Cerebral Function Monitoring - Full Clinical Guideline

Reference no.: NIC NE 06/July 22/v002.1

1. Introduction

The cerebral function monitor provides information on global cerebral activity. An abnormal CFM trace in the first six hours of life, after an asphyxial insult, is predictive of abnormalities on acute neurological testing and long term neuro developmental outcome. The CFM also provides information on duration, intensity and frequency of neonatal seizures that may be helpful in diagnosis and treatment.

2. Aim and Purpose

To outline the clinical indications, set up process, application, and analysis a cerebral function monitor can provide to babies in neonatal unit.

3. Description

An amplitude-integrated EEG, or Cerebral Function Monitor (CFM), is a device used to measure background electro-cortical activity in the brain. Using a single lead, consisting of three wires placed over the biparietal or frontal region; it filters, rectifies and compresses a signal to indicate the generalized level of electrical activity occurring across the entire brain. The signal is displayed on an x-y axis, using a very slow chart speed representing a generalized view of brain activity. Research showed it could be a sensitive tool for predicting severity of hypoxic ischemic encephalopathy, if applied in the first 6–12 hours following perinatal asphyxia. The CFM has also demonstrated itself as a valuable detection tool for neonates experiencing clinical or sub clinical seizures.

Indication:

- Hypoxic Ischemic Encephalopathy
- Seizures or clinical scenario mimicking seizure disorders

May also be helpful in,

- Significant neurological disorders (e.g., congenital brain malformations)
- Neonatal abstinence syndrome (e.g., alcohol/opiate withdrawal)

Pitfalls:

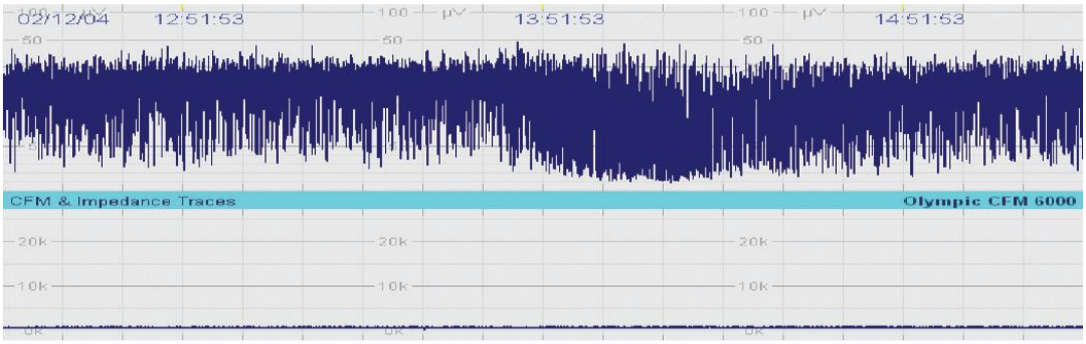
Requires proper lead stabilization to reduce or eliminate artefact caused by high frequency oscillation.

Setup Guidelines:

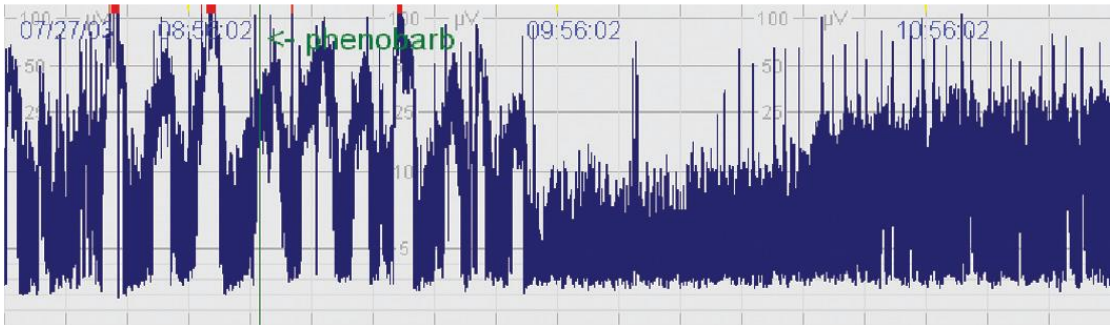
1. Connect the cable to the cable input on the front of the CFM.
2. Plug CFM into A/C outlet and turn power switch to ON in rear of device.
3. Obtain three CFM needle electrodes
4. Establish where the three leads will be placed on the head.
    a) Black wire lead (ground): placed in centre of forehead(away from fontenalle)
    b) Red wire lead (left): placed 3.75 cm left of midline as close to the coronal plane as possible.
    c) Yellow wire lead (right): placed 3.75 cm right of midline as close to the coronal plane as possible.
    d) A high forehead location is acceptable but parietal positioning will get a more accurate, global representation of brain activity.
5. Securely place the three CFM needles to appropriate areas.
6. Connect lead wires to CFM cable module.
7. Press PATIENT button on CFM screen and fill in the name, birth date and ID number of the patient.
8. Press RECORD button on CFM screen - Small cursor arrow on right will begin to move up and down on CFM tracing indicating recording.

