6-17-2015

Prognosis of Neurological Injuries in the ICU

Michael Baram, MD
Thomas Jefferson University

Coma

Michael Baram, MD
Medical Intensivist

ECMO avoids COMA

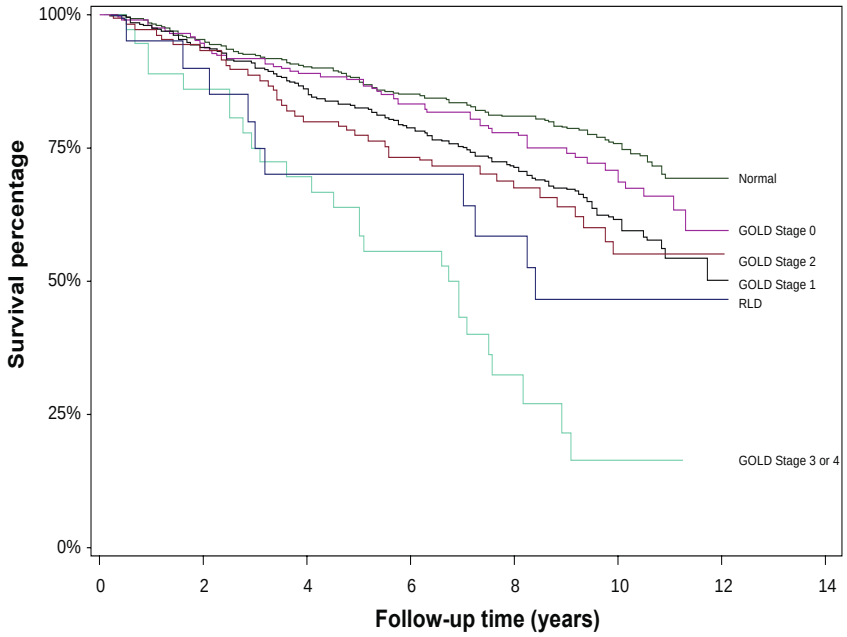
Objectives:

- Teach Medical Intensivists what evidence based medicine knows about prognostication post CNS – event.
- How can testing help?
- What can families expect?

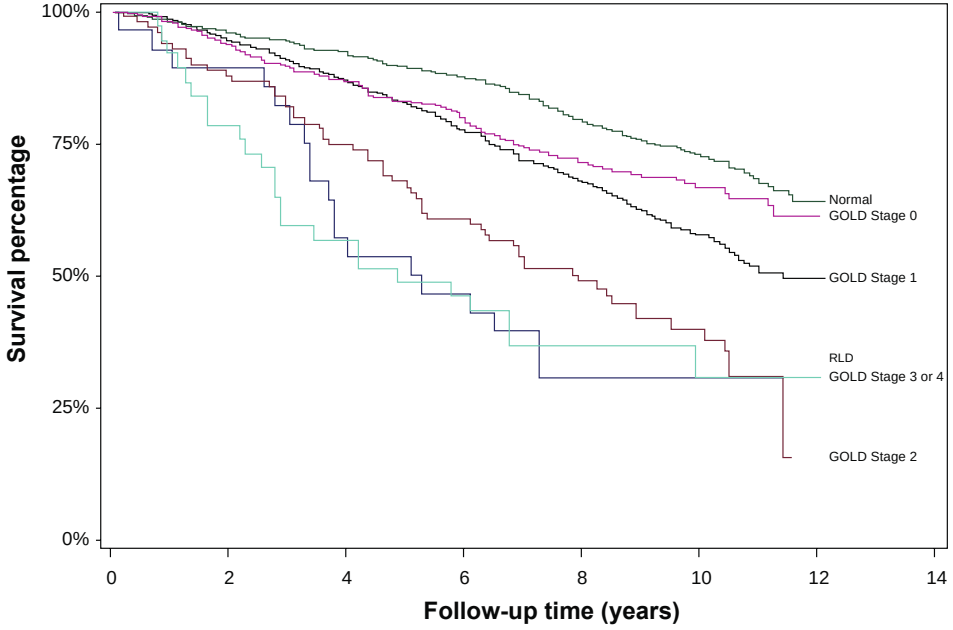
Overview:

- Tools to Use
- The Neuro-Consult
- Outcomes of Common Scenarios

Life expectancy and years of life lost in chronic obstructive pulmonary disease: Findings from the NHANES III Follow-up Study



Previous smokers



Current smokers

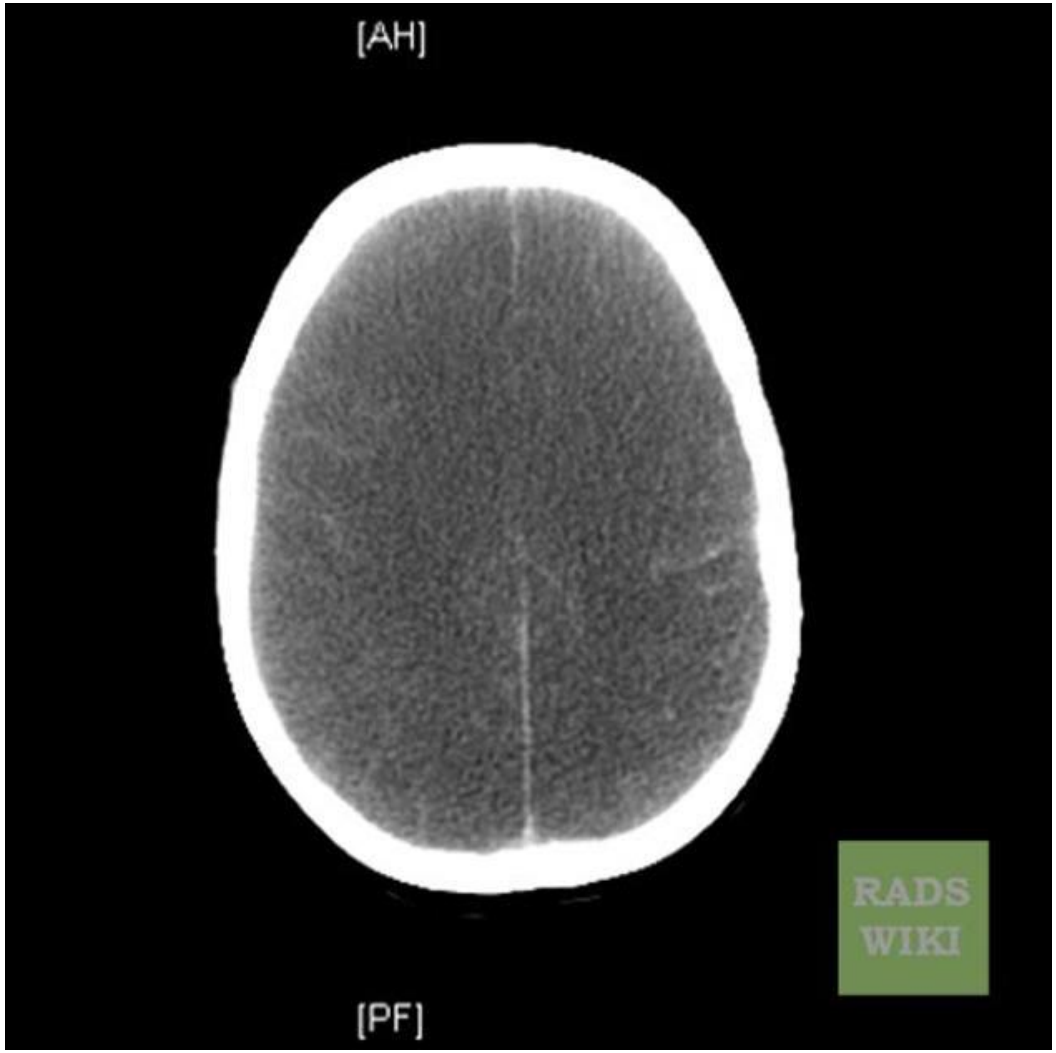
Consciousness, Coma, and Brain Death—2009

During the past 20 years, PVS and the minimal conscious state have been defined as being separate and identifiable from the comatose state. Positive developments include reports of patients in PVS regaining consciousness within a few weeks. Consciousness may be regained after being in PVS within the first 6 months, although regaining consciousness after 1 year in PVS is infrequent. Additional issues involve recovery of consciousness and recovery of function. The former refers to regaining wakefulness, awareness, and self-awareness. The latter includes meaningful interaction and comprehensiveness with others and the environment, the ability to learn, care for self, and participation in life's activities. Clearly, a meaningful and functional return to consciousness occurs with regularity from PVS and also from the minimal conscious state. It is, therefore, vital for the clinician to observe and recognize a patient's emergence from PVS into the minimal conscious state and to provide maximal clinical support with psychological and physical rehabilitation to allow for the possibility of full consciousness to develop.[1-3,7,8]

JAMA. 2009;301(11):1172-1174.
doi:10.1001/jama.2009.224.

Tools to Help

Imaging



Fever

Each degree above 37degrees Celsius:

2 x more likely to die or remain in vegetative State after 6 months

Zeiner A. Hyperthermia After Cardic Arrest Is Associated With an Unfavorable Neurologic Outcome. Archives of internal medicine. 2001;161:6.

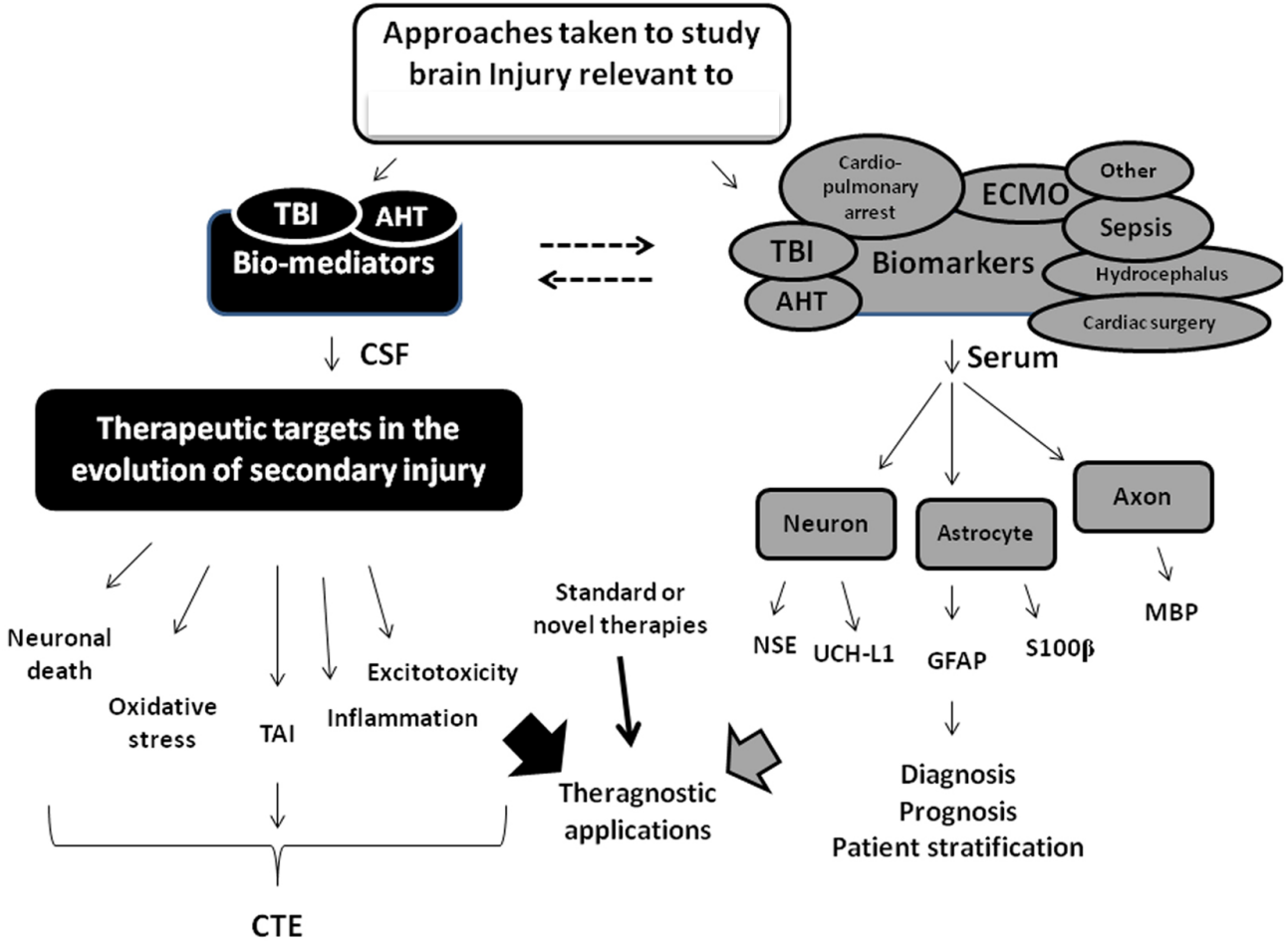
EEGs

Table 1 EEG grading system for cEEG findings following cardiac arrest

Mild (grade 1)	Moderate (grade 2)	Severe (grade 3)
Excess beta	Diffuse or focal delta slowing	Burst suppression pattern
Theta slowing	SIRPIDS	Low voltage output pattern (≤10 μV)
Anesthetic pattern	ELAE	Alpha/theta coma
	Spindle coma	Focal or generalized seizures
	Interictal epileptiform discharges	Nonreactive to stimuli
	Generalized triphasic waves	GPED
	FIRDA, TIRDA, OIRDA	Status epilepticus
	PLED	

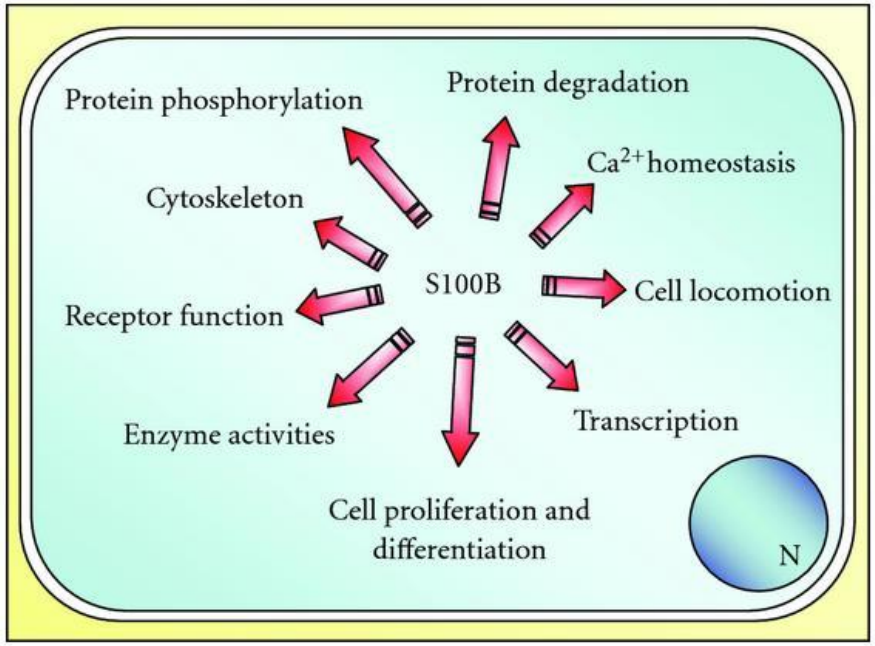
Abbreviations: cEEG = continuous EEG; ELAE = episodic low-amplitude events; FIRDA = frontal intermittent rhythmic delta activity; GPED = generalized periodic epileptiform discharges; OIRDA = occipital intermittent rhythmic delta activity; PLED = periodic lateralized epileptiform discharges; SIRPIDS = stimulation-induced rhythmical, periodic, or ictal discharges; TIRDA = temporal intermittent rhythmic delta activity.

