Clinical Governance Guideline for EMG (Electromyography)

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

The department of Clinical Neurophysiology is a county wide service, providing both outpatient and inpatient investigations for a wide range of conditions. With the continued development of extended roles, the department has been proactive in developing new ways of working. This is not only for the benefit of the patient but allows for an investment in staff training to a highly specialist level.

This guideline focuses on Electromyography being performed and interpreted by Clinical Scientists/Chartered Scientists.

This guideline is for use by the following staff groups:

Lead Clinician(s)

Dr Sarah Green	Consultant Supervisor, Neurophysiology
Approved by *Divisional Management Board* on:	29th January 2024
Approved by Medicines Safety Committee on: *Where medicines included in guideline*	N/A
Review Date: This is the most current document and should be used until a revised version is in place	29th January 2027

Key amendments to this guideline

Date	Amendment	Approved by:
29th January 2024	Document reviewed and approved for publication	Divisional Management Board

Users

Clinical Scientists, medical consultants

Rationale

With the ever-increasing demand on service for EMG studies there is a need to look at the approach taken in the delivery of the service. WAHT has a single-handed clinical consultant. Recruitment to these posts is limited and training of new specialist consultants is becoming a workforce concern. (BSCN 2015)

The role of the Scientist has expanded over the past decade and previously deemed 'medical' roles have been introduced for scientists with supporting training packages both in house and as part of a national training scheme (Modernising Scientific Careers 2012).
Scientists who have undertaken the WAHT training competencies (appendix 1) and who are working at a clinical scientist or chartered scientist level will be deemed competent to perform EMG procedures as part of the devised protocols within the Neurophysiology department, ensuring the minimum knowledge to this level (appendix 2).

This will initially only apply to cervical radiculopathy, and carpal tunnel syndrome.

Patient documentation

Informed consent to the EMG/NCS procedure in line with WAHT policy. Identification of the patient is checked prior to starting recording.

Clinical Evaluation

A full clinical history should be taken and documented, and brief clinical examination. Each specific test type will have guidance for clinical evaluation for condition type.

Potential risks should be identified, such as bleeding risk (anticoagulant medication, low platelet levels) and infection risk (lymphoedema, open skin lesions). Ideally, any of these risks will have been identified at the point of triage. Patients will be carefully selected for allocation to these clinics by the medical consultant; those identified as low risk and likely to have an easily identifiable cause for their symptoms (upper limb entrapment neuropathy such as carpal tunnel syndrome, cervical radiculopathy or normal).

Nerve conduction study

Upper limb nerves will be tested to rule out entrapment neuropathy or peripheral neuropathy (median and ulnar sensory and motor studies, +/- radial).

Follow appropriate departmental guideline.

Preparation

In preparation of the participant for intramuscular electrode insertion, the patient will lie on the couch with the upper limb exposed up to the shoulder. The skin area over the muscle will be thoroughly cleaned with an alcohol wipe.

Insertional technique

Each muscle will be activated, and the area of muscle bulk identified. The muscle will then be relaxed, and the needle steadily inserted, until the reading confirms that the electrode is in situ (confirmed insertional activity, etc).

The muscle is assessed relaxed, and then activated to assess volitional activity.
When sufficient data has been obtained, this is stored, and the needle removed.
Pressure is applied to the puncture site until any bleeding has stopped. A plaster may be offered if the patient prefers this.

Infection control: Needles used within the department are single use. The scientist will be wearing gloves during the insertions. All needles will be disposed of safely in the sharps container located in the room and full infection control and sharps safety will be followed (WAHT? infection control guidelines).

Risks

If the EMG reading shows end plate potentials or the patient is in pain, the needle is removed and resited.

Mild discomfort or pain is seen in around 1 in 10 patients.

Less than 1 in 100 patients may feel faint. If this occurs, the needle is immediately removed and the bed flattened. The patient should rest until they feel well enough to sit up again. They may also be offered water. This should be noted in the report.

