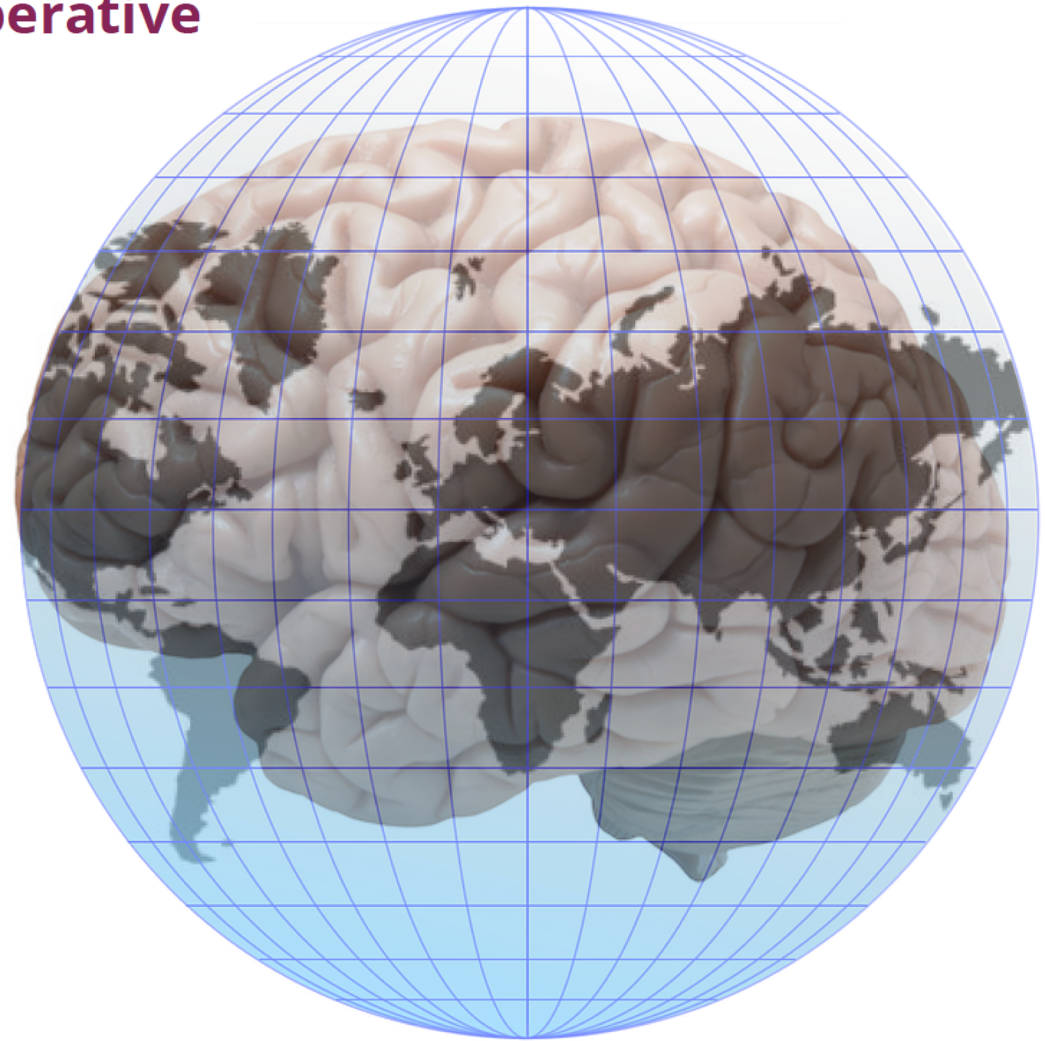
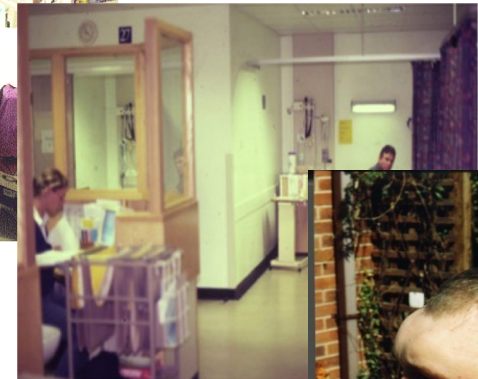
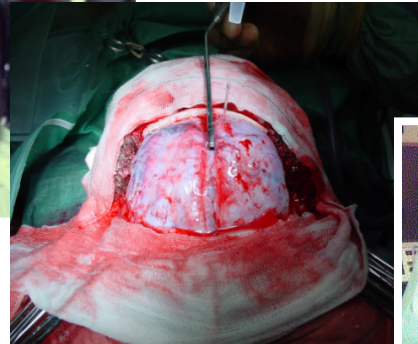