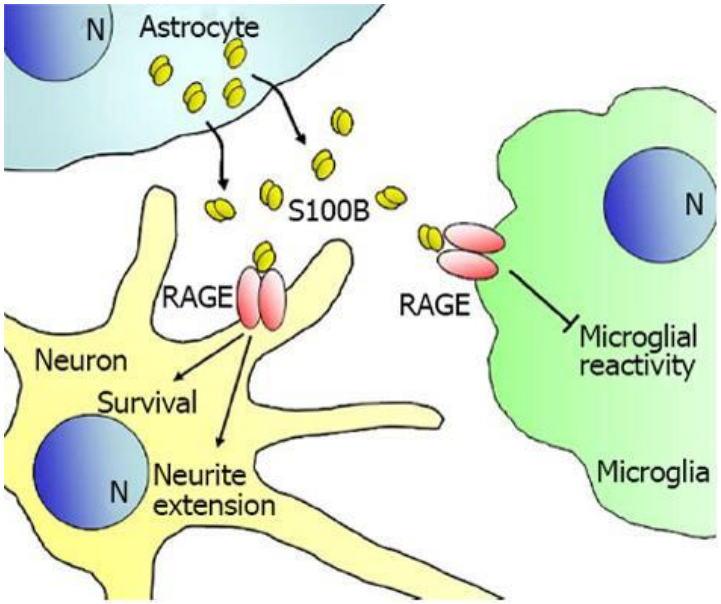
Markers Of Nerve Injury



Front. Neurol., 26 April 2013

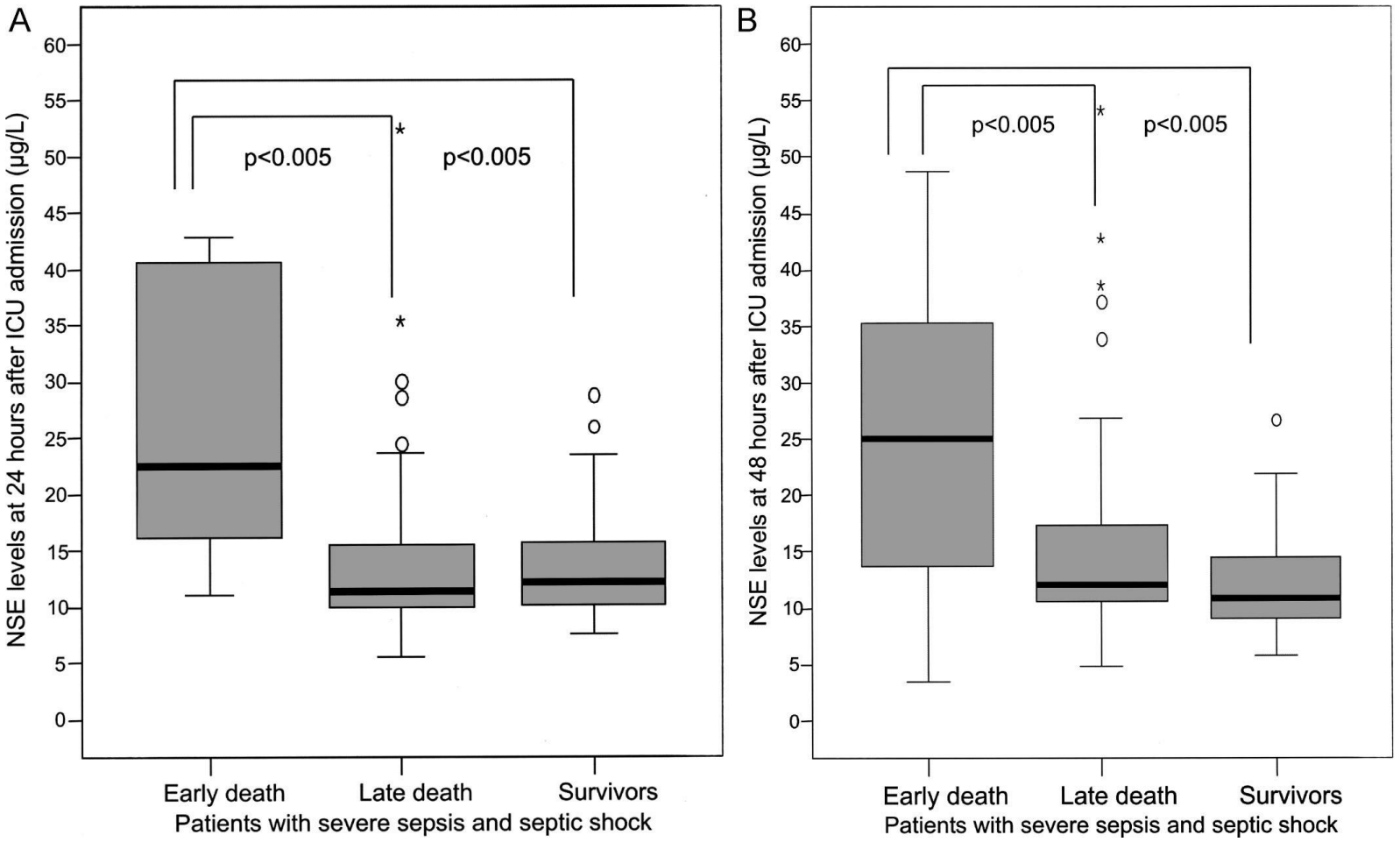
S-100B





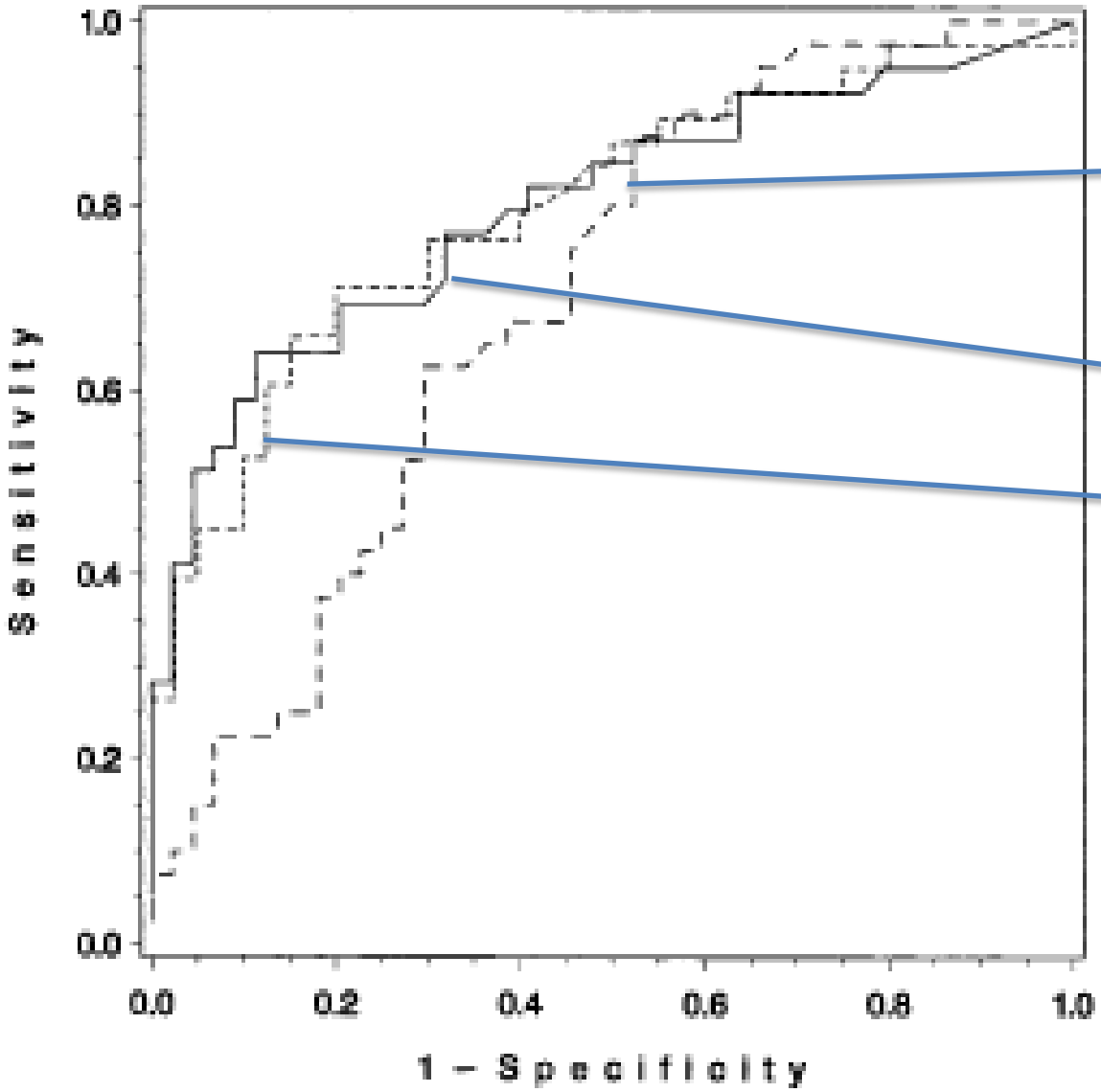
World J Biol Chem. 2013 February 26; 4(1): 1-12.

Enolase



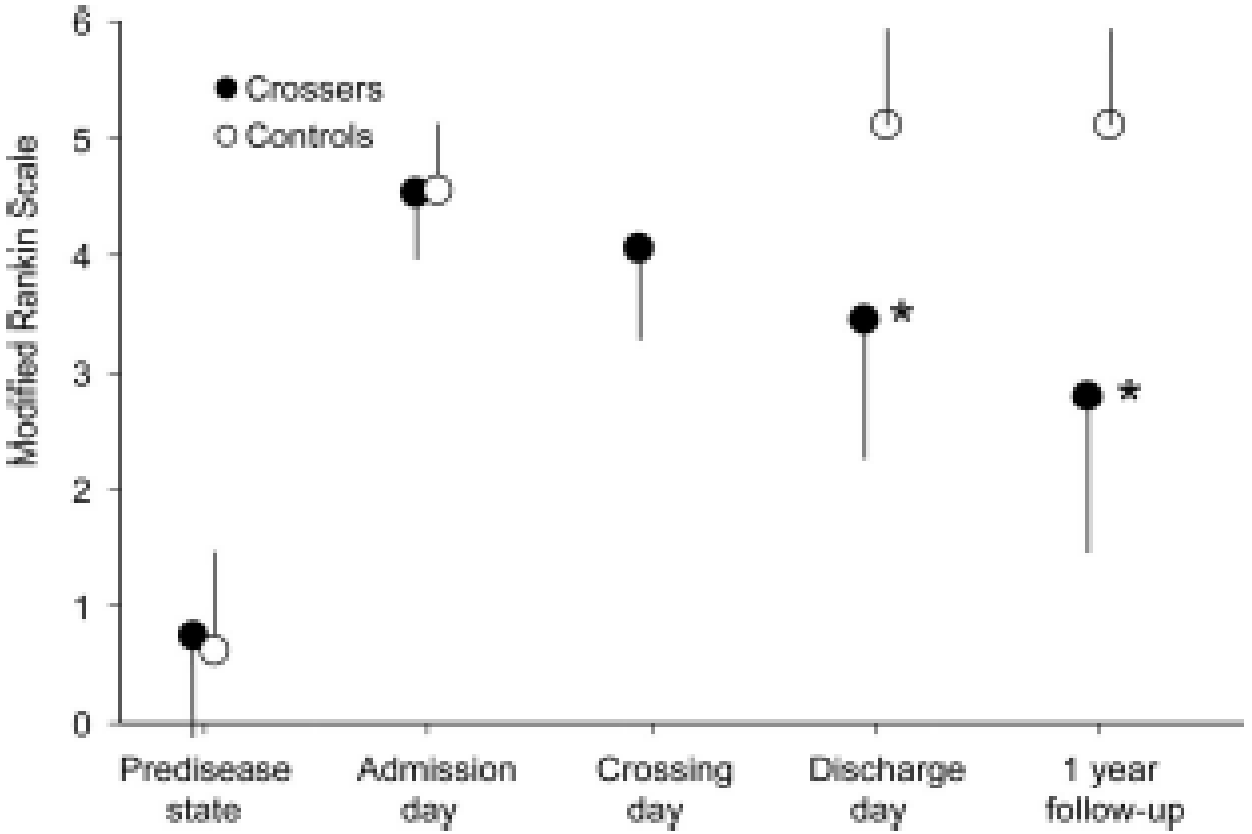
Crit Care Med 2006 Vol. 34, No. 7

Glial and neuronal proteins in serum predict outcome after severe traumatic brain injury



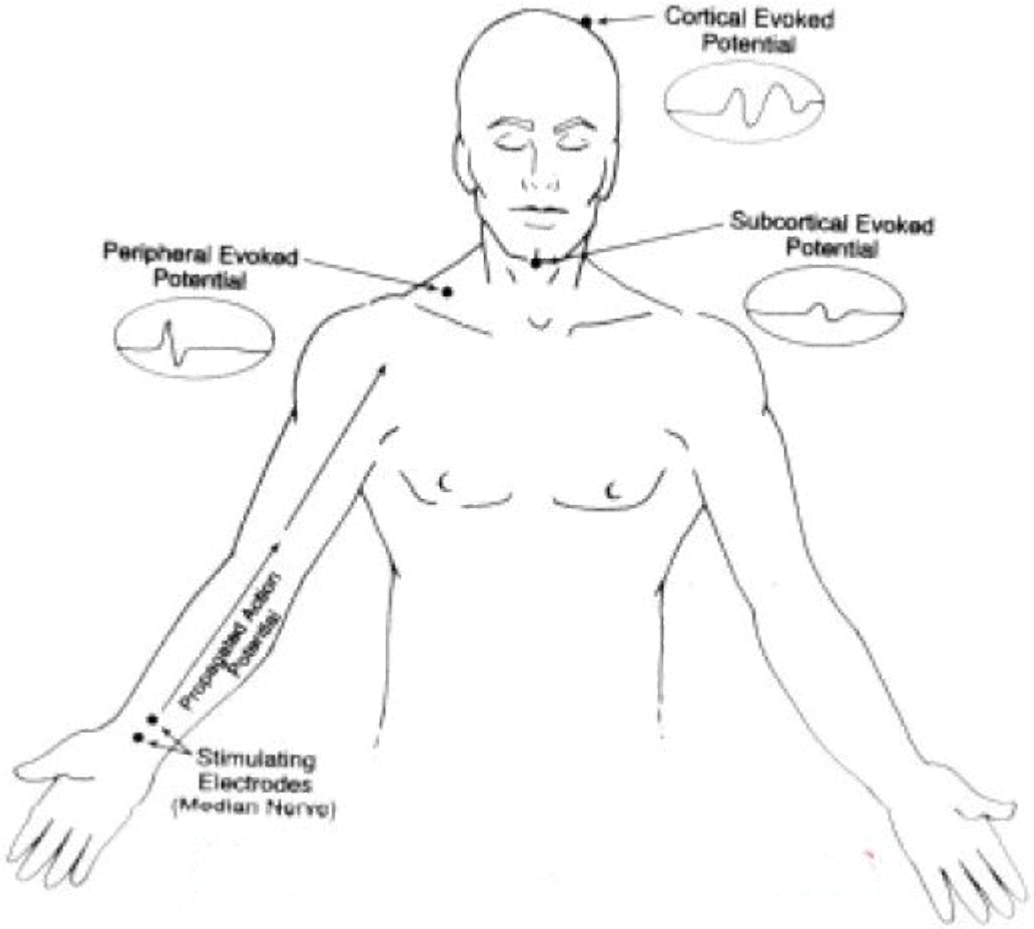
NEUROLOGY 62 April (2 of 2) 2004

Figure 2 **Modified Rankin Scale**



Modified Rankin Scale scores, indicating level of disability, in the crossed leg ("crossers," full circles) and control groups (empty circles). High values represent high disability. Error bars indicate the SD. *$p < 0.001$.

Somatosensory evoked potentials (SSEP)

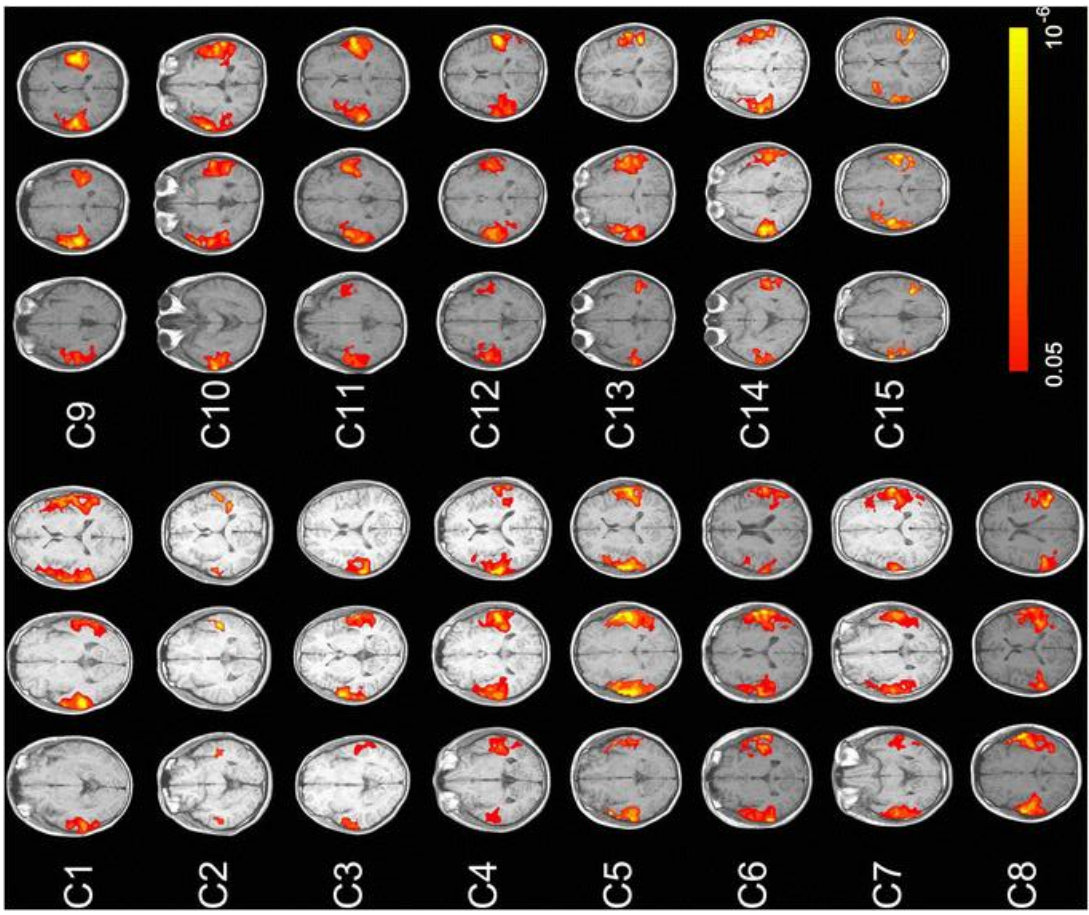


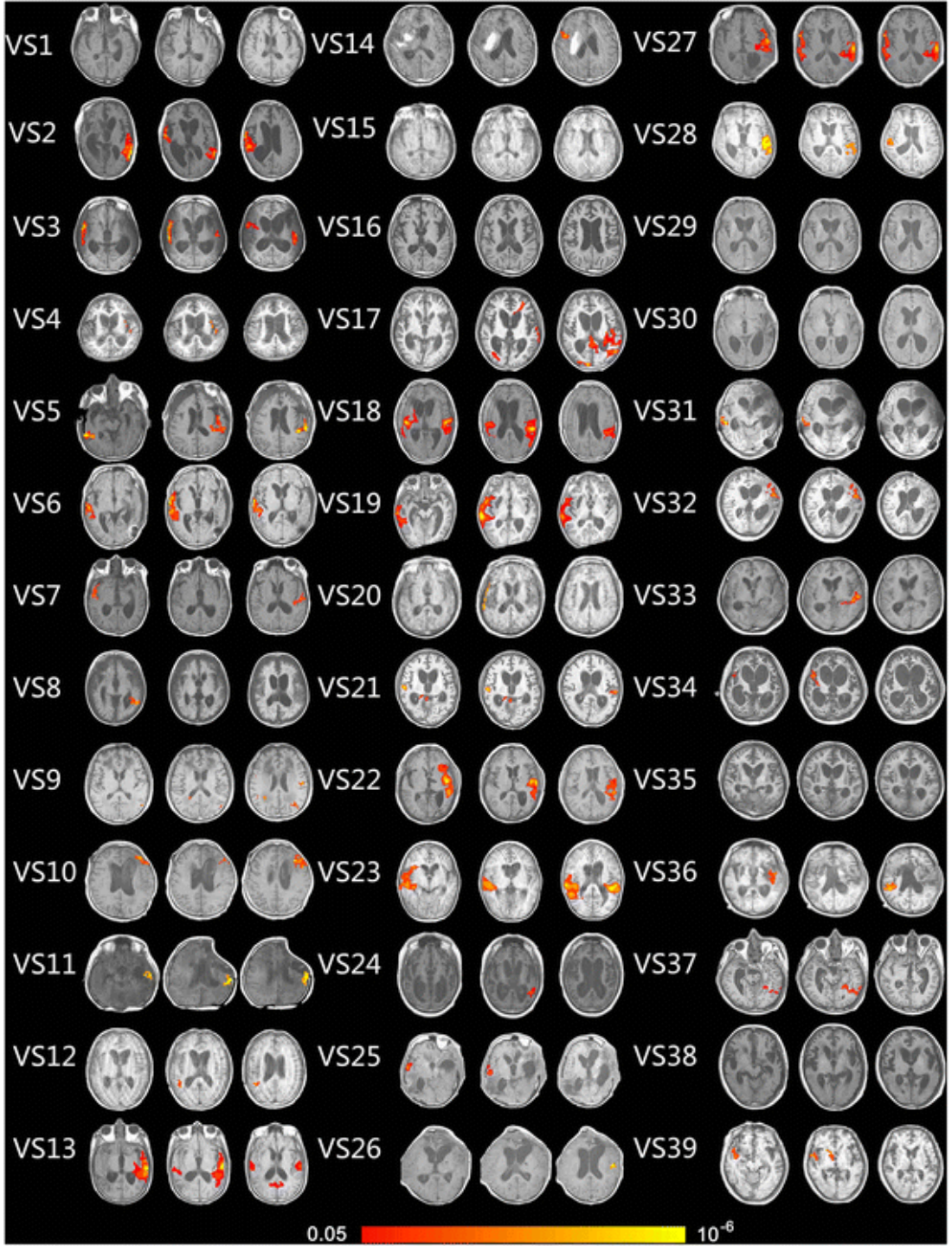
Hold on to your seats

Hold on to your seats

Show activation of auditory cortex caused by own name stimulation in 15 **controls** (axis view, P <0.05, corrected).

