

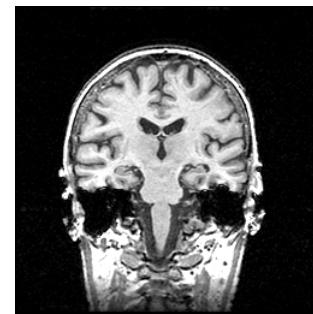


# Réanimation des traumatisés crâniens

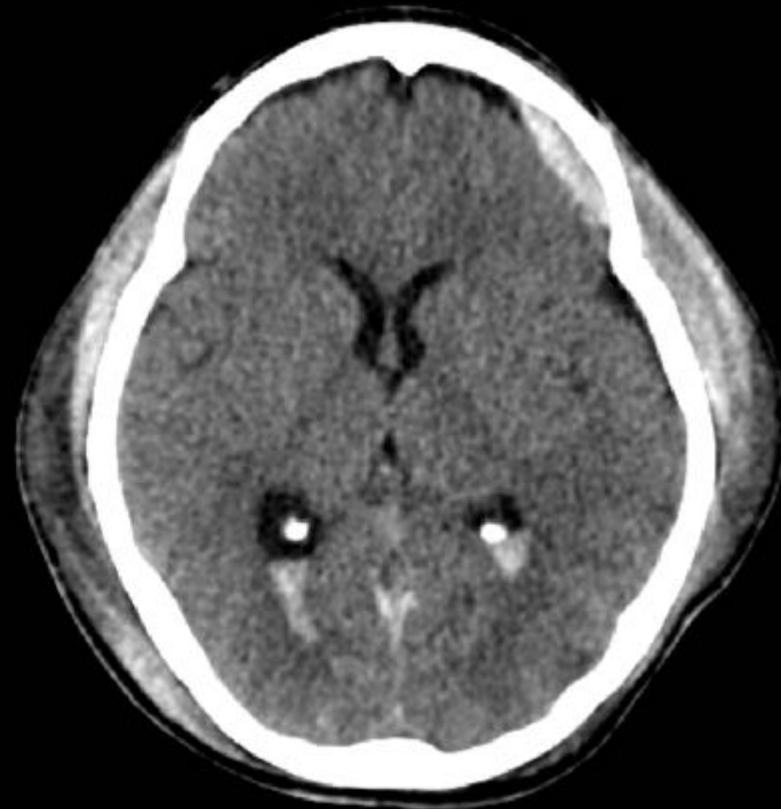


Nicolas Bruder

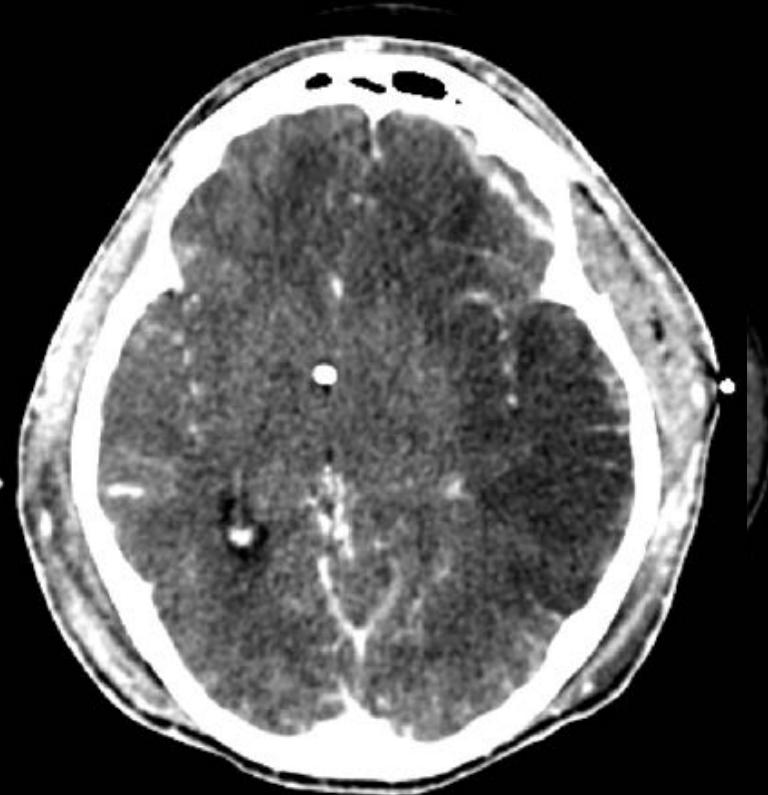
Pôle Anesthésie-Réanimation  
CHU Timone, Marseille



# La contusion initiale



# L'ischémie secondaire...



# Resultats

Ile de France (n=504)

**518 patients inclus en 22 mois**

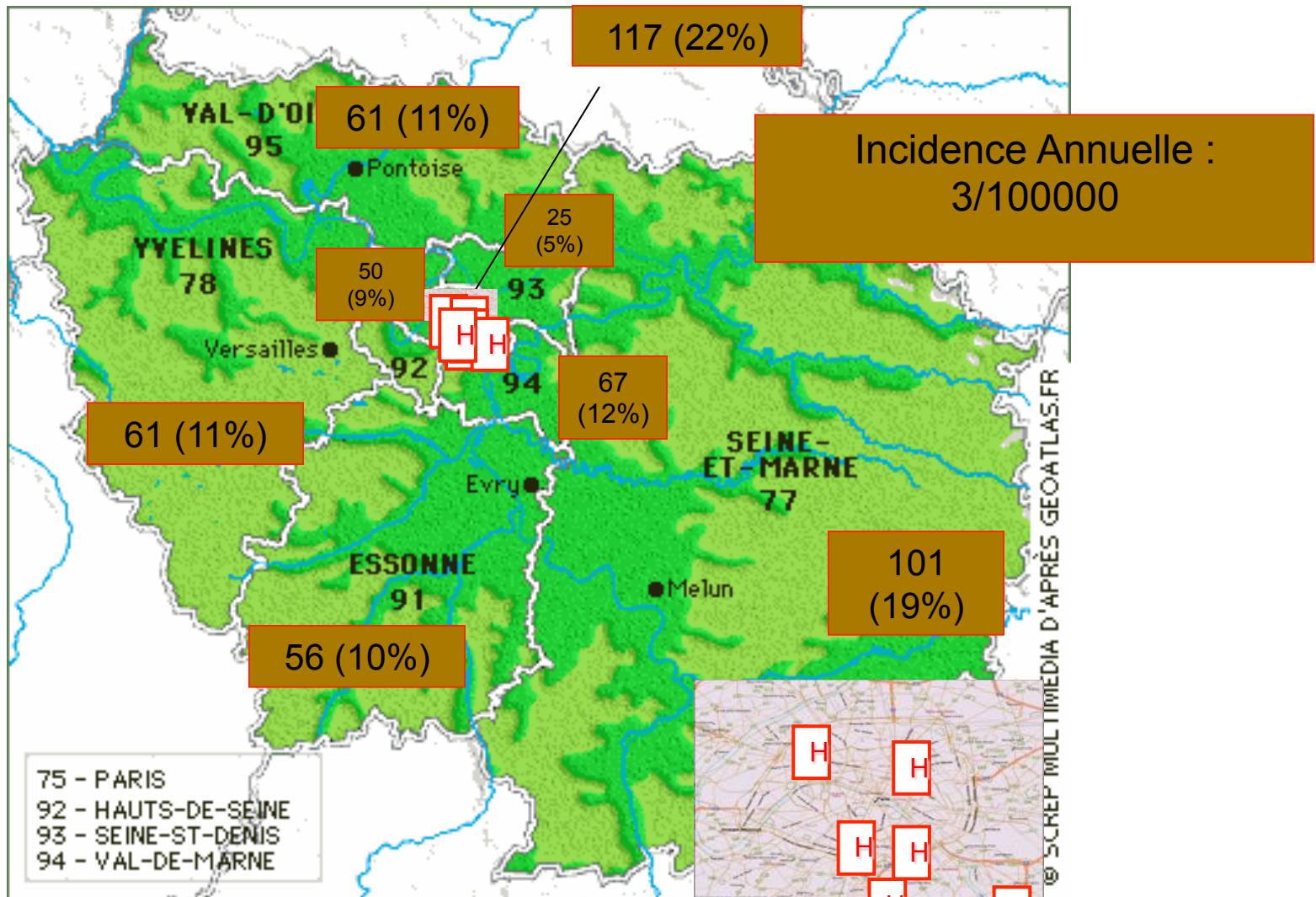
→ 14 exclus (données inexploitables)

→ **504 patients étudiés**

→ 23 décès pendant le transport

**481 patients arrivés à l'hôpital**

# En 05-07 ; PariS-TBI ; n=504

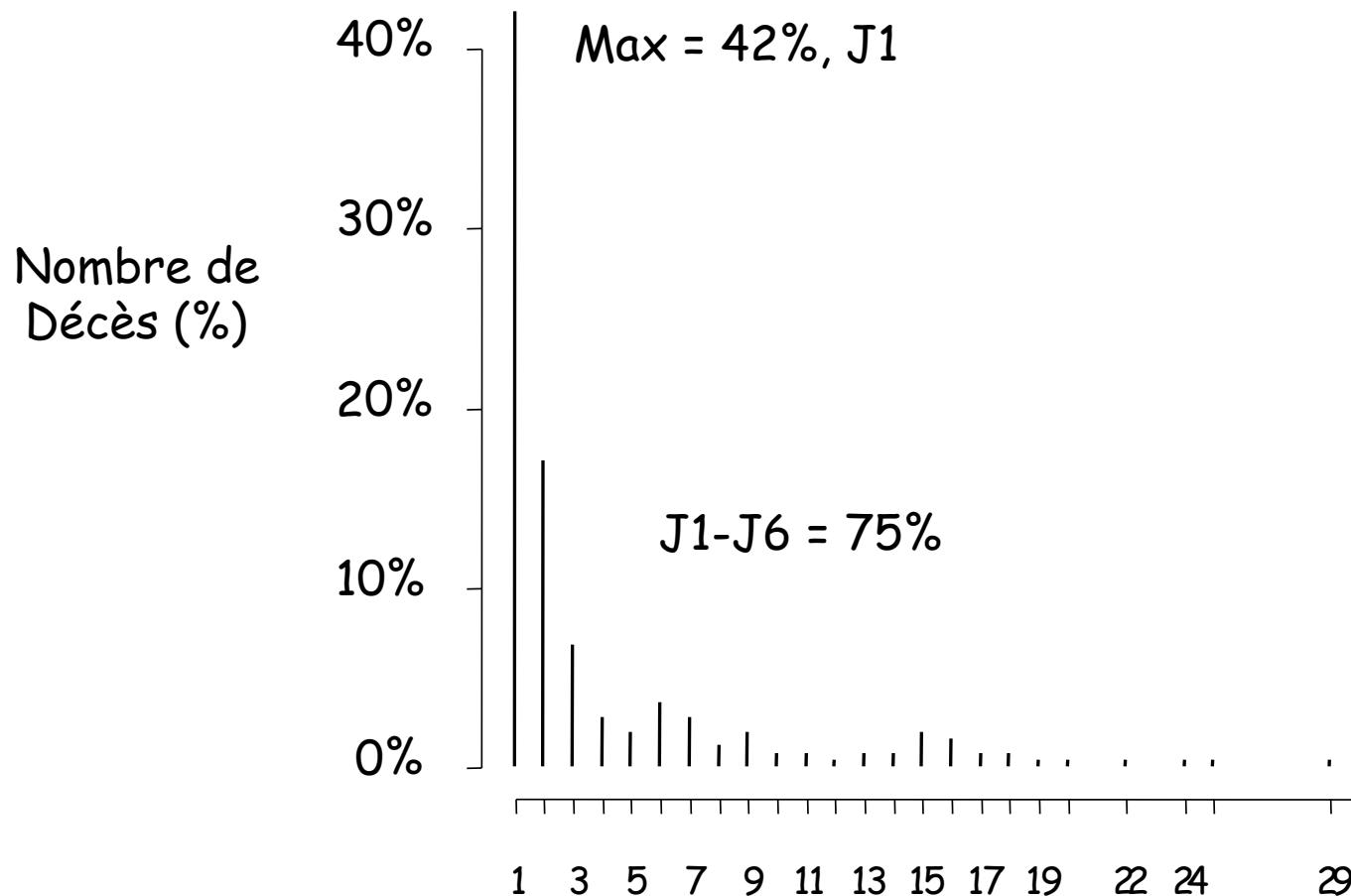


Place des traumatismes (n=504) et place des hôpitaux spécialisés (n=6)

B Vigué PHRC trauma Ile de France

# Résultats (PariS-TBI ; n=504)

Nombre de patients décédés quotidiennement (%) les 30 premiers jours rapportés au nombre total de patients décédés (n=250)

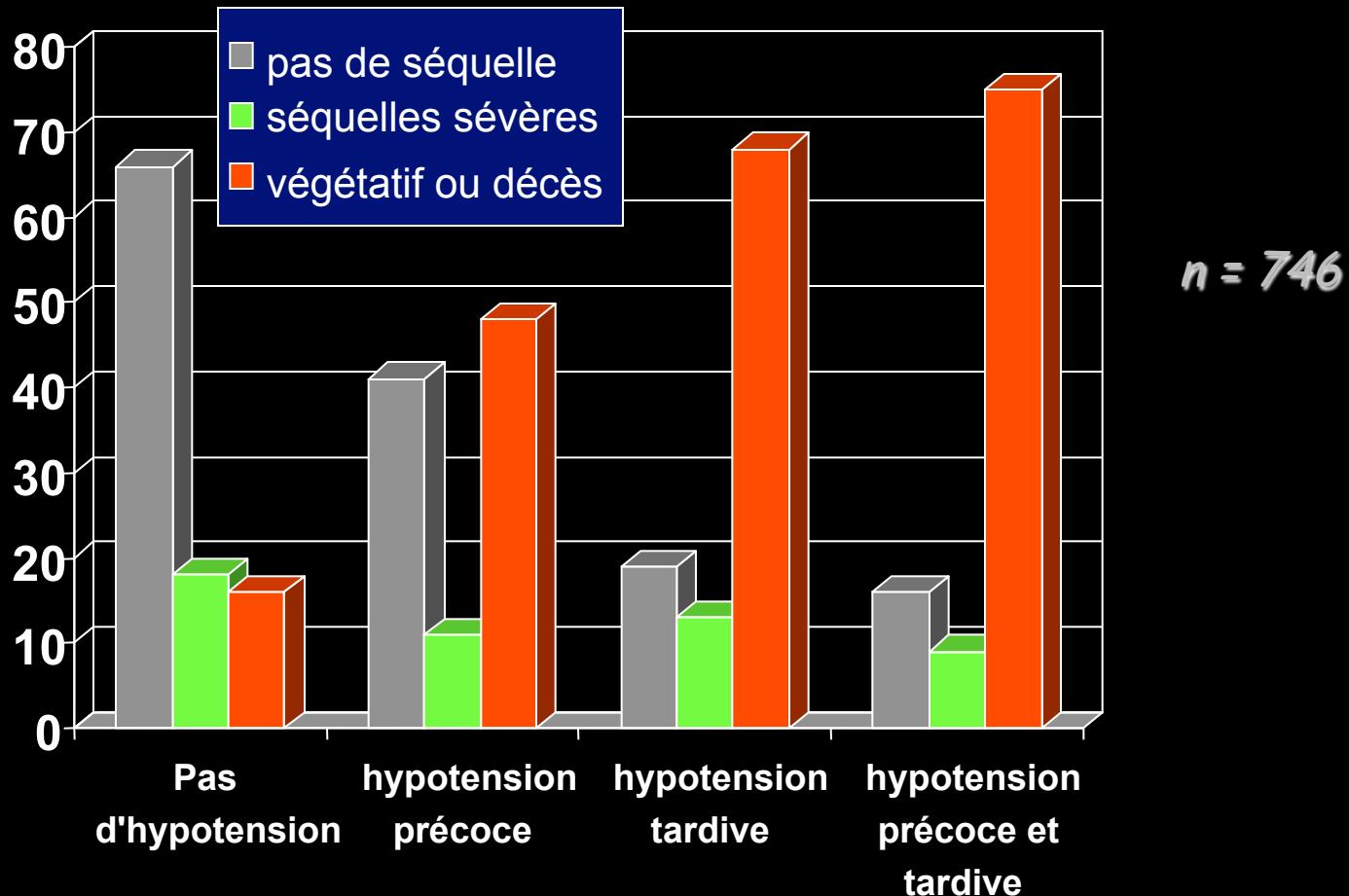


# Score de propension centré sur la PIC (Paris-TBI)

**Hazard Ratio   Limites 95% HR**

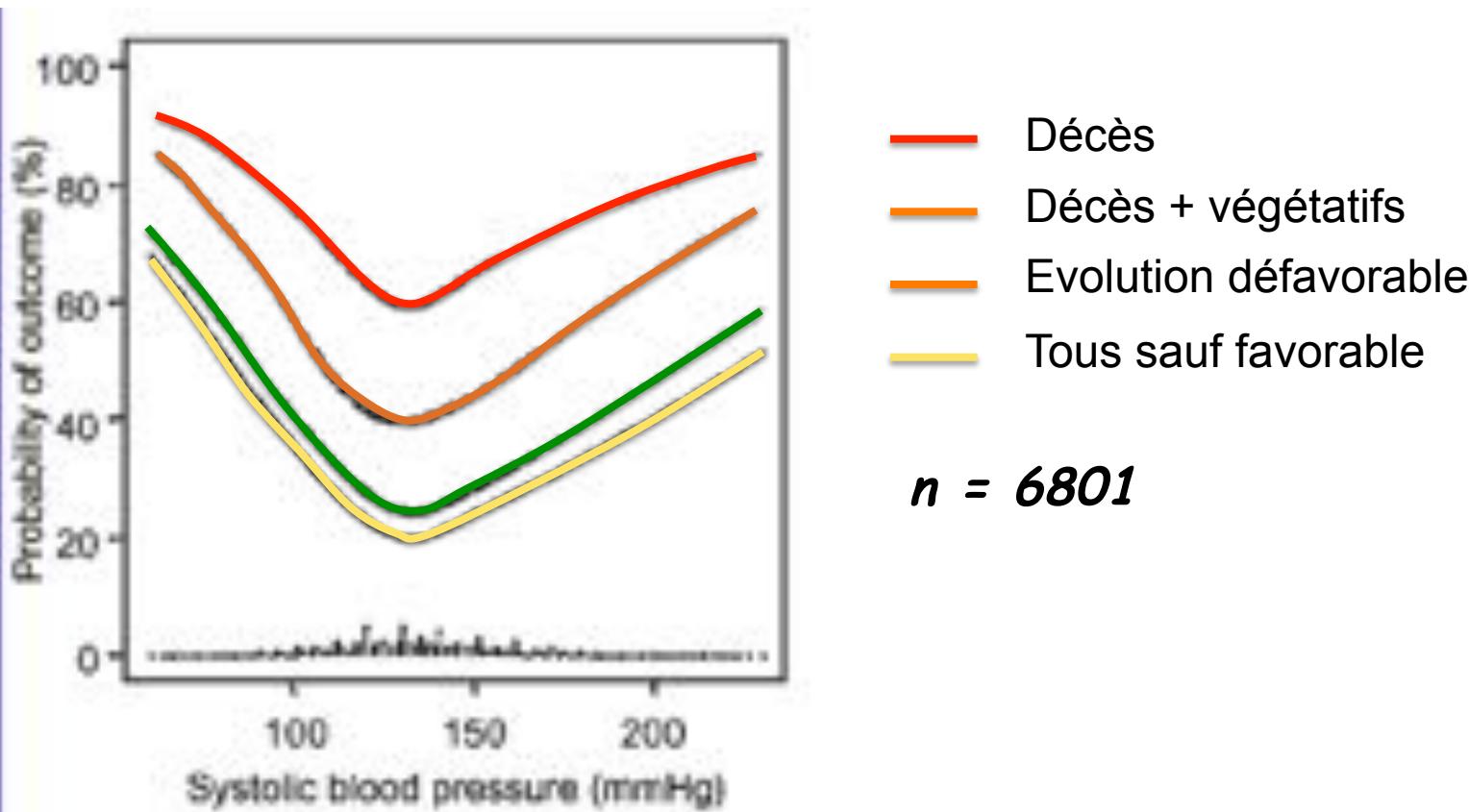
PIC		<b>0.462</b>	<b>0.292</b>	<b>0.731</b>
PAS < 90mmHg		<b>2.821</b>	<b>1.921</b>	<b>4.141</b>
Centres Spécialisés		<b>0.667</b>	<b>0.455</b>	<b>0.977</b>
SEXE (M)		0.928	0.643	1.338
Age (vs 18-30)	30-45	0.832	0.509	1.360
Age (vs 18-30)	45-60	1.079	0.675	1.723
Age (vs 18-30)	60-75	1.690	0.989	2.887
Age (vs 18-30)	75-99	<b>2.998</b>	<b>1.713</b>	<b>5.245</b>
IdF (Grde vs pte couronne)		0.689	0.487	0.976
Trauma associé		0.795	0.563	1.122
Choc Hémorragique		<b>1.878</b>	<b>1.122</b>	<b>3.144</b>
GCS (vs GCS=3)	GCS 4-5	0.757	0.491	1.167
GCS (vs GCS=3)	GCS 6-7	<b>0.462</b>	<b>0.282</b>	<b>0.756</b>
GCS (vs GCS=3)		<b>0.490</b>	<b>0.252</b>	<b>0.952</b>
Mydriase (uni or bi)		<b>2.855</b>	<b>1.907</b>	<b>4.274</b>