Fewer than 1 in 10,000 patients may experience bleeding into the muscle, requiring treatment. As these patients will be carefully selected and not taking a blood thinner, this would not be expected to occur. Minor bleeding can occur in any patient if the needle punctures a small blood vessel. If this occurs, then pressure should be applied until the bleeding stops. If there are any concerns that the bleeding does not stop easily, the medical consultant should be consulted.

Report

At the end of the test, the scientist will inform the patient that the results will be analysed and a result will be sent to their referrer within 2 weeks. They will not provide a clinical diagnosis at this point.

The scientist will analyse the recorded waveforms and complete a report, which will be checked by the medical consultant before the results are sent to the referrer.

Training

The scientists will be trained in relevant anatomy, physiology and clinical correlations to allow them to safely perform and interpret the procedure.

Anatomy

To ensure safe needle insertion, the scientists will be trained in:

- Basic anatomy of the upper limb: skeletal structure, course of the main blood vessels and peripheral nerve innervation.
- Functional anatomy of muscles and the motor unit.
- Anatomy of the muscles to be sampled: origin, insertion, innervation and function, as well as surface localisation.

Electromyography

Normal and abnormal spontaneous activity.
Volitional activity: assessment of the motor unit, recruitment and interference pattern.

Clinical correlations

Neuropathic findings.
Myopathic findings.
How to complete the report: insertional activity, abnormal spontaneous activity, amplitude, duration, polyphasia, plus free text comments to aid interpretation (limited volitional activity, patient in pain, etc.).
Typical patterns of abnormalities in: mononeuropathy, plexus disorders radiculopathy, motor neurone disease, muscle disorders.

Appendix 1

Training Competencies

Demonstrate knowledge of the basic anatomy of the upper limb
Demonstrate knowledge of the muscles to be sampled by needle EMG:
Deltoid
Biceps
Triceps
Flexor carpi radialis
Extensor indicis
First dorsal interosseous
Abductor pollicis brevis

Competencies: history and examination

Date	Competency	Consultant signature
	Identify the key features required in a history of radiculopathy	
	Assess tone in the upper limbs	
	Assess power in the main muscle groups of the upper limbs	
	Assess reflexes in the upper limbs	
	Explain the procedure to the patient	

Competencies: basic anatomy

Date	Competency	Consultant signature
	Demonstrate knowledge of the basic anatomy of the upper limb	
	Describe the functional anatomy of muscles and the motor unit	

Competencies: muscle anatomy

Date	Competency	Origin	Insertion	Innervation	Function	Surface localisation	Consultant signature
	Anatomy of deltoid						
	Anatomy of biceps						
	Anatomy of triceps						
	Anatomy of flexor carpi radialis						
	Anatomy of						

	extensor indicis						
	Anatomy of first dorsal interosseous						
	Anatomy of abductor pollicis brevis						

Competencies: electromyography of spontaneous activity

Date	Competency: recognise and describe the identifying features of the discharges below	Consultant signature
	Normal: end plate potentials	
	Abnormal: fibrillations and positive sharp waves	
	Abnormal: fasciculations	
	Abnormal: myotonia	
	Abnormal: neuromyotonia	
	Abnormal: complex repetitive discharges	

Competencies: electromyography of volitional activity

Date	Competency	Consultant signature
	Describe the features of a normal motor unit	
	Define the typical parameters of a normal motor unit, i.e. amplitude & duration	
	Define polyphasia and its significance	
	Define recruitment and interference pattern	

Competencies: clinical correlations

Date	Competency	Consultant signature
	Describe neuropathic findings on EMG	
	Describe myopathic features on EMG	
	Describe the time course over which abnormalities can be identified	
	Tabulate the findings in a standardised format	
	Describe the pattern of abnormalities in: mononeuropathy	
	Describe the pattern of abnormalities in: plexopathy	
	Describe the pattern of abnormalities in:	

	radiculopathy	
	Describe the pattern of abnormalities in: motor neurone disease	
	Describe the pattern of abnormalities in: myopathy	

