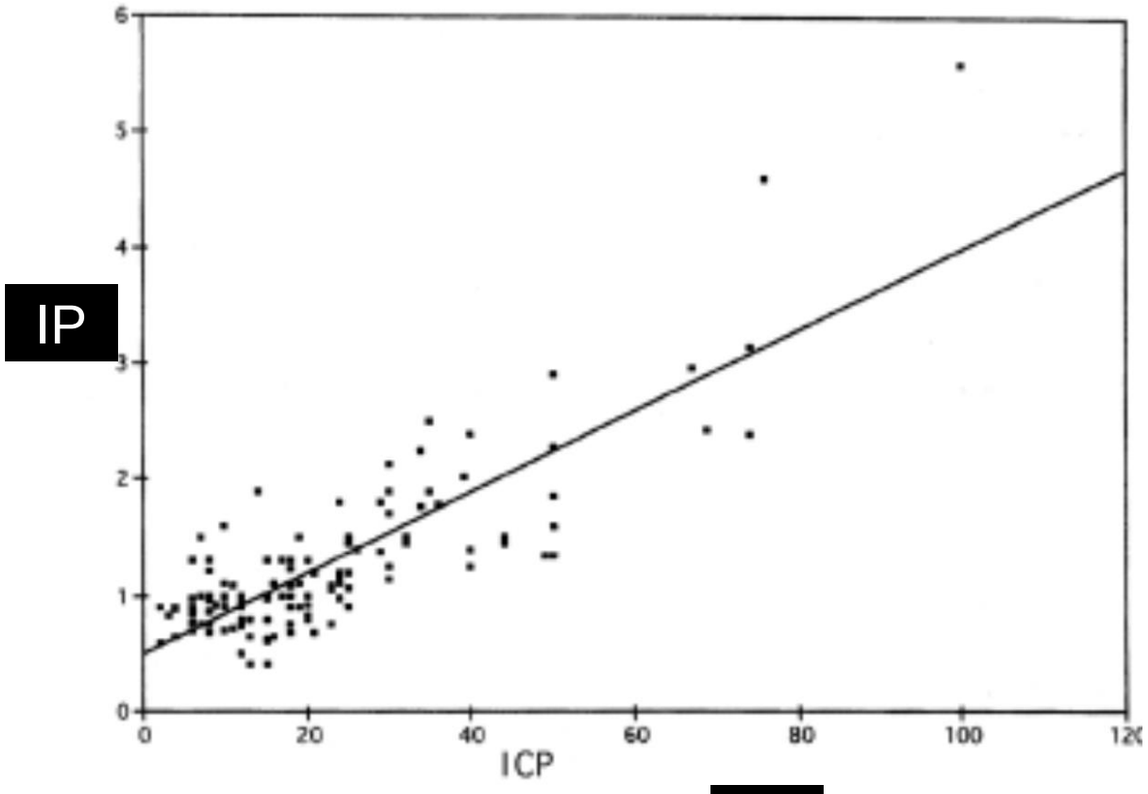


Fig. 1. Graph illustrating the correlation between ICP and PI.

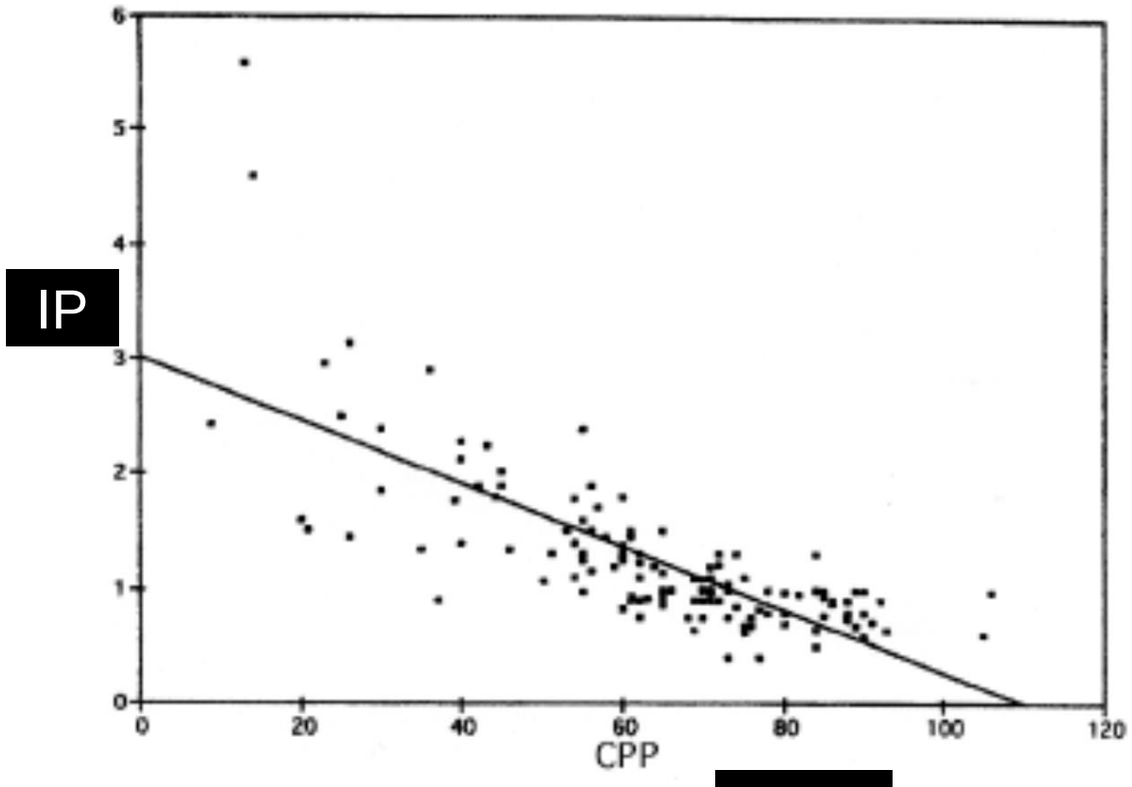
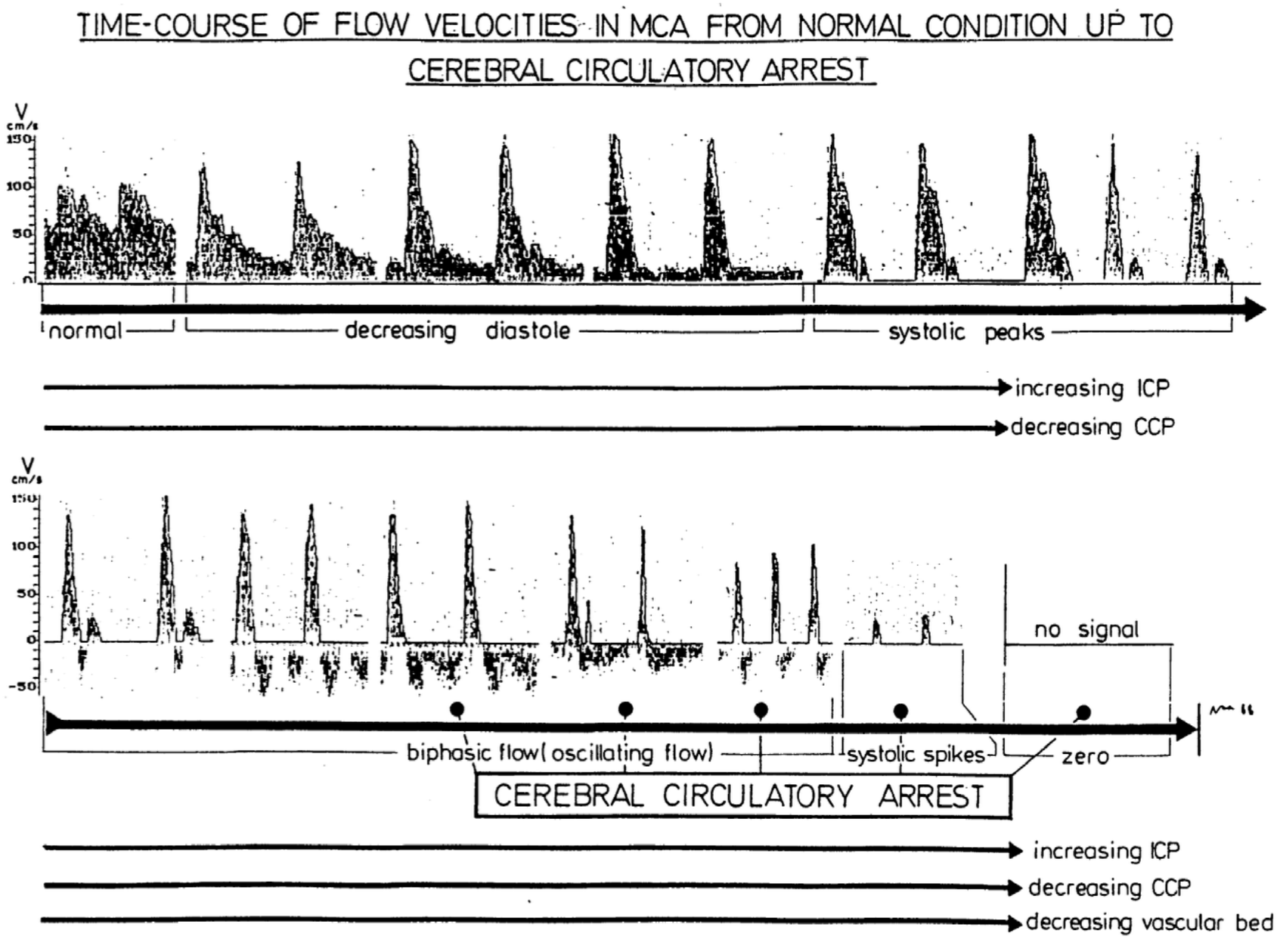


Fig. 2. Graph illustrating the correlation between CPP and PI.