Stratification of Technology for Global Neurotrauma

Peter Hutchinson



Brain trauma- the patient's pathway



Commonest cause of death under the age of 40 years in high income countries

89% of TBI occurs in low and middle income countries

14000 deaths per day from trauma globally

Major cause of morbidity in survivors

What are the un-met needs? in high income countries

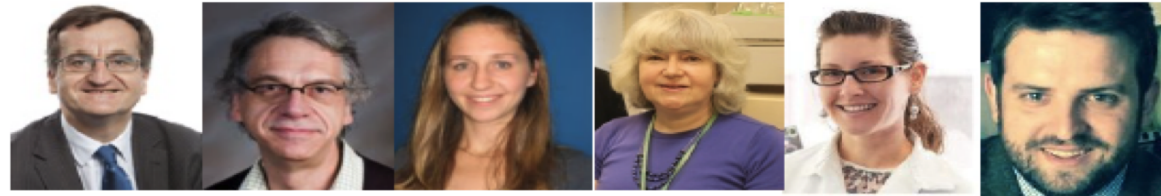
- Prevention
- Diagnosis and prognosis of concussion
- Non-invasive monitoring of intracranial pressure
- Continuous monitoring of brain chemistry
- Challenges in skull reconstruction
- Traumatic brain injury registry

Prevention



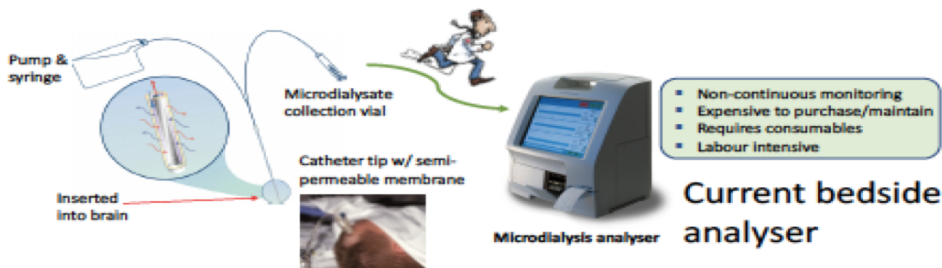
Development of microdialysis online sensor technology for use in critical care of acute brain trauma patients

Peter Hutchinson¹, Stephen Elliott²,
Tanya Hutter², Keri Carpenter¹,
Susan Giorgi-Coll¹, Adam Young¹

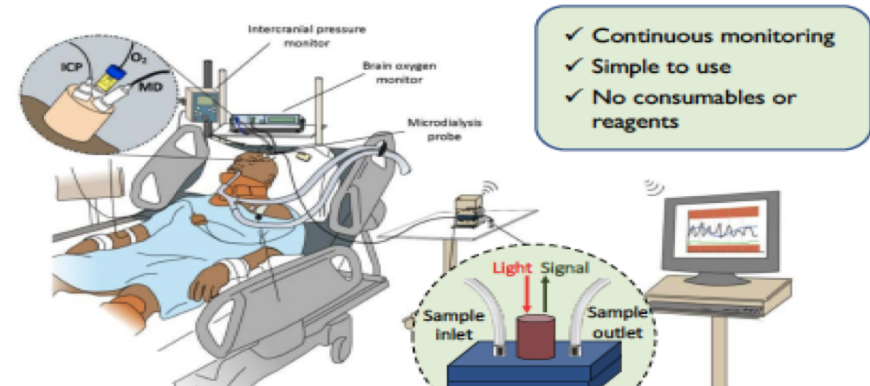


Clinical need

- Every 90 seconds an individual in the UK sustains a traumatic brain injury
- Management of the injured brain: close monitoring to guide intervention



✓ New sensor technology



- **Brain injury monitoring of glucose, lactate, pyruvate.**
- Also for sensing of similar chemical molecules in biological fluids.
- Other organs and tissues, e.g. skin grafts in plastic (reconstructive) surgery, liver and kidney transplantation, gastrointestinal surgery, muscle, adipose tissue, diabetic patients and critically ill septic patients.

