Abstracts March 2010

1. A Survey of Spinal Intraoperative Monitoring (IOM) Provided by NHS Hospitals in the UK. G. Mullins, H.J. Grover, A. Rai and J.C. Blake. (Norfolk and Norwich University Hospital, Norwich, UK).

A prospective study was performed to evaluate intraoperative monitoring as practiced currently in the UK. An online survey was distributed to all NHS monitoring teams identified from Neuromonitoring UK's database. 20/24 hospitals contacted completed the questionnaire.

IOM for scoliosis corrective surgery is performed in all centres and for spinal cord tumour resection in 30% of centres. Other indications include complex cervical and lumbar fusions and spinal cord decompressions, including traumatic cases.

All centres use Somatosensory Evoked Responses (SSEPs), Motor evoked potentials (MEPs) are performed in 55% and free run/stimulated EMG in 35%. Some centres include H reflex monitoring.

Written protocols are available in 80% of departments. Preoperative studies are performed in 45% with written consent (for monitoring) obtained in 21%. 70% record SSEPs from the lower limbs only with 35% using a peripheral control (popliteal fossa or Erb's point). MEPs are performed in both upper and lower limbs in 65%.

Warning criteria for SSEPs and MEPs were broadly consistent across all centres and are reported verbally to the surgical and anaesthetic team. All centres monitoring both MEPs and SSEPs report cases where MEP changes occurred in isolation and also where MEP changes preceded SSEP changes. 35% of centres have access to consultant cover.

The findings have revealed some variability between departments in the choice of monitoring modalities and in the protocols followed. Since an increasing demand for Neurophysiology units to provide IOM for spinal surgery is likely, given the current medico-legal climate, the development of national IOM guidelines should help ensure a more standardised high quality service.

2. Pre- and Post- Surgical Evaluation of Cervical Myelopathy With Transcranial Magnetic Stimulation. A. Nicotra[1], N.K.K. King[2], M. Catley[2], N. Mendoza[1], A.H. McGregor[2] and P.H. Strutton[2]. ([1]West London Neurosciences Centre, Imperial College Healthcare NHS Trust and [2]Department of Surgery & Cancer, Imperial College London, UK).

Transcranial magnetic stimulation (TMS) can be used to assess corticospinal (CS) function in cervical myelopathy. However, CS excitability following cord decompression has not been investigated. To this aim, we examined CS integrity using TMS in six patients prior to, and following surgery. Clinical (ASIA) and functional (peg board test and shuttle walking) scores were also taken.

We found that MEPs and silent periods (SPs) recruitment curves at varying stimulus intensities were comparable pre and post-surgery. Similarly, MEP area at maximum stimulator output (MSO; pre 34.16±11.15, post 23.01±4.92), SP duration at 100% MSO (pre 245.29±22.10ms, post 263.48±11.58ms), CMCT (pre 12.34±2.26ms, post 13.78±2.97ms) were not significantly different.

Improvement was observed in ASIA scores (pre 86.40±4.76, post 95.00±2.41), peg board test (pre 32.32±9.80s, post 23.22±2.75s) and mean shuttle walking distance (pre 252.50±175.39m, post 449.00±175.43m).

Our findings using TMS suggest that parameters of CS function are unchanged 3 months following cord decompression. Whether changes occur in the longer term warrants further investigation.

3. Multimodal Intraoperative Monitoring (IOM) in Patients Undergoing Spinal Surgery : The Norwich Experience. G. Mullins, H.J. Grover, S.J. Scott, M. Davies, A. Rai and J. Blake. (Norfolk and Norwich University Hospital, Norwich, UK).

Introduction: IOM is an important tool for monitoring the functional integrity of neural structures during spinal surgery. Sudden and/or sustained changes in somatosensory responses (SSEPs), motor evoked responses (MEPs) and free run EMG techniques alert the surgeon to possible neurological injury at a time when corrective measures can be taken to prevent or minimise irreversible injury.

Methods: All patients undergoing intraoperative spinal monitoring were retrospectively identified from the IOM database at NNUH. Medical notes, operative notes and neurophysiological traces were reviewed.

Results: 236 operations were monitored in the study period. Most patients had SSEPs (211) and MEPs (151) performed. Free run EMG was performed in 52 patients. Significant intraoperative monitoring changes were reported in 33 using usual warning criteria. 15 patients had post operative neurological deficits; 12 were predicted by changes in SSEPs and MEPS and 3 by abnormal firing in free run EMG. 23/32 reported cases were associated with identifiable surgical events and corrective measures taken. 1 case was, in retrospect, thought to be technical in origin.

Conclusions: Intraoperative monitoring is a reliable method for the identification of potential neural injury in patients undergoing spinal surgery. It is often necessary to monitor several modalities (including free run/stimulated EMG) in order to optimise identification of the pathways at risk.

4. Intra-Operative Neurophysiological Recordings During Micro-Vascular Decompression for Hemi-Facial Spasm. P. Walsh, N. Kane and H. Marriott. (The Grey Walter Department of Clinical Neurophysiology, Frenchay Hospital, Bristol, UK).

Introduction : Patients who suffer from hemifacial spasms (HFS) have characteristic and specific electrophysiological findings. These abnormal muscle responses, that are due to ephaptic cross-talk, are observed in the facial muscles as the 'lateral spread response' (LSR). The neurovascular conflict that occurs at the facial nerve root exit zone can be removed during microvascular decompression (MVD) surgery, with alleviation of the patients symptoms.

Methods : 36 patients who had MVD surgery for HFS from May 2006 to January 2009 were included in this study. Monitoring of the facial LSR was performed to assess the adequacy of the decompression of the facial nerve during surgery. Clinical outcome of the patient's spasms were evaluated at discharge and at 3 and 12 months post-operatively. The patients were assigned into two groups on the basis of the LSR, viz. those in whom the LSR was abolished after MVD, and those in whom the LSR remained.

Results : In those patients in whom the LSR was abolished after MVD, 72%, 76% and 92% were spasm free at discharge, 3 months and 12 months respectively. By contrast, only 38%, 25% and 25% were spasm free when the LSR remained.

Conclusion : MVD for HFS is a definitive treatment to cure spasms and the LSR can be used to guide the surgeon and confirm adequate decompression. When it is abolished, the LSR has a high predictive value for long term cure.

5. Evolution of Cranial Nerve Monitoring in Skull Base Surgery : The Aberdeen Experience. A. Forster, M.H. Kamel, A. Hussein, J. Lumsden, M. Smith, W.J. Gerrie, L. Henderson, L. S. Clark and K. Ferguson. (Aberdeen Royal Infirmary, Aberdeen, UK).

Large tumours in the skull base can compromise several cranial nerves. Though facial nerve monitoring has been routine for many years in acoustic neuroma surgery, as has auditory nerve monitoring in trigeminal and facial microvascular decompression, the monitoring of multiple cranial nerves – III to XII – has only recently become routine in some centres. Though strict 'double blind' studies are not feasible, the impression has formed that such intraoperative monitoring is a valuable technique (Ref). In Aberdeen we have followed the pioneers and successfully monitored nerves III-XII in a variety of skull base procedures

We have reviewed our last 13 cases, involving a total of 69 intracranial nerves (2-8 nerves per case). Spontaneous and evoked EMG, transcranial stimulation, and auditory evoked responses, were combined to assist the surgeon locate hidden nerves and detect incipient damage to brainstem structures. The cases ranged from sphenoidal wing meningiomas to large nasopharyngeal carcinoma and brainstem tumours. Recordings were, in the main, made with needle electrodes. The principal problems encountered were concerned with the location of extraocular muscles, with early failures being chiefly related to electrodes becoming dislodged or to various forms of interference.

Surgeons feel safer with more radical dissection once nerves have been localised and our preliminary data suggest that more complete tumour excisions, with reduced complications, have been achieved.

Ref : Topsakal C et al. Neurosurg Rev. 2008; 31(1):45-53.

6. Nerve Excitability Parameters Are Sensitive Biomarkers That Can Be Used to Study Voltage-gated Sodium Channel (VGSC) bBockers. K. Shields and M. Koltzenburg. (Institute of Child Health, London, UK).

Excitability studies were performed on rat saphenous skin-nerve preparations *in vitro* with lidocaine, carbamazepine (CBZ) and lacosamide. Drug responses were compared with baseline values using student's t-tests for analyses.

Lidocaine had reversible dose-dependent effects on all excitability parameters. Strength duration time constant (SDTC), depolarising threshold electrotonus (TEd) and superexcitability were all *decreased* and the I/V curve was shifted towards outward rectification. TEd was the most sensitive parameter with effects seen at concentrations as low as 1 μM (P = 0.05), indicating use-dependent blockade of VGSCs. Significant differences in SDTC (P = 0.006) and superexcitability (P = 0.01) required concentrations > 10 μM. CBZ had qualitatively similar effects but with less efficacy. Lacosamide showed a different pattern with less effects on TEd and an *increase* in superexcitability which increased up to 30 μM (P = 0.01).

Nerve excitability parameters are therefore sensitive biomarkers for drug activity at VGSCs, capable of discriminating quantitative and qualitative differences between VGSC blockers. They may be used to screen for drug activity and provide comparative functional information on dosing.

7. **Regional Ulnar Neuropathy Service Evaluation by Wessex, South West and South Wales (WSWSW) Clinical Effectiveness Group. N. Kane (on behalf of WSWSW Group). (The Grey Walter Department of Clinical Neurophysiology, Frenchay Hospital, Bristol, UK).**

Objective: Ulnar neuropathy at elbow (UNE) is a common entrapment but few guidelines advise on management. By multicentre service evaluation we compared the utility of clinical staging, neurophysiological classification and presence of conduction block (CB), in relation to outcome.

Method: 344 patients were included in 6 centres with clinical staging (1) and neuro-physiological classification (2). The presence of a severe motor CB of ≥50% cMAP across the elbow was noted. A questionnaire was sent to patients 1 year after NCS to ascertain their treatment and symptomatic outcome (i.e. cured, better, same,a little worse, or a lot worse).

Results: We received completed questionnaires from 162 of a possible 269 (60%) patients and found patient's judgement of their outcome correlated weakly with their neurophysiological classification ($R = 0.22$, $p = 0.005$) but not with their clinical stage ($R = 0.002$, $p = 0.98$). Due to the relatively small numbers of patients who had ≥50% CB (44/162 = 27%) and surgery (63/162 = 39%), we dichotomised their outcome into "improved" (i.e. cured or better) and "unchanged/worse" (i.e. the same, a little worse, or a lot worse). In patients with CB ≥50% and treated surgically there was a trend to better outcomes; with "improvement" in 31 of 44 patients (70%) compared to 64 of 110 (58%) without CB, and 42 of 63 (67%) compared to 54 of 99 (55%) of those treated conservatively, but this was not statistically significant (Chi square $X_2 = 3.48$, $p = 0.06$, and $X_2 = 2.34$, $p = 0.13$, respectively).

Conclusion: The clinical and neurophysiological grading scales for UNE are both easily applied tools for assessing severity of UNE across different centres, but only neurophysiological grading informs patient outcome.

Refs : (1) Lee Dellon A., J. Hand Surg. 1989: 14A: 688-700 (2) Padua L. et al., Neurol Sci 2001; 22: 11-16