Amplitude-Integrated Electroencephalography: A Runaway Horse?

The use of amplitude-integrated electroencephalography (aEEG) is becoming established in many neonatal intensive care units in advanced economies, including Canada. The potential applications of aEEG have been discussed in several papers, and advertised by vendors of commercial machines. Therefore, the paper by Appendino et al from Toronto, in this issue of the Canadian Journal of Neurological Sciences, is timely. They call for Canadian neonatologists, pediatric neurologists, and pediatric clinical neurophysiologists to collectively develop national guidelines for aEEG monitoring in neonates. A brief overview of the salient issues may help to kick-start the process.

In 1969, Maynard et al described a device, they called ‘cerebral function monitor’ (CFM) to assess brain activity continuously yet conveniently and cost-effectively in a number of acute clinical settings. The limitation to one channel, paper output, problems with pens and ink, and the challenges of recognizing artifact on-line, discouraged general clinical acceptance of the CFM at that time.

In 1983, Bjerre et al described the use of the CFM in neonates with severe asphyxia; however, widespread usage had to await electronic miniaturization and digital technology, so that aEEG monitors (aEEG is the commonly used term for the tracing from CFM) could be conveniently incorporated with other instruments at the bedside. Additionally, many neonatal intensive care units did not have ready access to timely 24/7 prolonged conventional video-EEG monitoring and interpretation. Hence, many neonatologists began to use aEEG monitors to assess brain activity continuously on-line in selected critically ill neonates.

With use, the literature on the interpretation and classification of aEEG waves and patterns, including normative data on term and pre-term infants, has been expanding as well. Readers are directed to recent references for details. Many commercially available aEEG monitors now allow for various display options, including showing the time compressed aEEG alongside initially single, and more recently two-channel “raw” EEG source tracing. Several conventional video-EEG machines also offer the option of displaying EEG signals continuously in an aEEG format. The automated analysis of aEEG signals is the subject of “intense ongoing research”.

The introduction of hypothermia for neonatal hypoxic ischemic encephalopathy was a major impetus for aEEG. Amplitude-integrated electroencephalography performed in < 6 hours of age was used to screen subjects for entry to a clinical trial on therapeutic hypothermia for neonatal hypoxic ischemic encephalopathy. However, reservations have been expressed about using aEEG to select neonates for (hypothermic) neuroprotective interventions; one study also suggested that the aEEG did not add to the information provided by the modified Sarnat staging.

The prognostic significance of aEEG patterns in term and pre-term neonates who have suffered hypoxic ischemic and other neurological ‘injuries’ is another area of clinical discussion. Nevertheless, the conventional EEG with the full ‘neonatal’ array of electrodes is still the clinical neurophysiologic gold standard for prognostication.

There is a large body of literature on the use of aEEG for clinical and electrographic seizure detection in the neonate. However, Wheeler, in this edition, makes a compelling case that there is no need for routine monitoring in the neonatal intensive care unit (NICU), even in very sick pre-term neonates. He reminds us that EEG monitoring is ”unintended consequences” of unwise use of new technology. Therefore, Canadian guidelines for aEEG are overdue. The recent guideline on neonatal EEG monitoring from the American Clinical Neurophysiology society provides an excellent starting point for a Canadian effort.
1. Only a select number of references from the many available through electronic searches have been cited. We apologize if we have omitted to cite any seminal ones.
2. Reference numbers 1,3,6,12 and 23 should be ‘core’ reading on the subject; references 8 and 9 are also very informative.

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