Super Specialization – Friend or Foe?

The Cambridge Experience

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Divisional Director

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Cambridge University Hospitals, Cambridge, UK.

Cambridge City

Cambridge University Hospitals

the heart of

Cambridge Biomedical Campus

Addenbrooke's – Where it all began . . .1766

Current Partner Organisations

University of Cambridge School of Clinical Medicine
MRC Laboratory of Molecular Biology
Cancer Research UK Cambridge Research Institute
Cambridge Institute for Medical Research (CIMR)
The MRC/Hutchison Centre
NHS Blood and Transplant Service
GlaxoSmithKline
Institute of Metabolic Science
Wellcome Trust
East of England Ambulance Service NHS Trust Astra Zeneca

Nobel Prizes

Have been awarded to scientists associated with campus:

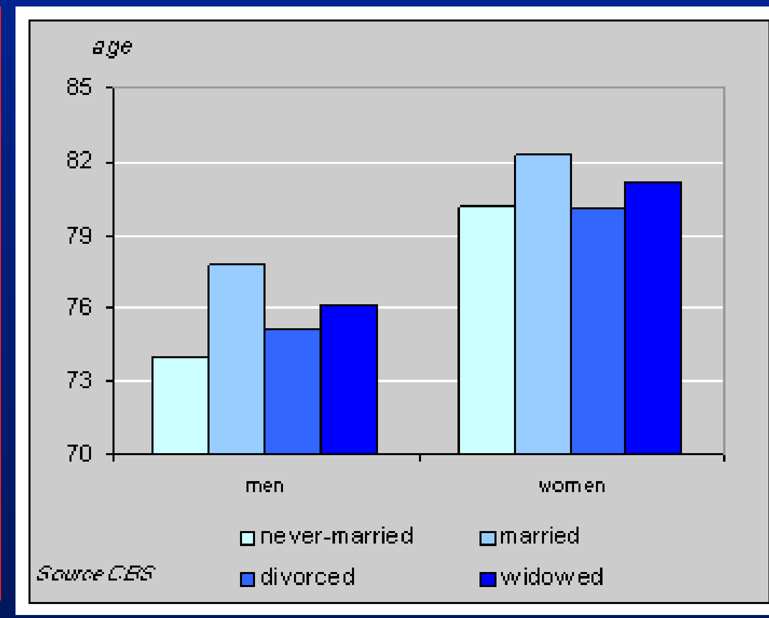
1915: William & Lawrence Bragg, x-ray diffraction
1958: Frederick Sanger, work on insulin
1962: Frances Crick & James Watson discovers DNA
1963: Alan Hodgkin & Andrew Huxley nerve conduction
1980: Frederick Sanger nucleic acids
1984: Cesar Milstein & Georges Kohler monoclonal antibodies
1997: John Walker synthesis of adenosine triphosphate
2002: Sydney Brenner, John Sulston, Bob Horvitz regulation of organ development and programmed cell death in caenorhabditis elegans
2009: Venki Ramarkrishnan, studies of the structure and function of the ribosome

Cambridge University Hospitals

- 1,000 beds, ~ 80 CC beds
- 7,000 staff
- 5,726 births
- £650m turnover
- Attendances at A/E > 100, 000
- Admissions to inpatients ~ 180, 000
- Outpatient attendances ~ 500, 000



Healthcare – the facts!



- Healthcare has come a long way!
- People expect more:
  - live longer, survive injury, good outcome
- Doctors to be highly specialised

Improving Healthcare

- Basic programs;
  - immunisations, antenatal care, antibiotics
- Safety laws;
  - helmets, speed restrictions, seat belts
- Technological advances;
  - car design, airbags, antilock brakes, roll bars
- Better treatment at roadside and at EDs
- Outreach support;
  - ambulances, medivac teams, RRTs

What is a “Specialist”?

- A specialist is a person who concentrates primarily on a particular subject or activity and becomes highly skilled in a specific and restricted field.

- In medicine – a Doctor highly trained in a particular branch of medicine, thus possessing detailed knowledge and skill to treat a particular disease or group of diseases.

General Vs Specialised

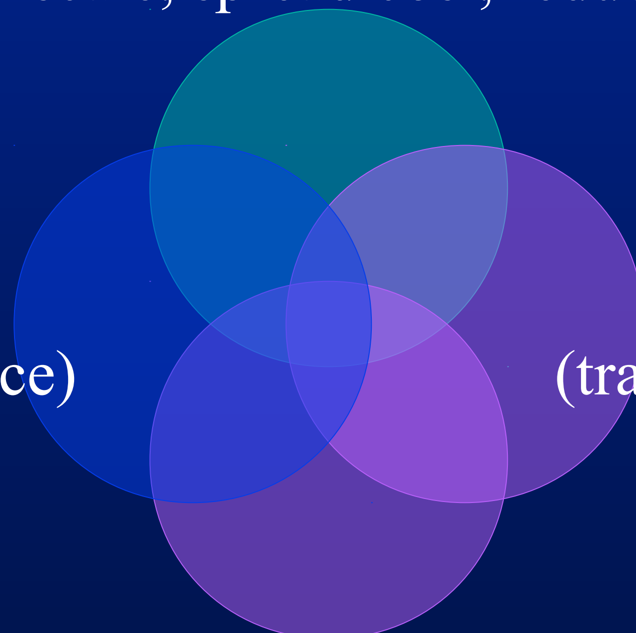
How do we decide?

- Needs assessment
  - Size of population, Incidence of the disease
  - Availability of expertise
  - Complexity of the treatment
  - Cost of treatment
  - Geographic boundaries
  - Sustainability of the system
- Avoid making specialization an instrument looking for an illness to treat, rather than keeping people healthy!

Specialisation – why?

Economic Considerations

(economies of scale, spread cost, reduce duplication)



Outcomes

(experience, practice)

Education

(training doctors, AHP)

Research

(epidimiology, research trials, translational research)

Economic Argument

- Expensive set up – buildings, machinery
  - Reduce cost by concentrating, sweating assets
- Purpose built facilities
  - Proper design fit for purpose
  - Adjacencies – ICU with MRI
- Reduce cost through economies of scale
  - Combine back office functions
  - Less duplication – teams on call

Education & Research Argument

- Volume of cases – easier to learn
  - Specialists, fellows, nurses, AHP
- Concentration of disease
  - Understand epidemiology and pathophysiology
- Research is easier – recruitment for trials
- Data analysis – what if scenarios
- Translational and drug research quicker route

Better Outcomes Argument

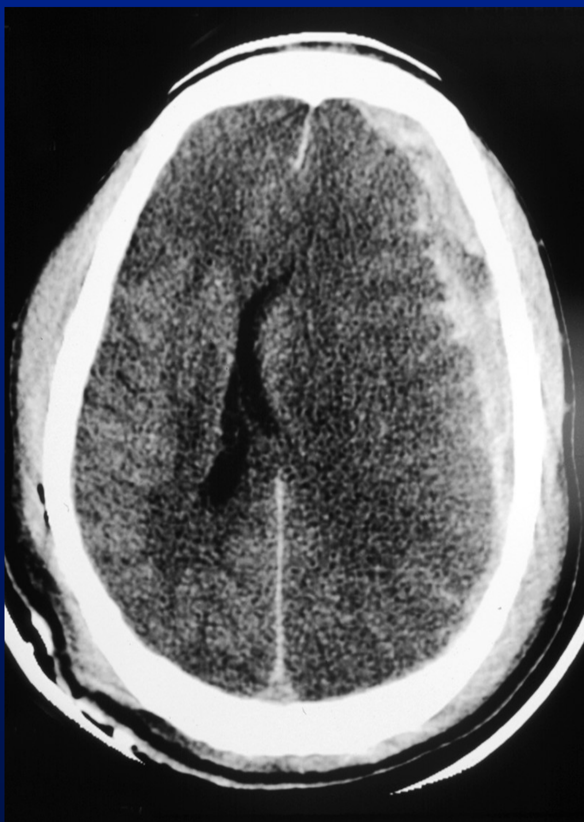
- Volume of cases – experience
- Earlier recognition of signs and symptoms
- Earlier institution of therapies
- Protocol driven therapies
- Multi-speciality teams availability

Better Outcomes Argument

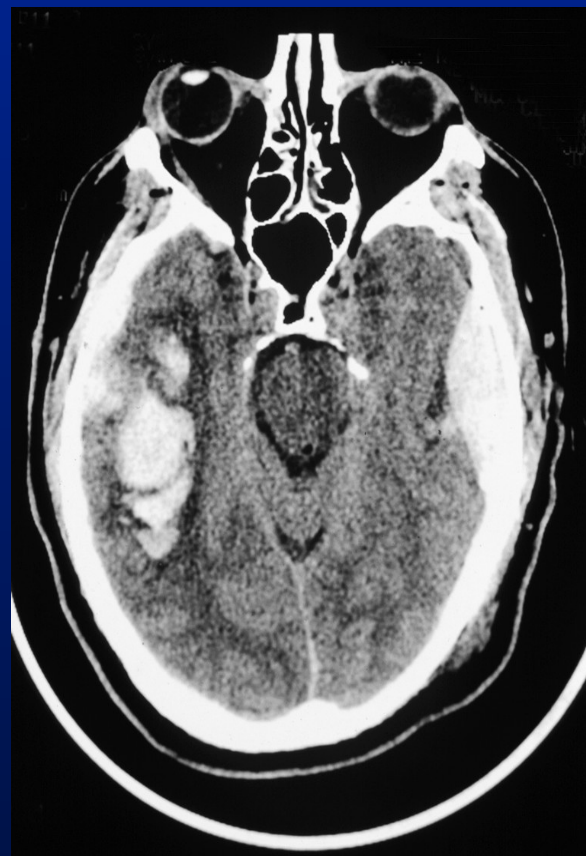
Where is the evidence?