# Pronostic de l'hypotension



*Traumatic Coma Data Bank 1993*

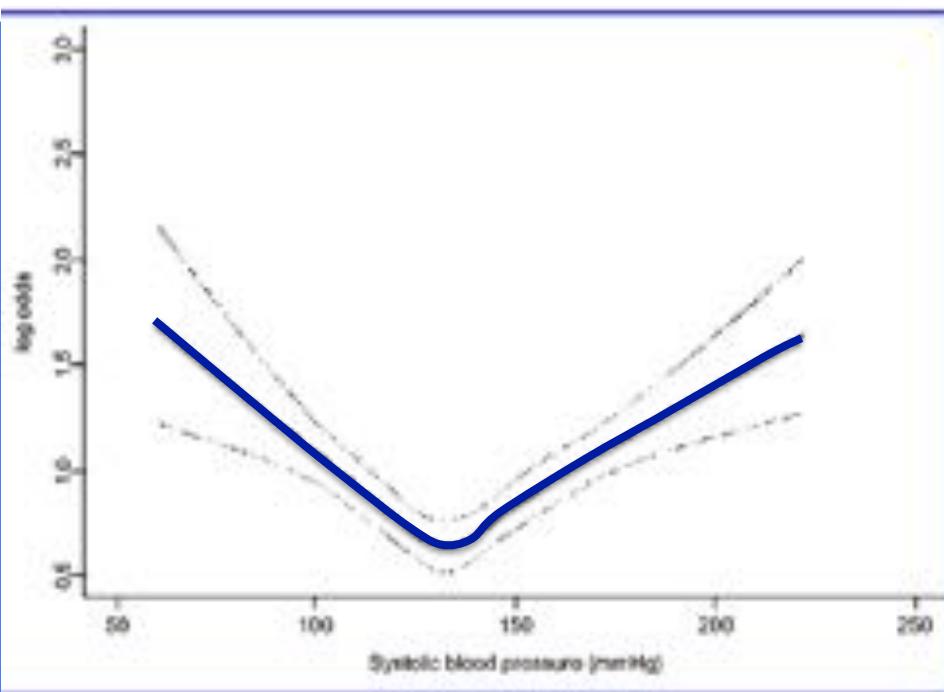
# Pronostic et hypotension



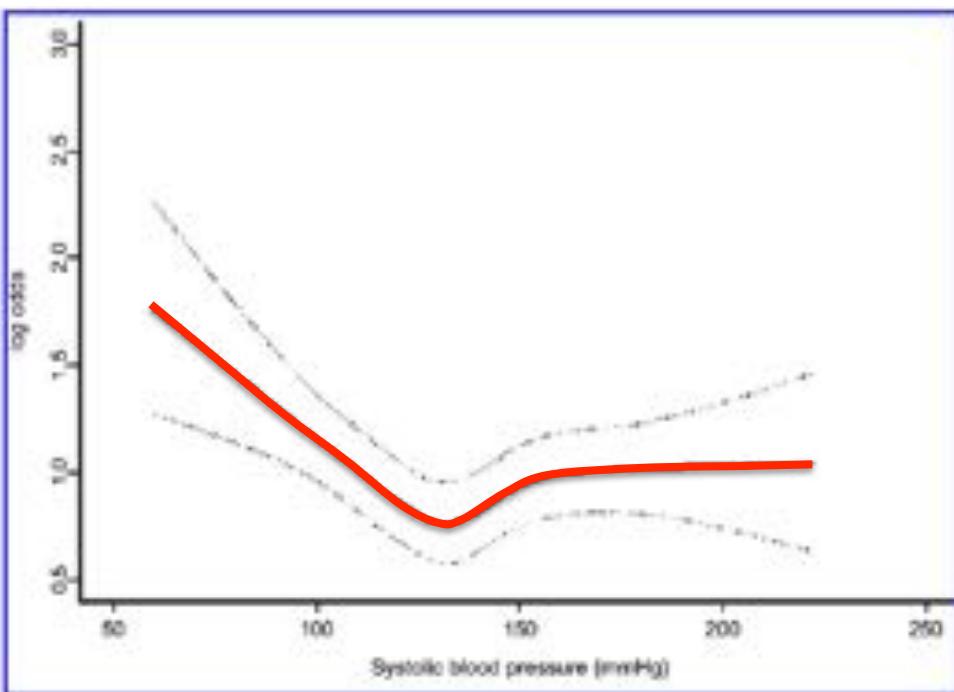
$n = 6801$

**Meilleur outcome : PAS 135 mm Hg  
PAM 90 mm Hg**

# Pronostic et hypotension



Non ajusté

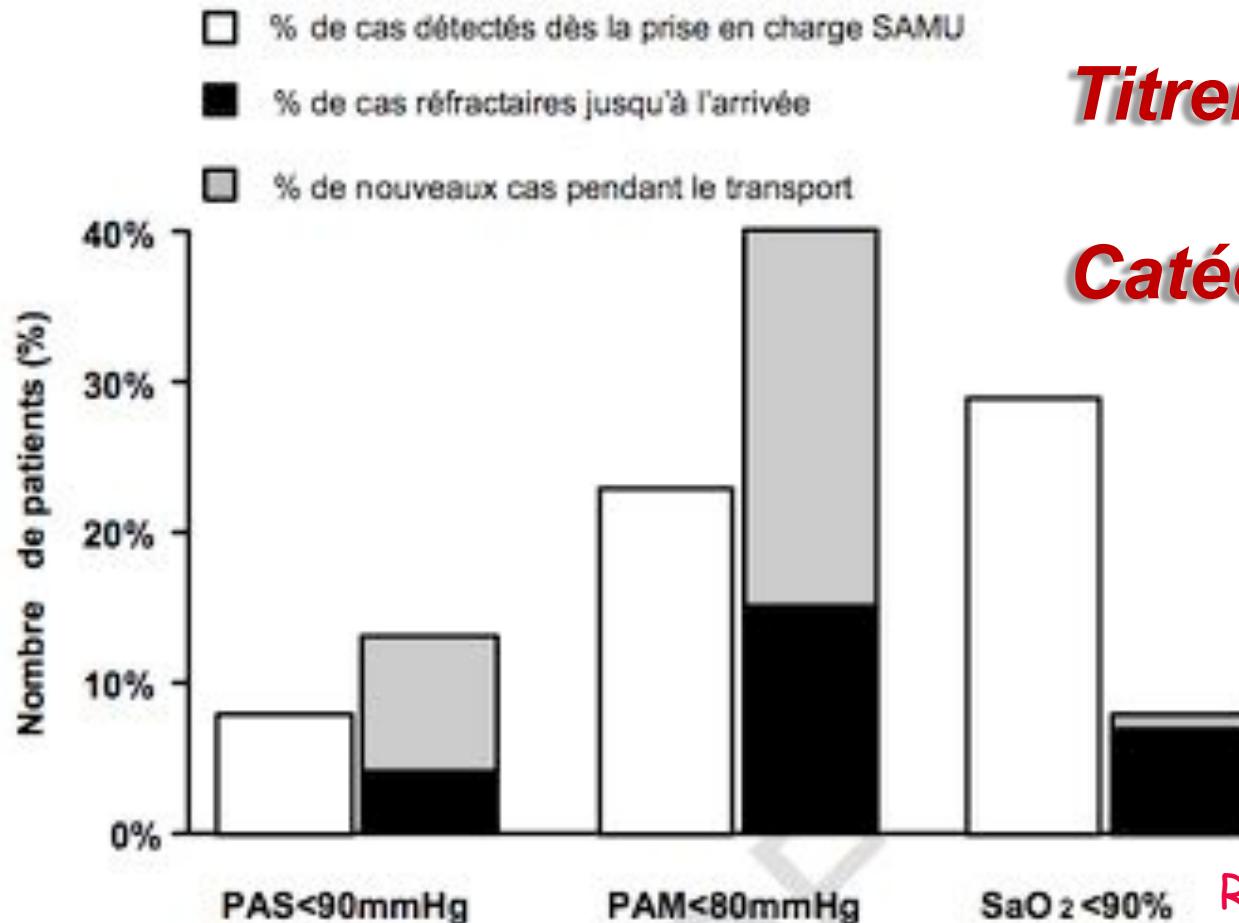


Ajusté sur âge,  
score moteur, pupilles

# **RFE 2015**

- PAS > 110 mm Hg et PAM > 80 mm Hg

## Influence de la prise en charge préhospitalière sur le devenir des patients traumatisés crâniens (n=304)



**Titrer la sédation**

**Catécholamines**

Rouxel, AFAR, 2004

# **La sédation n'est pas un traitement de l'HIC**

- Elle permet l'adaptation au respirateur et le contrôle de la capnie
- Elle permet le contrôle des crises d'épilepsie
- Elle permet la prise en charge du patient dans de bonnes conditions de sécurité
- Elle permet la réalisation de gestes invasifs

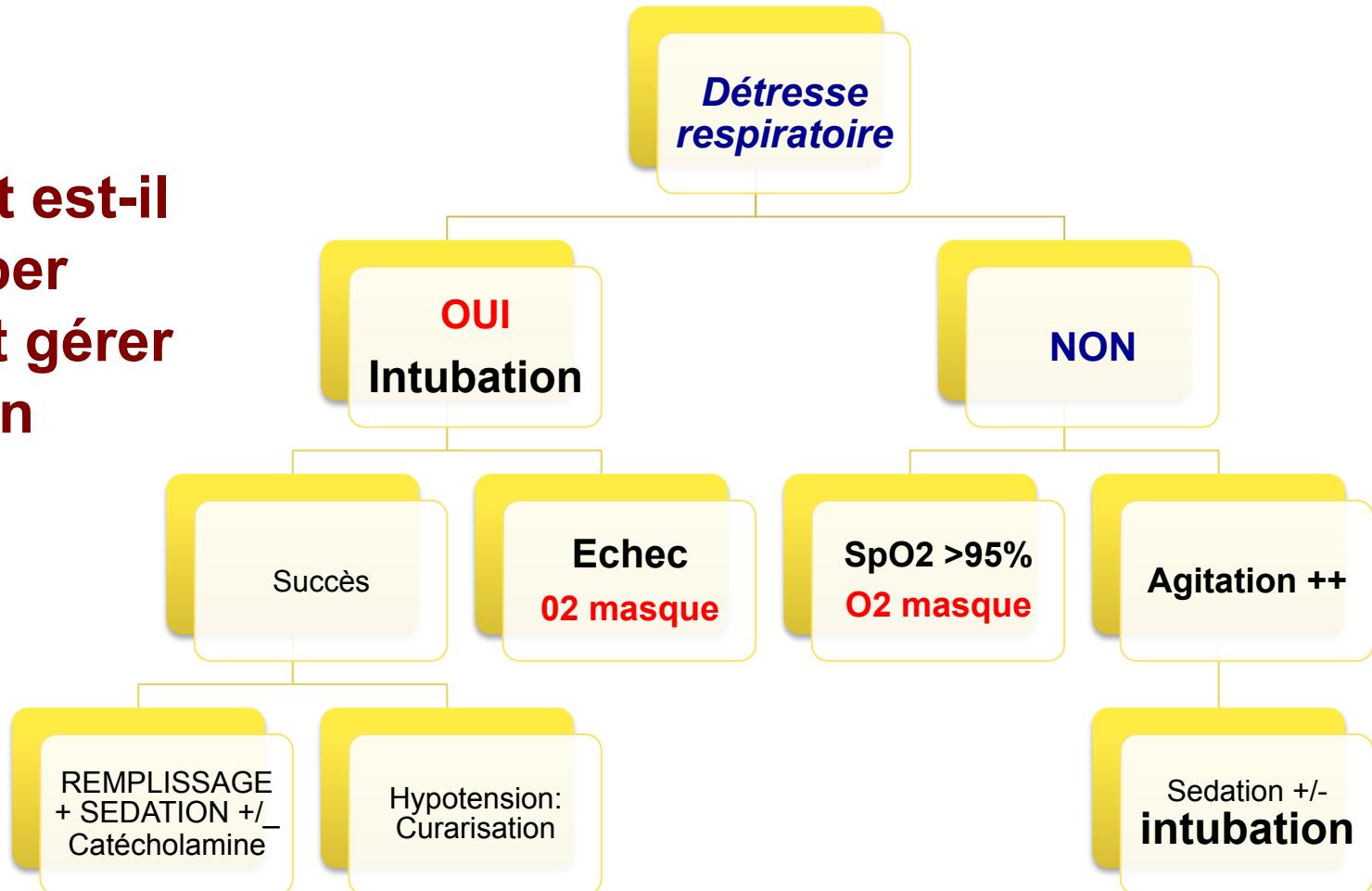
***Elle s'accompagne toujours d'une hypotension***

# Faut-il intuber les traumatisés crâniens graves ?

**RECOMMANDATION : EVITER PAO<sub>2</sub> < 60 MM HG**

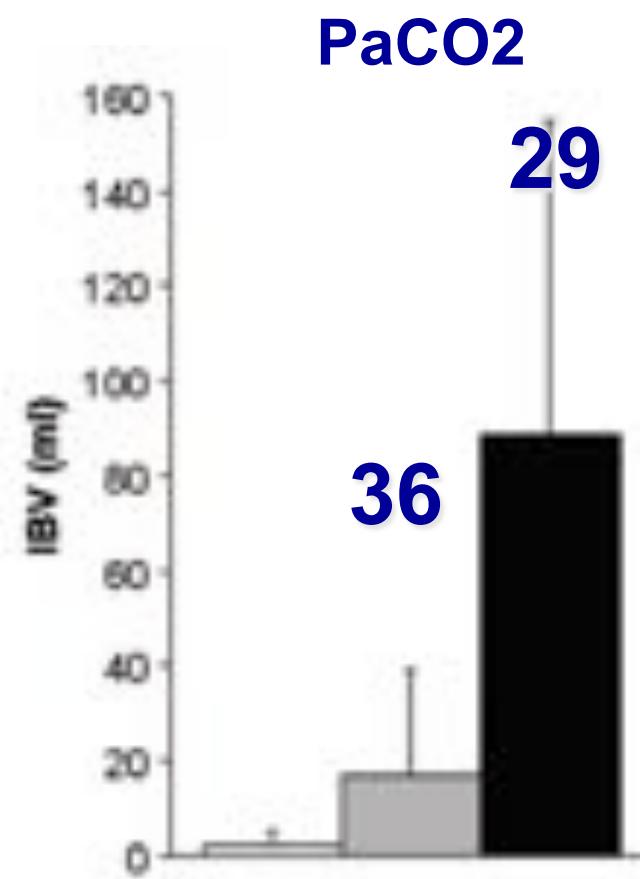
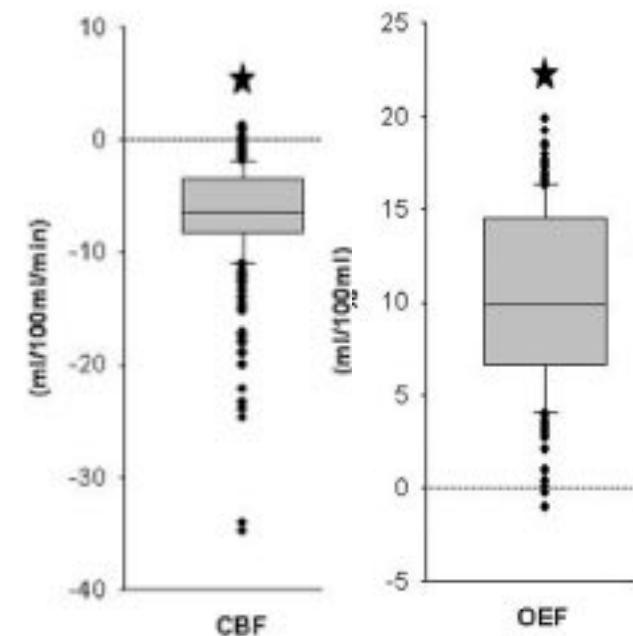
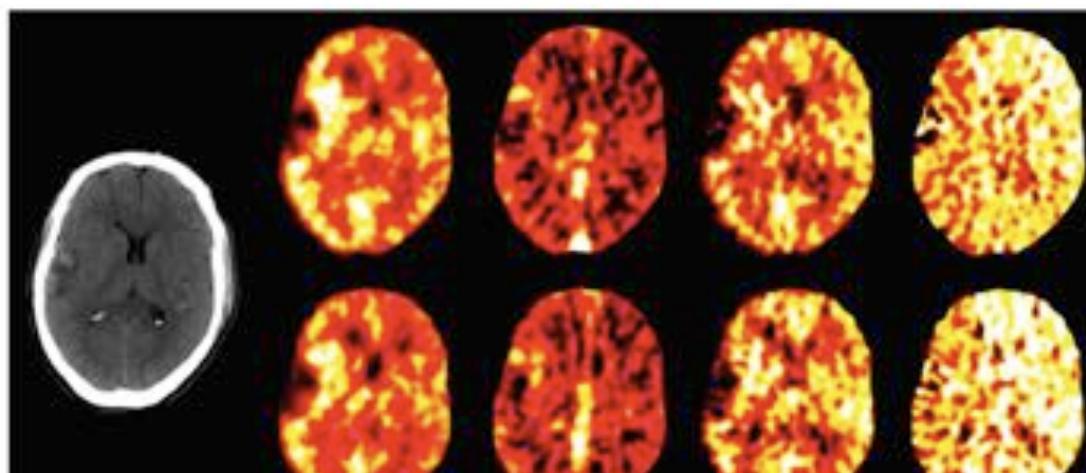
## Questions:

- Le patient est-il facile à intuber
- Comment gérer l'hypotension

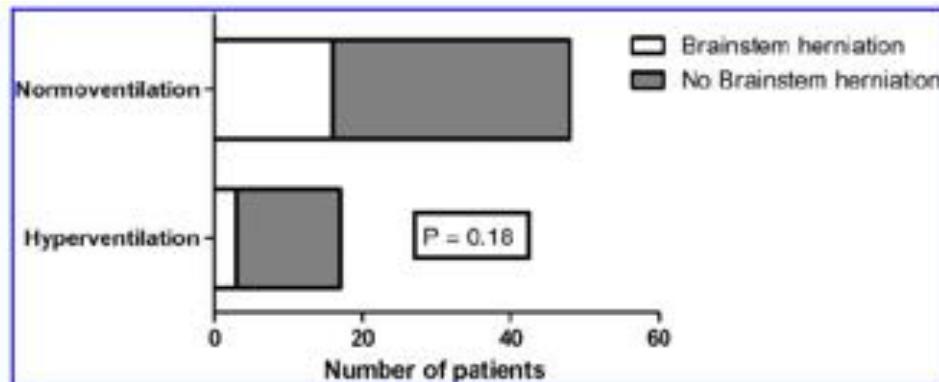
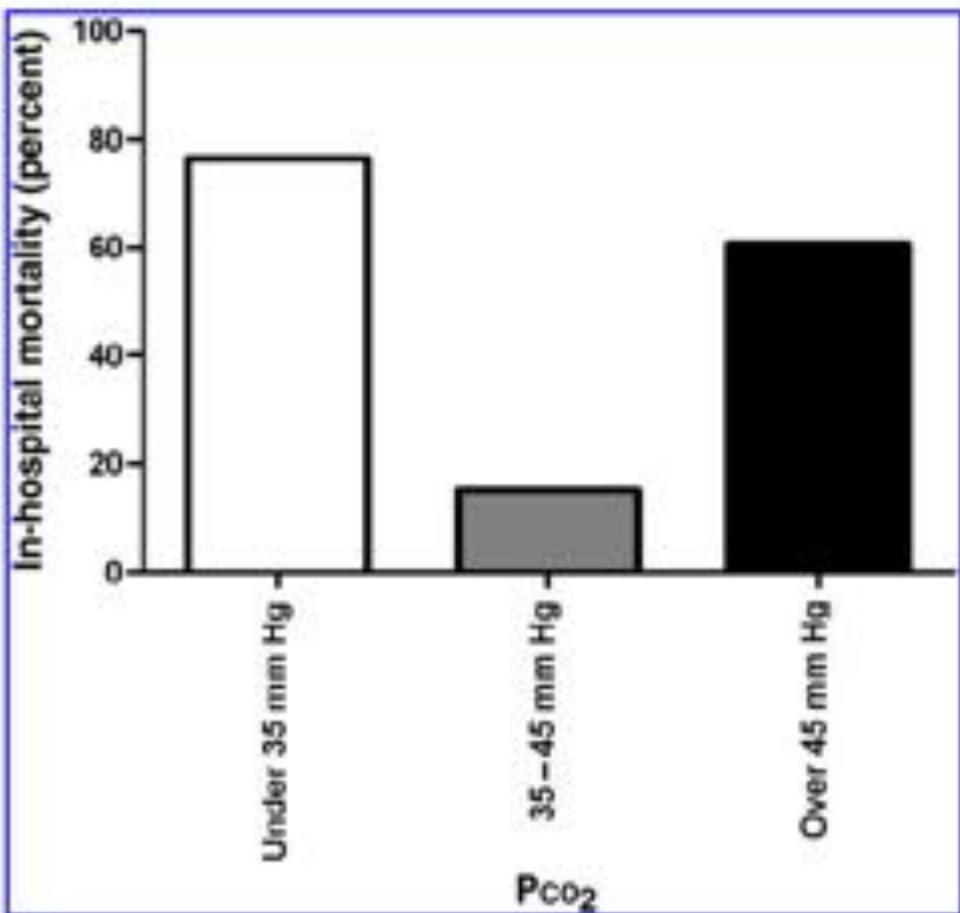