Development of 3D cranioplasty printing and novel internal sensors

SmartSkull: Sensor-Integrated Smart Wireless Skull-Monitoring System

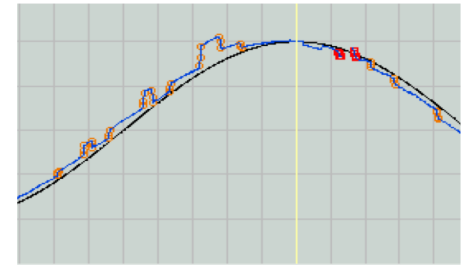
Adel Helmy

Collaborative: Cambridge University Hospitals NHS Foundation Trust & University of Cambridge



Monitoring mild traumatic brain injury and concussion

Concussion can occur from: contact sports such as rugby; a clinical diagnosis; motorsport- challenge return to safe driving



'a complex pathophysiological process affecting the brain induced by biomechanical forces' ¹

Un-met needs- LMICS

- Prevention
- Access to hyperacute care and resuscitation
- Access to brain imaging
- Access to neurosurgery
- Intracranial pressure monitoring
- Telemedicine
- Traumatic brain injury registry

Developing technology for low and middle income countries (Themes)



- 1: Mapping traumatic brain injury care
- 2: Understanding traumatic brain injury care
- 3: Innovation in traumatic brain injury care
- 4: Traumatic brain injury research capacity

Theme 1

Mapping traumatic brain injury care

Geography, epidemiology, & outcomes

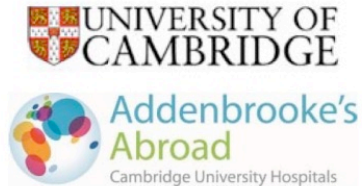
Using an online registry endorsed by the World Federation of Neurosurgical Societies, we are seeking to understand the volume, case-mix, and neurosurgical practice within our partnership and around the world.





Global Neurotrauma Outcomes Study (GNOS)

globalneurotrauma.com



Emergency surgery for TBI

- Timely and appropriate surgical intervention for

Must do

Acute, high-value procedures that need consistency through local structures; and less complex, urgent procedures that can be delivered through these same structures.

Acute, high-value procedures include

- Laparotomy
- Caesarean delivery
- Treatment of open fracture

Lesser complex, urgent procedures include

- Wound debridement
- Dilatation and curettage
- Closed fracture reduction

Should do

High-priority, high-volume procedures for planned surgery at the first-level hospital.

Lower-risk procedures include

- Hernia repair
- Contracture release
- Superficial soft tissue tumour resection
- Gastroscopy

Medium-risk procedures include

- Cholecystectomy
- Intracranial haematoma evacuation
- Thyroidectomy
- Mastectomy

Can do

Important procedures potentially needing specialist support. Ideally, higher-risk procedures should be done at tertiary centres, or done at first-level hospitals with the assistance of visiting super-specialist teams.

Examples include

- Thoracic surgery
- Transurethral resection of prostate
- Uretero-renaloscopy
- Vesicovaginal fistula
- Basic skin flaps
- Rectal prolapse repair
- Cataract
- Cleft lip and palate repair

The Lancet Commissions

Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development



GNOS Proposal

- The GNOS study aims, for the first time, to provide a comprehensive picture of the management and outcomes of patients undergoing emergency cranial surgery after a TBI worldwide.
- “Snapshot clinician-driven study” methodology successfully used by the GlobalSurg 1 project



PaedSurg Africa

BNTRC 

Objectives

Objective

- Compare treatment and outcomes for emergency surgery for traumatic brain injury (TBI) between high and low Human Development Index (HDI) countries

Methodology

- Multi-centre, prospective observational study
- Any hospital in the world performing emergency cranial surgery following TBI can participate
- Every patient receiving emergency surgery for TBI in any consecutive 30-day period between October 2018 and April 2019

Theme 2

Understanding traumatic brain injury care

Complexity, systems, & design

Using a Systems Engineering methodology, we want to understand the complexity of improving neurotrauma care in low-resource settings, and develop a framework for improvement led by local stakeholders.