Wang *et al. BMC Medicine* 2015 **13**:83 doi:10.1186/s12916-015-0330-7




VS1
VS2
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VS4
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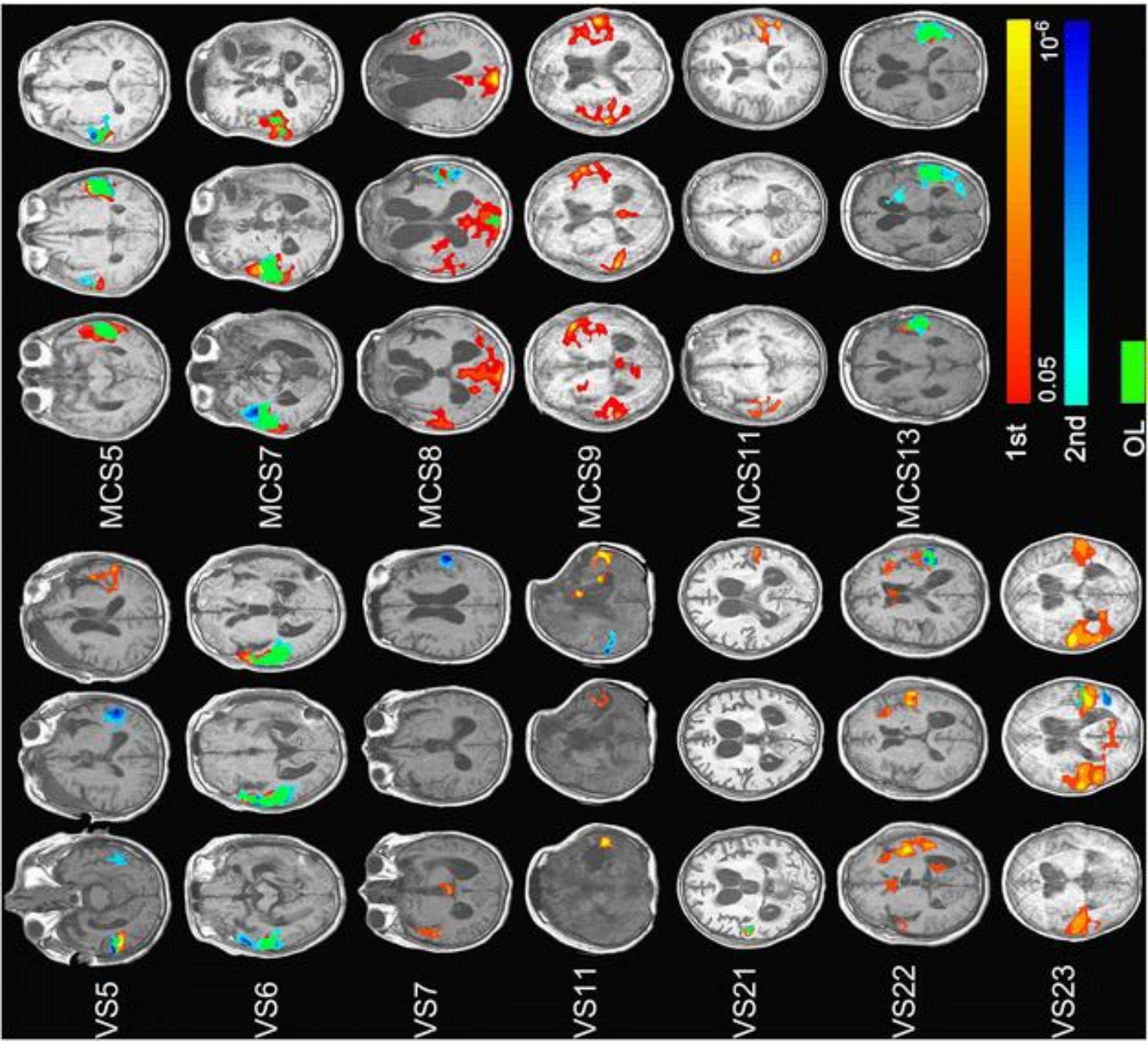
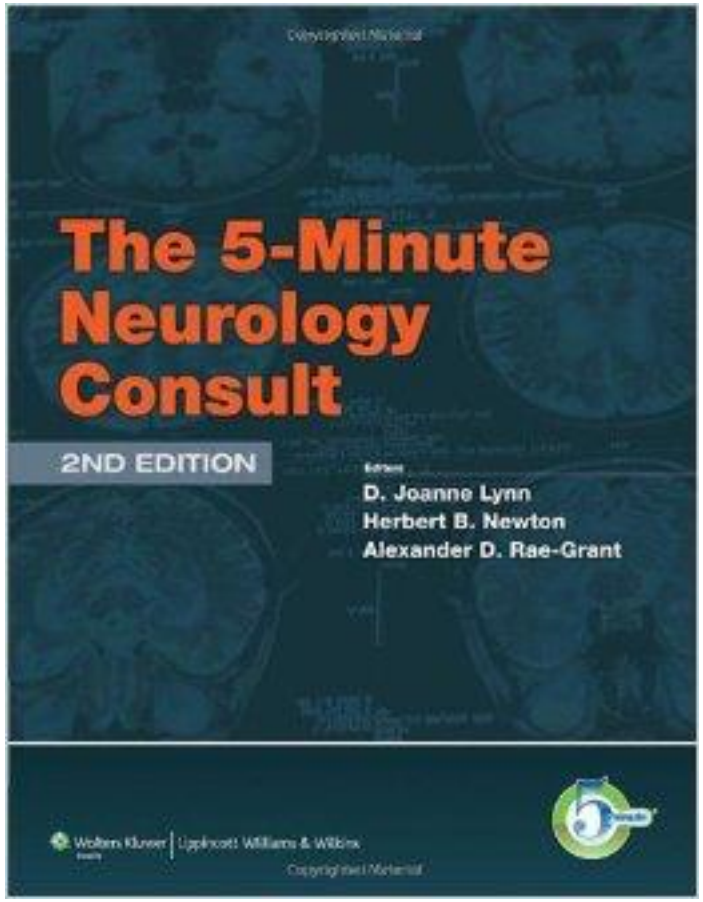
Wang *et al. BMC Medicine* 2015
13:83 doi:10.1186/s12916-015-0330-7




The 5-Minute Neurology Consult
2ND EDITION
D. Joanne Lynn
Herbert B. Newton
Alexander D. Rae-Grant
Wolters Kluwer | Lippincott Williams & Wilkins

Spectrum of catastrophic brain injury: Coma and related disorders of consciousness

Distinguishing features of differential diagnosis of DOCs

State	Sleep-wake cycles	Episodes of awareness	Responsiveness
Coma	Absent	None	Primitive reflexes only
VS/UWS	Present	None	Nonpurposeful, reflexive
MCS−	Present	Uncommon periods	Visual pursuits, localization to stimuli
MCS+	Present	Intermittent periods	Command following, intelligible verbalizations, object manipulation
Emergence from MCS	Present	Prolonged periods	Functional communication or object use
Normal consciousness	Normal	Normal	Preserved cognition
Classic LIS	Normal	Normal but not measurable	Preserved cognition Only preserved up gaze & eye opening

Locked-in state is *not* a disorder of consciousness but is included for comparison.

Table 2. The differential diagnosis of the vegetative state.

Condition	Vegetative state	Minimally conscious state	Locked-in syndrome	Coma	Death confirmed by brainstem tests
Awareness	Absent	Present	Present	Absent	Absent
Sleep–wake cycle	Present	Present	Present	Absent	Absent
Response to noxious stimuli	+/–	Present	Present (in eyes only)	+/–	Absent
Glasgow Coma Scale score	E4, M1–4, V1–2	E4, M1–5, V1–4	E4, M1, V1	E1–2, M1–4, V1–2	E1, M1–3, V1
Motor function	No purposeful movement	Some consistent or inconsistent verbal or purposeful motor behaviour	Volitional vertical eye movements or eyeblink preserved	No purposeful movement	None or only reflex spinal movement
Respiratory function	Typically preserved	Typically preserved	Typically preserved	Variable	Absent
EEG activity	Typically slow wave activity	Insufficient data	Typically normal	Typically slow wave activity	Typically absent
Cerebral metabolism (PET)	Severely reduced	Insufficient data	Mildly reduced	Moderately to severely reduced	Severely reduced or absent
Prognosis	Variable: if permanent, continued vegetative state or death	Variable	Depends on cause but full recovery unlikely	Recovery, vegetative state or death within weeks	Already dead

NB: as explained in the text, EEG and measures of cerebral metabolism are not *required* to make these clinical diagnoses.
EEG = electroencephalography; PET = positron emission tomography.

Box 1. Checklist for the diagnosis of the permanent vegetative state.

The diagnosis of the permanent vegetative state requires prolonged observation, experience in the assessment of disorders of consciousness, and discussion with relatives and with medical and paramedical staff. It cannot be made by following a simple protocol. However, we hope that this checklist will be of some practical help by highlighting the key steps on the way to the diagnosis.

1 In cases due to head injury, has at least one year elapsed since the onset?

or,

2 In cases due to other causes, have at least six months elapsed since the onset?

3 Has the cause been established? (It should be established 'as far as possible'.)

4 Have effects of drugs been excluded?

5 Have effects of metabolic disturbance been excluded?

6 Has the possibility of a treatable structural cause been excluded by brain imaging?

7 Have two doctors, who are experienced in the assessment of disorders of consciousness, independently confirmed that there is no evidence of:
- awareness of self or environment
- purposeful movement
- any attempt to communicate?

8 Do medical staff, nursing staff and other therapists agree?

9 Do family and friends agree?*

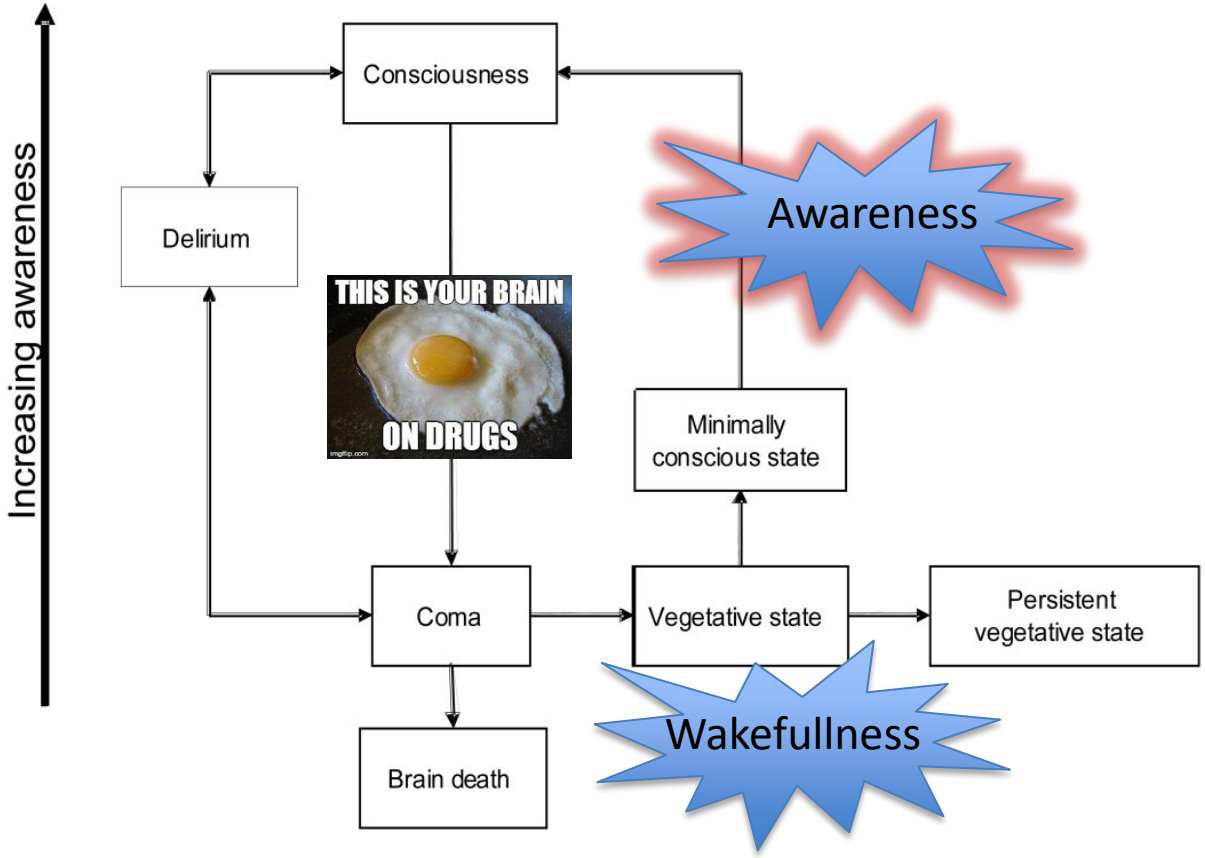
10 In case of doubt, has an expert clinical neuropsychological assessment been carried out?

Where the answer is 'yes' to all these questions, the diagnosis of the permanent vegetative state is confirmed.

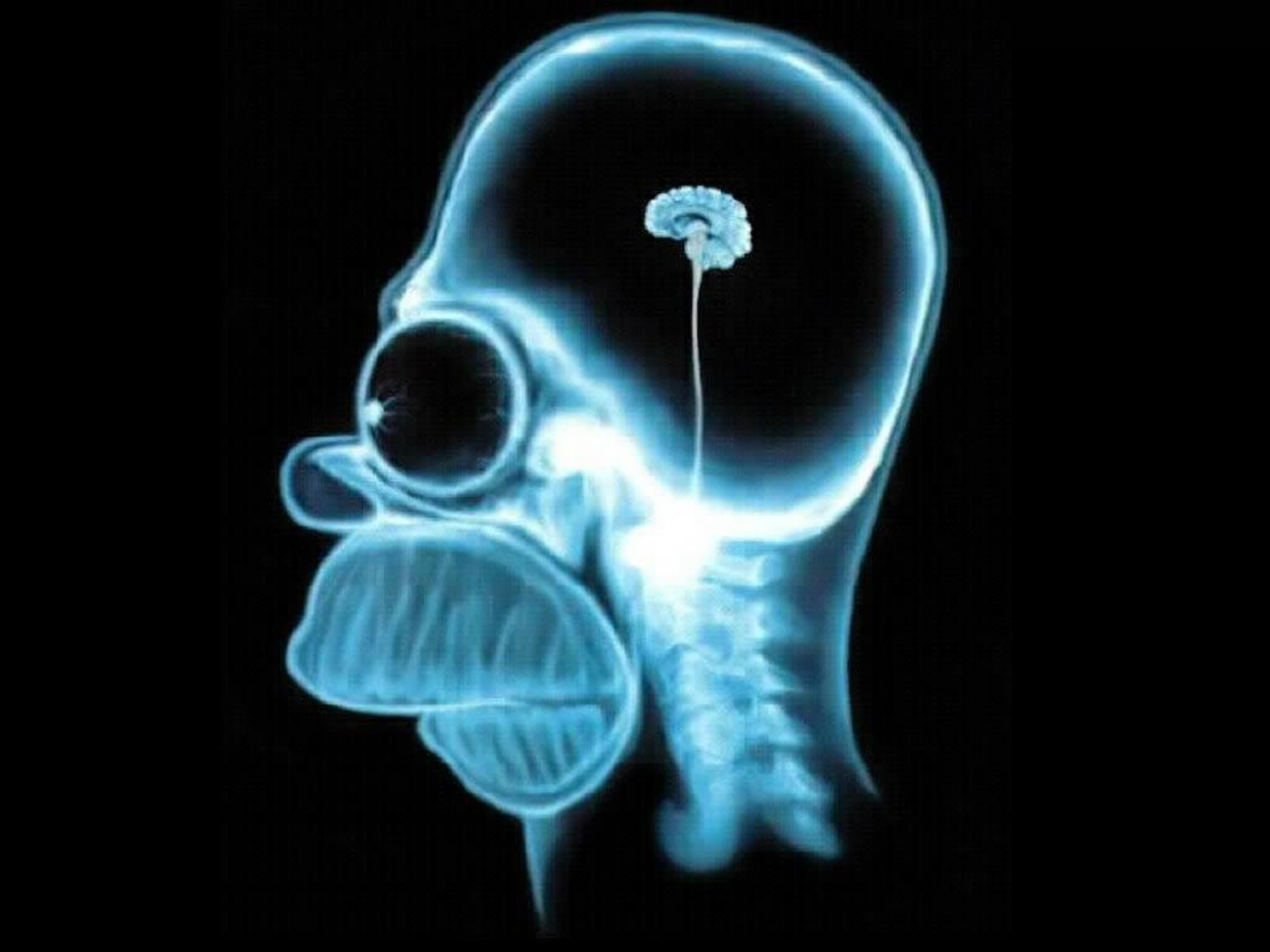
First assessing doctor:	Second assessing doctor:
Name	Name
Qualifications	Qualifications
Signature	Signature
Date	Date

*Sometimes, even when all other members of the family and friends of the patient are in agreement, one individual may be unable to agree with the general conclusion that the patient lacks awareness. Any evidence of awareness should be examined very seriously, but in these circumstances the continuing disagreement of one individual with the conclusion of health professionals and others close to the patient is not a bar to the diagnosis of the permanent vegetative state.

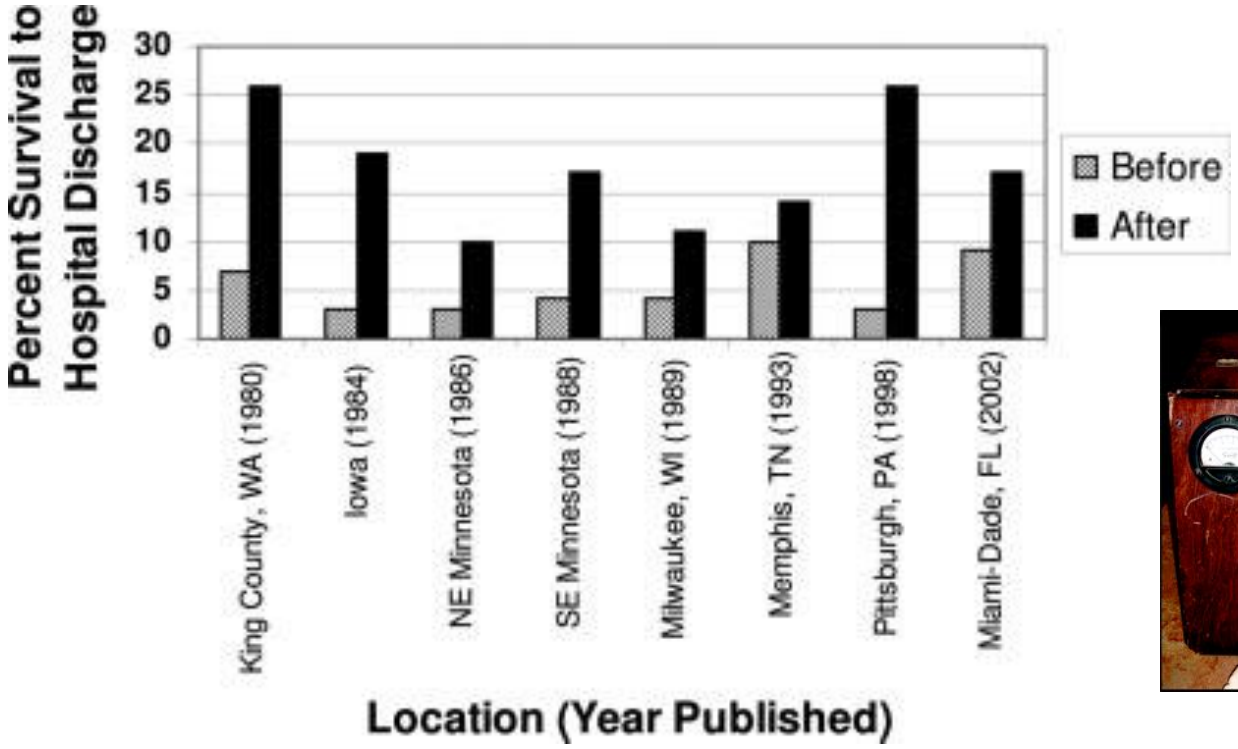
Spectrum of Consciousness Disorders



Crit Care Med 2006 Vol. 34, No. 1

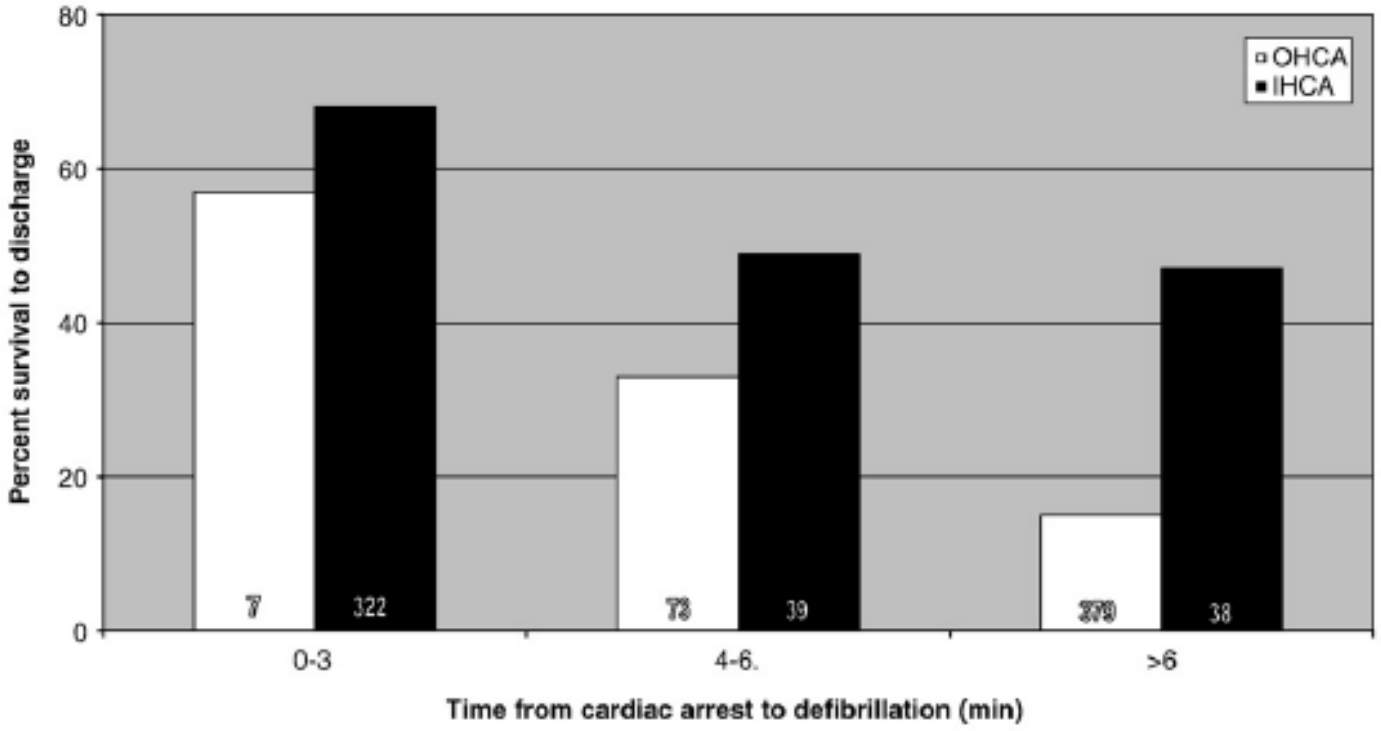


Cardiac Arrest



Cardiopulmonary Resuscitation : History, Current Practice, and FutureDirectionJonas A. Cooper, Joel D. Cooper and Joshua M. Cooper. Circulation 2006:114:2839-2849

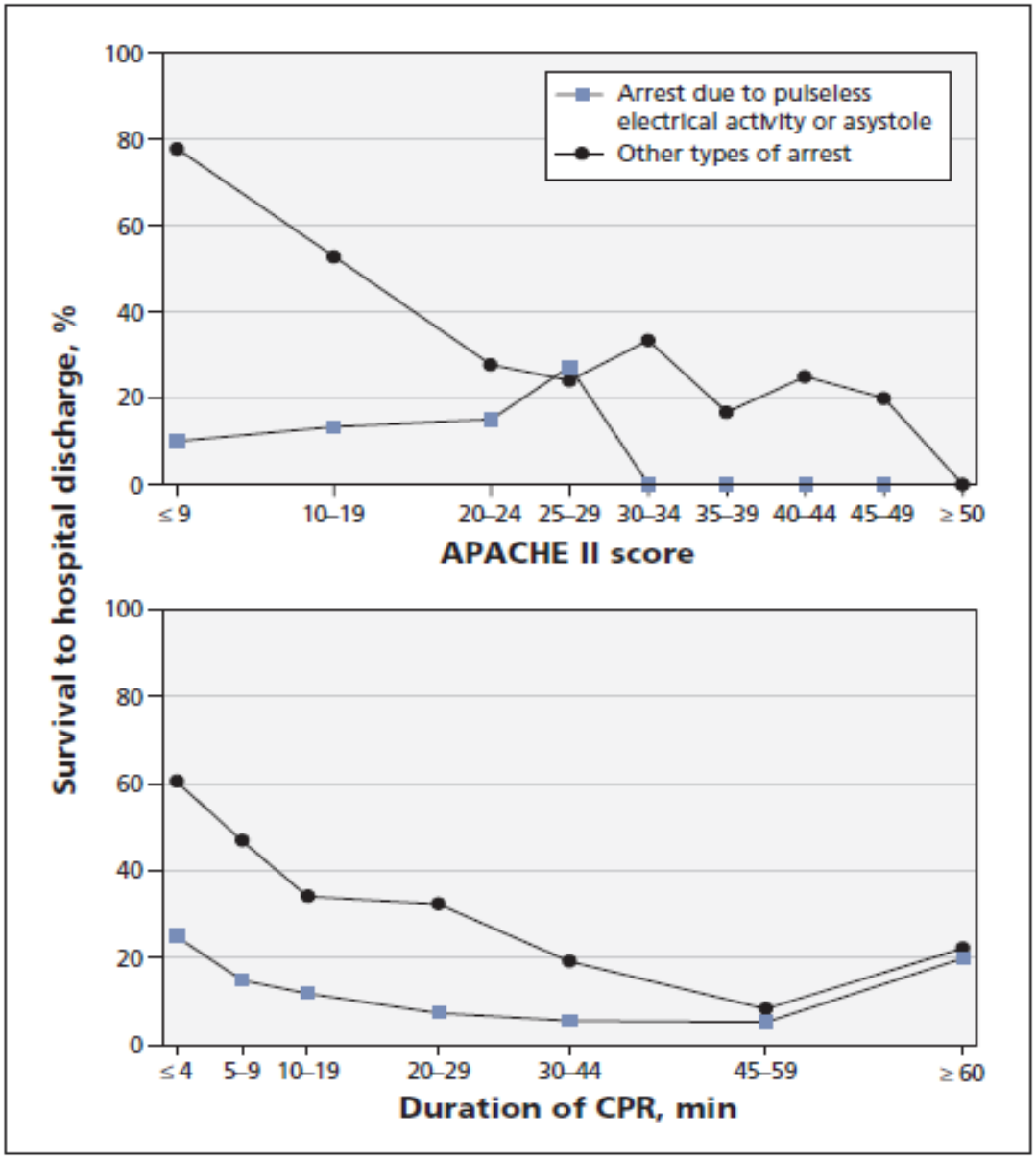
Survival to Discharge

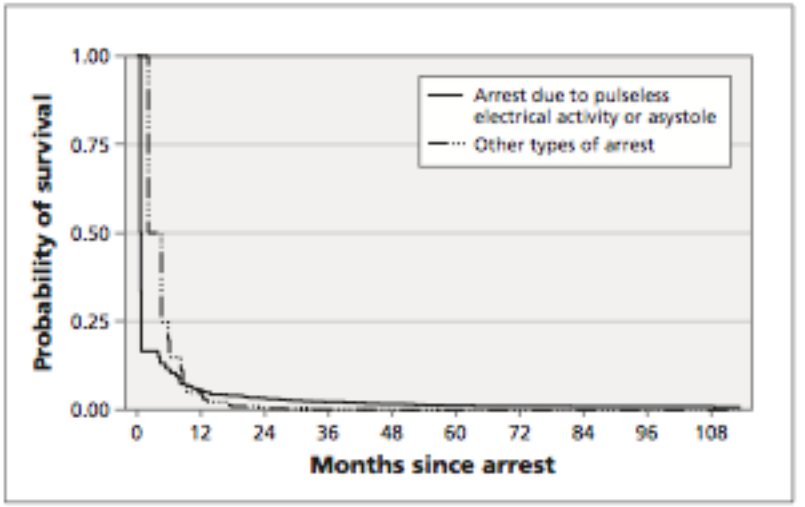


Relationship between delay from collapse to defibrillation and survival after OHCA and IHCA among patients found with a shockable rhythm. Figures in bars refer to number of patients who were evaluated.

(Am Heart J 2010;159:749-56.)

CPR





Demetrios et al. CMAJ 2011 (early release)

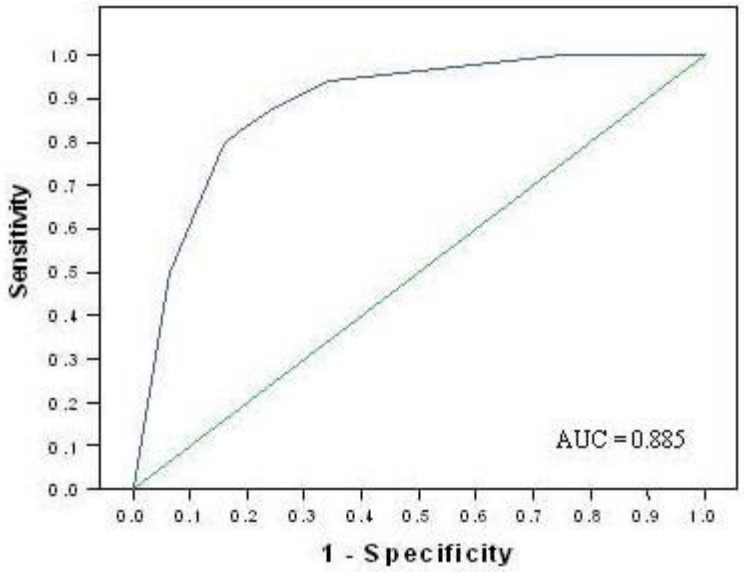
Systematic review of early prediction of poor outcome in anoxic-ischaemic coma

Eveline G J Zandbergen, Rob J de Haan, Christiaan P Stoutenbeek, Johannes H T M Koelman, Albert Hijdra

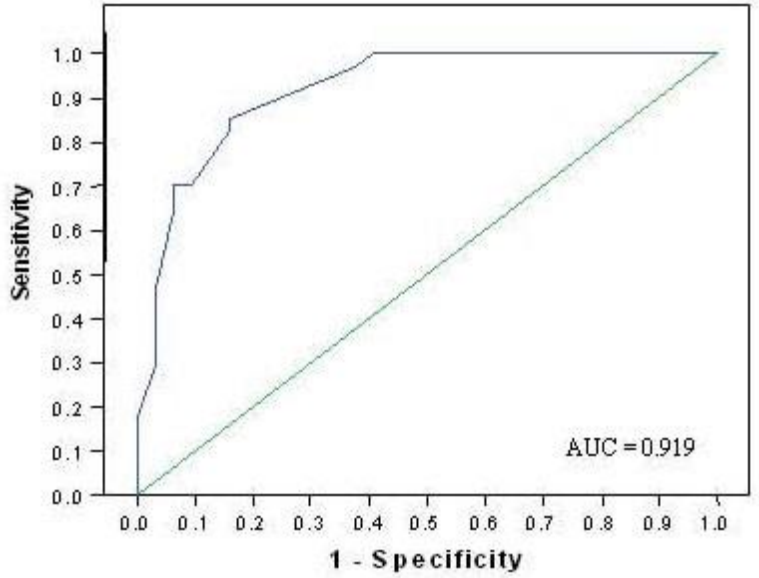
Factor	Study reference	Number of patients studied	Prevalence poor outcome (95% CI)	Prevalence poor test (95% CI)	Sensitivity range	Specificity range
Pupillary reactions						
Absent on admittance	12, 19, 21, 22	491	59% (55–63)	22% (19–26)	30–50%	69–100%
Absent on day 3	12, 18, 19	152	68% (61–76)		22–55%	100%
Motor response						
M1–3 on GCS in first 24 h	11, 24, 31, 38	269	58% (53–64)	73% (68–79)	63–95%	30–79%
M1–3 on GCS day 1	11, 17	87	69% (58–78)	76% (67–85)	85–87%	42–59%
M1–3 on GCS day 3	15, 21, 24	307	73% (66–79)	64% (57–71)	70–100%	29–100%
M1–2 on GCS day 3	12, 15, 18	171	70% (63–77)	48% (41–55)	56–92%	93–100%
M=1 on GCS day 3	12, 15, 18	171	70% (63–77)		11–58%	100%
EEG						
α-coma pattern	8, 9, 10, 15, 25, 35	453	66% (62–71)	20% (16–24)	15–43%	71–100%
α-coma pattern, burst-suppression pattern, or isoelectric	2, 9, 10, 15, 16, 32, 35, 23, 26, 29	638	67% (63–71)	44% (40–47)	42–84%	71–100%
Burst-suppression pattern, or isoelectric	9, 10, 11, 15, 29, 35	365	57% (52–62)	33% (28–38)	31–84%	71–100%
Convulsions						
Convulsons and/or myoclonus	11, 18, 19, 20, 37	361	74% (69–79)	35% (30–40)	16–85%	25–92%
Status epilepticus and/or myoclonus	20, 28	221	68% (56–80)	34% (32–37)	38–67%	96–100%
GCS						
3–5 in first 24 h	14, 33, 36	137	77% (70–84)	68% (64–83)	63–82%	54–100%
N20						
Bilateral absence on SSEP first week	7, 11, 13, 14, 15, 19, 30, 23, 27, 33, 34	563	76% (73–80)		28–73%	100%

Somatosensory evoked potentials (SSEP)

Day #1



Day #3



BMC Cardiovascular Disorders 2008, 8:35

Markers of Death

Values of cutoff points and predictive accuracy for dead

Authors	On admission cut/spe/sen/acc	Day 1 cut/spe/sen/acc	24 hours cut/spe/sen/acc	Day 2 cut/spe/sen/acc	48 hours cut/spe/sen/acc	Day 3 cut/spe/sen/acc
NSE						
Grubb and colleagues	-	NM	-	(24)/86/60/**72**	-	-
Grubb and colleagues	-	NM	-	(71)/100/14/**54**	-	-
Auer and colleagues	NM	NM	-	(30)/100/79/**88**	-	-
S-100B						
Grubb and colleagues	-	NM	-	(0.3)/76/73/**75**	-	-
Grubb and colleagues	-	NM	-	(1.2)/100/45/**74**	-	-
Bottiger and colleagues	(0.2)/**45/100/82**	-	(0.2)/**80/100/91**	-	(0.2)/**70/100/84**	-
Rosen and colleagues	-	(0.2)/**81/77/79**	-	(0.2)/**100/79/92**	-	NM

Values in bold are the results of our calculation. cut = values of cutoff points (ng/mL); spe = specificity (%); sen = sensitivity (%); acc = accuracy (%).
NM = not mentioned for cutoff values and predictive accuracy; NSE = neuron specific enolase.

Critical Care 2009, **13**:R121 (doi:10.1186/cc7973)

Values of cutoff points and predictive accuracy for no-return to independent daily life

Authors	on admission cut/spe/sen/acc	Day 1 cut/spe/sen/acc	24 hours cut/spe/sen/acc	Day 2 cut/spe/sen/acc	48 hours cut/spe/sen/acc	Day 3 cut/spe/sen/acc
NSE						
Tiainen and colleagues (hypothermia)	-	-	(31)/96/22/**76**	(26)/96/30/**79**	(25)/96/25/**77**	-
Tiainen and colleagues (normothermia)	-	-	(13)/100/59/**80**	(13)/100/63/**82**	(9)/100/76/**88**	-
Rosen and colleagues	-	(25)/**100/14/44**	-	(23)/**100/34/59**	-	(13)/**100/44/69**
Bottiger and colleagues	NM	-	NM	-	NM	-
Schoerkhuber and colleagues	NM	(39)/100/17/**59**	(40)/100/8/**55**	-	(25)/100/48/**75**	-
Schoerkhuber and colleagues	NM	(15)/72/70/**71**	(18)/80/56/**68**	-	(16)/79/72/**76**	-
S-100B						
Tiainen M and colleagues (hypothermia)	-	-	(0.21)/100/30/**81**	(0.2)/96/20/**76**	(0.23)/96/22/**76**	-
Tiainen M and colleagues (normothermia)	-	-	(0.19)/100/59/**80**	(0.5)/100/18/**59**	(0.12)/100/88/**94**	-
Mussack and colleagues	NM	(0.76)/100/54/**62**	-	-	-	-
Rosen and colleagues	-	(0.4)/**85/62/70**	-	(0.2)/**100/67/80**	-	(0.19)/**100/40/66**
Bottiger and colleagues	NM	-	NM	-	NM	-

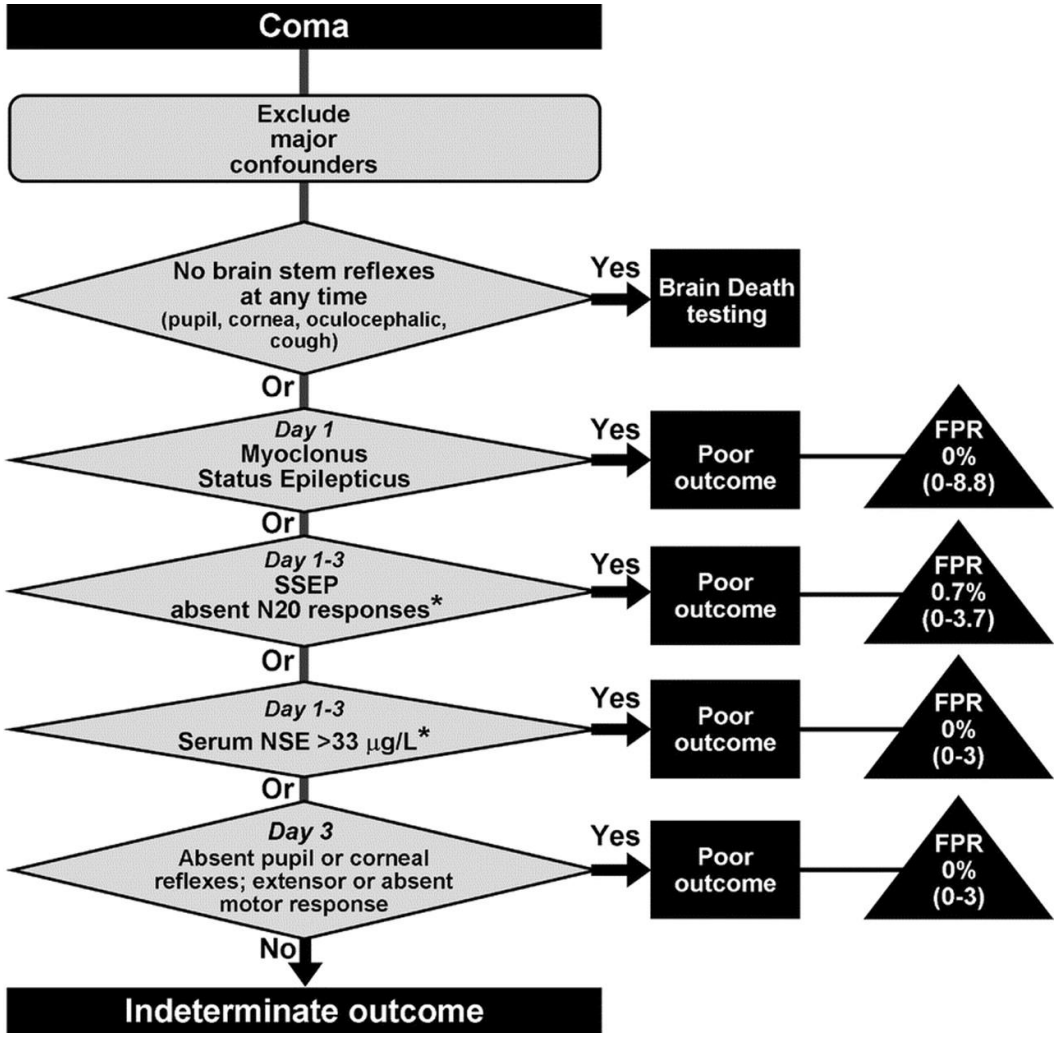
Values in bold are the results of our calculation. cut = values of cutoff points (ng/mL); spe = specificity (%); sen = sensitivity (%); acc = accuracy (%).
NM = not mentioned for cutoff values and predictive accuracy; NSE = neuron specific enolase.

Practice Parameter: Prediction of outcome in comatose survivors after cardiopulmonary resuscitation (an evidence-based review)

by E.F.M. Wijdicks, A. Hijdra, G. B. Young, C. L. Bassetti, and S. Wiebe

Neurology
Volume 67(2):203-210
July 25, 2006

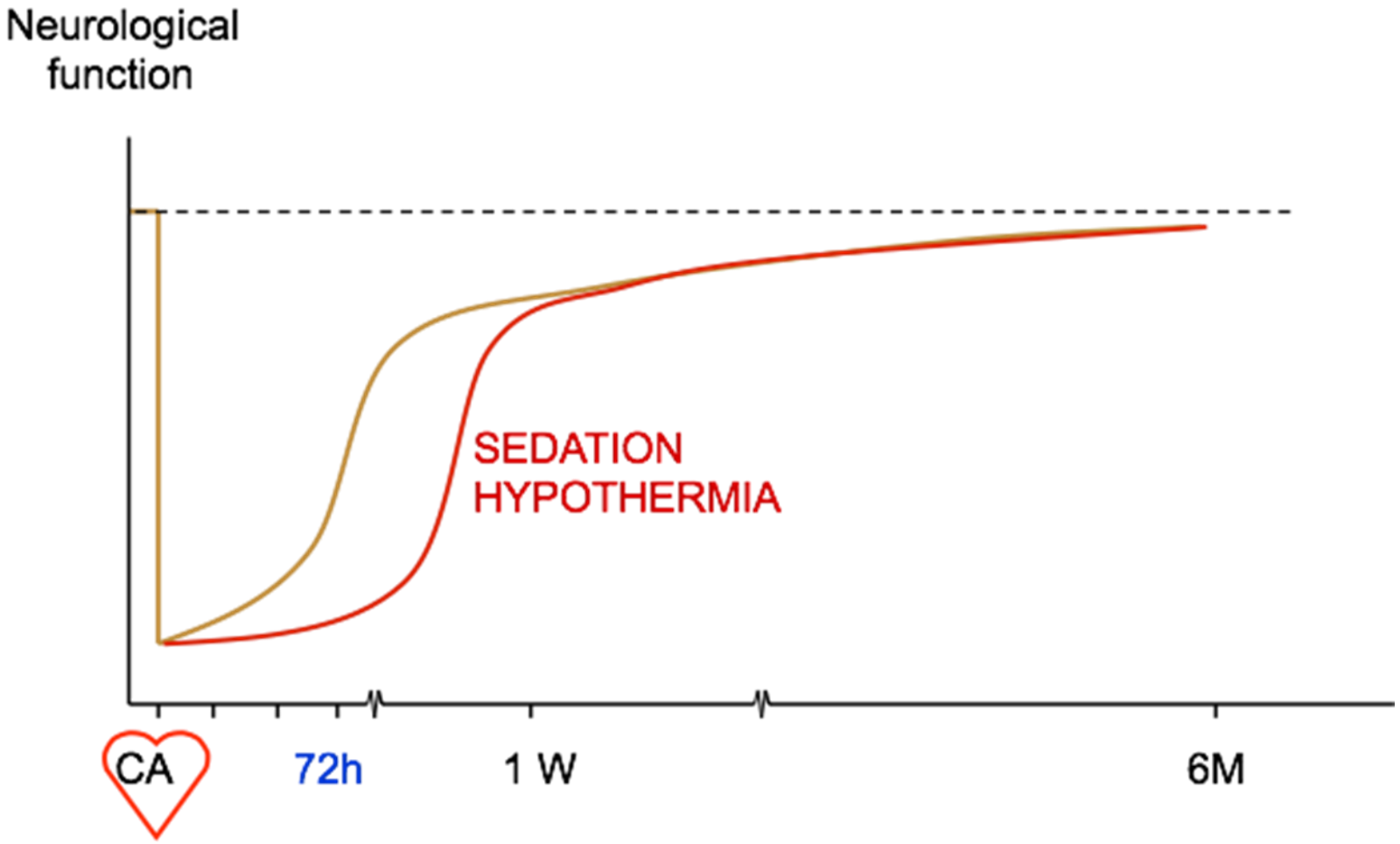
Figure. Decision algorithm for use in prognostication of comatose survivors after cardiopulmonary resuscitation.



E.F.M. Wijdicks et al. Neurology 2006;67:203-210

AMERICAN ACADEMY OF NEUROLOGY

Hypothermia and sedation may delay recovery and make a clinical examination less reliable



Samaniego EA, et al. Neurocrit Care. 2011 Aug;15(1):113–9.

ELSEVIER

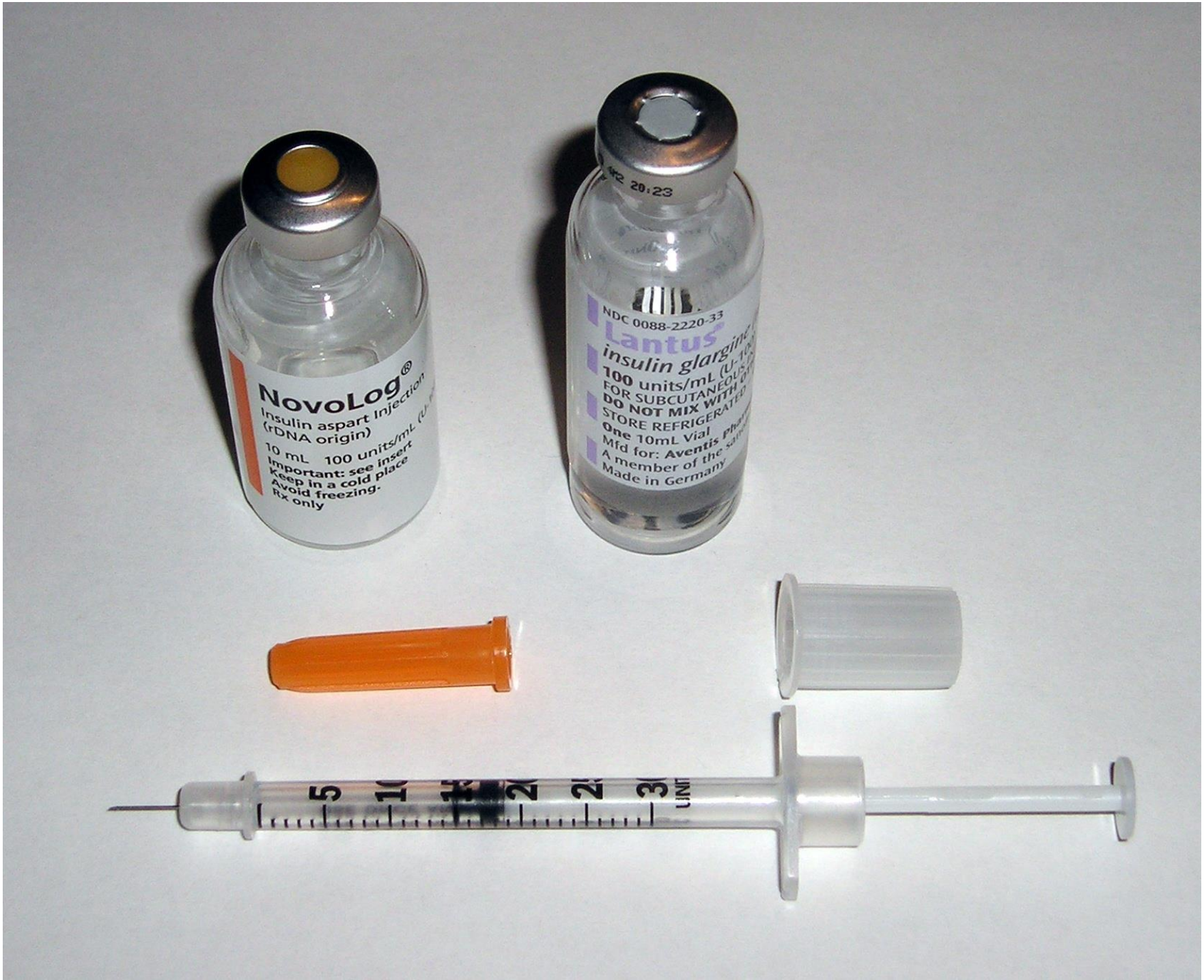
General Hospital Psychiatry 25 (2003) 269–276

General Hospital Psychiatry

Incidence and correlates of near-death experiences in a cardiac care unit

Bruce Greyson, M.D.

Division of Personality Studies, Department of Psychiatric Medicine, University of Virginia Health System, Charlottesville, VA, USA


NovoLog®
Insulin aspart injection
(rDNA origin)
10 mL 100 units/mL
Important: see insert
Keep in a cold place
Avoid freezing.
Rx only
NDC 0088-2220-33
Lantus
insulin glargine
100 units/mL
FOR SUBCUTANEOUS
DO NOT MIX WITH
STORE REFRIGERATED
One 10mL Vial
Mfd for: Aventis
A member of the
Made in Germany
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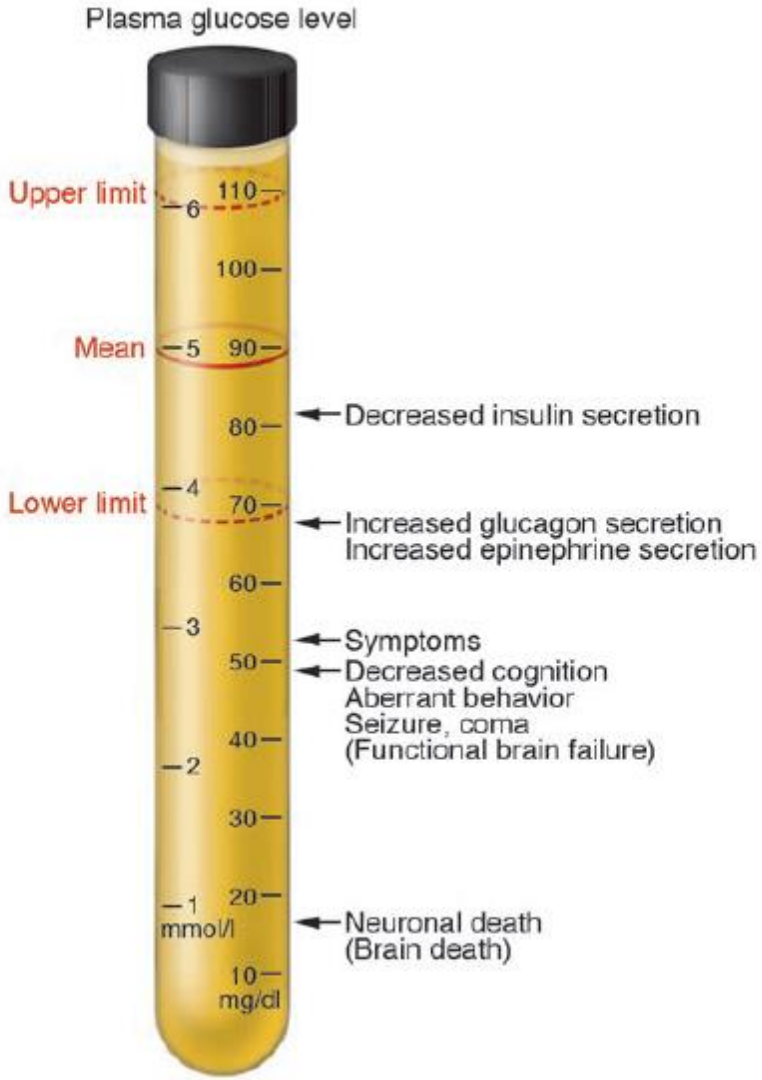
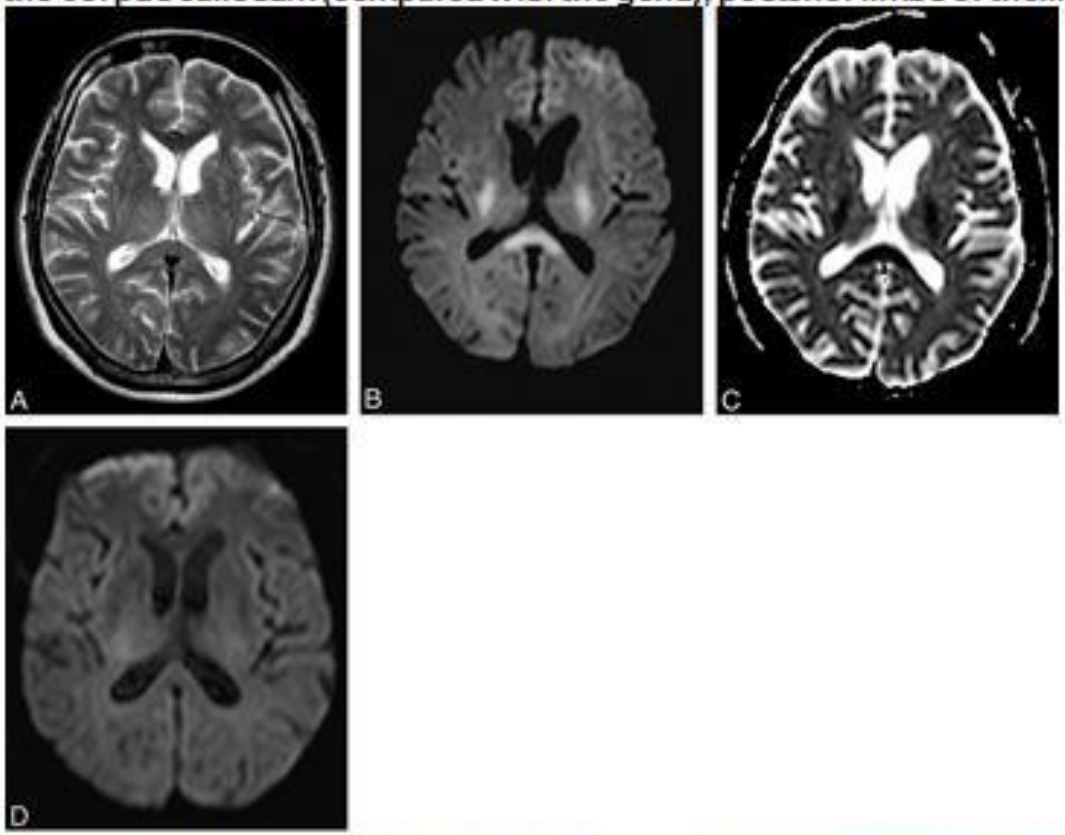
UNIT


Plasma glucose level
Upper limit
Mean
Lower limit
6
5
4
3
2
1
mmol/l
110
100
90
80
70
60
50
40
30
20
10
mg/dl
Decreased insulin secretion
Increased glucagon secretion
Increased epinephrine secretion
Symptoms
Decreased cognition
Aberrant behavior
Seizure, coma
(Functional brain failure)
Neuronal death
(Brain death)

Case 2, a 69-year-old diabetic man with atrial fibrillation who suddenly became unresponsive.A, T2-weighted (3000/80 effective) MR image shows subtle increased intensity in the splenium of the corpus callosum (compared with the genu), posterior limbs of the...



L. Lo et al. AJNR Am J Neuroradiol 2006;27:1222-1224

Sepsis Encephalopathy

- “Present in 50%” of “septic patients”
- Pathology/Autopsy with Ischemic and Hemorrhagic lesions

Crit Care Med 2006 Vol. 34, No. 7

Elevated serum levels of S-100β protein and neuron-specific enolase are associated with brain injury in patients with severe sepsis and septic shock*

	Total Group (%) n = 170	Group 1 (%) GCS = 15–14 n = 78	Group 2 (%) GCS = 13–10 n = 51	Group 3 (%) GCS = 9–3 n = 41	*p* Value
S-100β elevation	72/170 (42)	26/78 (33)	25/51 (49)	21/41 (51)	.09
NSE elevation	90/170 (53)	42/78 (54)	24/51 (47)	24/41 (58)	.54
MV	164/170 (96)	75/78 (96)	49/51 (96)	40/41 (98)	.91
ICU mortality	103/170 (60)	48/78 (61)	34/51 (67)	21/41 (51)	.32
Encephalopathy	27/170 (16)	9/78 (11)	8/51 (16)	10/41 (24)	.19

GCS, admission Glasgow Coma Scale before sedation.
All data represent number of patients, unless stated otherwise.

