Enhanced Neonatal Encephalopathy Evaluation Including aEEG in the Special Care Nursery

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1. Background

Outborn infants with neonatal encephalopathy (NE) are at risk of worse outcome due to difficulties in monitoring markers of encephalopathy, lack of standardized clinical practice and challenges in transferring eligible newborns within the therapeutic window for therapeutic hypothermia (TH). Although amplitude integrated EEG (aEEG) improves early detection of NE as early as three hours of life, it is not routinely used in community hospitals or Special Care Nurseries (SCN).

2. Objectives

The aim of this study was to assess the application of standardized NE guideline and the use of aEEG in the SCN to optimize an early evaluation and the selection of newborns to transfer for therapeutic hypothermia.

3. Methods

Newton-Wellesley Hospital has 4000 annual births, with 600 yearly admissions to the SCN. Prior to the implementation of NE guideline and of aEEG, most newborns at risk for NE were transferred to our tertiary care center, and for those evaluated and not transferred, there was large variation in practice. In 2018 we introduced the NE Guideline which includes:

1.Huddle OB/NICU team
2. Cord gas and neonatal gas analysis guideline
3. Standardized neurological exam;
4. Two channel aEEG (Olympic Brainz Monitor)
5. Passive Cooling guideline
6. Use of rectal probe
7. Placenta pathology

Since 2018 we revised the guidelines, converted form hydrogel electrodes to subdermal needles and conducted quarterly quality reviews. In May 2021 we started active cooling on transport.

4. Results

Figure 1. Newborn not transferred . aEEG continuous, sleep cycle present, no seizures

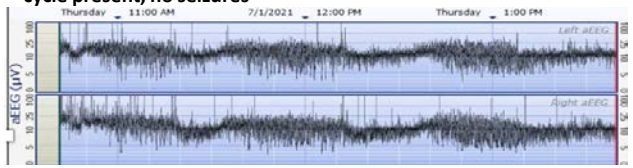


Figure 2. Newborn transferred. aEEG discontinuous, sleep cycle absent, no seizures

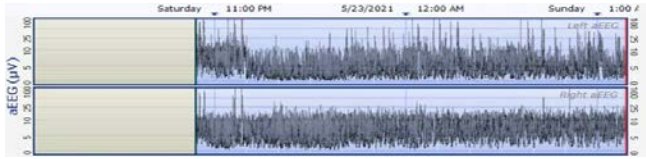


Table 1. **Evaluations and transfers for therapeutic hypothermia**

	2018	2019	2020	2021	Total
Total Evaluated (N)	26	19	23	48	116
- Evaluated and transferred	4	8	6	14	32 (28%)
- Evaluated and not transferred	22	11	17	34	84 (72%)
Total Transferred (N)	4	8	6	14	32
- Transferred and cooled	3	8	5	8	24 (75%)
- Transferred and not cooled	1	0	1	6	8 (25%)
- Placenta pathology	4	7	6	14	31 (97%)
Transferred and cooled (median)	2018	2019	2020	2021	Total
-HOL transferred	3.3	3.15	4	3.07	3.5
-HOL started active cooling	7	4.8	5.5	4.5	5.1
-HOL reached goal temp	7.2	4.9	5.9	4.7	5.4

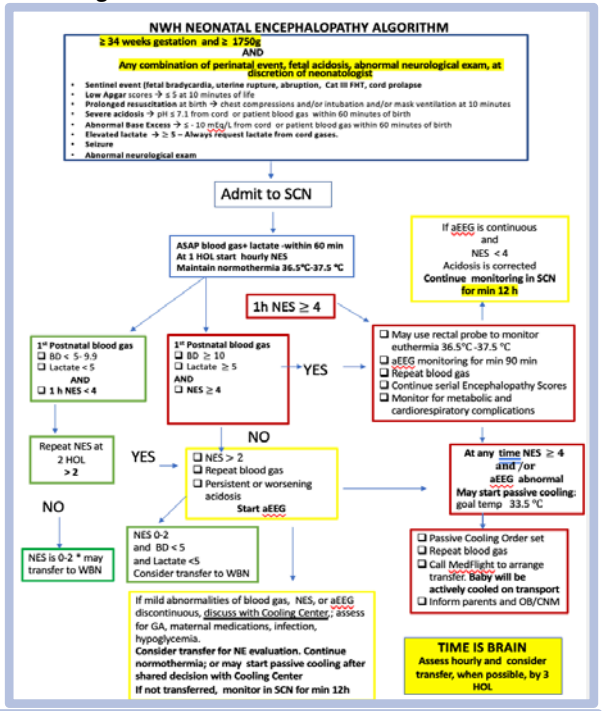
From April 2018 to December 2021

- 116 newborns evaluated
- 84 (72%) evaluated and not transferred
- 32 (28%) evaluated and transferred
- 24 (75%) transferred and cooled
- 116 (100 %) had standardized neuro exam
- 76 (65%) aEEG recordings
- 31 (97%) placenta path in transferred newborns
- 3.5 h time to transfer (median)
- 5.4 hours life (median) to achieve target temperature

Table 2. **Use of aEEG in evaluation**

Newborns evaluated per year	Newborns with aEEG
2018 (n=26)	12 (46%)
2019 (n=19)	11 (58%)
2020 (n=23)	18 (78%)
2021 (n=48)	35 (73%)
Total (n=116)	76 (65%)
Newborns evaluated and not transferred per year	Newborns with aEEG
2018 (n=22)	9 (40%)
2019 (n= 11)	8 (72%)
2020 (n= 17)	13 (76%)
2021 (n=34)	26 (76%)
Total (n= 84)	56 (66 %)
Newborns transferred per year	Newborns with aEEG
2018 (n=4)	3 (75%)
2019 (n= 8)	3 (37%)
2020 (n= 6)	5 (83%)
2021 (n=14)	9 (64%)
Total (n=32)	20 (62%)

Figure 3



5. Conclusions

The use of NE guidelines and aEEG can support clinicians to conduct accurate evaluations and selection of newborns at risk for NE without delaying the start of TH. The potential benefits are: 1. Early identification of patients eligible for TH and expediting the transfer to cooling centers within the first six hours of life; 2. ability to reach target cooling temperature by 6 HOL; 3. minimize mother-newborn separation and unnecessary procedures. The use of aEEG in the Special Care Nursery is feasible and offers important information with the clinical decision making in the community setting.