- Major Trauma
- Head Trauma
- Stroke
- SAH

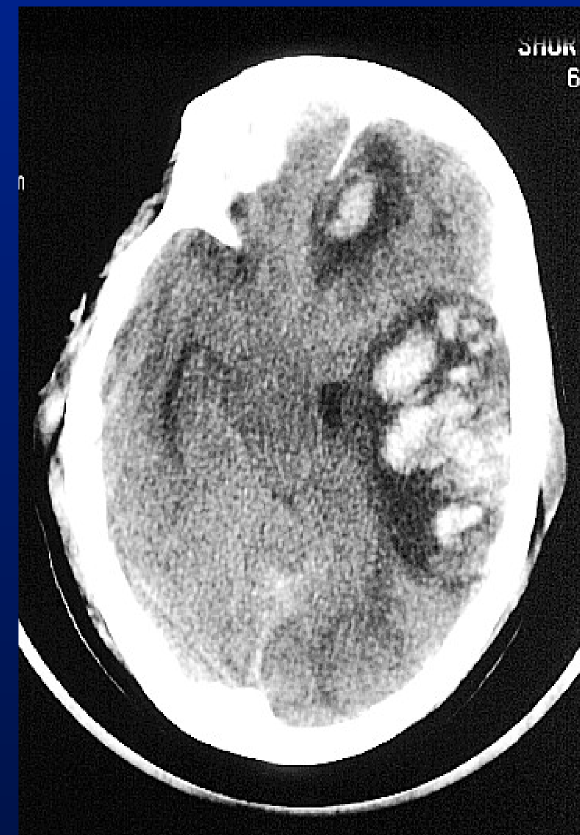
Traumatic Brain Injury



SDH



SDH + Contusion

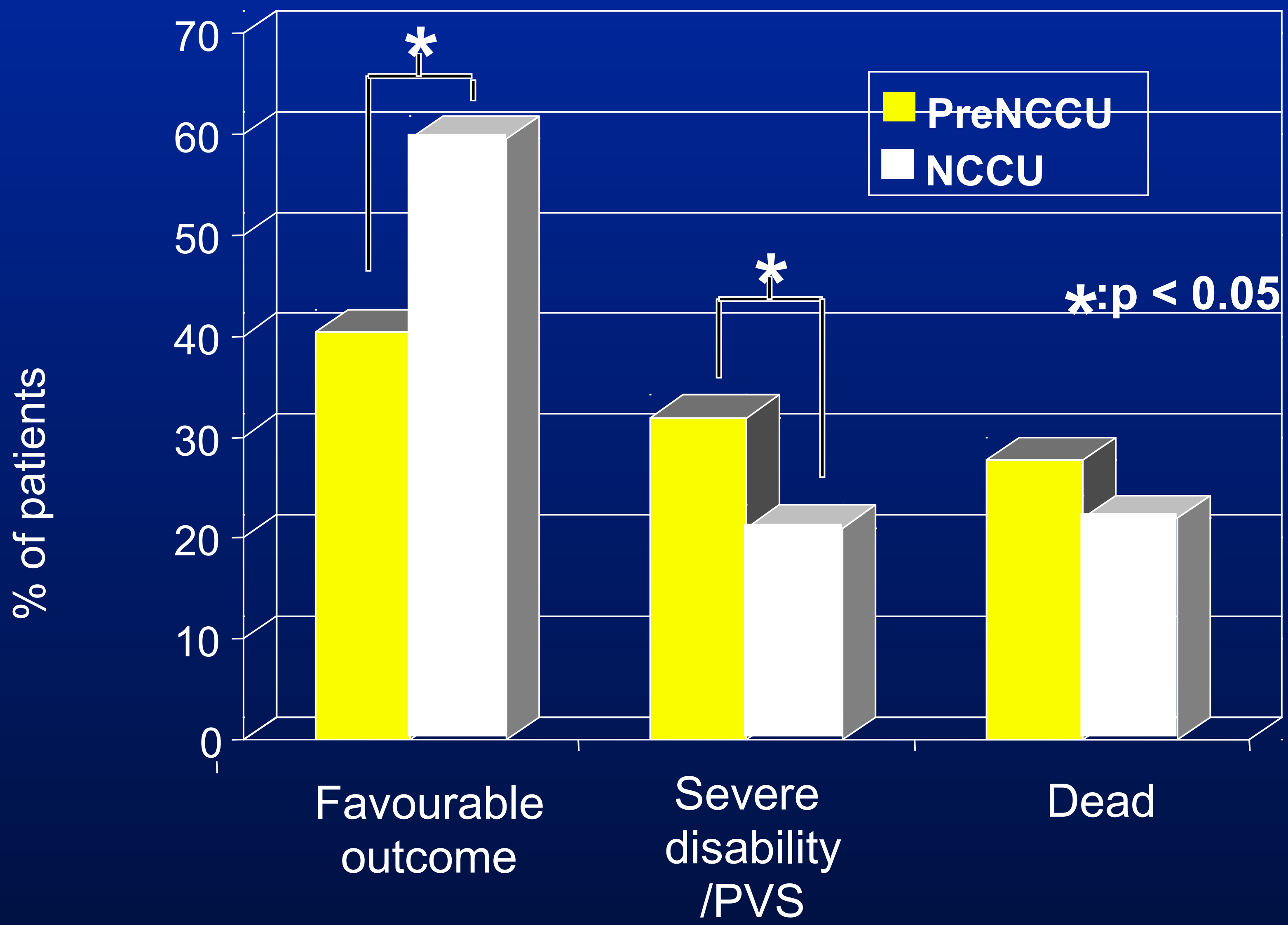


SOL + contusions

Retrospective Outcome Audit

- Notes review of two epochs (1991-1993/1994-1997)
- 285 patients (83 + 202), 182 SHI (53+ 129)
- No significant change in LOS
- Follow up at $\geq$ 6 months (Glasgow Outcome Scale)

Favourable	1: good recovery 2: moderate disability
Unfavourable	3: severe disability 4: vegetative state 5: death



Patel et al. Intensive Care Med 2002

Outcome after traumatic brain injury improved by an organized secondary insult program and standardized neurointensive care.

Elf K, Nilsson P, Enblad P

Department of Neuroscience, Section of Neurosurgery, Uppsala University Hospital, Uppsala, Sweden.

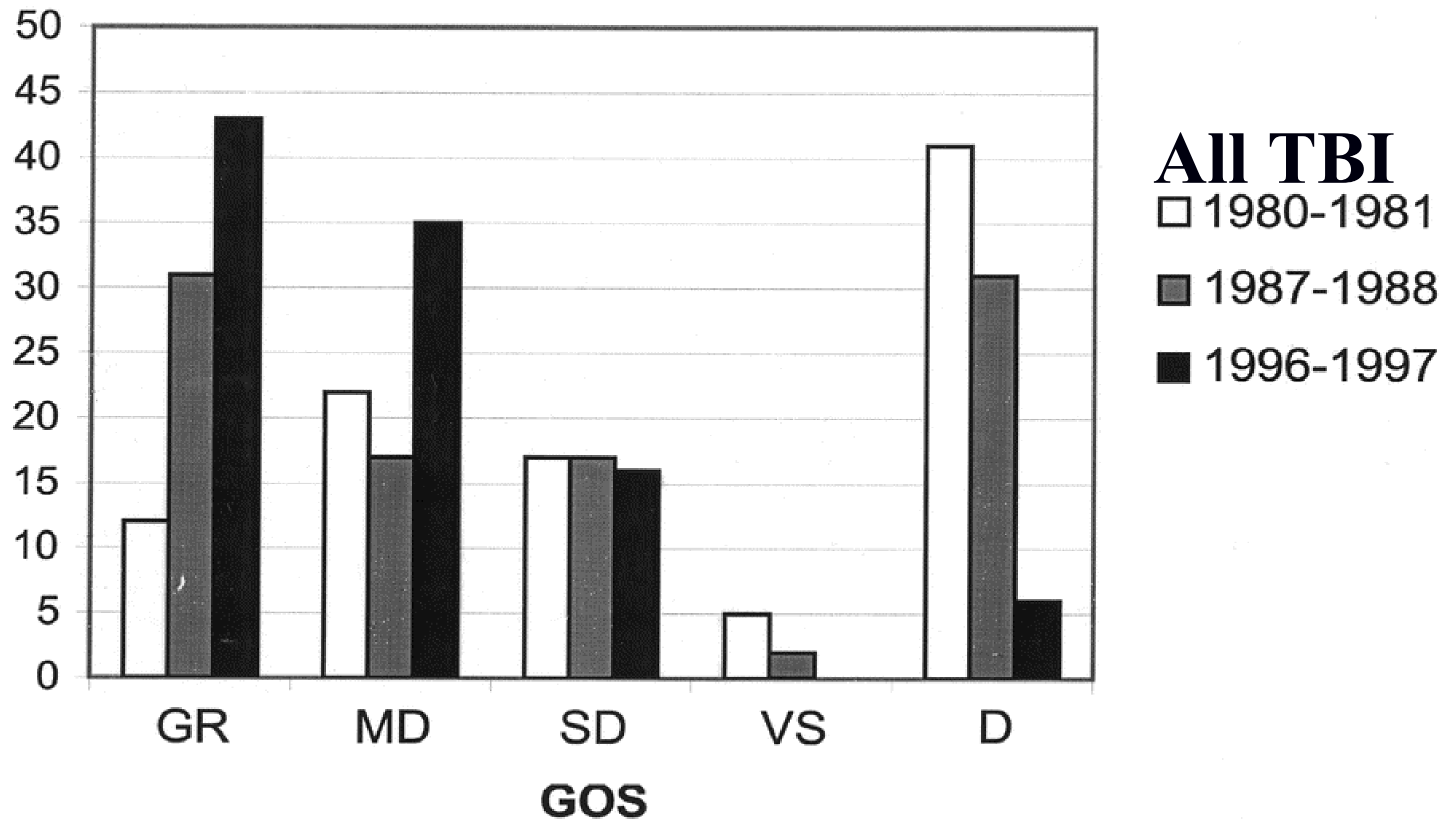
- Evaluated outcome after TBI in 154 patients
  - 1980 – 1981
    - Pre NICU
  - 1987 – 1988
    - Basic NICU
  - 1996 – 1997
    - Advanced Protocol-driven NICU

Crit Care Med. 2002 Sep;30(9):2129-34.

al Care Medicine 2002; 30: 2129 –2134

Outcome after traumatic brain injury improved by an organized secondary insult program and standardized neurointensive care*

Kristin Elf, MD; Pelle Nilsson, MD, PhD; Per Enblad, MD, PhD



Reduction in mortality from severe head injury following introduction of a protocol for intensive care management.

Clayton TJ, Nelson RJ, Manara AR.
Intensive Care Unit, Frenchay Hospital, Bristol BS16 1LE, UK.

- Methods:
  - longitudinal observational study 1992 – 2000
  - All patients admitted with TBI to the ICU at Frenchay Hospital, Bristol, UK: a tertiary referral centre for the clinical neurosciences (mixed ICU)
  - Effect of an intensive care management protocol on ICU and hospital mortality
- Results:
  - No reduction in LOS
  - > 6% reduction in ICU Mortality
  - > 4% reduction in hospital mortality.

Br J Anaesth. 2004 Dec;93(6):761-7.

