Neurocríticos: abordaje inicial y estrategias óptimas de neuromonitorización. Consideraciones para hospitales con y sin neurocirugía

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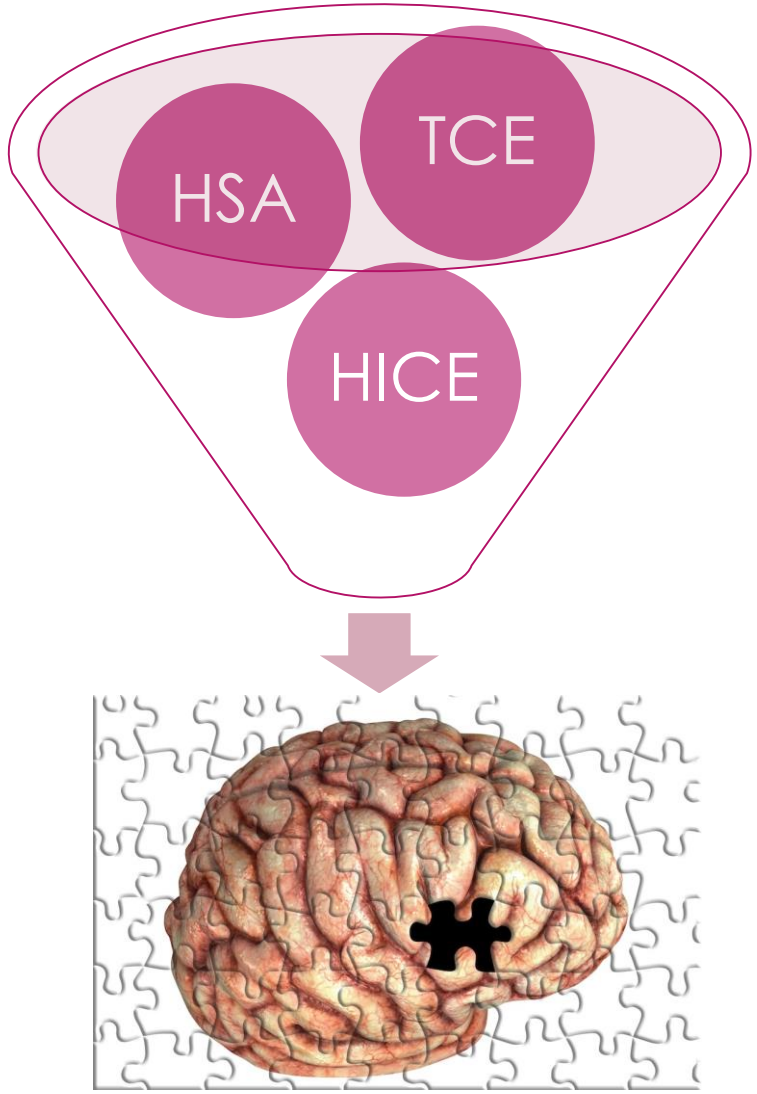
INDICE

1.- ¿Pensamos en el cerebro en las Unidades de Cuidados Intensivos?
2.- ¿Son necesarias las unidades de Neurocríticos?
3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?
4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?
5.- ¿Qué patologías son susceptibles de neuromonitorizar?
6.- ¿Cuáles son mis conclusiones?

1.- ¿Pensamos en el cerebro en las Unidades de Cuidados Intensivos?



1.- ¿Pensamos en el cerebro en las Unidades de Cuidados Intensivos?

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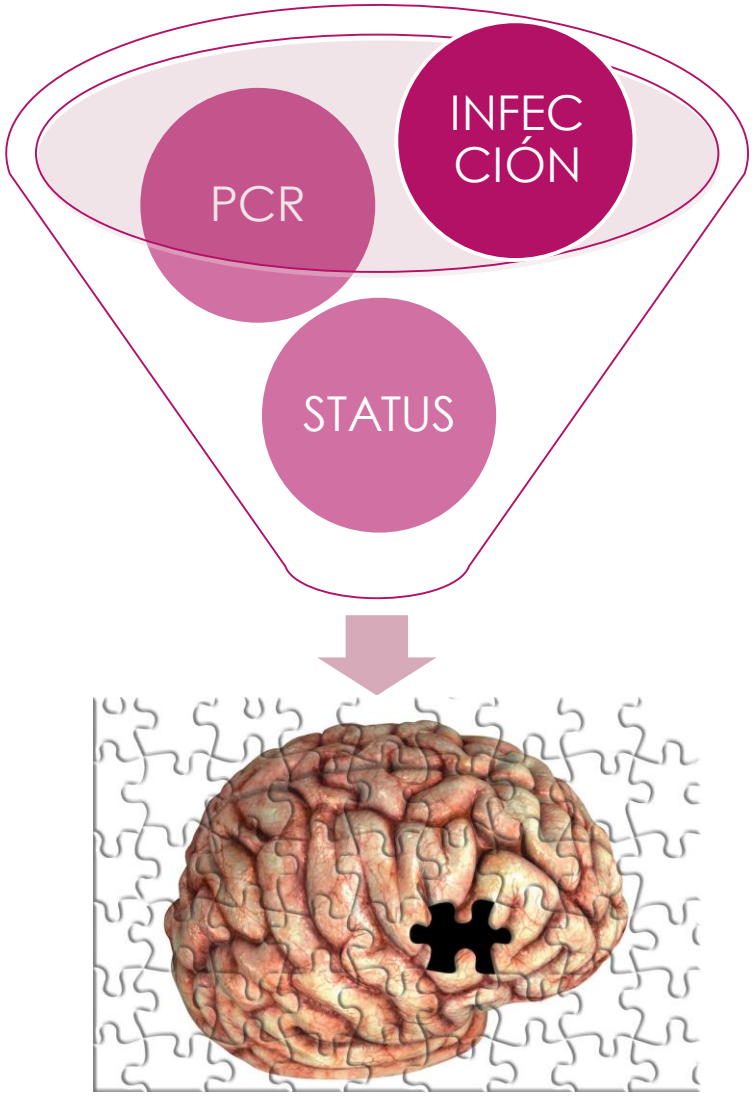
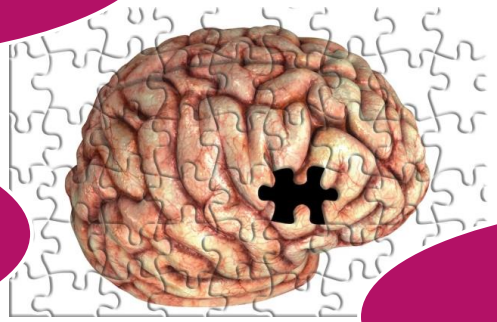


1.- ¿Pensamos en el cerebro en las Unidades de Cuidados Intensivos?

- Encefalopatía inmunomediadas
- Encefalopatía séptica
- Encefalopatía hepática
- Síndrome posterior reversible
- Encefalopatía metabólica
- Trombosis venosa cerebral
- Síndrome de vasoconstricción cerebral transitoira
- Hidrocefalia



2.- ¿Son necesarias las unidades de Neurocríticos?

Neurocritical care: a distinct discipline?

Fred Rincon[a] and Stephan A. Mayer[a,b]

Purpose of review
We sought to review the evidence supporting neurocritical care as a distinct specialty of medicine.
Recent findings
Over the past 20 years, neuro-intensive care units have evolved from neurosurgical units focused primarily on postoperative monitoring to units that provide comprehensive medical and specialized neurological support for patients with life-threatening neurological diseases. In addition to standard interventions, areas of expertise unique to neurocritical care include management of intracranial pressure, hemodynamic augmentation to improve cerebral blood flow, therapeutic hypothermia, and advanced neuromonitoring (i.e. continuous electroencephalography, brain-tissue oxygen, and microdialysis). Neurointensivists defragment care by focusing on the interplay between the brain and other systems, and by integrating all aspects of neurological and medical management into a single care plan. Outcomes research has established that victims of traumatic brain injury and hemorrhagic stroke experience reduced mortality, better functional outcomes, and reduced length of stay when cared for by neurointensivists in a dedicated neuro-intensive care unit. In the US a national system for accrediting training programs and certifying intensivists with special qualifications in neurocritical care is currently being established by the United Council of Neurologic Subspecialties.
Summary
Neurocritical care is one of the newest subspecialties of medicine and is at the forefront of bringing effective new therapies to patients with life-threatening neurological diseases.

Keywords
length of stay, neurocritical care, outcomes

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Current Opinion in Critical Care 2007, 13:115–121

Abbreviations

ICH	intracerebral hemorrhage
ICU	intensive care unit
LOS	length of stay
SAH	subarachnoid hemorrhage
TBI	traumatic brain injury
UCNS	United Council of Neurological Subspecialties

1070-5295

Introduction

Therapeutic and technological advances in intensive care medicine have greatly improved the outcome in a wide variety of life-threatening disorders. These advances have resulted in part from a better understanding of the physiology of critical illness, improved monitoring techniques, and by the introduction of more effective treatments. Parallel to advances in the management of respiratory failure, cardiogenic shock, severe sepsis, and a host of other diseases that predominate in medical and surgical intensive care units (ICUs,) neurocritical care has emerged as a subspecialty dedicated to the treatment of critically ill patients with neurological diseases. As the field has evolved from a primary focus on the postoperative monitoring of neurosurgical patients, the primary challenge of neurocritical care in the new millennium is the resuscitation of patients with massive brain injuries that until recently had been assumed to be unsalvageable. This article reviews the history, organization, and evolution of neurocritical care, and emphasizes the rationale for neurocritical care teams serving as the focal point for all hospital-based neuroscience centers of excellence.

History of neurointensive care

The specialty of neurocritical care was developed to fulfil practical needs for neurological patients in tertiary medical centers. Over the past 10 years the field has evolved from a niche specialty limited to the largest tertiary care teaching hospitals into a distinct medical specialty that links neurology, neurosurgery, and critical care medicine in the comprehensive management of complex and life-threatening neurological problems.

The true origins of the specialty go back to the European poliomyelitis epidemics of the mid-20th century. Specialized wards such as the Spalding and Crampton respirat-

Clinical Review & Education

JAMA Neurology | Review

Neurocritical Care Outcomes, Research, and Technology
A Review

Katharina Maria Busl, MD, MS; Thomas P. Bleck, MD; Panayiotis N. Varelas, MD, PhD

IMPORTANCE Neurocritical care has grown into an organized specialty that may have consequences for patient care, outcomes, research, and neurointensive care (neuroICU) technology.

OBSERVATIONS Neurocritical care improves care and outcomes of the patients who are neurocritically ill, and neuroICUs positively affect the financial state of health care systems. The development of neurocritical care as a recognized subspecialty has fostered multidisciplinary research, neuromonitoring, and neurocritical care information technology with advances and innovations in practice and progress.

CONCLUSIONS AND RELEVANCE Neurocritical care has become an important part of health systems and an established subspecialty of neurology. Understanding its structure, scope of practice, consequences for care, and research are important.

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Neurocritical care (NCC) is a specialty drawing professionals with background training in neurology, neurosurgery, anesthesiology, internal medicine, and emergency medicine. Since the 1980s, NCC has grown into an organized subspecialty with establishment of neurointensive care units (neuroICUs) and professional organizations. The most prominent dedicated society, the Neurocritical Care Society (NCS), founded in 2002, counts more than 2500 members, with neurologists comprising the largest primary specialty (Rakela Miller, NCS, written communication, June 5, 2018).

Neurocritical care education varies among different countries. In the United States, neurocritical care subspecialization can be pursued through fellowship training after completion of residency training in neurology, neurosurgery, anesthesiology, internal medicine, or emergency medicine, or as additional training after completing a critical care fellowship program. Fellowships are accredited by 2 organizations, United Council for Neurologic Subspecialties (UCNS) and, for neurosurgeons, Committee on Advanced Subspecialty Training. Currently, there are 68 UCNS-accredited neurocritical care programs and 22 Committee on Advanced Subspecialty Training programs, the numbers are growing. Among 1374 UCNS-certified diplomats in neurocritical care, 576 (41.9%) are board-certified neurologists (Becky Swanson, UCNS, written communication, April 17, 2018). Following efforts to integrate neurocritical care with other subspecialties, neurocritical care has recently been approved as a subspecialty by the American Board of Medical Specialties. It is yet to be seen how this approval will affect organization and education.

In other countries, the proportion of neurologists within the pool of neurointensivists varies, but independently, the addition of neurocritical care has opened a new career path to neurologists that is in growing demand. Within the specialty of neurology, neurocritical care education has also become a part of education during residency. As an example, neurocritical care elements required for neurology residency programs in the United States are given in the Box.[1,2]

NeuroICUs and Neurocritical Care Teams

Most neuroICUs are combined neurologic-neurosurgical units. The 3 common ICU—models open, semi-open/semi-closed, and closed—are outlined in Table 1. A closed or semi-open ICU with mandatory intensivist consultation is also called a high-intensity staffing unit, compared with a low-intensity staffing unit with elective or no intensivist consultation. Although many neuroICU services function as assigned beds within the ICU environment without a dedicated unit, most modern neuroICUs are housed as a separate entity. Intensive care team composition varies depending on the unit model and often differs between academic and nonacademic medical centers. In addition to the intensivist, the team may include house staff of various training programs as well as, in growing number, advanced practice providers. Access to specialized support staff is essential, such as a critical care pharmacist, respiratory therapist, dietitian/nutrition specialist, case management and social worker, as well as physical, occupational, and speech language therapists. Optimal staffing varies with the type of ICU. With growing involvement of advanced practice providers and establishment of neuroICUs, more data are expected to shed light on optimal models.[3] The structural and practical organization of neuroICUs and teams vary in other countries, and most data and organizational descriptions available in the literature and presented herein pertain to North America.

2.- ¿Son necesarias las unidades de Neurocríticos?

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A Review

Katherine Marie Bird, MD, MS; Thomas P. Bleck, MD; Panayiotis N. Varelas, MD, PhD

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jamaneurology.com

Table 2. Outcomes of Neurocritical Care

Disease	Outcome	Source
Ischemic stroke	Decreased hospital LOS, decreased ICU LOS, increased odds for better discharge disposition, increased rate of return to prestroke function at 3 mo	Bershad et al,[10] 2008; Varelas et al,[11] 2008; Knopf et al,[12] 2012
Intracerebral hemorrhage	Decreased ICU LOS, decreased in-hospital mortality, decreased mortality, decreased or no change in short- and long-term outcomes	Varelas et al,[11] 2008; Diringer and Edwards,[13] 2001; Mirski et al,[14] 2001; Knopf et al,[12] 2012
Subarachnoid hemorrhage	Increased rate of good functional recovery of patients with high-grade SAH, decreased hospital LOS, decreased or slightly increased ICU LOS, decreased rate of ventriculoperitoneal shunting, decreased or no change in in-hospital mortality, increased rate of favorable disposition	Lerch et al,[15] 2006; Varelas et al,[11] 2008; Josephson et al,[16] 2010; Knopf et al,[12] 2012; Egawa et al,[17] 2016
Traumatic brain injury	Decreased mortality, increased rate of good functional recovery, increased odds for better discharge disposition, decreased hospital LOS, increased quality of life	Elf et al,[18] 2002; Patel et al,[19] 2002; Varelas et al,[20] 2006; Grieve et al,[21] 2016; Ryu et al,[22] 2017

Abbreviations: ICU, intensive care unit; LOS, length of stay; SAH, subarachnoid hemorrhage; TBI, traumatic brain injury.

Table 3. Multimodal Monitoring in the NeuroICU

Monitoring Modality	Indication or Application[a]	Source
ICP and CPP	Protocol-driven care in patients at risk of elevated ICP based on clinical and/or imaging features; guidance of medical/surgical interventions; detection of imminent herniation	Alali et al,[37] 2013; Dawes et al,[38] 2015; Gerber et al,[39] 2013; Talving et al,[40] 2013
Cerebral perfusion	Monitoring, assessment of autoregulation in broad targeting of cerebral perfusion management goals and prognostication	Steiner et al,[41] 2002
Cerebral oxygenation	Patients with or at risk for cerebral ischemia and/or hypoxia; guidance of ICP/CPP therapy; management of DCI	Ponce et al,[42] 2012
Cerebral blood flow	Prediction of angiographic vasospasm after aneurysmal SAH with TCD or TCCS	Turek et al,[43] 2012
Cerebral metabolism	Patients with or at risk of cerebral ischemia, hypoxia, energy failure, and glucose deprivation	Marcoux et al,[44] 2008; Timofeev et al,[45] 2011; Vespa et al,[46] 2016
Continuous EEG	All patients with acute brain injury and unexplained and persistent altered consciousness; refractory status epilepticus; therapeutic hypothermia; detection of DCI in SAH	Beuchat et al,[47] 2018; Claassen et al,[48] 2004; Claassen et al,[49] 2013; Rosenthal et al,[50] 2018

Abbreviations: CPP, cerebral perfusion pressure; DCI, delayed cerebral ischemia; EEG, electroencephalography; ICP, intracranial pressure; neuroICU, neurointensive care unit; SAH, subarachnoid hemorrhage; TBI, traumatic brain injury; TCCS, transcranial color-coded duplex sonography; TCD, transcranial Doppler ultrasonography.

[a] As suggested in international multidisciplinary consensus guidelines on multimodality monitoring in neurocritical care.[51]

2.- ¿Son necesarias las unidades de Neurocríticos?

REVIEW

1

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DOI:10.1097/MCC.0000000000000076

Neurocritical care: why does it make a difference?

Andreas H. Kramer[a] and David A. Zygun[b]

Evaluación de estudios observacionales de mas de 40000 pacientes

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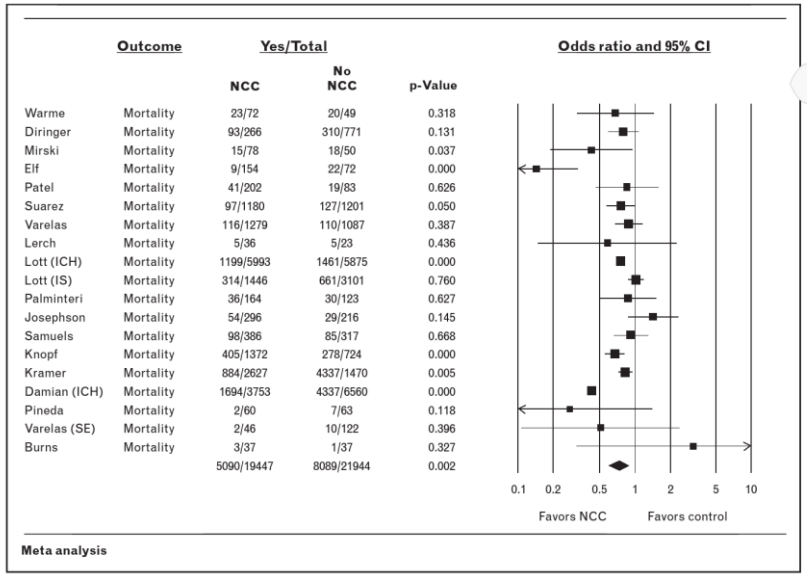
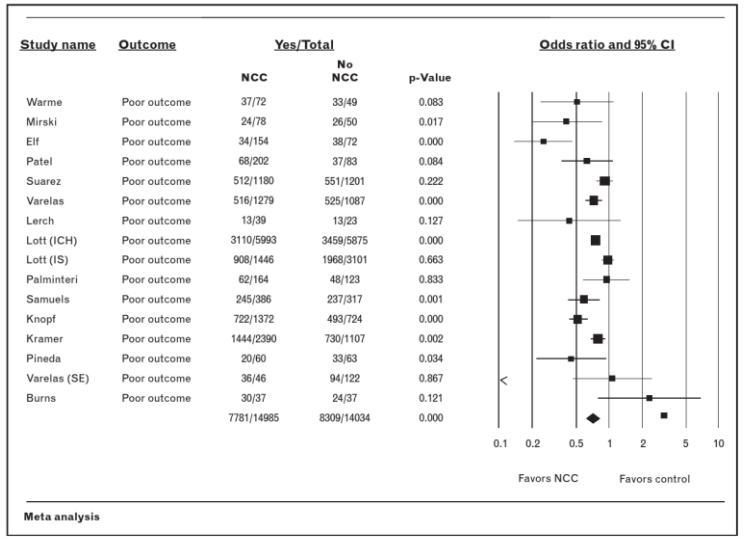


	Outcome	Yes/Total NCC	Yes/Total No NCC	p-Value
Warme	Mortality	23/72	20/49	0.318
Diringer	Mortality	93/266	310/771	0.131
Mirski	Mortality	15/78	18/50	0.037
Elf	Mortality	9/154	22/72	0.000
Patel	Mortality	41/202	19/83	0.626
Suarez	Mortality	97/1180	127/1201	0.050
Varelas	Mortality	116/1279	110/1087	0.387
Lerch	Mortality	5/36	5/23	0.436
Lott (ICH)	Mortality	1199/5993	1461/5875	0.000
Lott (IS)	Mortality	314/1446	661/3101	0.760
Palminteri	Mortality	36/164	30/123	0.627
Josephson	Mortality	54/296	29/216	0.145
Samuels	Mortality	98/386	85/317	0.668
Knopf	Mortality	405/1372	278/724	0.000
Kramer	Mortality	884/2627	4337/1470	0.005
Damian (ICH)	Mortality	1694/3753	4337/6560	0.000
Pineda	Mortality	2/60	7/63	0.118
Varelas (SE)	Mortality	2/46	10/122	0.396
Burns	Mortality	3/37	1/37	0.327
		5090/19447	8089/21944	0.002

FIGURE 1. Observational studies comparing mortality between specialty neurological ICUs and alternative models of care.



Study name	Outcome	Yes/Total NCC	Yes/Total No NCC	p-Value
Warme	Poor outcome	37/72	33/49	0.083
Mirski	Poor outcome	24/78	26/50	0.017
Elf	Poor outcome	34/154	38/72	0.000
Patel	Poor outcome	68/202	37/83	0.084
Suarez	Poor outcome	512/1180	551/1201	0.222
Varelas	Poor outcome	516/1279	525/1087	0.000
Lerch	Poor outcome	13/39	13/23	0.127
Lott (ICH)	Poor outcome	3110/5993	3459/5875	0.000
Lott (IS)	Poor outcome	908/1446	1968/3101	0.663
Palminteri	Poor outcome	62/164	48/123	0.833
Samuels	Poor outcome	245/386	237/317	0.001
Knopf	Poor outcome	722/1372	493/724	0.000
Kramer	Poor outcome	1444/2390	730/1107	0.002
Pineda	Poor outcome	20/60	33/63	0.034
Varelas (SE)	Poor outcome	36/46	94/122	0.867
Burns	Poor outcome	30/37	24/37	0.121
		7781/14985	8309/14034	0.000

FIGURE 2. Observational studies comparing the proportion of patients developing poor outcomes between specialty neurological ICUs and alternative models of care.

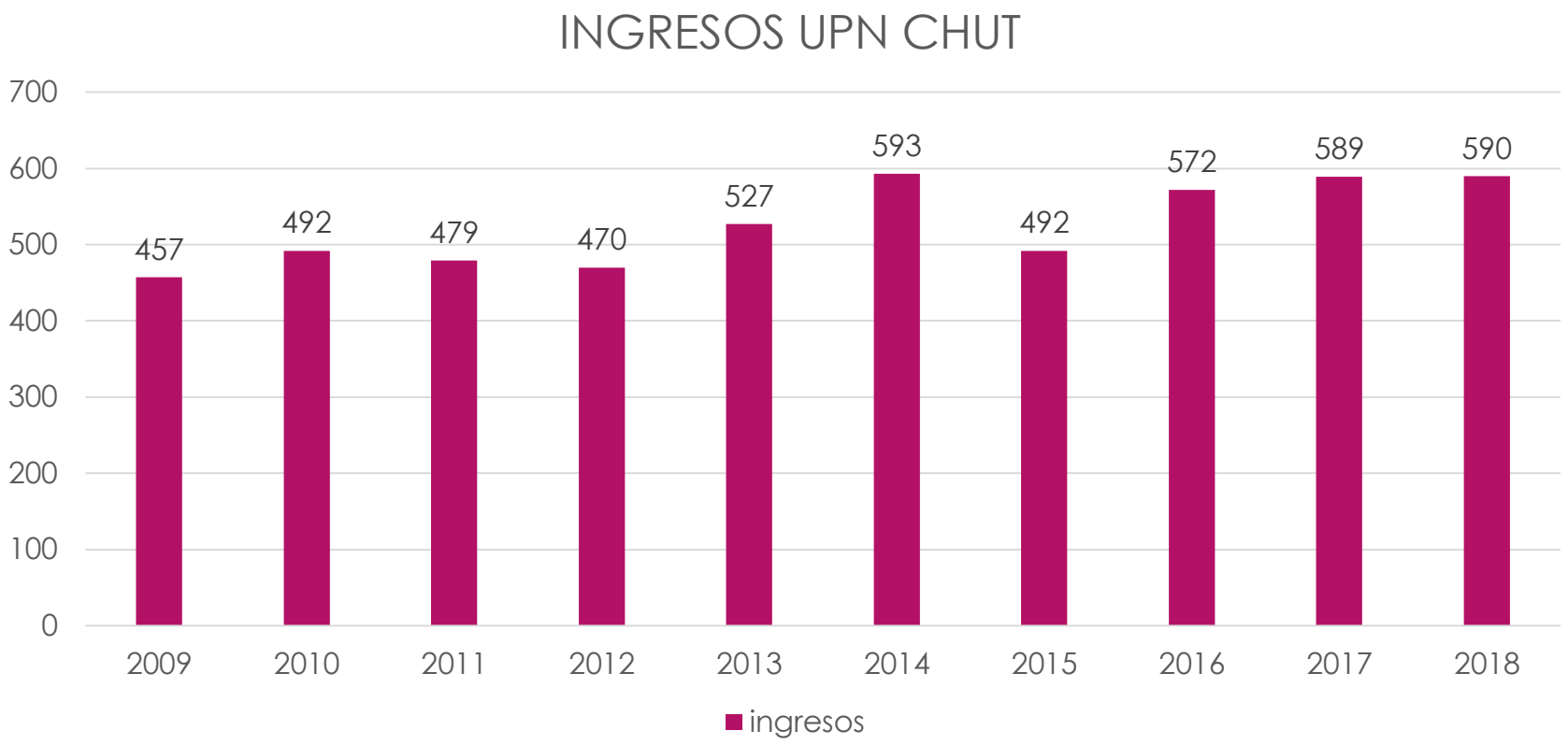
2.- ¿Son necesarias las unidades de Neurocríticos?

Como pueden explicarse estos resultados?

1.- Mayor volumen de pacientes
2.- Mayor adherencia a protocolos
3.- Interpretación habitual de los datos de neuromonitorización

4.- Evalución pronóstica menos nihilista…

2.- ¿Son necesarias las unidades de Neurocríticos?



