

Analgesia for lumbar puncture in infants and children

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Abstract

Question As a family physician who works in the local community emergency department, my skills include performing lumbar puncture in young children and infants. I hear conflicting recommendations in regard to provision of analgesia during lumbar puncture in these patients. Does local analgesia affect the success rate of the procedure? What is the best practice for analgesia in young children and infants?

Answer Lumbar puncture is one of the most commonly encountered painful procedures in pediatric medicine; it is imperative for timely diagnosis of central nervous system infections in febrile young infants. For many years it has been documented that health care providers provide suboptimal analgesia, despite the understanding that this is a painful procedure for infants and children of all ages. Using a lidocaine and prilocaine combination or a 1% lidocaine infiltration (or both) is recommended and has been associated with improved outcomes during the procedure.

L'analgésie pour une ponction lombaire chez les nourrissons et les enfants

Résumé

Question En tant que médecin de famille qui travaille à l'urgence communautaire de la région, j'ai acquis les compétences voulues pour effectuer une ponction lombaire chez les jeunes enfants et les nourrissons. Les recommandations sur l'analgésie durant une ponction lombaire chez de tels patients me semblent contradictoires. L'analgésie locale affecte-t-elle les taux de réussite de cette intervention? Quelles sont les pratiques exemplaires en matière d'analgésie chez les jeunes enfants et les nourrissons?

Réponse La ponction lombaire est l'une des interventions les plus douloureuses couramment rencontrées en médecine pédiatrique; il est impératif de diagnostiquer rapidement une infection du système nerveux central chez les nourrissons fébriles. Depuis de nombreuses années, il est documenté que les professionnels de la santé offrent une analgésie sous-optimale, même s'il est reconnu que la ponction lombaire est douloureuse pour les nourrissons et les enfants de tous âges. Il est recommandé d'utiliser une combinaison de lidocaïne et de prilocaïne ou une infiltration de lidocaïne à 1% (ou les 2); cette analgésie a été associée à de meilleurs résultats durant la procédure.

Lumbar puncture (LP) is a common procedure in pediatrics, performed mostly in the hospital setting. The most common reasons to perform an LP, especially in young febrile infants, are to rule out meningitis and encephalitis, determine a source of inflammation, treat inflammatory conditions such as Guillain-Barré syndrome, diagnose malignancy, and find evidence of bleeding in the area around the brain or spinal cord.

For neonates with documented fever, the best practice involves a mandatory LP to rule out bacterial meningitis.¹ The procedure is extremely common, despite recent propositions for modified Philadelphia criteria that do not include routine cerebrospinal fluid testing while still identifying most infants who are febrile with invasive bacterial infections.²

Research in neonatology in recent decades brought the realization that neonates do experience pain from noxious stimuli and might do so at an even greater intensity

than older children or adults.³ They carry the pain experience with a "memory" and long-term consequences.⁴

Why analgesia is not given

The LP procedure has been specifically associated with being a painful experience.^{5,6} Hence, the Canadian Paediatric Society and the American Academy of Pediatrics recommend topical analgesia or subcutaneous lidocaine in children undergoing LPs, including neonates.^{7,8} However, adequate use of analgesia during this painful procedure is limited,⁹ likely owing to several reasons. A few examples are concerns about systemic absorption of the local anesthetic and toxic side effects, considerations of the pain associated with local needle injection, and apprehension about deformation of the skin owing to injected liquid, which would mask the location for LP needle insertion. However, concerns about the increased difficulty of LP after injecting local

anesthetic have proved to be unfounded. In a study from the early 1990s, newborns' struggling motion score increased in response to lidocaine injection before an LP, but response to needle insertion for the LP was statistically significantly decreased.¹⁰ Rate of LP failure (15% in the lidocaine group and 19% in the control group), number of attempts, and number of traumatic taps (46% in both groups) were not different with lidocaine use.

More than a decade ago Baxter et al reported that, among 279 successful LP procedures performed by trainees, LPs were 3 times more likely to be successful among infants older than 12 weeks of age than among younger infants (odds ratio [OR] of 3.1; 95% CI 1.2 to 8.5). Use of a local anesthetic was associated with twice the likelihood of success (OR=2.2; 95% CI 1.04 to 4.6).¹¹