Theme 3

Brain Injury MedTech Co-operative

Innovation in traumatic brain injury care

Technology, clinical practice, & data collection

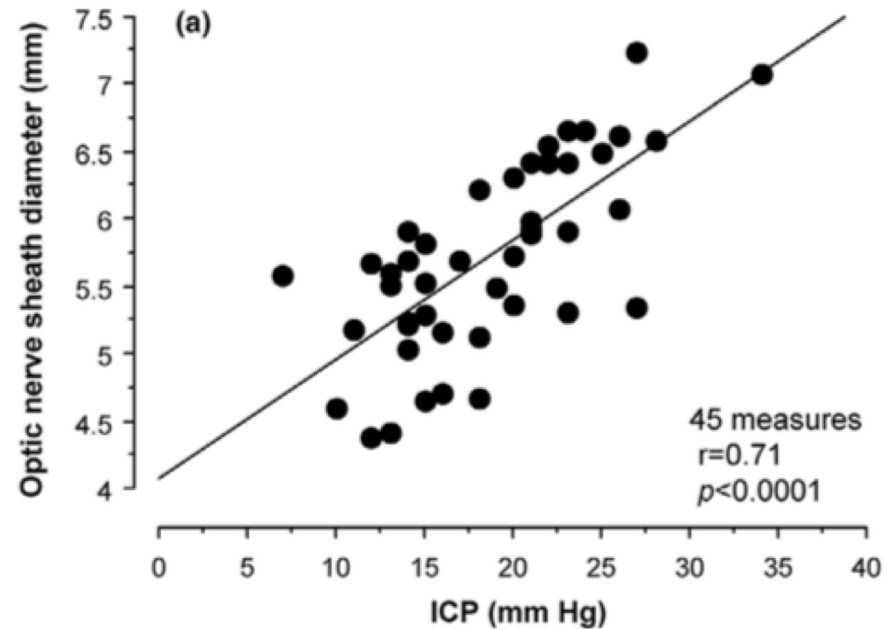
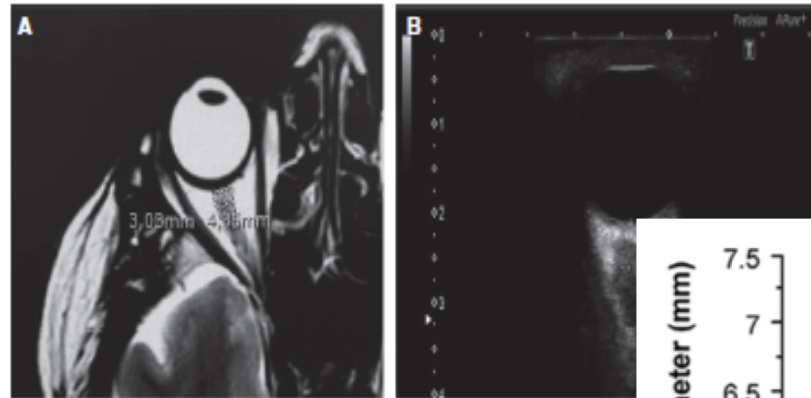
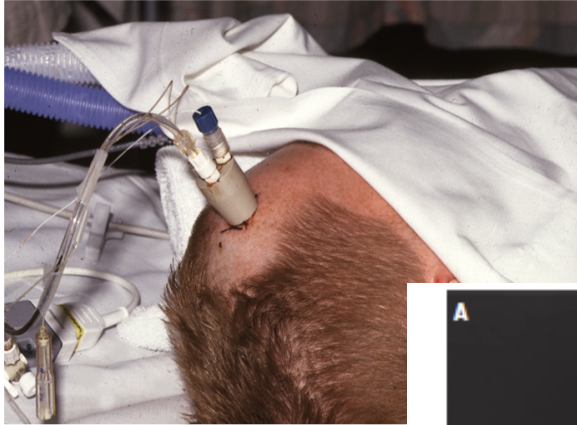
We are looking to develop innovative technologies and practices to improve neurotrauma care, targeting system optimisation, risk stratification, surgical intervention, and long-term outcome data collection.



Detection of blood clots



Measurement of intracranial pressure



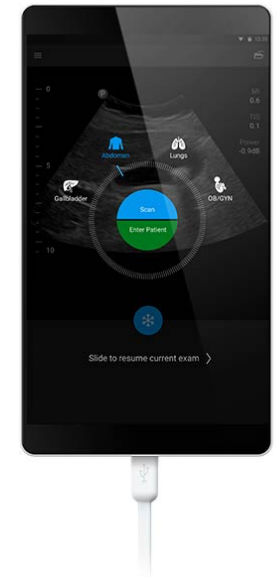
Measurement of intracranial pressure



Ultrasound non-invasive measurement of intracranial pressure in neurointensive care: A prospective observational study

Chiara Robba, Danilo Cardim, Tamara Tajsic, Justine Pietersen, Michael Bulman, Joseph Donnelly, Andrea Lavinio, Arun Gupta, David K. Menon, Peter J. A. Hutchinson, Marek Czosnyka

Published: July 25, 2017 • <https://doi.org/10.1371/journal.pmed.1002356>



Theme 4

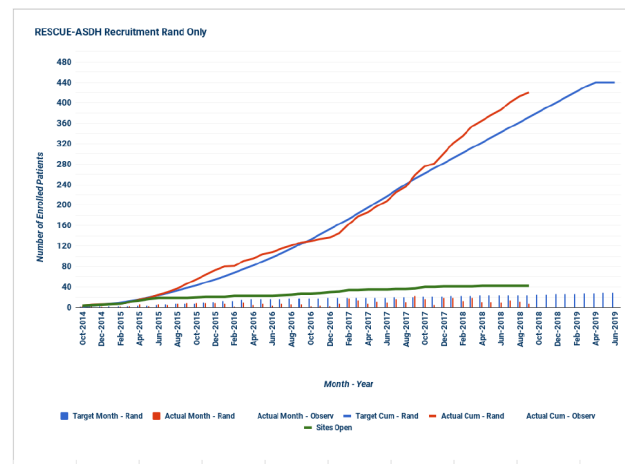
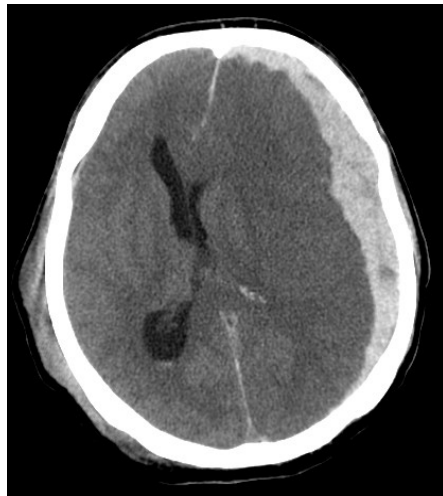
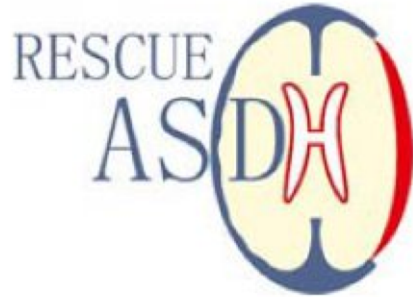
Traumatic brain injury research capacity

Capacity, output, and training

We intend to map the current research capacity and output of our partnership, create a network of institutions engaged in international clinical trials, and develop appropriate formal research skills training.



Surgical trials- traumatic brain injury



	Randomised	Observational	Total
NIMHANS (Bangalore)	126	35	161
Bart's (Royal London)	45	15	60
Cambridge	30	33	63
St Mary's Hospital, London	24	38	62
Delhi (AIIMS)	23	47	70
Southampton	20	31	51
Liverpool	13	13	26
Chandigarh (PGIMER)	12	1	13
Sheffield	10	0	10
Manchester	9	19	28
Birmingham	9	18	27
Leeds	9	10	19
Middlesbrough	9	4	13
Toronto	8	6	14
University Malaya Medical Centre	8	3	11
Nottingham	7	9	16
King's College Hospital, London	5	17	22
Hull	5	7	12
Plymouth	5	4	9
Romford	5	0	5
Bristol	4	17	21
Oxford	4	9	13
Munich (TU Munchen)	4	5	9
Cardiff	4	2	6
St George's Hospital, London	4	2	6
Newcastle	4	0	4
Hospital Universitario La Paz (Madrid)	4	0	4
Calgary (Foothills Medical Centre)	4	0	4
Ontario	3	0	3
Dallas (UTSW)	2	6	8
Preston	2	5	7
Boston (BIDMC)	2	1	3
Brighton	1	6	7
Glasgow	1	0	1
Tan Tock Seng Hospital	1	0	1
Coventry	0	6	6
The Alfred Hospital (Melbourne)	0	4	4
Edinburgh	0	1	1
University Hospital of Larissa (Greece)	0	1	1
Dundee	0	0	0
Singapore General Hospital	0	0	0
Littleton Adventist Hospital	0	0	0
MedStart (Washington)	0	0	0
Total	426	375	801
UK (23/26 centres randomised)	229	266	495
International (12/17 centres randomised)	197	109	306
Percent from UK	54%	71%	62%

Technology evaluation

**Brain Injury
MedTech Co-operative**

**The Surgical Technology
Evaluation Portal (STEP)**

- early engagement with specialist research, clinical and technical experts in the NHS
- efficient development of the device or technology
- safe and high quality research
- access to clinical trials specialists, including the NIHR Clinical Research Network
- support with generation of evidence
- rapid feedback to the innovator or company

Acknowledgements

Global Neurotrauma Investigators