Consensus opinion on diagnosis of cerebral circulatory arrest using Doppler-sonography

Task Force Group on cerebral death of the Neurosonolgy Research Group of the World Federation of Neurology



Journal of the Neurological Sciences 159 (1998) 145–150

Review: pathophysiology of intracranial hypertension and noninvasive intracranial pressure monitoring

Nicolas Canac*, Kian Jalaleddini, Samuel G. Thorpe, Corey M. Thibeault and Robert B. Hamilton

Estimation PIC par DTC -> cela ne fonctionne pas, même modèles intégrant $PaCO_2$, PAM, Hte

Table 4 Studies exploring PI-based TCD method

References	Population	Classification use score	Estimation use score
Gao [124]	TBI, 43; hemorrhagic stroke, 7	2	1
Prunet [126]	TBI/stroke/SAH, 20 Control, 20	4	–
Robba [127]	TBI/polytrauma/SAH, 22	1	–
Robba [128]	TBI/SAH/intracranial hemorrhage, 64	1	–
Voulgaris [129]	TBI, 37	3	–
Wakerley [130]	Varied, 78	3	–
Wang [131]	TBI, 75; hypertensive brain injury, 15; intracranial lesions, 3	4	–
Zweifel [132]	TBI, 290	2	1
Bellner [133]	TBI/SAH/other, 81	4	3
Moreno [134]	TBI, 125	4	–
Brandi [135]	TBI, 45	–	2
Behrens [136]	INPH, 10	–	1
Rainov [137]	Hydrocephalus, 29	2	1
Rajajee [138]	ALF, 21	1	–
Park [125]	TBI, 11	2	3

Refer to Table 3 for interpretation of scores. If a method was not evaluated in the context of either classification or evaluation, then no score is provided for that use case

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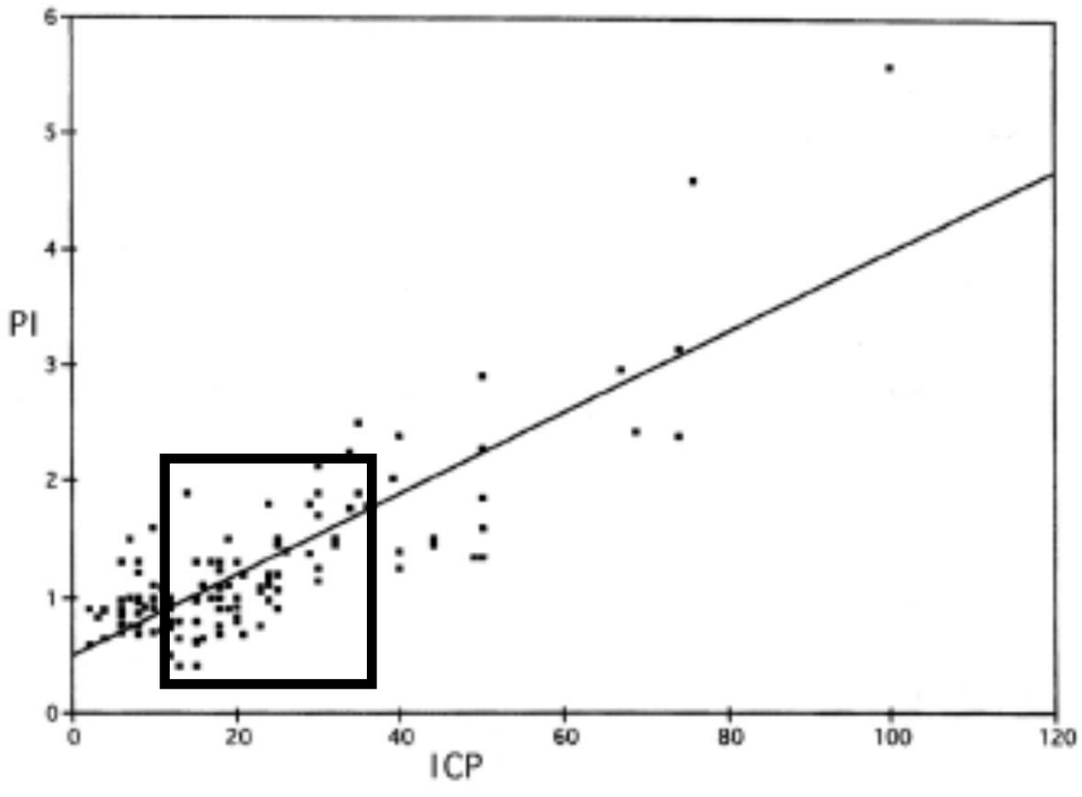


IP

PIC

Zone d'intérêt clinique

Fig. 1. Graph illustrating the correlation between ICP and PI.

Transcranial Doppler as a screening test to exclude intracranial hypertension in brain-injured patients: the IMPRESSIT-2 prospective multicenter international study

N = 266 patients (interruption COVID)
Patients cerebro-lésés avec indication monitorage invasive PIC

Calcul de la PIC par estimation PPC par le doppler trans-crânien

PPCe = PAM x Vd/Vm + 14

PIC = PAM - PPC

Comparaison de 3 couples de mesures PIC invasive vs PICdtc
Evaluation performance diagnostique pour 3 seuils de PIC 20, 22 et 25 mmHg

	PIC> 20	PIC>22	PIC>25
VPP	32,6 %	23 %	23,1 %
VPN	91,3 %	95,6 %	98,6 %

Rasulo *et al. Critical Care* *(2022) 26:110*

Nombreuses approches pour évaluer la PPC de manière non-invasive

Czosnyka M, Matta BF, Smielewski P, Kirkpatrick PJ, Pickard JD. Cerebral perfusion pressure in head-injured patients: a noninvasive assessment using transcranial Doppler ultrasonography. J Neurosurg 1998;88(5):802–8.

PPCe = (PAM x Vd) / Vm + 14

Bellner J, Romner B, Reinstrup P, Kristiansson KA, Ryding E, Brandt L. Transcranial Doppler sonography pulsatility index (PI) reflects intracranial pressure (ICP). Surg Neurol 2004;62(1):45–51 [discussion].