# Hyperventilation following head injury: Effect on ischemic burden and cerebral oxidative metabolism\*

Jonathan P. Coles, PhD; Tim D. Fryer, PhD; Martin R. Coleman, PhD; Peter Smielewski, PhD;



# Hyperventilation préhospitalière



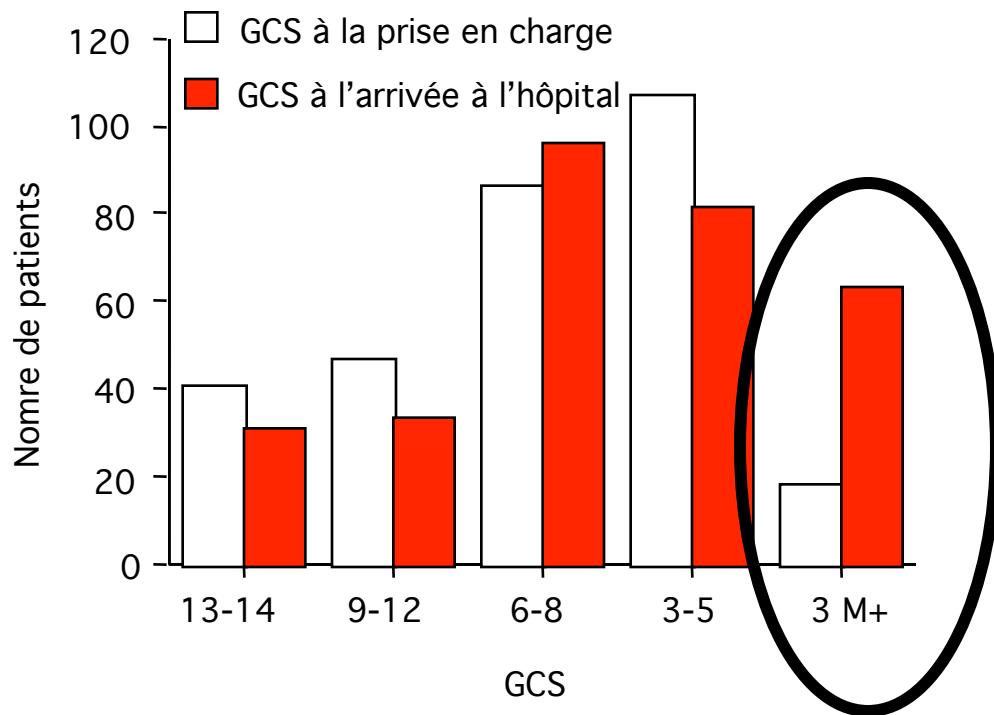
Variable	Odds ratio	95% CI
Intercept	—	—
$\text{PCO}_2 (<35 \text{ or } >45 \text{ mm Hg})$	14.2	1.89,106
Age ( $>50$ years)	13.1	2.48,69.3
GCS ( $<6$ )	1.87	0.358,9.71
ISS ( $>25$ )	2.72	0.373,19.8
Brainstem herniation	5.92	0.867,40.3
Hypoxia and hypotension	3.66	0.331,40.5

# Score de propension centré sur la PIC (Paris-TBI)

**Hazard Ratio   Limites 95% HR**

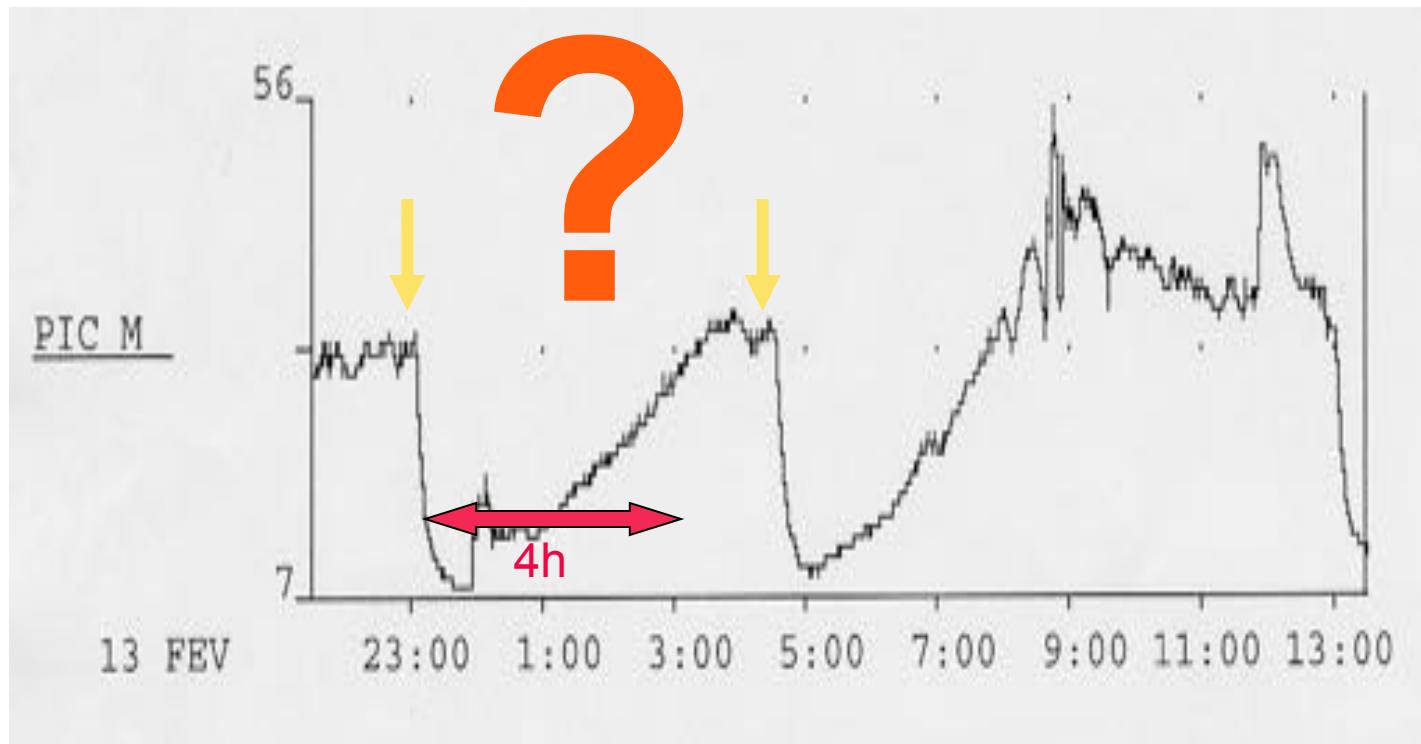
PIC		<b>0.462</b>	<b>0.292</b>	<b>0.731</b>
PAS < 90mmHg		<b>2.821</b>	<b>1.921</b>	<b>4.141</b>
Centres Spécialisés		<b>0.667</b>	<b>0.455</b>	<b>0.977</b>
SEXE (M)		0.928	0.643	1.338
Age (vs 18-30)	30-45	0.832	0.509	1.360
Age (vs 18-30)	45-60	1.079	0.675	1.723
Age (vs 18-30)	60-75	1.690	0.989	2.887
Age (vs 18-30)	75-99	<b>2.998</b>	<b>1.713</b>	<b>5.245</b>
IdF (Grde vs pte couronne)		0.689	0.487	0.976
Trauma associé		0.795	0.563	1.122
Choc Hémorragique		<b>1.878</b>	<b>1.122</b>	<b>3.144</b>
GCS (vs GCS=3)	GCS 4-5	0.757	0.491	1.167
GCS (vs GCS=3)	GCS 6-7	<b>0.462</b>	<b>0.282</b>	<b>0.756</b>
GCS (vs GCS=3)		<b>0.490</b>	<b>0.252</b>	<b>0.952</b>
Mydriase (uni or bi)		<b>2.855</b>	<b>1.907</b>	<b>4.274</b>

# Mydriase à l'hôpital

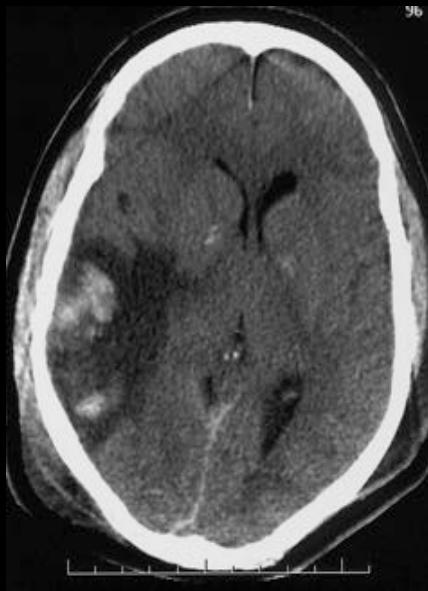


Apparition de mydriases aréactives pendant le transport

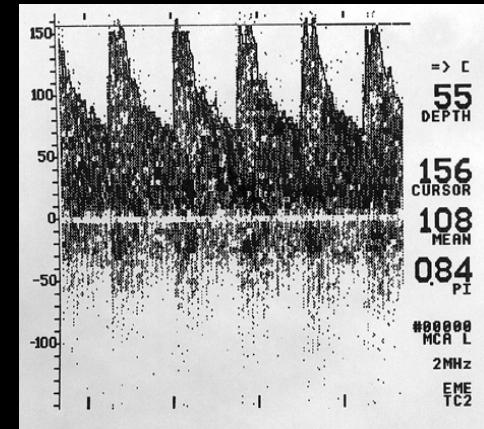
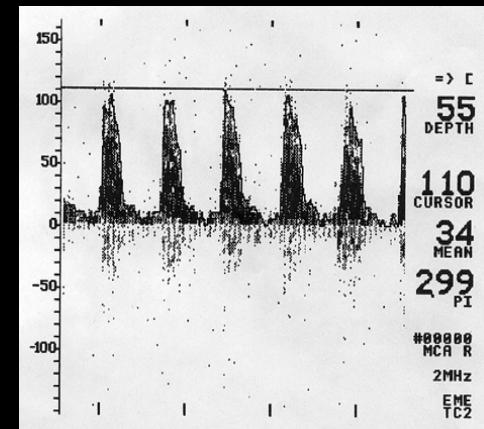
# Traitement de l'HTIC



# Traitement de l'HIC: Mannitol



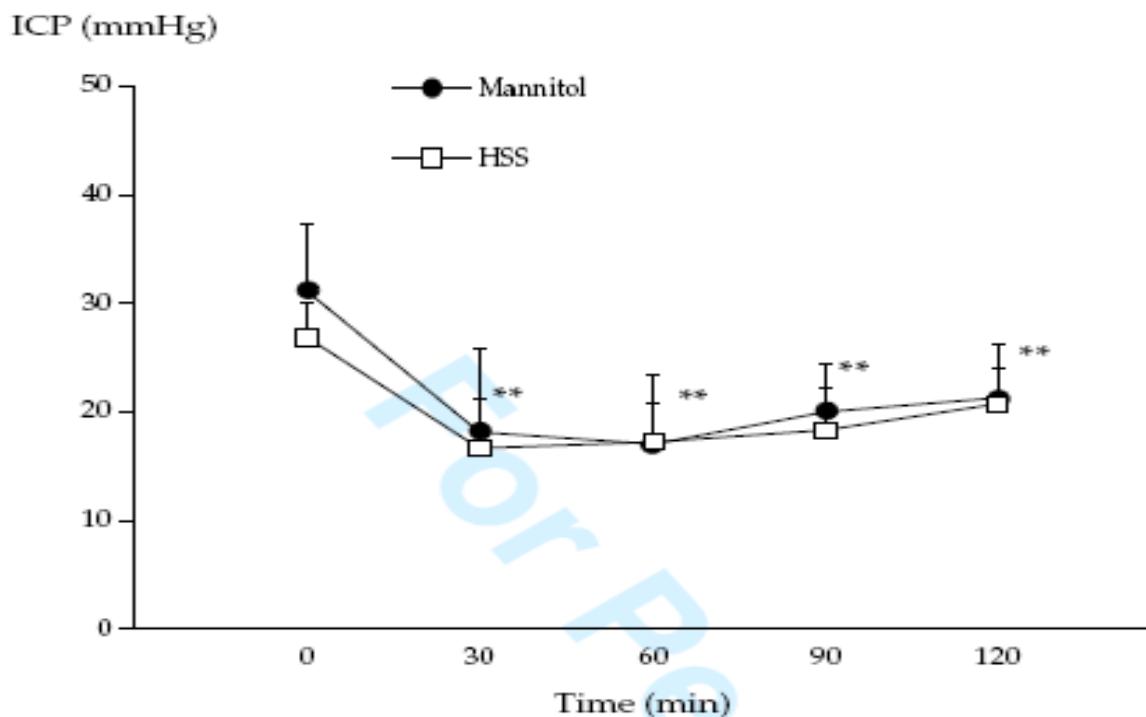
PIC mm Hg	PPC mm Hg	SjO <sub>2</sub> %
71	46	51
Avant Mannitol		
22	96	61
Après Mannitol		



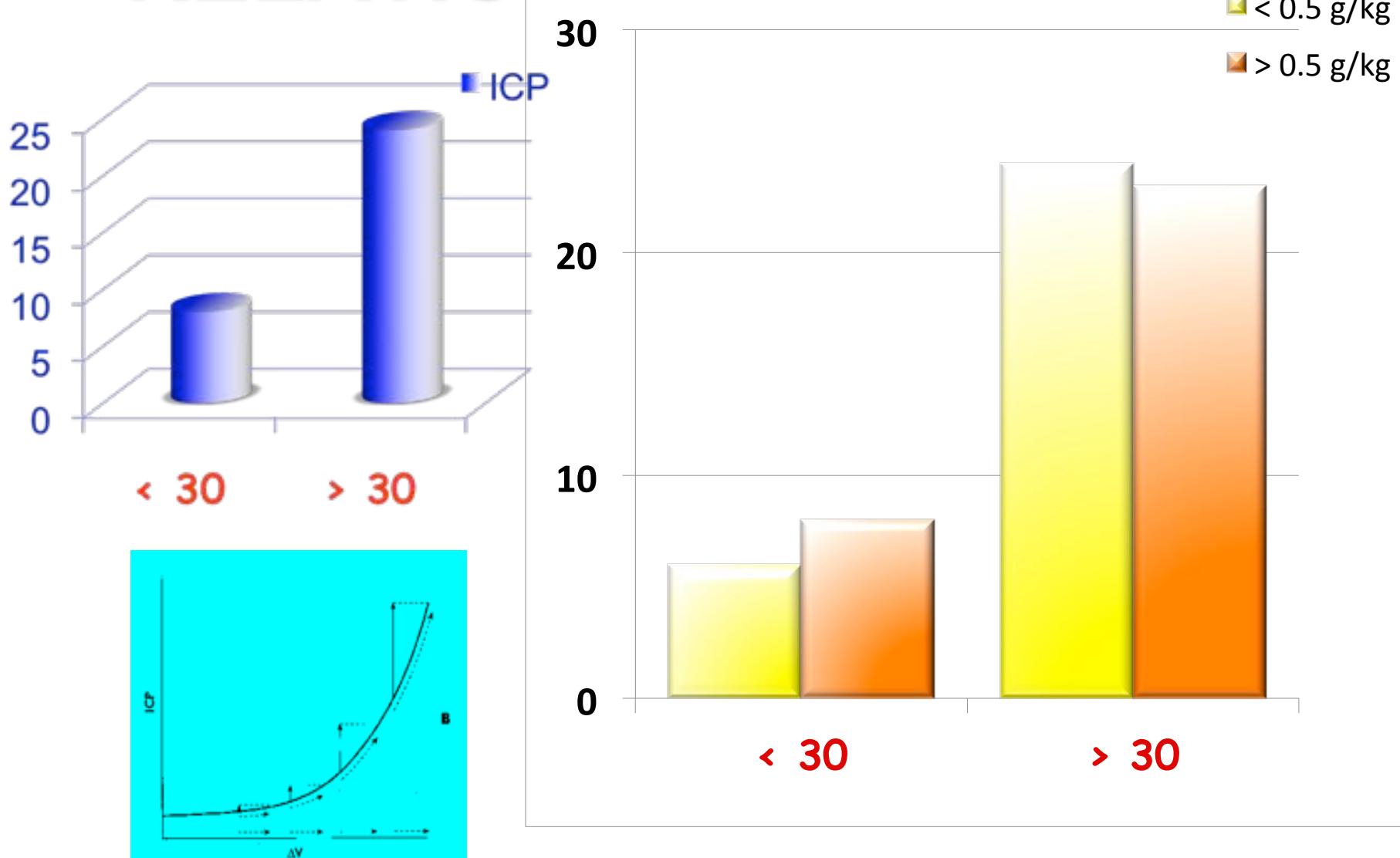
# Lutter contre l'œdème cérébral

	Osmolarité	Pression Oncotique
HEA 6 %	308	25
Mannitol 20 %	<b>1098</b>	0
SSH 7,5 %	<b>2464</b>	0

*n = 20*

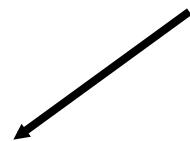


# RELATION EFFECT DOSE ?



# Utilisation du mannitol en préhospitalier

37 services d' urgences - 96 médecins



3 services  
**Pas de mannitol**



35 % pas d' utilisation du mannitol  
17 % utilisation unique  
31 % ne connaissaient pas la dose

**Mydriase à l' arrivée à l' hôpital et pas de mannitol**

=

**100 % mortalité**

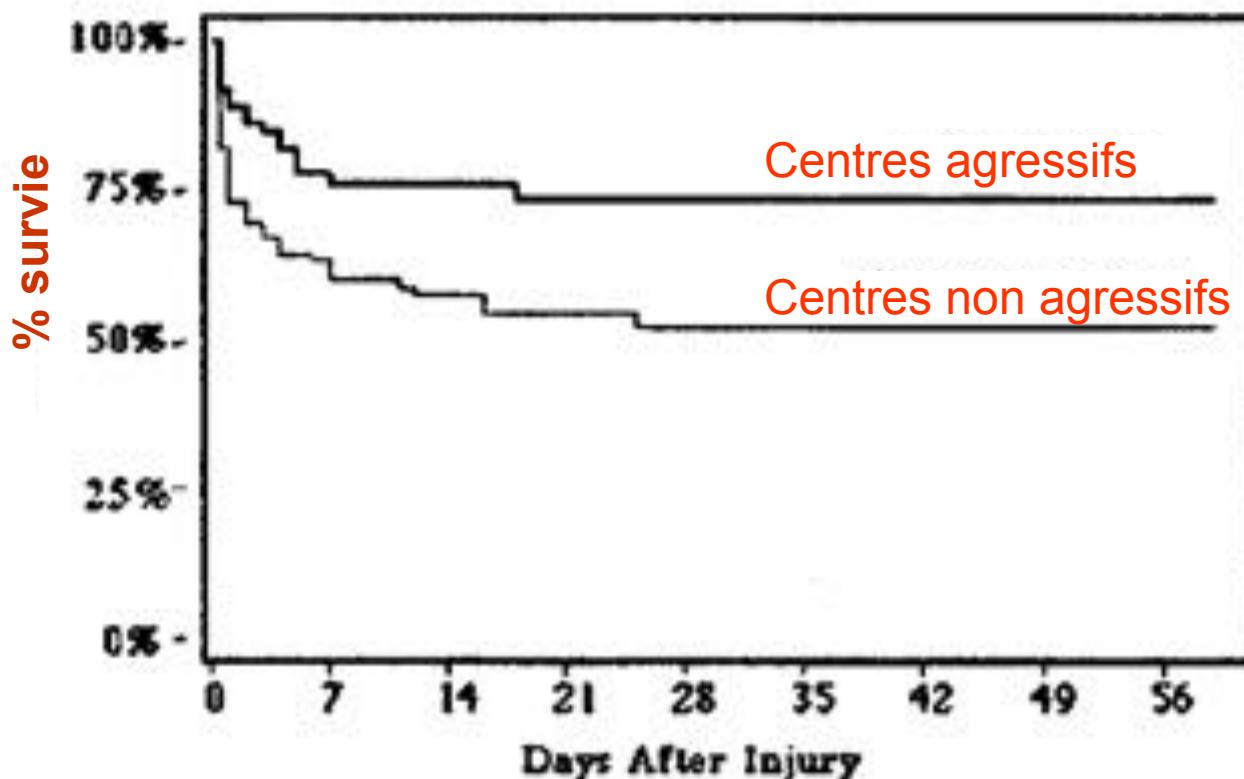


# Organisation des soins

# Prise en charge des TC graves en fonction des centres

**34 hôpitaux**

Centres agressifs = PIC chez plus de 50 % des TC avec GCS < 8



Pas de différence sur :

