


# Regional anesthesia in neonates and infants outside the immediate perioperative period: A systematic review of studies with efficacy and safety considerations

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## Abstract

This review examines the quality and quantity of literature regarding methods that measure efficacy in the context of reported safety of regional anesthesia techniques in preterm and term infants <1 year of age. Because the role of anesthesiologists continues to expand outside the operating room, we focused on all relevant settings with assessments that extend beyond 24 hours from the intraoperative period. All study designs were included from a search of MEDLINE, EMBASE, CINAHL, Scopus, and Cochrane databases from 1946 to the end of 2019. A total of 31 studies were included ( $n = 1038$  participants), consisting of five randomized controlled trials and 26 observational studies. Twenty-three studies examined neuraxial procedures, seven studies examined peripheral procedures, and one study examined both. Efficacy measures included pain assessment tools, analgesic use, and factors pertaining to the recovery of patients. Safety was assessed in multiple systems (neurological, cardiovascular, respiratory, pathological) and with vital signs and/or measures of systemic toxicity. Evidence in this review establishes that neuraxial and peripheral anesthesia treatments may be applied to neonates and infants with a high degree of safety. However, large gaps in the consistency of methods used to assess pain in these studies underline the need for rigorous prospective efficacy studies of these techniques in this population. This systematic review was registered on PROSPERO (CRD42018114466).

## KEYWORDS

efficacy, infant, neonate, neuraxial anesthesia, NICU, regional anesthesia, safety

## 1 | INTRODUCTION

Infants are at a high risk of anesthesia-related adverse events compared to older children.<sup>1</sup> Increased risks may be attributed to evolving cardiovascular and respiratory physiology, to heightened neuroplasticity, and to the vulnerability of the developing brain to noxious somatosensory stimuli.<sup>2,3</sup> Such exposures benefit from anesthesia and include procedural stressors, acute medical

events, and painful conditions in neonatal intensive care unit (NICU) patients during and outside of the perioperative period. Painful stimuli in the neonatal period may have long-term adverse consequences on the maturation of the nociceptive system and on behavioral outcomes,<sup>4,5</sup> resulting from untreated pain's effect on the construction of neurodevelopment systems.<sup>6</sup> Unfortunately, critically ill preverbal patients such as those in the NICU often experience multiple daily skin-breaking procedures,<sup>7,8</sup> chronically