Inter-hospital Rehabilitation Meeting

"When you lose your mind..."

Dept. of Rehabilitation & Extended Care
TWGHS Wong Tai Sin Hospital
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"When you lose your mind..."

- **Part I** (by Dr. T.P. Chan):
  - 2 cases + Cognitive Assessment & Rehabilitation
- **Part II** (by Dr. C.K. Tam):
  - Introduction to Hyperbaric Oxygen Therapy
- **Part III** (by Dr. H.P. So):
  - Some Medico- legal Consideration

Part I - Content

1. Two “similar” cases…
2. Basic concepts
3. Any tools for assessment?
4. What can we do?
5. A medicolegal concern…

History

Case 1

- Mr. C, a 33 year-old gentleman
- Stabbed on left side of neck in July 05
- Cardiac arrest on arrival to CMC
- Immediate resuscitation and repair of left carotid artery laceration performed on the same day
- Transferred to KWH 3 days later for further management

Case 1

CT brain

"Diffuse oedema, presumably due to ischemia and subsequent infarction more in the left cerebral hemisphere."

July 22, 2005

Case 1

MRI brain

"Sequel of hypoperfusion with major effect over the left supratentorial cortices. Some effect on the right occipital tip and right basal ganglia. There was extensive bilateral brain oedema."

July 23, 2005

Case 1

SPECT

"Decrease in perfusion to the brain parenchyma especially marked to the left cerebral hemisphere and also moderate decrease in perfusion to the right medial temporal lobe."

August 16, 2005

Case 1

- In the first year, main clinical concerns were
  1. Prevention and treatment of complications
  2. Nutrition / feeding problem (PEG)
  3. Spasticity

Case 1

- Received treatment in mainland China from Sept 06 till Feb 08, including
  - Acupuncture
  - Massage
  - Hyperbaric oxygen therapy
  - Botulinum toxin injection

Case 1

- Transferred to WTSH in Feb 08
  - Spontaneous eye opening but no meaningful eye contact / fixation / pursuit
  - Limbs spastic with no voluntary control
  - Could not follow one step verbal command
  - SIB 0/100, MBI 0/100, MMSE 0/30

Case 1

FDG-PET / CT

"Further atrophy of left hemisphere noted compared with the findings in mid 2007..."

February 20, 2008

Case 1

- 9-week neurorehabilitation program
  - Multisensory stimulation modified from a program of International Coma Recovery Institute (ICRI)
    - Aiming at increasing the arousal level
      - visual stimulation: on/off torch light x 10 times for one trial from inferior, superior, and lateral direction; 4 trial an hour
      - auditory stimulation: 5 times alternating left and right; 4 times an hour
      - thermal stimulation of upper lip and tip of nose; 10 seconds a trial, 4 times an hour
      - *No. of stimulation session adjusted according to clinical responses*

Case 1

- Latest cognitive status
  - More alert in daytime, sleep at night
  - Spontaneous eye opening with increased horizontal eye movement (but tends to look to left side)
  - Right hemianopia
  - No eye contact / fixation / pursuit
  - Occ. vocalization and facial expression of discomfort when icing

Case 1

- Latest cognitive status
  - "responsive" to familiar subjects e.g. wife and mother ?? Blinking eyes and moving left thumb on verbal command ???
  - Unable to close eye and "stop" moving left thumb on verbal command

Case 2

- Mr. P, a 40 year-old gentleman
- RTA in late March 06
- GCS 3/15 on arrival to CMC A&E

Case 2

MRI brain

•Hemorrhagic lesions at right frontal, corpus collosum, right parietal and left centrum semiovale.

April 12, 2006

Case 2

- After chest infection settled and feeding secured by PEG, transferred to WTSH in July 06
- On admission
  - GCS 9/15
  - 4 limbs in spasticity on baclofen

Case 2

- 8-week Neurorehabilitation completed (multisensory stimulation program)
- Findings in late Sept 2007
  - Some improvement in sitting balance with support but bed mobility and transfer dependent
  - Limited bilateral shoulder AROM, right hand able to hold spoon with mild clumsiness
  - Lower limbs contractures improved
  - On minced diet and assisted feeding
  - Mental recovery better than motor; aiming at unsupported sitting and self feeding
  - Disorientated to date, poor short term memory, but able to follow 2-step commands
  - Powered wheelchair under supervision
  - Carer training given to girl friend

Case 2

- Discharged in June 2008 to OAH with GDH FU
  - More verbal communication
  - Pinch / NPT
  - BLL better ROM

Basic concepts

Awareness

- Interchangeable with consciousness
- Meaning
  - Waking state or
  - Content of one's experience from moment to moment or
  - Related to knowledge or intentions

Self-consciousness

- Even more complex
  - "awareness of stimuli which impinge directly on a person"
  - "*an idea of me*"

Open eyes = awake and aware of oneself / surroundings?

Obviously not true!

VS vs MCS?

