

An evaluation of current UK practice for Evoked Potentials

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INTRODUCTION AND RATIONALE

- Evoked potentials (EPs) widely used in Neurophysiology departments throughout the UK
- Whilst still clinically useful, imaging has largely surpassed their use
- Guidelines available but large amount of work historic
- Need for evidence based standards
 - Quality
 - Standardisation

METHODS

- 83 UK Neurophysiology departments
- 36 Departments responded
- Form A: Survey of current practice
 - Overview and PRVEP, SSEP and BSEP
 - 36 responses
- Form B: Prospective study of every PRVEP, SSEP

and BSEP performed between April 1st to June 30th 2018

• 1401 responses from 36 centres



AIM – FORM A

- Evaluation of current practice in Evoked Potential recording throughout the UK
 - TO DETERMINE GUIDELINES CURRENTLY BEING USED FOR PATTERN REVERSAL (PRVEP), UPPER AND LOWER LIMB SOMATOSENSORY (UL AND LLSSEP) AND BRAINSTEM (BSEP) EVOKED POTENTIALS

Joint National Audit Project

• To set nationally agreed UK minimal standards for each of the above EP modalities.

FORM A



A survey of practice of Neurophysiology Departments in the UK for performing Evoked Potentials.

FORM A Please complete once only for each department

+ 1. Do you perform evoked potentials in your Yes / No department? If no, then the form is complete. There is no need to answer any further questions. If yes, please continue with the form Which of these modalities do you perform? (if Yes please give number performed per year) 2.VEP Full field checkerboard Number performed = Yes / No 3. VEP Half field checkerboard Number performed = Yes / No 4. VEP pattern onset Yes / No Number performed = 5. VEP Flash Number performed = Yes / No 6. BAEP Yes / No Number performed = 7. SEP upper limb Number performed = Yes / No 8. SEP Lower limb Number performed = Yes / No 9. Magnetic MEP upper limb Number performed = Yes / No 10. Magnetic MEP lower limb Number performed = Yes / No

Visual Evoked Potentials	
11. Do you use published guidelines for the recording of VEP?	Yes / No / Not performed
	If 'not performed' go to guestion 29
12. If yes, please give reference	in not performed go to question zo
13. Do you use a local protocol for the	Yes / No
recording of VEP	
14. If yes, please attach a copy	
What are your routinely used machine settings/stimulus parameters for VEP?	
Settings:	
15. High frequency filter	
16. Low frequency filter	
17. Time base	
18. Sensitivity	
19. Stimulation rate (Hz)	
20. Field size (angle subtended)	
21. Check size (angle subtended)	
22. Stimulus – screen type (please circle)	CRT LED
23. Have you performed a local or regional audit on VEPs?	Yes/No
24. If yes, please provide a summary and main recommendations	
25. Do you use published normative data for VEP interpretation?	Yes / No
26. If yes, please give reference	
27. Do you use locally derived normal values for VEP interpretation?	Yes/No
28. If yes, please attach	

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FORM A OVERVIEW

- 36/83 centres responded
 - 43% response rate.
- 100% of respondent centres performed EPs (36/36)
- Centres asked which EPs they perform
- Only pattern-reversal VEP (PRVEP) and SSEP (UL and LL) were performed by all centres (36/36)
- 61.1% of respondents perform BSEP (22/36)





FORM A OVERVIEW



- Numbers of different EPs performed over a 12 month period requested
- PRVEP the most commonly requested EP
 - PRVEP 3206 (range 4-247)
 - LLSSEP 2239 (range 1-255)
 - ULSSEP 1866 (range 2-255)
 - BSEP 331 (range 1-132)



DO YOU USE PUBLISHED GUIDELINES?



VEP – 69% respondents used published guidelines (25/36)

• 80% referenced (20/25)

SSEP – 46% respondents used published guidelines (16/35)

• 87.5% referenced (14/16)

BSEP – 45% respondents used published guidelines (10/22)

• 80% referenced (8/10)



STATED PUBLISHED GUIDELINES

VEP

ISCEV (2010, 2014 and 2016)

ACNS (2009)

IFCN (1993)

Evoked potentials in clinical testing (Halliday et al 1993)

Evoked potential techniques in the evaluation of visual function (Cellesia 1984)

Clinical Neurophysiology (Binnie et al 1995)

SSEP

ACNS (2009)

IFCN (1999)

Clinical Neurophysiology (Binnie et al 1995)

Evoked Potentials in Clinical Medicine (Chiappa 2000)

SSEPs from posterior tibial nerve and lumbrosacral dermatomes (Katifi & Sedgwick, 1986)

BSEP

ACNS (2008)

IFCN (1994)

Evoked Potentials in Clinical Medicine (Chiappa 2000)



MOST WIDELY ACCEPTED PUBLISHED GUIDELINES

- VEP 44% use current ISCEV standards (11/25)
- SSEP 25% use ACNS guidelines (4/16)
- BSEP 20% use ACNS guidelines (2/10)



DO YOU USE LOCAL GUIDELINES?