- âge
- ISS
- Sexe
- % hypotension
- Volume de patients traumatisés admis

# **Les conditions réglementaires**

- Circulaire n° 2004-280; 18 juin 2004  
***relative à la filière de prise en charge  
sanitaire, médico-sociale et sociale des  
traumatisés crânio-cérébraux et des  
traumatisés médullaires***

**La prise en charge ne s'arrête pas à la porte du  
service de réanimation**

# Score de propension centré sur la PIC (Paris-TBI)

**Hazard Ratio   Limites 95% HR**

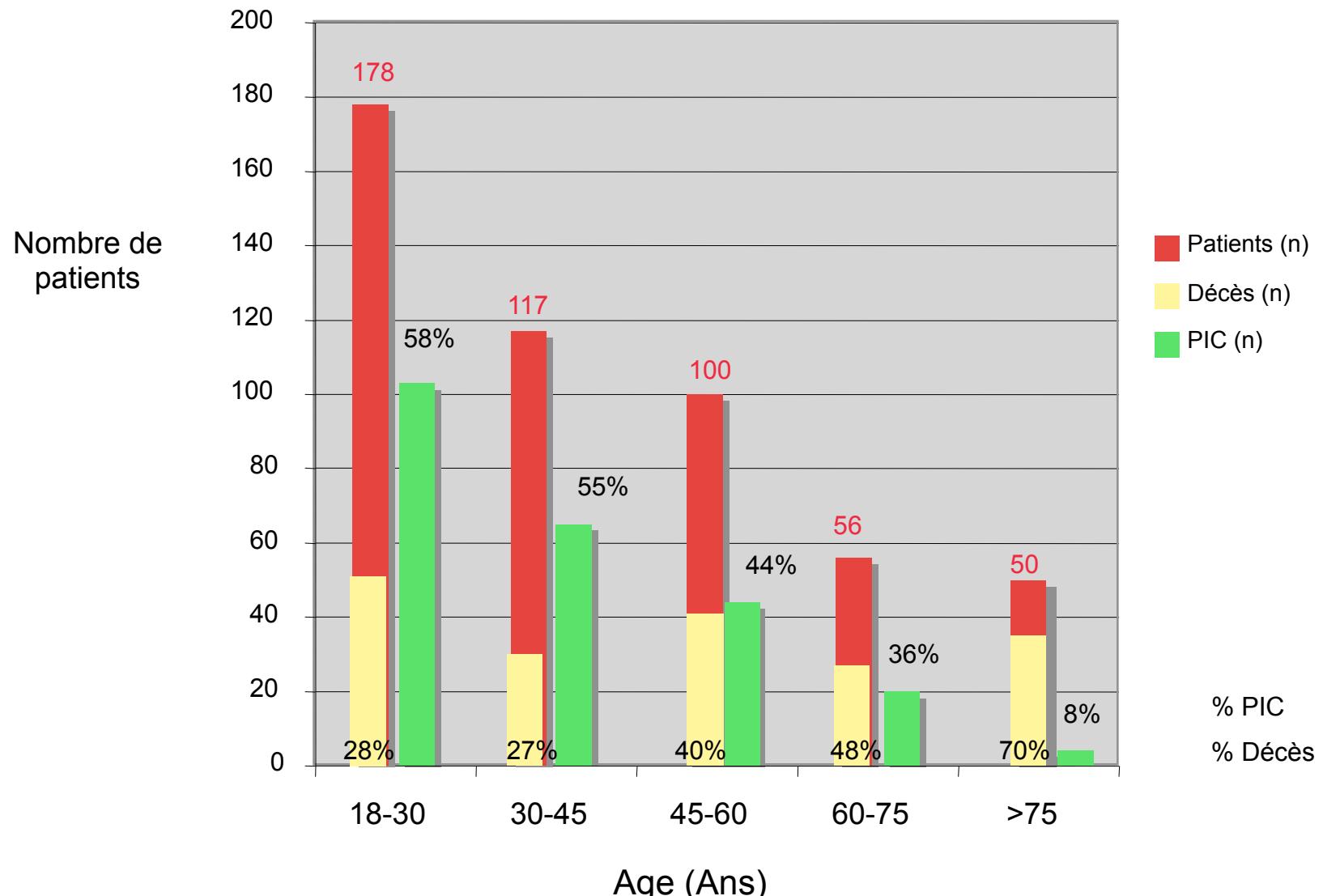
PIC		<b>0.462</b>	<b>0.292</b>	<b>0.731</b>
PAS < 90mmHg		<b>2.821</b>	<b>1.921</b>	<b>4.141</b>
Centres Spécialisés		<b>0.667</b>	<b>0.455</b>	<b>0.977</b>
SEXE (M)		0.928	0.643	1.338
Age (vs 18-30)	30-45	0.832	0.509	1.360
Age (vs 18-30)	45-60	1.079	0.675	1.723
Age (vs 18-30)	60-75	1.690	0.989	2.887
Age (vs 18-30)	75-99	<b>2.998</b>	<b>1.713</b>	<b>5.245</b>
IdF (Grde vs pte couronne)		0.689	0.487	0.976
Trauma associé		0.795	0.563	1.122
Choc Hémorragique		<b>1.878</b>	<b>1.122</b>	<b>3.144</b>
GCS (vs GCS=3)	GCS 4-5	0.757	0.491	1.167
GCS (vs GCS=3)	GCS 6-7	<b>0.462</b>	<b>0.282</b>	<b>0.756</b>
GCS (vs GCS=3)		<b>0.490</b>	<b>0.252</b>	<b>0.952</b>
Mydriase (uni or bi)		<b>2.855</b>	<b>1.907</b>	<b>4.274</b>

# Score de propension centré sur la PIC (Paris-TBI)

**Hazard Ratio   Limites 95% HR**

		<b>Hazard Ratio</b>	<b>Limites 95% HR</b>
PIC		<b>0.462</b>	<b>0.292</b> <b>0.731</b>
PAS < 90mmHg		<b>2.821</b>	<b>1.921</b> <b>4.141</b>
Centres Spécialisés		<b>0.667</b>	<b>0.455</b> <b>0.977</b>
SEXE (M)		0.928	0.643   1.338
Age (vs 18-30)	30-45	0.832	0.509   1.360
Age (vs 18-30)	45-60	1.079	0.675   1.723
Age (vs 18-30)	60-75	1.690	0.989   2.887
Age (vs 18-30)	75-99	<b>2.998</b>	<b>1.713</b> <b>5.245</b>
IdF (Grde vs pte couronne)		0.689	0.487   0.976
Trauma associé		0.795	0.563   1.122
Choc Hémorragique		<b>1.878</b>	<b>1.122</b> <b>3.144</b>
GCS (vs GCS=3)	GCS 4-5	0.757	0.491   1.167
GCS (vs GCS=3)	GCS 6-7	<b>0.462</b>	<b>0.282</b> <b>0.756</b>
GCS (vs GCS=3)		<b>0.490</b>	<b>0.252</b> <b>0.952</b>
Mydriase (uni or bi)		<b>2.855</b>	<b>1.907</b> <b>4.274</b>

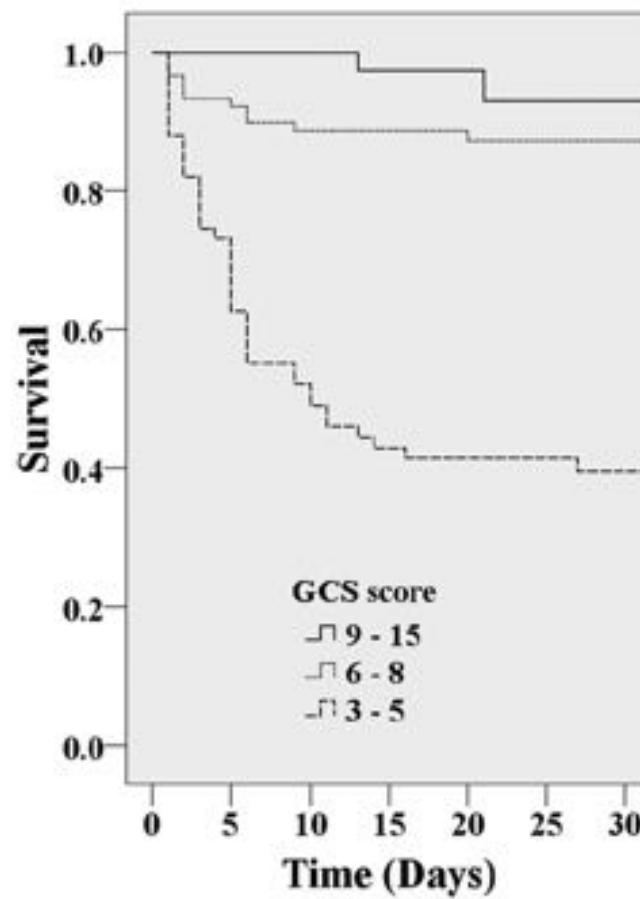
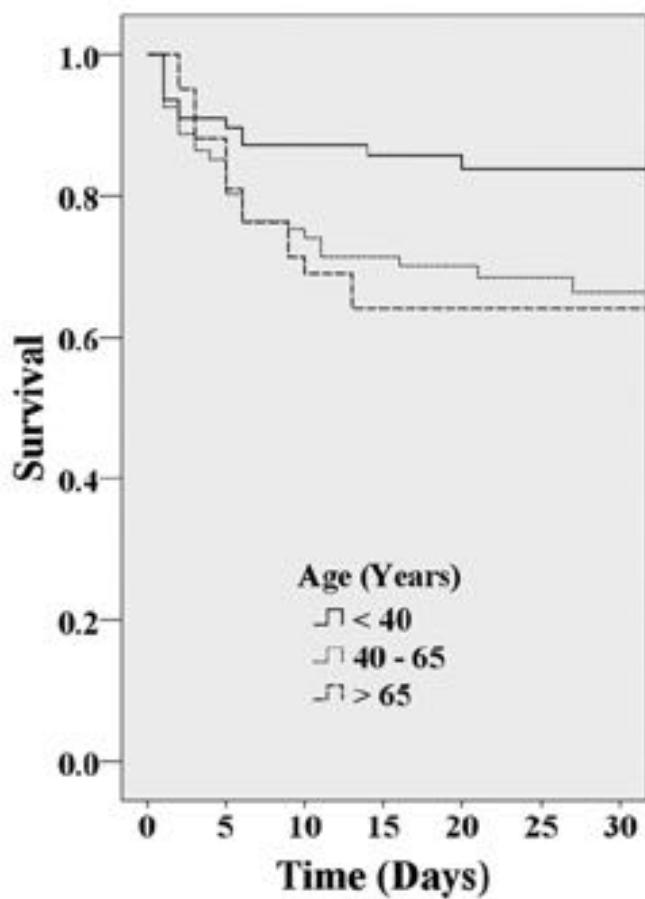
# PIC & Age



# Mortalité après TC

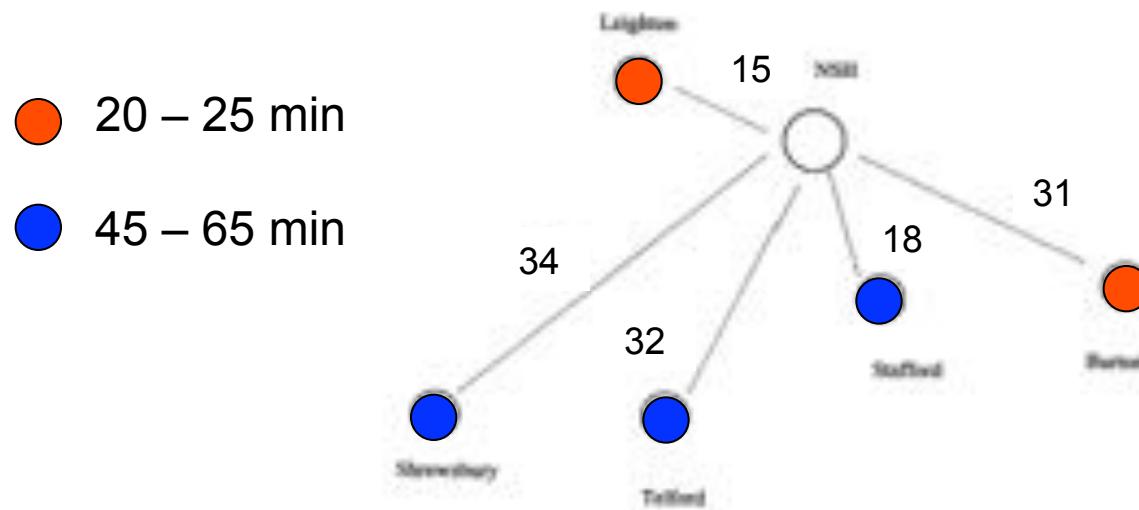
Mortalité à 30 jours = 26.4 %

n = 201



brain swelling  
and brain  
infarction  
79.2 % mortality

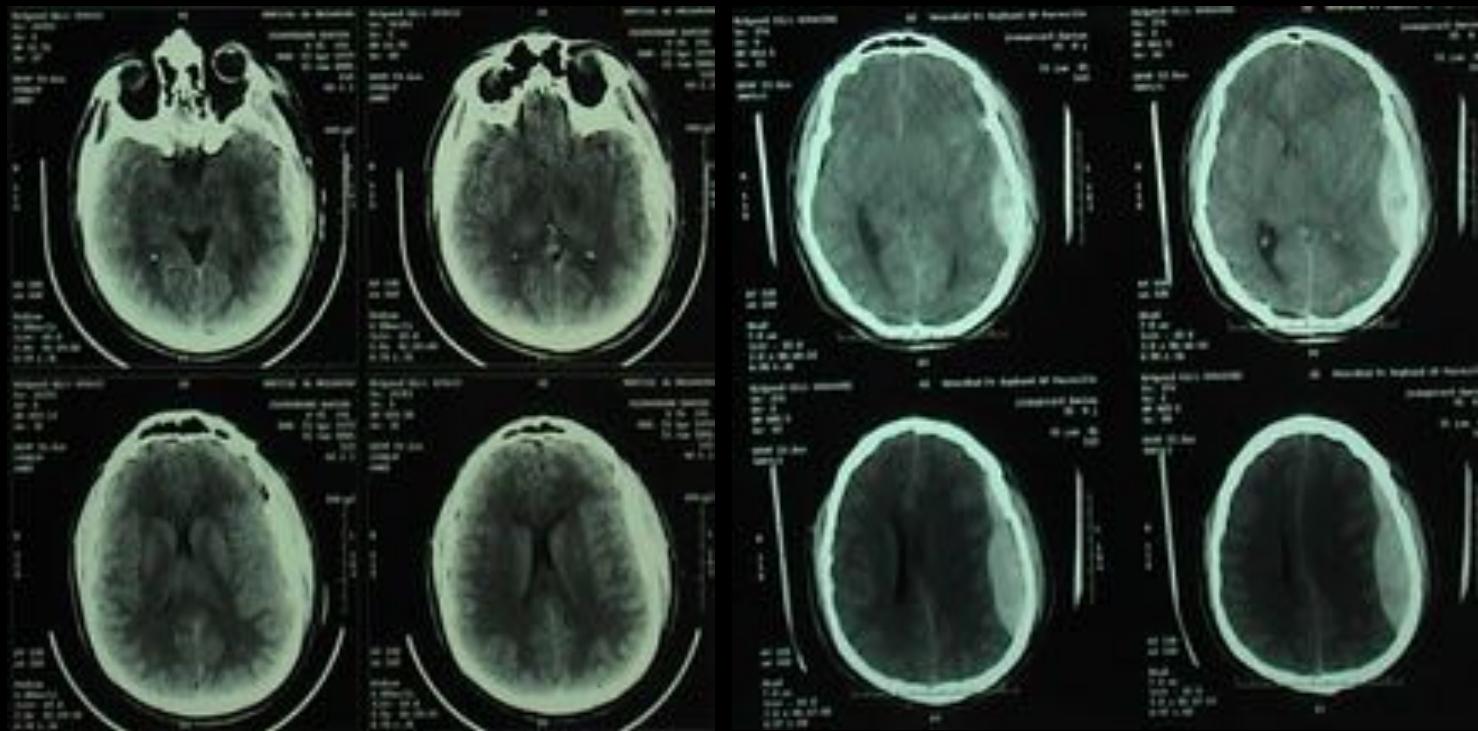
# Stratégie du transfert initial



**En moyenne**, transférer tous les patients TC avec un AIS > 2 directement dans  
Un centre neurochirurgical était la meilleure stratégie

**Mais :**  
Théorique  
Pas de SAMU

# Hématome extra-dural : Intervalle libre

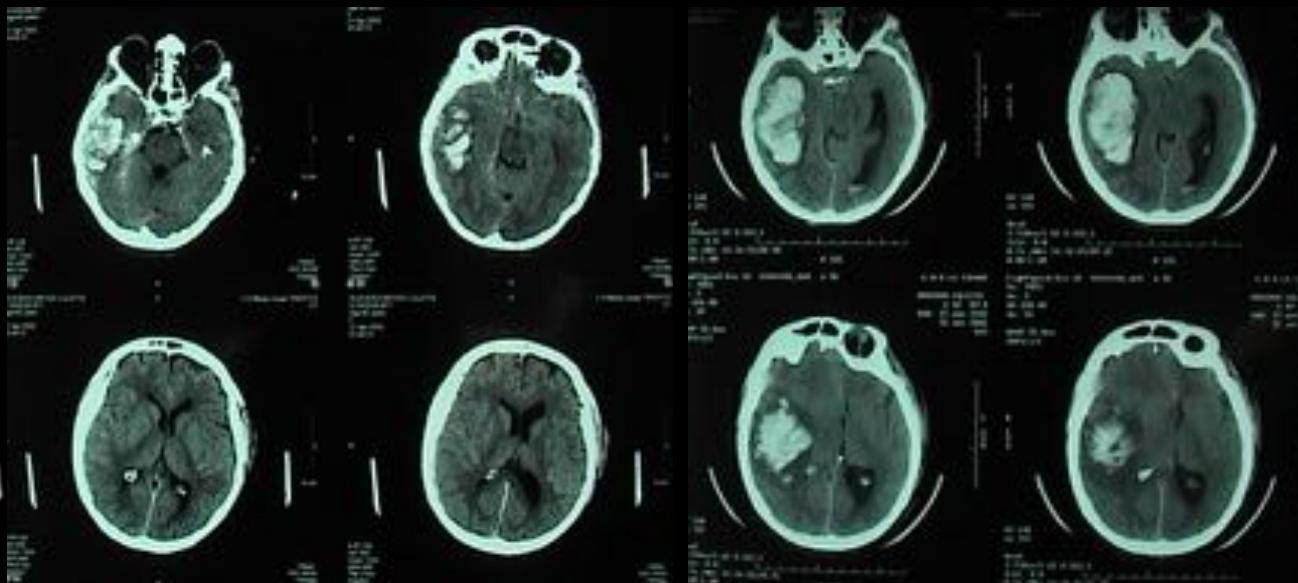


HED + 1h

HED + 6h

# Contusion cérébrale

GCS = 15  
puis 10



GCS = 6  
pupille dte  
4 mm  
pupille Gche  
2 mm

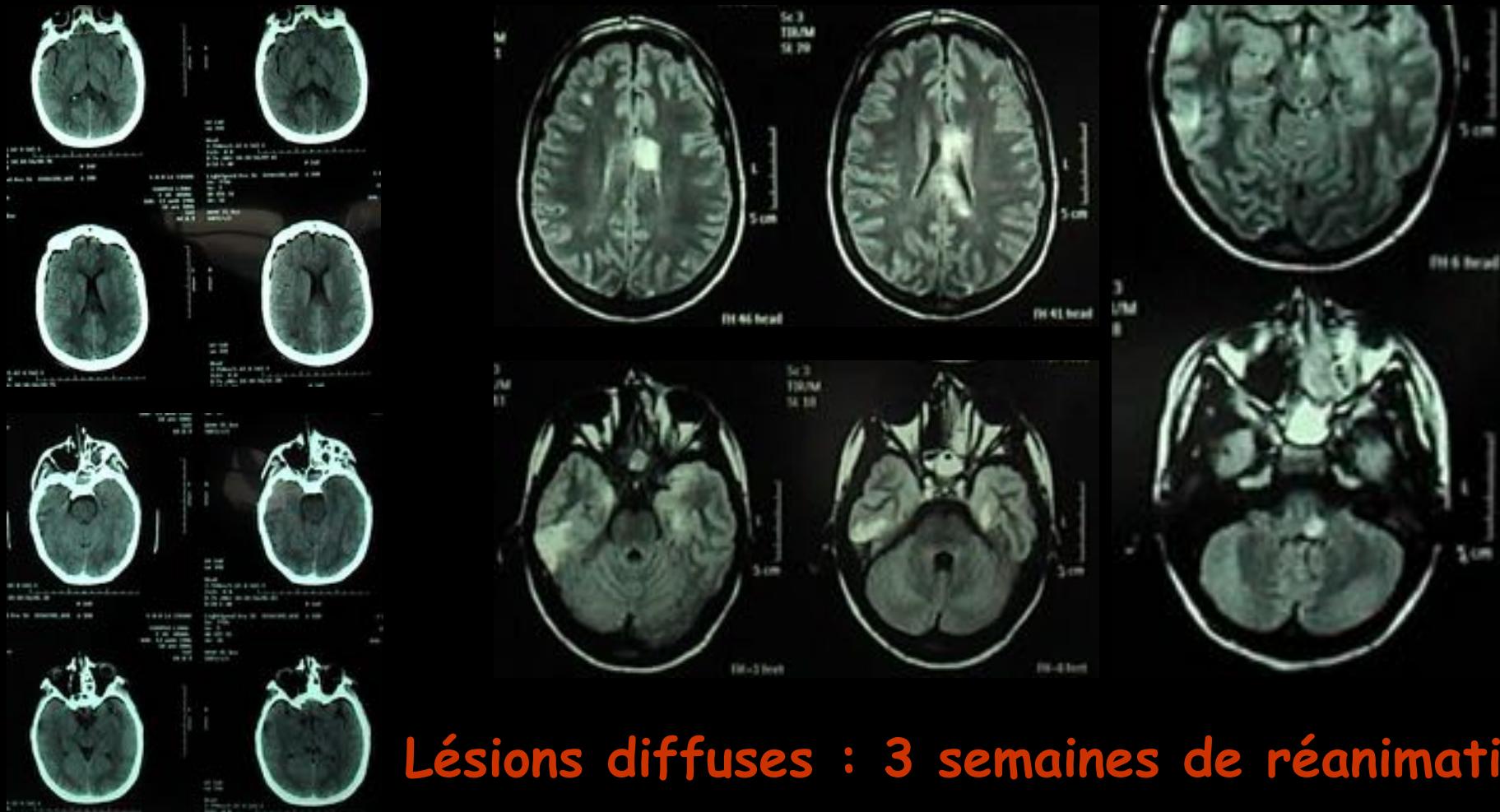
TC +6h

TC +13h

GCS = 10  
Régression mydriase

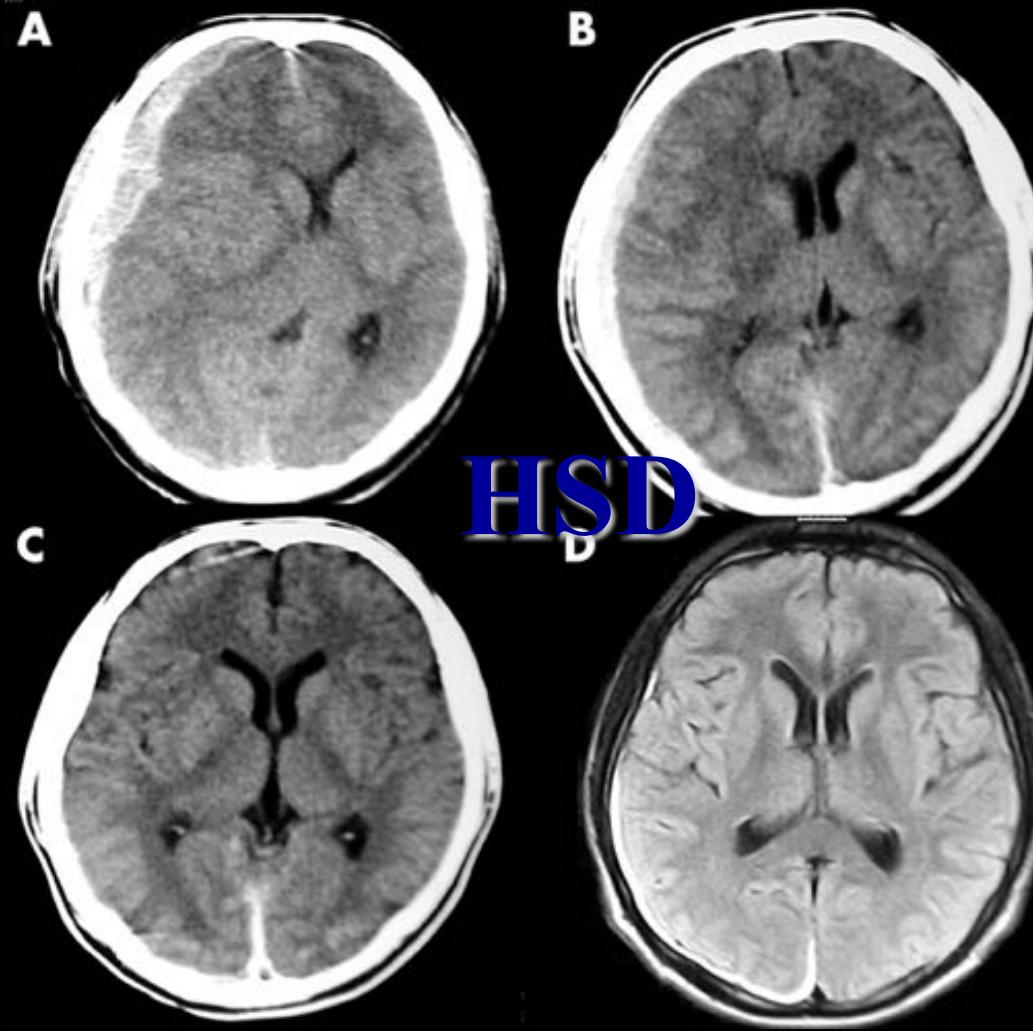
Post op (TC+30h)

# Le scanner: un bon examen pour évaluer la gravité ?

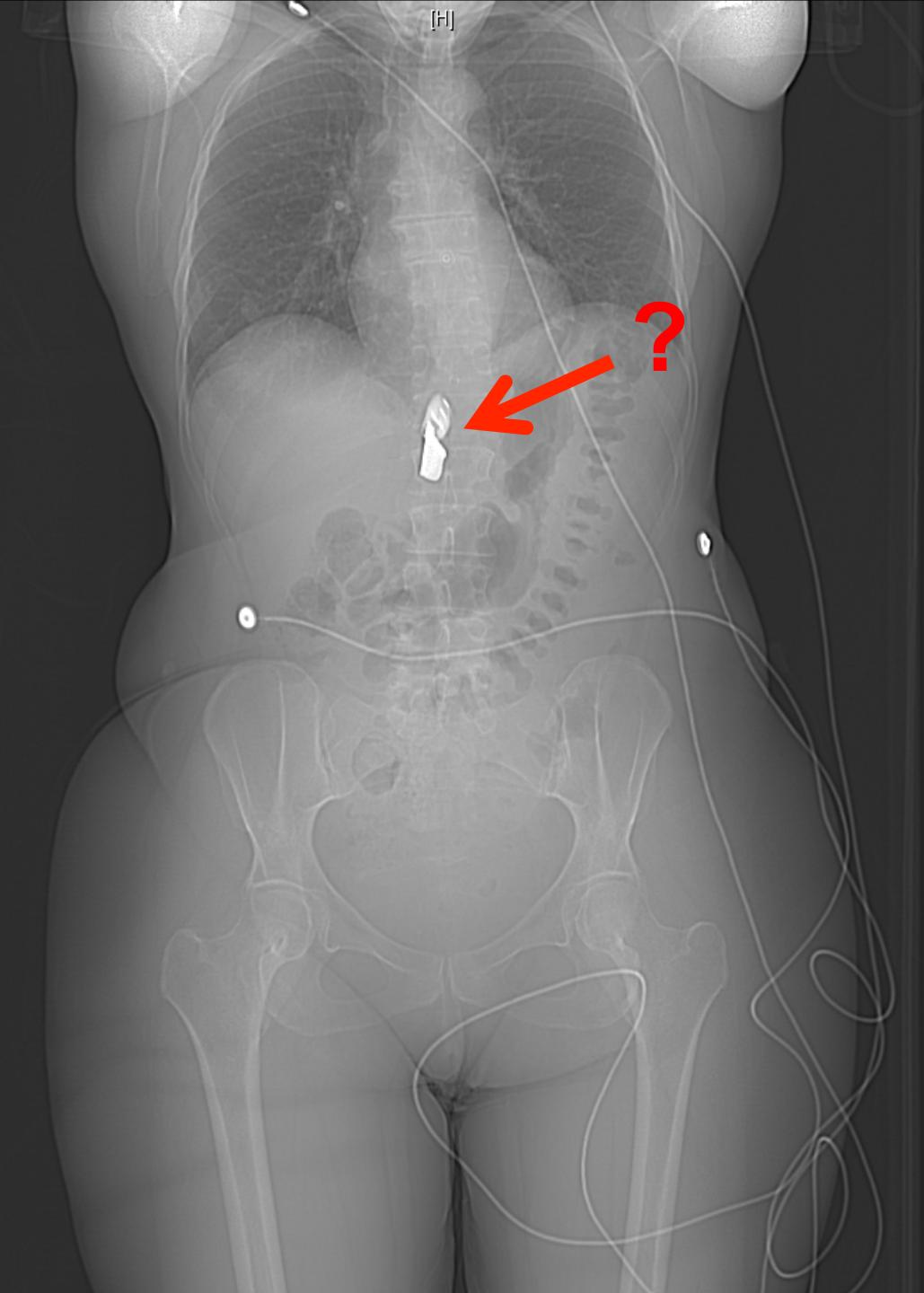


Lésions diffuses : 3 semaines de réanimation

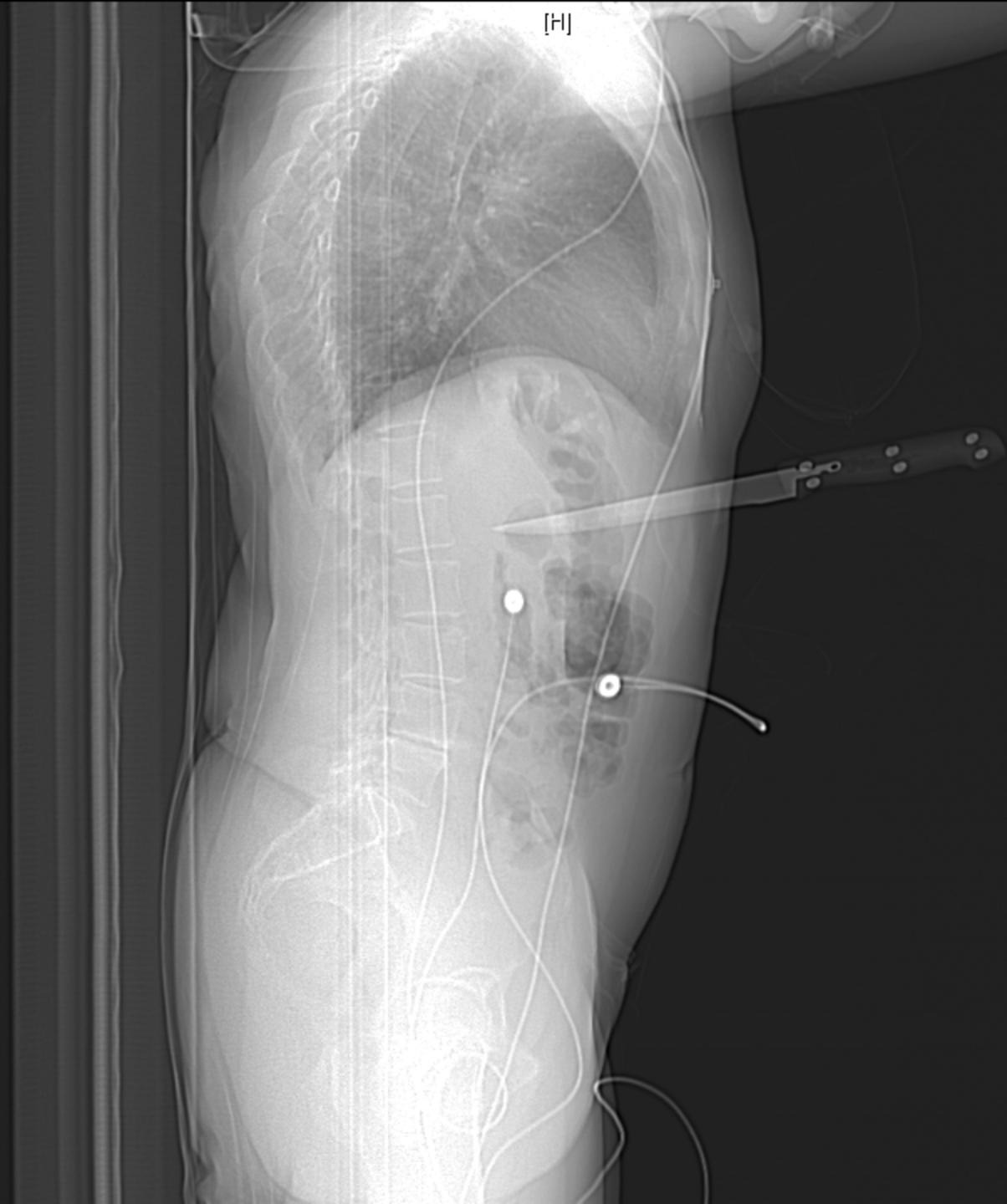
**Figure 1 (A) Initial CT scan shows subdural haematoma in the right frontoparietal region and a marked midline shift; (B) Post-traumatic second hour CT shows substantial decrease in oedema and size of subdural haematoma; (C) Post-traumatic eighth hour CT shows total resolution of the subdural haematoma and the appearance of subarachnoidal haemorrhage; (D) Fifth day MRI shows mild subarachnoidal haemorrhage.**



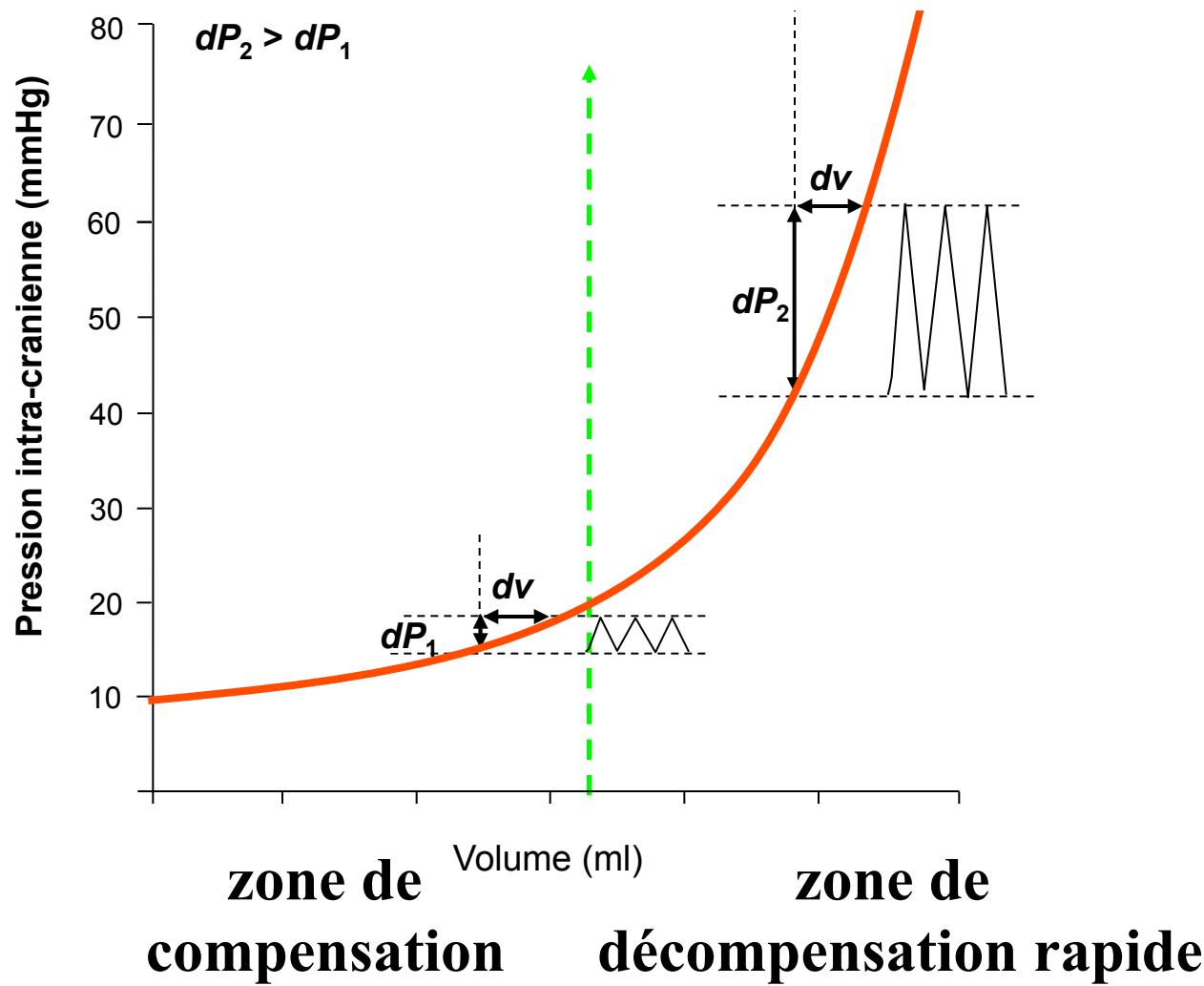
[H]



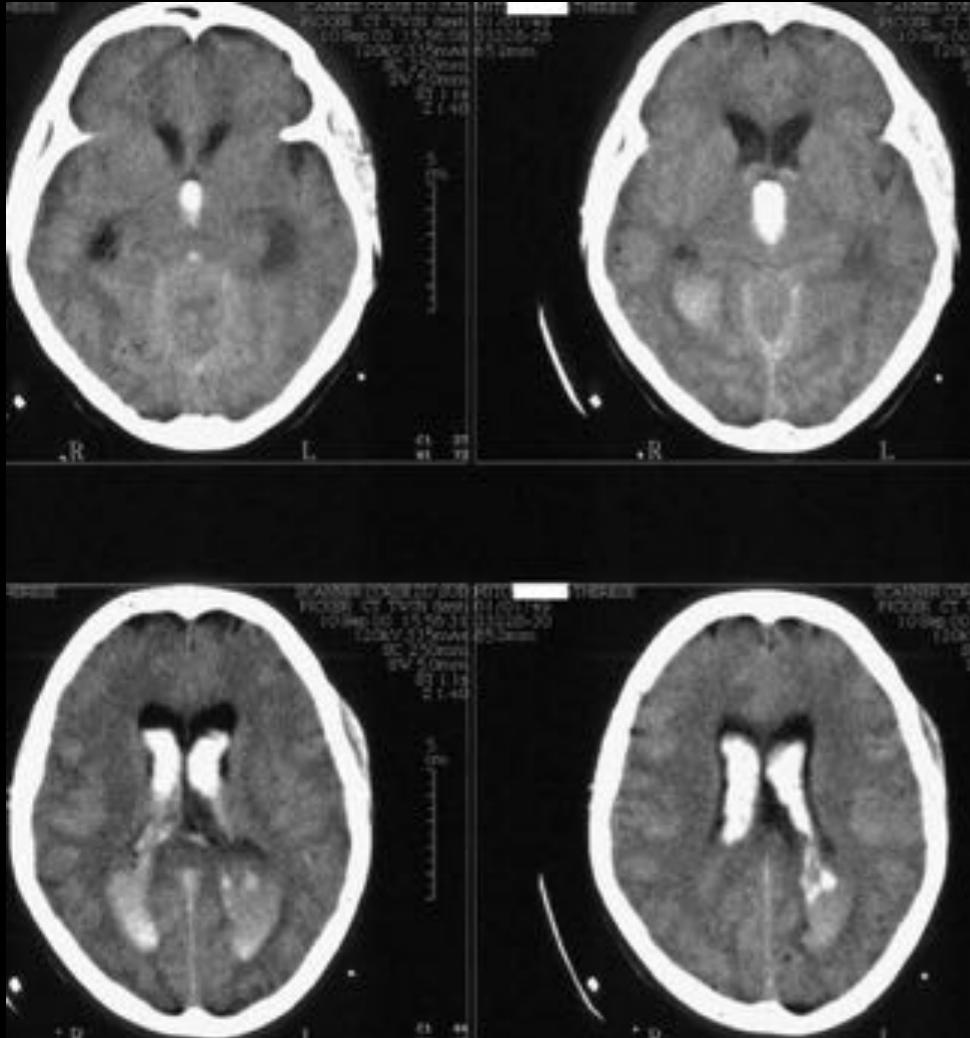
[H]



