

Association of Neurophysiological Technologists of
Australia Inc

(also known as ANTA)

ABN: 80 872 615 302

www.anta.org.au



Neonatal EEG Recording Guideline

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1. PURPOSE

These guidelines have been prepared to offer guidance towards best practice for recording an EEG on a neonate in clinical practice within Australia.

2. INTRODUCTION

The following guidelines should be considered as minimum standards to record an EEG on a neonate in clinical practice. These neonatal EEGs include EEG monitoring on babies with a conceptional age (CA)* of up to 50 weeks ⁽¹⁾. 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.

NB: *Conceptional Age (CA): The time from the mother's first day of the last menstruation to the time of recording ⁽¹⁾.

3. LIMITS OF THE GUIDELINE

This guideline relates to neonatal EEG recording in clinical practice.

4. ELECTRODES

(i) Electrode Placement

Electrodes should be placed in accordance with 'The 10-20 Electrode System of the International Federation' ⁽²⁾ including a ground and reference electrode where applicable.

Additional physiological recording electrodes should also be applied including electrocardiogram (ECG), electro-oculogram (EOG), submental electromyogram (EMG), movement and respiration ^(1,3). (See section 6(i) for further detail).

(ii) Electrode Choice

Refer to the ANTA Inc. Routine EEG Recording Guideline ⁽⁴⁾.

(iii) Electrode Impedance

Refer to the ANTA Inc. Routine EEG Recording Guideline ⁽⁴⁾.

5. PRE-TEST CHECKS

(i) Calibration

(ii) Biological Calibration

(iii) All electrode Check

Refer to the ANTA Inc. Routine EEG Recording Guideline ⁽⁴⁾.

6. RECORDING

(i) Electrode Placement

a) EEG electrode positions should be measured in accordance with the International 10/20 System where possible ^(2, 3, 5, 6, 8). It may be necessary to apply a reduced number of electrodes depending on the head size of the baby although a full complement of electrodes can be applied ^(1, 3, 5, 6). This is to ensure an adequate inter electrode distance is achieved. The minimum electrodes which should be applied are Fp2, C4, T4, O2, Fp1, C3, T3, O1, Fz, Cz, Pz, A2 and A1(mastoid electrodes) ^(5, 6). A modified version of the 10/20 Electrode Placement system for neonatal recording may include repositioning prefrontal electrodes a further 10% posteriorly ⁽⁵⁾. (See Appendix 2 below).

b) Polygraphic Electrodes

Neonatal EEG recording should routinely include but not be limited to Electrocardiogram (ECG), Electro-oculogram (EOG), sub-mental Electromyogram (EMG) and Respiratory (Resp) monitors ^(1, 3, 5).

Refer Appendix 3 below for further details.

(ii) 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 of mains equipment, have been fully explored ⁽⁷⁾. 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.

(iii) Patient Information

Additional patient and clinical information is required for recording EEG in neonates ^(3, 5) which shall include but not be limited to:

- Conception and gestational age
- Medical history (e.g. asphyxia, intra ventricular haemorrhage)
- History of abnormal movements or events – detailed features of events, circumstances or precipitants
- Conscious state
- Apgar score
- Mechanical ventilation
- Cooling protocol if cooled
- Head circumference
- Time of last feeding.

Refer to ANTA Inc. EEG Guidelines for minimum patient information - section 6(i).

(iv) Annotations
Continuous observation and annotation is important ^(1, 3, 5) and should include but is not limited to:

- Patient state (awake/indeterminate sleep/active sleep/quiet sleep)
- Behaviour/movements (gross and subtle)
- Physiologic parameters (changes in oxygen saturation, heart rate etc)
- Administration of medication (time and type)
- Passive eye opening/closure
- Reactivity to stimuli from the environment
- Features of clinical events
- Position of the child (e.g. lying on the right side against mother)
- External influences on the recording (artefacts from respirator, BP monitor, IV infusions).

(v) Montages

a) When a full set of electrodes have been applied, montages for neonatal EEG recordings should not differ to the routine EEG practice. Refer to the ANTA Inc. Routine EEG Recording Guideline ⁽⁴⁾.

b) When a modified 10/20 Electrode Placement System is used for neonatal recording a modified wide placement montage is used.

Example of modified neonatal EEG recording montage where F2 and F1 are placed 10% posteriorly to Fp2 and Fp1. This suggested montage is adapted from the recommended montage from Mizrahi ⁽⁵⁾.

F2 – C4	A2 –T4
C4 – O2	T4 – C4
F1 – C3	C4 – Cz
C3 – O1	Cz – C3
	C3 – T3
F2 – T4	T3 – A1
T4 – O2	
F1 – T3	ECG
T3 – O2	Respiration
	Submental EMG
Fz –Cz	EOG
Cz – Pz	

(vi) Length of recording the neonatal recording should include both awake and sleep cycles ⁽⁶⁾. A minimum recording of 60 minutes should be performed ^(3, 6, 8).

(vii) Stimulation

Tactile, auditory and flash stimuli should be applied toward the end of the recording and reactivity noted in the annotations ^(1, 3, 8).