PPCe = 89,646 - 8,258 x IP

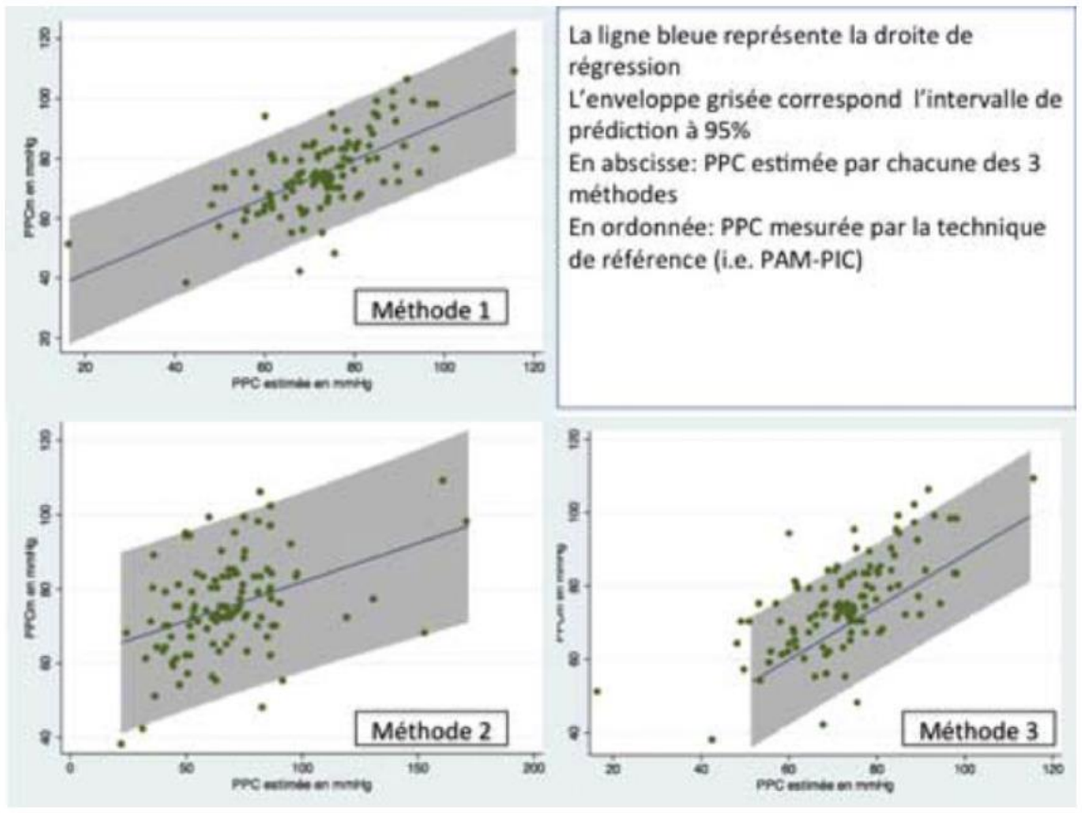
Édouard AR, Vanhille E, Le Moigno S, Benhamou D, Mazoit JX. Non-invasive assessment of cerebral perfusion pressure in brain injured patients with moderate intracranial hypertension. Br J Anaesth 2005;94(2):216–21.

PPCe = (Vm/(Vm-Vd)) x PAM-PAD

R043

Estimation de la pression de perfusion cérébrale par le Doppler transcrânien : quelle est la meilleure méthode ?

C. Leviland *, N. Mayeur, M. Srairi, S. Mrozek, H. Gonzalez, O. Fourcade, T. Geeraerts

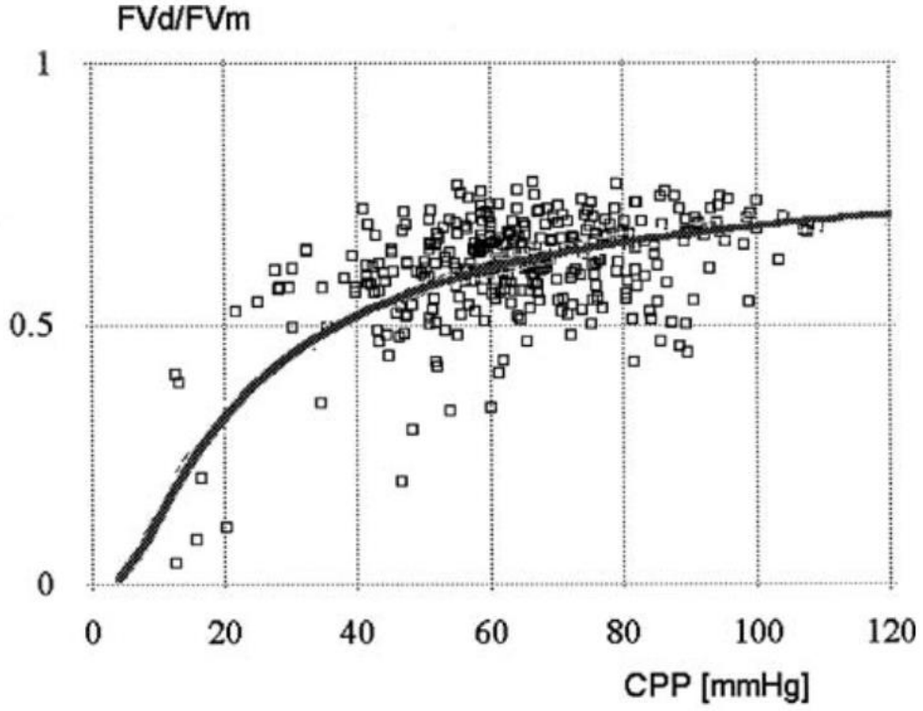


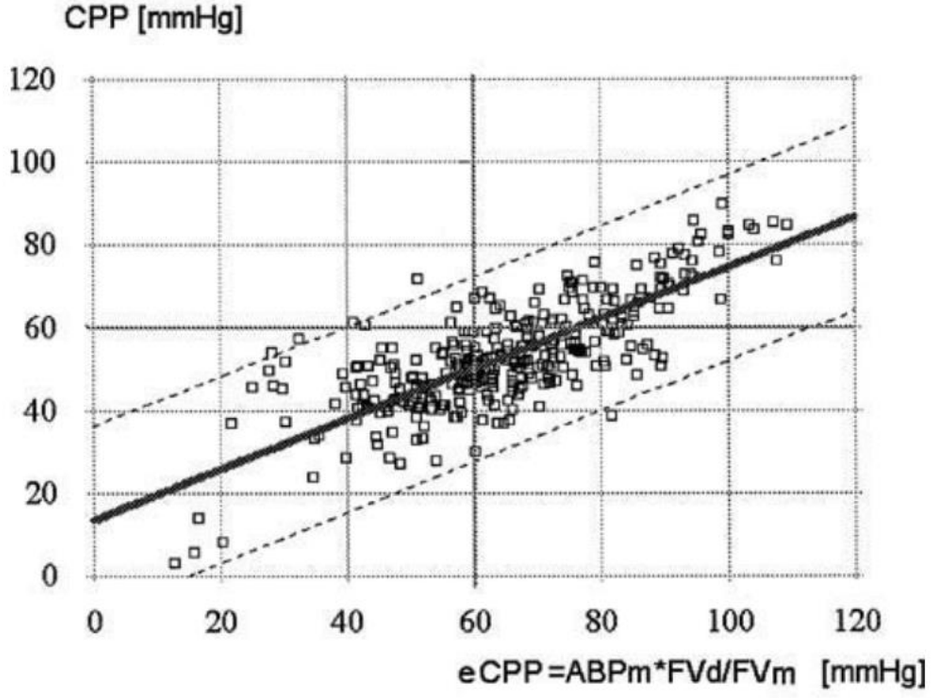
http://dx.doi.org/10.1016/j.annfar.2014.07.057

Cerebral perfusion pressure in head-injured patients: a noninvasive assessment using transcranial Doppler ultrasonography

MAREK CZOSNYKA, PH.D., BASIL F. MATTA, M.B., F.R.C.A., PIOTR SMIELEWSKI, PH.D., PETER J. KIRKPATRICK, M.D., F.R.C.S., AND JOHN D. PICKARD, M.CHIR., F.R.C.S.

Wolfson Brain Imaging Centre, Medical Research Council/Cambridge Centre for Brain Repair and Academic Neurosurgical Unit, Department of Anaesthesia, and The Neurosciences Critical Care Unit, Addenbrooke's Hospital, Cambridge, United Kingdom





J Neurosurg 88:802–808, 1998

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VPP	32,6 %	23 %	23,1 %
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Rasulo *et al. Critical Care* *(2022) 26:110*

