HIPOTENSIÓN NEONATAL INTRAOPERATORIA

¿CUANDO Y COMO DEBEMOS INTERVENIR?

Dr. Ignacio Gálvez

UNITAT D'ANESTÈSIA PEDIÀTRICA

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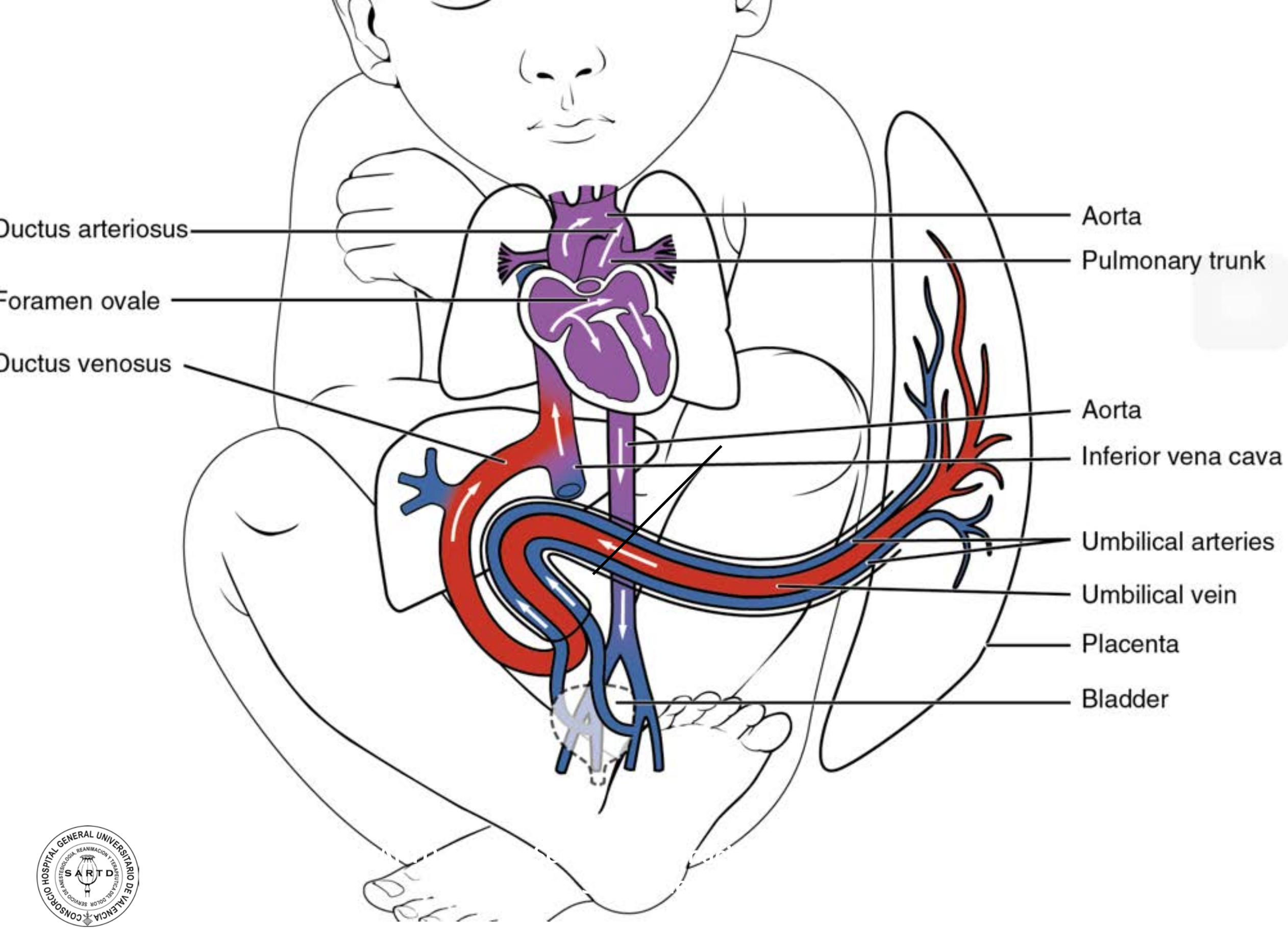
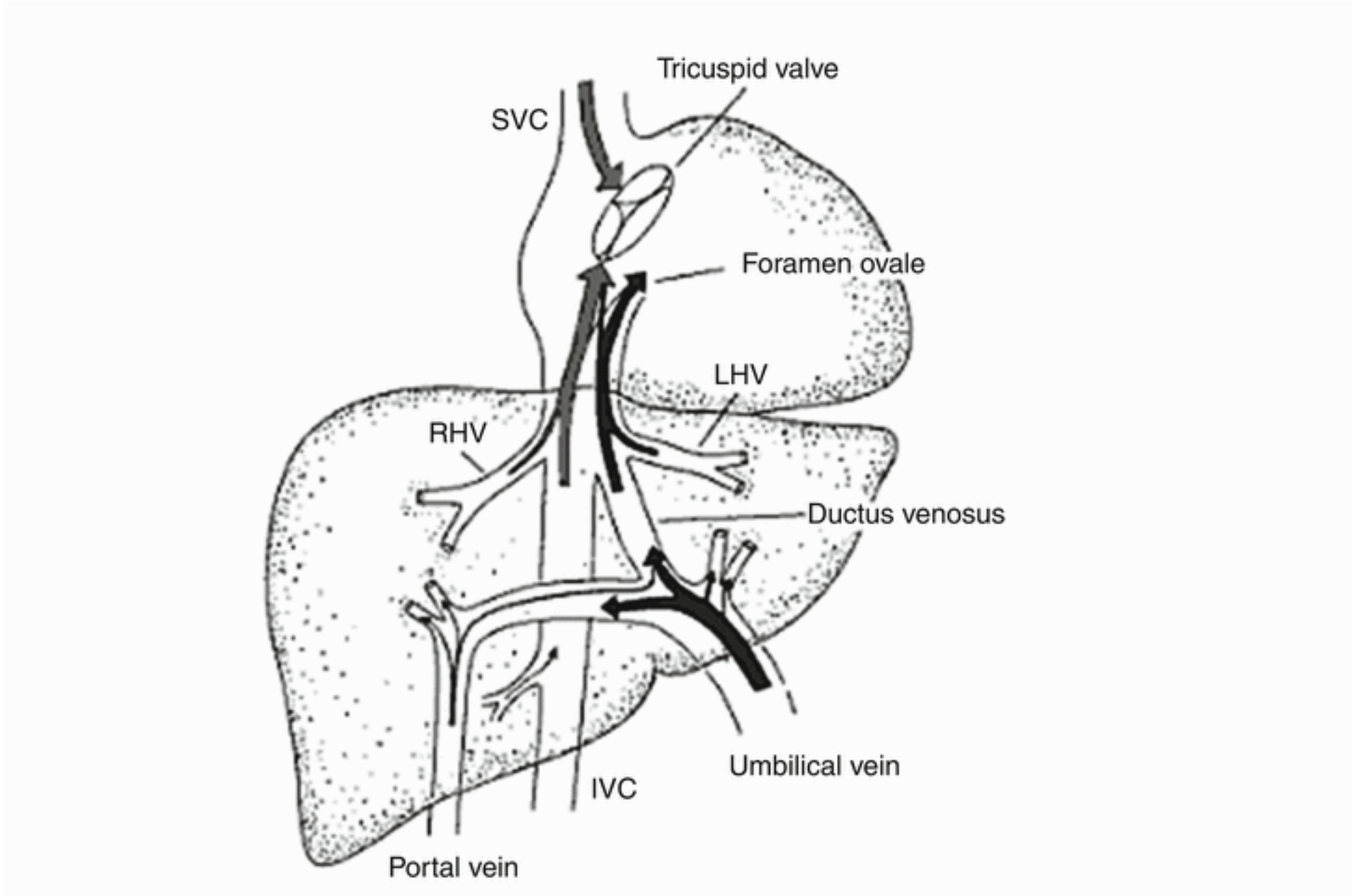
Valencia 31 de Enero de 2014



FETAL-TRANSICIONAL



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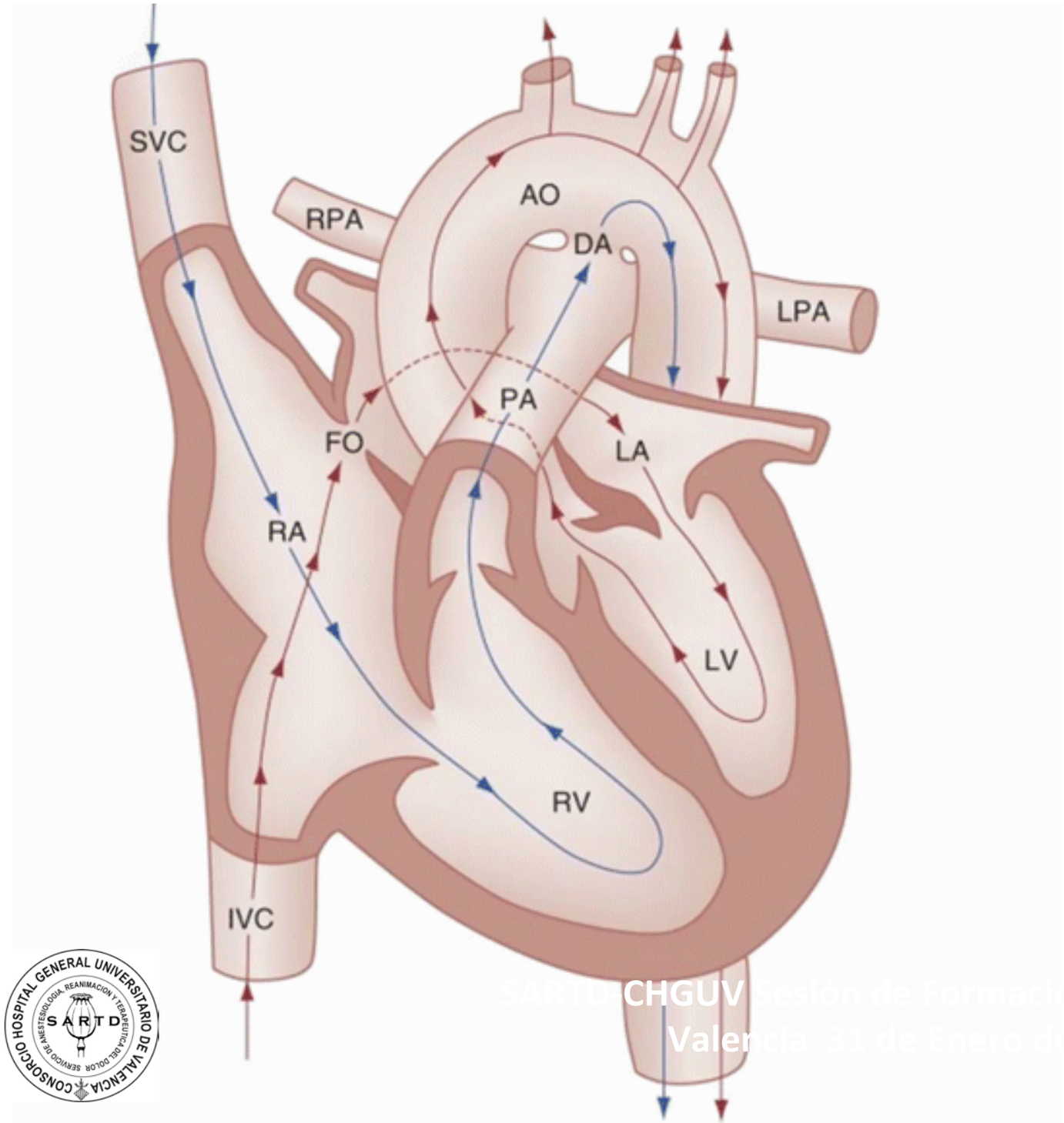

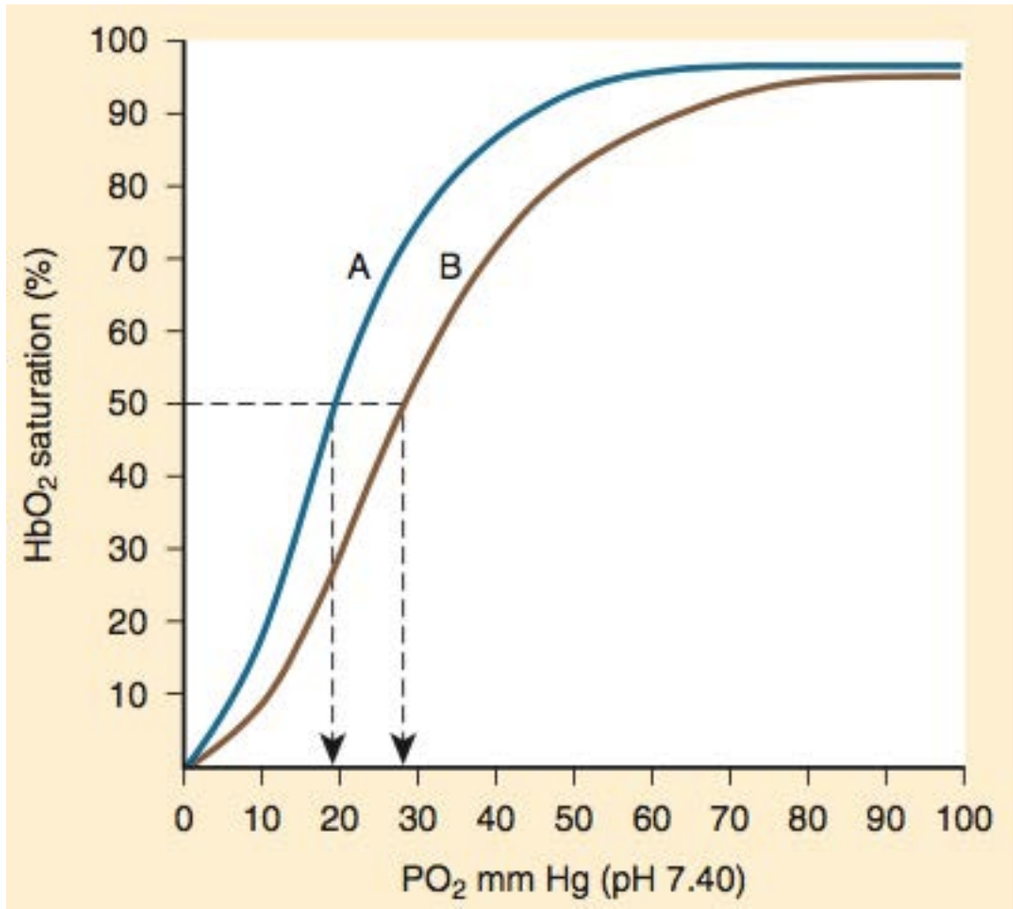

Journal of Perinatology (2011) 31, 524–534

www.nature.com/jp

ORIGINAL ARTICLE

Early postnatal hypotension is not associated with indicators of white matter damage or cerebral palsy in extremely low gestational age newborns

JW Logan[1], TM O'Shea[2], EN Allred[3,4,5], MM Laughon[6], CL Bose[6], O Dammann[7], DG Batton[8], KC Kuban[9], N Paneth[10] and A Leviton[4,5], for the ELGAN Study Investigators

[1]Division of Neonatal-Perinatal Medicine, Betty H Cameron Women's and Children's Hospital, New Hanover Regional Medical Center, Wilmington, NC, USA; [2]Wake Forest University School of Medicine, Winston-Salem, NC, USA; [3]Harvard School of Public Health, Boston, MA, USA; [4]Harvard Medical School, Boston, MA, USA; [5]Children's Hospital Boston, Boston, MA, USA; [6]The University of North Carolina at Chapel Hill, Chapel Hill, NC, USA; [7]Floating Hospital, Tufts Medical Center, Boston, MA, USA; [8]Southern Illinois University School of Medicine, Springfield, IL, USA; [9]Boston University School of Medicine, Boston, MA, USA and [10]Michigan State University, East , MI, USA

¿DEFINICIÓN?

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HIPOTENSIÓN (?)

PRETÉRMINO < 37 SEM

< 1er día(62,5 mmHg)

PALS hipotensión TAS< 60 mmHg

↓TAS vs ↓PAM

PAM no < edad gestacional en semanas

PAM <30 mmHg en < 30 sem

TA proxy perfusión visceral(?)

Presión Perfusión Cerebral?

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HIPOTENSIÓN (?)

↑HIC
↑ECN
AFECTACIÓN NEUROLÓGICA
↑MORTALIDAD

↓TAS vs ↓PAM
PAM no < edad gestacional en semanas
PAM <30 mmHg en < 30 sem
TA proxy perfusión visceral(?)
Presión Perfusión Cerebral?

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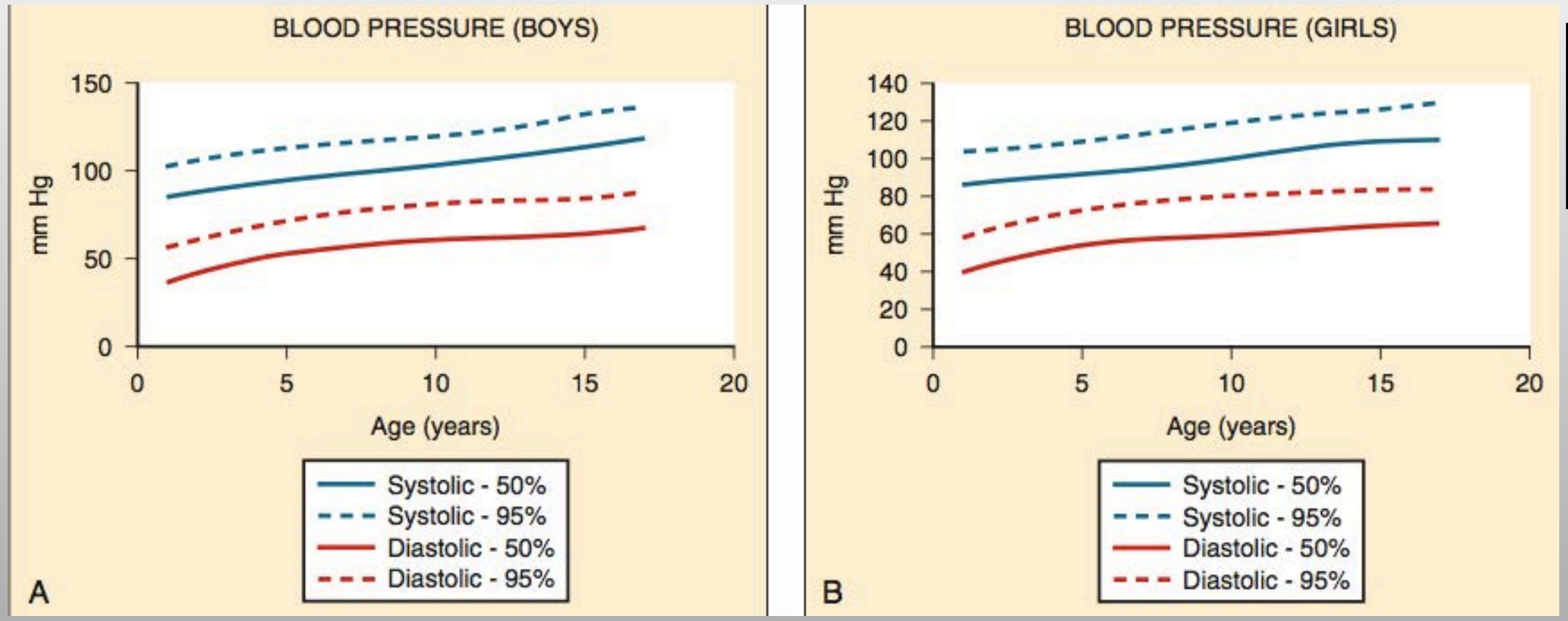

Working Group in High Blood Pressure in children & adolescents

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Valencia 31 de Enero de 2014

Pediatric Anesthesia

Pediatric Anesthesia 2009 **19**: 1048–1053 doi:10.1111/j.1460-9592.2009.03140.x

How do pediatric anesthesiologists define intraoperative hypotension?

OLUBUKOLA O. NAFIU MD FRCA, TERRI VOEPEL-LEWIS MSN RN, MICHELLE MORRIS MS, WILSON T. CHIMBIRA MD FRCA, SHOBHA MALVIYA MD, PAUL I. REYNOLDS MD AND KEVIN K. TREMPER MD PHD

Department of Anesthesiology, University of Michigan, Ann Arbor, MI, USA

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Table 1
Values and methods used to define IOH by societal affiliation

Age group	*SPA members (n = 337)*	*APA members (n = 115)*	P *value*
SBP threshold values mean (SD) mmHg for IOH			
Neonates	45.5 (8.5)	49.6 (8.4)	0.001
Infant-2 year	54.8 (8.3)	59.6 (9.1)	0.001
Children 2–12 years	66.9 (8.9)	70.1 (6.8)	0.001
Adolescents	78.4 (10.0)	84.5 (5.3)	0.001
Change from baseline SBP indicative of IOH (% respondents)			
10–20% decrease	12.3	10.3	n.s.
20–30% decrease	70.3	89.7	0.001
30–40% decrease	10.9	0.0	0.001
>40% decrease	6.5	0.0	0.001
Parameters used to identify IOH (% respondents)			
SBP	78.3	96.2	0.001
MAP	86.3	85.7	n.s.
DBP	46.3	30.6	0.002

REVIEW ARTICLE

General Anesthesia: A Gateway to Modulate Synapse Formation and Neural Plasticity?

Laszlo Vutskits, MD, PhD

Appropriate balance between excitatory and inhibitory neural activity patterns is of utmost importance in the maintenance of neuronal homeostasis. General anesthetic–induced pharmacological interference with this equilibrium results not only in a temporary loss of consciousness but can also initiate long-term changes in brain function. Although these alterations were initially considered deleterious, recent observations suggest that at least under some specific conditions, they may eventually improve neural function. The goal of this review is to provide insights into the mechanisms underlying these dual effects. Basic science issues on the important role of critical periods during neural circuitry assembly will be discussed to better understand how even brief exposures to general anesthetics could initiate context-dependent lasting changes in neuronal structure and function. Recent series of observations suggesting a developmental stage–dependent impact of these drugs on synaptogenesis will then be summarized together with currently known molecular mechanisms underlying these effects. Particular emphasis will be placed on how anesthetic drugs modulate neural plasticity in the adult brain and how this may improve neural function under some pathological states. The ensemble of these new observations strongly suggests that general anesthetics should not merely be considered toxic drugs but rather acknowledged as robust, context-dependent modulators of neural plasticity. (Anesth Analg 2012;X:•••–•••)

- MODULADORES PLASTICIDAD NEURONAL

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bonate may cause rapid changes in serum osmolality and is to be avoided. Slow correction, over an hour or two, is usually preferable.

CARDIOVASCULAR STABILISATION

It is essential to monitor blood pressure so that hypotension can be promptly recognised, its cause assessed, and appropriate treatment offered. Facilities for intravascular blood pressure monitoring should be available, but non-invasive blood pressure measurement using the Doppler technique may give a reliable estimate of systolic pressure. Further studies of the normal range of blood pressure in very premature infants are needed, but at the present time the working group agrees that a mean arterial blood pressure equivalent to the gestational age in weeks is adequate as a minimum value (C).

Hypotension should be treated initially with colloid or blood if there is the possibility of hypovolaemia (C). The effectiveness of inotrope infusion in the preterm newborn has not been proved, but a starting dose of dopamine 10 μg/kg/min may be needed in the preterm neonate as they are relatively resistant to this form of treatment. Its use must be avoided in the presence of hypovolaemia.

BRAIN

Preterm cerebral injury (periventricular haemorrhage or leucomalacia) is to some extent

not been achieved medically surgical ligation by an experienced surgeon should be considered (C).

NECROTISING ENTEROCOLITIS

There are few objective data to suggest that the risk of necrotising enterocolitis can be reduced by alterations in the management of RDS. The working group agrees that the risk of necrotising enterocolitis can be minimised by avoidance, or rapid treatment, of shock and by the practice of general measures to maintain homoeostasis (C).

Adequate nutrition is an important part of the management of RDS (C). Facilities for total parenteral nutrition must be available, but minimal enteral feeding should be considered in infants with stable or improving RDS (C). There is also no evidence that uncomplicated umbilical catheterisation increases the risk of necrotising enterocolitis.

Chronic lung disease

This has been defined as the requirement of supplementary oxygen after 28 days from birth.[28] It has been shown that an additional oxygen requirement in a prematurely born infant after 36 weeks' postmenstrual age is a better predictor of severe pulmonary outcome.[29] The majority of these infants will have bronchopulmonary dysplasia. Steroids reduce the duration of mechanical ventilation in

¿CONSECUENCIAS?

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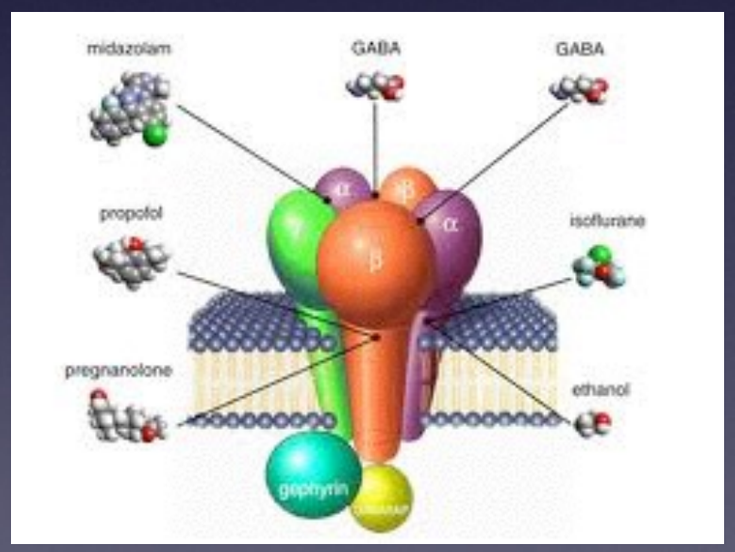
Qué agentes?

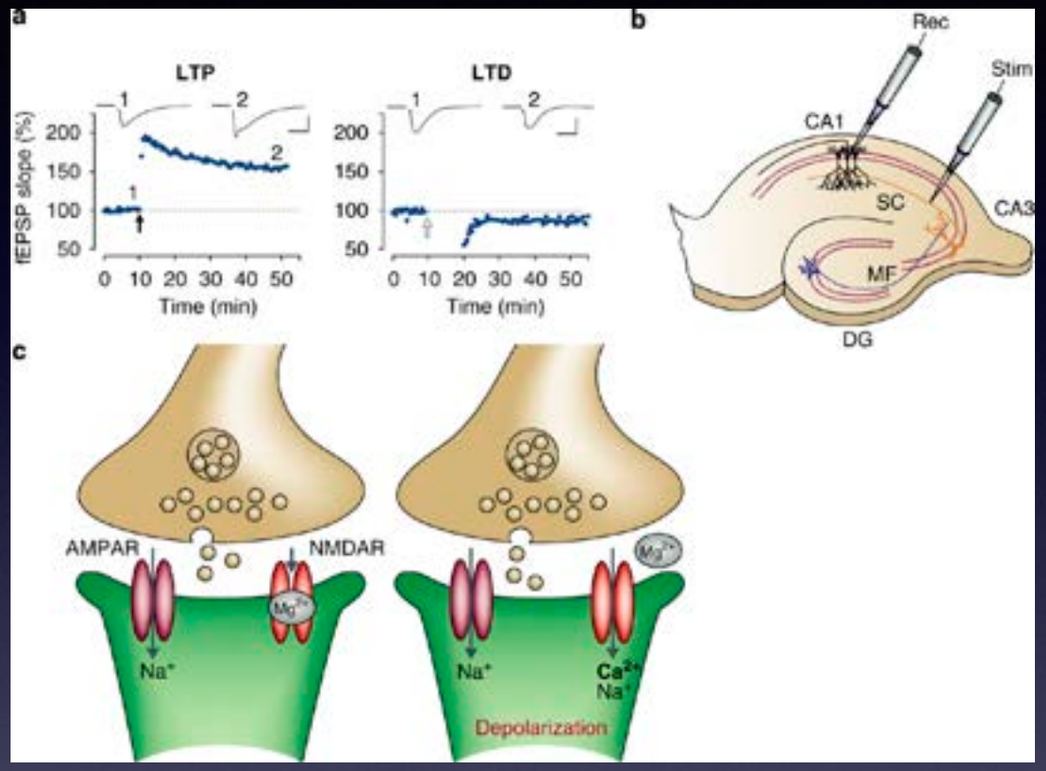
- **Agonistas GABA**: propofol, benzodiazepinas, etanol, agentes volátiles,barbitúricos



Actúan como excitadores neuronales en neuronas immaduras!(transportador de cloro)

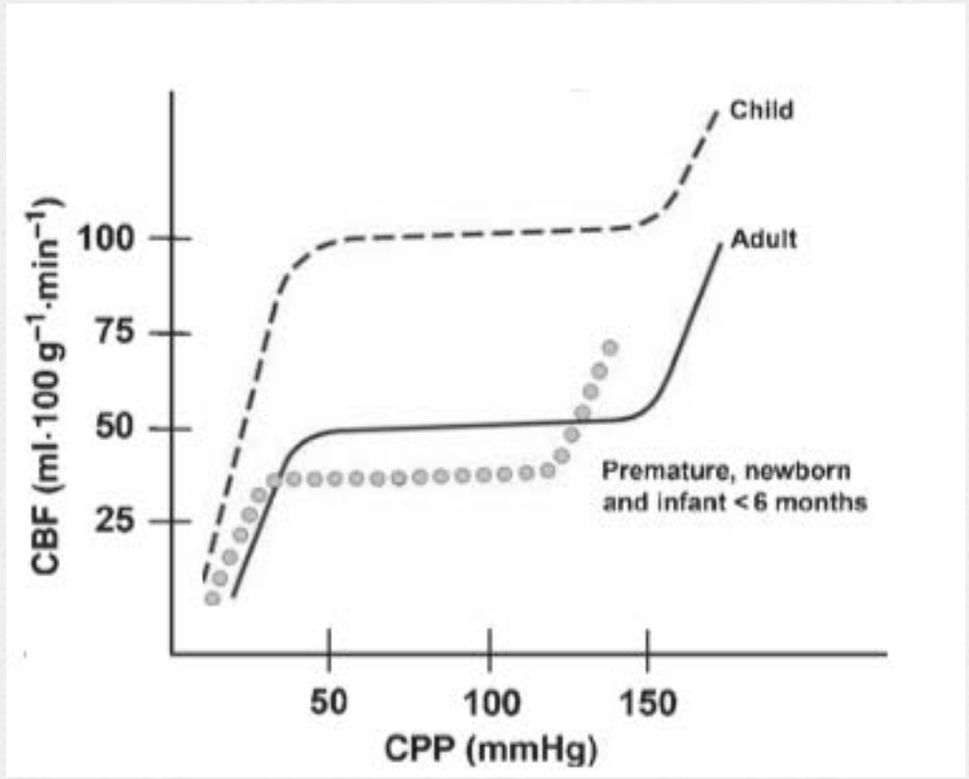
Sinaptogénesis

- Supresión actividad evita formación sinapsis?
- Transición GABA excitatorio/ inhibitorio?
- Sevoflurano: excitación cortical generalizada en ratas(epilepsia)? y muerte neuronal....
- Bumetanida inhibe transportador Cl- inmaduro



Edwards DA, Shah HP, Cao W, Gravenstein N, Seubert CN, Martynyuk AE. Bumetanide alleviates epileptogenic and neu- rotoxic effects of sevoflurane in neonatal rat brain. Anesthesiology 2010;112:567–75

AUTOREGULACIÓN



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Valencia 31 de Enero de 2014

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

RESEARCH REPORT

Arterial blood pressure in anesthetized neonates and infants: a retrospective analysis of 1091 cases

Frank Weber, Gijsbert H. M. Honing & Gail P. Scoones

Department of Anaesthesia, Erasmus University Medical Center – Sophia Children's Hospital, Rotterdam, The Netherlands

What is already known

- Intraoperative hypotension may contribute to poor neurodevelopmental outcome.
- A mean arterial pressure ≥35 mmHg in anesthetized neonates and infants < 6 months and ≥43 mmHg in infants > 6 months appears to preserve cerebral oxygenation.

What this article adds

- Intraoperative hypotension is a common feature in anesthetized children under 1 year, with the highest incidence and severity in neonates.
- Intraoperative hypotension occurs more often in nonelective cases than in elective cases.

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What this article adds

- Intraoperative hypotension is a common feature in anesthetized children under 1 year, with the highest incidence and severity in neonates.
- Intraoperative hypotension occurs more often in nonelective cases than in elective cases.

< 35 mmHg en menores 6 meses

< 45 mmHg en mayores

10 min o más

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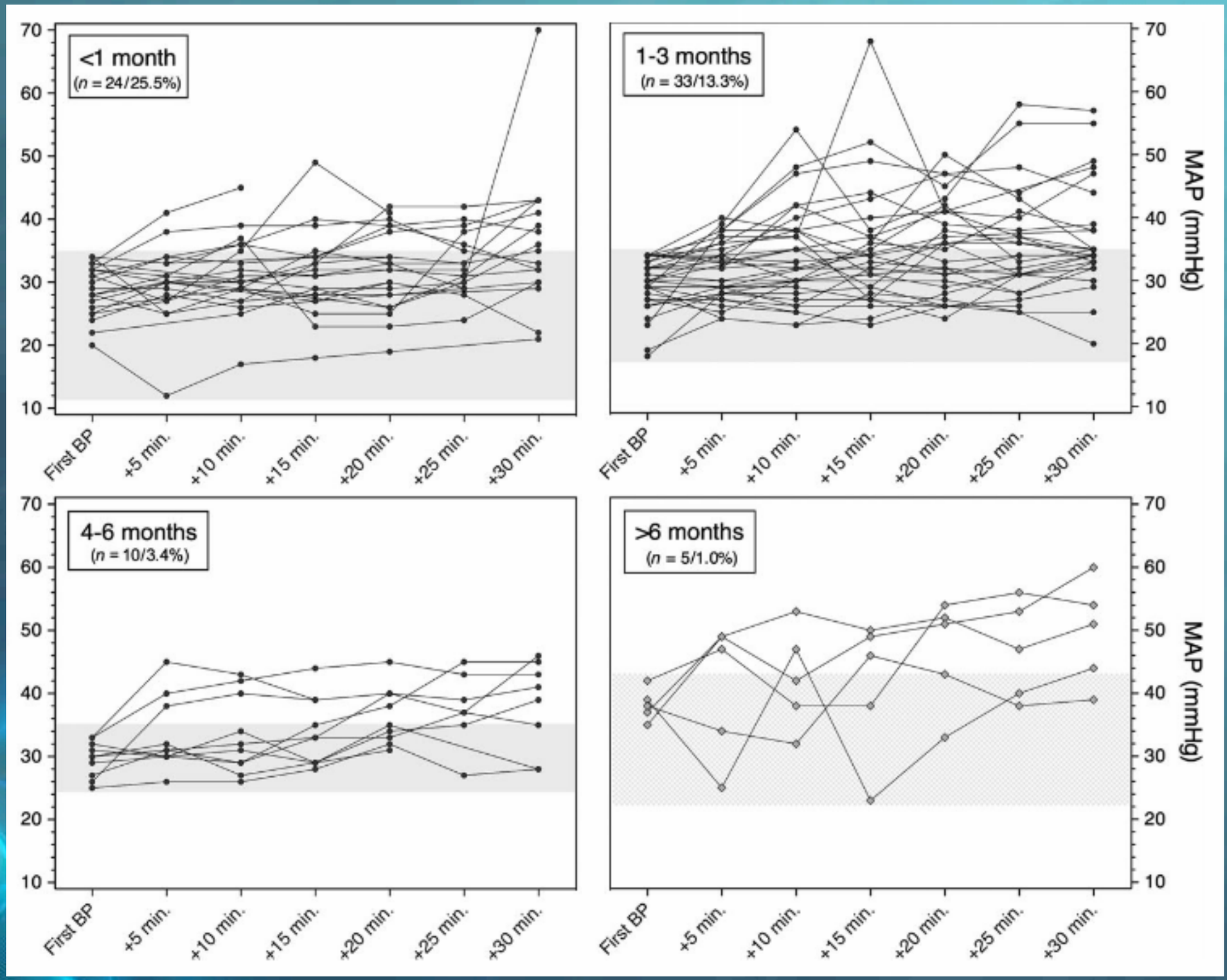

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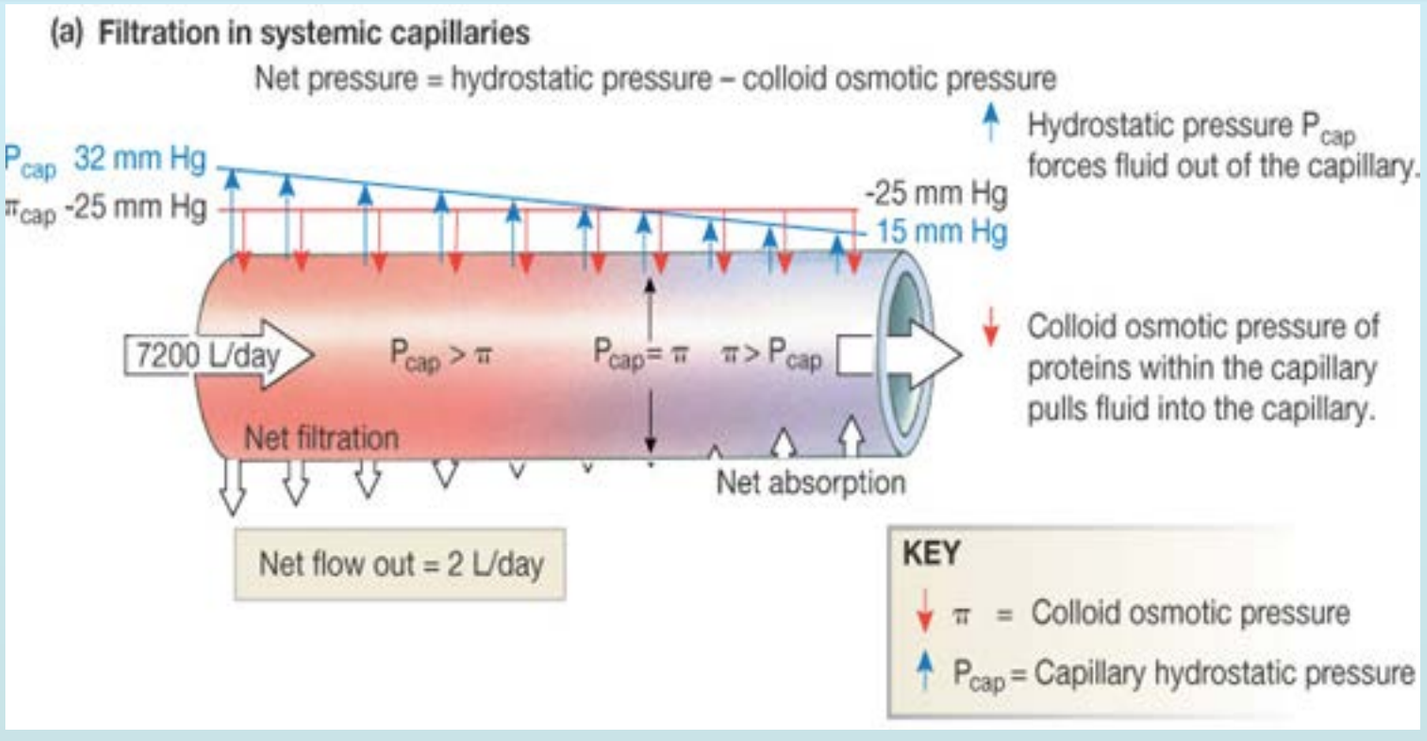
“ASIGNACIÓN ORGANOS VITALES”

MALA CORRELACIÓN ENTRE TA Y PRESIÓN PERFUSIÓN

TA NORMAL Y MALA PERFUSIÓN

↓TA Y BUENA PERFUSIÓN



Seminars in Fetal & Neonatal Medicine 19 (2014) 45–53

Contents lists available at ScienceDirect

Seminars in Fetal & Neonatal Medicine

journal homepage: www.elsevier.com/locate/siny

Transitional cardiovascular physiology and comprehensive hemodynamic monitoring in the neonate: Relevance to research and clinical care

Timur Azhibekov [a,b], Shahab Noori [a,b], Sadaf Soleymani [a,b], Istvan Seri [a,b,*]

[a] Division of Neonatology and The Center for Fetal and Neonatal Medicine, Department of Pediatrics, Children's Hospital Los Angeles, Los Angeles, CA, USA

IGUALAR DEMANDA/APORTE O2

↓APORTE-VASOCONSTRICCIÓN ORGANOS NO VITALES

VASODILATACIÓN ÓRGANOS VITALES

FASE COMPENSADA SHOCK

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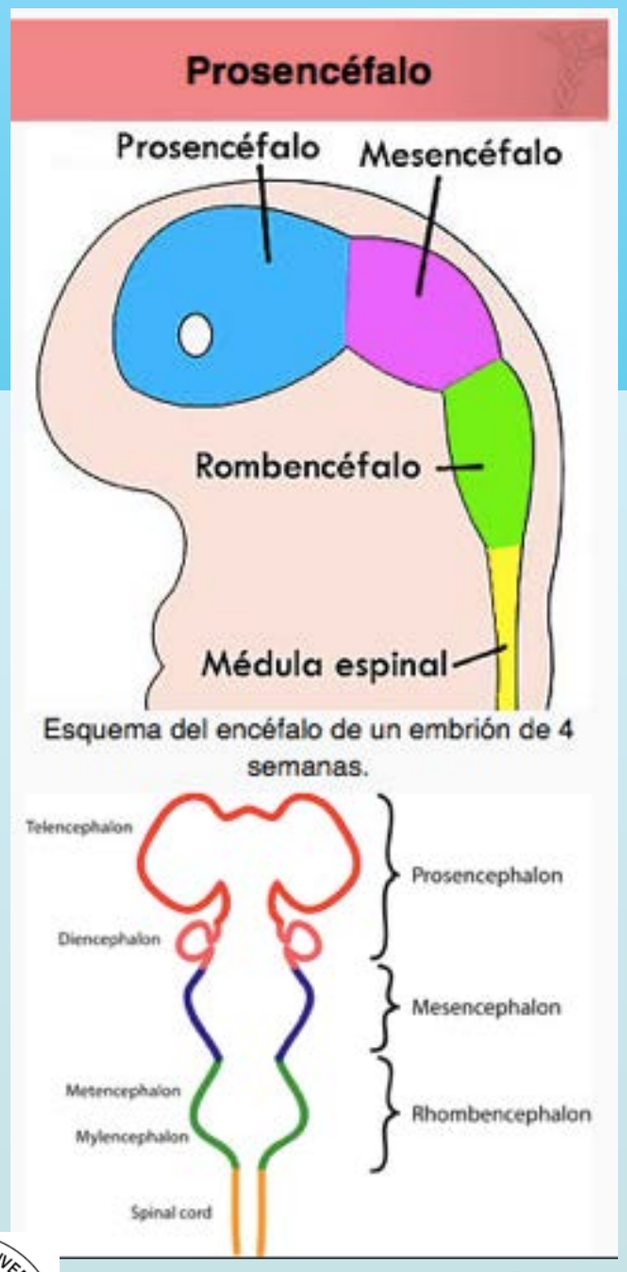
ASIGNACIÓN ORGANOS VITALES



INMADUREZ PROSENCEFALO
ASIGNACIÓN “INCOMPLETA”

VASOCONSTRICCIÓN

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PREMATURIDAD

Exposición luz/ruido
Enf. aguda/crónica
Separación maternal
Procedimientos invasivos
Medicación
Movilización

¿Efectos a largo plazo?

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ALOSTASIS

Homeostasis

hipotálamo-pituitario-adrenal
Sistema Inmune
SNV

Adaptación constante

↑ESTRÉS
ESTADOS ALOSTÁTICOS

CARGA ALOSTÁTICA

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CARGA ALOSTÁTICA

↑MEDIADORES ESTRÉS/NO ↓
RESPUESTA INADECUADA
EXPOSICIÓN PROLONGADA

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Original Article

The developmental origins of adult disease

Peter D. Gluckman FRS*, **Mark A. Hanson** DPhil† **and Catherine Pinal** PhD*

*Liggins Institute, University of Auckland, Grafton, Private Bag 92019, Auckland, New Zealand, and †Centre for Developmental Origins of Health and Disease, University of Southampton, Princess Anne Hospital Level F (887), Southampton S016 5YA, UK

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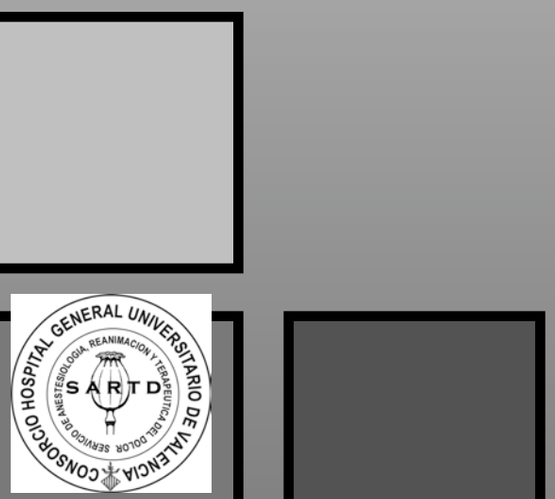
¿LÍMITES?



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Valencia 31 de Enero de 2014

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Sevoflurane anesthesia and brain perfusion

Ossam Rhondali[1,2], Agnès Pouyau[1], Aurélie Mahr[1], Simon Juhel[1], Mathilde De Queiroz[1], Khalid Rhzioual-Berrada[1], Sylvain Mathews[2] & Dominique Chassard[1]

1 Department of Pediatric Anesthesia, Hôpital Mère-Enfant, Lyon, France

2 Department of Pediatric Anesthesia, Hôpital Sainte Justine, Montréal, QC, Canada

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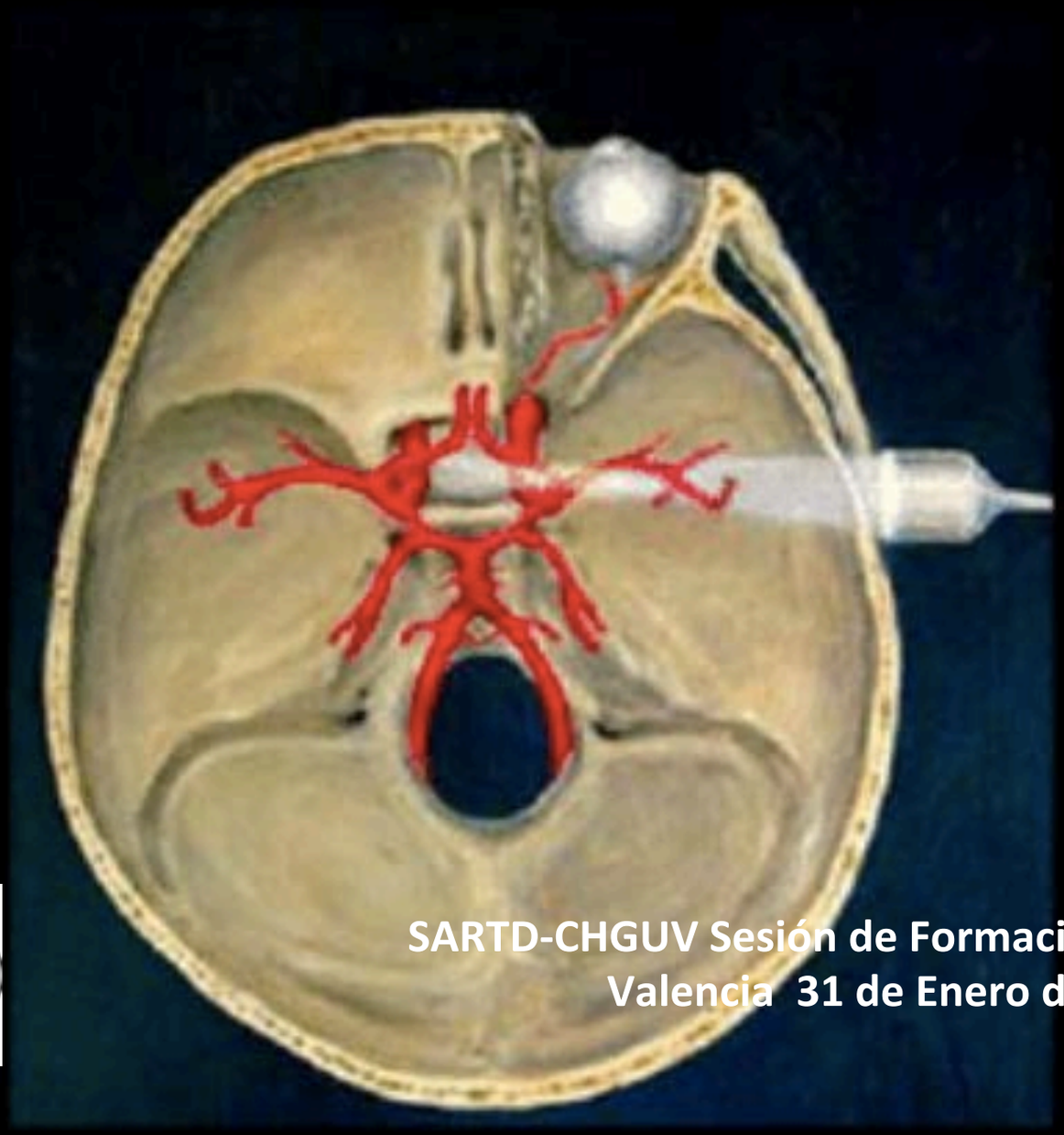
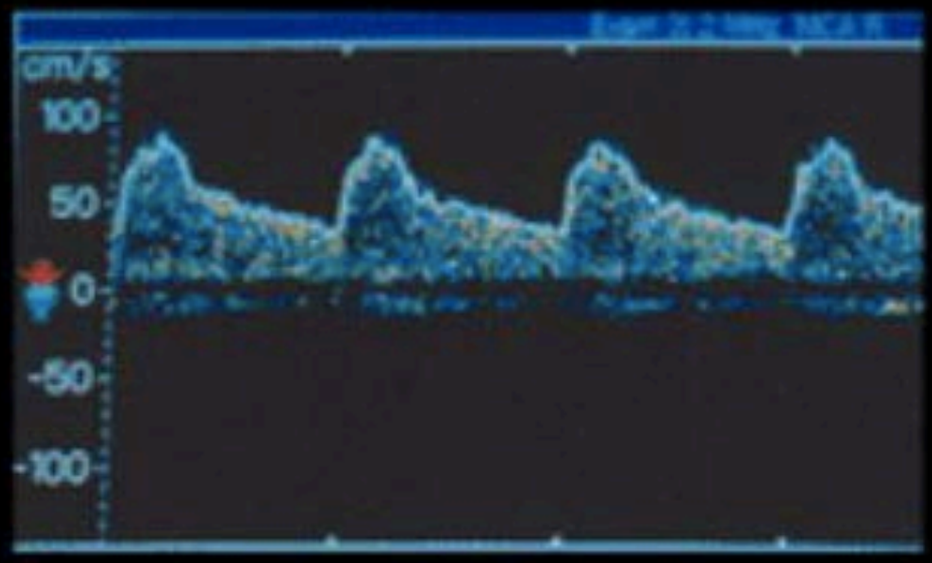
Valencia 31 de Enero de 2014

Transcranial Doppler Ultrasound

Transcranial Doppler (TCD)





TCD Parameters

Peak velocity (PV)

End-diastolic velocity (EDV)

Mean velocity (MV)

$MV = PV+(2 \times EDV)/2$

Pulsatility index (PI)

$PI = (PV-EDV)/MV$

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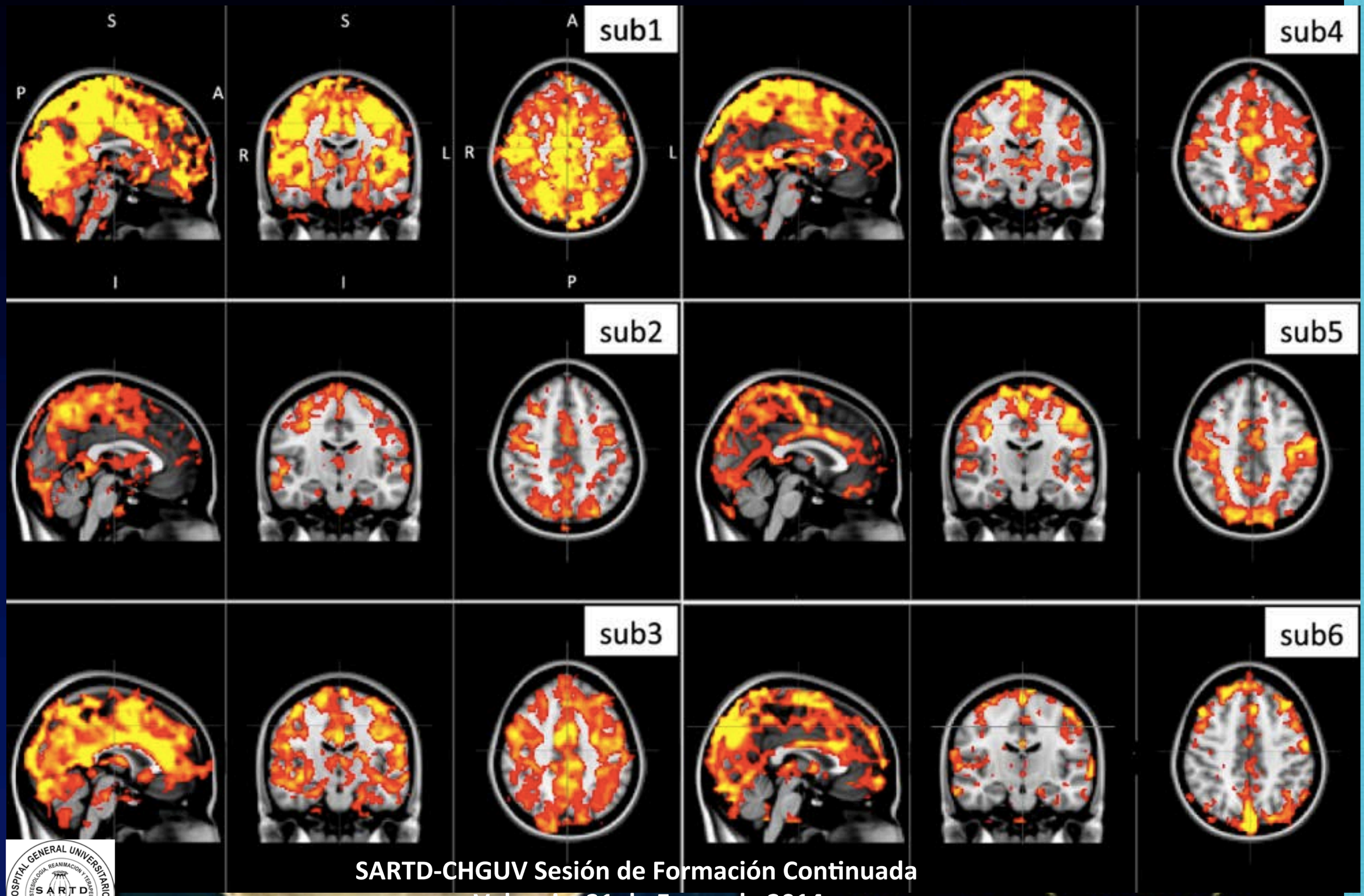

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Pulsatility index (PI)

