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Electroencephalography During Acute Painful Procedures in Neonates: a Scoping Review

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Abstract

Although electroencephalography (EEG) is used to assess neonatal pain in research settings, EEG assessments have not been sufficiently characterized for use as end points to assess the efficacy of analgesics in regulatory-endorsed, industry-sponsored trials. We aimed to identify all studies conducted in neonates with EEG recordings during acute somatic nociceptive skin-breaking procedures, and to create a network of authors who will be invited to contribute their individual participant data (IPD) to an IPD meta-analysis to establish the validity, reliability, and clinical interpretability of an EEG-based neonatal pain measure. To identify literature, we searched MEDLINE, Embase, CINAHL, Web of Science, Scopus, Google Scholar, ClinicalTrials.gov, and the WHO ICTRP from database inception to July 2, 2025. Eligible studies were primary empirical studies that included neonates with EEG recordings during acute skin-breaking procedures. We identified 55 studies across 11 countries. Heel lance was the most common painful procedure; others included venipuncture, immunization, and lumbar puncture. The impact of 12 analgesic interventions has been studied to date, mostly nonpharmacological interventions. Individual-electrode EEG is more common than EEG caps. We noted relatively high data loss due to EEG data-quality concerns. A wide range of non-EEG pain-relevant measures have been recorded alongside EEG (eg, behavior, vital signs). Coauthorship network analysis highlighted that authors commonly work within discrete authorship hubs, with limited coauthorship across hubs. The predominance of studies was from European and American institutions, which limits generalizability. We conclude that sufficient data are available to undertake an IPD meta-analysis.

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