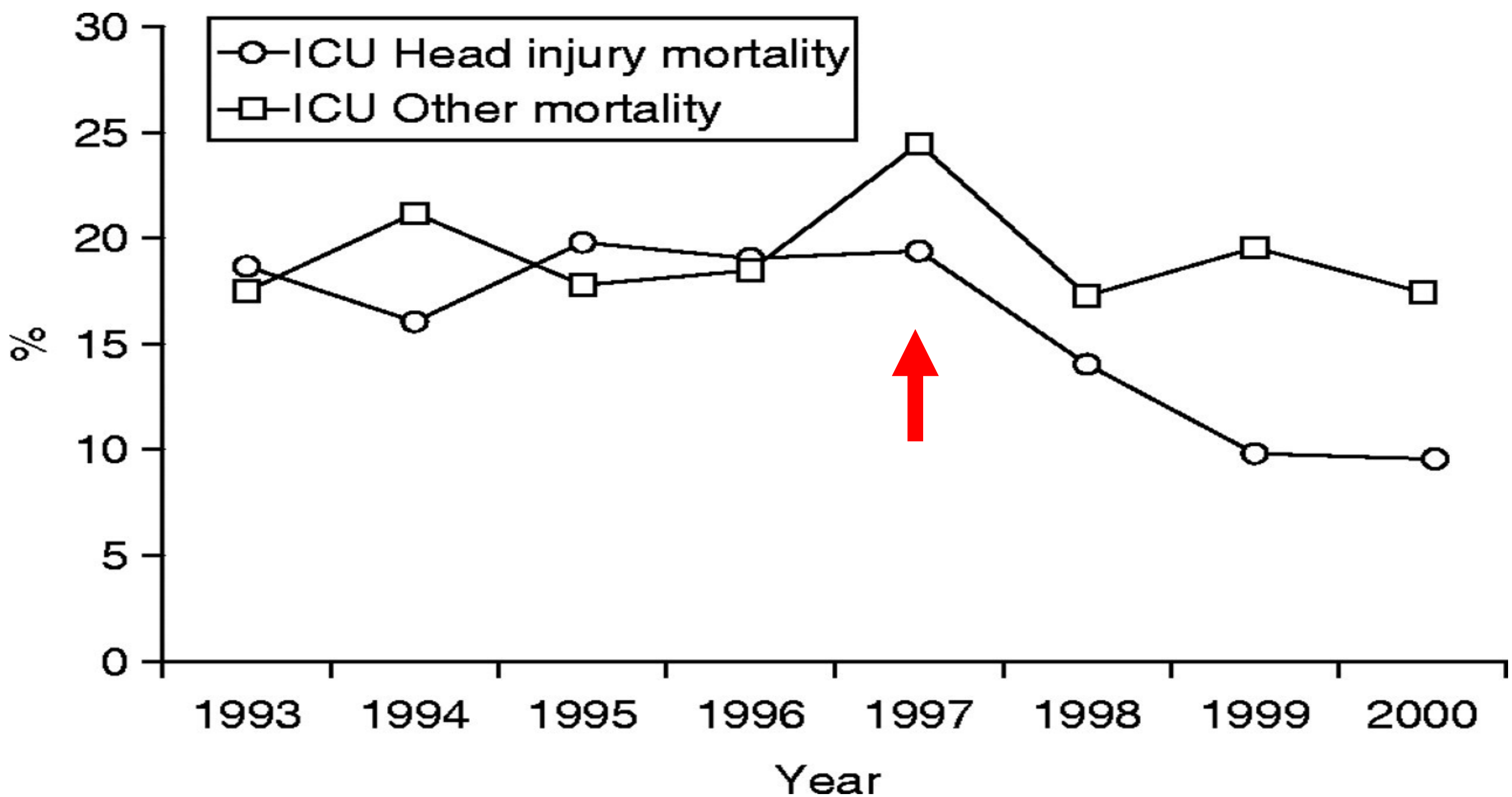
British Journal of Anaesthesia **93 (6)**: 761–7 (2004)
doi:10.1093/bja/aeh249 Advance Access publication September 3, 2004

BJA

CLINICAL INVESTIGATIONS

Reduction in mortality from severe head injury following introduction of a protocol for intensive care management†‡

T. J. Clayton, R. J. Nelson and A. R. Manara*



Management of severe head injury: institutional variations in care and effect on outcome.

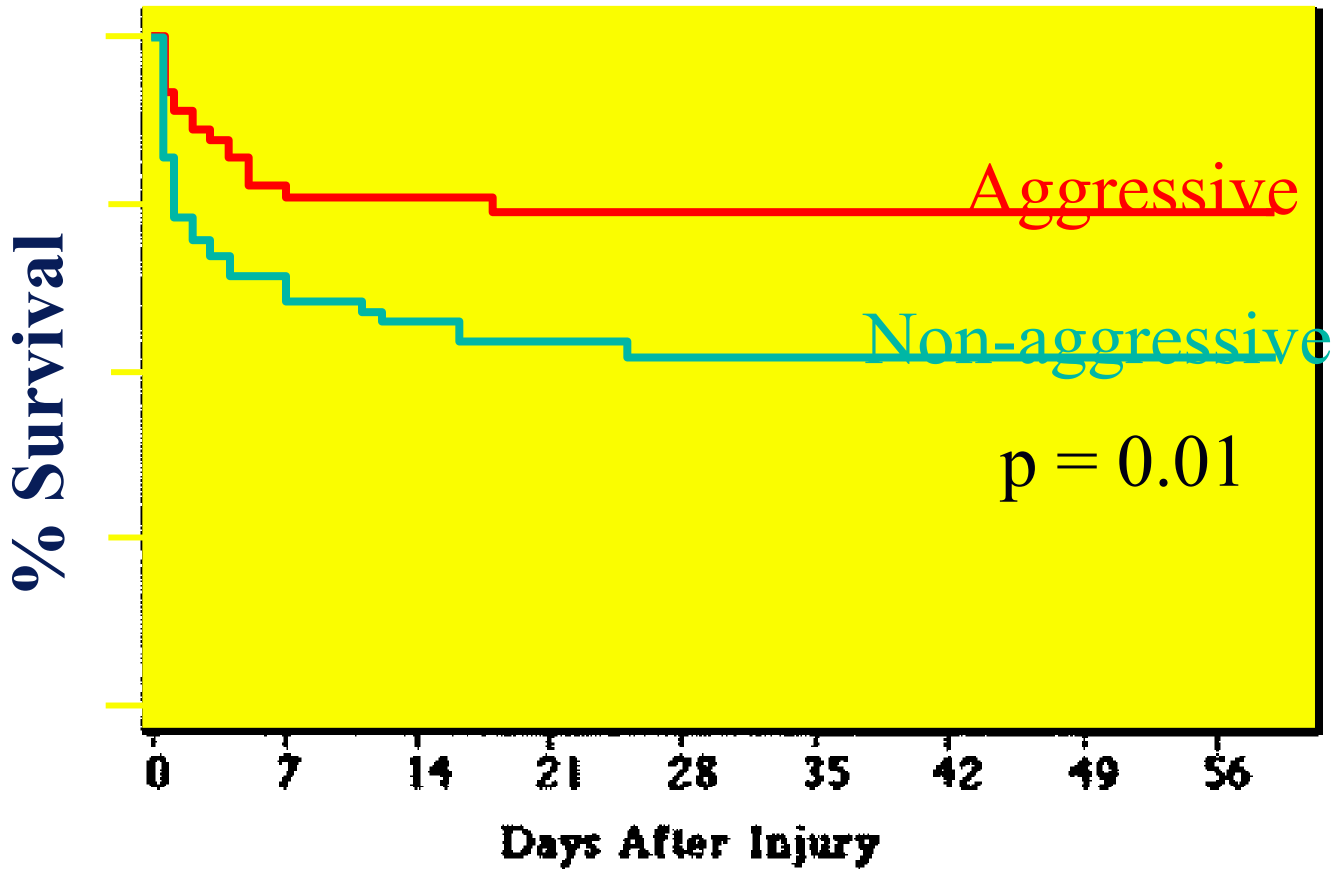
Bulger EM, Nathens FP, Morre M et al
Department of Surgery, University of Washington, Seattle, WA, USA.

- Methods
  - Retrospective data collection
  - All patients with severe TBI GCS < 9 admitted to 34 US trauma centers over 8 months.
  - Correlated outcome, Functional status on discharge, and LOS with the care received.
  - Aggressive vs non-aggressive centers
    - Aggressive centers (ICP monitors > 50% of patients and BTF guidelines)
- Results:
  - Aggressive centers lower mortality but no change in fucntional recovery at discharge
  - Aggressive centers has shorter LOS

Crit Care Med. 2002 Aug;30(8):1870-6.

Critical Care Medicine 2002; 30: 1870–1876

Management of severe head injury: Institutional variations in care and effect on outcome*



R3-Survey of traumatic brain injury management in European Brain IT Centres 2001

Enblad P et al.

Intensive Care Med 2004;30:1058.

Management of severe head injury: Institutional variations in care and effect on outcome

Bulger M et al.

Crit Care Med 2002;30:1870.

Considerable national variation in the care of severely head-injured patients persists.

An “aggressive” management strategy is associated with decreased mortality in patients with severe head injury.

J Neurosurg Anesthesiol. 2011 Jul;23(3):198-205. doi: 10.1097/ANA.0b013e3182161816.

The effect of specialist neurosciences care on outcome in adult severe head injury: a cohort study.

Fuller G, Bouamra O, Woodford M, Jenks T, Patel H, Coats TJ, Oakley P, Mendelow AD, Pigott T, Hutchinson PJ, Lecky F.

Trauma Audit and Research Network, Health Sciences Research Group, Manchester Academic Health Sciences Centre, University of Manchester, Clinical Sciences Building, Salford Royal Hospital, Salford, UK. gordonwfuller@doctors.net.uk

RESULTS: 5411 patients were identified with SHI between 2003 and 2009, with 1485 (27.4%) receiving treatment entirely in non-NSU centers. SHI management in a non-NSU was associated with a 11% increase in crude mortality ($P<0.001$) and 1.72-fold (95% confidence interval: 1.52-1.96) increase in odds of death. The case mix adjusted odds of death for patients treated in a non-NSU unit with SHI was 1.85 (95% confidence interval: 1.57-2.19).

CONCLUSIONS: Our data support current national guidelines and suggest that increasing transfer rates to NSUs represents an important strategy in improving outcomes in patients with SHI.

ICP monitoring as clinically indicated. Primary targets:
ICP $\leq$ 20 mmHg and **CPP 50 to 70 mmHg**
If advanced monitoring is available, fine-tune treatment based on multimodality targets:
PRx < 0.2; **LPR < 25**; **$PbtO_2 \geq$ 15 mmHg**; **SjO_2 > 50%**

STAGE 1

- **Sedation:** Propofol 2-5 mg/kg/h, Fentanyl 1-4 μg/kg/h; consider Atracurium 0.5 mg/kg/h
- **Ventilation:** $SpO_2 \geq$ 94%; $PaCO_2$ 4.5-5.0 kPa (33-38 mmHg)
- **Circulation:** correct hypovolaemia; vasopressors titrated to CPP > 50 mmHg
- **Temperature:** $\leq 37^{o}$C (regular paracetamol +/- automated cooling blanket)
- **Nursing:** 15^{o}-30^{o} head up; avoid venous obstruction
- **Antiepileptics:** EEG to esclude seizures +/- institute or escalate antiepileptic therapy

ICP > 20 mmHg? Escalate to **STAGE 2**
consider re-scan +/- SOL evacuation

- **CSF drainage:** open EVD (or consider ventricular catheter insertion)
- **Osmotherapy:** Hypertonic NaCl (up to Na $\simeq$ 160 mmol) or Mannitol (up to 2 g/kg QDS)
- **Mild hypothermia:** Temp $\simeq 35^{o}$C (monitor daily lipids, CK and ECG if still on Propofol)