Competencies: supervised EMG practice in 20 patients

Date	Comments	Consultant signature

Appendix 2

Applied Knowledge

Analyse, synthesise, critically evaluate and apply knowledge with respect to peripheral nerve disorders, including:

- the anatomy of peripheral nerves and muscles so that detailed anatomical considerations and anomalies can be taken into account with regard to electrode placement and needle insertion.
- physiology of nerve conduction, neuromuscular transmission and excitation–contraction mechanisms in muscle;
- epidemiology; hereditary and acquired chronic and acute causes of peripheral nerve disorder; the natural history of the three commonest causes of neuropathy in the developed world (diabetes, alcohol and vitamin deficiencies); conditions detected by blood tests included in neuropathy screens, pathophysiology, to include: mononeuropathy: compression; ischaemia; inflammation, mononeuritis multiplex, polyneuropathy, amyotrophic lateral sclerosis, Bell's palsy, cervical spondylosis, muscular dystrophy, Charcot-Marie-Tooth disease, myasthenia gravis, trauma, brachial plexus injury.

Clinical presentation:

- clinical presentation and pathophysiology of diseases of the peripheral nerves, neuromuscular junction and muscles, including peripheral neuropathy (toxic +/- inflammatory), entrapment neuropathies.
- typical referrers, e.g. neurologists.
- history, focusing on type of symptoms, onset, progression and location, as well as information about potential causes (e.g. family history, toxic exposures, past medical disorders).
- physical and neurological examination to define type of deficit (e.g. motor deficit, type of sensory deficit, combination).
- evaluation of sensation (using temperature for small fibres; using vibration proprioception tests for large fibres), motor strength and deep tendon reflexes.
- cranial nerves as well as peripheral nerve function are evaluated.
- evaluation of autonomic function.

Signs and symptoms.
Diagnostic investigations and management, including:

- laboratory blood tests:

Treatment options, including communication and liaison with other clinical teams; the role of lumbar puncture and CSF analysis; the role and scope of genetic testing, including issues of consent; neuroimaging, e.g. radiculopathy or to rule out cervical spinal cord compression; clinical neurophysiology investigations; nerve conduction studies and electromyography, including: techniques for study of peripheral nerves, e.g. sensory, motor and F wave studies; H reflex; repetitive nerve stimulation; and blink reflex.

Adaptations necessary in particular patient groups or difficult recording situations. To include Normal values, including anatomical variants, effects of age, temperature, height and co-morbid conditions.

The use of internal controls, e.g. the opposite limb in contralateral conditions.
Other relevant investigations, including: genetic testing if a hereditary neuropathy is suspected, nerve biopsy, e.g. to help differentiate demyelinating from vasculitis large-fibre neuropathies.

Medical management of peripheral nerve disorders:

- treatment of underlying disorder with particular reference to entrapment neuropathies such as carpal tunnel syndrome.
- role of the multidisciplinary team, including physiotherapists, occupational therapists, speech and language therapists.

Clinical scientific research topics:

- stem cell biology;
- vascular biology;
- genomics.

Perform and critically evaluate appropriate nerve conduction studies in complex patients, taking into account special circumstances, contraindications, confounding factors and risks. Electromyographers will be expected to analyse the results of nerve conduction studies and present accurate, clear and concise documentation of patient data. They will also be expected to contribute to the supervision, teaching and assessment of colleagues.

Clinical examination:

- obtaining informed consent.
- taking a relevant focused history (see Stage 1(ii), Advanced History Taking and Clinical Examination).
- selecting the neurophysiological investigations, taking into account special circumstances, contraindications, confounding factors and risks.

