Clinical Management Update - Intraoperative Neuromonitoring (IONM)

Background

IONM can reduce the risks of permanent neurological deficit associated with spinal surgery. However, whilst its use in certain spinal surgical procedures is well established there is currently no consensus view on the use of IONM in degenerative cases and in resection of intradural spinal cord tumours.

Indications for the use of IOM

The indications for spinal cord monitoring set out below are based on the results of a recent BASS / SBNS survey of its members[1] and a literature review[2-13].

Based on established and current practice, IONM is considered mandatory for the following procedures: correction of spinal deformity in the thoracic spine, DLIF/XLIF procedures and the reduction of a high-grade spondylolisthesis.

According to the results of the BASS/SBNS membership survey and a literature review, the use of IONM should be strongly considered for anterior thoracic discectomy and intramedullary tumour resection but is not mandatory. When used, the risks of neurological injury need to be balanced against the primary surgical aims of decompression and tumour resection.

According to the results of the BASS/SBNS survey and a literature review, the use of IONM is neither mandatory nor commonplace for the following procedures: cervical decompression for myelopathy, posterior thoracic decompression for myelopathy and resection of intradural extramedullary tumours.

The local availability of neurophysiological monitoring services, regional spinal network practices and agreements, and individual case factors should guide decision making for the use of IONM for all non-mandatory procedures.

Planning Intraoperative Neuromonitoring

No form of intraoperative monitoring is 100% specific or sensitive for detecting all injuries to the spinal cord or peripheral nerves but when well performed, relevant multimodal intraoperative neuromonitoring (MIONM) can approach this.

Clinical judgement must always be used to assess the risks associated with specific stages or manoeuvres during an operation.

Discussion of any planned IONM with the patient during the consenting process is advisable.

Preoperative planning of IONM techniques to be employed is critical to ensure relevant information can be obtained and good communication is critical to ensuring the information is delivered in a timely manner.

Confirm that the anaesthetist is aware that multimodal IONM is to be used to ensure appropriate anaesthetic and relaxant employed.

Where appropriate and safe, perform and document pre-positioning (and sometimes pre-intubation) baseline recordings in cases where there is a high risk associated with positioning. e.g. prone positioning for dislocation/severe myelopathy.

Establish baseline recording again prior to commencing surgery: normally continuing monitoring until closure.

Keep detailed records of any adverse monitoring events and remedial steps taken.

Neuromonitoring Modalities

Motor evoked potentials (MEPs) are normally best used in conjunction with free running electromyography (EMG) and somatosensory evoked potentials (SEPs).

Consider D-wave utilisation to provide additional monitoring of corticospinal tracts in intradural procedures, particularly intramedullary tumour cases.

Consider spinal mapping procedures to localise the midline where this is distorted (eg in intramedullary tumour surgery).

Consider direct nerve stimulation (DNS) to localise/identify roots where required.

Bilateral recording and recording above and below the operative level can be utilised to help locate problems e.g. to discriminate between artefactual, physiological (e.g. anaesthetic induced) and pathological changes in MEP/EP and sometimes D-wave recordings.

Management of reduction/loss MEP/SSEP prior to manipulation of neural tissue or correction of deformity

- Ensure that deterioration is not artefactual. Check lead connections. Ensure that muscle relaxants have not been administered.
- Consider correcting hypotension and hypothermia if present.
- Consider that deterioration could be positioning related. Consider returning patient to supine position.
- Consider “wake up test” to identify motor responses.

Management of reduction/loss of MEP/SSEP during direct manipulation of the spinal cord

- Discontinue manipulation of the cord for 5-15 mins and assess for improvement.
- Consider correcting hypotension or hypothermia if present.
- Consider dexamethasone bolus.
- If no improvement occurs with these manoeuvres then the surgeon will need to decide whether to proceed with surgery accepting the likelihood of significant post-operative deficit or to discontinue surgery. This decision will be individualised and take into account the patient's underlying condition, rate of pre-surgical clinical deterioration, and likely prognosis.

Management of reduction/loss of MEP/SSEP during deformity correction surgery

- Ensure that deterioration is not artefactual. Check lead connections. Ensure that muscle relaxants have not been administered.
- Consider correcting any hypotension or hypothermia if present.
- Consider lightening the plane of anaesthesia. The use of the Bispectral Index and Spectral Edge Frequency can be helpful in determining the depth of anaesthesia.
- If no improvement occurs with these manoeuvres, then release all corrective measures and check screw positions with imaging.
- Wait to see if there is a return of normal MEP / SSEP.
- Consider "wake-up test" to identify motor responses.
- Consider discussion with colleague.

Acknowledgements

Dr Alan Forster, F.R.C.P., Consultant Clinical Neurophysiologist (for neurophysiology advice)
Mr Paul Brewer, Spinal Surgery ST6 (for literature review)

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