Application guidelines:

The main screen is divided into 2 main graphing strips. The top strip is the cerebral function graph that measures electrical brain activity [(μV), semi-logarithmic y-axis] versus time [(hr: min: sec), x-axis]. The bottom strip measures impedance of the leads and evaluates the connection of the leads to the patient's scalp. The impedance strip should show a relatively flat line that is less than < 20 μV to ensure accuracy of the CFM tracing. An increasing level of impedance means the leads are lifting off the scalp and must be reapplied. If the lead lifts off enough, an alarm condition will sound.



Due to the slow charting speed of the CFM, it takes approximately 20 minutes before the clinician can preliminarily analyze the strip. Therefore, seizure treatment should never be delayed if clinical symptoms are observed. Doctors should make a habit of reviewing the CFM every 2–3 hours.



Markers should be labelled on the CFM tracing

- Any clinical symptoms of seizures
- Administers any sedation or anticonvulsant therapy
- Repositioning of the baby
- X rays
- Procedures like UAC/UVC/Cannulation etc

Markers are placed by pressing the MARKER button, tapping the CFM strip at the appropriate time, and then typing or selecting the appropriate marker from the window that pops up.

The CFM functions nicely as a long-term monitor and can be left in place for several days of constant recording. If recording is stopped on a patient at any time and is to be restarted, the operator should reapply leads (if not already on), press TOOLS, select the patient's name from the list and press ACCEPT to display file. RESUME will continue the recording.

Different patterns of CFM monitoring:

Observe the impedance graph and ensure the line is relatively flat and preferably below 10 µV. This indicates an accurate CFM tracing.

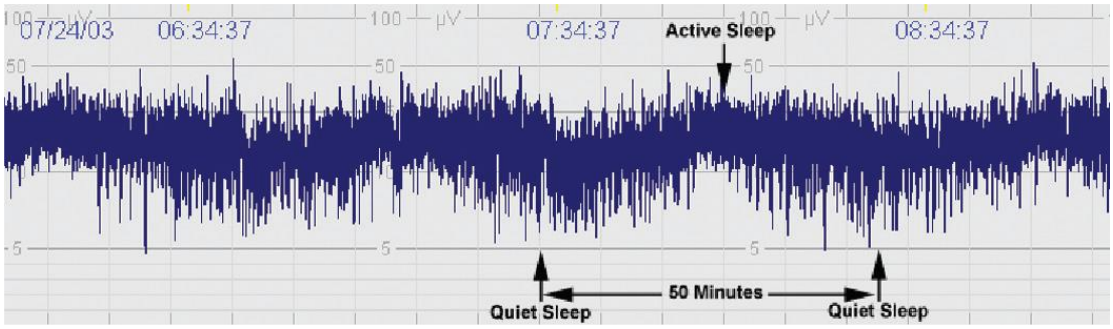
Sleep Wake Cycling (SWS): Undulation of the wave forms indicates normal sleep wake cycle.

Normal Tracing:

Examine the CFM strip as a whole.

- Is it a gentle wave? YES
- Do the lower and upper margins seem to flow in parallel? YES
- Is the **lower margin above 5 µV**? YES
- Is the **upper margin above 10 µV**? YES
- Is their Sleep Wake Cycling? YES

This is classified as a normal trace and in most cases is a good prognostic sign. Early return of sleep wake cycling after an asphyxial insult is also a good prognostic sign.