Diagnostic investigations and management and will:

- identify and evaluate appropriate clinical neurophysiological procedures needed to achieve a differential diagnosis, taking into account special circumstances, contraindications, confounding factors and risks.
- interpret the relevance of structural neuroimaging data.
- interpret the results of nerve conduction studies and produce a supervised clinical report.
- explain results and clinical implications simply and effectively to both clinicians and, where appropriate, patients.
- advise and communicate effectively with patients, relevant clinicians and the public, and other healthcare professionals working within the multidisciplinary team.
- reflect on the challenges of applying research to practice in relation to these areas of practice and suggest improvements, building on a critique of available evidence.
- recognise and respond to the evolving information needs of each patient.
- adopt a multidisciplinary approach to the diagnosis and management of peripheral nerve disorders.

Mapping codes of conduct associated with Healthcare Scientists in the advancing field of Neurophysiology:

Association of Neurophysiological Scientists (Professional Body)

Standard	
To advance for the public benefit the science and practice of Clinical Neurophysiology and allied subjects by the promotion of improved standards of training and education and of research work therein and by making the results of such study and research available to practitioners and the general public.	
To promote, advance and encourage study and practice of the various techniques involved in the physiological measurement of the central and peripheral nervous systems.	
To establish, uphold and improve standards of education training competence and conduct of all practicing members.	
To ensure and promote the health and safety of the public within the field of Clinical Neurophysiology.	
To exercise professional supervision by ensuring that practitioners for admission for Full Membership are suitably qualified.	
The practitioner's responsibility is to contribute to the governance of teamwork through good working relationships, effective communication and responsibility for their own professional development. The practitioner needs to understand the nature of different individuals, their rights and responsibilities.	
The practitioner's responsibility is to meet the requirements of relevant health and safety legislation and to promote the health and safety of all those with whom they come into contact.	
The practitioner should be able to recognise culture, gender and differences in behaviour and relate this to a different interpretation of situations.	
The practitioner should always be polite, listen and respect the views of the patient and respond to patients' complaints according to professional and local guidelines	
The privacy and dignity of patients must be upheld at all times.	
A practitioner must hold in confidence any information relating to a patient whether this be verbal, written or multimedia based.	
It is the practitioner's responsibility to maintain effective communication with patients and carers in the explanation of any further arrangements which have or may be made. The practitioner must fulfil their role in ensuring that procedures and reports are prioritised appropriately according to local guidelines. It is the practitioner's responsibility to maintain effective communication with other health care professionals, both written and verbal. The practitioner must always maintain accurate and legible documentation of patients' records.	
A practitioner must not abuse the trust of the patient and/or carer.	
Practitioners should respect the rights of their professional colleagues but have a duty of care to report any untoward incidence that contravenes their code of practice.	
The practitioner must only participate in safe practices in order to protect patients undergoing investigations in their care.	

Registration council for Clinical Physiologists (Voluntary Register)

Standard
A Registrant shall exercise his or her professional skill and judgement to the best of his or her ability and/or discharge his or her duties with integrity and with full regard to the public interest.
A Registrant shall not be party to any act or default likely to bring discredit on the register or any other scientist or technologist in a health care profession.
A Registrant shall not be engaged in any activity inconsistent with the responsibilities attached to her own appointment or position within his or her health care profession.
A Registrant shall at all times take care to ensure that his or her work and the results of such work does not constitute any avoidable danger of death or injury or ill health to any person.
A Registrant shall take all reasonable steps to maintain and develop his or her professional competence by attention to new development relevant to his or her field of professional activity and shall encourage persons working under his or her supervision to do so.
A Registrant shall not undertake responsibility as a Clinical Physiologist which he or she does not believe himself or herself competent to discharge.
A Registrant shall accept personal responsibility for all work done by himself or herself or under his or her supervision or direction, and shall take all reasonable steps to ensure that persons working under his or her authority are competent to carry out the tasks assigned to them and they accept personal responsibility for work done under the authority delegated to them.
A Registrant whose professional advice is not accepted shall take all reasonable steps to ensure that the person overruling or neglecting this advice is aware of any danger which the member believes may result from such overruling or neglect.