Intérêt DTC dans la prise en charge thérapeutique

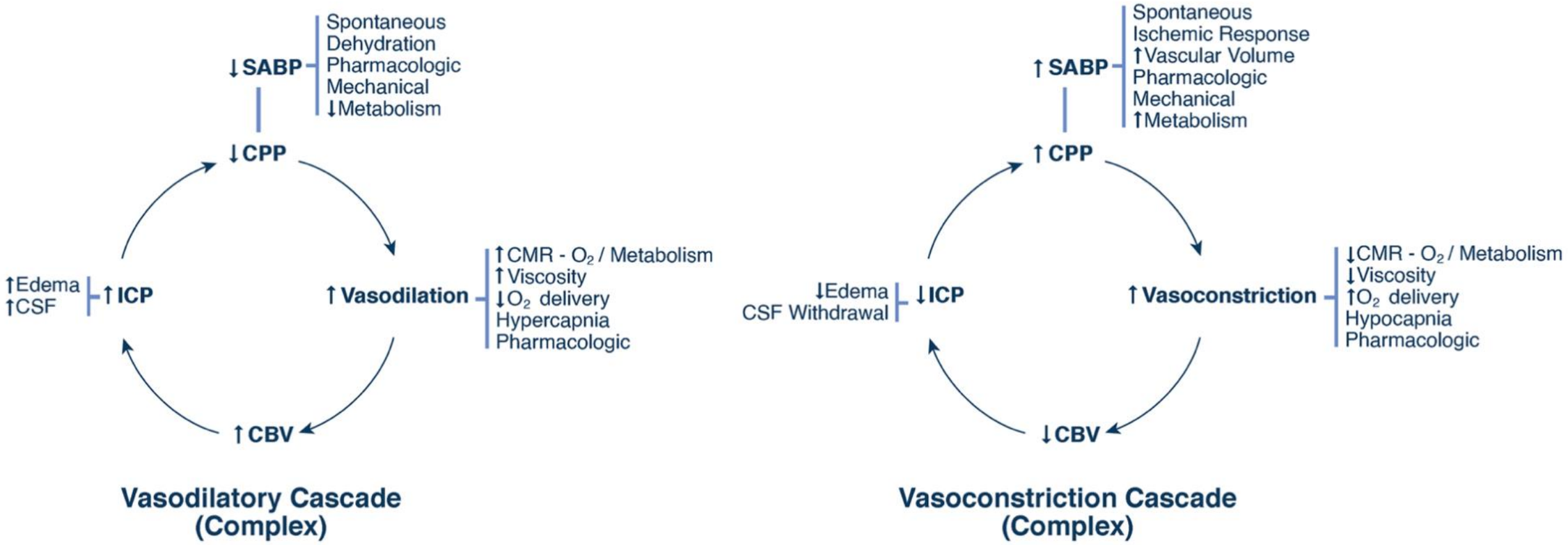
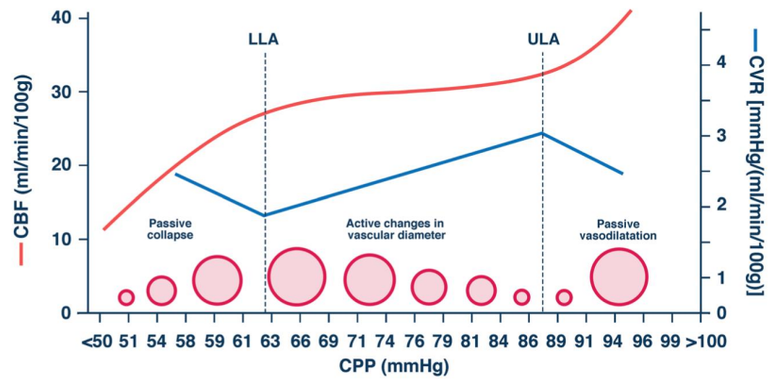


Fig. 4 Rosner's vasodilatory and vasoconstriction cascades. The vasodilatory and vasoconstriction cascades reflect broad autoregulatory processes which can influence the diameter of the cerebral vasculature and thus the cerebral blood volume and intracranial pressure despite injury to the brain. These cascades were described by Rosner based on clinical observations. These cascades are clinically relevant as they demonstrate a means by which ICP can be reduced by increasing nutrient delivery to the brain. Adapted from Rosner et al., 1995 [54]

Bénéfice patient
-> optimisation du débit sanguin cérébrale



Transcranial Doppler to Predict Neurologic Outcome after Mild to Moderate Traumatic Brain Injury

Pierre Bouzat, M.D., Ph.D., Luc Almeras, M.D., Pauline Manhes, Ph.D., Laurence Sanders, M.D., Albrice Levrat, M.D., Jean-Stephane David, M.D., Ph.D., Raphael Cinotti, M.D., Russel Chabanne, M.D., Aurélie Gloaguen, M.D., Xavier Bobbia, M.D., Sophie Thoret, M.Sc., Lydia Oujamaa, M.D., Jean-Luc Bosson, M.D., Ph.D., Jean-François Payen, M.D., Ph.D., for the TBI-TCD Study Investigators*

Modèle de triage à la phase initiale en complement du TDM

N = 356 TC légers à modérés
-> Glasgow 9 à 15

TDM avec lésions
-> Traumatic data bank : II

DTC : Définition olighémie
Vd < 25 cm/sec
IP > 1,25

Modèle prédictif incluant :
Age, Glasgow, DTC

Table 1. Demographic Data Collected on Admission of the Study Population (n = 356 Patients)

Variable	Value
Age (yr)	42 (29–61)
Male/female, n	277/79
ISS	16 (14–22)
Circumstances, n (%)	
Road traffic accident	139 (39)
Falls	59 (17)
Sport	76 (21)
Admission, n (%)	
Emergency room	173 (49)
Emergency service	151 (42)
ICU	32 (9)
Pre–hospital medical care, n (%)	225 (63)
GCS on admission	14 (14–15)
Alcohol intoxication, n (%)	61 (17)
Aspirin, n (%)	22 (6)
Mean arterial pressure (mmHg)	93 (84–105)
Heart rate (beats/min)	80 (70–90)
Respiratory rate (breaths/min)	16 (15–20)
Arterial oxygen saturation (%)	98 (97–100)
Temperature (°C)	36.9 (36.4–37)
VAS (n)	2 (1–4)

Continuous values are medians (25th to 75th interquartiles).

GCS = Glasgow coma scale; ICU = intensive care unit; ISS = injury severity score; VAS = visual analog pain scale.

Anesthesiology 2016; 125:00-00

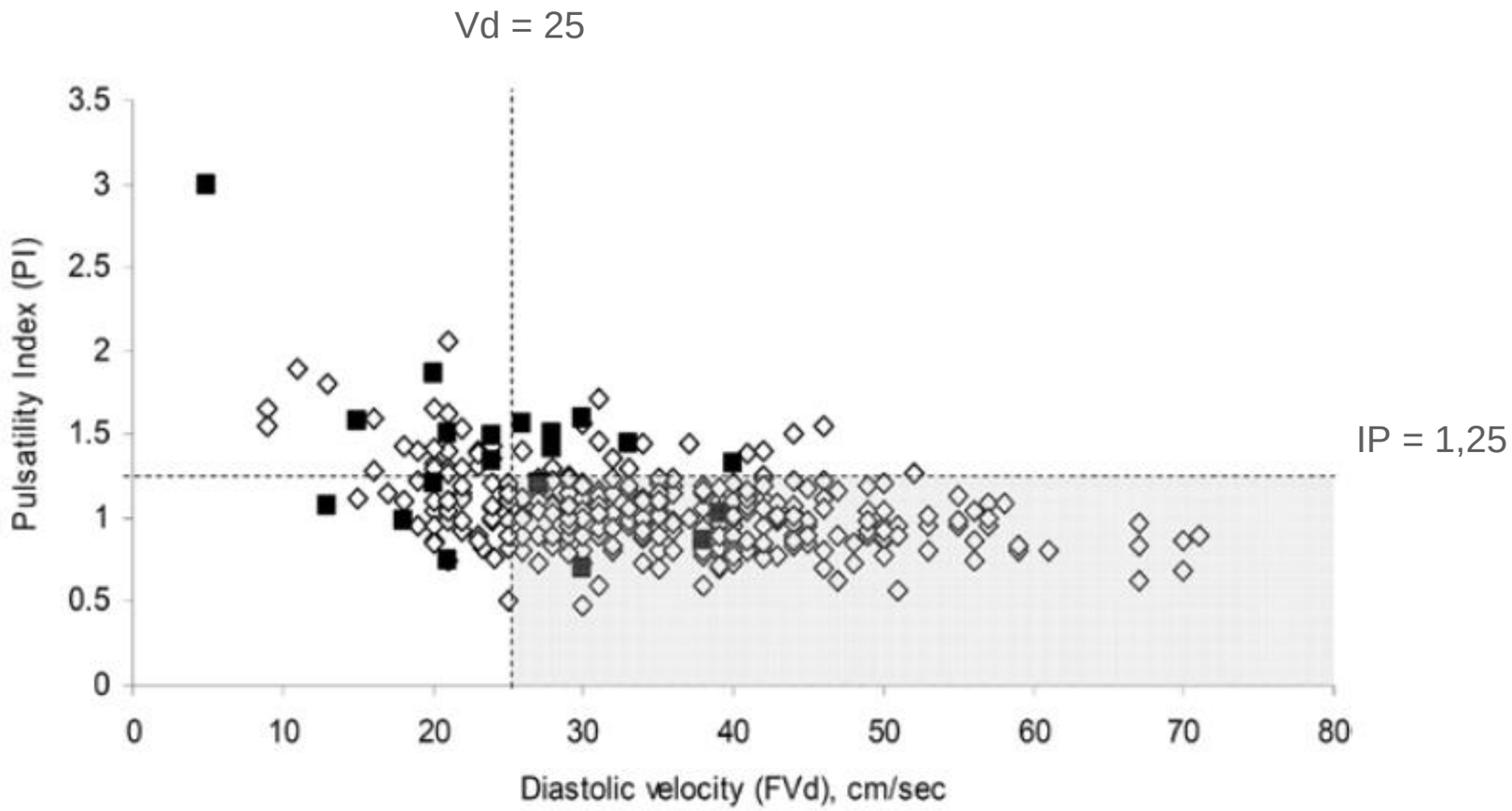
Transcranial Doppler to Predict Neurologic Outcome after Mild to Moderate Traumatic Brain Injury

