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The burden of venipuncture pain in neonatal intensive care units: EPIPPAIN 2, a prospective observational study

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ABSTRACT

Background: Newborns in intensive care units (ICUs) undergo numerous painful procedures including venipunctures. Skin-breaking procedures have been associated with adverse neurodevelopment long-term effects in very preterm neonates. The venipuncture frequency and its real bedside pain management treatment are not well known in this setting.

Objectives: To describe venipuncture frequency, its pain intensity, and the analgesic approach in ICU newborns; to determine the factors associated with the lack of preprocedural analgesia and with a high pain score during venipuncture.

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Design: Further analysis of EPIPPAIN 2 (Epidemiology of Procedural Pain In Neonates), which is a descriptive prospective epidemiologic study.
Setting: All 16 neonatal and pediatric ICUs in the Paris region in France.
Participants: All newborns in the ICU with a maximum corrected age under 45 weeks of gestation on admission who had at least one venipuncture during the study period.
Methods: Data on all venipunctures, their pain score assessed with the DAN scale and their corresponding analgesic therapies were prospectively collected. The inclusion period lasted six weeks, from June 2, 2011, to July 12, 2011. Newborns were followed from their admission to the 14th day of their ICU stay or discharge, whichever occurred first.
Results: 495 newborns who underwent venipunctures were included. The mean (SD) gestational age was 33.0 (4.4) weeks and duration of participation was 8.0 (4.5) days. A total of 257 (51.9%) neonates were very preterm (<33 weeks). The mean (SD; range) number of venipunctures per neonate during the study period was 3.8 (2.8; 1–19) for all neonates and 4.1 (2.9; 1–17) for neonates <33 weeks. Of the 1887 venipunctures, 1164 (61.7%) were performed successfully in one attempt, 437 (23.2%) with continuous analgesia, 1434 (76.0%) with specific preprocedural analgesia. In multivariate models, lack of preprocedural analgesia was associated with higher disease-severity score, intrauterine growth retardation, invasive or noninvasive ventilation, venipuncture performed on the first day of hospitalization or at nighttime, and the use of continuous sedation/analgesia. High pain scores were significantly associated with absence of parents during procedures, surgery during the study period, and higher number of attempts.
Conclusions: Venipuncture is very frequent in preterm and term neonates in the ICUs. 76% were performed with preprocedural analgesia. Strategies to reduce the number of attempts and to promote parental presence seem necessary.

What is already known about the topic?

- Newborns undergo numerous painful procedures including venipunctures in the ICU.
- Skin-breaking procedures have been associated with adverse neurodevelopment long-term effects in very preterm neonates.
- Analgesic treatments are not always used during painful procedures.

What this paper adds

- During the first two weeks of ICU admission, very preterm neonates undergo a mean of 4.1 venipunctures and a fourth of them undergo more than 5 venipunctures.
- 76% of venipunctures were performed with preprocedural analgesia.
- Only 6/10 venipunctures were succeeded in one attempt. Multiple attempts were associated with higher pain.

1. Introduction

Newborns in intensive care units (ICUs) undergo numerous painful procedures (Carbajal et al., 2008; Simons et al., 2003). This is worrisome because a vast literature has shown that neonates are able to feel pain (Anand and Hickey, 1987; Fitzgerald, 1991). Studies using, for example, the flexor reflex threshold as a measure of sensation have even shown that preterm infants are more sensitive to pain than term neonate (Fitzgerald et al., 1988). Moreover, several studies strongly suggest that repeated pain in preterm neonates leads to poorer cognition (Vinall et al., 2014) and motor function (Grunau et al., 2009), and impaired brain development (Anand et al., 2013; Zwicker et al., 2013); in term neonates, altered pain responses have been found after neonatal pain (Taddio et al., 1997). It appears that early pain/stress may influence the developing brain and thereby neurodevelopment and stress-sensitive behaviors, particularly in the most immature neonates (Ranger and Grunau, 2014). It has thus become essential to prevent and treat pain in newborns. The acknowledgment of the importance of neonatal pain has led scientific organizations to issue guidelines for the prevention of pain during invasive procedures by pharmacological and nonpharmacological means (AFSSAPS, 2009; American Academy of Pediatrics Committee on Fetus and Newborn et al., 2006).

Venipuncture has been reported in a large multicenter study as the second most frequent skin breaking procedure in neonates in the ICU (Carbajal et al., 2008). It is usually performed in this setting in order to insert an intravenous line or to obtain blood for analyses (Barker and Rutter, 1995; Carbajal et al., 2008). Venipuncture is considered painful (Anand et al., 2005) and it often requires multiple attempts to be completed. The EPIPPAIN 1 study, which collected data in 2005–2006, showed that newborns might have as many as 14 attempts for intravenous cannula insertion before successful completion (Carbajal et al., 2008). EPIPPAIN 1 was an epidemiological study that prospectively collected data on all painful and stressful procedures performed in neonates admitted to all ICUs of the Paris region (Carbajal et al., 2008). Numerous randomized trials have assessed the efficacy of analgesics during venipunctures in neonates (Anand et al., 2005). Nonpharmacological methods effective for reducing venipuncture pain include nonnutritive