PI = (PV-EDV)/MV

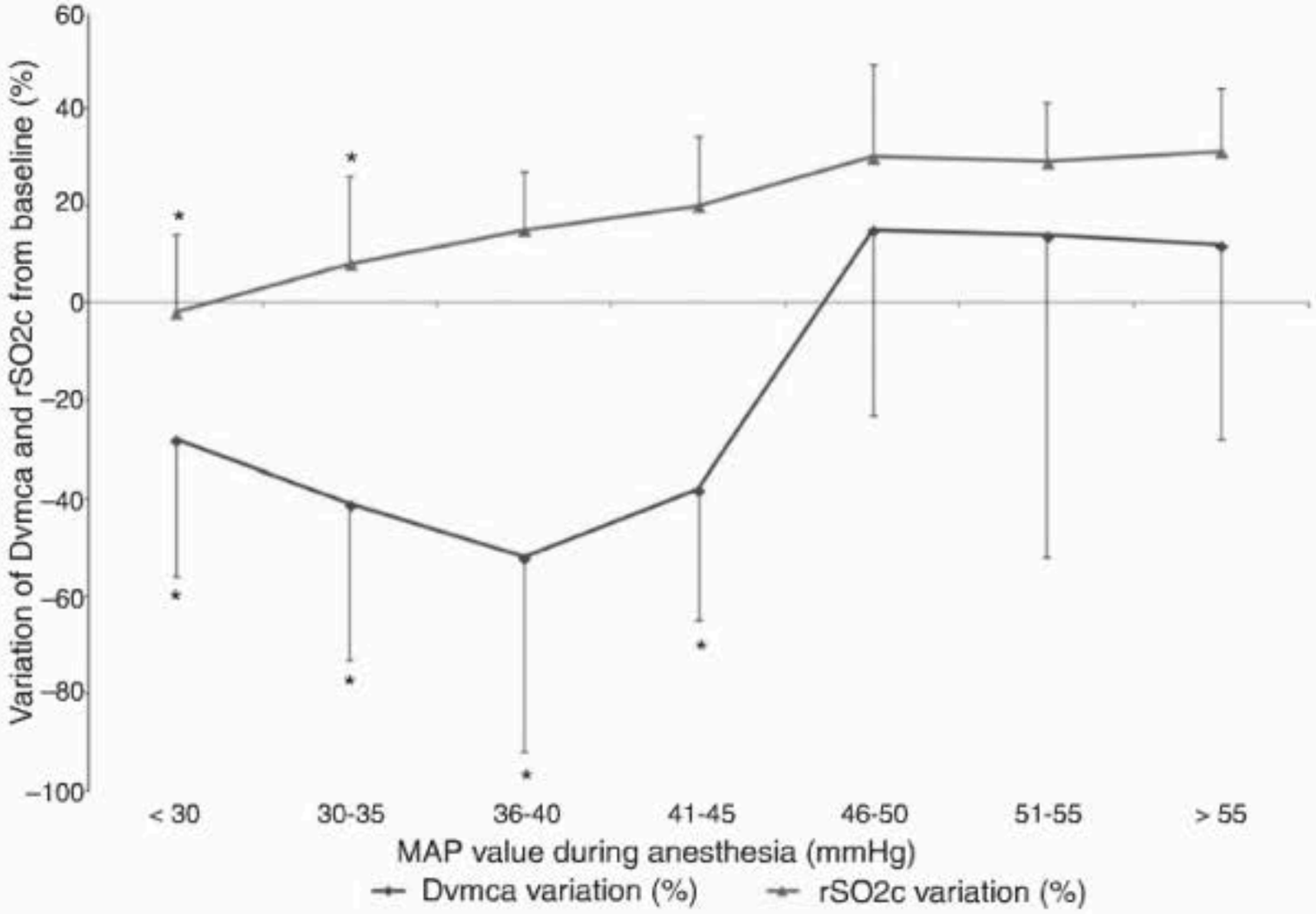

Figure 3 Brain oxygenation (rSO2c) and cerebral blood flow (Dvmca) variation from awake baseline value, according to MAP value during anesthesia. Mean and SD. *ANOVA and *posthoc* analysis, $P < 0.05$.

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Intraoperative changes in blood pressure associated with cerebral desaturation in infants

Daphné Michelet[1,2], Ozkan Arslan[1,2], Julie Hilly[1,2], Nyamjargal Mangalsuren[1,2], Christopher Brasher[1,2], Robert Grace[3], Arnaud Bonnard[2,4], Serge Malbezin[1,2], Yves Nivoche[1,2] & Souhayl Dahmani[1,2,3,5]

1 Department of Anesthesia, Intensive Care and Pain Management, AP-HP, Robert Debré University Hospital, Paris, France
2 Paris Diderot University (Paris VII), Pres Paris Sorbonne Cité, Paris, France
3 Department of Anesthesia, Intensive Care and Peri-operative Medicine, Cairns Hospital, Cairns, Qld, Australia
4 Department of General and Urological Surgery, AP-HP, Robert Debré University Hospital, Paris Diderot University, Paris, France
5 University and Hospital Department PROTECT, Robert Debré University Hospital, Paris, France

What is already known

- Pediatric hypotension has been defined as a decrease in mean blood pressure of 20–30% from baseline. However, there is little evidence to support this definition.

What this article adds

- During noncardiac surgery in neonates and infants < 3 months, decreases in systolic blood pressure of < 20% from baseline are associated with a < 10% chance of cerebral desaturation. Falls in systolic arterial pressure > 20% must be avoided in infants under 3 months.

Implications for translation

- In neonates and infants < 3 months, systolic blood pressure variation must be maintained < 20%.

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¿TRATAMIENTO?

SARTD-CHGUV Sesión de Formación Continuada
Valencia 31 de Enero de 2014

ARTICLE

Treated Hypotension Is Associated With Neonatal Morbidity and Hearing Loss in Extremely Low Birth Weight Infants

Jonathan M. Fanaroff, MD, JD, Deanne E. Wilson-Costello, MD, Nancy S. Newman, RN, Michelle M. Montpetite, MS, Avroy A. Fanaroff, MB, BCh

Department of Pediatrics, Rainbow Babies & Children's Hospital, Case Western Reserve University, Cleveland, Ohio

The authors have indicated they have no financial relationships relevant to this article to disclose.

SARTD-CHGUV Sesión de Formación Continuada
Valencia 31 de Enero de 2014

ARTICLE

Early Systemic Hypotension and Vasopressor Support in Low Birth Weight Infants: Impact on Neurodevelopment

Adelina Pellicer, MD, PhD[a], María del Carmen Bravo, MD[a], Rosario Madero, MD[b], Sofía Salas, MD[a], José Quero, MD, PhD[a], Fernando Cabañas, MD, PhD[a]

[a]Department of Neonatology and [b]Biostatistics Unit, La Paz University Hospital, Madrid, Spain

The authors have indicated they have no financial relationships relevant to this article to disclose.

What's Known on This Subject

Prospective research evaluating the effects of cardiovascular support on outcome has been limited to LBW infants treated because of low superior vena cava. Retrospective studies have shown increased risk of adverse outcome in hypotensive LBW infants who received cardiovascular support.

What This Study Adds

This is the first prospective study to evaluate the effects of a standardized treatment protocol for early systemic hypotension and neurodevelopment in LBW infants. This is also the first study to report the outcome of LBW infants who were treated with epinephrine as first-line inotrope.

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HIPOTENSIÓN

TA sistólica < percentil 5%
Niños > 1a percentil 5% = 70 mmHg +(2 x edad en años)

Causas de hipotensión

↓PRECARGA	↓CONTRACTILIDAD	↓POSTCARGA
-Hipovolemia -Vasodilatación -↓retorno venoso -Tamponamiento -Embolismo pulmonar	-Inotrópicos negativos(anestésicos!) -Arritmias -Hipoxemia -IC(isquemia)	-Vasodilatación farmacológica -Sepsis -Anafilaxis -Alteraciones endocrinas

Tratamiento

Informar equipo quirúrgico
Asegurar/comprobar oxigenación y ventilación
Detener administración anestésicos
Comprobar hipotensión, tamaño y colocación manguito

Expansión volemia Trendelemburg Vía EV o intraósea	Inotrópicos(dopamina,dobutamina,milrinona, adrenalina) ECG: arritmia,isquemia Analítica	Vasopresores: fenilefrina, noradrenalina Algoritmo anafilaxis Esteroides?

ARTICLE

Cumulative Index of Exposure to Hypocarbia and Hyperoxia as Risk Factors for Periventricular Leukomalacia in Low Birth Weight Infants

Seetha Shankaran, MD[a], John C. Langer, MS[b], S. Nadya Kazzi, MD, MPH[a], Abbot R. Laptook, MD[c], Michele Walsh, MD, MS Epi[d], for the National Institute of Child Health and Human Development Neonatal Research Network

[a]Department of Pediatrics, Wayne State University School of Medicine, Detroit, Michigan; [b]Department of Biostatistics, Research Triangle Institute, Research Triangle Park, North Carolina; [c]Department of Pediatrics, Brown Medical School, Providence, Rhode Island; [d]Department of Pediatrics, Case Western University, Cleveland, Ohio

The authors have indicated they have no financial relationships relevant to this article to disclose.

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CONCLUSIONES

-TAM >=35 mmHg en neonatos
-< 20% basal variación en < 3 meses
-"Reserva" cerebral(CBF)
-Hipocapnia, hipoglucemia, hipoxemia
-Uso indicadores indirectos
-Evitar sobretratamiento
-Orígenes desarrollo -enfermedad adulta?

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GRACIAS