Pierre Bouzat, M.D., Ph.D., Luc Almeras, M.D., Pauline Manhes, Ph.D., Laurence Sanders, M.D., Albrice Levrat, M.D., Jean-Stephane David, M.D., Ph.D., Raphael Cinotti, M.D., Russel Chabanne, M.D., Aurélie Gloaguen, M.D., Xavier Bobbia, M.D., Sophie Thoret, M.Sc., Lydia Oujamaa, M.D., Jean-Luc Bosson, M.D., Ph.D., Jean-François Payen, M.D., Ph.D., for the TBI-TCD Study Investigators*

N = 356 TC légers à modérés

Vd < 25 cm/sec
IP > 1,25

Modèle prédictif incluant :Age, Glasgow, DTC



Carré noirs = évolution défavorable

Anesthesiology 2016; 125:00-00

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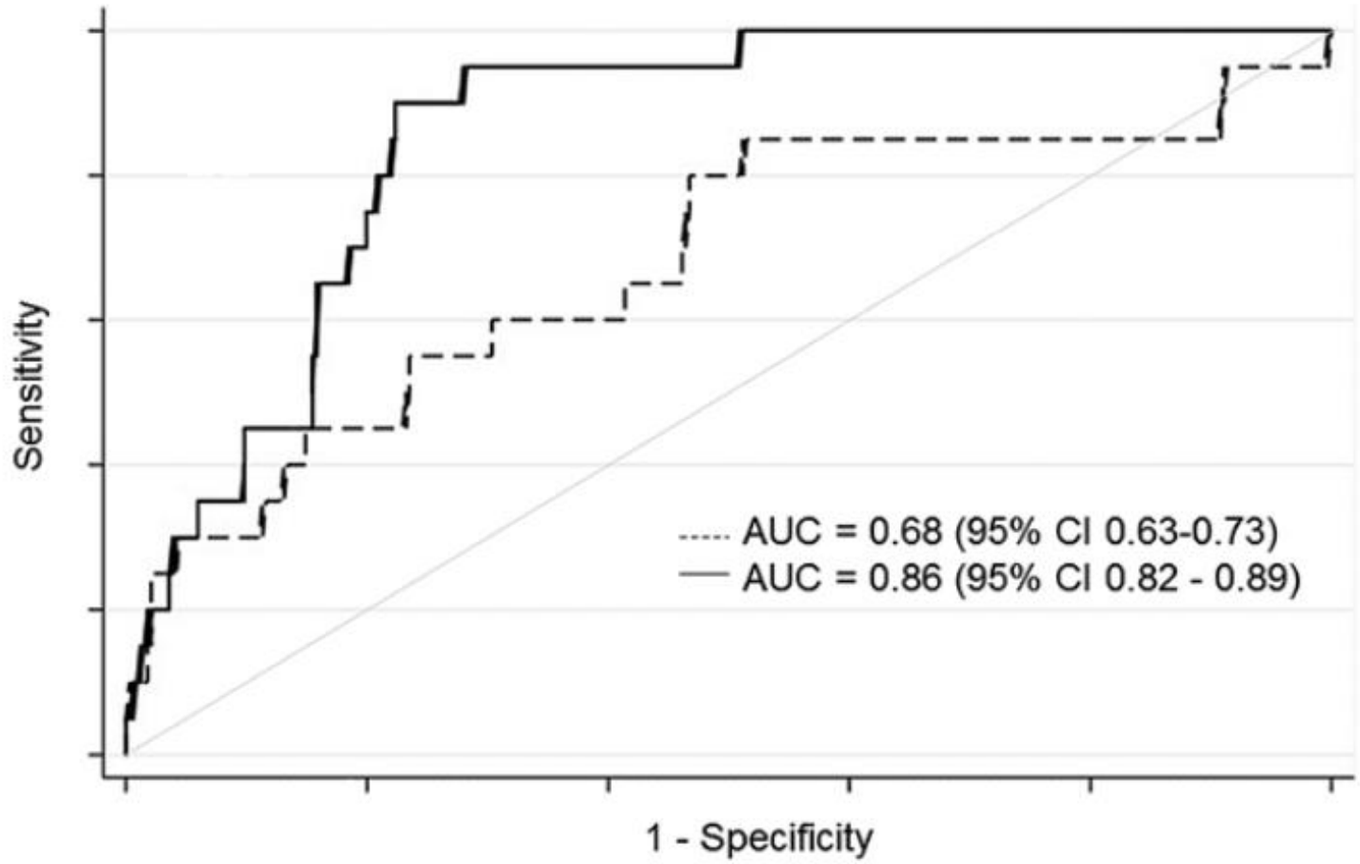

Pour le sous-groupe Glasgow 14-15
VPN = 98%

Attention faux négatif possible si lésion en fosse postérieure
-> limite de l'exploration régionale par DTC

Anesthesiology 2016; 125:00-00

Transcranial Doppler ultrasound goal-directed therapy for the early management of severe traumatic brain injury

Catherine Ract
Sophie Le Moigno
Nicolas Bruder
Bernard Vigué

N = 24 TCG
Prospectif observationnel
DTC à l'admission -> groupe Normal vs Anormal
Anormal si :
- Vm < 30 cm/sec
- Vd < 20cm/sec
- IP>1,4

Intervention si anormal : mannitol ou noradrénaline

Table 1 Demographic data

	Abnormal admission TCD ($n = 11$)	Normal admission TCD ($n = 13$)
Age (years)	33 ± 12	35 ± 12
Glasgow Coma Scale*	5 [3–7]	7 [3–8]
Injury Severity Score	25 [16–34]	20 [16–57]
Multiple injuries (n)	2	7
Time from trauma to admission (min)	202 ± 139	142 ± 64
Glasgow Outcome Score*	3 [1–5]	1 [1–4]

Data are given as median [range] or mean $\pm$ SD
Glasgow Outcome Score *1* good recovery, *2* moderate disability, *3* severe disability, *4* vegetative state, *5* dead.
* $p < 0.05$ between groups

Intensive Care Med (2007) 33:645–651

Transcranial Doppler ultrasound goal-directed therapy for the early management of severe traumatic brain injury

	Abnormal admission TCD ($n=11$)		Normal admission TCD ($n=13$)	
	T0	T1	T0	T1
Delay from admission (min)	16 ± 8	219 ± 96	20 ± 12	262 ± 123
Abnormal TCD (n)	11	2	0	0
Mean velocity (cm/s)	30 ± 6	43 ± 10*	49 ± 13**	51 ± 11
Diastolic velocity (cm/s)	13 ± 5	25 ± 8*	34 ± 11**	36 ± 11**
Pulsatility index	2.1 ± 0.5	1.4 ± 0.3*	1.2 ± 0.6**	0.9 ± 0.3**
MAP (mmHg)	89 ± 15	105 ± 17*	89 ± 11	93 ± 19
ICP (mmHg)		32 ± 13		22 ± 10**
CPP (mmHg)		73 ± 15		71 ± 14
$SjvO_2$ (%)		67 ± 2		72 ± 9
pH	7.39 ± 0.04	7.39 ± 0.02	7.32 ± 0.06**	7.36 ± 0.07*
$PaCO_2$ (mmHg)	40 ± 5	42 ± 5	45 ± 6**	41 ± 6*
Haemoglobin (g/dl)	12 ± 1	11 ± 1	12 ± 2	11 ± 2
Norepinephrine (n)	1	9	2	4
Mannitol (n)	0	5	1	0
Neurosurgery (n)	-	3	-	0

* $p<0.05$ between T0 and T1
** $p<0.05$ between groups

Intensive Care Med (2007) 33:645–651

Transcranial Doppler ultrasound goal-directed therapy for the early management of severe traumatic brain injury