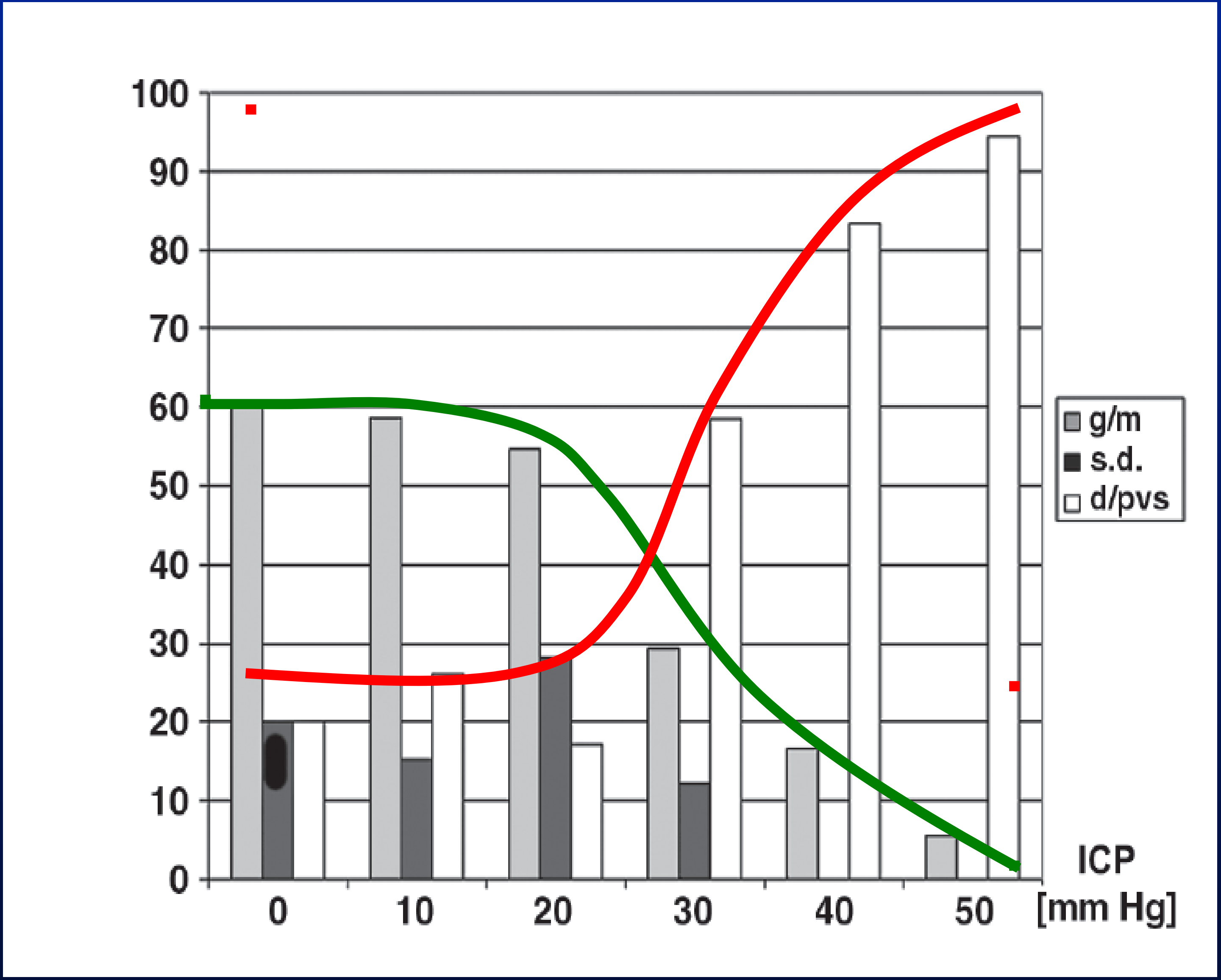
ICP > 20 mmHg? Escalate to **STAGE 3**
consider re-scan +/- SOL evacuation

- **Moderate hypothermia:** Temp 32^{o}C-34^{o}C (change sedation to Midazolam)
- **Ventilation:** $PaCO_2 \simeq$ 4.0 kPa (30mmHg) if SjO_2 > 50% and $PbtO_2$ > 15 mmHg

ICP > 20 mmHg? Escalate to **STAGE 4**
consider re-scan +/- SOL evacuation

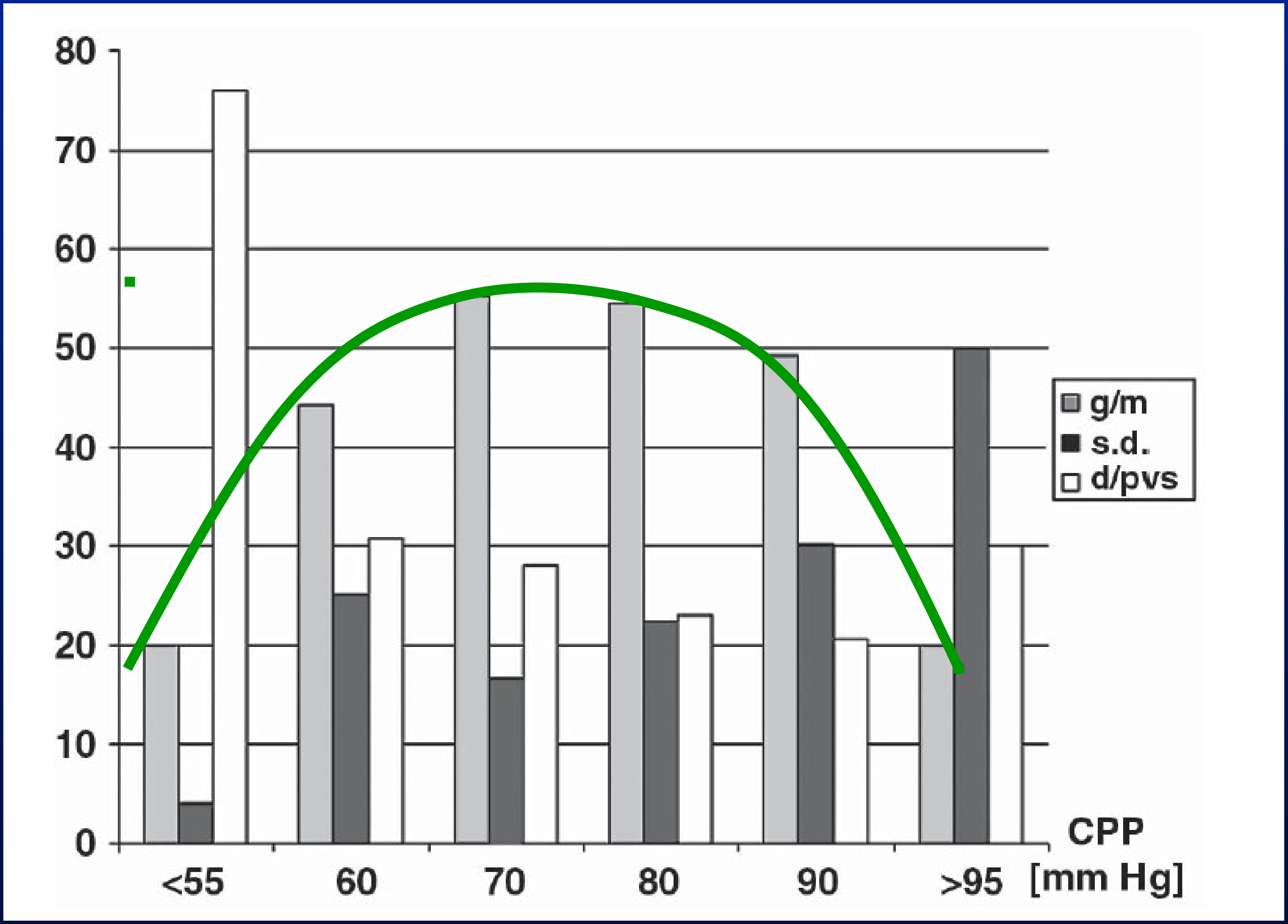
- **Burst suppression:** Thiopentone 5 mg/kg + 3-8 mg/Kg/h (titrate to EEG S.R. $\simeq$ 50%)
- **Surgical decompression:** bifrontal or large fronto-temporo-parietal craniectomy

ICP: independent predictor of mortality + poor outcome



Balesteri et al 2006

CPP: independent predictor of mortality + poor outcome

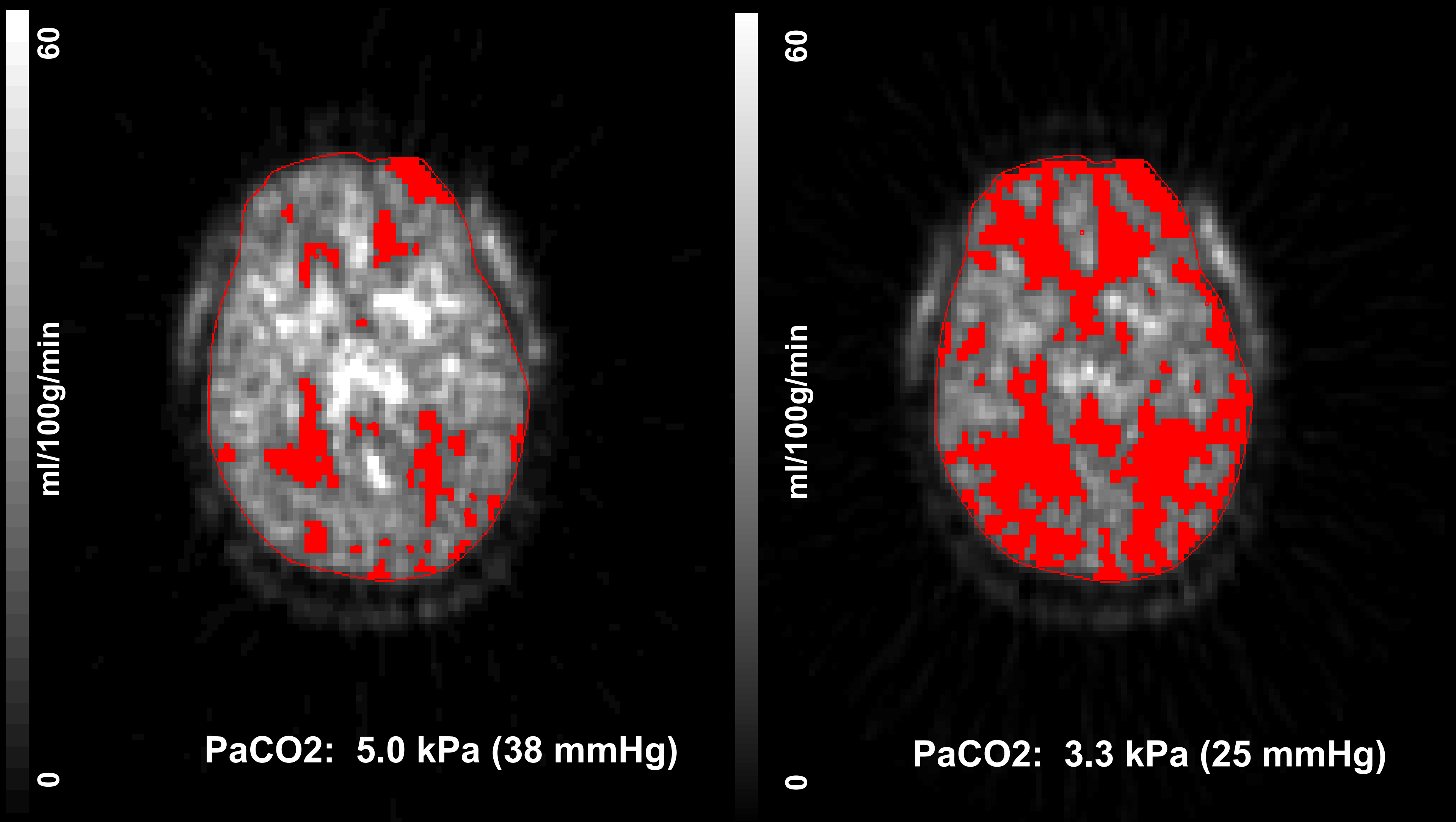


Balesteri et al. Neurocritical Care 2006

Hyperventilation in TBI (6 hrs post impact)

