Joint ANS/BSCN Ulnar Nerve Audit

What is the evidence

Colin Shirley
Jeff Holman
Nick Kane
Current Guidelines

- **ANS/BSCN**
  - **Standard 1**
    Before starting testing the patient is identified and the clinical information from the referral verified.
  - **Standard 2**
    Hand temperature is measured, recorded and maintained above 30 degrees C.
  - **Standard 3**
    Sensory nerve conduction is performed on an ulnar digital sensory nerve in the most affected hand using surface electrodes and measuring response amplitude and latency/velocity. A comparative test of conduction in a digital nerve not innervated by the ulnar nerve is performed in the same hand.
  - **Standard 4**
    A test of ulnar motor nerve conduction in the affected hand is performed using surface electrodes and measuring response amplitude and latency/velocity. Stimulation points must include just proximal to the wrist and proximal and distal to the elbow.
  - **Standard 5**
    The report of the investigation contains the numerical data. It makes a statement about any abnormality detected. The qualification of the practitioner performing the investigation and report is identified.
  - **Standard 6**
    The report is signed by the practitioner taking medico-legal responsibility for it.
Current Guidelines

• **Guideline 1**
  Referrals are screened before allocation of patients by a suitably qualified practitioner to assess appropriateness of clinical question posed.

• **Guideline 2**
  A focussed patient history and examination are recorded, including the presence of co-existing disease.

• **Guideline 3**
  Digital sensory nerve conduction as per standard 3 is performed in the contra-lateral hand.

• **Guideline 4**
  Ulnar motor nerve conduction in the affected limb is tested over a short segment around the elbow using surface electrodes and measuring response amplitude and latency/conduction velocity.

• **Guideline 5**
  Motor nerve conduction in the median nerve is performed in the affected limb using surface electrodes and measuring response amplitude and latency/conduction velocity.

• **Guideline 6**
  Ulnar motor nerve conduction is performed in the contra-lateral limb as in standard 4.

• **Guideline 7**
  Short segment ulnar motor nerve conduction is recorded in the contra-lateral limb, as in guideline 4.

• **Guideline 8**
  Ulnar mixed nerve conduction is measured in the affected arm using surface electrodes and recording response amplitude and latency/velocity around an elbow segment of nerve. This may be compared with the same test in the contra-lateral arm.

• **Guideline 9**
  Needle EMG recording of ulnar innervated hand/arm muscles is performed by a medically qualified practitioner.

• **Guideline 10**
  The patient is seen by a suitably qualified practitioner at the end of the test to verify the clinical presentation, make a clinico-electrophysiological correlation, to include this in the final report, and to answer any clinical questions the patient may have.

• **Guideline 11**
  The report details any technical factor that could influence the results.
Current Evidence

• American Association of Electrodiagnostic Medicine
• Drew upon 13 peer reviewed articles which were accepted against pre-set criteria (took account of age, temperature controlled etc)
• Diagnosis based of UNE based on clinical criteria independent of electro diagnostic criteria
AAEM

• Elbow position: moderate flexion (70 to 90 degrees) – greatest correlation of true segment length
• Across elbow distance in the range of 10 cm
• Stimulation more than 3 cm distal to medial epichondyle to be avoided
• 3 points of stimulation (W, BE, AE)
• Absolute MCV values suggested as being more robust than relative slowing compared to distal segments
Suggestions in Severe lesions

- “Practice options”
- With severe Wallerian degeneration, distal forearm velocities may be inaccurate and slow BE-W velocities.
- Comparison of AE and BE velocities with axilla to be acceptable.
- Limitation of using forearm flexor muscles but may be used as last resort (but limitations to this).
Current Evidence

• Padua
• 3 point motor stimulation and ulnar sensory studies
• Suggested a shorter distance across the elbow. (but study did not focus on this)
Padua – Severity rating

Hands were divided into five classes of severity on the basis of the following neurophysiological classification:

1. “Negative UAE” (NEG): normal findings on all tests
2. “Mild UAE” (MILD): slowing of ulnar MNCV across elbow and normal ulnar SNAP;
3. “Moderate UAE” (MOD): slowing of ulnar MNCV across elbow and reduced amplitude of ulnar SNAP;
4. “Severe UAE” (SEV): absence of ulnar SNAP (fifth digit-wrist segment) and slowing of motor nerve conduction velocity (MNCV) across elbow;

Specificity and Sensitivity

• Difficult to define as lack of “gold standard” of UNE diagnosis
• Padua suggests likely high false negative rate
• Padua series 15 of 63 (arms) false negatives
• AAEM reviewed studies suggested sensitivities of 37% to 86 percent and specificities of 95% or greater
Prognostic Indicators

• Retrospective study of the “EDX” results compared with subjective resolution of symptoms
• 193 patients 59 with “definite” UNE
• Conduction block across elbow with FDI and preserved ADM CMAP strongly associated with recovery (86%) to 7% with abnormal CMAP without conduction block
Ultrasound correlation with Electro diagnostic Criteria

• Study examined cross sectional area (CSA) of ulnar nerve and correlated to electro diagnostic severity criteria

• CSA found to be highly correlated to EDX severity

• Suggest USS may have a role in diagnosis and severity stratification in UNE

• Discussion – does this add greatly to the diagnostic paradigm, ? ideally would detect increased CSA in electro physiologically normal UNE
Potential Controversies

- In which lesions to surgically intervene – lack of accepted criteria for intervention
- Should those which are electrophysiologically neuropraxic be observed
- Should normal studies preclude surgery – many surgeons treat clinically
- Which is the best surgical approach, "simple" decompression, transposition, medial epichondylectomy
- Role of ultrasound assessment
Potential Research

• Need multi-centre approach to achieve adequate power
• Adhere to an agreed pre-operative clinical and electro diagnostic assessment
• Ethical issues if proposal to alter surgical practice?
• Use natural variance in surgical practice to assess value of each surgical procedure
References

• Thanks to Dr Ramesh Gowda StR QEHB for help with the literature review
  • Ultrasound evaluation of ulnar neuropathy at the elbow correlation with electrophysiological studies (Rheumatology 2009:48 1098-1101)
  • Prognostic indicators from electro diagnostic studies for ulnar neuropathy at the elbow (Muscle and Nerve April 2011)
  • Neurophysiological classification of ulnar entrapment across the elbow (Neurol Sci (2001) 22:11-16
  • Practice Parameters: Electro diagnostic studies in ulnar neuropathy at the elbow (Neurology 1999: 52: 688)
  • ANS/BSCN Guidelines (BSCN website)
  • Electrodiagnostic Evaluation of Ulnar neuropathy and other upper limb extremity mononeuropathies (Neurol Clin 30 (2012) 479-503)
DISCUSSION
Audit of Ulnar Neuropathy Entrapment

Form A (47 Returns)

Jury’s Inn
125 Broad Street
Birmingham B1 2HQ

10th October, 2014

Presented by
N. Kane
J. S. Holman
### FORM A: Please complete once only for each department

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
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<tbody>
<tr>
<td>Centre Code</td>
<td></td>
</tr>
<tr>
<td>1. Do you use published guidelines for the diagnosis of Ulnar Entrapment Neuropathy?</td>
<td></td>
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<tr>
<td>2. If so please give reference:</td>
<td></td>
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<tr>
<td>3. Do you use a local protocol for the diagnosis of Ulnar Entrapment Neuropathy?</td>
<td></td>
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<td>4. If so please attach copy</td>
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<tr>
<td>5. Have you performed a local or regional audit on this topic?</td>
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<tr>
<td>6. If so please provide a summary and main recommendations.</td>
<td></td>
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<tr>
<td>7. Do Physiologists undertake NCS for the diagnosis of Ulnar Entrapment Neuropathy in your Department?</td>
<td></td>
</tr>
<tr>
<td>8. Do you use grading criteria for Entrapment Neuropathy?</td>
<td></td>
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<tr>
<td>9. Technical Questions*, please circle the most appropriate to your usual practice:</td>
<td></td>
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<tr>
<td>a) Elbow position:</td>
<td></td>
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<tr>
<td>b) Do you record the Ulnar Mixed Nerve Action Potential (NAP) at the elbow?</td>
<td></td>
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<tr>
<td>c) Which muscle do you record the Ulnar Motor Potential (cMAP) from?</td>
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<tr>
<td>d) How do you define the Ulnar motor conduction velocity (MCV) abnormality at the elbow? (one or more answers may apply)</td>
<td></td>
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<tr>
<td>e) If Conduction block what degree do you consider as significant?</td>
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<tr>
<td>10. Would you be interested in taking part in a multi-centre research study on Ulnar Entrapment Neuropathy?</td>
<td></td>
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</tbody>
</table>

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Guidelines and Protocols

- Do you use published Guidelines? 32/47
  - BSCN/ANS 19
  - AAEM 9
  - Padua 2
  - Liveson 1

Do you use a local Protocol? 29/47
Neither 2/47
Protocols (n=21): ‘Best Practice’

- UNE Guidelines: Poole and Calderdale
- Check List: Luton and Dunstable
- Clinical History and Signs: R D & Exeter
- Anastomoses: Norfolk and Norwich
- General Approach: Derby and Gloucester
  - (Trust hand hygiene and infection control policies, Reassure patient no side effects).
- Aiming for Uniformity: West Midlands
Local or Regional Audits (n=16)

• Skin temp: warm if <30. >31 to >33 °C (S. 2).
• Contralateral NCS recommended (G. 3 & 6).

• Elbow segment: 6-8, 8-10, 9-11 cm.
• Elbow CV: >45 to >50 m/s.
• Consent process.

• If Diabetic perform Sural SNAP.
• Do Physiologists undertake NCS for UNE?
  - Yes 44  No 3

• Do you use Grading criteria?
  - Yes 22  No 24  No Answer 1

  • Padua et al (2001) mentioned by 4 Depts.
Technical Questions

a) Elbow position
   \[70^\circ\text{-}90^\circ = 35\], \(>90^\circ = 8\), \(<70^\circ = 4\)

b) Record Ulnar NAP (G.8)
   Yes = 27, No = 17, No answer = 3

c) Muscle cMAP (Op.1)
   Both = 36, ADM = 17, FDI = 1

d) Definition of MCV abnormality
   MCV <50m/s = 34, CB = 33, >10m/s = 30

e) Conduction Block (CB)
   >50\% = 14, 25-50\% = 15, 10-25\% = 10, None = 8
Research

- Yes 37 Possibly 3
- No 6 Undecided 1

Ideas (Romford and NHNN):
- Conduction Block in relation to Outcome
- Conservative versus Surgical Management
- Severity grading scale
Joint National Audit Project
BSCN/ANS Standards for NCS in Ulnar Neuropathy screening.
Audit Results

Form 2 (48 Returns)
FORM B: Please complete for 20 consecutive patients attending for investigation of Ulnar Neuropathy at the Elbow

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Before starting testing the patient is identified and the clinical information from the referral verified.</td>
<td></td>
</tr>
<tr>
<td>2. Hand temperature is measured, recorded and maintained above 30 degreesC.</td>
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</tr>
<tr>
<td>3a. Sensory nerve conduction is performed on an ulnar digital sensory nerve in the most affected hand using surface electrodes and measuring response amplitude and latency/velocity.</td>
<td></td>
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<tr>
<td>3b. A comparative test of conduction in a digital nerve not innervated by the ulnar nerve is performed in the same hand.</td>
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<tr>
<td>4. A test of ulnar motor nerve conduction in the affected hand is performed using surface electrodes and measuring response amplitude and latency/velocity. Stimulation points must include just proximal to the wrist and proximal and distal to the elbow.</td>
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<tr>
<td>5a. The report of the investigation contains the numerical data</td>
<td></td>
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<tr>
<td>5b. Were the results abnormal?</td>
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<tr>
<td>5c. If abnormal, does the report make a statement on any abnormality detected?</td>
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<tr>
<td>5d. The professional status of the practitioner performing the investigation is identified.</td>
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<tr>
<td>5e. The professional status of the practitioner reporting the investigation is identified.</td>
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<tr>
<td>6. The report is signed by the practitioner taking medico-legal responsibility for it.</td>
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</tbody>
</table>
1. Response Analysis

1. Pre-test analysis

• Identification of patient and clinical information.
• Hand temperature measurement.

3. Recording analysis

• Sensory nerve (Ulnar) testing and comparative investigation
• Test of Ulnar motor nerve conduction proximal to the wrist and distal to the elbow.

4. Report analysis

• The investigation report.
• Abnormality reporting analysis.
• Professional status of reporter and recorder identified.
• Responsibility marking.
Response analysis

48 Centres contributed data across Great Britain, Wales and Scotland. (Up 60%)

825 Individual studies recorded and submitted. (Up 39.5%)

20 Is the Mode of responses received.

17.2 Is the Mean of the responses received.

20 Is the median of the responses received.

2– 20 Was the range of responses received.
1. Before starting testing the patient is identified and the clinical information from the referral verified.

Number of responses = 825 of which YES = 800 (97%) and NO = 25 (3%)
Pre-test analysis

2. Hand temperature is measured, recorded and maintained above 30 degrees Centigrade.

Number of responses = 825 of which YES = 555 (67%) and NO = 270 (33%)
Pre-test analysis

Hand temperature measurement – results by centre
Centre analysis (N=48)

Affected by a **YES** response = 39 (81%)
> 3 = 39 (100%), of which all responses were YES = 17 (44%)

Affected by a **NO** response = 31 (64.5%)
1 = 3 (9.7%)
2-3 = 5 (16.1%)
>3 = 23 (74.2%), of which ALL responses were NO = 2 (6.5%)
1. Sensory nerve conduction is performed on an ulnar digital sensory nerve in the most affected hand using surface electrodes and measuring response amplitude and latency/velocity.

Number of responses = 825 of which YES = 805 (97.6%) and No = 20 (2.4%). 1 centre affected by a no result (100%).
2. A comparative test of conduction in a digital nerve not innervated by the ulnar nerve is performed in the same hand.

Number of responses = 825 of which YES = 805 (97.6%) and NO = 20 (2.4%). 1 centre affected by a no result (100%)
3. A test of ulnar motor nerve conduction in the affected hand is performed using surface electrodes and measuring response amplitude and latency/velocity.

Number of responses = 825 of which YES = 824 (99.9%) and NO = 0 (%). 1 spoilt response.
4. Stimulation points must include just proximal to the wrist and proximal and distal to the elbow. (3 points of data collection).

Number of responses = 825 of which YES = 800 (97%) and NO = 23 (2.8%). Centres affected = 7 (30.4%). Spoilt results = 2
4. Stimulation points must include just proximal to the wrist and proximal and distal to the elbow. (3 points of data)– by centre.

Centre analysis (N=48)

Affected by a YES response = 47(97.9%)

all responses were YES = 40 (85%)

Affected by a NO response= 7(14.5%)

1 = 3(42.9%)
2-3 = 2(28.5%)
>3 = 2(28.5%), of which ALL responses were NO = 1 (14.2%)
Post-test (Report) analysis

1. The report of the investigation contains the numerical data.

Number of responses =825 of which YES = 818(99.2%) and NO = 7(0.8%). 1 centre affected by NO response. 1 spoilt response.
Post-test (Report) analysis

2. Were the results abnormal?

Number of responses = 825 of which YES = 390 (47.3%) and NO = 435 (52.7%). 2 ruined responses.
Post-test (Report) analysis

3. If abnormal, does the report make a statement on any abnormality detected?

Number of responses = 390 of which YES = 386 (98.9%), No = 3 (0.8%). N/A = 430. 6 ruined responses.
3. If abnormal, does the report make a statement on any abnormality detected? – by centre.

Number of responses = 825 of which YES = 386 (46.8%) and N/A = 430 (52.1%), No = 3 (0.4%). 6 ruined responses.

Centre analysis (N=48)

Affected by a YES response = 48 (100%)

1 = 2 (4.2%)
2-3 = 6 (12.5%)
>3 = 40 (83.3%), of which all responses were YES = 0 (0%)

Affected by a N/A response = 48 (100%)

1 = 2 (4.2%)
2-3 = 2 (4.2%)
>3 = 44 (92%), of which ALL responses were N/A = 0 (100%)
4. The professional status of the practitioner performing the investigation is identified.

Number of responses = 825 of which YES = 763 (92.5%) and NO = 61 (7.4%). Spoilt response = 1
4. The professional status of the practitioner performing the investigation is identified. – centre analysis.

Number of responses = 825 of which YES = 763 (92.5%) and NO = 61 (7.4%). Spoilt response = 1

Centre analysis (N=48)

Affected by a YES response = 46 (95.8%)

1 = 0 (0%)
2-3 = 1 (2.2%)
> 3 = 45 (97.8%), of which all responses were YES = 42 (91.3%)

Affected by a NO response = 6 (12.5%)

1 = 1 (16.7%)
2-3 = 0 (%)
> 3 = 5 (83.3%), of which ALL responses were NO = 2 (33.3%)
5. The professional status of the practitioner reporting the investigation is identified.

Number of responses = 825 of which YES = 820 (99.4%) and NO = 4 (0.5%). Spoilt response = 1
6. The report is signed by the practitioner taking medico-legal responsibility for it.

Number of responses = 825 of which YES = 781 (94.6%) and NO = 42 (5%) 3 centres. Spoilt response = 2
Summary

The findings of this study can be summarised as below:

BEFORE RECORDING

Before testing the patient is identified, clinical information sought in the majority of cases (97%).

Hand temperature is measured, recorded and maintained to at or >30 degrees Centigrade in the majority of cases (67%) but this has been found to be an inconsistent practice within a number of centres audited.

RECORDING

In nearly all cases (97.6%) sensory nerve conduction is performed on the affected Ulnar nerve in the most affected hand. Amplitude, latency and velocity are all measured.

A comparative test of conduction in a digital nerve NOT innervated by the Ulnar nerve is performed in nearly all cases (97.6%). Amplitude, latency and velocity are all measured.

A test of Ulnar motor nerve conduction, in the affected hand, is performed in nearly all of the cases (99.9%). Amplitude, latency and velocity are all measured.

Ulnar motor conduction just proximal to the wrist and proximal/distal to the elbow are also measured in nearly all cases. Amplitude, latency and velocity are all measured.

REPORT

The report contained the numerical data (99.2%) most of the time, and abnormal results are recorded and a statement of abnormality is made nearly all of the time (98.9% of cases). The sample yielded 47.3% abnormality discovery.

The report contains the status of the recording professional most of the time (92.5% of the cases) or the reporting professional nearly all of the time (99.4%) and is signed (94.6%) by the individual taking responsibility for it.
Recommendations

Based on the audit results..............................

We, the BSCN and ANS Audit group offer

**NATIONAL UNE recording STANDARD of PRACTICE.**

This comprises of the following:::

1. Identify and verify the identity of the patient. Gather clinical information and record/maintain peripheral hand temperature at or >30 degrees centigrade.

2. Sensory Ulnar nerve to be recorded in the affected hand with a comparative NON Ulnar nerve. Amplitude, latency and velocity are all measured.

3. Motor nerve conduction to be recorded just proximal to the wrist, proximal and distal to the elbow of the affected limb. Amplitude, latency and velocity are all measured.

4. The report should contain the numerical data, identification of the professional recording, reporting the data and a signature of the individual taking medico-legal responsibility for it. A statement of ANY abnormal results should be made.

The standard does not indicate non standard testing that may be used to enhance marginal changes. These should be used then documented as if adhering to the standard.
Acknowledgements

To all those that contributed to this audit.
To all those that contributed to the initial development of this audit
To all those on the audit committee
To the ANS and BSCN for continuing support

(If you want a copy of YOUR results, possibly for IQUIPS, please contact me jeffery.holman@porthosp.nhs.uk)