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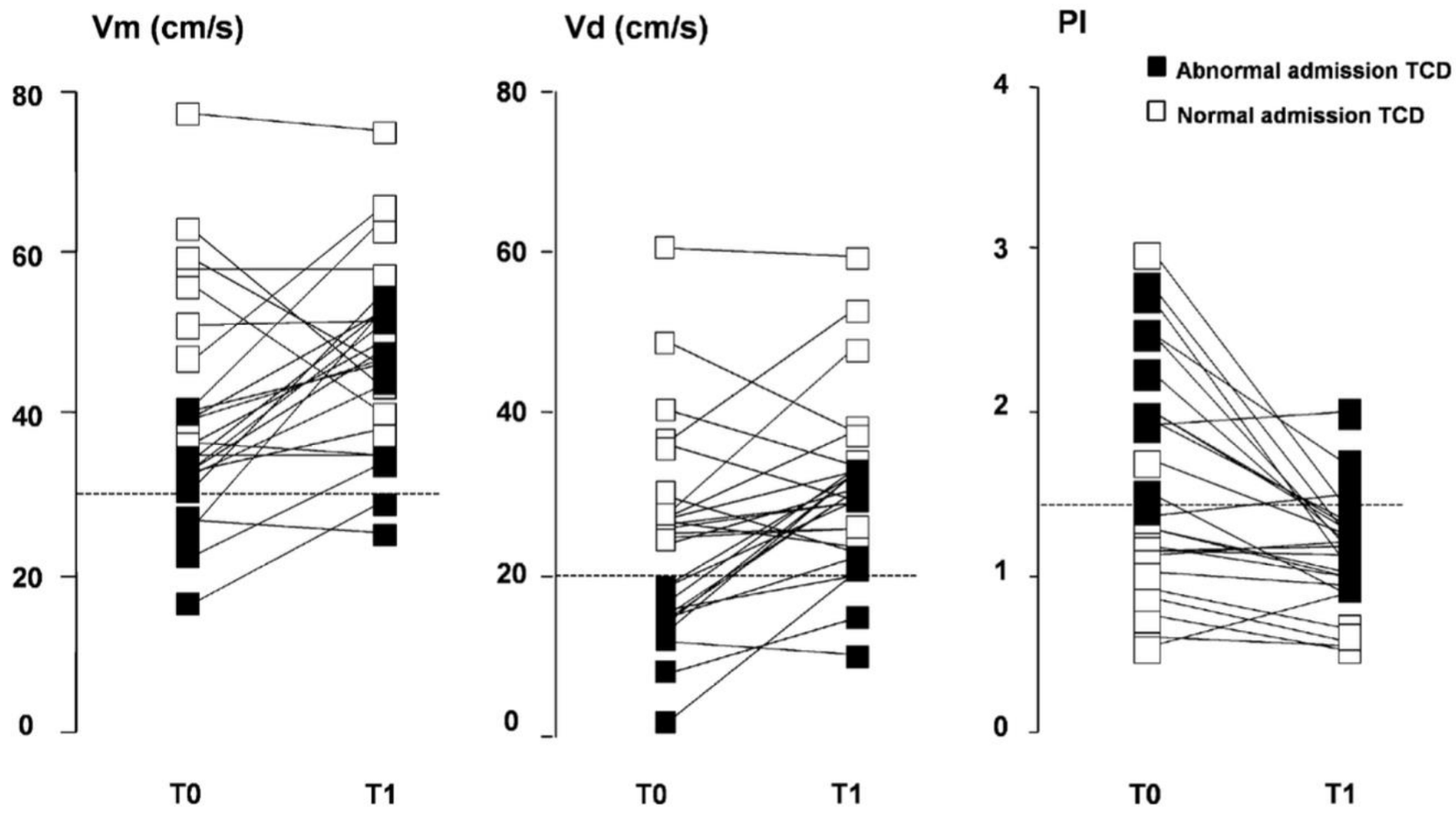


Pas de possibilité de conclure sur devenir à long terme, vu design de l'étude

Intensive Care Med (2007) 33:645–651

Table 1 Summary of the main characteristics of invasive and non-invasive methods for intracranial pressure (ICP) estimation

	Availability	Accuracy	Risks of infection/ hemorrhage	Operator dependency	Cost
External ventricular drain	Moderate/high	High	Moderate	Low (Level of external transducer)	Moderate (antibiotic impregnation approximately doubles cost)
ICP microtransducer	Moderate/high	High	Low	None	High (higher than both conventional and antibiotic impregnated EVDs)
Radiological findings (MRI/CT)	High	Low	None	Low	Low/moderate
ONSD	High	Low	None	High	Low
Transcranial Doppler	High	Low	None	High	Low
Automated pupillometry	High	Low	None	Low	Low

MRI, magnetic resonance imaging; CT, computed tomography; ONSD, optic nerve sheath diameter

DTC ET TRAUMATISME CRÂNIEN

Utilisation clinique

- Evaluation initiale
  - Triage

→ Traitement en urgence

- Suivi thérapeutique
  - Dépister olighémie - monitorage cérébral
  - Dépister le vasospasme

→ Intégration dans réflexions clinique globale

- Intégration dans un monitorage multimodale (DTC, PIC, $PtiO_2$, TDM…)

Limites

- Examen ponctuel

- NE MESURE PAS LA PIC NI LE DSC

- Les résultats donnés par le DTC sont le reflet des conditions hémodynamique intra cérébrales ET systémiques

Attention lésions en fosse postérieure

DTC ET MORT ENCEPHALIQUE

Transcranial Doppler study of intracranial circulatory arrest

Werner Hassler, M.D., Helmuth Steinmetz, M.D., and Jürgen Pirschel, M.D.

Departments of Neurosurgery and Radiology, University of Tübingen, Tübingen, West Germany

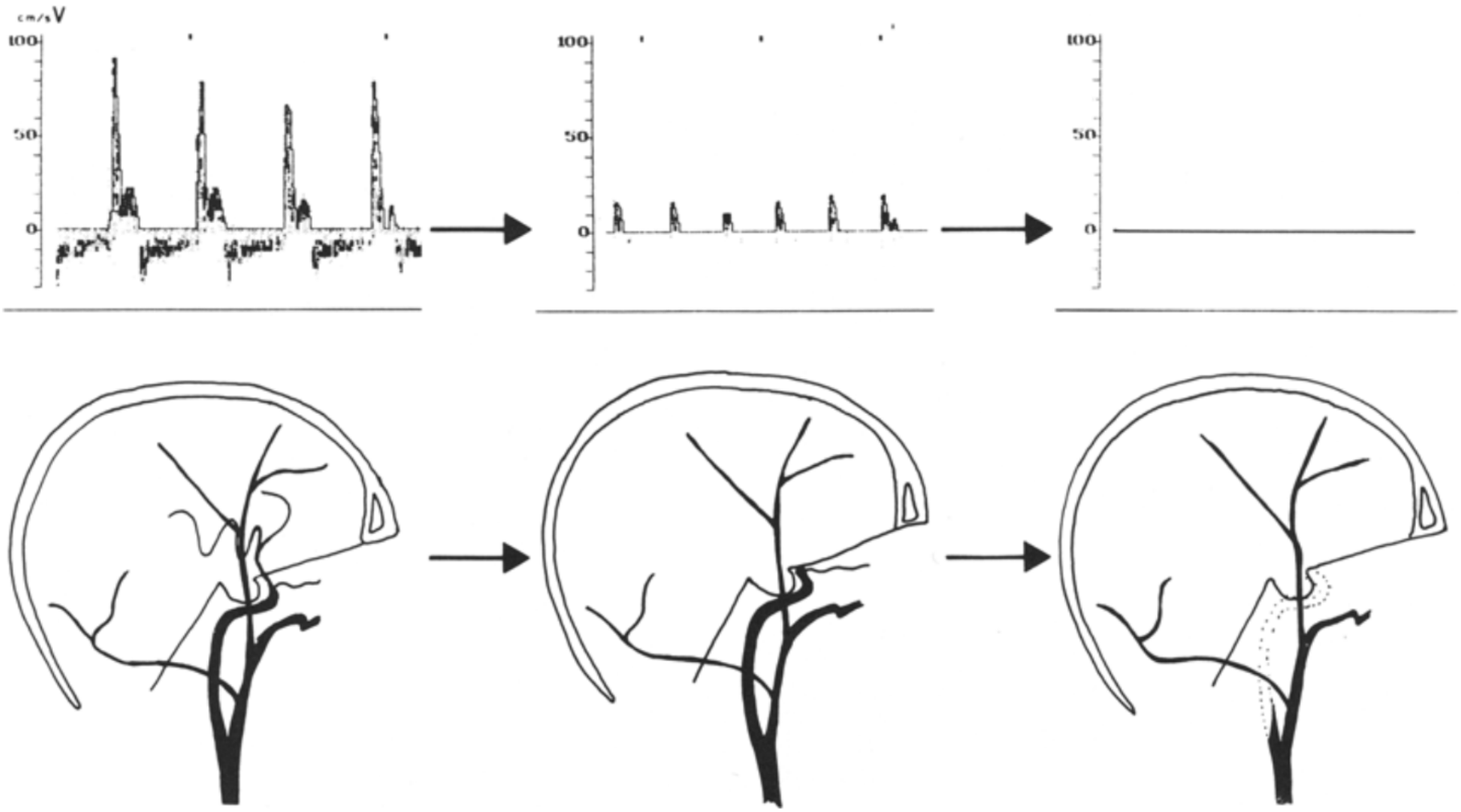
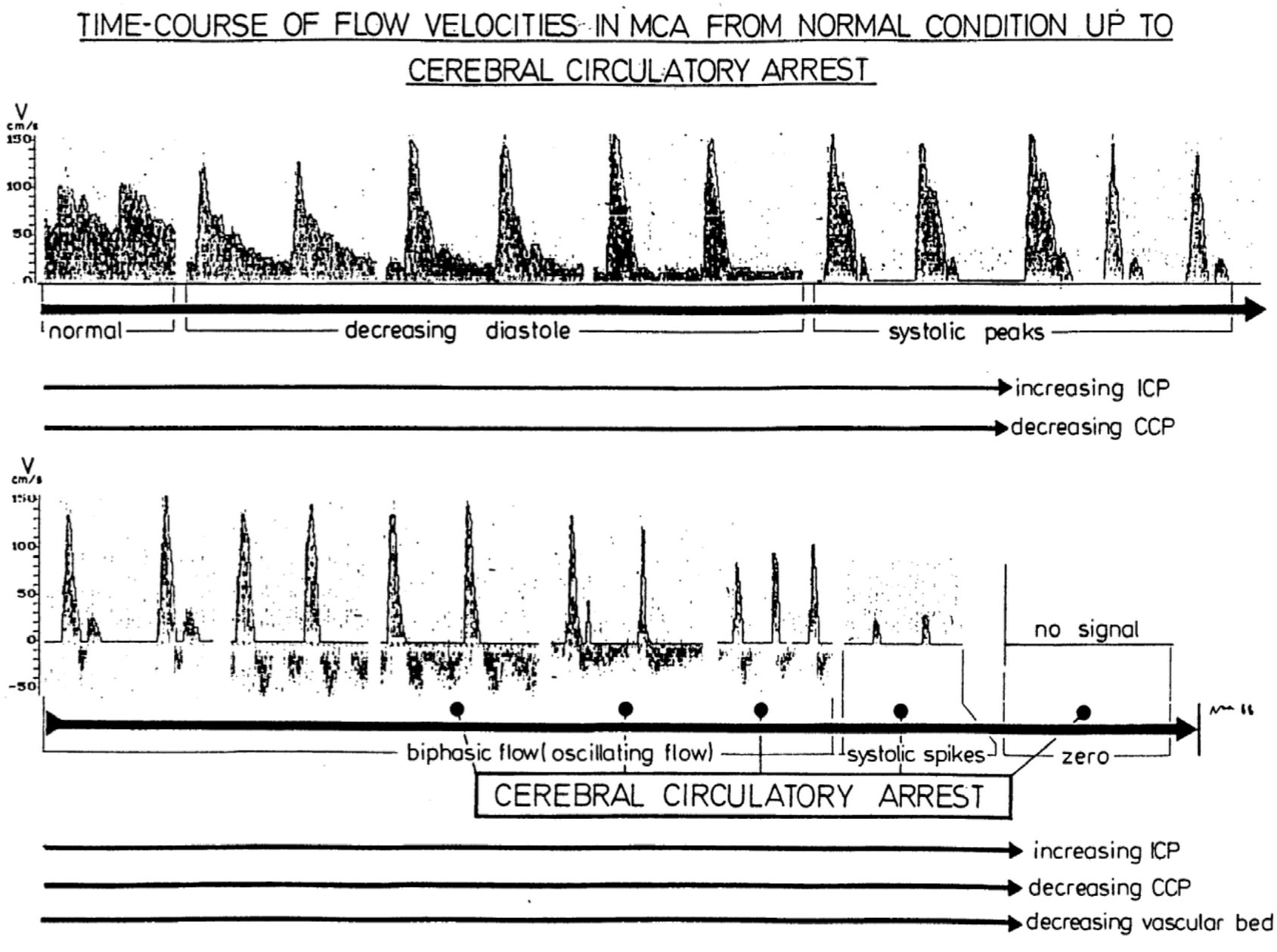