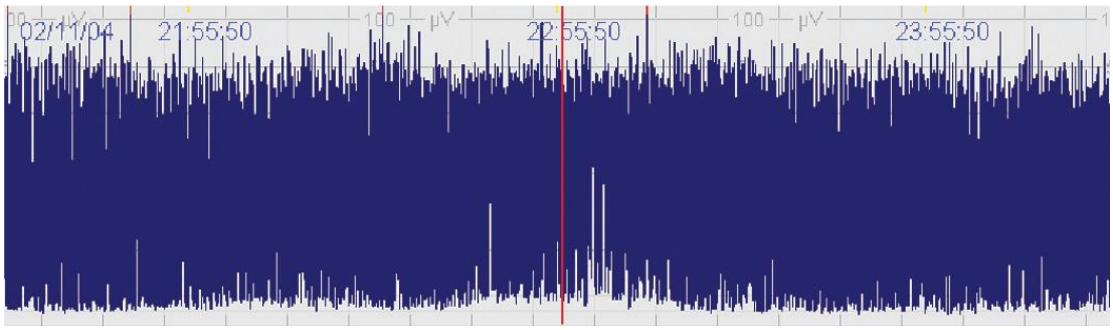
Normal trace: Lower margin is >5 µV & upper margin is >10 µV. Undulation of the wave forms indicates normal sleep wake cycle (SWS).

Moderately Abnormal Tracing

- Is the **lower margin below 5 µV**? YES
- Is the **upper margin above 10 µV**? YES
- Is there a Sleep wake cycling? NO

This is classified as a moderately abnormal tracing.

Keep in mind that anti-convulsant therapy may shift the wave downward.



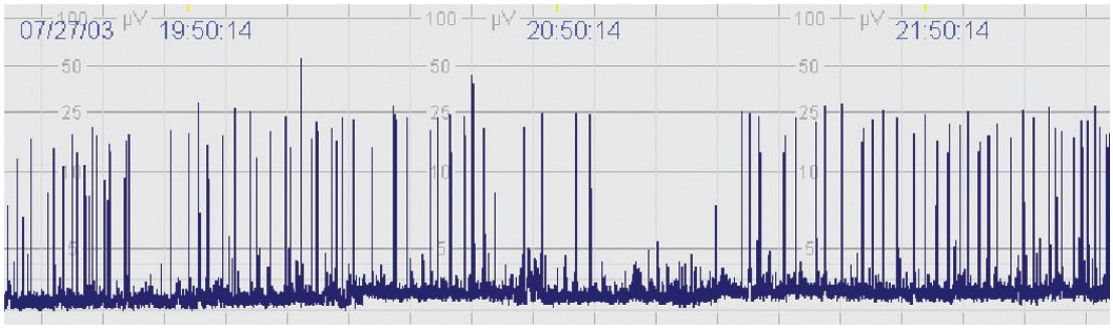
Moderately abnormal trace: Lower margin is <5 µV & upper margin is >10 µV throughout the trace.

Severely abnormal tracing

- Is the **lower margin below 5 µV**? YES
- Is the **upper margin below 10 µV**? YES
- Is there a Sleep wake cycling? No
- Does the thickness of the wave appear thinner? YES
- Has the wave appeared to flatten out? YES

This is classified as a severely abnormal trace.

This may correspond with burst suppression or continuous low voltage on a regular EEG.

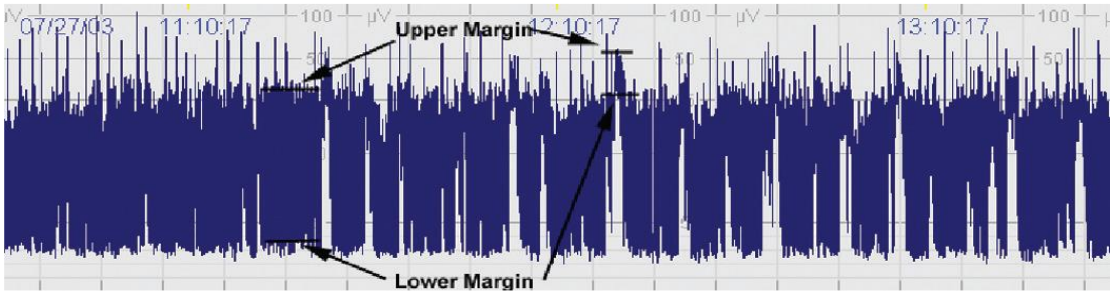


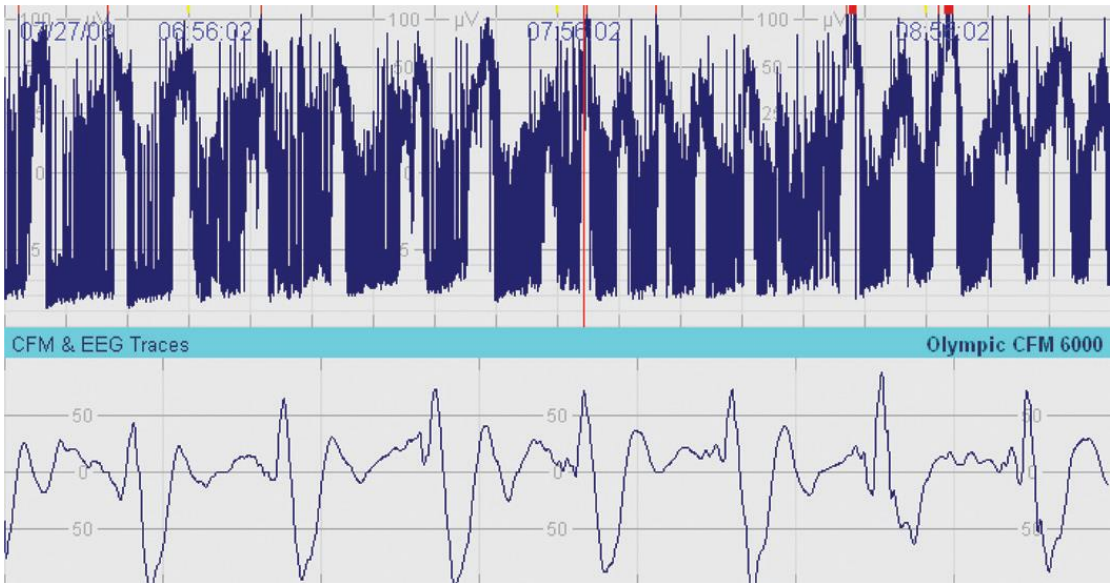
Severely abnormal trace: Lower margin is < 5 µV & upper margin is < 10 µV throughout the trace. Periodic bursts of electrical activity are seen.

Seizures

- Is there a rising and narrowing pattern in the CFM tracing? YES
- In the gaps of the rising and narrowing (lower margin becomes suddenly raised for several minutes), does the EEG tracing show a distinct repetitive pattern? YES

Seizures are present.





The above pattern shows **moderately abnormal trace with multiple seizures**; Upper margin is > 10 µV & lower margin is < 5 µV throughout the trace. There is no evidence of SWS. Frequent and prolonged periods of elevation in both the lower and upper margins are seen that coincide with a repetitive rhythmic pattern on the EEG. This is characteristic of seizure activity

CFM abnormality:

	Normal	**Moderately abnormal**	**Severely abnormal**
Lower margin	>5 µV	<5 µV	<5 µV
Upper margin	>10 µV	>10 µV	<10 µV
Sleep wake cycle	Present	Absent	Absent

Analysis and Prematurity:

The CFM monitoring is generally not recommended in preterm babies (<34 weeks). EEG is feasible for monitoring cerebral activity in preterm infants and normative values have been suggested. Sleep wake cycle can be clearly identified on the trace from around 30

week's gestation although a cyclical pattern emerges in some babies at 25-26 weeks gestation. There are no definitive reports on seizure patterns in premature infants. Pathological patterns should be confirmed by more formal EEG evaluation.

References (including any links to NICE Guidance etc.)

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(3) Gluckman PD, Wyatt JS, Azzopardi D, Ballard R, Edwards AD, Ferriero DM et al. Selective head cooling with mild systemic hypothermia after neonatal encephalopathy: multicentre randomised trial. Lancet 2005; 365(9460):663-670.

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4. Documentation Controls

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