(ix) Settings

Refer to the ANTA Inc. Routine EEG Recording Guideline ⁽⁴⁾.

A slower display speed of 15mm/second or 20 seconds per page ^(5, 6) may be useful to identify specific neonatal complexes.

7. POST-RECORDING CHECKS

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

Refer to the ANTA Inc. Routine EEG Recording Guideline⁽⁴⁾.

8. FACTUAL REPORT

Refer to the ANTA Inc. Routine EEG Recording Guideline⁽⁴⁾.

9. REFERENCES

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6. André, M., Lamblin, M., d'Allest, A., Curzi-Dascalova, L., Moussalli-Salefranque, F., Nguyen The Tich, S., Vecchierini-Blineau M., Wallois, F., Walls-Esquivel, E., Plouin, P. (2010). Electroencephalography in premature and full-term infants. Developmental features and glossary. Neurophysiologie Clinique/Clinical Neurophysiology: 40, 59—124.
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Additional Readings

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Pisani. F., Copioli. C., Di Gioia. C., Turco. E., Sisti. L. (2008) Neonatal seizures: Relation of ictal video-electroencephalography (EEG) findings with neurodevelopmental outcome. *Journal of Child Neurology* 23(4) 394-398.

Appendix 1 – Stakeholders

Stakeholders

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

Original Document Document development subcommittee

Mary Lynch, Joanne Wex, Holly Campbell, Anna Exley, Santhi Chigurupati, Malcolm Corkhill, Kate Martin, Emma Fetherston, Amy Lofts, Vicky Grant.

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.

Appendix 2

Modified 10/20 Electrode placement system for neonatal EEG recording⁽⁵⁾

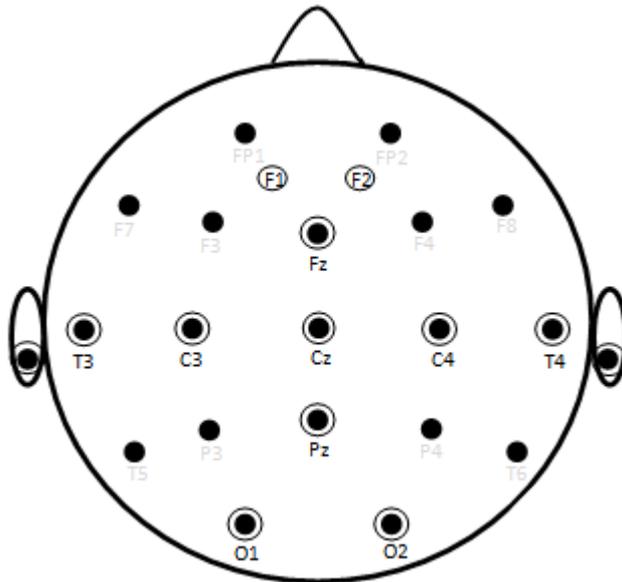


Figure 1. Modified neonatal EEG electrode placement

Appendix 3

Suggested polygraphic electrode placements for neonatal recording:

ECG: Electrodes can be placed on the left side of the chest (referential recording) or both sides of the chest (bipolar recording). Lead 1 ECG ⁽⁵⁾. (Figure 2)

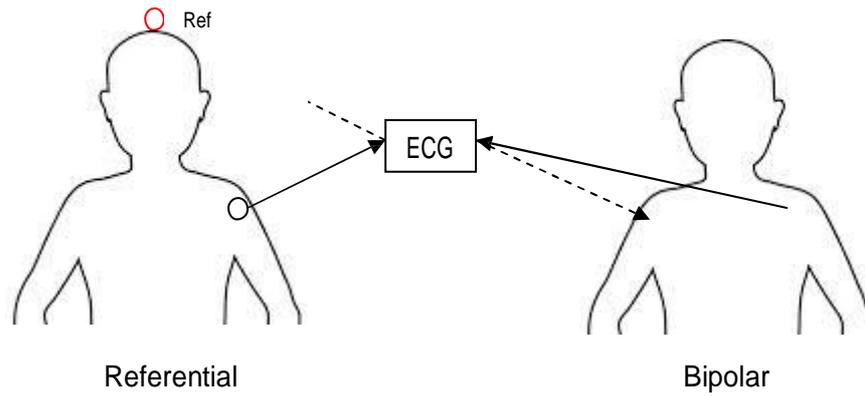


Figure 2. ECG electrode placement

EOG: Right upper outer canthus – left lower out canthus ^(1, 5). (Figure 3)

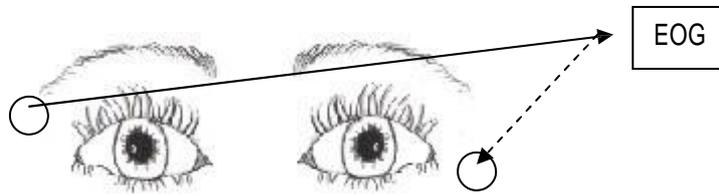


Figure 3. EOG electrode placement - combined lateral and vertical eye movement

or refer outer canthus to mastoid either ipsilaterally or contralaterally ⁽⁵⁾. (Figure 4)

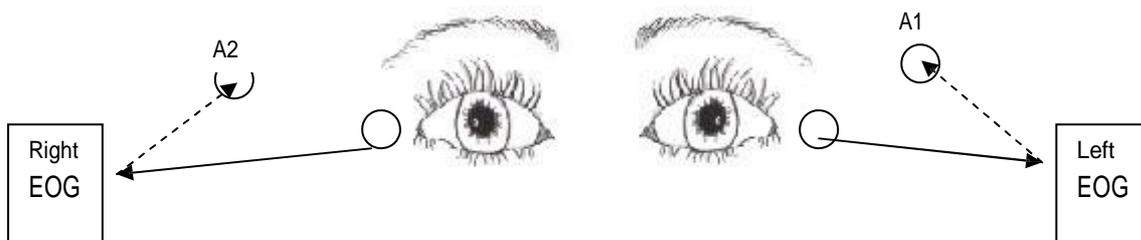


Figure 4. EOG electrode placement - lateral eye movement

or right outer canthus to mid nasion ⁽³⁾. (Figure 5)

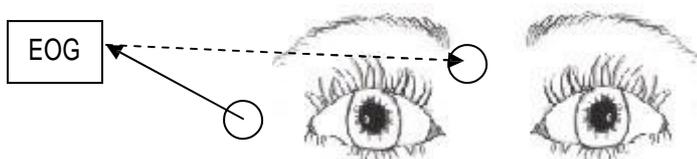


Figure 5. EOG electrode placement - unilateral combined lateral and vertical eye movement

Submental EMG: Two electrodes 2cm apart placed under the midline of the chin ⁽⁵⁾.
(Figure 6)

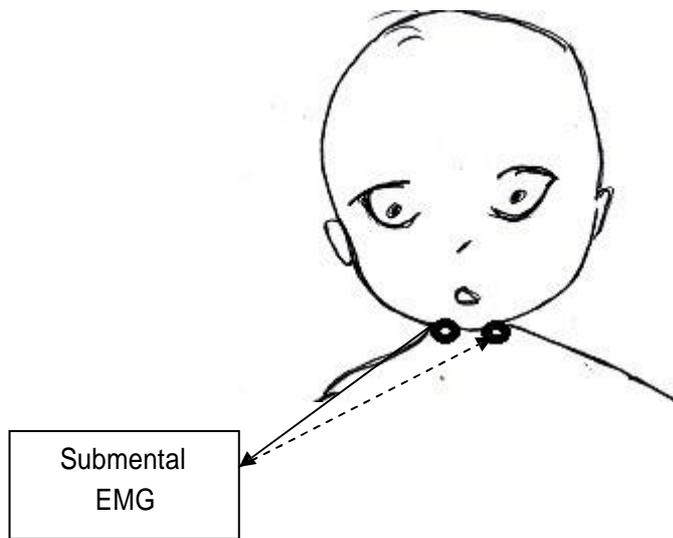


Figure 6. Submental EMG electrode placement

Respiratory: Respiratory transducer recording thoracic abdominal movements ⁽¹⁾ two centimetres above umbilicus ⁽⁶⁾ or two electrodes placed 2cm apart at the base of the ribcage over the diaphragm. (Figure 7)

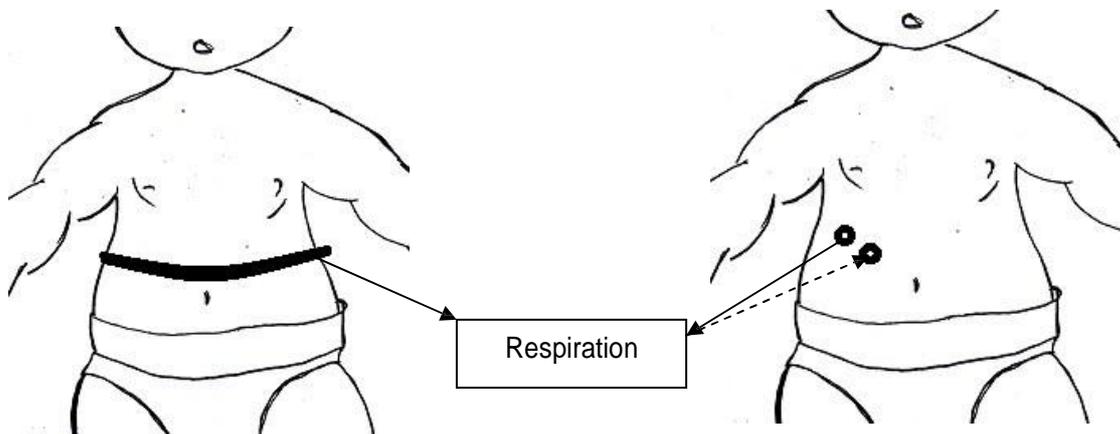


Figure 7. Resp electrode placement

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