Fig. 6. Intracranial hemodynamics in early *(left)*, intermediate *(center)*, and late *(right)* intracranial circulatory arrest. The typical progress of the transcranial Doppler ultrasonography patterns *(upper)* correlates with a descent of the angiographic cessation of flow from subarachnoid to cervical levels *(lower)*. V = velocity.

Consensus opinion on diagnosis of cerebral circulatory arrest using Doppler-sonography

Task Force Group on cerebral death of the Neurosonolgy Research Group of the World Federation of Neurology



Journal of the Neurological Sciences 159 (1998) 145–150

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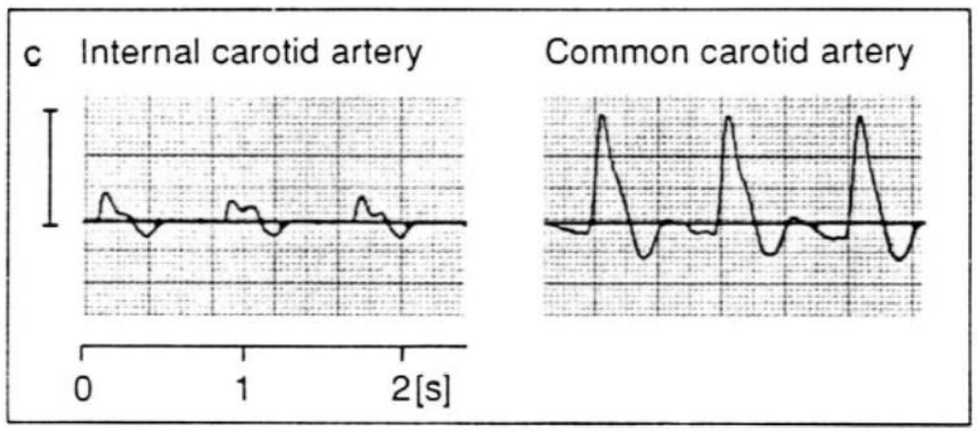

Fig. 2. Recording of the extracranial internal carotid artery and the common carotid artery with conventional zero crossing technique (a) and of the middle cerebral artery by transtemporal recording with spectrum analysis (b) in the same patient with established cerebral circulatory arrest. The examination of the middle cerebral artery shows the typical systolic spikes. For further explanation see text. (Reprinted from [37].)

Consensus opinion on diagnosis of cerebral circulatory arrest using Doppler-sonography

Task Force Group on cerebral death of the Neurosonolgy Research Group of the World Federation of Neurology

- L'utilisation du DTC est toujours soumise aux pré-requis fondamentaux

  Démarche diagnostic de l'état de mort encéphalique
  Connaissance du diagnostic
  Absence de facteurs confondant
  Examen clinique de mort encéphalique

- PAM>60mmHg

- Examen bilatéral
  Artères intra et extra crâniennes
  2 examens enregistrés à au moins 30 minutes d'intervalle

  Flux oscillant (aire sous la courbe positives et négatives égales)
  OU
  Pic systolique < 200ms et < 50 cm/sec

  Absence de signal n'est pas une preuve
  La disparition du signal est acceptée

PAS EN FRANCE

Possible en Allemagne

Journal of the Neurological Sciences 159 (1998) 145–150

Diagnostic Accuracy of Transcranial Doppler for Brain Death Confirmation: Systematic Review and Meta-Analysis

J.J. Chang, G. Tsivgoulis, A.H. Katsanos, M.D. Malkoff, and A.V. Alexandrov

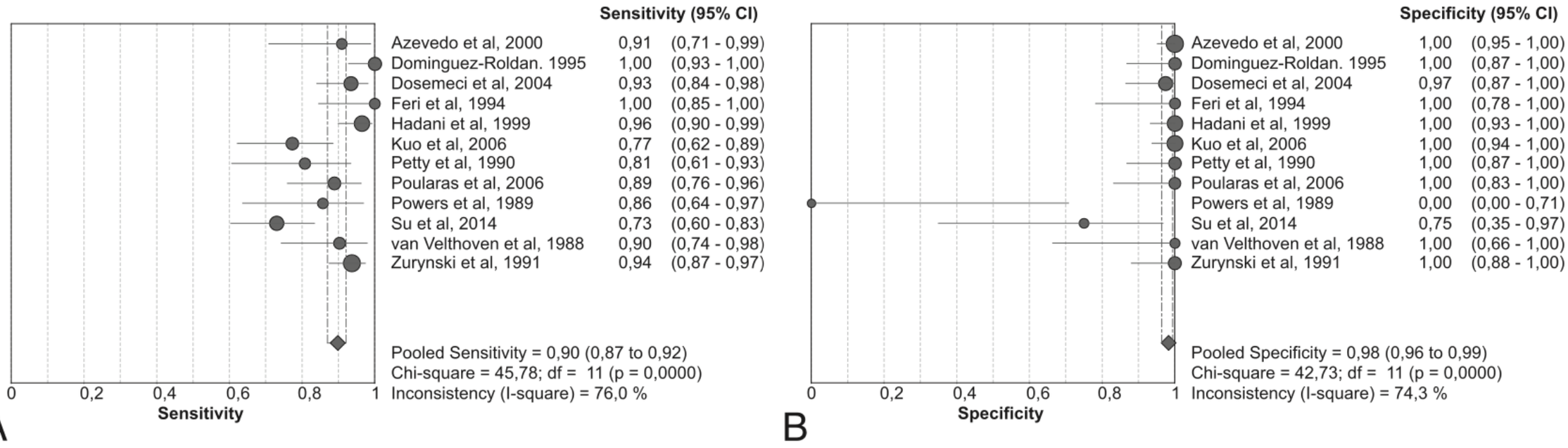

FIG 3. Pooled sensitivity (*A*) and specificity (*B*) of eligible studies reporting both diagnostic accuracy testing parameters.