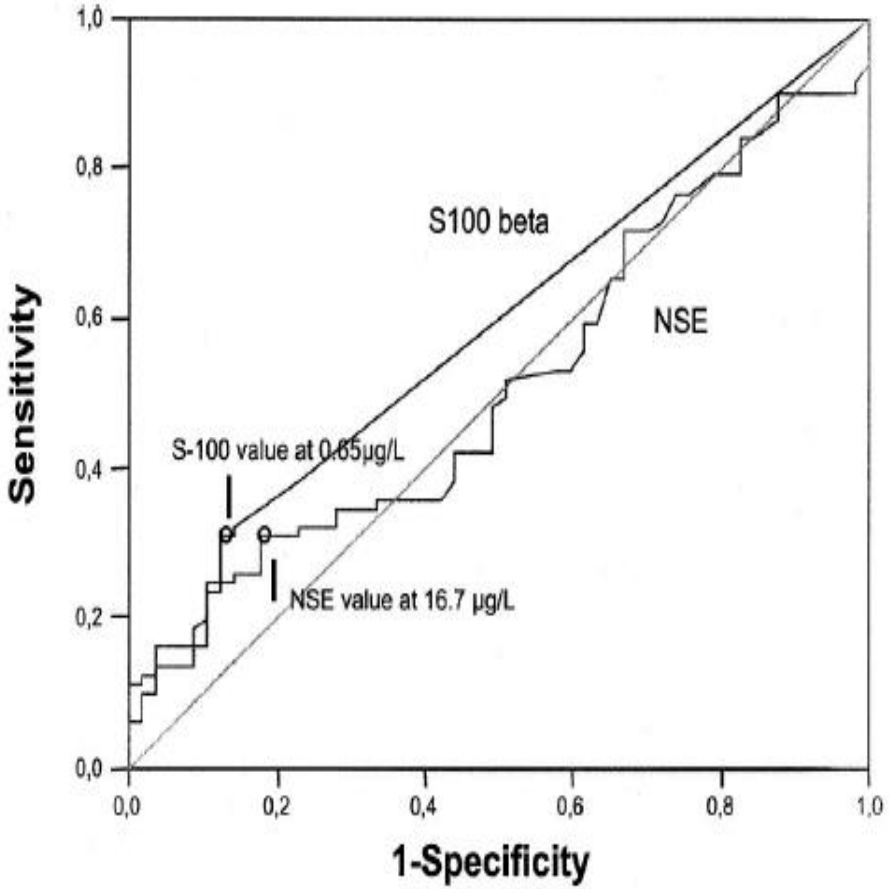
Elevated serum levels of S-100β protein and neuron-specific enolase are associated with brain injury in patients with severe sepsis and septic shock*

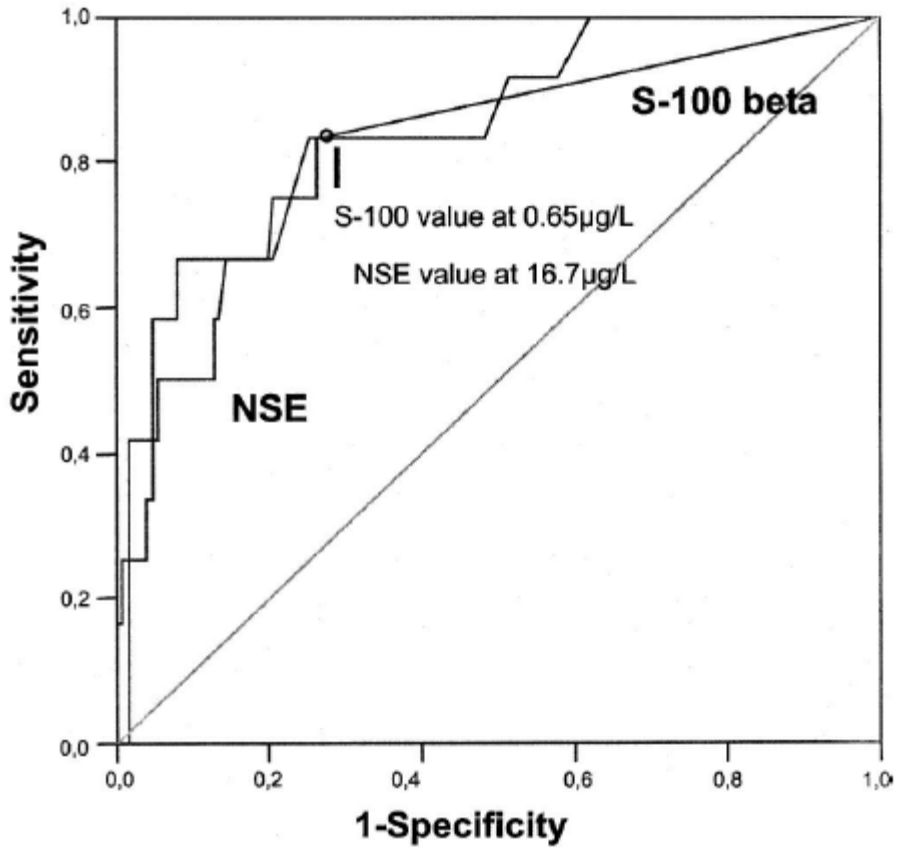
Table 4. Relationship between biomarkers elevation and the types of encephalopathy developed after withdrawing sedation

	Encephalopathy A n = 13	Encephalopathy B n = 14	*p* Value
S-100β+ (%)	3/13 (23)	11/14 (79)	.004
NSE+ (%)	9/13 (69)	10/14 (71)	.901

S-100+, patients with elevated S-100β; NSE+, patients with elevated neuron-specific enolase.

Elevated serum levels of S-100β protein and neuron-specific enolase are associated with brain injury in patients with severe sepsis and septic shock*



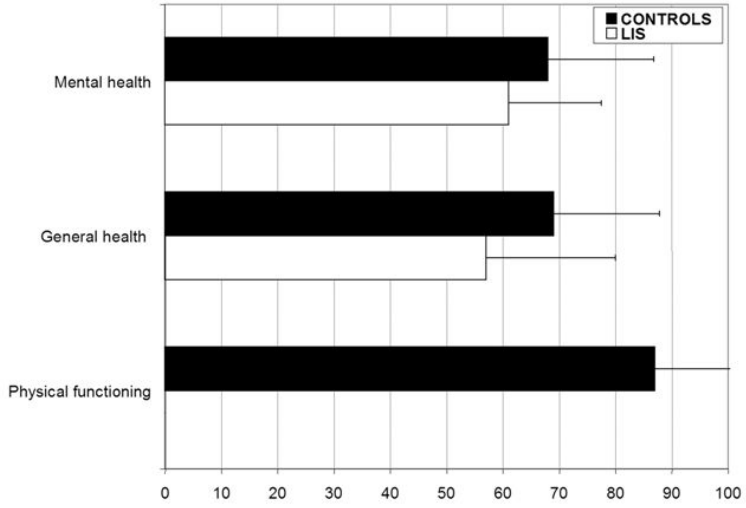


Crit Care Med 2006 Vol. 34, No. 7

Locked in Syndrome

Years	Percent Alive
5	84
10	56
20	31

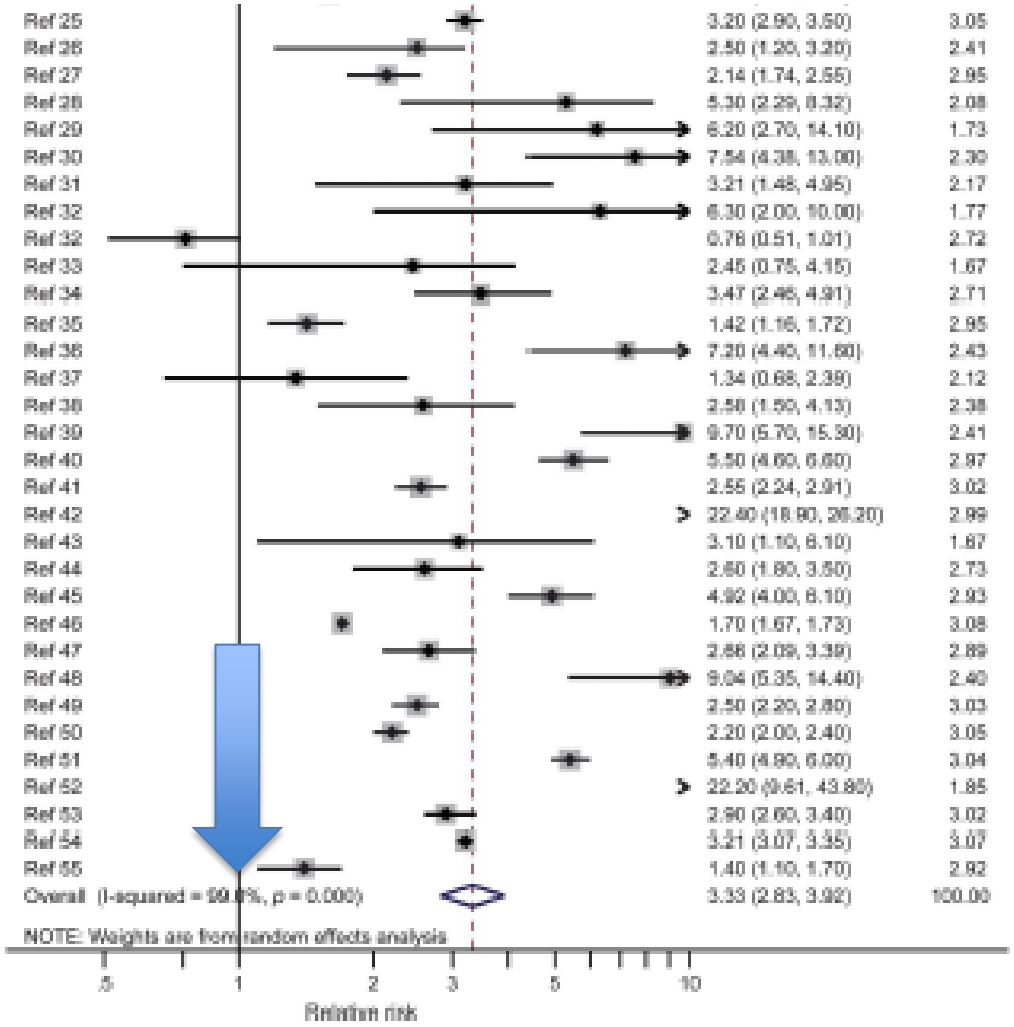
Shavelle RM, Strauss DJ, Katz RT (2008). Survival of persons with locked-in syndrome: A correction. Archives of Physical Medicine and Rehabilitation, 89:1005.



Bruno, Pellas, & Laureys, Yearbook of IC & EM 2008

Epilepsy-related clinical characteristics and mortality

A systematic review and meta-analysis



CI = confidence interval.

Excess Mortality in Remote Symptomatic Epilepsy

Steven Day, PhD, MAT; David Strauss, PhD, FASA; Robert Shavelle, PhD, MBA; Yvonne W. Wu, MD, MPH

Table 5. Comparison of Mortality Rates for Persons in the Study who had Recent (<12 Months) Status Epilepticus

Attained Age (years)	Exposure Patient-Years E	Number of Deaths		Mortality Ratio 100 d/d′	Mean Annual Mortality Rate per 1000 Patient-Years		
		Observed d	Expected* d′		Observed q	Expected q′	Excess q − q′
5–17	1108	6	1.0	612%	5.4	0.9	4.5
18–65	2090	22	6.6	335%	10.5	3.1	7.4
5–65	3198	28	7.5	371%	8.8	2.3	6.4

* Basis of expected deaths: Quinquennial mortality rates for person-years in the study population with no history of epilepsy.

Table 6. Baseline Mortality Rates for Persons in the Study who had no History of Epilepsy Compared With the California General Population

Attained Age (years)	Exposure Patient-Years E	Number of Deaths		Mortality Ratio 100 d/d′	Mean Annual Mortality Rate per 1000 Patient-Years		
		Observed d	Expected* d′		Observed q	Expected q′	Excess q − q′
5–14	94036	60	19.1	314%	0.6	0.2	0.4
15–24	121765	187	122.8	152%	1.5	1.0	0.5
25–34	118443	283	152.4	186%	2.4	1.3	1.1
35–44	78210	284	172.2	165%	3.6	2.2	1.4
45–65	46942	443	268.9	165%	9.4	5.7	3.7
5–65	459396	1257	735.4	171%	2.7	1.6	1.1

* Basis of expected deaths: California annual mortality rates, 1988–1999.

JOURNAL OF INSURANCE MEDICINE

SPECIAL ARTICLE

THE LIFE EXPECTANCY OF PROFOUNDLY HANDICAPPED PEOPLE WITH MENTAL RETARDATION

RICHARD K. EYMAN, PH.D., HERBERT J. GROSSMAN, M.D., ROBERT H. CHANEY, M.D., AND THOMAS L. CALL, M.A.

No.	99,543	1550	4513	997
Mental-retardation level (%)				
Unknown	0.3	0.0	0.0	0.0
Mild-to-moderate	66.7	0.0	0.0	0.0
Severe	13.0	10.3	16.1	20.1
Profound	13.1	70.8	55.1	41.8
Suspected	6.9	18.9	28.8	38.1
Age (%)				
0–4 years	14.2	35.6	37.1	43.2
5–9	11.9	18.9	15.2	19.0
10–14	8.8	10.1	9.8	9.5
15–19	10.5	12.0	7.4	6.3
20–24	13.4	8.6	6.9	4.9
25–29	12.1	5.3	7.1	5.2
30–34	9.5	4.0	6.1	5.2
35–39	6.9	1.9	4.7	3.6
40–49	6.8	2.0	3.4	2.1
≥50	5.9	1.6	2.3	1.0
Crude death rate (per 1000)	29	245	113	35

All were non-ambulatory and incontinent-
Group 1- on- tube feeds
Group 2- could be feed
Group 3- mobile

(N Engl J Med 1990; 323:584-9.)

Long-term mortality trends in functionally-dependent adults following severe TBI

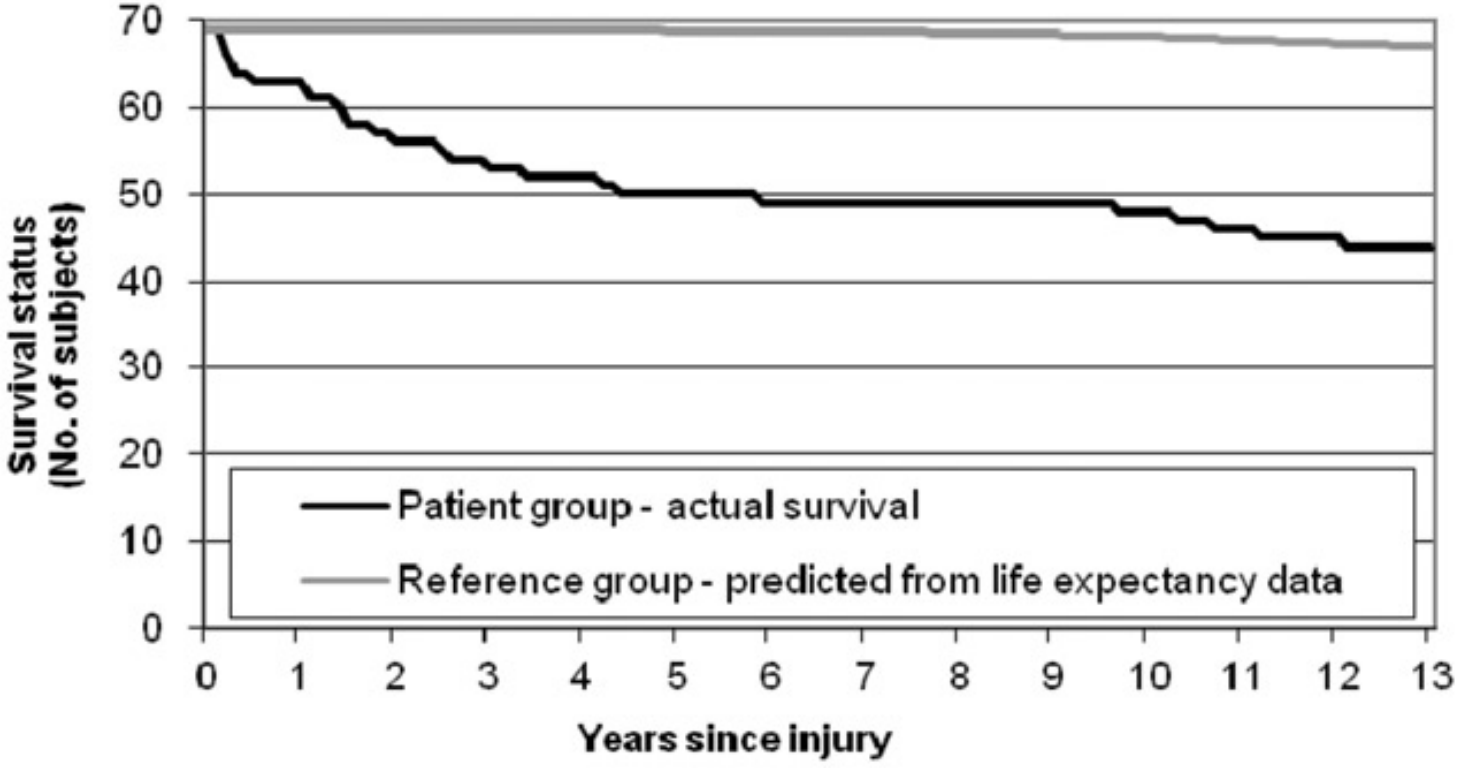


Figure 1. Survival status of predicted and actual sample.

Brain Injury, November 2008; 22(12): 919–925

Prognosis after One Month Of Persistent Vegetative State

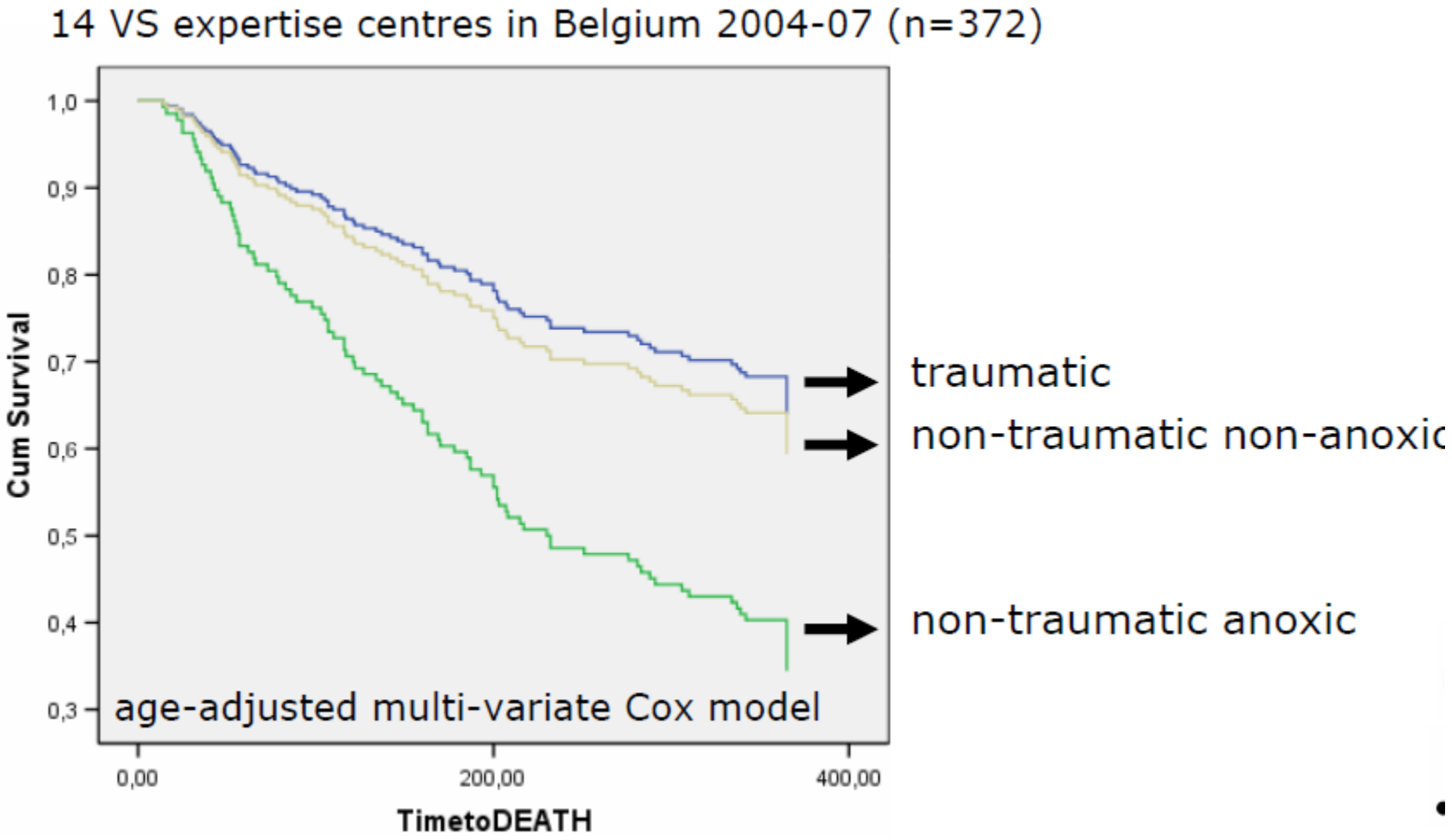
Glasgow Outcome	Scale	TBI	Non-TBI
Death	1	33	53
Persistent Vegetative State	2	15	32
Severe Disability	3	28	11
Moderate Disability	4	17	3
Good Recovery	5	7	1

Medical aspects of the persistent vegetative state (2): The Multi-Society Task Force on PVS. *N Engl J Med* 1994; 330:1572–1579

1	Death	
2	Persistent vegetative state	Patient exhibits no obvious cortical function.
3	Severe disability	(Conscious but disabled). Patient depends on others for daily support due to mental or physical disability or both.
4	Moderate disability	(Disabled but independent). Patient is independent as far as daily life is concerned. The disabilities found include varying degrees of dysphasia, hemiparesis, or ataxia, as well as intellectual and memory deficits and personality changes
5	Good recovery	Resumption of normal activities even though there may be minor neurological or psychological deficits.

Jennett B, Bond MR: Assessment of outcome after severe brain damage. *Lancet* 1975; 1:480–484

Outcomes of Vegetative State



Ledoux et al, Belgian Federal Project on Vegatative State

Table 1. Acute and Total Accumulated Long-term Mortality Rates for the Whole Study Population and for the Eight Different Coma Etiologies

Coma Etiologies	Number (%)	Proportion Male %	Mean Age, Years	Hospital Mortality %	Total 1-Year Mortality %	Total 2-Year Mortality %	Age-matched 1-Year Mortality in the Swedish Population (7)
Poisoning	329 (38.0)	55.6	44	2.4	10.9	13.7	0.11%
Stroke	213 (24.6)	43.7	74	60.6	70.9	73.7	2.2%
Epilepsy	113 (13.1)	55.8	61	0.9	15.9	23.9	0.8%
Circulatory	60 (6.9)	65	71	71.7	85.0	86.7	2.2%
Infection	56 (6.5)	62.5	68	26.6	51.8	60.1	1.3%
Metabolic	44 (5.1)	40.1	57	15.9	31.8	40.9	0.5%
Respiratory	33 (3.8)	45.5	78	60.6	72.7	75.8	3.7%
Malignancy	17 (2.0)	52.9	65	29.4	76.5	88.2	1.3%
Study population	865 (100)	52.6	59	26.5	38.9	43.0	0.5%

Neuroimaging activation studies in the vegetative state: predictors of recovery?

Haibo Di, Melanie Boly, Xuchu Weng, Didier Ledoux and Steven Laureys

Table 2. Published functional magnetic resonance imaging and positron emission tomography activation studies stratified depending on activation patterns (absent or 'low level' primary cortical activation versus atypical 'higher order' associative cortical activation) and outcome (death or permanent vegetative state (VS) versus recovery from VS). Note that atypical 'higher order' activation more often is followed by recovery of consciousness.

Cerebral activation	No activation or primary cortical activation	Atypical 'higher order' cortical activation	Total
Bad outcome	25	2	27
Good outcome	4	9	13
Total	29	11	40

MCA Stroke: ages 18- 60

Modified Rankin scale

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent, and requiring constant nursing care and attention
6	Dead

Reproduced with permission from: Van Swieten JC, Koudstaa PJ, Visser MC, et al. Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988; 19:604. Copyright © 1988 Lippincott Williams & Wilkins.

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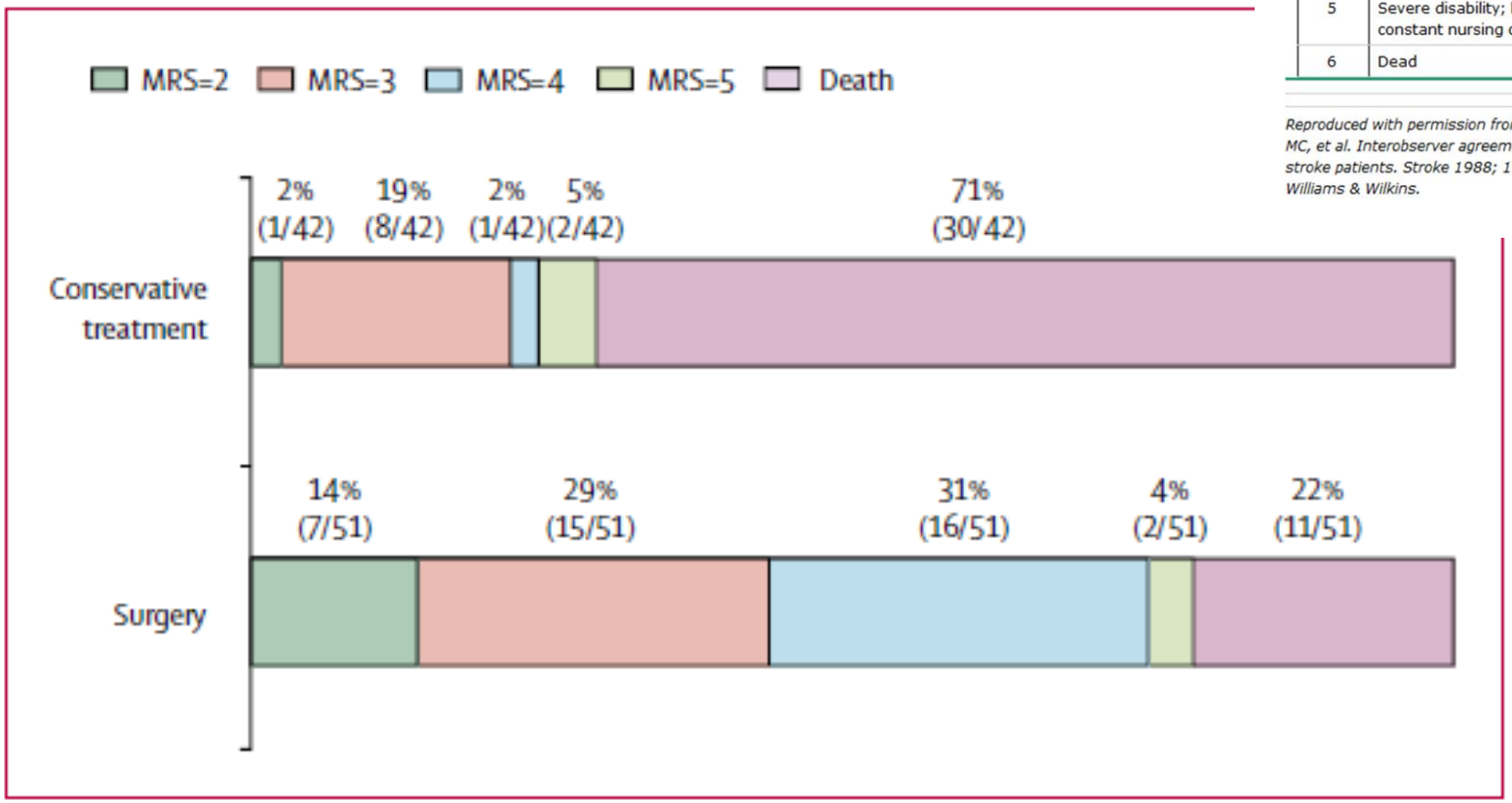
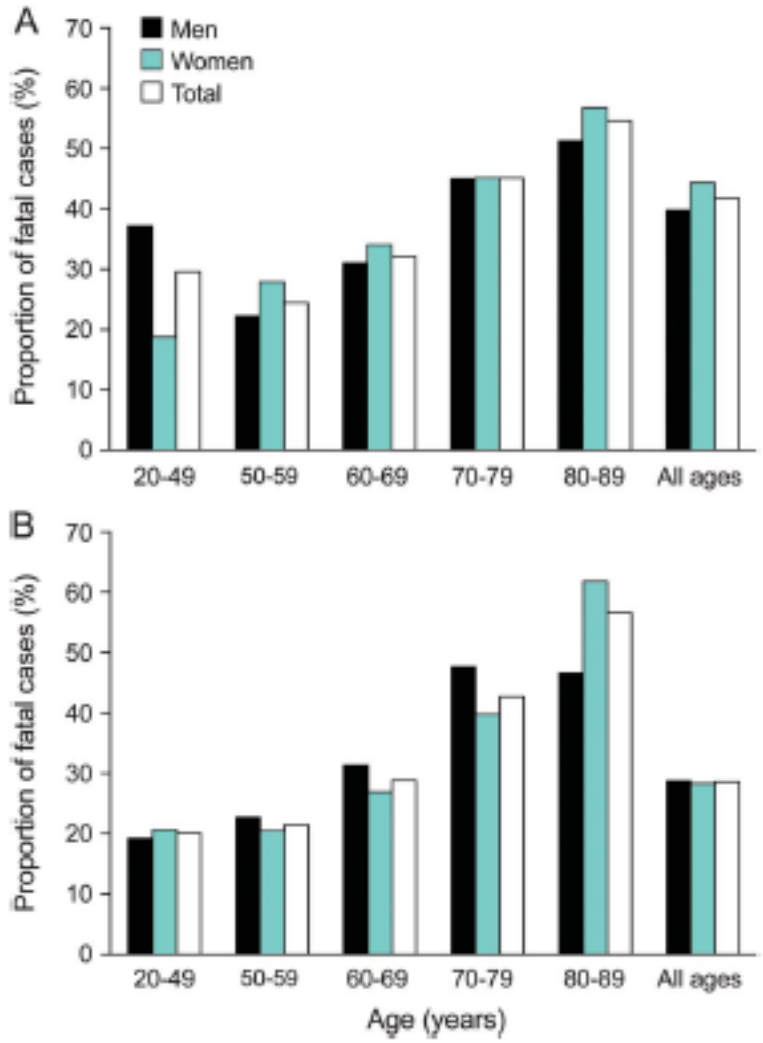


***Figure 1*: Distributions of the scores on the mRS and death after 12 months for patients treated with or without decompressive surgery**

The Lancet: Neurology, Volume 6, Issue 3, March 2007, Pages 215–222

Mortality after hemorrhagic stroke

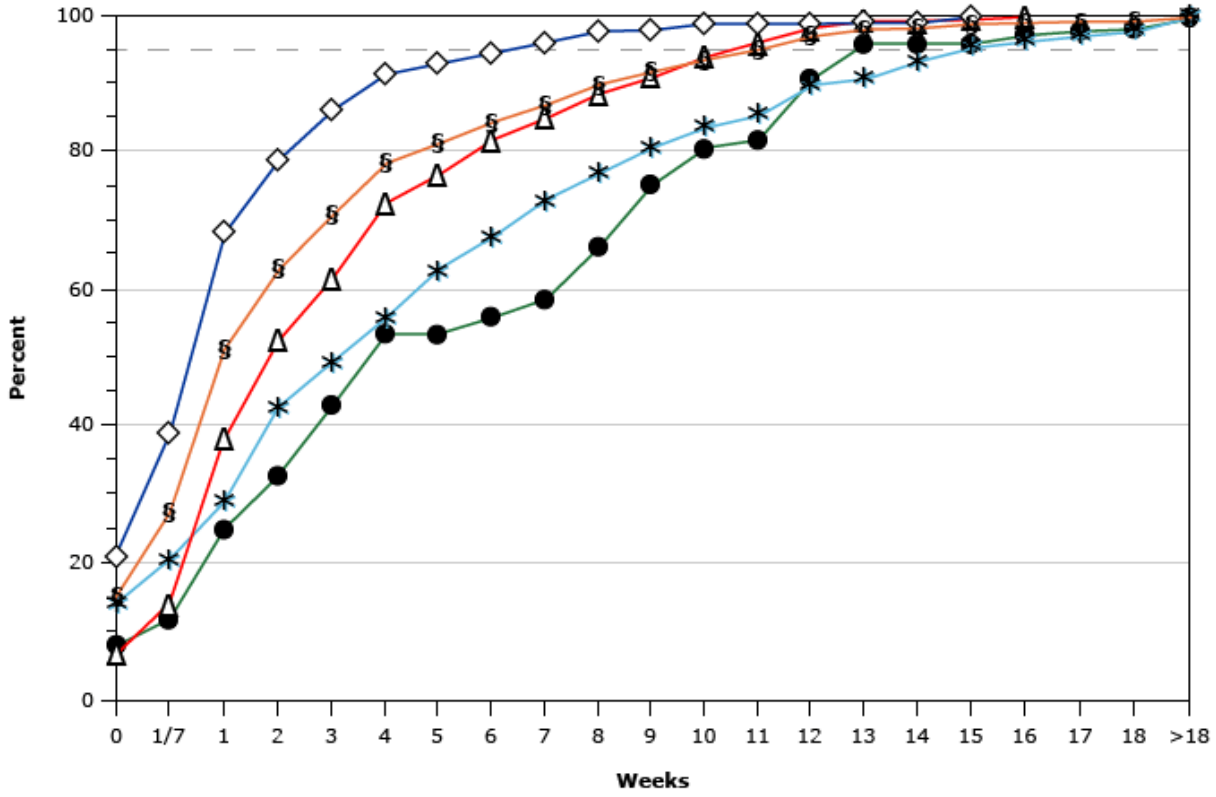
Figure 1 Thirty-day case fatality after stroke, stratified by sex



Intracerebral

Sub-Arachnoid Hemorrhage

Time course of neurologic recovery after stroke



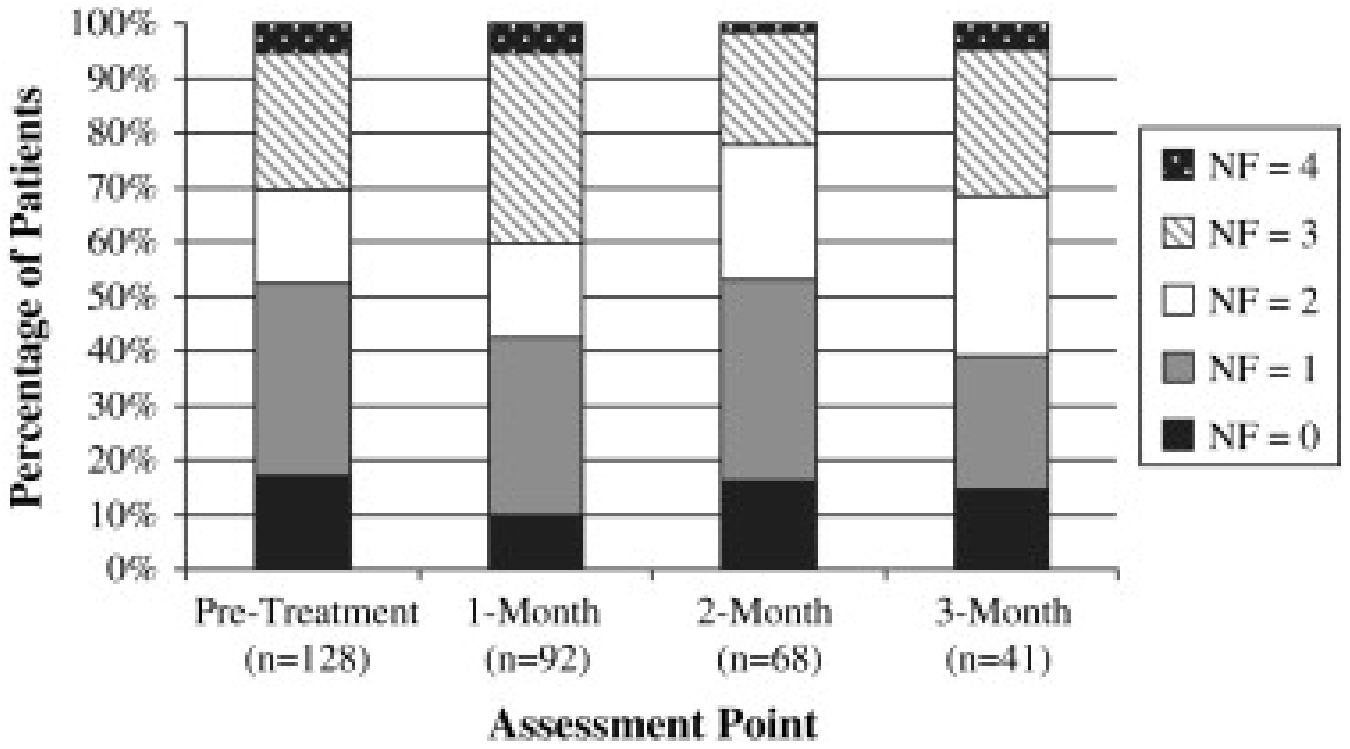
The time course of recovery in survivors shown as the cumulated rate of patients having reached their best neurological outcome. Rates are given for all patients, §; for patients with initial mild stroke severity, ◇; for patients with initial moderate stroke severity, Δ; for patients with initial severe stroke severity, *; for patients with initial very severe stroke severity, ●. The ANOVA test showed an overall difference in the time course of recovery between the groups, $p<0.0001$. Further analyses showed that the time course of recovery differed significantly between patients with initially mild strokes versus moderate strokes, $p<0.0001$, and between patients with moderate strokes versus severe strokes, $p<0.03$. No difference was found between patients with severe versus very severe strokes, $p = 0.19$.

Neuro Radiation for Treatment

An estimated 20%–40% of cancer patients will develop brain metastases. Whole-brain radiotherapy (WBRT) is the standard treatment for patients with brain metastases. Although WBRT can reduce neurologic symptoms, the median survival following WBRT is between 3 and 6 months.

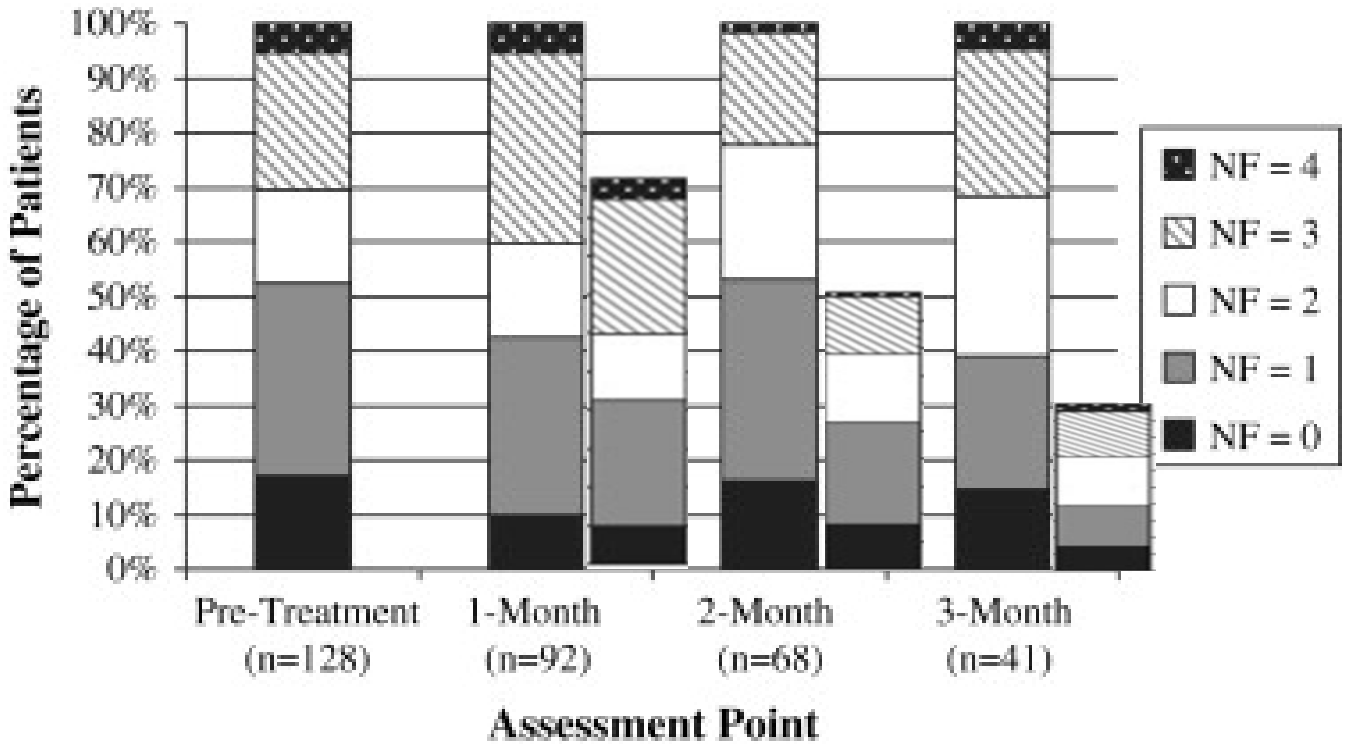
QUALITY OF LIFE IN BRAIN METASTASES RADIATION TRIALS
CURRENT ONCOLOGY—VOLUME 15, NUMBER 5

Function Post XRT for Mets



Clinical Oncology (2001)13:91–94

Function Post XRT for Mets



Clinical Oncology (2001)13:91–94

The spectrum of acute encephalitis

Causes, management, and predictors of outcome

Table 4 Poor outcome factors in encephalitis: Multivariate analysis

	OR (95% CI)	*p* Value
Age ≥65 y	2.28 (1.08–4.91)	0.0307
Immunocompromised	2.79 (1.22–6.59)	0.0153
Coma, GCS score ≤8	5.06 (1.56–19.89)	0.0062
Mechanical ventilation	3.44 (1.30–9.54)	0.0124
Acute thrombocytopenia	2.36 (1.07–5.26)	0.0329
CSF polymorphonuclear cells	1.01 (0.83–23.94)	0.0821

Abbreviations: CI = confidence interval; GCS = Glasgow coma scale; OR = odds ratio.

Good Outcome: modified Renkin Score 0-2
Poor Outcome: modified Renkin Score 3-6

Neurology 84 January 27, 2015


Your Organ Grinder

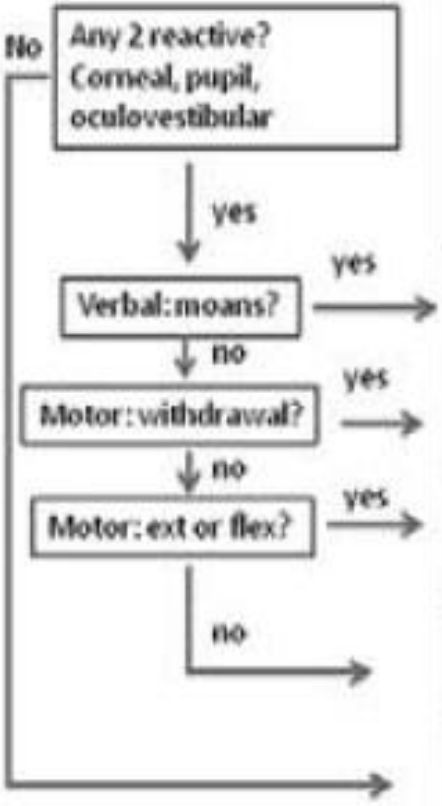
Clinical examination for outcome prediction in nontraumatic coma.

Cause of Coma	Rankin Scale at Month 6						
	0	1	2	3	4	5	6
All patients (n = 500)	5 (1)	6 (1)	14 (3)	9 (2)	12 (2)	17 (3)	437 (87)
Subarachnoid hemorrhage (n = 80)	1 (1)	0 (0)	1 (1)	2 (3)	5 (6)	5 (6)	66 (83)
Ischemic stroke (n = 54)	0 (0)	0 (0)	1 (2)	0 (0)	1 (2)	6 (11)	46 (85)
Intracerebral hemorrhage (n = 112)	0 (0)	0 (0)	2 (2)	1 (1)	3 (3)	1 (1)	105 (94)
Hypoxia-ischemia (n = 202)	4 (2)	6 (3)	7 (3)	3 (1)	0 (0)	3 (1)	179 (89)
Hepatic encephalopathy (n = 10)	0 (0)	0 (0)	1 (10)	0 (0)	1 (10)	0 (0)	8 (80)
Miscellaneous (n = 42)	0 (0)	0 (0)	2 (5)	3 (7)	2 (5)	2 (5)	33 (79)

Data presented as n (% of patients).

Crit Care Med 2012 Vol. 40, No. 4

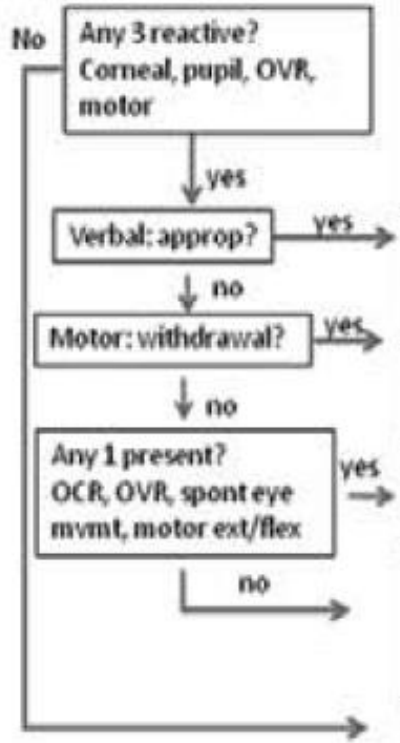
500 patients at Admission
Best 6 month recovery (Levy in parentheses)



Number of patients	No recovery veg state (mRS 5/6)	Severe disability (mRS 4)	Moderate disability/good recovery (mRS 0-3)
0 (56)	0% (46%)	0% (13%)	0% (41%)
0 (106)	0% (58%)	0% (19%)	0% (23%)
153 (135)	86% (69%)	3% (14%)	12% (17%)
57 (83)	86% (80%)	4% (8%)	11% (12%)
289 (120)	94% (97%)	2% (2%)	3% (1%)

Crit Care Med 2012 Vol. 40, No. 4

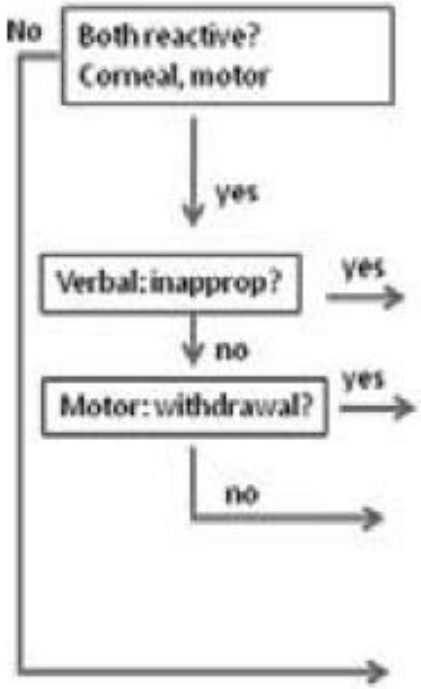
375 Patients on Day 1
(387 Levy patients in parentheses)



Number of patients	No recovery/veg state (mRS 5/6)	Severe disability (mRS 4)	Moderate disability/good recovery (mRS 0-3)
4 (24)	0% (0%)	0% (33%)	100% (67%)
45 (136)	56% (42%)	13% (21%)	31% (37%)
94 (104)	88% (76%)	2% (13%)	9% (11%)
0 (36)	0% (54%)	0% (11%)	0% (4%)
232 (87)	95% (98%)	2% (0%)	3% (2%)

Crit Care Med 2012 Vol. 40, No. 4

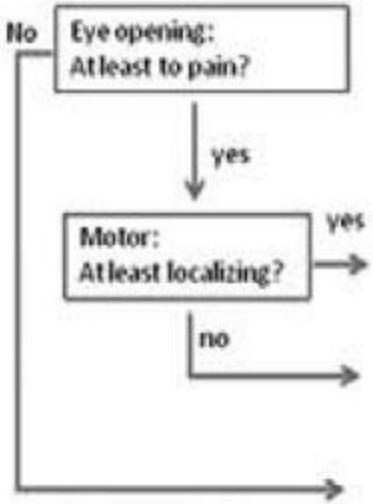
223 patients on Day 3
(261 Levy patients in parentheses)



Number of patients	No recovery/vegetative state (mRS 5/6)	Severe disability (mRS 4)	Moderate disability/good recovery (mRS 0-3)
9 (68)	22%(0%)	0%(26%)	78%(74%)
49 (75)	57%(40%)	12%(27%)	31%(33%)
0 (62)	0%(76%)	0%(16%)	0%(8%)
168 (56)	89%(96%)	4%(4%)	7%(0%)

Crit Care Med 2012 Vol. 40, No. 4

128 patients on Day 7
(179 Levy patients in parentheses)



Number of patients	No recovery/veg state (mRS 5/6)	Severe disability (mRS 4)	Moderate disability/good recovery (mRS 0-3)
42 (99)	31% (1%)	10% (24%)	60% (75%)
36 (54)	72% (63%)	14% (28%)	14% (10%)
50 (26)	86% (92%)	6% (8%)	8% (0%)

Crit Care Med 2012 Vol. 40, No. 4

My Emails

Mike;

- Sorry for my late response I have added some info for your talk. In terms of prognosis, it depends on the type of brain injury. It is very hard to predict. What we can effectively do is predict who is gonna do poorly. We can't accurately predict who is gonna recover or do better than PVS, thats the bottom line.

- Most prediction is based on disease specific grading systems, usually mortality. Prediction of disability is expert based, very hard to do. Most research is after Cardiac Arrest.

Risk For Delerium

Older age (more than 70 years),

Male gender,

Poor functional status,

Malnutrition,

Substance abuse

Pre-morbid medical conditions or cognitive impairment

Polypharmacy, including medications that affect neurotransmitters (such as anticholinergic or dopaminergic)

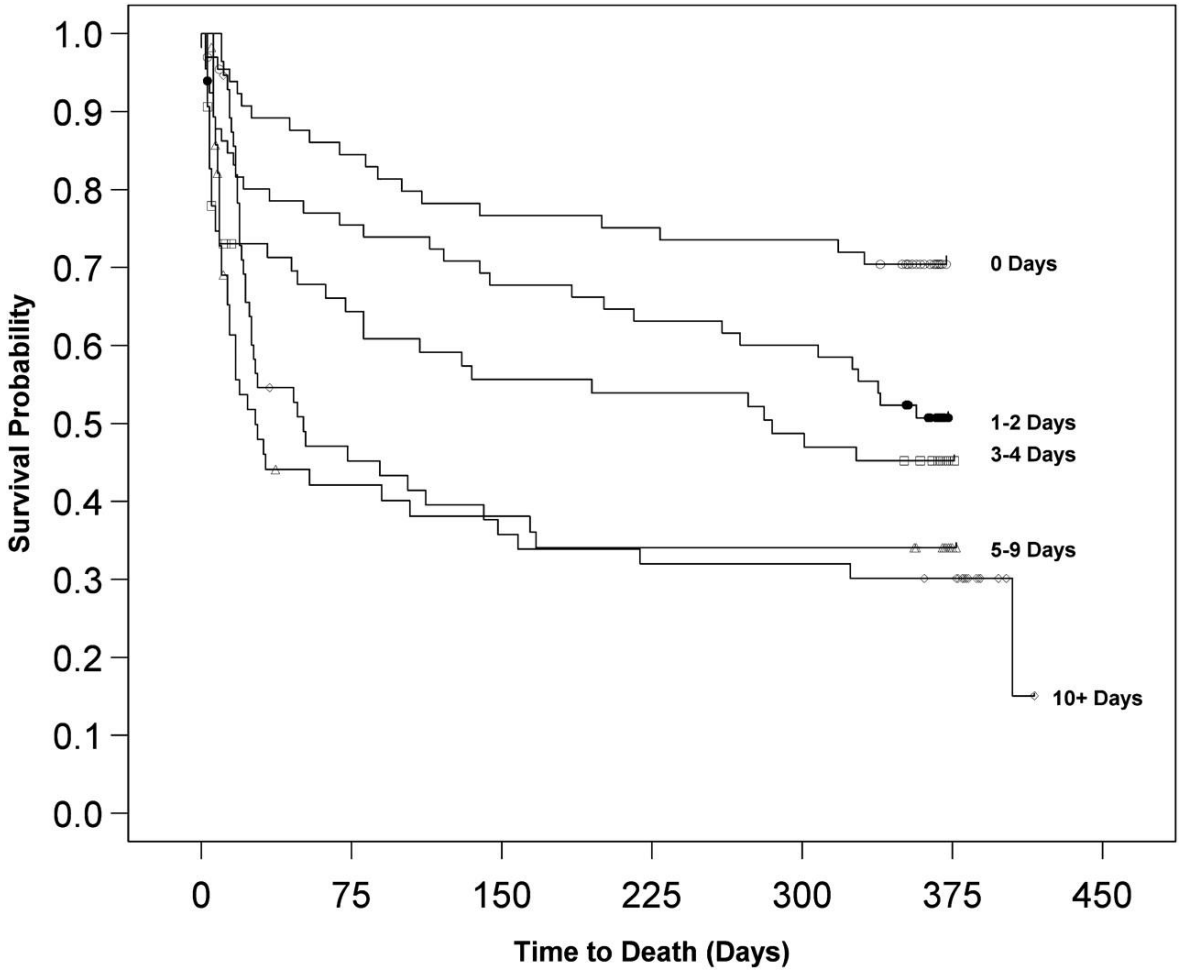
Physical restraints

Visual or hearing impairment

Prior history of delirium

Katramados A, Varelas P. Encephalopathy. In: Torbey M, ed. Neurocritical Care: Cambridge University Press; 2010:220-6.

Days of Delerium with Mortality in ICU pts over 60 y.o.



Pisani et al. American Journal of Respiratory and Critical Care Medicine Vol 180. pp. 1092-1097, (2009)

Quality Of Life- SF 36

Outcome	3 Months	6 Months	12 Months
SF-36 score***			
Physical functioning			
Median (normal value)	35 (90)	55 (89)	60 (89)
Interquartile range	15–58	30–75	35–85
Physical role			
Median (normal value)	0 (85)	0 (84)	25 (84)
Interquartile range	0–0	0–50	0–100
Pain			
Median (normal value)	42 (77)	53 (77)	62 (77)
Interquartile range	31–73	37–84	41–100
General health			
Median (normal value)	52 (78)	56 (77)	52 (77)
Interquartile range	35–67	36–74	35–77
Vitality			
Median (normal value)	45 (69)	55 (68)	55 (68)
Interquartile range	30–55	28–63	28–63
Social functioning			
Median (normal value)	38 (88)	63 (88)	63 (88)
Interquartile range	19–69	38–88	38–100
Emotional role			
Median (normal value)	33 (84)	67 (84)	100 (84)
Interquartile range	0–100	0–100	17–100
Mental health			
Median (normal value)	68 (78)	70 (78)	72 (78)
Interquartile range	54–80	54–88	52–88

Palliative care and neurology

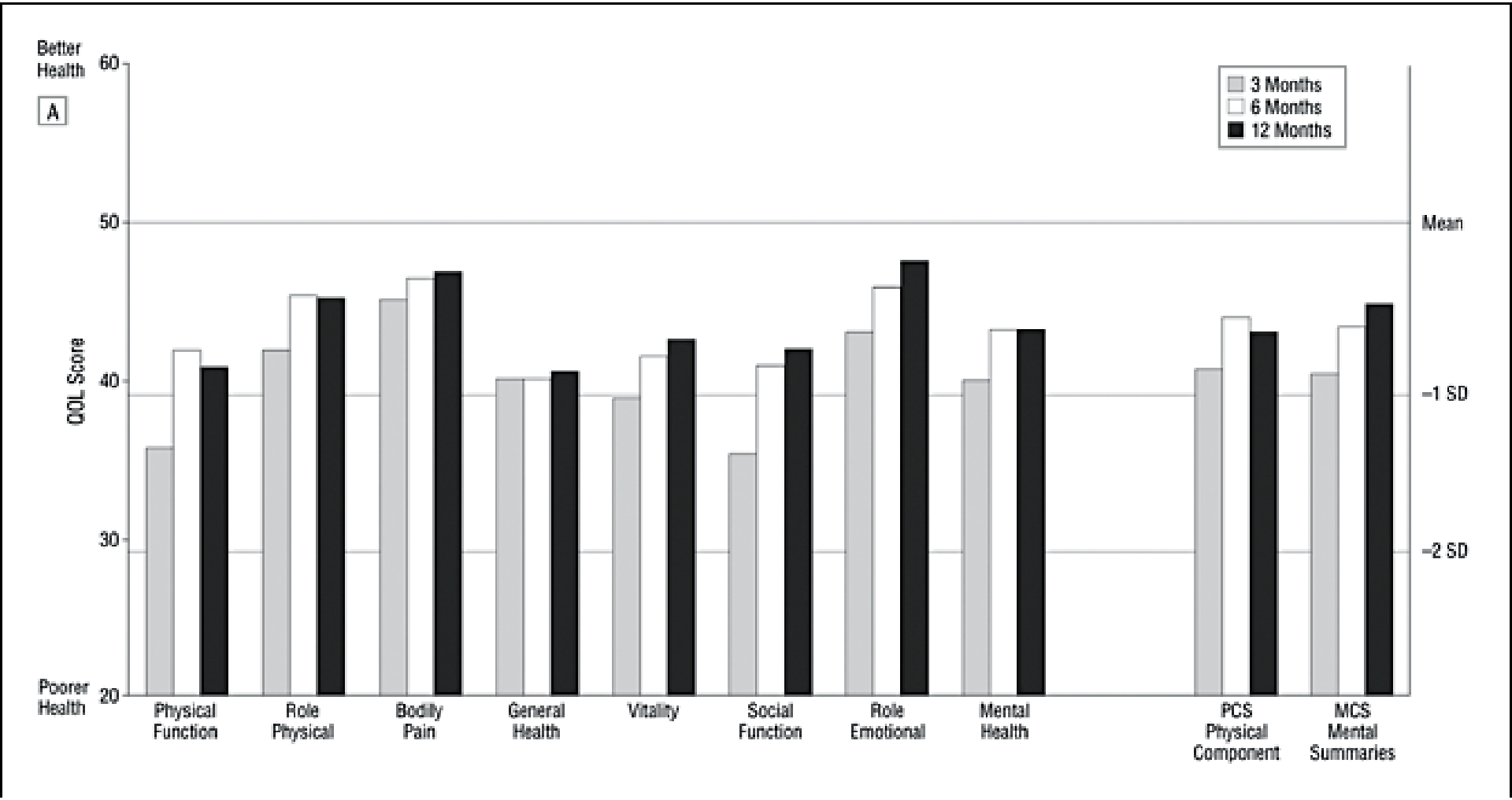
Time for a paradigm shift

Table Hospice guidelines for neurologic disorders[e18]

Dementia	1. Stage 7C or higher on the FAST scale[e19] AND
	2. One or more of the following in the past year: aspiration pneumonia, pyelonephritis, septicemia, stage 3 or 4 pressure ulcers, recurrent fevers, other conditions suggesting limited prognosis, or inability to maintain sufficient fluid/caloric intake in past 6 months (10% weight loss or albumin <2.5 g/dL)
Stroke or coma	1. Palliative Performance Scale[e20] score ≤40% AND
	2. Poor nutritional status with inability to maintain sufficient fluid/caloric intake (10% weight loss in 6 months, 7.5% weight loss in 3 months, serum albumin ≤2.5 g/dL, or pulmonary aspiration resistant to speech therapy interventions)
Other neurologic disease including ALS, PD, MD, MG, or MS	1. Critically impaired breathing including dyspnea at rest, vital capacity <30%, O_2 need at rest, AND refusal of artificial ventilation, OR
	2. Rapid disease progression (to bed-bound status, unintelligible speech, need for pureed diet, and/or major assistance needed for ADLs) with either:
	A. Critical nutrition impairment in the prior year (inability to maintain sufficient fluid/caloric intake, continuing weight loss, dehydration, AND refusal of artificial feeding methods) OR
	B. Life-threatening complications in the prior year (recurrent aspiration pneumonia, pyelonephritis, sepsis, recurrent fever, OR stage 3 or 4 pressure ulcers)
Generic criteria	1. Terminal condition (can be multiple conditions) AND
	2. Rapid decline over past 3–6 months as evidenced by progression of disease signs, symptoms and test results, decline in PPS ≤40%, and involuntary weight loss >10%, and/or albumin <2.5 g/dL

Abbreviations: ADL = activities of daily living; ALS = amyotrophic lateral sclerosis; FAST = Functional Assessment Staging Test; MD = muscular dystrophy; MG = myasthenia gravis; MS = multiple sclerosis; PD = Parkinson disease; PPS = Palliative Performance Scale.

The Brain Post ICU



Arch Intern Med. 2007;167(12):1312-1320.

This is your brain on Drugs

This is your brain after MICU

Any Questions?