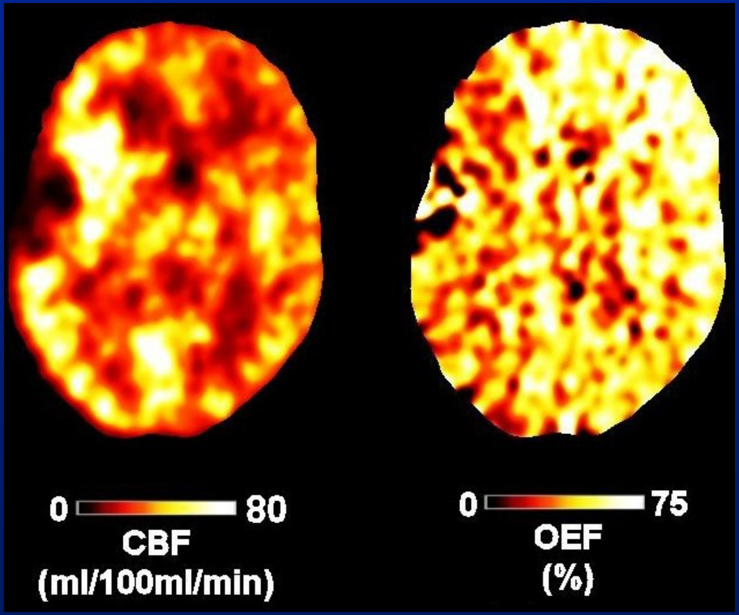
Areas in red show regions with rCBF ≤ 20 ml/100g/min)

(Coles et al. Crit Care Med. 2002)



Hyperventilation therapy - ^{15}O PET

3 days post head injury



Baseline:

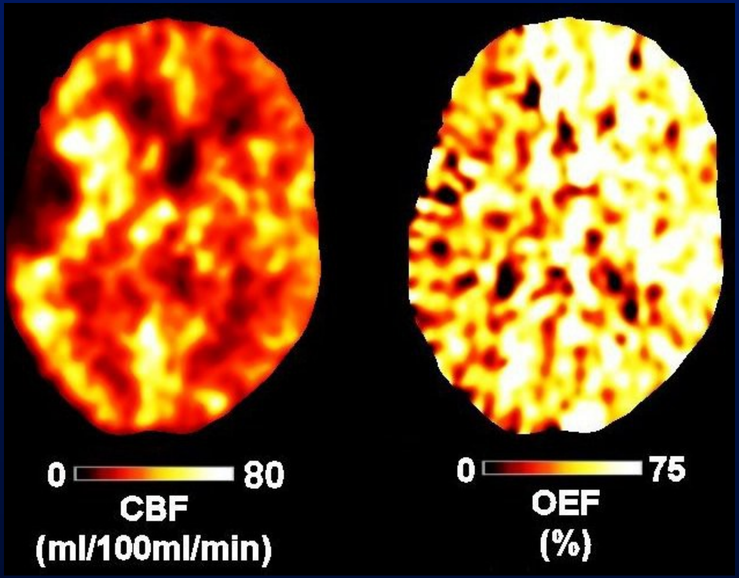
$PaCO_2$ 4.7 kPa (35 mmHg)

ICP 22 mmHg

CPP 73 mmHg

SjO_2 70 %

IBV 44 ml



Post Intervention:

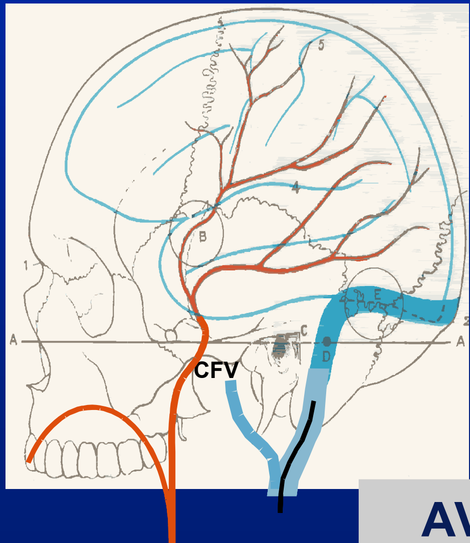
$PaCO_2$ 3.8 kPa (29 mmHg)

ICP 17 mmHg

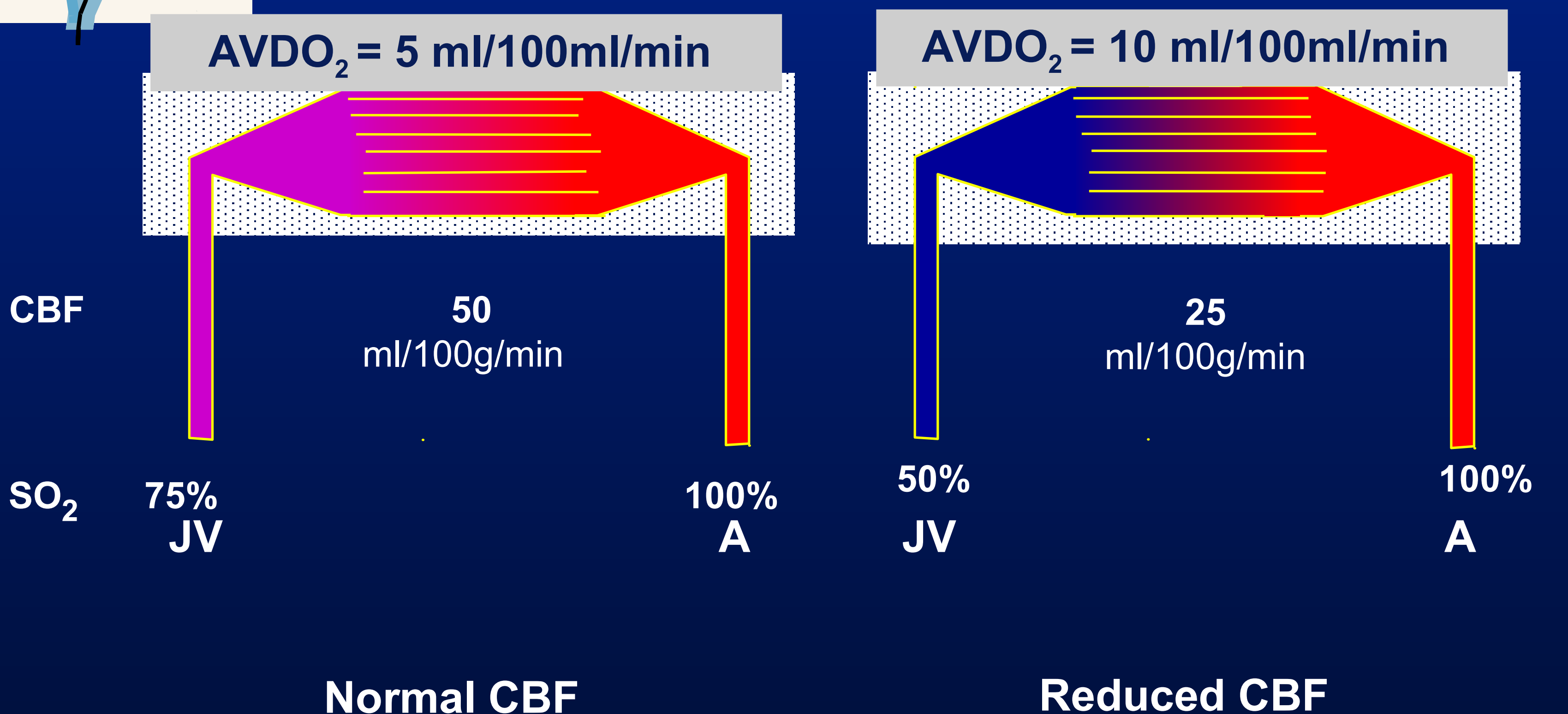
CPP 80 mmHg

SjO_2 54 %

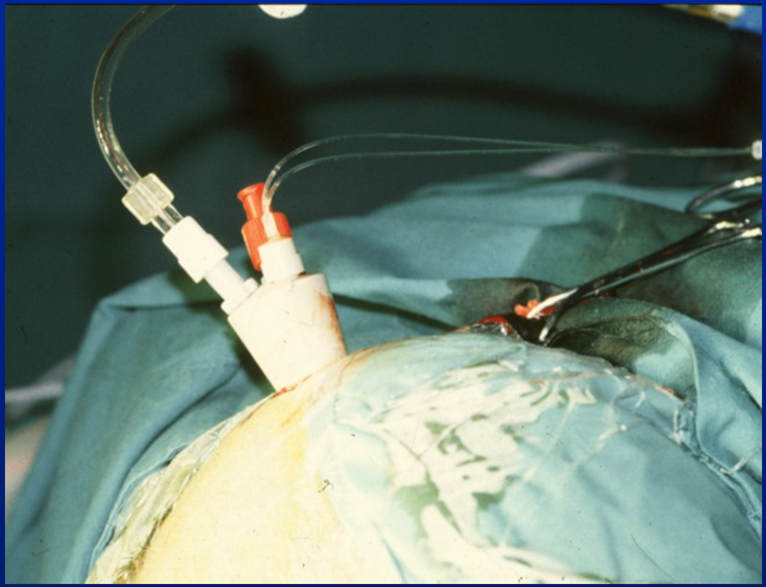
IBV 135 ml



SjO_2 monitoring to detect adequacy of CBF



$SjvO_2$ < 50% (<55%); $AJDO_2$ > 9 ml/100ml in critical ischaemia



Tissue chemistry targets

Tissue pO_2 > 15 mmHg[1] 20/25 mmHg[2,3]

Lactate/pyruvate < 25[4] (> 40 = late atrophy)[5]
(LPR)

Hutchinson Triple Bolt

- Codman ICP, 100kDa cutoff microdialysis catheter, Licox probe

References

1. Brain Trauma Foundation Guidelines
2. Spiotta et al *(LeRoux).* J Neurosurg. 2010;113(3):571–80.
3. Steifel et al *(Le Roux)*. J Neurosurg. 2005;103(5):805–11.
4. Timofeev et al *(Hutchinson)*. Brain 2011;134:484-94.
5. Marcoux et al *(Vespa)*. Crit Care Med 2008;36:2871-7

Names in italics are senior authors on publications

ORIGINAL ARTICLE

The first 72 hours of brain tissue oxygenation predicts patient survival with traumatic brain injury

Evert A. Eriksson, MD, Jeffrey F. Barletta, PharmD, FCCM, Bryan E. Figueroa, MD, Bruce W. Bonnell, MD, Chris A. Sloffer, MD, MBA, Wayne E. Vanderkolk, MD, Karen J. McAllen, PharmD, *and* **Mickey Ott, MD,** *Charleston, South Carolina*

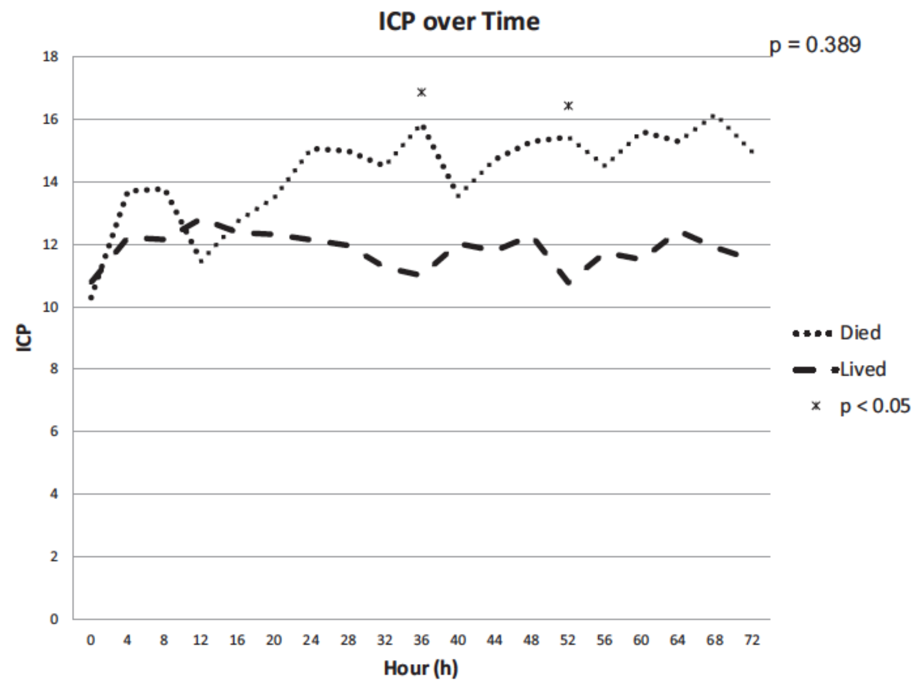


Figure 2. Intracranial pressure over time. $p < 0.05$ by pairwise comparison for time points: 36 hours and 52 hours.

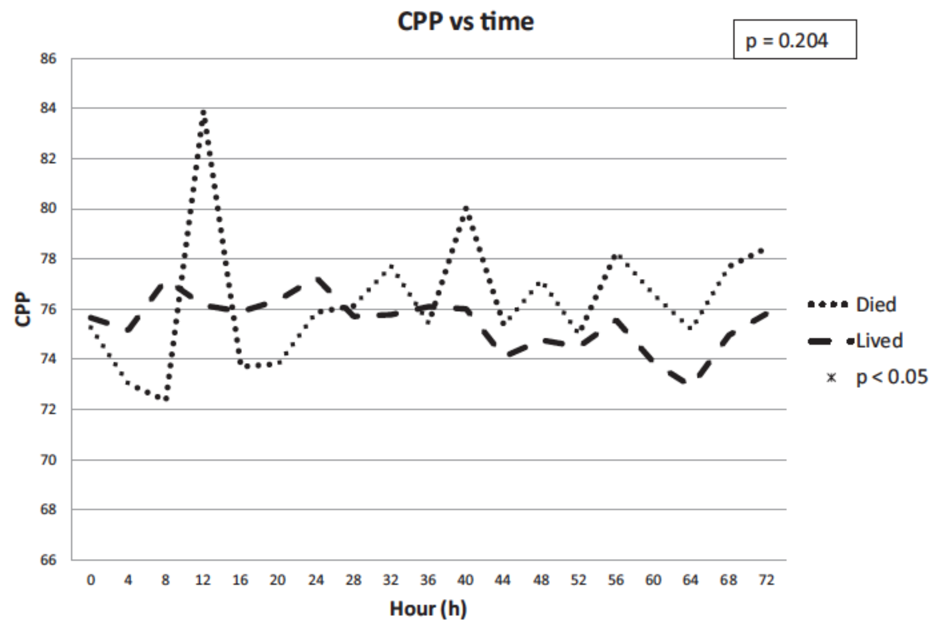


Figure 3. Cerebral perfusion pressure over time. $p > 0.05$ by pairwise comparison all time points.

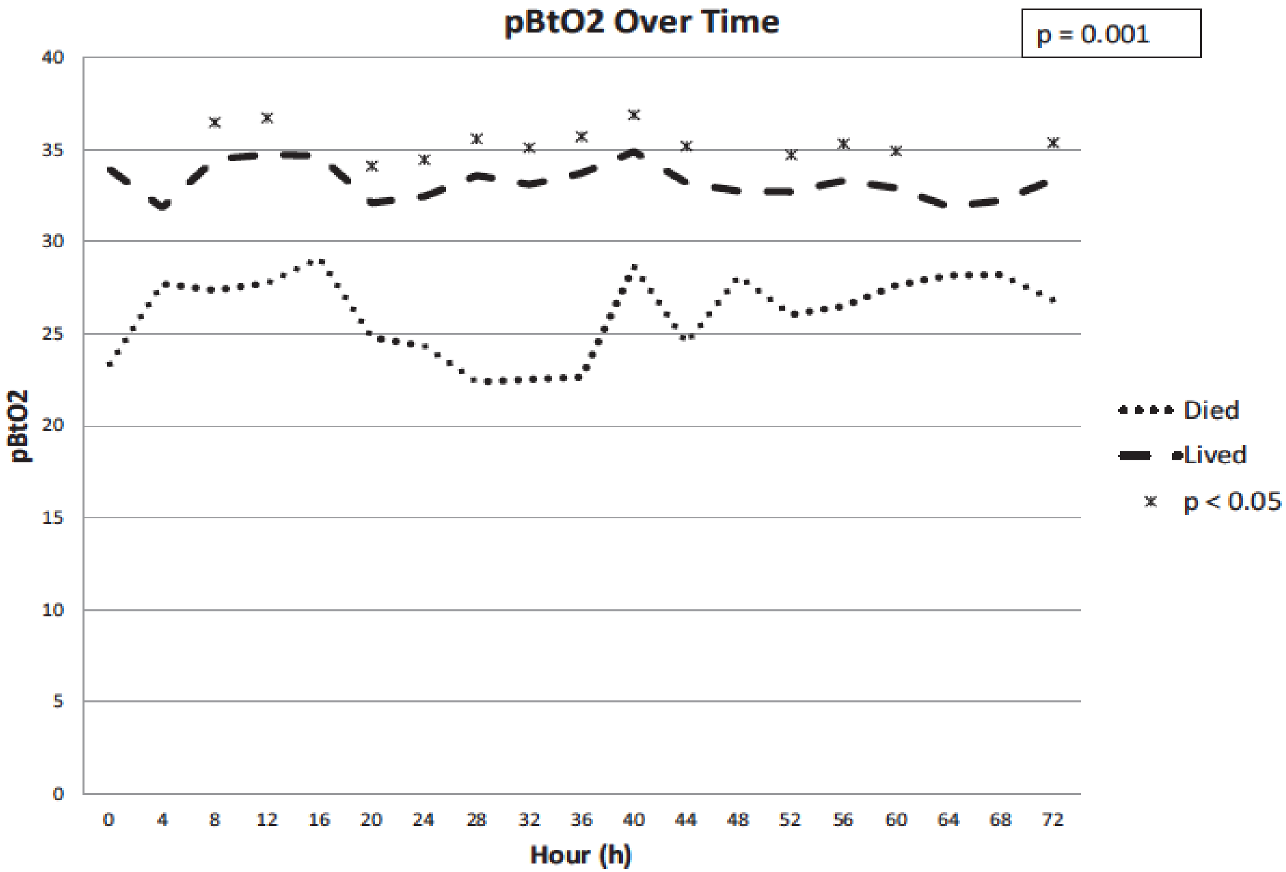


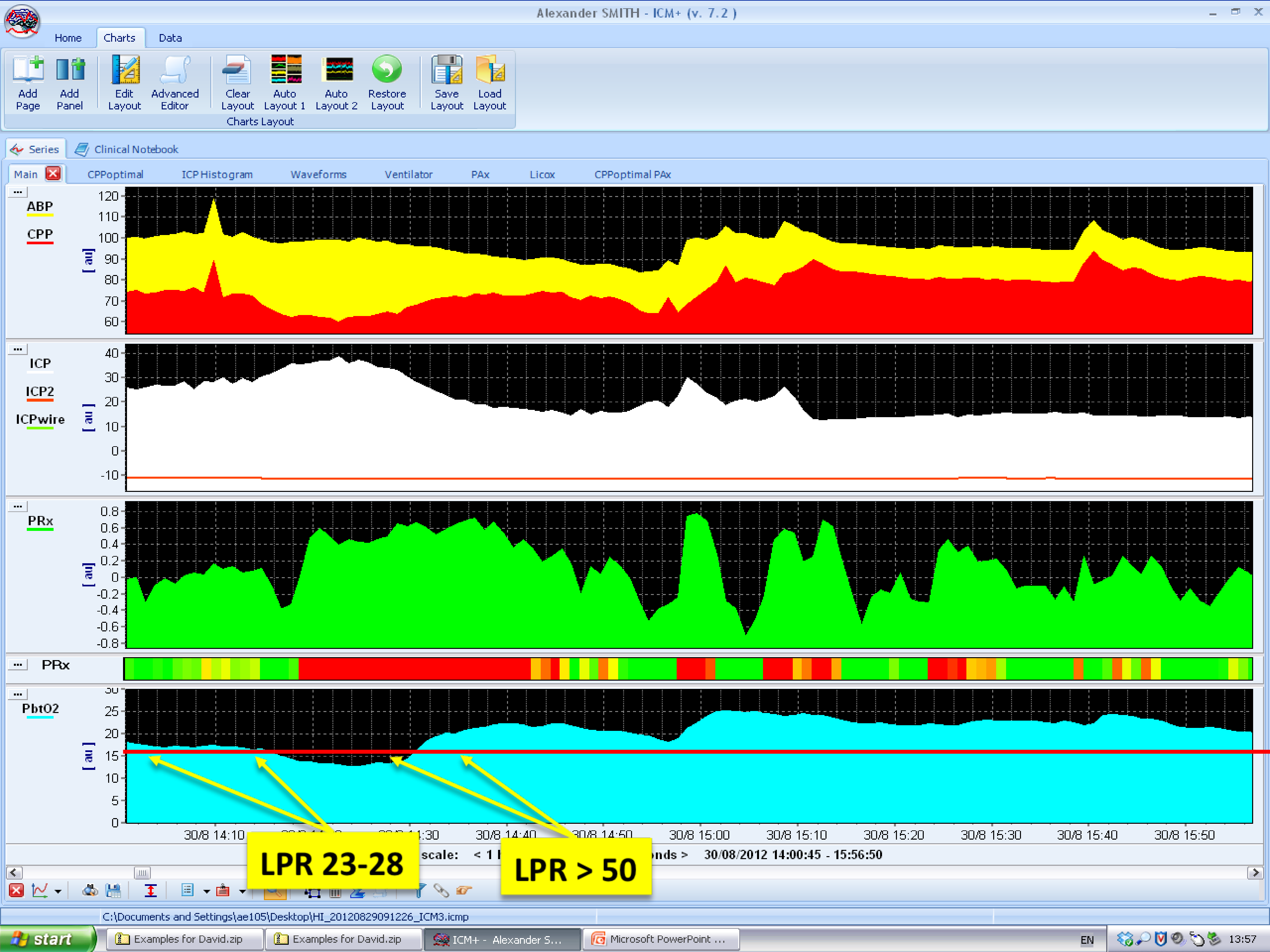
Figure 1. Brain tissue oxygenation over time. $p < 0.05$ by pairwise comparison for time points: 8 hours, 12 hours, 20 hours, 24 hours, 28 hours, 32 hours, 36 hours, 40 hours, 44 hours, 52 hours, 56 hours, 60 hours, and 72 hours.

CONCLUSION

The first 72 hours of pBtO2 monitoring predicts mortality.

pBtO2 < 29 mmHg in the first 72 hrs is associated with higher mortality.

This challenges the accepted threshold of 15 mmHg to 20 mm Hg predictive of outcome.



Alexander SMITH - ICM+ (v. 7.2)
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Clear Layout
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Auto Layout 2
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Cerebral extracellular chemistry and outcome following traumatic brain injury: a microdialysis study of 223 patients

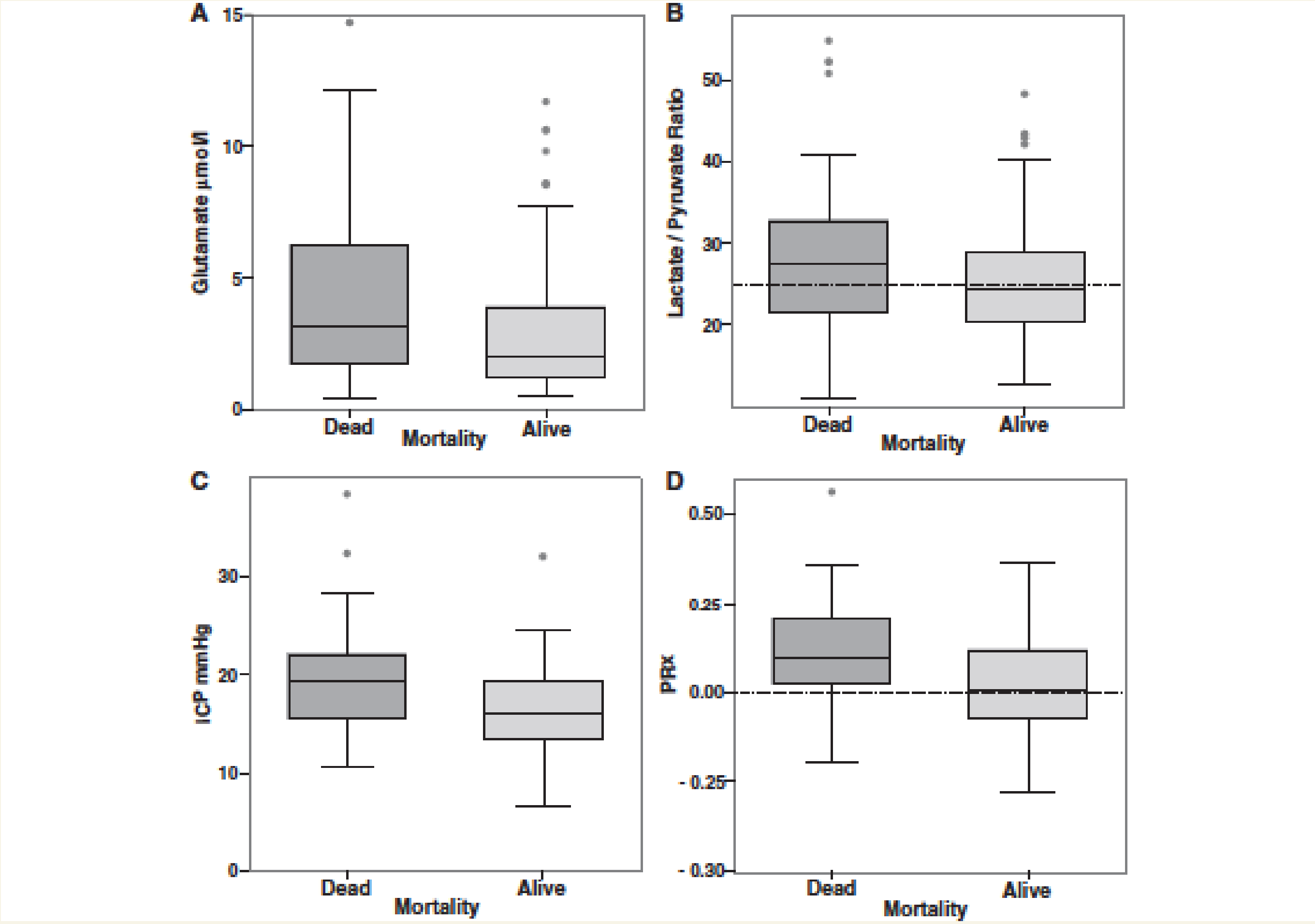

Figure 2 The median values of monitoring parameters split by mortality categories (data represent the whole monitoring period). Graphs display concentrations (in microdialysates) of glutamate (µmol/l) (A), values of microdialysate lactate/pyruvate ratio (B), intracranial pressure (mmHg) (C) and cerebrovascular pressure reactivity index PRx (D).

Ivan Timofeev et al, Brain 2011: Page 1 of 11

The RESCUEicp Study

Randomised **E**valuation of **S**urgery with **C**raniectomy for **U**ncontrollable **E**levation of **I**ntra-**C**ranial **P**ressure

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Stroke
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association | American Stroke Association

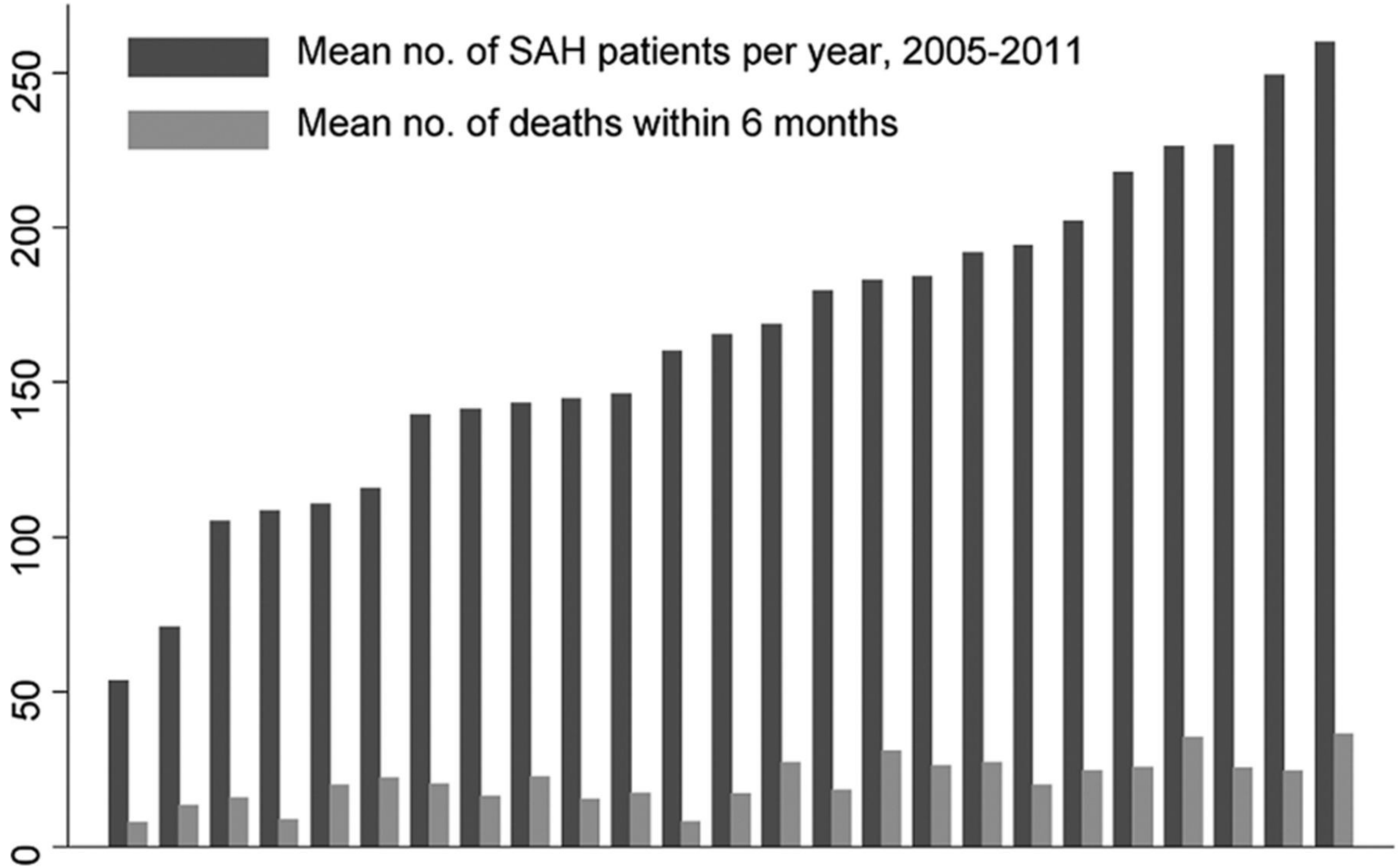
Effects of Institutional Caseload of Subarachnoid Hemorrhage on Mortality: A Secondary Analysis of Administrative Data

Lisa McNeill, Shane W. English, Nicholas Borg, Basil F. Matta and David K. Menon

Stroke. 2013;44:647-652; originally published online January 29, 2013;
doi: 10.1161/STROKEAHA.112.681254
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

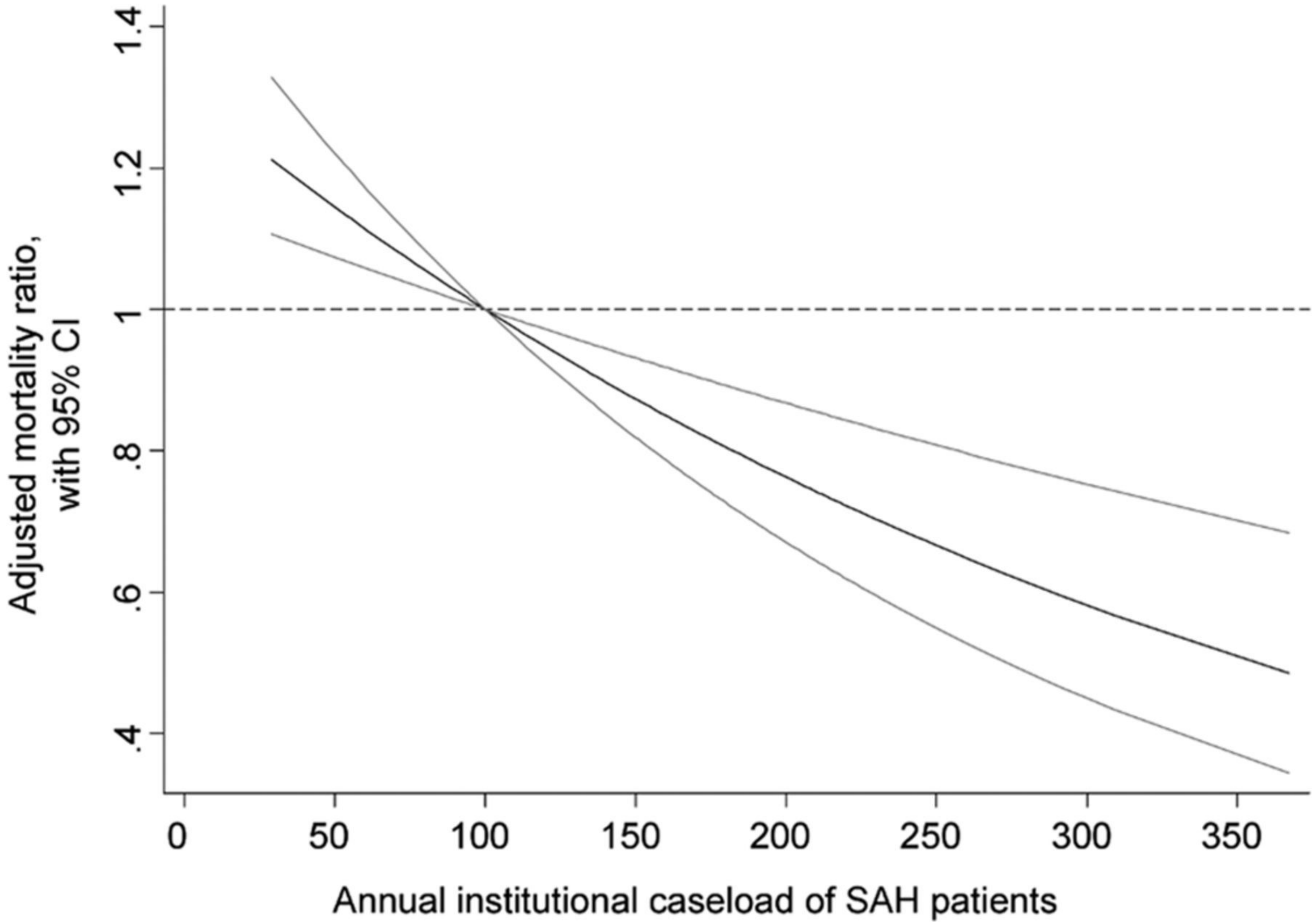
Print ISSN: 0039-2499. Online ISSN: 1524-4628

Average number of subarachnoid hemorrhage (SAH) patients seen per year and average number of deaths within 6 months in 25 neurosurgical units in England.



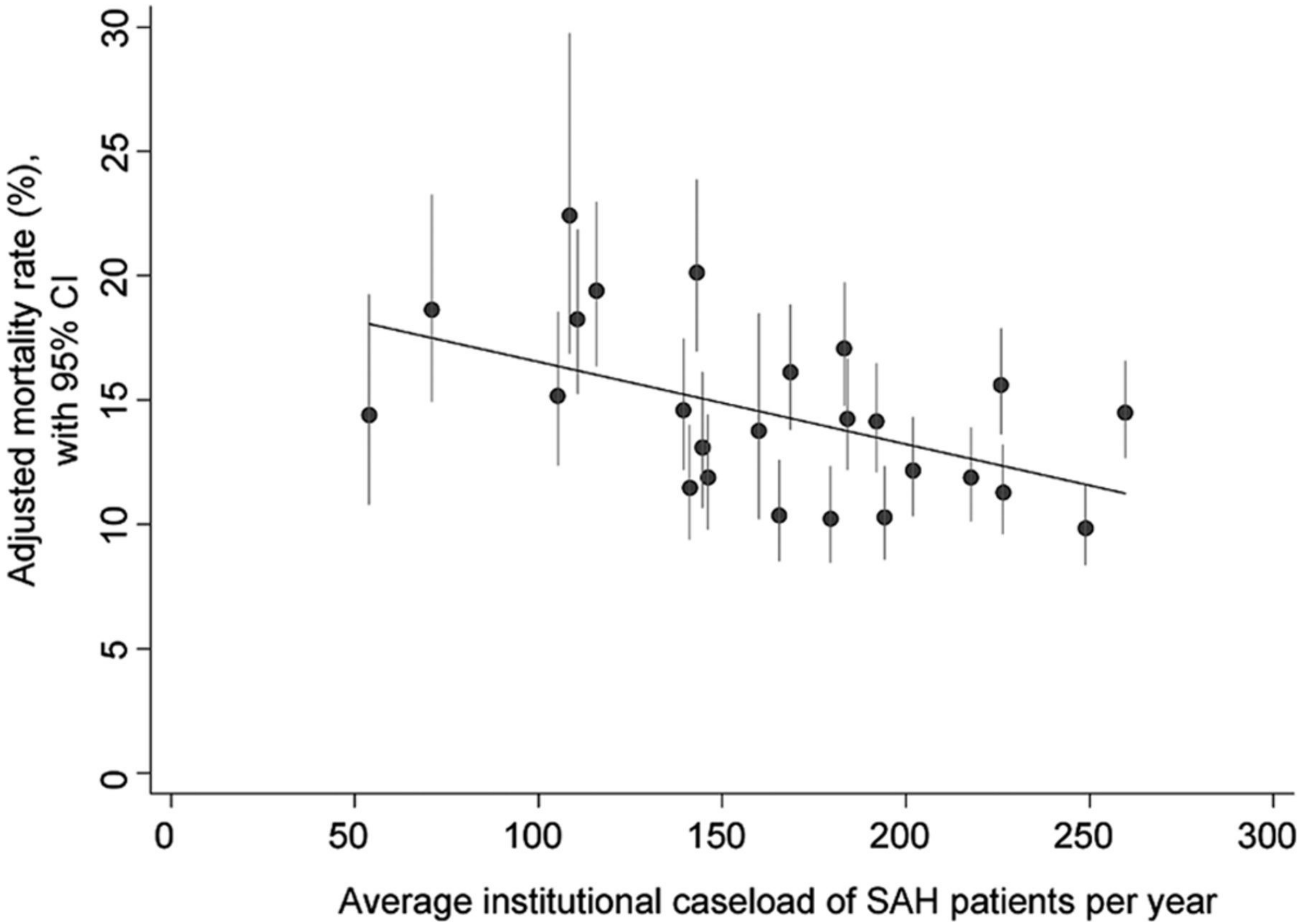
McNeill L et al. *Stroke*. 2013;44:647-652

Comparison of 6-month mortality rates for a range of annual subarachnoid hemorrhage (SAH) caseloads.



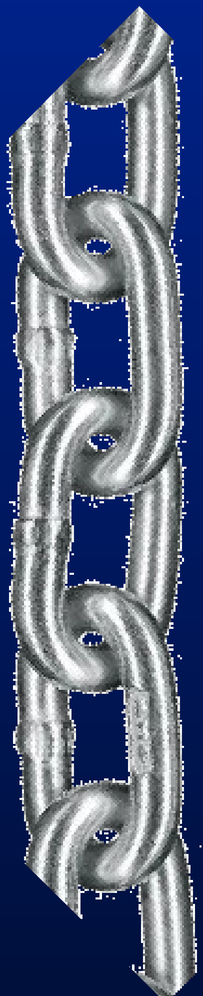
McNeill L et al. *Stroke*. 2013;44:647-652

Relationship between average subarachnoid hemorrhage (SAH) caseload per year and fitted 6-month mortality rate.



McNeill L et al. *Stroke*. 2013;44:647-652

Major Trauma - Chain of Survival




Trauma: Who cares?

A report of the National Confidential Enquiry into Patient Outcome and Death (2007)

NCEPOD

www.ncepod.org.uk


POLICE
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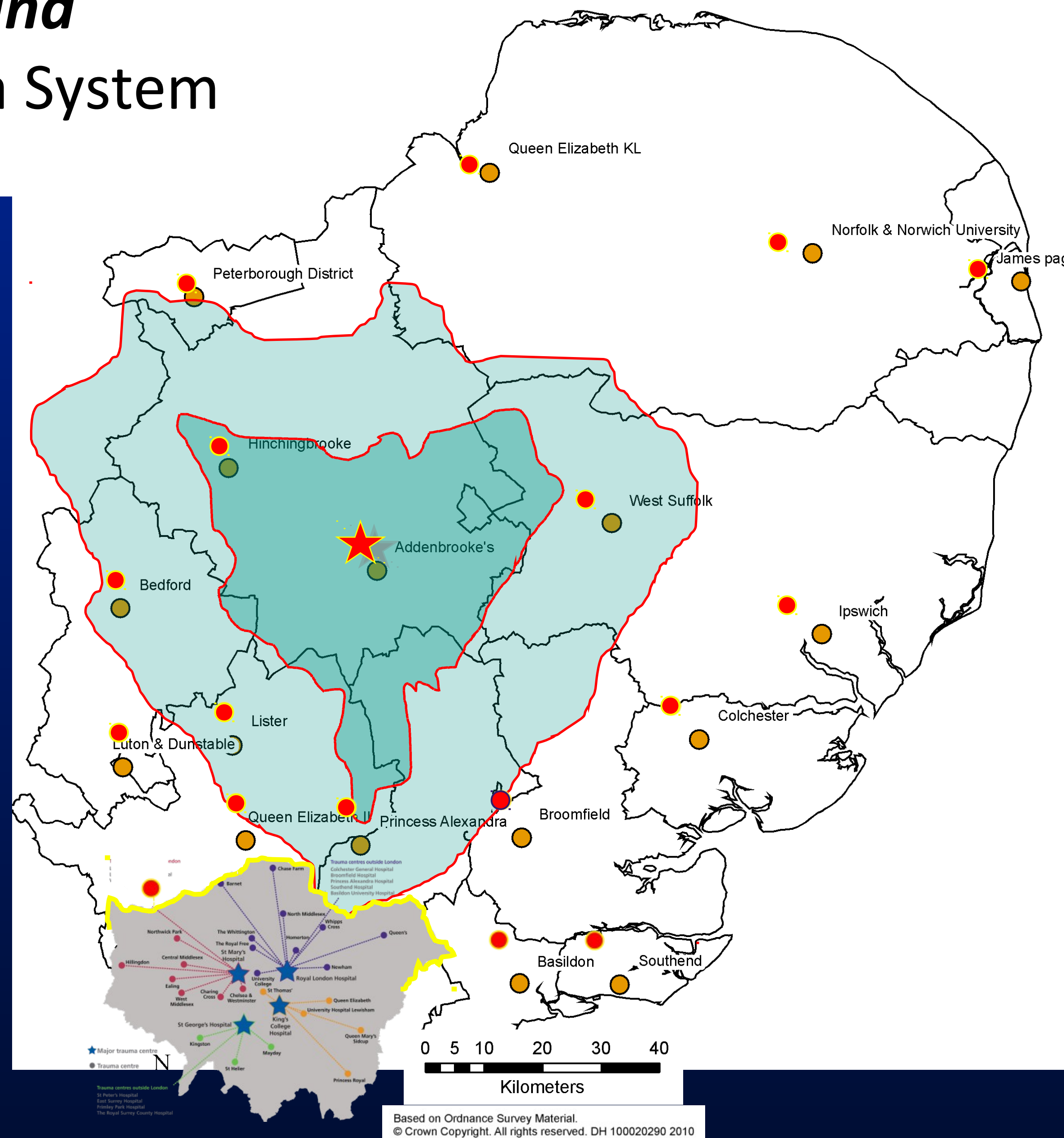
East of England
Integrated Trauma System

- Trauma Network Office
- Ambulance Service
- Network Co-ordination Service
- Trauma Units
- Network Transfer Services
- Major Trauma Centre
- Re-habilitation Services



EoE Hospital Type 1 ED

EoE Major Trauma Centre

Primary (peak and off –peak 45 minute) transfer zone*

London's Hyperacute Stroke Units *Improve Outcomes and Lower Costs*

- Stroke
  - major health and health system burden
  - stroke care accounts for about 5% total spending on health care in the UK, rising to 10% when indirect costs (such as caregivers) are taken into account.
- There are 150,000 strokes per year in UK, of whom 34,000 die.

London's Hyperacute Stroke Units
Improve Outcomes and Lower Costs

- Prior to 2010
  - 34 hospitals in London provided acute stroke care
  - each receiving ~ 150 to 450 stroke patients/year
  - wide variation in access to specialized treatments
  - Many units were unable to provide 24/7 clot thrombolysis with < 3.5% of stroke patients across city thrombolysed

London’s Hyperacute Stroke Units
Improve Outcomes and Lower Costs

- Darzi Report
  - The strategy consolidated the treatment of all early-phase (first 72 hours) acute stroke patients in London within eight specialized high volume centers designated hyperacute stroke units,or “HASUs”.
  - These HASUs, treated 600 to 1,200 patients per year. Each could provide 24/7 diagnostic testing, interventions and multidisciplinary care.

London's Hyperacute Stroke Units
Improve Outcomes and Lower Costs

- Results
  - 3 month mortality rates fallen by 25%
  - cost of treating each stroke patient reduced by 6%
  - HASUs were in the top quartile of national performance, and thrombolysis rose from 3.5% in early 2009 to 11% of all patients in 2012.
  - average length of stay fell from 15 to 11.5 days

Conclusions

- *Specialisation can improve outcome, enhance education and research potential*
- *Specialisation necessitates centralising services*
- *Specialisation only works in partnership – networks*
- *Specialisation must not compromise basic care*

Common Sense?


NO REFUNDS
IT DON'T LOOK GOOD BUDDY!!
SUCKER