Universal Ethical Code for Scientists

Standard
Act with skill and care in all scientific work. Maintain up to date skills and assist their development in others.
Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest.
Be alert to the ways in which research derives from and affects the work of other people and respect the rights and reputations of others.
Ensure that your work is lawful and justified.
Minimise and justify any adverse effect your work may have on people, animals and the natural environment.
Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others.
Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately.

Monitoring

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the Policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
	WHAT?	**HOW?**	**WHEN?**	**WHO?**	**WHERE?**	**WHEN?**
Training competencies	Ensure scientist staff have undertaken competency training	Via the competency training policy for EMG	On commencement of performing EMG independently	Departmental Manager/Clinical Consultant	Departmental Manager/Clinical Consultant	Annually
Continued CPD	Ensure scientist staff adhere to competencies for EMG	Via the on-going monitoring CPD sheet in professional portfolio	Annually at PDR	Departmental Manager/divisional Manager	Departmental manager/Divisional Manager	Annually
Risks	Ensure all risks are monitored and actioned	Via risk management within Neurophysiology staff meeting	Monthly	Departmental Manager	Departmental manager/Consultant neurophysiologist	Monthly

References

https://www.networks.nhs.uk/nhs-networks/msc-framework-curricula/documents/hsst-curricula-2015-16/hsst-curriculum-neurophysiological-science-for-2015-16-v1.1

Academy for health Care Science; STP equivalence programme v3.2 2015

Health and care Professions council 2012: Standards of Conduct Performance and ethics London HPC

Association of Neurophysiologists (ANS)

Standard Protocols for nerve conduction studies 2013; British Society for Clinical neurophysiologists 2012.

NICE 2017

Contribution List

This key document has been circulated to the following individuals for consultation;

Designation
Kelly Bill – Clinical Service Manager Neurophysiology
Dr Alison Blake – Consultant Neurophysiologist original document 2017
Neurophysiology clinical staff 2017 and 2023
Dr Ramesh Gowda – Consultant neurophysiologist – Original document 2018
Dr Sarah Green – reviewed and updated 2023
Kelly Bill – clinical Service Manager Neurophysiology
Dr Alison Blake – Consultant Neurophysiologist original document 2017
Neurophysiology clinical staff 2017 and 2023

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee
Neurophysiology – governance/staff meeting
DMB – speciality medicine

Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and included as an appendix to key document when submitted to the appropriate committee for consideration and approval.

Please complete assessment form on next page;

NHS Worcestershire Acute Hospitals NHS Trust

Herefordshire & Worcestershire STP - Equality Impact Assessment (EIA) Form
Please read EIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council		Herefordshire CCG	
Worcestershire Acute Hospitals NHS Trust		Worcestershire County Council		Worcestershire CCGs	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust		Other (please state)	

Name of Lead for Activity	

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
Date assessment completed			

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title:**			
What is the aim, purpose and/or intended outcomes of this Activity?				
Who will be affected by the development & implementation of this activity?	❑ Service User ❑ Patient ❑ Carers ❑ Visitors		❑ Staff ❑ Communities ❑ Other _____	
Is this:	❑ Review of an existing activity			

	❑ New activity ❑ Planning to withdraw or reduce a service, activity or presence?
What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	
Summary of relevant findings	

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age				
Disability				
Gender Reassignment				
Marriage & Civil Partnerships				
Pregnancy & Maternity				
Race including Traveling Communities				
Religion & Belief				
Sex				
Sexual Orientation				
Other Vulnerable and				

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)				
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)				

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
		.		
How will you monitor these actions?				
When will you review this EIA? (e.g in a service redesign, this EIA should be revisited regularly throughout the design & implementation)				

Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation

1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.

1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing EIA	
Date signed	
Comments:	
Signature of person the Leader Person for this activity	
Date signed	
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	NO
2.	Does the implementation of this document require additional revenue	NO
3.	Does the implementation of this document require additional manpower	NO
4.	Does the implementation of this document release any manpower costs through a change in practice	NO
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	NO
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval.