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Non-Routine EEG Recording Guideline

1. PURPOSE

   These guidelines have been prepared to offer guidance towards best practice for recording a non routine EEG within Australia.

2. INTRODUCTION

   The following guidelines should be considered as minimum standards to record a non routine EEG in clinical practice. These non routine EEGs include EEG monitoring in critical care environments, EEG in suspected Electro-Cerebral Silence (ECS) and other EEGs outside the routine setting. They have been prepared by a sub-committee governed by ANTA Inc. and have been presented to stakeholders within the field of Clinical Neurophysiology in Australia (see Appendix 1). A review of international guidelines was made to ensure that this ANTA Inc. Guideline is consistent with worldwide standards.

3. LIMITS OF THE GUIDELINE

   This guideline relates to non routine EEG for children and adults including EEGs performed in critical and intensive care settings and EEG recordings performed in the clinical setting of electro-cerebral silence. This guideline does not relate to recording neonatal EEGs or in the operating theatre.

4. ELECTRODES

   (i) Electrode Placement
   (ii) Electrode Choice
   (iii) Electrode Impedance

   Refer to the ANTA Inc. Routine EEG Recording Guideline [(1)].

5. PRE-TEST CHECKS

   (i) Calibration
   (ii) Biological Calibration
   (iii) All electrode Check

   Refer to the ANTA Inc. Routine EEG Recording Guideline [(1)].

6. RECORDING

   (i) EEG MONITORING IN CRITICAL CARE ENVIRONMENTS

   a) Electrode Placement

   When possible, electrode positions should be measured in accordance with 'The 10-20 Electrode System of the International Federation' [(2)] or a modified version if required due to placement restrictions. If the head cannot be measured due to clinical constraints this information should be made available to the reporting clinician. When an electrode placement is changed the placement of the corresponding electrode over the opposite hemisphere should be changed to

maintain symmetry [11]. Any deviation from the placement system should also be documented e.g. in the instance of a surgical wound at a measured electrode placement.

b) Electrical Safety

Electrical safety precautions in accordance with the 'Australian and New Zealand Standards: Guide to the Safe Use of Electricity in Patient Care AS2500:2004 Electrical Installations - Patient Areas' should be adhered to [3]. All recording equipment should be connected via an isolated transformer.

c) Filter Settings

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

Notch Filter

A 50Hz notch filter should only be used after all other methods of eliminating mains interference, such as reduction of electrode impedances and/or appropriate earthing and positioning or removal of surrounding mains equipment, have been fully explored [4]. If a notch filter is used this should be documented within the factual report. A period of recording without the 50Hz notch filter should be recorded if the 50Hz notch filter is used.

d) Sensitivity

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

e) Calibration

The square wave calibration should represent machine parameters (filters and sensitivity settings) used during the EEG recording [1].

f) Patient Information

Additional patient and clinical information is required for recording EEG in the critical care unit which should include but not be limited to [5]:

- All medications and dosages including sedative agents and any agents introduced during the recording period
- How long prior to the EEG sedative agents were ceased (if applicable)
- Glasgow Coma Scale (GCS) at the time of the recording
- Artificial ventilation
- Body temperature.

Refer to the ANTA Inc. Routine EEG Recording Guideline [1] for minimum patient information – section 6(i).

g) Annotations

Continuous observation and annotation are important and should include where appropriate but not be limited to [6]:

- Change to or the administration of medication during the recording including dosage

- Nursing intervention/patient interaction
- Environmental stimuli such as ward noise
- Heart rate, saturation of peripheral oxygen (SpO_2) level and blood pressure at regular intervals and for any noted changes
- Any intentional stimulation including the nature of the stimulation, both when it is applied and ceased
- Any clinical features/events or changes to the patients state.

h) Montages

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

i) Additional Physiological Measurements

The electrocardiogram (ECG) should be recorded for recognition of ECG artefact for recording at these screen sensitivities. Other polygraphic channels such as Electromyogram (EMG), Electro-oculogram (EOG), respiration and movement may also be included where appropriate [8].

Refer to the ANTA Inc. Additional Physiological Measurements Recording Guideline[10].

j) Length of Recording

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

See further information in section 6(ii) for montages and recording time in the case of suspected electro-cerebral silence.

k) Stimulation

Any nonresponsive patient should be stimulated during the EEG recording to determine the clinical and EEG reactivity to the stimulus [7]. In patients who are not sedated this has proven to yield prognostic value [8].

Stimulation should include but not be limited to:

Auditory Stimulation [7, 8]

- Loud claps should be performed close to both sides of the patient's head for auditory stimulation. It is important to stimulate bilaterally as there may be blockage of an ear canal or unknown reduced hearing on one side. A minimum of 20 seconds should be left between each set of claps to determine any developing changes to the EEG that may occur.
- The patient's first name or preferred name (if known) should be called loudly next to each of the patient's ears. There should be a 20 second pause between side stimulation.

Painful Stimulation [7, 8]

- Painful stimulation should be applied on either side of the body each for 5 seconds with a 20 second pause between each stimulus. Both sides should be stimulated separately to take into account any unknown hemiplegia or hemiparesis. Examples of painful stimulation include:
  - Pressure applied to the nail bed of the thumb or great (big) toe
  - Trapezius squeeze
  - Sternal rub (midline only).

Central Stimulation [5, 8]

- If the patient is intubated, suction of the patient's oral airway performed by attending nursing or medical staff can be useful.

l) Activation Procedures

Activation procedures as per ANTA Inc. Routine EEG Guidelines [1] should be performed if the patient is able to co-operate.

For unresponsive patients the following activations may be useful

- a period of assisted eyes open for 5-10 seconds
- photic stimulation

(ii) EEG IN SUSPECTED ELECTROCEREBRAL SILENCE (ECS) [5, 8, 9]

a) Electrode Placement

When possible, placement should not differ from the routine EEG practice.

Refer to the ANTA Inc. Routine EEG Recording Guideline [1]. See EEG Monitoring in Critical Care Environments point 6.(i).(a) above.

b) Electrical Safety

As per EEG Monitoring in Critical Care Environments. See 6 (i)(b) above.

c) Filter Settings

High frequency filters (HFF) should not be set below 30Hz and low frequency filters (LFF) should not be set above 1Hz to avoid attenuation of low voltage slow or fast activity [8].

Notch Filter

A 50Hz notch filter should only be used after all other methods of eliminating mains interference, such as reduction of electrode impedances and/or appropriate earthing and positioning or removal of surrounding mains equipment, have been fully explored [4]. If a notch filter is used this should be documented within the factual report. A period of recording without the 50Hz notch filter should be recorded if the 50Hz notch filter is used.

d) Sensitivity

The EEG in cases of suspected ECS should be recorded at a sensitivity of 2µV/mm for a minimum of 30 minutes [2, 8].

e) Calibration

The square wave calibration should represent machine parameters (filters and sensitivity settings) used during the EEG recording [1]. In suspected ECS it is therefore appropriate to calibrate at 2 µV/mm.

f) System Integrity

The integrity of the recording system should be confirmed when there is evidence of electro-cerebral silence. Each electrode should be tapped by the technologist at the beginning of the recording to create an artefact potential to ensure connection to the head box is intact [8].

g) Patient Information

As per EEG Monitoring in Critical Care Environments. See 6 (i)(f) above.

h) Annotations

As per EEG Monitoring in Critical Care Environments. See 6 (i)(g) above.

i) Montages

Montages for recording in suspected ECS should represent inter-electrode distances of 10cm or more.

Montages comprised of double distance electrode channels should be used in addition to existing montages [8].

Example of wide placement EEG recording montage

Anterior to posterior	Transverse
Fp2 – C4	F8 – Fz
C4 – O2	Fz – F7
F4 – P4	F4 – F3
Fp1 – C3	A2 – C4
C3 – O1	C4 – C3
F3 – P3	C3 – A1
	T4 –Cz
Fp2 – T4	Cz – T3
T4 – O2	
F8 – T6	T6 - Pz
	Pz – T5
Fp1 – T3	P4 – P3
T3 – O1	
F7 – T5	
Fz – Pz	
ECG	
Respiration and movement /EMG where applicable	

j) Additional Physiological Measurement

The electrocardiogram (ECG) should be recorded for recognition of ECG artefact for recording at these screen sensitivities. Other polygraphic channels such as EMG EOG, respiration and movement may also be included where appropriate [8].

Refer to the ANTA Inc. Additional Physiological Measurements Recording Guideline [10].

k) Length of Recording

EEG recordings in cases of suspected ECS should be no less than 30 minutes in duration [8].

l) Stimulation

Refer to section 6.(i).(g) 'Stimulation'.

7. POST-RECORDING CHECKS

(i) Biological Calibration
(ii) All Electrode Check
(iii) Calibration

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

8. FACTUAL REPORT

Refer to the ANTA Inc. Routine EEG Recording Guideline [1].

9. REFERENCES

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Appendix 1 – Stakeholders

Stakeholders

- ANTA Inc. Members
- Document Development Committee
- Document Development Committee Advisory Group
- Other interested parties

Original Document

Document Development Committee

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Advisory Committee

The document development committee identified a group of key stakeholders to view the draft documents for feedback. The advisory group was made up of technologists, scientists and neurologists working in the neurophysiology industry around Australia. The comments from this group were considered, compared against the reference material and included where appropriate.

Members Feedback

On completion of the final draft the document was put out to all members of ANTA Inc. for feedback. The comments from members were considered, compared against the reference material and included where appropriate.

Guideline Acceptance

This Guideline was accepted by members in July 2014.

Amendments

2016 May Disclaimer and Copyright statements added.

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