Whether awareness retained

Vegetative state

- Profound and diffuse damage to the cortex, and /or white matter connecting them
- Disconnection syndrome
  - Extensive frontoparietal network encompassing the polymodal association cortices is disrupted, dysfunctional, or disconnected from the thalami
- No capacity for awareness of self and environment despite the presence of wakefulness, sleep-wake cycles, and generally intact hypothalamic and brainstem functioning

Minimally conscious state

- Similarly distributed but less severe damage
- Some fragments of awareness and high-level behavior can be observed, such as sustained visual pursuit, reaching for objects, or responding to questions by word or gesture

Emergence from MCS

- Reliable and consistent demonstration of one or both of the following
  - Functional interactive communication
  - Functional use of two different objects

To avoid pitfalls in assessment

1. Adequate stimulation to ensure that arousal level maximized.
2. Factors adversely affecting arousal removed .
3. Attempts to elicit behavioral responses through verbal instruction should not involve behaviors that frequently occur on a reflexive basis.
4. Command-following trials should incorporate motor behaviors that are within the patient's capability.
5. A variety of different behavioral responses should be investigated using a broad range of eliciting stimuli.
6. Examination procedures should be conducted in a distraction-free environment.
7. Serial reassessment incorporating systematic observation and reliable measurement strategies should be used to confirm the validity of the initial assessment.
8. Observations of family members, caregivers, and professional staff participating in daily care should be considered.

Giacino JT et al 2002

Cognitive assessment

Why?

1. Diagnostic assessment
2. Outcome prediction
3. Projection of disposition needs
4. Interdisciplinary treatment planning
5. Monitoring treatment effectiveness

Problem

- "Old" tools before 90s, e.g. GCS, LOCFAS unable to detect subtle but potentially meaningful changes in neurobehavioral function, esp. in MCS

"Newer" option

- JFK Coma Recovery Scale–Revised (CRS-R) 2004
  - CRS described by Giacino et al in 1991
  - 25 hierarchically arranged items in 6 subscales addressing auditory, visual, motor, oromotor, communication, and arousal processes
  - Scoring based on the presence or absence of specific behavioral responses to sensory stimuli administered in a standardized manner

CRS-R

- CRS
  - Gone through reliability and validity testings
  - Factor analysis shown items associated with brainstem, subcortical, cortical functions
- Revised because
  - Facilitate administration of test procedures
  - Clarify ambiguities in response scoring
  - Conform to MCS diagnostic criteria of Aspen Workgroup in 2002

Strength and weakness

- Few gone through vigorous psychometric analysis (e.g. interrater reliability, test and retest stability, validity, internal consistency), CRS-R being an exception
- Sensitive to discriminate MCS from VS
- However
  - Samll sample size
  - Limited no. of raters
  - Lack of criterion standard for comparison

Other tools?

Event-related potential

Why not BAEP? SEP?

- BAEP
  - Poor predictors of a return to consciousness
- SEP (median nerve)
  - Bilateral absence of cortical response → death / PVS
  - But normal SEP ***not*** = awakening / good functional outcome

Cant BR, et al. 1986; Zandbergen EG, et al. 1998; Sleigh JW, et al. 1999; Mazzini L, et al. 1999

ERP vs PET

- Advantages over PET
  - Measure neural activity in real time, but not as a secondary correlate
  - Measure cortical activity, the issue of interest

However, disadvantage is low spatial resolution

Prognosis of VS

- Age
- Etiology
- Time already spent in VS

American Multi-Society Task Force 1994

Functional neuroimaging

Functional imaging

- "...the resting MCS brain preserves an ability to recruit cerebral networks necessary for cognition and interaction despite a failure to spontaneously drive these networks, possibly as a result of a lack of ongoing brain activity associated in normal subjects with high metabolic demands."
- "... functional imaging may provide evidence of cerebral integrative activity not available at the bedside."
- "MCS brain is distinct from the vegetative state brain."
- ***Whether MCS patients have a greater capacity to experience subjective states and to benefit from therapeutic interventions?***

Schiff ND et al. 2005

Problems

- Quantitative PET – many assumptions
  - Estimation of cerebral metabolic rate using FDG-PET needs a correction factor, which varies in damaged brain
  - Glucose use may not couple with oxygen use
  - Measurement may include metabolic inactive spaces
- $H_2{}^{15}O$-PET, fMRI
  - Methodologically complex, results often equivocal
  - Coupling of neuronal activity and local hemodynamics in damaged brain different from healthy
  - Episodes of low arousal / sleep common in VS and MCS
- All PET preclude longitudinal studies because of radiation risk

Cognitive rehabilitation

Yes , there is evidence for cognitive rehabilitation

But what about severely brain-damaged as our patient??

Basic principles

- Physical rehabilitation – to prevent secondary damage (ROM, tone, alignment etc)
- Speech therapy – to restore normal feeding

- *Multisensory stimulation – ? increases arousal and produces behavioral changes by stimulating RAS, prolongs vigilance, enhances attention*
- *Music therapy – ? store some memories that can be recalled by providing music cues*

CBS protocol

- An attempt at applying cognitive-behavorial techniques in the early days of recovery
- Underlying principle is conditioning
- At a higher level, learning becomes more specific and is geared to associating behavorial responses to a communicative value intent

Mind the limitations

1. Methodology
   - *Control*
   - *Blinding?*
   - *Confounders not controlled by statistical method*
   - *ITT?*
   - *Complete FU?*
   - *Size of treatment effect?*
   - *Precision of effect?*
2. Length of FU
   - *Temporary vs "permanent" effect?*
3. Limitation of LOCFAS itself

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