Patient age as a factor

Use of a local anesthetic also varies by patient age, with younger children less likely to receive a local anesthetic. In one study only 41% (45 of 111) of infants received local analgesia before LP (1% lidocaine infiltration, lidocaine-prilocaine combination cream, or a combination of the 2). Infants were less likely to receive a lidocaine injection or lidocaine-prilocaine cream before LP compared with a control group of adult patients (OR=0.27; 95% CI 0.12 to 0.62).¹² No neonates younger than 1 month of age received local procedural anesthesia.¹² In another prospective observation trial 146 of 223 patients received a local anesthetic before an LP (126 received a 1% lidocaine infiltration and 20 received lidocaine-prilocaine cream). Only 65 of 120 children younger than 12 months of age, and almost all (81 of 82) patients 12 to 24 months of age received analgesia.¹³ Recently, Poonai et al reported that when several cases were presented, surveyed Canadian physicians were much less likely to provide local anesthetic to a 3-week-old infant going through an LP compared with older children.¹⁴

Providers' choice as a factor

While the level of experience of the physician performing the LP does not seem to affect the outcome of the procedure,¹⁵ several studies demonstrated considerable practice variation among providers. In one study, emergency physicians exclusively used 1% lidocaine infiltration while pediatricians preferentially administered lidocaine-prilocaine cream.¹³ In another pediatric emergency department, only 5% (9 of 198) of attending physicians provided local anesthesia for LP, whereas 93% of pediatric patients in a community emergency department were given lidocaine by nonpediatricians.⁹

Practice variation among attending physicians is likely a result of inconsistency among training practices. One prospective observational study showed that local anesthesia was used in 74% of infants during LP by medical students and residents and, along with proper stylet techniques, was associated with a higher LP success

rate.¹¹ A Canadian survey reported that pediatric residents were using injectable local anesthesia less often for LP in children, and sedation more often, and had notably less training in the use of sedation.¹⁶

Analgesia options for LP

For health care providers, 2 main options are available for attenuation of pain responses during an LP procedure, especially in young infants.

In one study, lidocaine-prilocaine cream, a 1:1 oil-in-water emulsion of a low (5%) concentration of lidocaine and prilocaine hydrochloride, was used on intact skin and reduced the pain responses during insertion and withdrawal of the LP needle, but did not affect the handling and positioning of young infants.¹⁷ Several other studies from the 1990s have shown effectiveness of lidocaine-prilocaine cream in children and adults.¹⁸⁻²⁰


While lidocaine-prilocaine cream is not recommended in the neonatal period owing to a rare risk of methemoglobinemia following systemic doses of prilocaine,²¹ it has been used safely for LP (and other procedures) in neonates.^{5,6} In a placebo-controlled trial from 2003, all newborns experienced pain during LP (increased heart rate, decreased oxygen saturation level, and increased total behavioural score; $P < .001$) but those receiving lidocaine-prilocaine cream had a lower heart rate at needle insertion (lidocaine-prilocaine cream: mean [SD] heart rate of 159.3 [2.3] beats/min; placebo: mean [SD] heart rate of 175.2 [2.7] beats/min; $P < .001$) and needle withdrawal (lidocaine-prilocaine cream: mean [SD] heart rate of 153.8 [2.6] beats/min; placebo: mean [SD] heart rate of 167.3 [2.5] beats/min; $P < .001$), and improved behavioural scores at insertion (lidocaine-prilocaine cream: mean [SD] score of 4.0 [0.3]; placebo: mean [SD] score of 5.0 [0.0]; $P = .004$) and withdrawal (lidocaine-prilocaine cream: mean [SD] score of 1.8 [0.3]; placebo: mean [SD] score of 3.9 [0.3]; $P < .001$).⁶

The second potential option to reduce pain is the use of locally injected 1% lidocaine at a dose of up to 4.5 mg/kg. Use of a small needle (27 gauge) and dilution with bicarbonate might reduce pain associated with local infiltration. Although in an initial study the administration of lidocaine did not minimize the physiologic response to LP,²² in another randomized trial 59% of patients in both the lidocaine and the no-anesthetic group required a single attempt for LP success, and there was no significant difference in severe traumatic LPs.¹⁵

Procedural sedation is another option to alleviate pain associated with LP, but it is not common practice. A group from Spain used 50% nitrous oxide (with oxygen) for LP in children, with good success.²³ A subset analysis in another study demonstrated that only pediatricians (and not emergency physicians) used moderate sedation (with midazolam and fentanyl) in 41 of 309 (13%) children.¹³ In a Canadian survey, most (72%) residents

reported that they had used sedation during LPs in children,¹⁶ mostly with benzodiazepines. Encountering side effects and concerns of potential respiratory depression were most commonly cited as reasons to avoid sedation.

Conclusion

Analgesia during a painful LP procedure in children is important and should be given more frequently. Infiltration of 1% lidocaine or lidocaine-prilocaine cream (or both) are recommended measures for pain management in young children. 

Competing interests

None declared

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