VEP – 86% respondents used local guidelines (31/36)

• 97% attached (30/31)

SSEP –89% respondents used local guidelines (31/35)

• 90% attached (28/31)

BSEP – 82% respondents used local guidelines (18/22)

• 89% attached (16/18)



SUMMARY OF GUIDELINES IN USE



Type of guidelines in use



GUIDELINES SUMMARY

- VEP only EP modality with updated published guidelines within the last 10y.
 - Primarily ophthalmic input
 - ISCEV update every 2-4y
- Most utilised SSEP and BSEP guidelines published 10y ago
 - Historic
 - Technical advances
- Local protocols variable and not always available
 - Required for IQIPS



HAS A LOCAL OR REGIONAL AUDIT BEEN PERFORMED?



Response



AUDIT RECOMMENDATIONS – VEP

- Ongoing comparison of CRT V LED to look at latency and amplitude differences.
- Local audit Comparison of current practice to ISCEV standards
 - Local protocol comparable to current ISCEV standards
- Single paediatric centre Age based normative data
 - CRT screen
- Single centre stated audit performed but no data attached



AUDIT RECOMMENDATIONS - SSEP

- Use of SSEPs in identification of brain death in patients after cardiac arrest.
- 2 centres performed local and regional audit looking at alternative reference sites for LLSSEP and/or ULSSEP
 - Both found addition of a contralateral reference site in addition to traditional Fz-Cz' montage avoids erroneously reporting cortical responses as delayed or absent.
- Single paediatric centre Height matched normative data
- Inter- and intra-observer variability in the interpretation of ULSSEP and LLSSEP
 - No significant difference between the ability of Consultant Neurophysiologists and other senior healthcare scientists in reporting SSEPs
 - Evidence of intra-variability which reinforces the requirement for robust standards for interpretation of SSEPs.



AUDIT RECOMMENDATIONS - BSEP

- Single centre performed audit
 - Does click polarity matter?
 - Alternating V Condensation V Rarefaction
 - Rarefaction produced clearest waveforms but alternating/condensation produced best wave I





NORMATIVE DATA USED



Type of normative data

VEP

- 8% published data (3/36)
- 78% local (28/36)
- 8% combination (3/36)
- 3% none (1/36)

SSEP

- 37% published data(13/35)
- 37% local (13/35)
- 11% combination (4/35)
- 11% none (4/35)

BSEP

- 41% published data (9/22)
- 45% local (10/22)
- 9% combination (2/22)
- 0% none (0/22)



REFERENCED NORMATIVE DATA

VEP

Clinical Neurophysiology (Binnie et al 1995)

ISCEV

Evoked potentials in clinical testing (Halliday et al 1993)

Aston

SSEP

IFCN (1999)

Clinical Neurophysiology (Binnie et al 1995)

Evoked Potentials in Clinical Medicine (Chiappa 2000)

SSEPs from posterior tibial nerve and lumbrosacral dermatomes (Katifi & Sedgwick, 1986)

Evoked potentials in clinical testing (Halliday et al 1993)

BSEP

ACNS

IFCN

Evoked Potentials in Clinical Medicine (Chiappa 2000)



NORMATIVE DATA SUMMARY

- Published normative data from historic sources
- Published guidelines in use (ISCEV and ACNS) advocate use of locally adopted matched normative data
- If published then audit should be performed to assess whether the data set is comparable
 - Age
 - Stimulation parameters
 - Recording parameters

Joint National Audit Project

FORM A SUMMARY

- EPs still routinely used within UK departments
- Protocols variable
- Number of tests performed between UK departments variable
- Published guidelines and normative data predominately historic.
- More recent advances in technology and machine capabilities
- Limited local or regional audits performed
- Highlights need for nationally agreed UK standards
 - Transferable data
 - Possibility of pooling of normative data for centres performing limited studies