**Neuromonitoring**

· EEG
· Evoked potentials
· ICP monitoring

**EEG**

*Indications*

· Diagnosis and differentiation of seizure type
· Confirmation of presence of non-convulsive status epilepticus
· Differentiation of encephalopathy - eg metabolic V alcoholic V encephalitis
· Diagnosis, severity grading and outcome indication of sepsis-associated encephalopathy
· Prognostication in hypoxic-ischaemic coma following cardiac arrest resuscitation

*Contraindications*

None

*Principle*

Cortical activity can be measured as electrical signals detected by scalp electrodes placed at standardized points. Certain waveforms (amplitude and frequency) have particular significance

*Device*

Various formats
· Formal 18-lead
· Bi-Spectral index (BIS)
· Augmented-integrated

*Outcome*

- Global V lateralised
- Waveforms
  · alpha - awake/alert, alpha coma also exists
  · theta, delta - frequency < 7Hz => sedation, encephalopathy, drugs, hypothermia
  · burst suppression => deep sedation
  · isoelectric/flat => deep sedation, hypothermia, brain death
  · regular triphasic => encephalopathy, usually metabolic
  · PLEDs => encephalopathy due to HSV encephalitis or CVA

*Complications*

Misinterpretation error

*Merits*

· Non-invasive
· Can be performed at bedside
· Evidence to support use of EEG as prognostic aid following successful resuscitation for cardiac arrest
  
  i) Swedish study of continuous augmented EEG monitoring in ICU for patients receiving therapeutic hypothermia post cardiac arrest; once normothermic, if normal EEG - survived with good function in 18/20 at 6months, if flat / burst suppression / status epilepticus then all died. ii) CARES trial ongoing, to examine use of 4-lead EEG in first 6hrs post cardiac arrest for prognostication.

*Limitations*

· Requires special training in performance and interpretation
· Often not available after hours
· Except for cardiac arrest, no significant outcome studies showing benefit to use

**Evoked potentials**

*Indications*
Determining locked-in syndrome
Neuropathologies, eg: cortical blindness, MS

Contraindications
None

Principle
Applying a specific stimulus produces detectable electrical activity at specific cortical locations.

Device

Outcomes
Somatosensory EPs (SSEPs) - often use the median nerve
Auditory EPs (AEPs)
Visual EPs (VEPs)

Merits
Some evidence to suggest role in prognostication in hypoxic-ischaemic coma -> i) J.Neurology 1996 - SSEPs alone correctly identified outcome in only 59%, but increased to 82% when combined with clinical and EEG assessment. ii) Zandbergen metanalysis 2006 of predictors of poor outcome (death or vegetative state) in HIE after cardiac arrest showed 100% specificity for absent SSEPs in first week, as well as absent pupil light reflex or motor response to pain on day 3. (EEG 100% specific in 5 of 6 studies.) Mostly small studies and reliability of results questionned.

Limitations
Specialised training to perform and interpret
Not available out of office hours
Limited evidence base

ICP monitoring

Traumatic brain injury and unconscious (GCS < 8/15) with:
a) significant lesion on CT brain -> DI II-IV or mass lesion > 25mm,
or,
b) normal CT brain and 2 or more of:
:age> 40yo
uni- or bilateral motor posturing
:sBP < 90mmHg

References
O'H's Intensive Care Manual, 6th Ed.
Brain Trauma Foundation