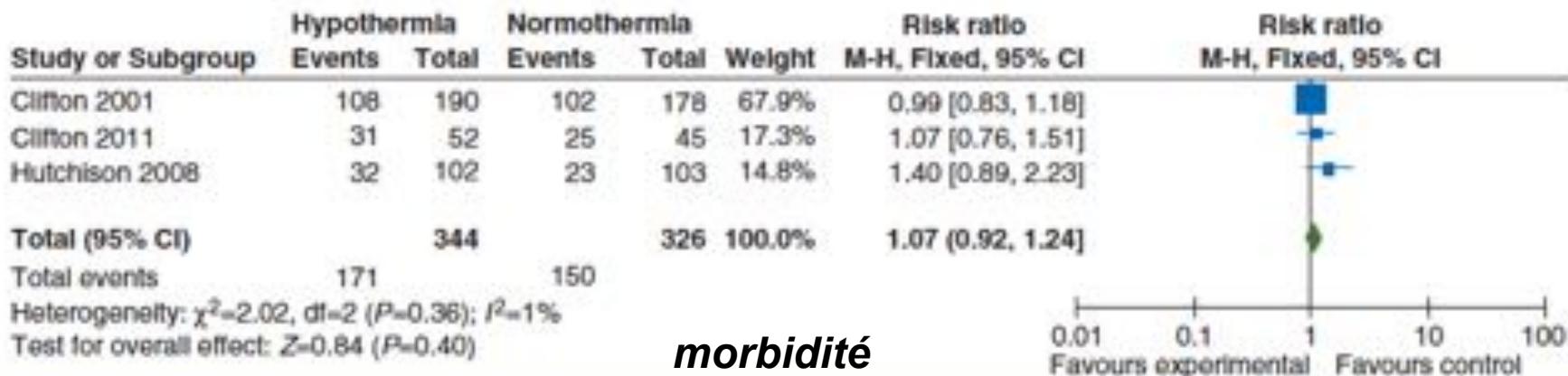
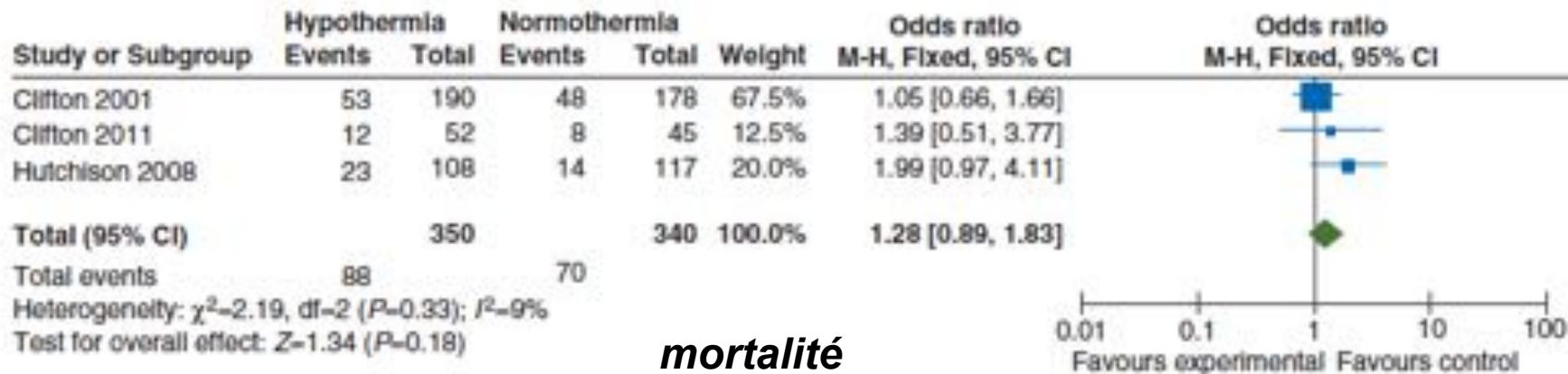
# Courbe de Langfitt



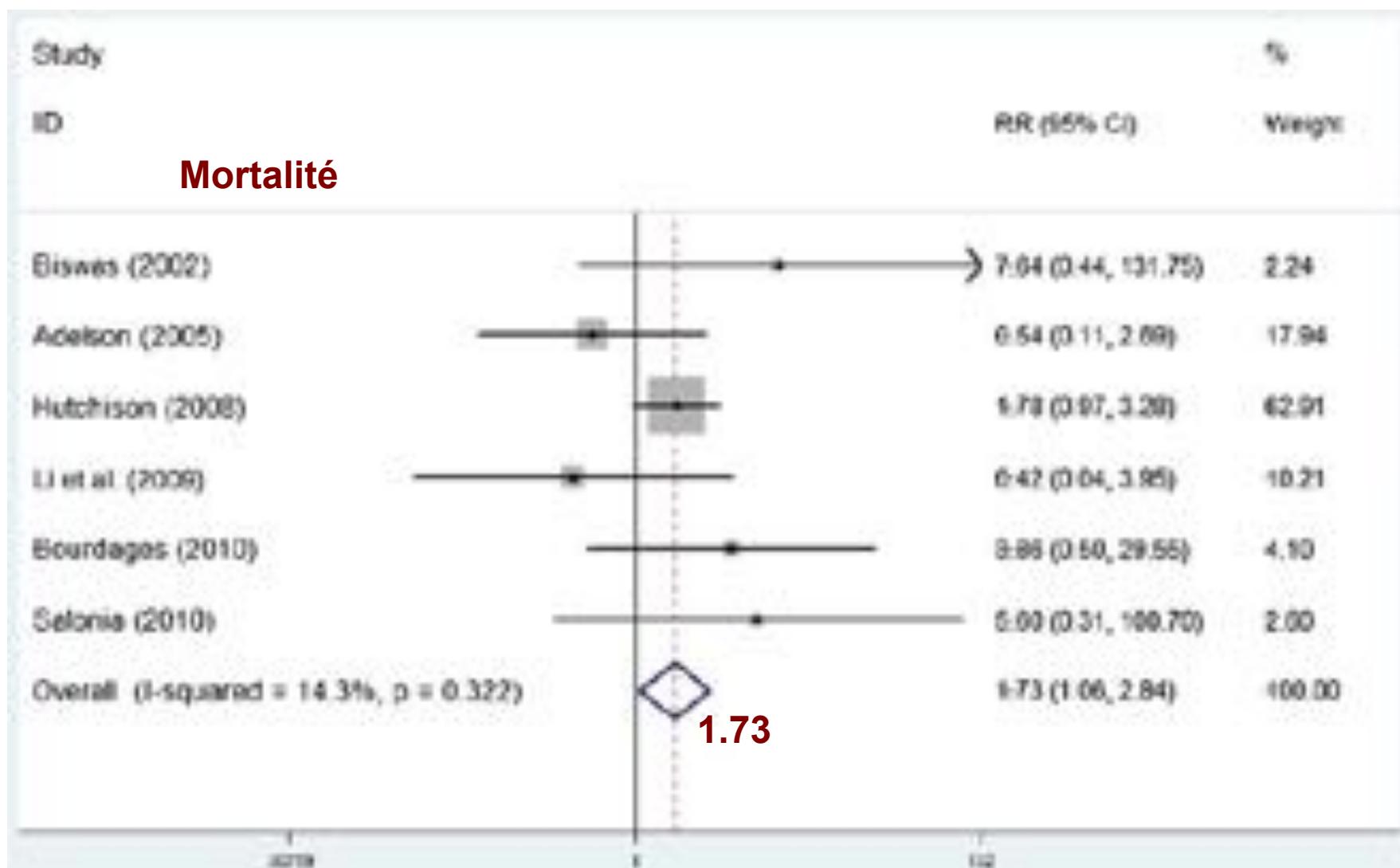
# Urgence thérapeutique : hydrocéphalie aiguë



# Effets de l'hypothermie préventive après TC grave



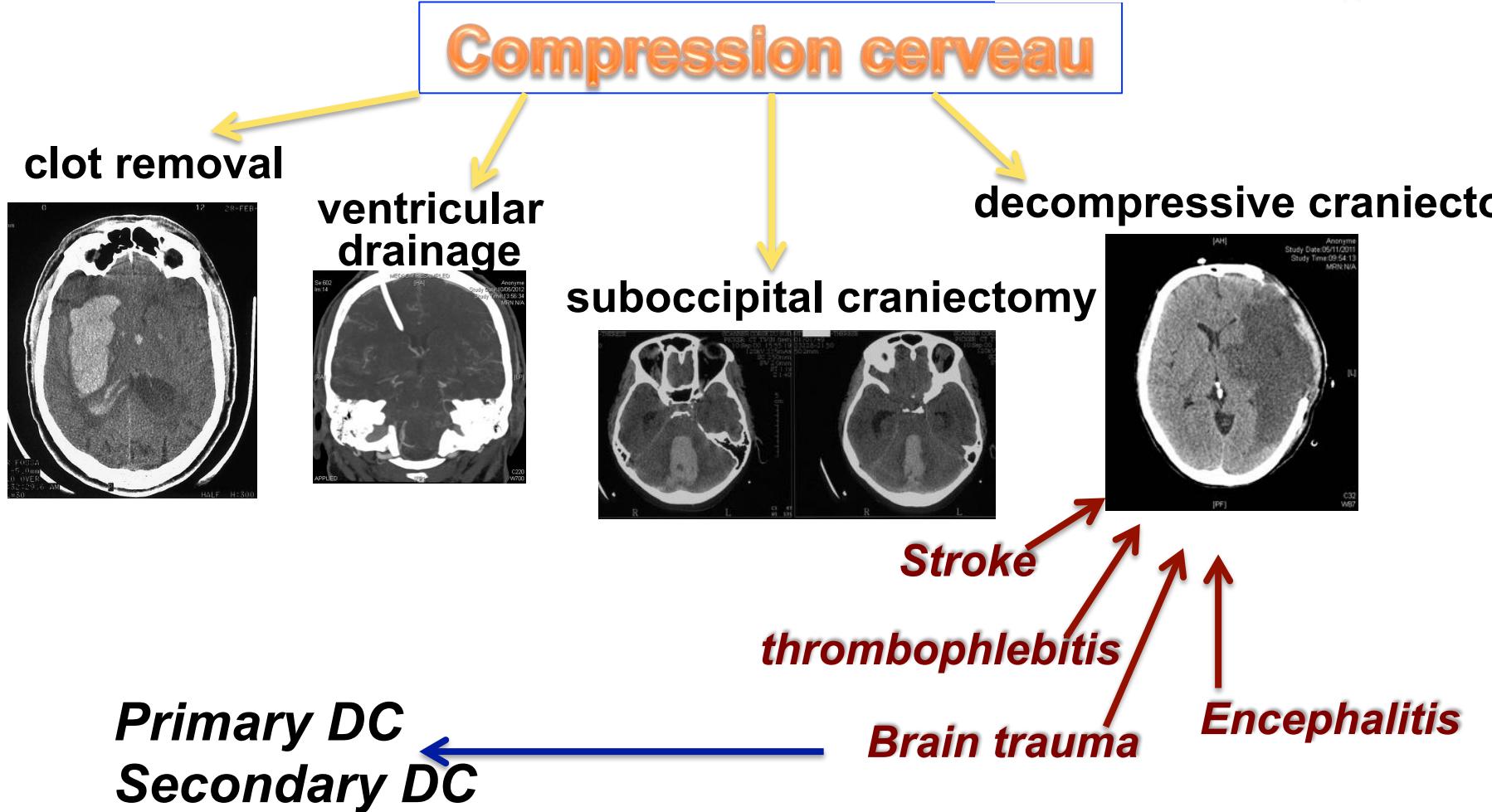
# Hypothermie et TC chez l'enfant



# Décompression chirurgicale

*"If there's no CSF pressure, but brain pressure exists, then pressure relief must be achieved by opening the skull"*

Theodor Emil Kocher, 1901

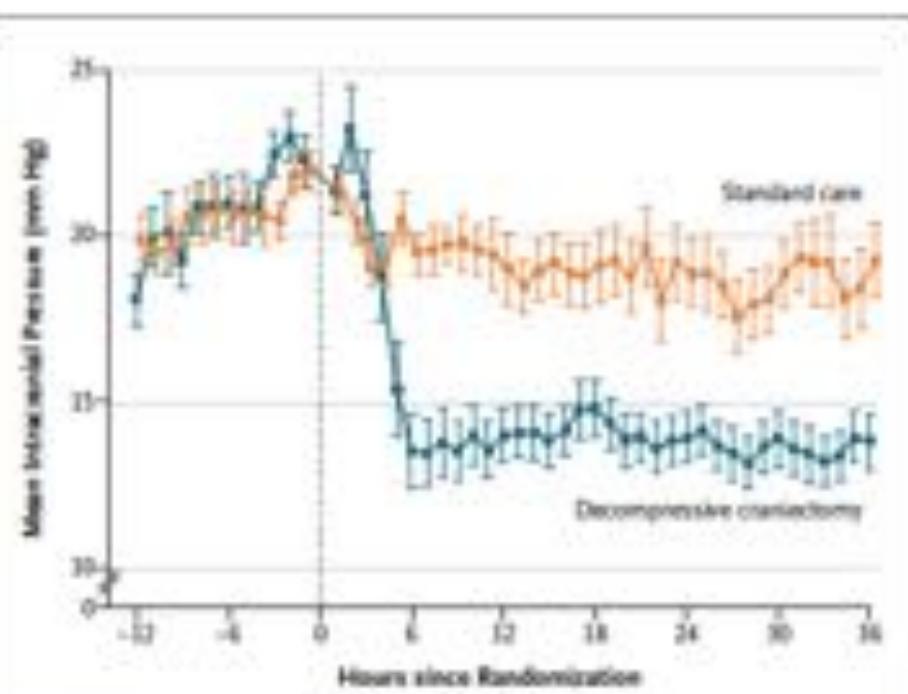


# Decompressive Craniectomy in Diffuse Traumatic Brain Injury

D. James Cooper, M.D., Jeffrey V. Rosenfeld, M.D., Lynnette Murray, B.App.Sci., Yaseen M. Arabi, M.D., Andrew R. Davies, M.B., B.S., Paul D'Urso, Ph.D., Thomas Kossman, M.D., Jennie Ponsford, Ph.D., Ian Seppelt, M.B., B.S., Peter Reilly, M.D., and Rory Wolfe, Ph.D., for the DECRA Trial Investigators and the Australian and New Zealand Intensive Care Society Clinical Trials Group\*

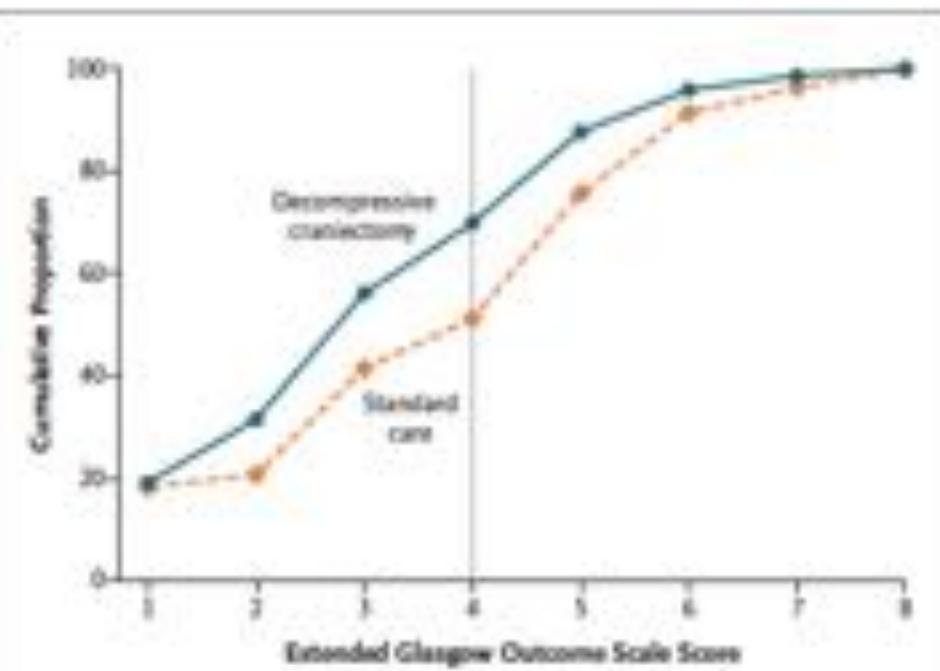
*n = 155*

- **Diffuse head injury (no mass lesion)**
- **ICP > 20 mm Hg > 15 min**
- **Bifrontal craniectomy**

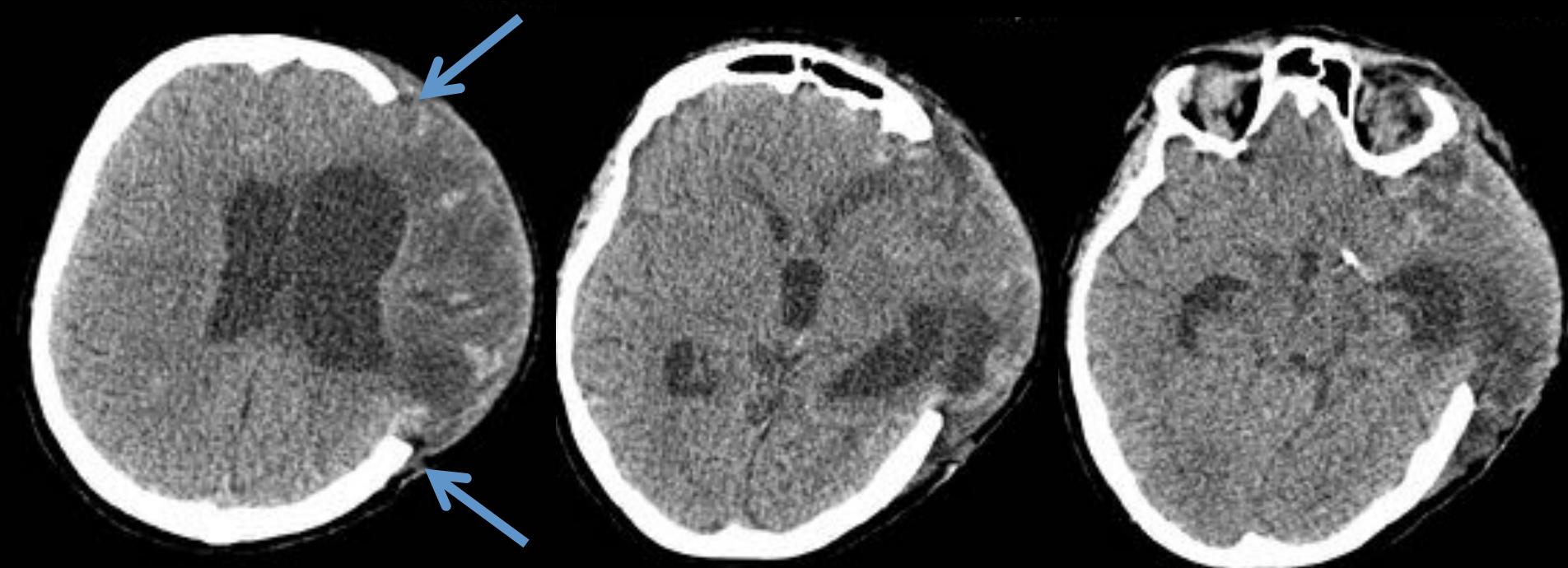


**Figure 1.** Intracranial Pressure before and after Randomization.

Show are the mean measurements of intracranial pressure in the two study groups during the 12 hours before and the 36 hours after randomization. The I bars indicate standard errors.