Limites

- Le DTC à une sensibilité inférieure à l'examen clinique
- Sensibilité de l'examen influencée par le mécanisme lésionnel
- Pas de sensibilité 100% (arrêt circulatoire survient après EME)
- Faux positifs
- Patients sans fenêtre echo

Transcranial Doppler Shortens the Time Between Clinical Brain Death and Angiographic Confirmation: A Randomized Trial

Jean-Christophe Orban,[1,2,4] Ali El-Mahjoub,[1] Laurent Rami,[1] Patrick Jambou,[2] and Carole Ichai[1,3]

N = 44
22 standard TDM H+6 examen clinique
22 TDM si DTC signant un arrêt circulatoire (pic systolique / oscillant / disparition). Répété toutes les 2 heures.

Critère de jugement temps diagnostic clinique -> TDM

TABLE 2. Number of flow patterns of the extra and intracranial arteries

	Normal Flow	Systolic Forward Flow and Diastolic to and fro Flow	Oscillating Flow	Systolic Spikes	Absence of Flow
ICA, n (%)	10 (23)	19 (43)	11 (25)	2 (4.5)	2 (4.5)
MCA, n (%)	0	0	9 (20)	13 (30)	22 (50)
VA, n (%)	0	0	4 (9)	5 (11)	35 (80)
BA, n (%)	0	0	3 (14)	1 (4)	18 (82)

BA, basilar arteries; ICA, internal carotid arteries; MCA, middle cerebral arteries; VA, vertebral arteries.

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22 TDM si DTC signant un arrêt circulatoire (pic systolique / oscillant / disparition). Répété toutes les 2 heures.

Critère de jugement temps diagnostic clinique -> TDM

Nb : 1 patient groupe DTC ayant nécessité 2 TDM

Bénéfice d'un raccourcissement du diagnostic de ME non établi
Intérêt logistique

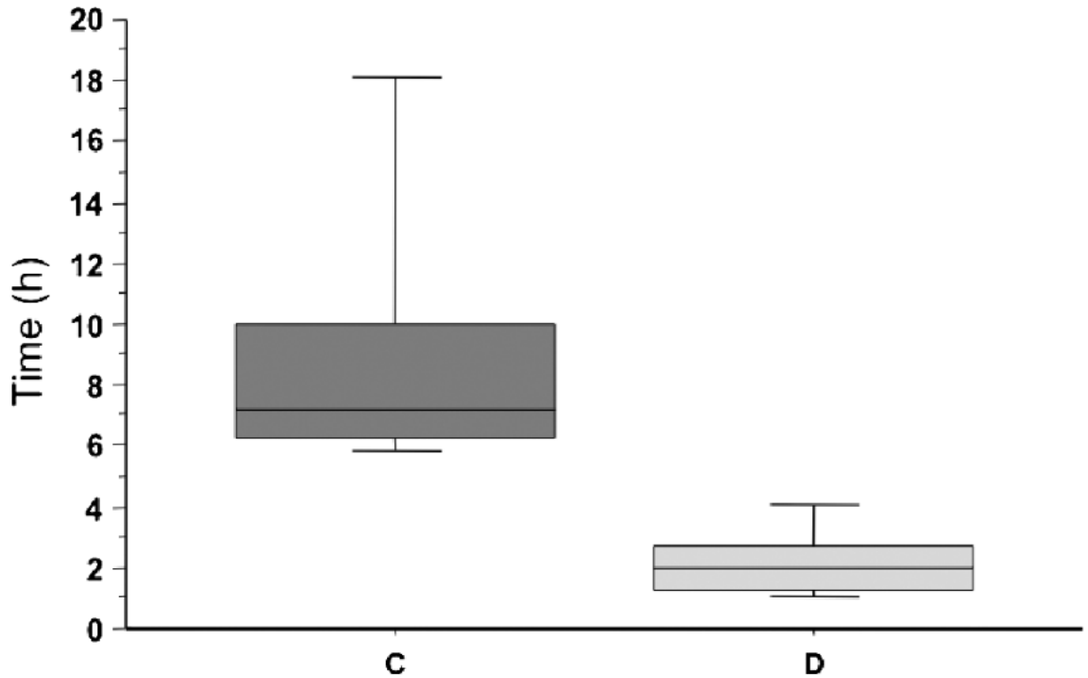

FIGURE 2. Time between clinical diagnosis of brain death and computed tomography angiography confirmation in the conventional (C) and Doppler (D) groups. Data are expressed as median and interquartile range.

DTC ET MORT ENCEPHALIQUE

- EN FRANCE outil non validé pour le diagnostic

- Intérêt?
  - Observationnel - physiopathologique
  - Augmenter la rentabilité du transport TDM
    -> ne pas « descendre au scanner» pour rien

- Législation à suivre

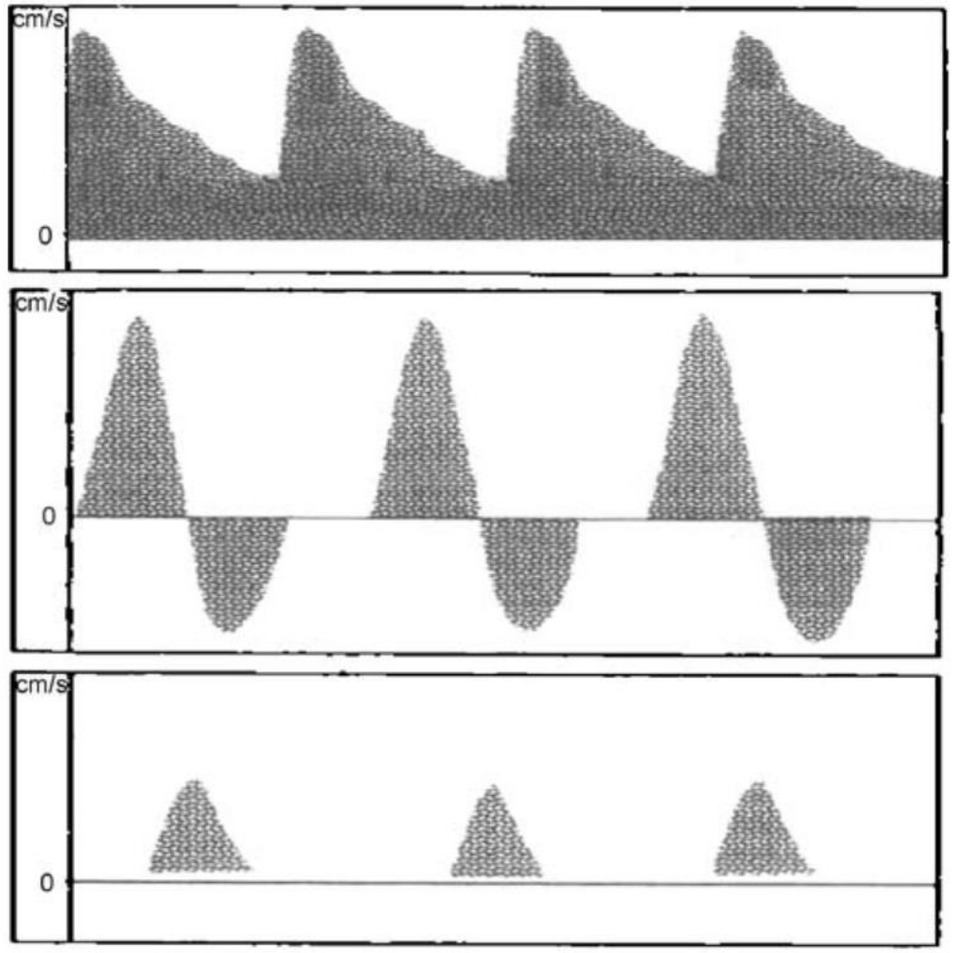

Fig. 1 Transcranial Doppler flow patterns. Transcranial Doppler flow patterns demonstrate normal flow with systolic and diastolic forward flow (*top*), oscillating flow with systolic forward flow and reversed diastolic flow (*middle*), and brief systolic forward flow (*bottom*)

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Merci pour votre attention

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