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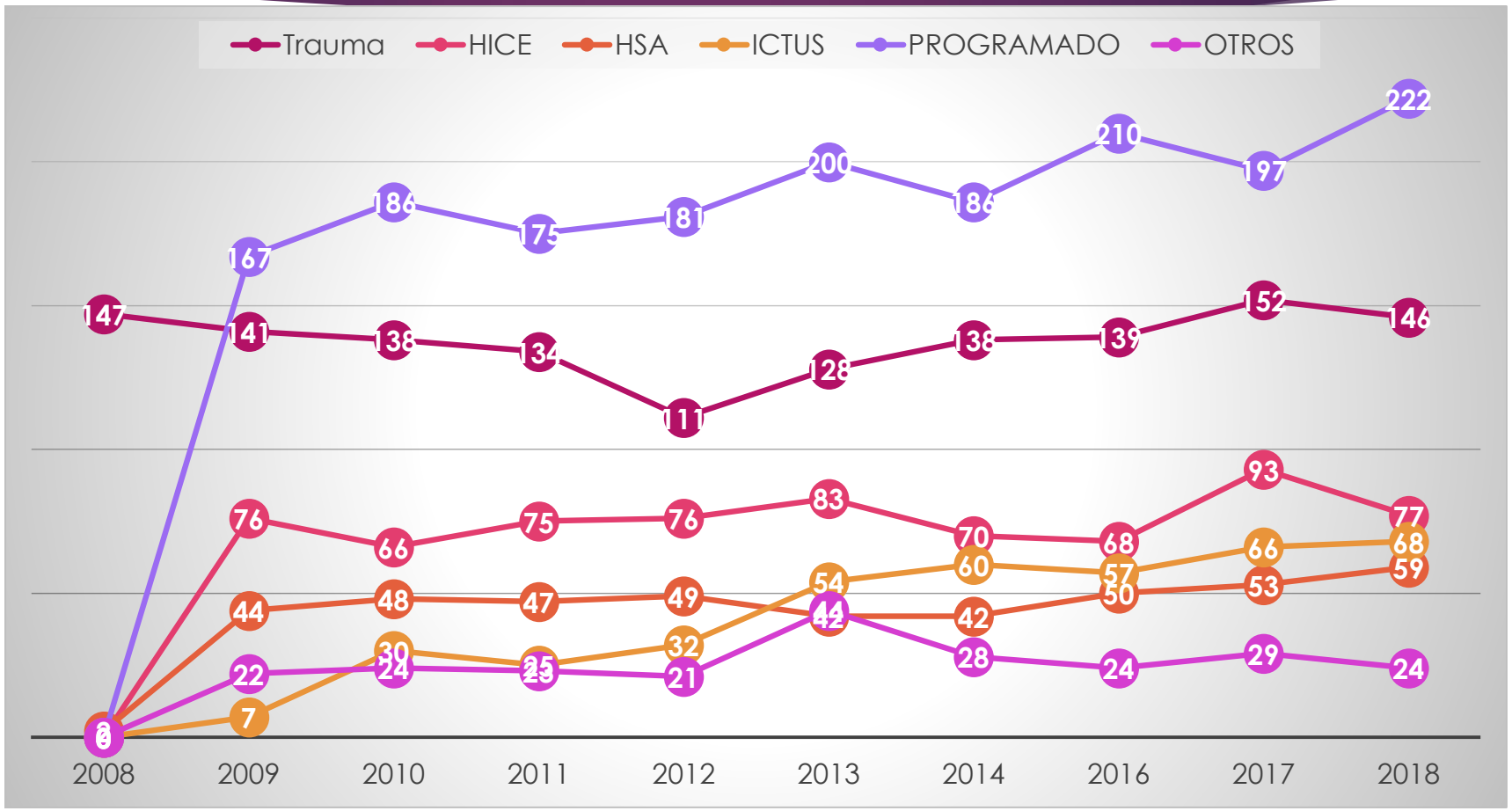

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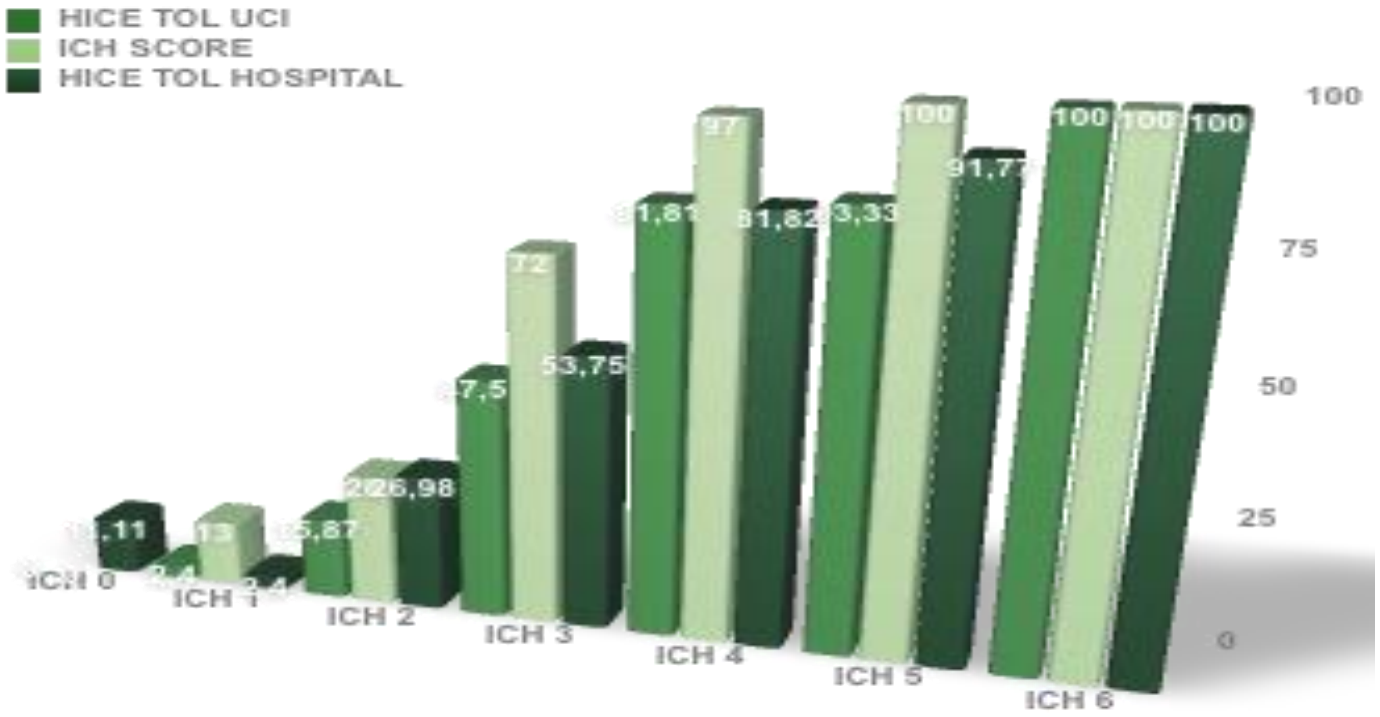
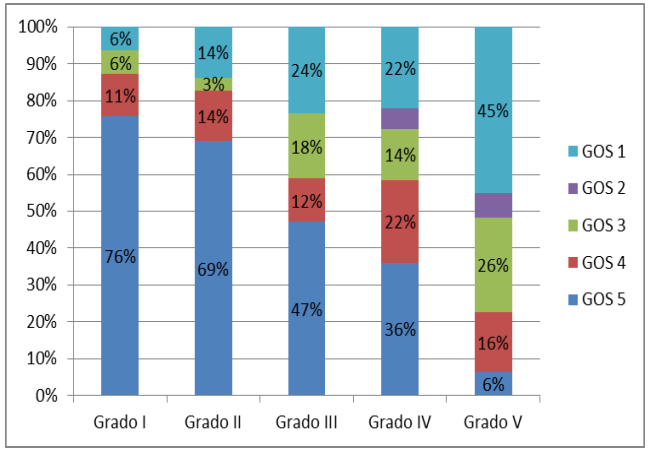
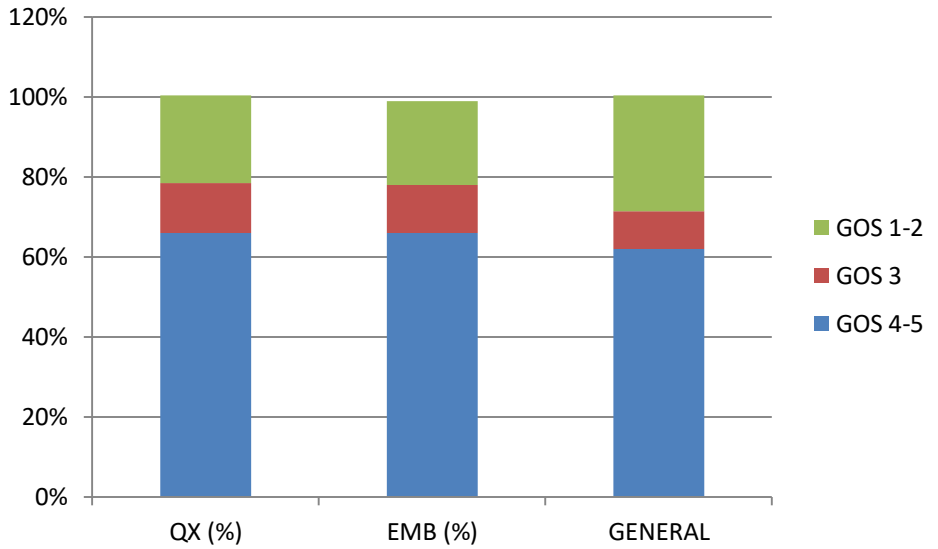


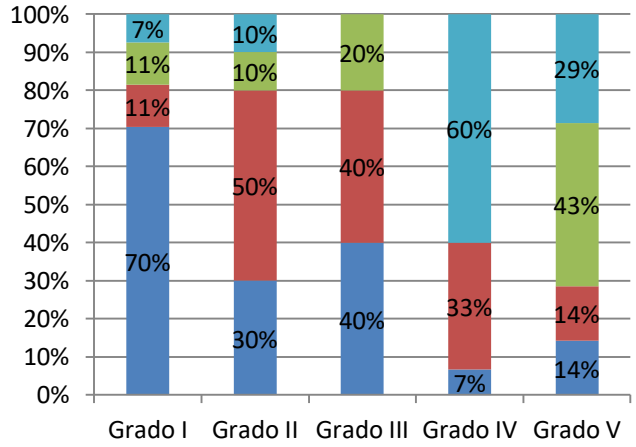
Cortesía Dra María Magro

2.- ¿Son necesarias las unidades de Neurocríticos?



Embolización





NQX

Datos HSA UPN CHUT.
Cortesía Dra María José Sánchez Carretero

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Indicaciones de Neuromonitorización en críticos:

- **Detección precoz de lesión secundaria después de una lesión cerebral:**
  - Hipertensión intracraneal.
  - Disminución presión de perfusión cerebral
  - Alteraciones metabólicas cerebrales.
  - Hipoxemia cerebral.
  - Crisis convulsivas y no convulsivas.

- **Guiar de forma específica la terapia al paciente:**
  - Optimizar PIC y PPC.
  - Optimizar oxigenación cerebral
  - Optimizar a portes metabólicos cerebrales
  - Monitorizar flujo sanguíneo cerebral
  - Optimizar tratamiento anticonvulsivo.
  - Pronóstico

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

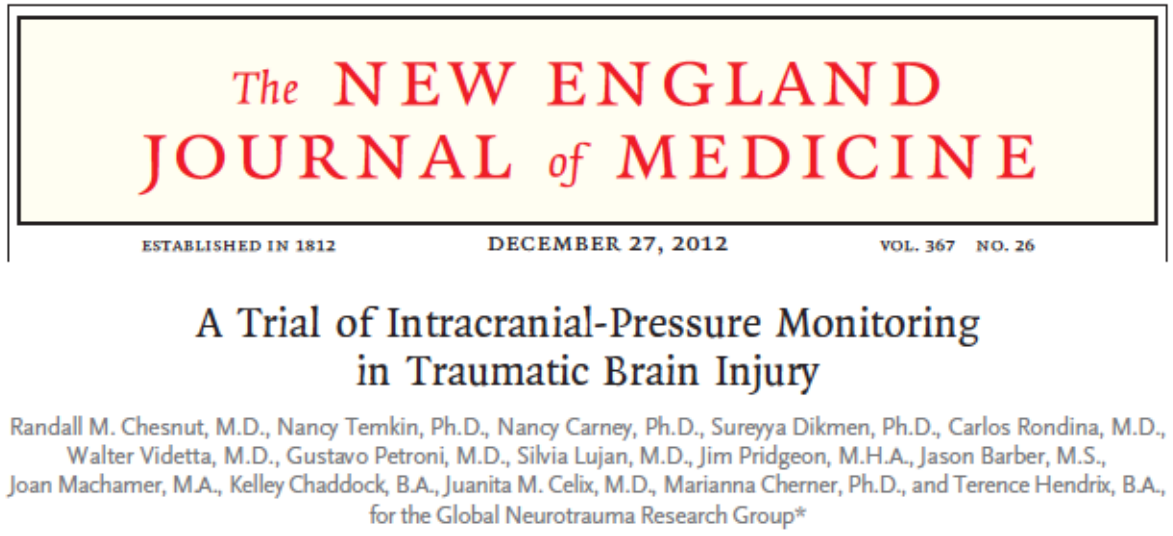
Tipos de neuromonitorización:

- **Monitorización de Presiones:**
  - PIC invasiva.
  - Estimación de la PIC
    - DTC e IP.
    - Diámetro del Nervio óptico por ECO o TC
- **Oxigenación cerebral:**
  - NIRS.
  - PtiO2
  - SjO2
- **Autorregulación cerebral:**
  - ICP +: PRx, Orx, Mx, COx
- **Flujo sanguíneo cerebral:**
  - DTC
  - Flujometría por difusión térmica
- **Actividad bioeléctrica cerebral:**
  - EEG continuo y discontinuo
  - BIS
  - Monitorización despolarizaciones corticales
- **Metabolismo cerebral:**
  - Microdiálisis cerebral

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Sin olvidar…

- Exploración clínica
- Pruebas de imagen: TC



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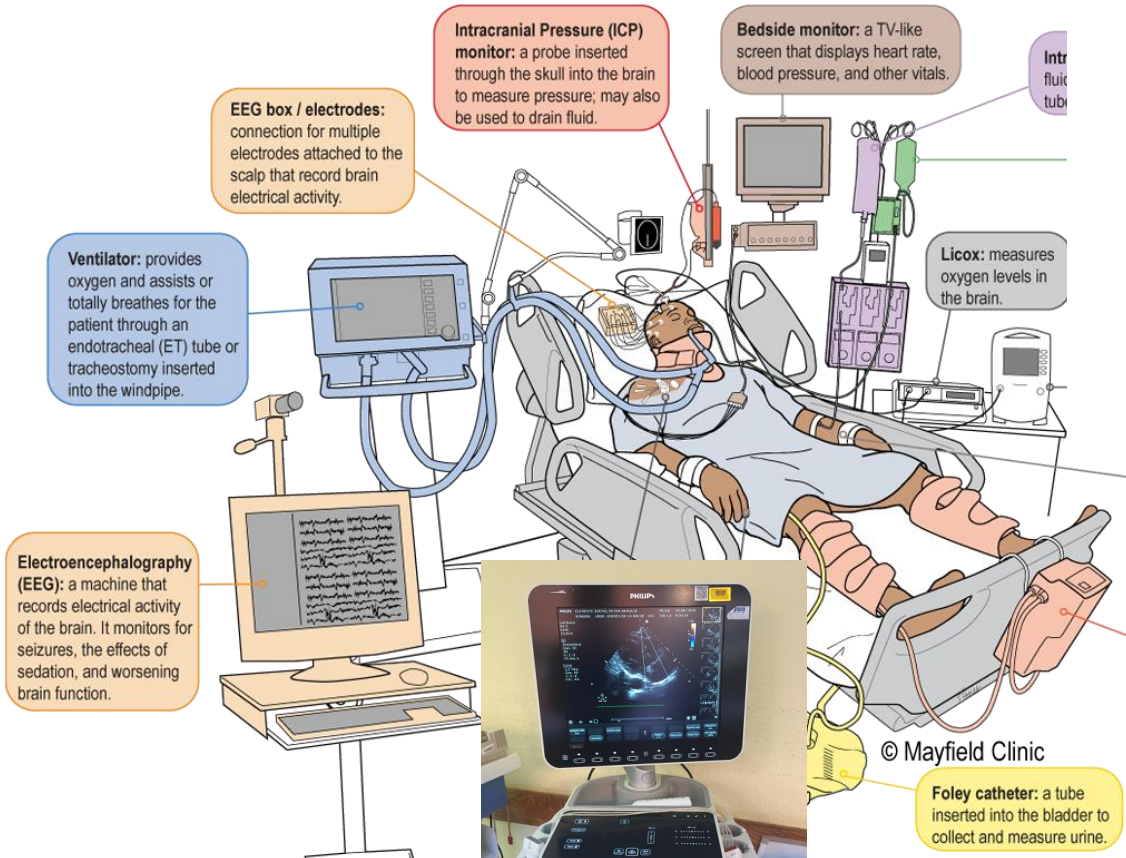
ESTABLISHED IN 1812 DECEMBER 27, 2012 VOL. 367 NO. 26

A Trial of Intracranial-Pressure Monitoring in Traumatic Brain Injury

Randall M. Chesnut, M.D., Nancy Temkin, Ph.D., Nancy Carney, Ph.D., Sureyya Dikmen, Ph.D., Carlos Rondina, M.D., Walter Videtta, M.D., Gustavo Petroni, M.D., Silvia Lujan, M.D., Jim Pridgeon, M.H.A., Jason Barber, M.S., Joan Machamer, M.A., Kelley Chaddock, B.A., Juanita M. Celix, M.D., Marianna Cherner, Ph.D., and Terence Hendrix, B.A., for the Global Neurotrauma Research Group*

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?



3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Duplex transcraneal (DTC)

Fortalezas:

- A pie de cama y reproducible . No invasiva
- Alta resolución a bajo coste
- Relativamente fácil de interpretar.

Debilidades:

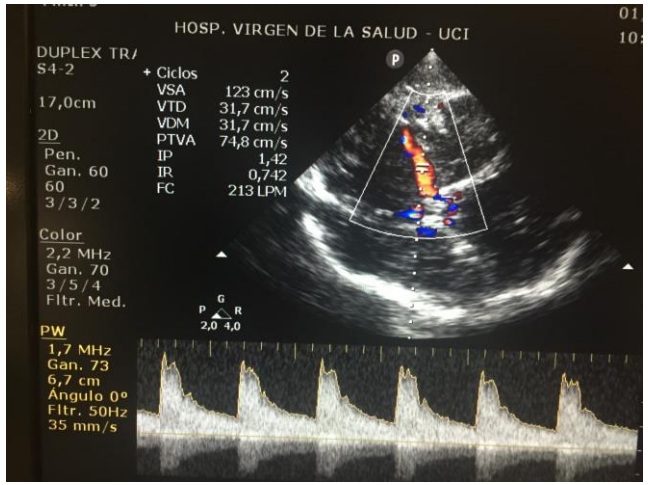
- Variabilidad interoperador
- Necesidad de entrenamiento
- Resolución espacial limitada.
- Un 20% pueden tener mala ventana acústica

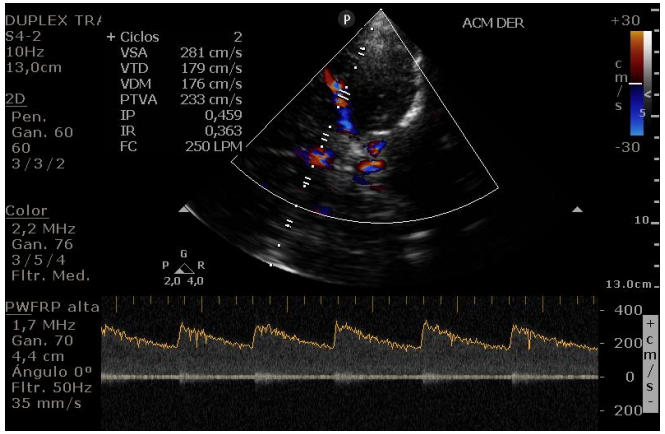
Indicaciones:

- HSA
- Estimación de la PIC
- Diagnóstico de muerte encefálica
- Monitorización de autorregulación cerebral
- Evaluación morfológica cerebral

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Duplex transcraneal (DTC)

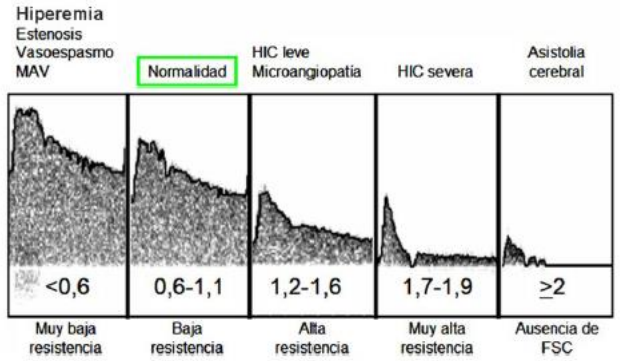




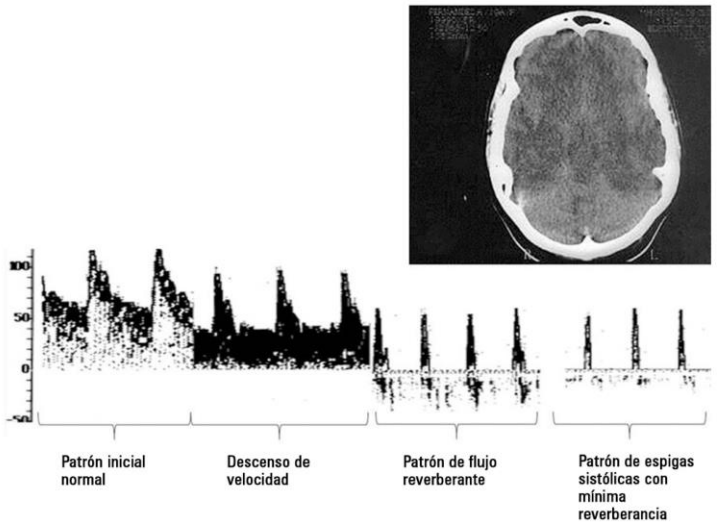
3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Duplex transcraneal (DTC)

EVALUACIÓN PIC



PARO CIRCULATORIO



3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Duplex transcraneal (DTC)

- Monitorización DTC o DTC-color para predecir vasoespasmo angiográfico después HSA aneurismática.
- Tendencias DTC o DTC-C pueden predecir déficits neurológicos secundarios isquemia tardía por VSC tras HSA aneurismática.
- DTC-C es superior a DTC en la detección de vasoespasmo angiográficamente significativo después HSA aneurismática.
- DTC o DTC-C pueden ayudar a predecir vasoespasmo después de HSA traumática.
- Screening con DTC mediante índice Lindegaard o comparación de V_M en ambas ACM para mejorar la sensibilidad para la detección de isquemia cerebral secundaria a vasoespasmo.
- Flujometría de difusión térmica (FDT) podría emplearse en pacientes con riesgo de isquemia cerebral focal.
- Sonda FDT empleada para valorar riesgo de isquemia tras HSA aneurismática debería ser colocada en el territorio vascular del aneurisma roto.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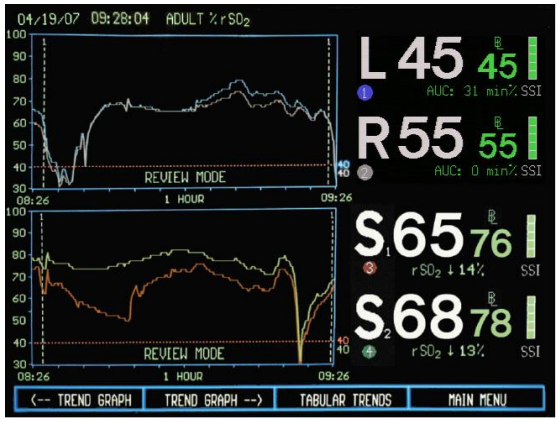
3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

NIRS



El NIRS está pensado para uso como monitor adyuvante de la saturación regional de oxígeno de la hemoglobina sanguínea en el cerebro o en otros tejidos bajo el sensor.

Actualmente indicado para monitorizar situaciones de isquemia cerebral en cirugía cardiaca

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

NIRS

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Validation of Near-Infrared Spectroscopy for Monitoring Cerebral Autoregulation in Comatose Patients

Lucia Rivera-Lara, MD[a,b], Romergryko Geocadin, MD[a,b], Andres Zorrilla-Vaca[b,c], Ryan Healy, BSc[b], Batya R. Radzik, CRNP[b], Caitlin Palmisano, CRNP[b], Marek Mirski, MD, PhD[a], Wendy C. Ziai, MD, MPH[*,a,b], and Charles Hogue, MD[*,d]

[a]Department of Neurology, Johns Hopkins University School of Medicine. Baltimore, Maryland. 21287

Buena correlación en la medición de la autorregulación comparado con la Mx

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

NIRS

Intensive Care Med (2010) 36:1309–1317
DOI 10.1007/s00134-010-1920-7

ORIGINAL

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Vicente Padilla
Carmen Ferrándiz-Millón
Yael Corcia
Claudio García-Alfaro
Rosario Amaya-Villar
Francisco Murillo-Cabezas

Invasive and noninvasive assessment of cerebral oxygenation in patients with severe traumatic brain injury

Table 5 Sensitivity, specificity, and positive (PPV) and negative (NPV) predictive values of the optimal rSO_2 cutoff in differentiating patients with moderate ($PbrO_2$ ≤15 mmHg) and severe ($PbrO_2$ ≤12 mmHg) intracerebral hypoxia

	Sensitivity	Specificity	PPV	NPV	LR+	LR−
$PbrO_2$ ≤12 mmHg						
(I) rSO_2 ≤60%	73 (67–78)	86 (85–87)	4 (3.3–4.3)	99.7 (99.6–99.8)	5.3	0.3
(C) rSO_2 ≤60%	28 (24–34)	89.8 (89.5–90)	2 (1.6–2.5)	99.4 (99.3–99.5)	2.8	0.7
$PbrO_2$ ≤15 mmHg						
(I) rSO_2 ≤70%	62 (60–64)	49 (48–50)	5.4 (5.1–5.6)	96.4 (96.1–96.7)	1.2	0.8
(C) rSO_2 ≤70%	52 (50–54)	69.7 (69.3–70)	7.6 (7.1–8)	96.8 (96.6–97)	1.7	0.6
(I) rSO_2 ≤60%	32 (30–34)	87 (86–87)	10 (9–11)	96.4 (96.2–96.6)	2.4	0.8
(C) rSO_2 ≤60%	16 (14–18)	89.9 (89.7–90)	7 (6–8)	95.7 (95.5–96)	1.6	0.9

En TCE grave la ptiO2 y la rSO2 estas relacionas, mejor en hipoxemias graves que en moderadas, pero no puede sustituir a la medida invasiva.

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Monitorización EEGc

Continuous EEG monitoring: is it ready for prime time?

Pedro Kurtz[a,*], Khalid A. Hanafy[a,*] and Jan Claassen[a,b]

[a]Division of Neurocritical Care and [b]Comprehensive Epilepsy Center, Department of Neurology, Columbia University, Milstein Hospital, New York, New York, USA

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* Pedro Kurtz and Khalid A. Hanafy contributed equally to the writing of this article.

Current Opinion in Critical Care 2009, 15:99–109

Purpose of review
Continuous electroencephalography (cEEG) is being used more frequently in intensive care units to detect epileptic activity and ischemia. This review analyzes clinical applications and limitations of cEEG as a routine neuromonitoring tool.
Recent findings
cEEG is primarily used to detect nonconvulsive seizures, which are frequent and possibly associated with harm. Cerebral ischemia, such as that from vasospasm after subarachnoid hemorrhage, can be detected earlier by EEG and quantitative EEG (qEEG). Highly skilled technicians and subspecialty-trained physicians are needed to generate good quality EEG and to interpret these data. qEEG allows more efficient interpretation of large amounts of EEG and may trigger prespecified alarms. Currently, there is little high-quality data on cEEG to define indications, cost-saving potential, and impact on outcome. A few studies have demonstrated how cEEG can be integrated into multimodality brain monitoring of severely brain-injured patients.

Monitorización EEGc

- 8-20% of all ICU patients show NCSE [1,2,3]
- NCSE are 20-47%of all the SE [4,5]
- 48% of patients after Generalised Convulsive Status Epilepticus (GCSE) presented NCSE [6]
- Showing NCSE after CSE increases mortality x2 [6,7,8]
- 9% of electrographic seizures showed clinical signs detected by medical personnel in Neonatal ICU [9]

Non-Convulsive Status Epilepticus (NCSE)
20-47% of all SE

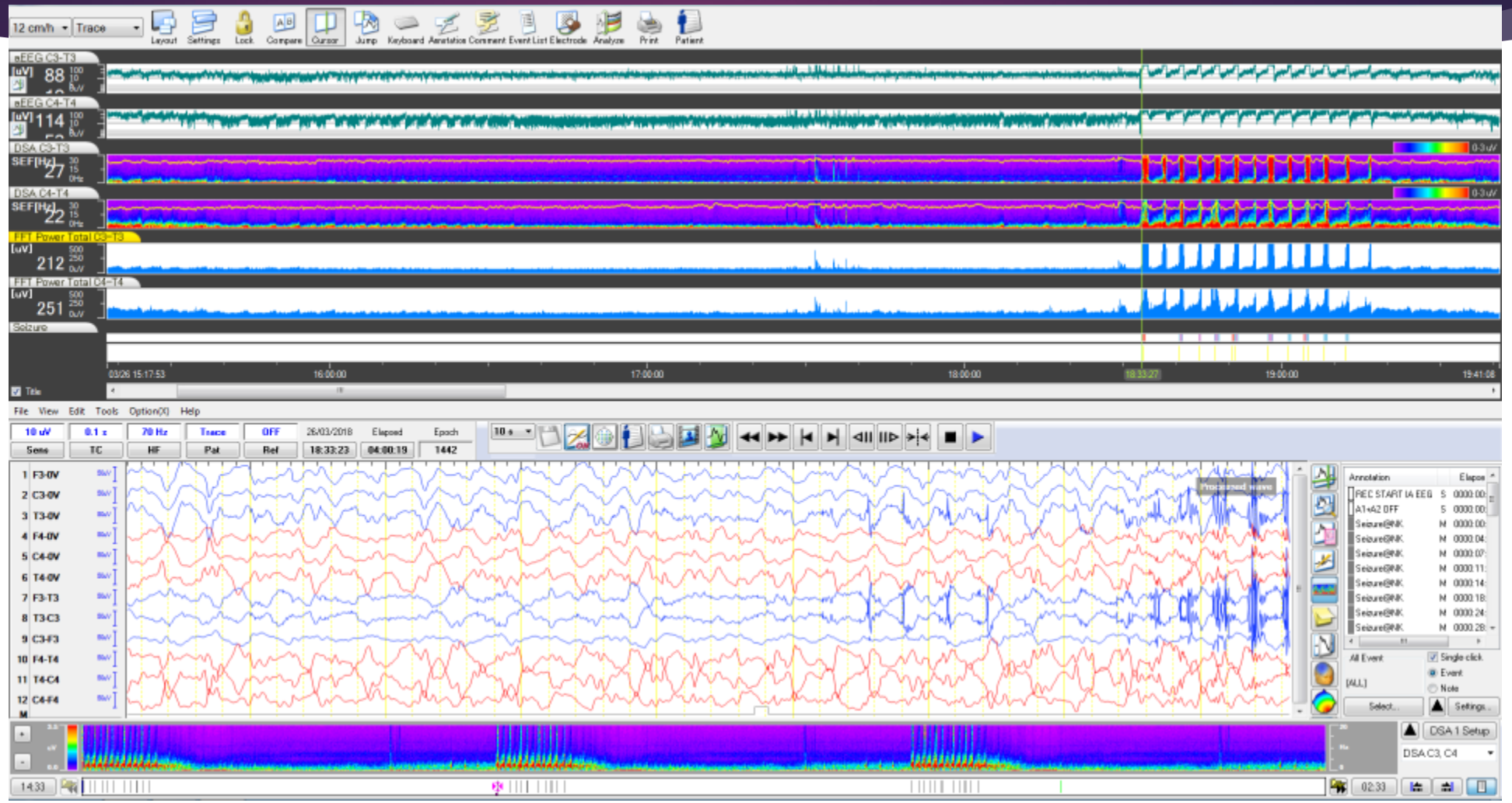
8-20% of all the ICU patients

Dunni 1987, Rudin 2011, Leccheo 2015, Towne, Vespa, Claasen

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

Monitorización EEGc

EEGc: Buscando descargas periódicas o puntas onda



3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?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Monitorización EEGc

- EEG en todos los pacientes con daño cerebral agudo y alteración del nivel de consciencia inexplicable y persistente.
- EEG urgente en estatus epiléptico 60 minutos tras administración de FAEs y en estatus epiléptico refractario.
- EEG durante hipotermia terapéutica y dentro de las primeras 24 horas de recalentamiento para excluir crisis no convulsivas en todo paciente en coma tras PCR.
- EEG en pacientes en coma sin sustrato neurológico con nivel de consciencia o déficits neurológicos inexplicables para excluir crisis no convulsivas, sobretodo en sepsis severa y fallo renal y/o hepático.
- EEG para detectar DCI en paciente en coma tras HSA cuando la exploración neurológica no es fiable.
- EEG continuo sobre EEG rutinario en pacientes en coma sin sustrato neurológico y nivel de consciencia o déficits neurológicos inexplicables para excluir crisis no convulsivas.

Cortesía Dra María Magro

3.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad polivalente?

World Journal of Hepatology

Submit a Manuscript: http://www.wjgnet.com/esps/
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DOI: 10.4254/wjh.v8.i22.915

World J Hepatol 2016 August 8; 8(22): 915-923
ISSN 1948-5182 (online)

REVIEW

Multimodal brain monitoring in fulminant hepatic failure

Fernando Mendes Paschoal Jr, Ricardo Carvalho Nogueira, Karla De Almeida Lins Ronconi, Marcelo de Lima Oliveira, Manoel Jacobsen Teixeira, Edson Bor-Seng-Shu

neurocritical care society Neurocrit Care (2017) 27:122–140
DOI 10.1007/s12028-016-0361-8

CrossMark

REVIEW ARTICLE

Noninvasive Neuromonitoring: Current Utility in Subarachnoid Hemorrhage, Traumatic Brain Injury, and Stroke

Luisa Vinciguerra[1] · Julian Bösel[2]

4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Monitorización Presión intracraneal

- Monitorización PIC y PPC cuando hay riesgo de PIC elevada de acuerdo con la clínica y/o hallazgos radiológicos.
- Monitorización PIC y PPC para guiar intervenciones médicas y quirúrgicas y detectar herniación inminente. El valor PIC incierto.
- Indicación y método para monitorizar PIC deben ser adaptados al diagnóstico.
- Monitorización PIC es un prerrequisito para la interpretación de otros datos proporcionados por otros dispositivos.
- Uso de protocolos de **inserción** y mantenimiento que aseguren la seguridad y fiabilidad del procedimiento.
- Sensor PIC y DVE proporcionan información fiable y exacta, se recomiendan para monitorizar PIC. Si hay hidrocefalia, usar DVE.
- Monitorización continua PIC y PPC. Mediciones intermitentes PIC deben ser interpretadas en el contexto clínico.
- HTIC refractaria es un predictor de mortalidad, pero PIC aislada no es buen marcador **pronóstico** funcional. No emplear PIC como **parámetro único, no es un buen marcador pronóstico**.


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4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Cortesía Dra María Magro

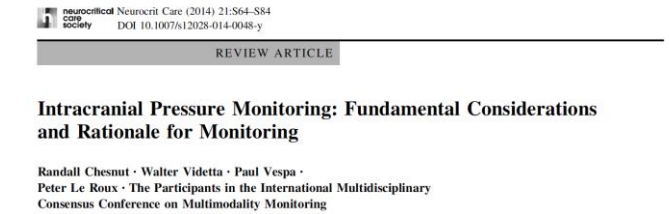
Monitorización Presión intracraneal

INDICACIONES MONITORIZACIÓN PIC Y PPC EN PACIENTES SIN TCE

SCG <8 | Edema cerebral | Deterioro neurológico | Efecto masa

- En **HSA**, las únicas indicaciones son **hidrocefalia obstructiva**, **monitorización perioperatoria**, **drenaje LCR** y **prerrequisito** para MMM. **DVE**, método de monitorización preferido en HSA con **hidrocefalia aguda**.
- En **HIC**, las indicaciones son **volumen HIC >30cc**, **hemorragia cerebelosa** e hidrocefalia obstructiva y **HIV** e hidrocefalia obstructiva.
- Podría ser considerada en meningitis/encefalitis, hipoxia cerebral, infarto isquémico y encefalopatía hepática.

- PIC y PPC deberían usarse en HSA, ICH y otras patologías no-TCE con riesgo de HTIC en función de los hallazgos clínicos y/o radiológicos.
- PIC **debería** considerarse en pacientes con riesgo de hidrocefalia o en aquellos con evidencia clínica y/o radiológica de hidrocefalia.
- Todos pobres grados HSA deberían ser monitorizados y considerados para monitorización cerebral multimodal.



4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Cortesía Dra María Magro

Monitorización oxigenación cerebral

- **Pulsioximetría en todos los pacientes y capnografía en los ventilador, además muestras seriadas de gases arteriales.**
- Monitorización O_2 cerebral en pacientes con o en riesgo de isquemia y/o hipoxia, empleando $PtiO_2$ o $SvjO_2$.
- Localización sonda $PtiO_2$ y de $SvjO_2$ depende del diagnóstico, tipo y localización de lesiones cerebrales, y factibilidad técnica.
- Aunque valores $PtiO_2$ y/o $SvjO_2$ bajos son predictores de mortalidad y resultados desfavorables, emplear la clínica y otros dispositivos de monitorización para un pronóstico exacto.
- Empleo monitorización O_2 cerebral para guiar manejo PIC y PPC, terapias médicas y quirúrgicas, identificar HTIC refractaria y los umbrales de tratamiento, ayudar en el manejo de DCI y seleccionar pacientes para segundas líneas de tratamiento.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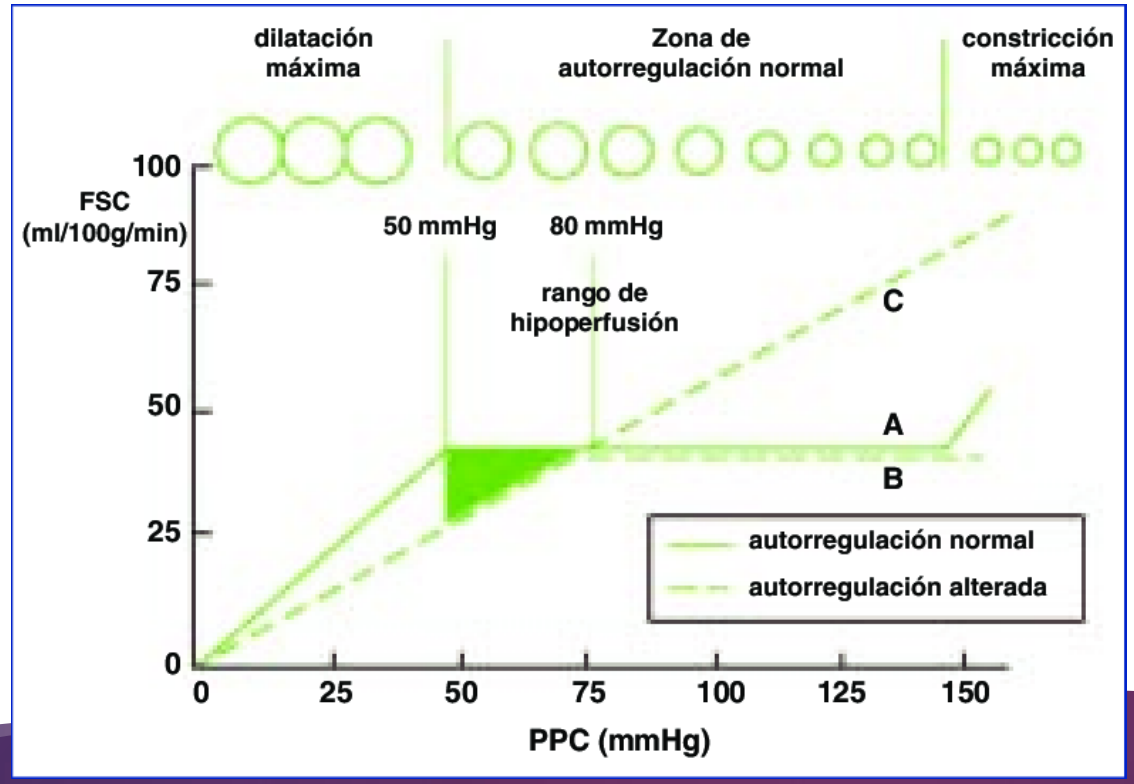
4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

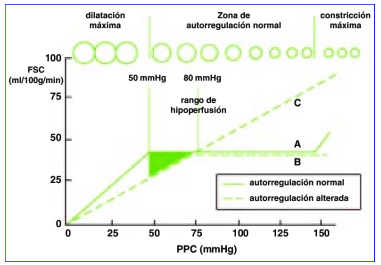
Cortesía Dra María Magro

Monitorización autorregulación cerebral



4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Monitorización autorregulación cerebral



- Monitorización y valoración de la autorregulación cerebral podría ser útil para alcanzar unos objetivos de perfusión cerebral y en el pronóstico del daño cerebral agudo.

- Monitorización continua a pie de cama de la autorregulación es posible, podría ser incluida dentro de monitorización multimodal.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4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Cortesía Dra María Magro

Monitorización metabolismo cerebral

- Microdiálisis cerebral en presencia o en riesgo de isquemia cerebral, hipoxia, déficit energético y deprivación de glucosa.
- Localización sonda de microdiálisis depende de: diagnóstico, tipo y localización de lesiones cerebrales y factibilidad técnica.
- Aunque glucemia cerebral baja y/o ratios lactato/piruvato elevados persistente son predictores de mortalidad y resultados desfavorables, microdiálisis debería emplearse en combinación con clínica y otros dispositivos de monitorización.
- Uso de microdiálisis cerebral para guiar el tratamiento médico, como el control glucemia, y de la isquemia cerebral tardía.
- Uso de microdiálisis cerebral para guiar la titulación de terapias médicas como transfusión, hipotermia terapéutica, hipocapnia e hiperoxia.


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4.- ¿Qué neuromonitorización puede hacer el intensivista en una unidad de neurocríticos?

Cortesía Dra María Magro

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Traumatismo craneoencefálico:

- Exploración e imagen TC
- Monitorización multimodal.
    - Monitorización de presión y oxigeno invasiva vs no invasiva.
    - Monitorización autorregulación: Recomendable.
    - Microdiálisis. Recomendable en centros con experiencia e investigación.
    - DTC. En fases iniciales y coadyuvante a la autorregualción.
    - EEG: Si coma no bien explicado. Si comicialidad

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Hemorragia subaracnoidea:

- Exploración e imagen TC
- Monitorización multimodal en altos grados (HH III a V).
    - DTC. A lo largo de todo el proceso en busca de vasoespasmo
    - Monitorización de presión y oxigeno invasiva vs no invasiva.
    - Monitorización autorregulación: Recomendable.
    - Microdiálisis. Posible en centros con experiencia e investigación.
    - EEG: Si coma no bien explicado. Si comicialidad.

6.- ¿Qué patologías son susceptibles de neuromonitorizar?

Hemorragia intraparenquimatosa:

- Exploración e imagen TC
- Monitorización multimodal poca evidencia clínica.
    - DTC. Monitorizando FSC
    - Monitorización PIC, con valores de PIC no muy bien establecidos
    - EEG: Si coma no bien explicado. Si comicialidad. Valorar EEGc

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Ictus isquémico:

- Exploración e imagen TC
- Monitorización multimodal: poca evidencia clínica.
    - DTC. Monitorizando FSC y arterias reperfundidas
    - Monitorización PIC, con valores de PIC no muy bien establecidos
    - EEG: Si coma no bien explicado. Si comicialidad. Valorar EEGc

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Encefalopatía anóxica:

- Exploración e imagen TC
- Monitorización multimodal: no evidencia clínica.
    - DTC. Evaluación de la PIC
    - EEG: Valorar EEG o EEGc. Altos niveles de comicialidad

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

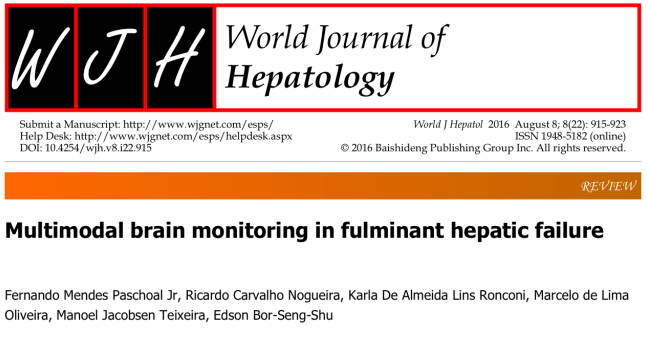
Meningitis/encefalitis:

- Exploración e imagen TC
- Monitorización multimodal: no evidencia clínica.
    - DTC. Evaluación del velocidades y posible desarrollo de hidrocefalia
    - EEG: Pacientes con riesgo de comicialidad. Si comicialidad. Valorar EEGc

5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Encefalopatía hepática:

- Exploración e imagen TC
- Monitorización multimodal: evidencia clínica en la monitorización de PIC.
    - DTC. Evaluación de la PIC y posible desarrollo de edema cerebral
    - Monitorización PIC continua. Evidencia clínica en grado III IV.
    - Monitorización oxigenación cerebral.
    - EEG: Si coma no bien explicado. Si comicialidad. V



5.- ¿Qué patologías son susceptibles de neuromonitorizar?

Encefalopatía séptica, metabólica:

- Exploración e imagen TC
- Monitorización multimodal: Ninguna evidencia.
    - EEG: Alto riesgo de crisis no convulsivas. Si comicialidad. Valorar EEGc
    - Podría tener lugar aquí el NIRS?

6.- ¿Cuáles son mis conclusiones?

- Debemos pensar en el cerebro de nuestros pacientes.
- Tenemos que saber "mirar" el cerebro como exploramos otros órganos y sistemas de nuestros pacientes
- El desarrollo de atención a enfermos neurocríticos puede mejorar el pronóstico de algunos grupos de pacientes.
- Los intensivistas debemos estar adiestrados en nuestra formación en neuromonitorización avanzada en enfermo neurocrítico.