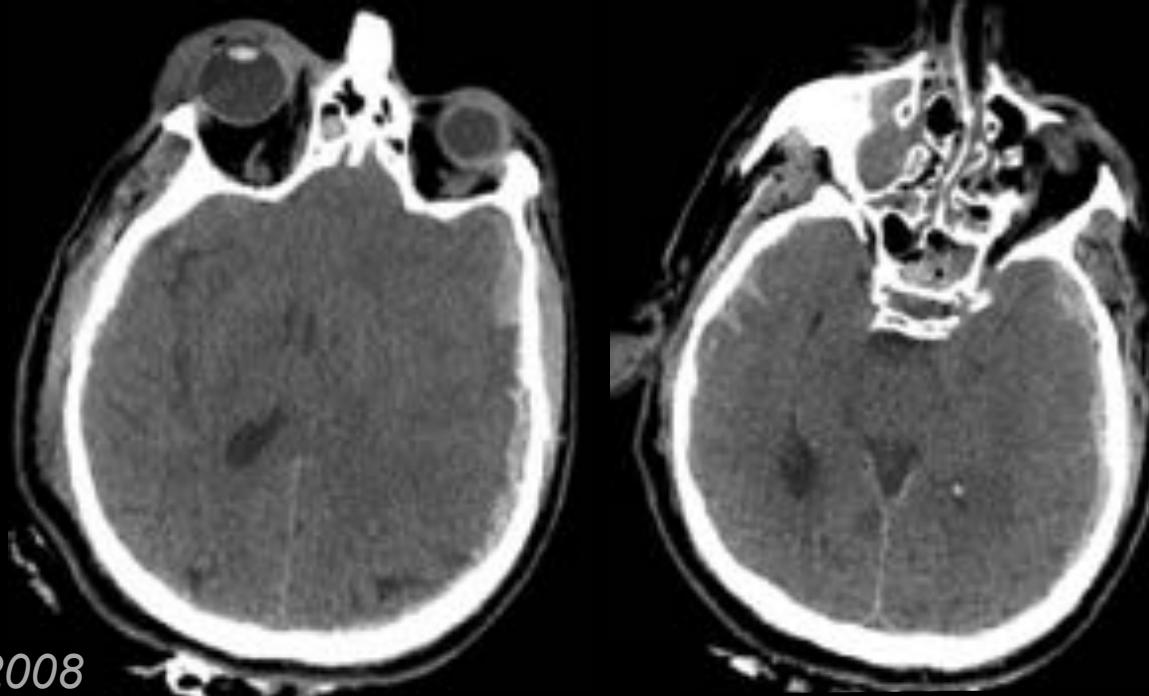
# Hernie cérébrale



# Early complications

**new or expanded hemorrhagic contusion**

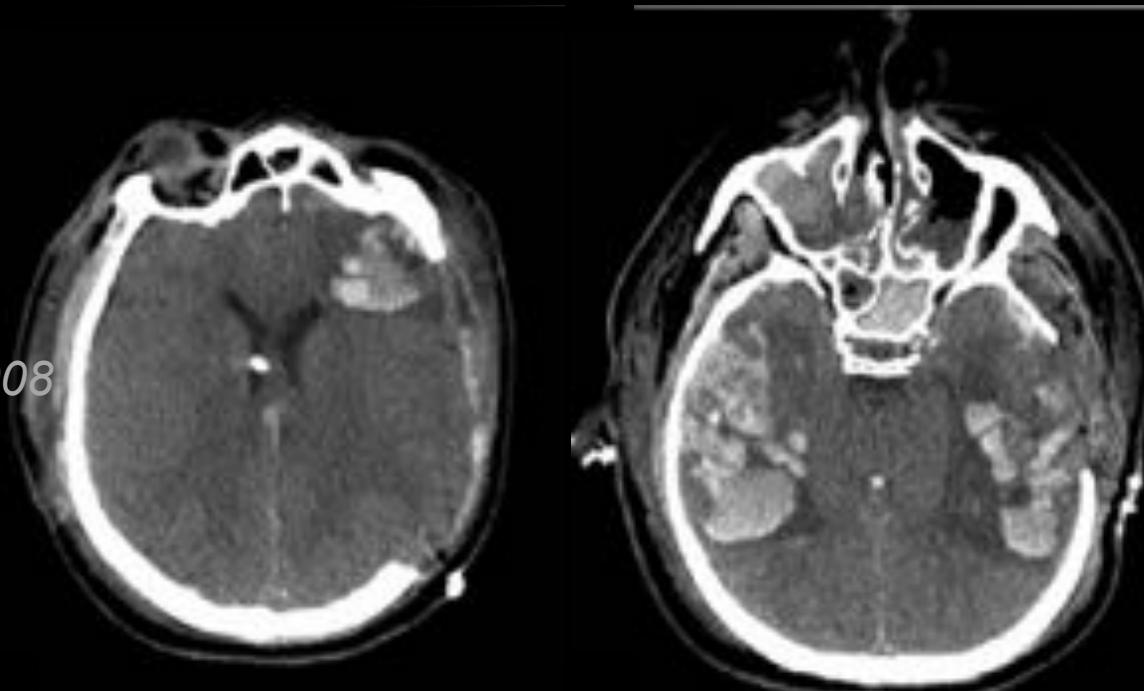
**58 % (n = 40)**  
*AC Flint et al. J Neurotrauma 2008*



**new contralateral hemorrhage**

**7% (n = 108)**

*XF Yang et al. Acta Neurochir 2008*

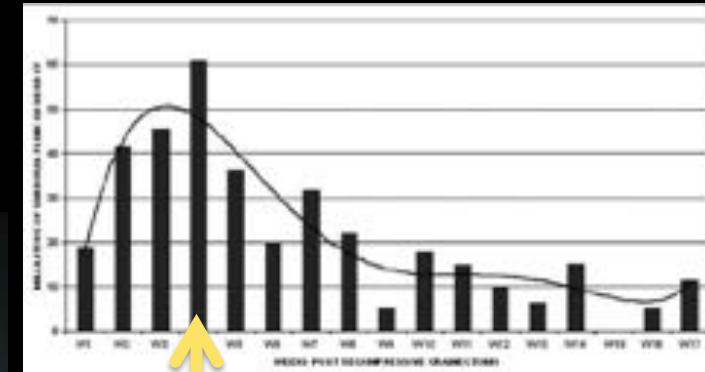
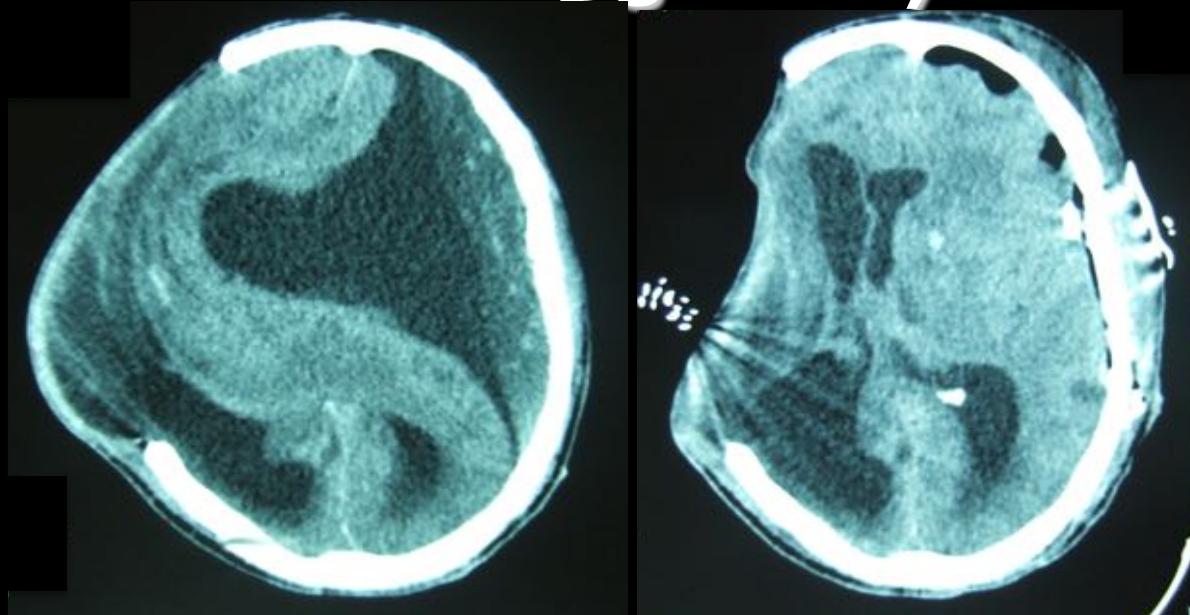


**Infection**

**1 – 6 %**

*SI Stiver Neurosurg Focus 2009*

# Extra-axial collection (Subdural hygroma)



week 4

B Aarabi Neurosurg Focus 2008

Sinking skin flap

25 %

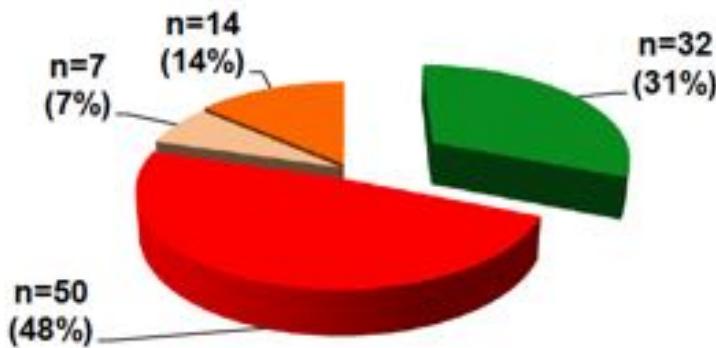
M Sarov et al. Stroke 2010



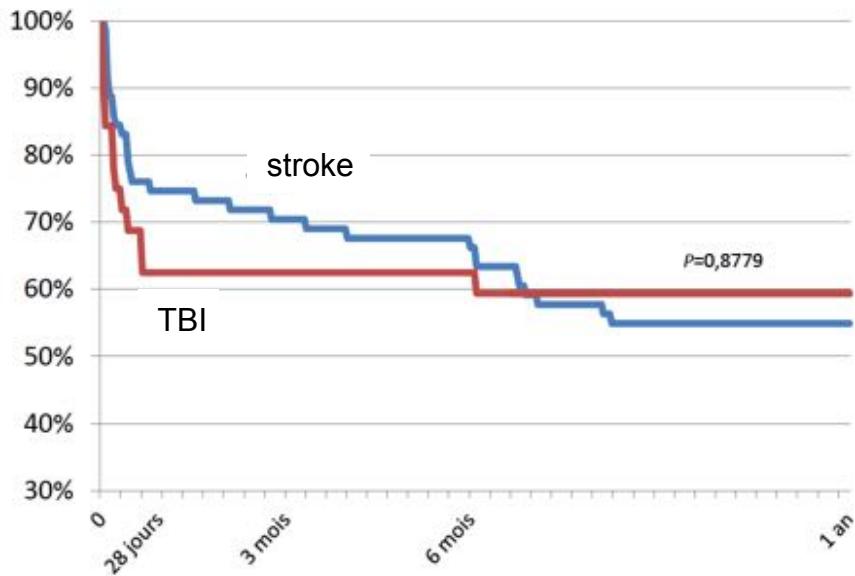
# Long term outcome

n = 103

■ TBI ■ iStroke ■ ICH ■ SAH

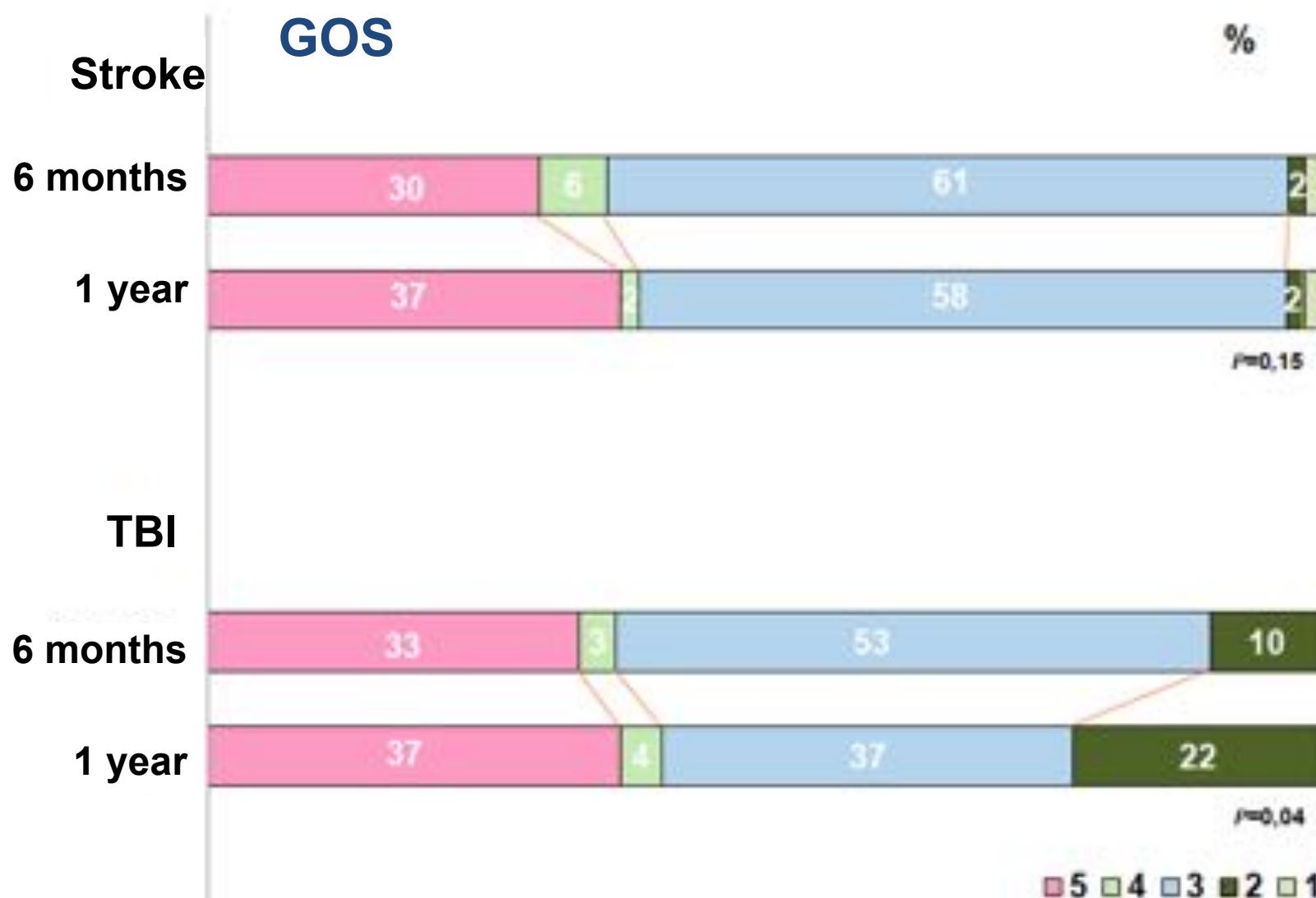


	TBI	Stroke
Age	35±13	51±11*
GCS	5 [3-6]	9 [7-13]
Mydriasis %	34	17
Delay	24 h [24-48]	48 h [36-96]

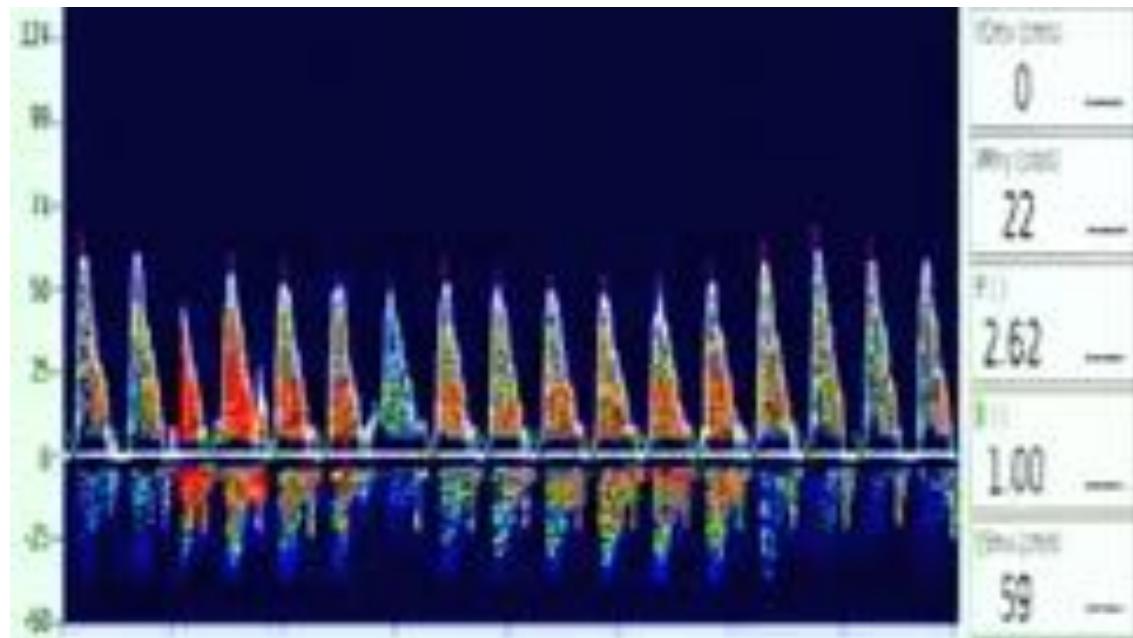
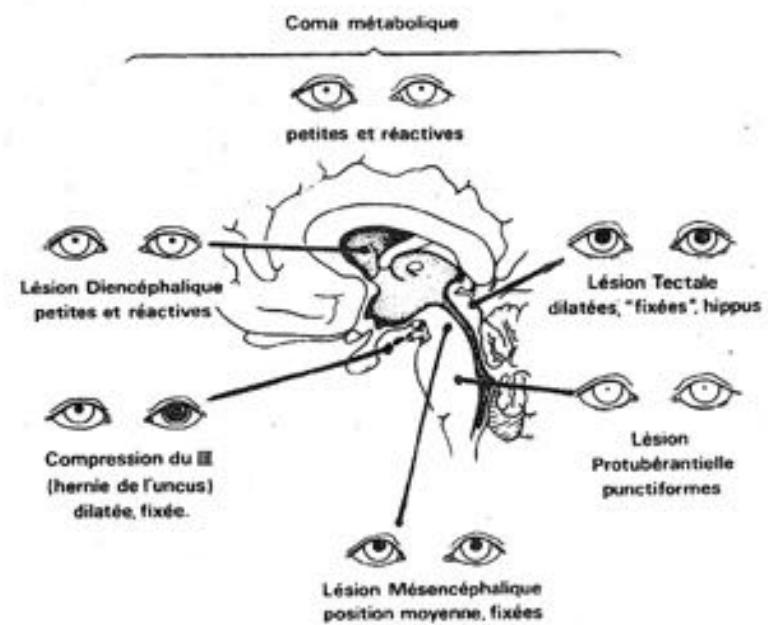


One year mortality  
TBI = 40 %  
Stroke = 45 %

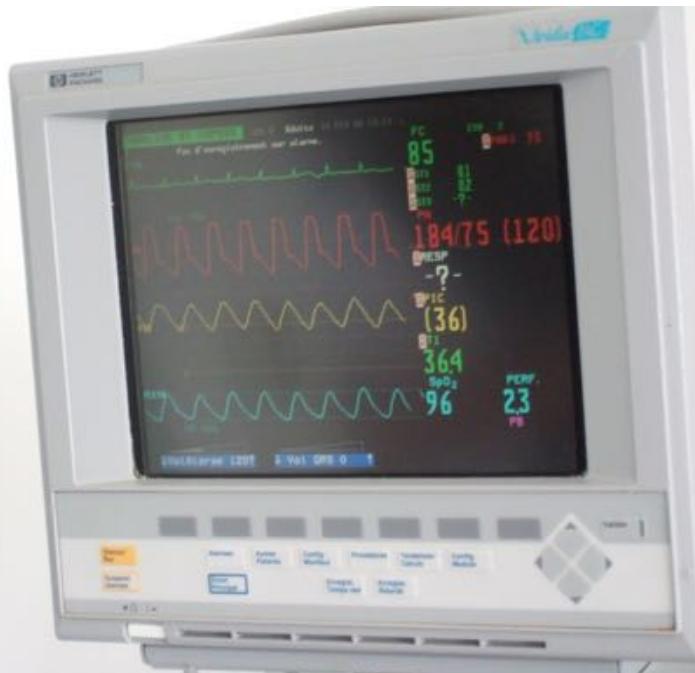
# Functional outcome



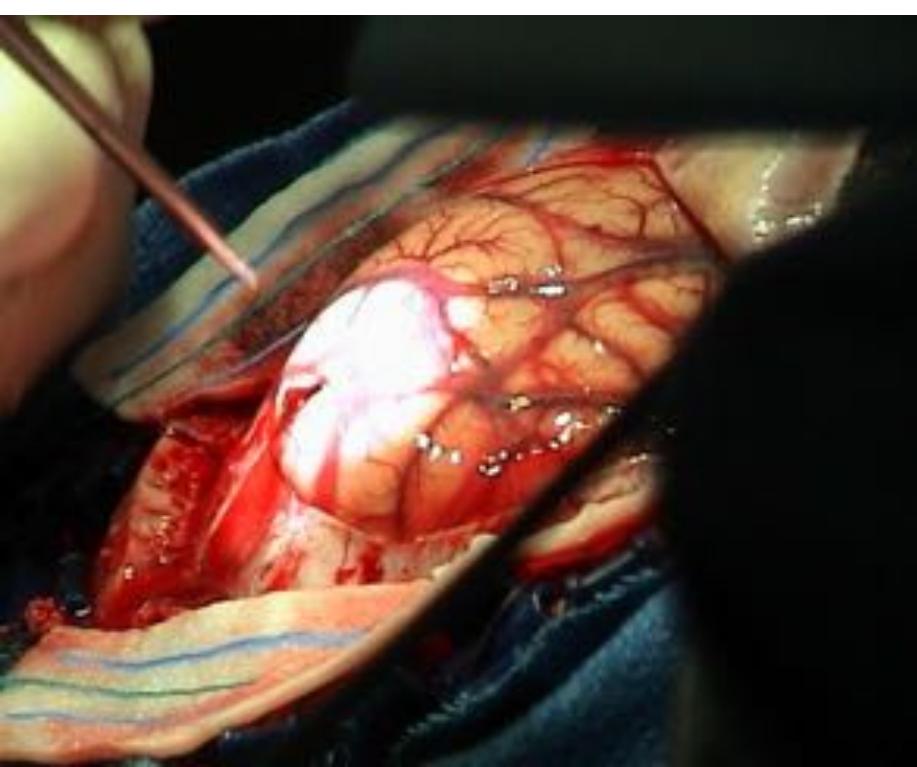
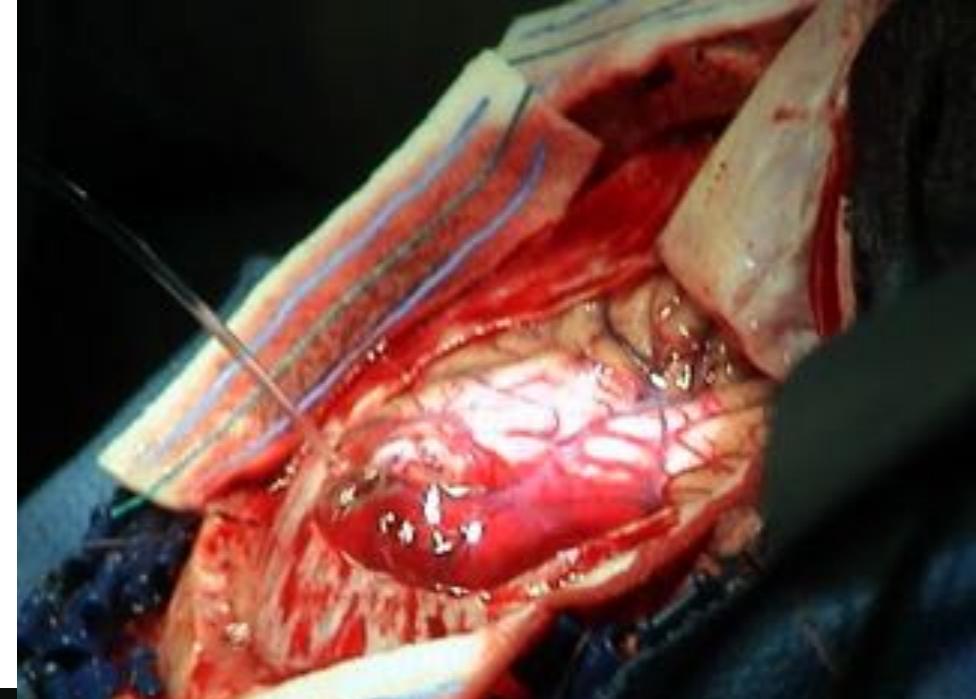
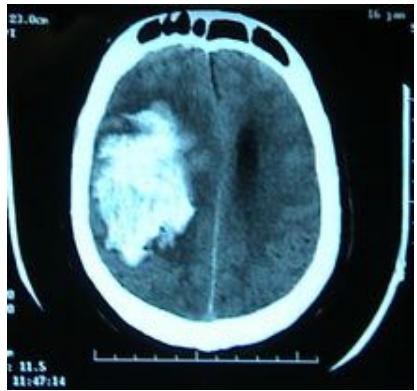
# Evaluation de l'HIC



# PIC vs Etat clinique



# HIC et chirurgie



PHILIPS NASLI

IM 1,3 18/05/2004

04-05-18-175157

CHU TIMONE - REA POLY

ITc 1,5

17:54:31

DTC OPTIM/

S3-1

68Hz

16cm

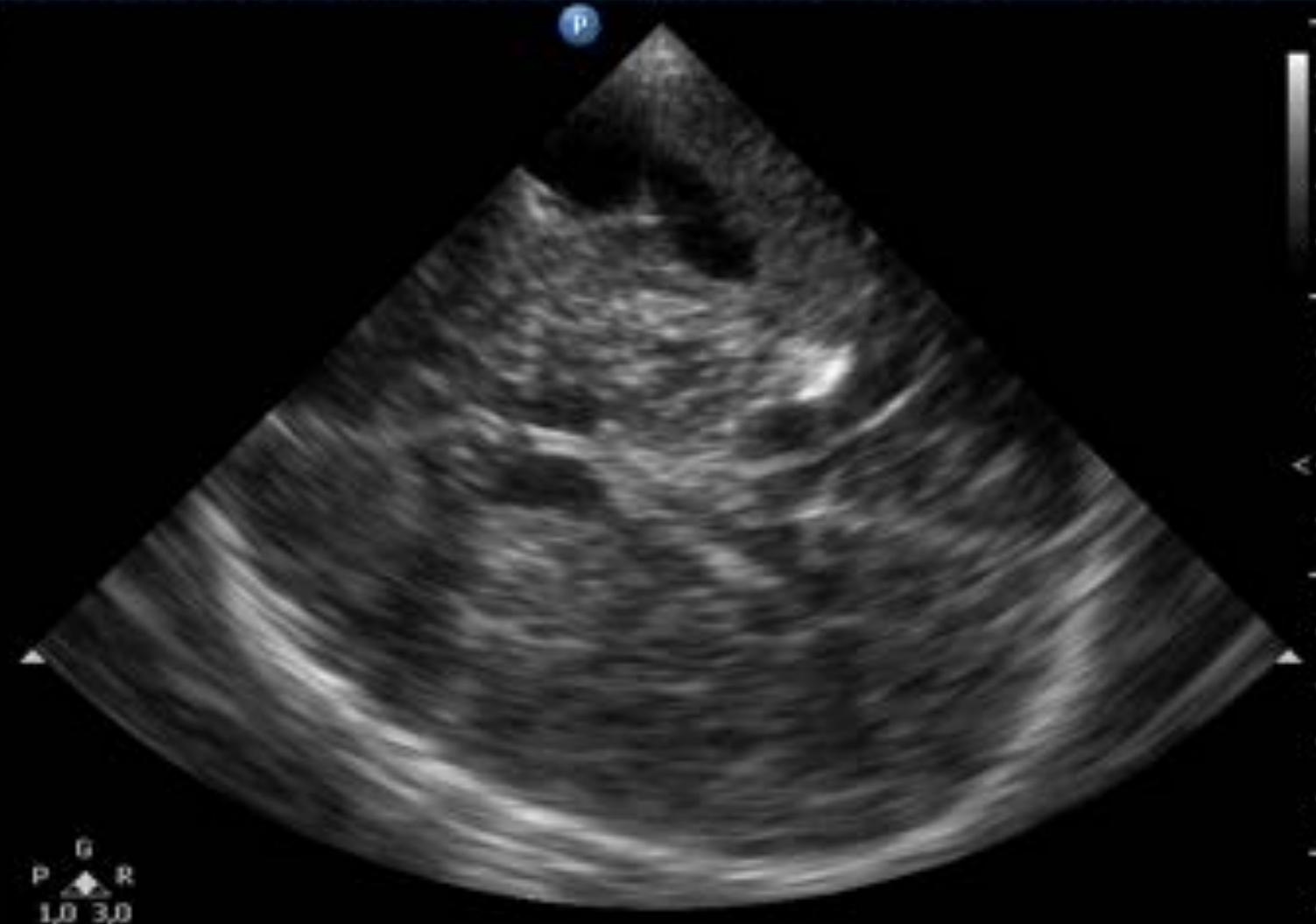
2D

F 3

Gn 79

232dB/C6

K / 4 / 2



PHILIPS NASLI

IM 1,4

18/05/2004

04-05-18-175157

CHU TIMONE - REA POLY

ITc 2,9

17:58:42

DTC OPTIM/

S3-1

7Hz

16cm

2D

F 3

Gn 79

232dB/C6

K / 4 / 2

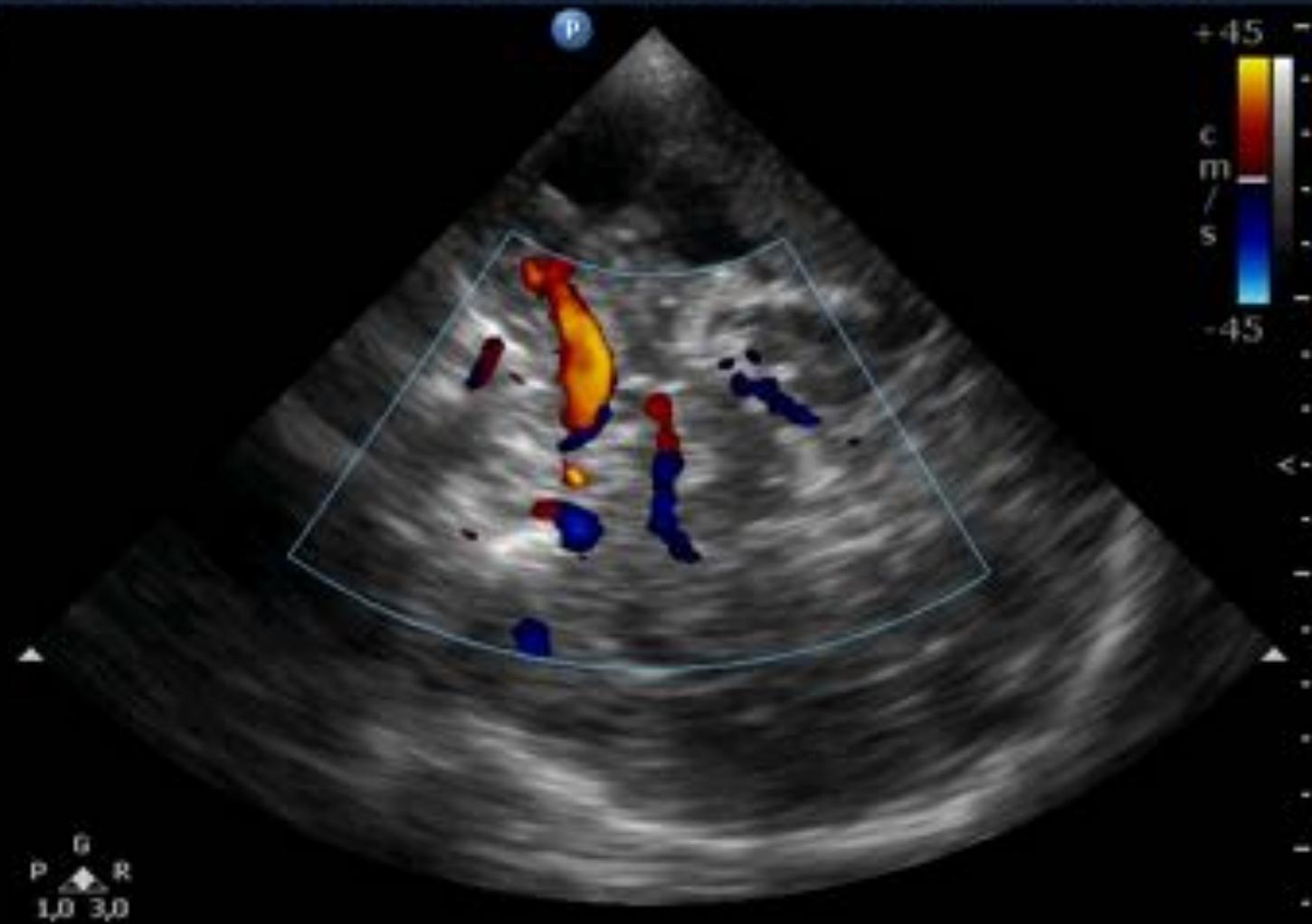
Couleur

1,9 MHz

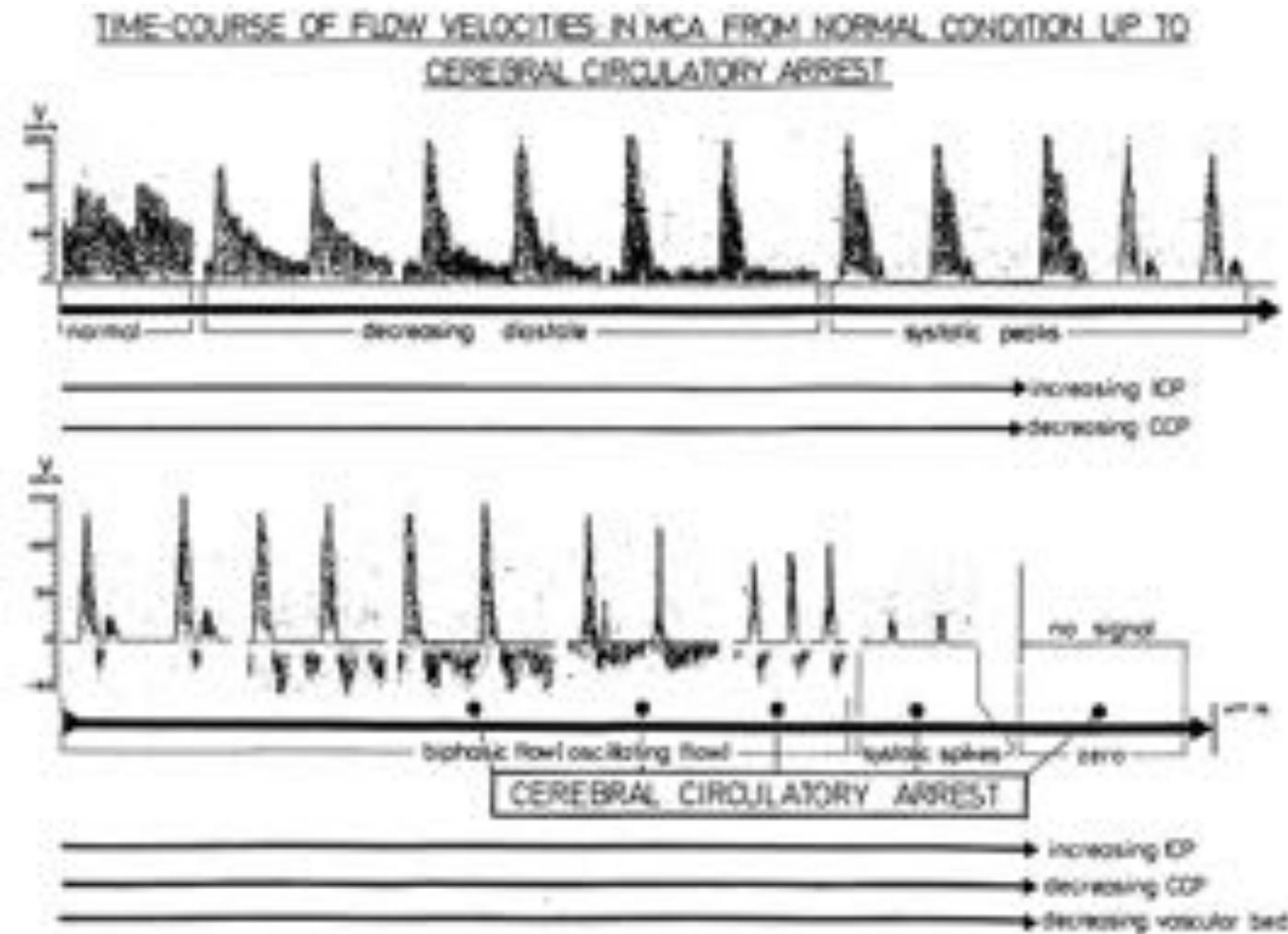
Gn 80

H/3/4

Filtre 4

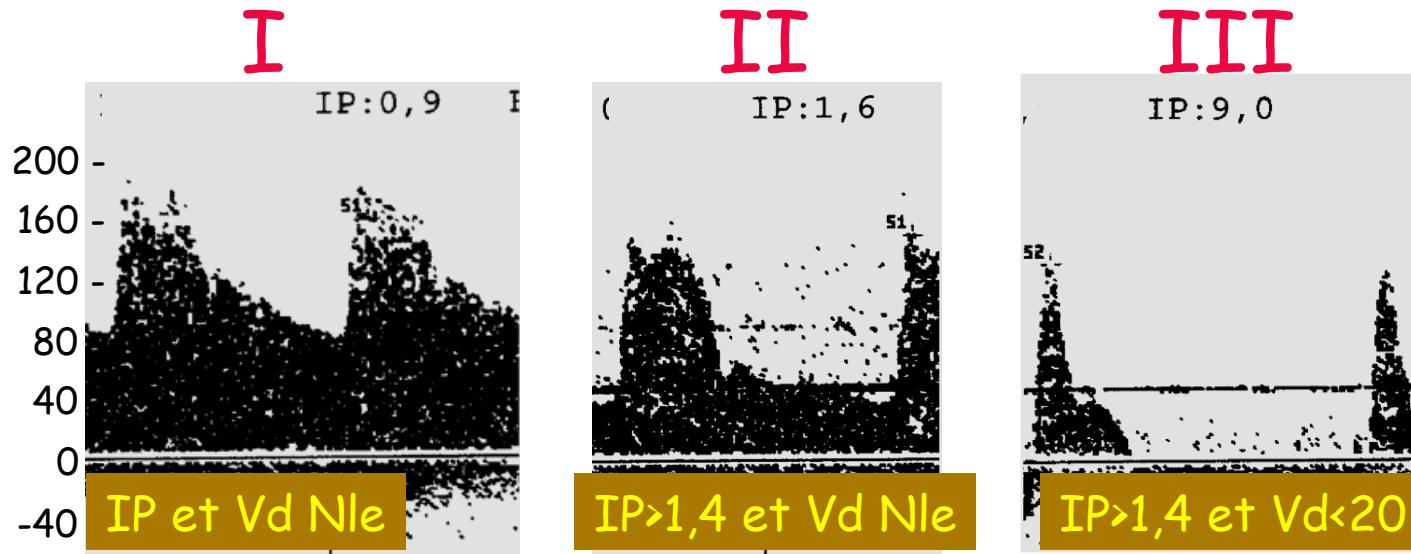


# HIC et Mort cérébrale



# Marseille - Bicêtre, n=150

(délais :  $180 \pm 100$  min vs  $150 \pm 50$  min)



n=80 (53%)

n=27 (18%)

n=42 (28%)

DCD

4

2

21

PAM

$88 \pm 21$

$83 \pm 15$

$84 \pm 15$

# DTC aux urgences

**24 TC graves : GCS 3 – 8**

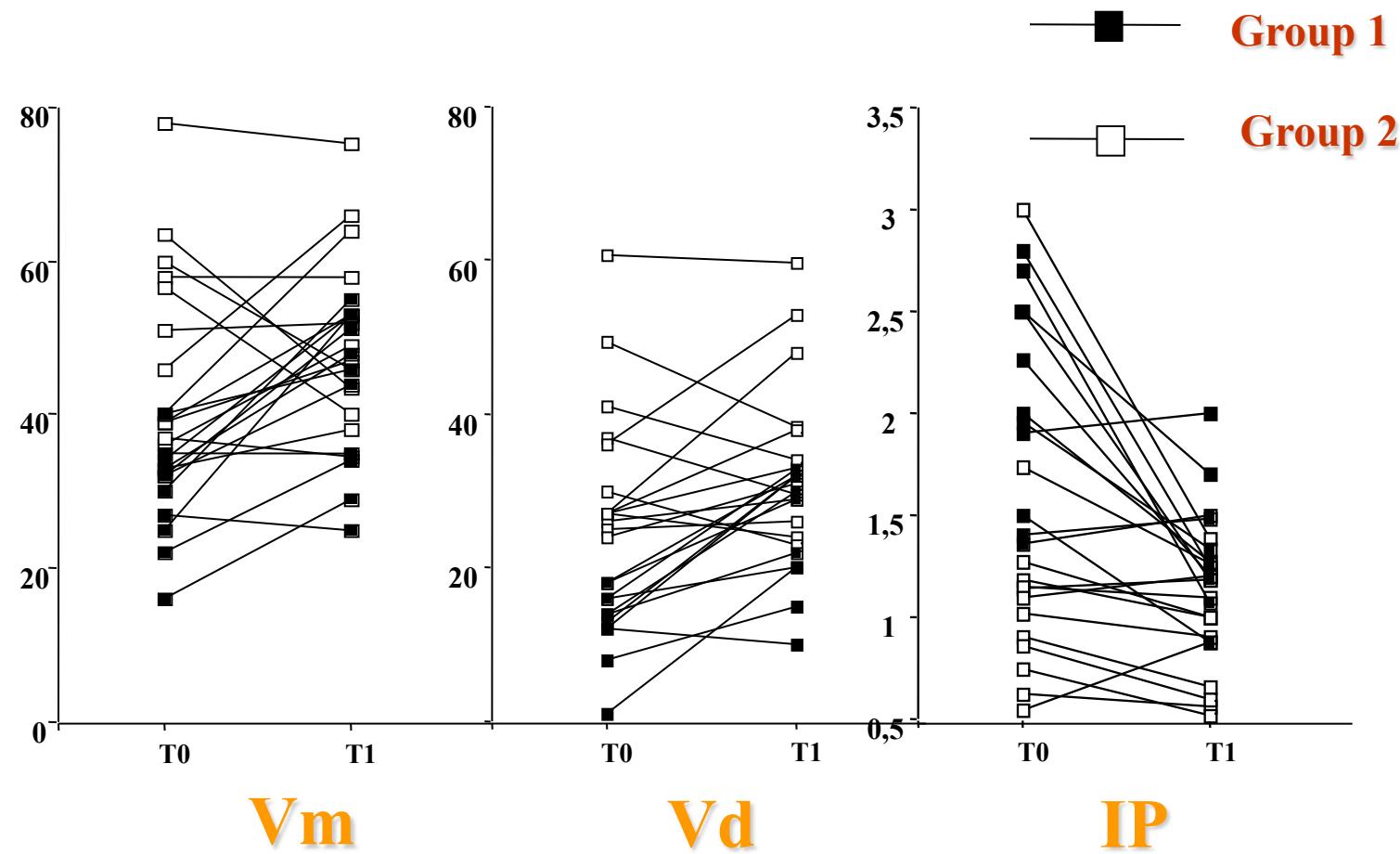
*IP > 1.4  
Vd < 20 cm/s  
Vm < 30 cm/s*



# Efficacité du traitement

	Gr 1	Gr 2
PIC	$32 \pm 13$	$22 \pm 10^{**}$
PPC	$73 \pm 15$	$71 \pm 14$
SvjO <sub>2</sub>	$67 \pm 2$	$72 \pm 9$

# DTC et traitement à l'arrivée



# CONCLUSION

- Chaque étape, chaque résultat compte pour le résultat final
  - Les conditions neurochirurgicales sont incertaines
  - Points clés: pré-oxygénation, dépressarielle, rémission cérébrale
- Pas de défaitisme**
- Pas de simplisme**
- Pas de protocole**