Article published online: 2022-12-21

Comparison of EMLA Cream versus Lidocaine Injection for Lumbar Puncture Pain Control in Pediatric Oncology Patients

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Avicenna J Med 2022;12:178–181.

Abstract

Background Subcutaneous lidocaine injection and topical EMLA cream are both used to control lumbar puncture (LP) pain; however, local analgesia usage is not standardized.

Methods We conducted a prospective, single-blinded, randomized-controlled cross-over trial comparing the two modalities in reducing LP pain. Pediatric patients requiring serial LPs were randomly assigned to receive EMLA cream or lidocaine injection prior to LP. On the subsequent LP, analgesia was defaulted to the other agent. Pain was assessed using the Wong-Baker FACES Pain Rating Scale pre-procedure: 30 to 60 minutes post-LP, and 24 hours post-procedure.

Results Ten patients were included in the analysis (median age: 5.5 years). Pain ratings at 1 and 24 hours post-LP did not differ between the two strategies ($p = 0.79$). No adverse local reactions were reported for either agent.

Conclusion Accordingly, both lidocaine and EMLA cream provided effective LP pain control.

Keywords
- pain control
- lumbar puncture
- pediatric oncology
- EMLA cream
- lidocaine

Introduction

Lumbar punctures (LP) are routinely performed in pediatric oncology patients for diagnostic testing or medication administration. Without adequate analgesia LPs are painful; however, analgesic use for pediatric LP has historically been underutilized and nonstandardized.[1] The American Academy of Pediatrics recommends either general anesthesia or a combination of sedative and analgesic for painful procedures (including LPs) in pediatric oncology patients.[2]

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DOI https://doi.org/10.1055/s-0042-1758389.
ISSN 2231-0770.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Lidocaine injected subcutaneously prior to LP needle insertion is commonly used but EMLA cream consisting of 2.5% lidocaine and 2.5% prilocaine is a topical alternative. Lidocaine (versus placebo) has been shown to decrease patient movement while maintaining LP success rates.[3,4] EMLA cream (vs. placebo) lowers pain scores in pediatric oncology patients,[5] but its analgesic effects can decrease with repeat LPs.[6] Minimal literature exists for prospective, randomized comparisons between the two analgesic agents, with no published studies in pediatric oncology patients. Thus, we performed a prospective, single-blinded, randomized crossover study comparing lidocaine injection versus EMLA cream for local site analgesia in serial LP procedures.

Following consent/assent, patients (aged: 3–18 years) with acute lymphocytic leukemia were randomly assigned to receive lidocaine injection or EMLA cream for local analgesia prior to their LP. On their subsequent scheduled LP, the local analgesia was defaulted to the other agent. Randomization was performed using computer-generated, simple, random-number table. Sequential numbered, sealed envelopes containing the randomized initial analgesic were opened post-consent by the study personnel. Patients and parents were blind to the local site analgesia. The protocol was approved by our Institutional Review Board and registered at clinicaltrials.gov (NCT04003012).

LP procedure followed our institution's standard protocol using a 22-gauge Quincke, LP needle. Patients were sedated via the anesthesia team using propofol with or without Sevoflurane gas. In LPs with EMLA cream, 5 g EMLA cream was applied at least 60 minutes prior to procedure. In LPs with lidocaine injection, patients received 1 to 4 mL lidocaine 1% subcutaneous injection at the appropriate site 30 to 60 seconds prior to LP needle insertion. Placebo in the form of a fragrance-free hypoallergenic moisturizer cream was applied to patients randomized to lidocaine injection at least 60 minutes prior to LP to reduce patient/parent reporting bias.

Primary outcome of interest was patients' self-reported pain measured by the Wong-Baker FACES Pain Rating Scale (WBS)[7] pre-procedure; 30 to 60 minutes post-procedure, and 24 hours post-procedure. Secondary measures included adverse reactions and pain signs at time of local analgesia administration and pain indirectly assessed by 24-hour home "as needed" (pro re nata) analgesics use. A sample of 10 patients had a 95% chance of detecting a 1-point difference (standard deviation =0.75) on the WBS when using paired two-tail analysis (Wilcoxon signed-rank test, G*Power 3.1). Pain scores were compared at each time point using Wilcoxon signed-rank test and comparisons of categorical variables were performed using McNemar's test. A *p*-value of less than 0.05 was used to determine statistical significance and the IBM-SPSS (Version 19) used in all analyses.

Ten patients (mean age: 5.5 years, 4 females) completed the two required LPs. No adverse events or adverse local reactions occurred after the 20 LPs performed. With the lidocaine injection regimen, five patients demonstrated pain signs at the time of lidocaine injection (1 patient increased heart rate and 4 patients movement; ►Table 1). With both agents, pain was not reported at baseline or at 30 to 60 minutes post-LP. At the 24-hour time point post-LP, 2 patients post-EMLA-cream reported pain, while 3 patients post-lidocaine reported pain, with median pain scores not differing between the two analgesics ($p = 0.79$). Total dosage of acetaminophen used did not differ between regimens ($p = 0.18$).

We found that both lidocaine injection and EMLA cream were effective in preventing local LP pain in pediatric oncology patients without either exhibiting clear superiority. As half the patients exhibited pain signs at time of lidocaine injection, the use of EMLA cream may be superior as EMLA cream circumvents the pain response that can occur when lidocaine injection is administered. However, a minimum of 60 minutes post-EMLA cream application is required for satisfactory dermal analgesia.[8] This delay with administration can postpone care, making EMLA cream less favorable in acute settings. Our study is the first prospective trial comparing effectiveness of EMLA cream and lidocaine injection for LP self-reported pain control in the pediatric oncology population. One of the few lidocaine injection-to-EMLA cream comparisons in the literature, a retrospective observational study, reported that EMLA cream shortened LP procedure time, required decreased Propofol, and resulted in fewer adverse events; however, the authors did not examine self-reported pain or nonimmediate outcomes.[9] Assessing self-reported pain is critical when examining pain management strategies as pain is an internal and subjective experience.

Our study's limitations included that self-reported pain levels higher than "no pain" were a rare event and may have contributed to the study's inability to detect a difference between the two local analgesic agents other than pain responses at the time of administration. An additional limitation is our small sample size that may have limited our ability to draw definitive conclusions.

Inadequate local analgesic in pediatric LPs causes avoidable pain and is linked to traumatic and unsuccessful procedures.[10] As pediatric patients with leukemia typically receive 20 or more LPs during their disease course, it is imperative that pain control be optimized with local analgesia utilization. Both lidocaine injection and EMLA cream provide effective pain control post-LP in pediatric oncology patients.

Note

The protocol was approved by our Institutional Review Board and registered at clinicaltrials.gov (NCT04003012). Link: https://clinicaltrials.gov/ct2/show/NCT04003012. Manuscript authors included Andrea D Merry-Sperry DO, Elham Alqudah MD, Alexa Magner, Stephanie Thompson PhD, Pamela Smith APRN, Ashley Meyer DO, and Mohamad Badawi MD with each contributing to the conceptualization and design the study as well as data analysis or manuscript preparation. All authors have reviewed and

Table 1 Comparison of lidocaine versus EMLA cream following LP

	EMLA cream	Lidocaine	*p* -Value
LP and local analgesia characteristics			
Initial randomized local analgesic	5 (50%)	5 (50%)	
Adverse local reaction to analgesic	0 (0%)	0 (0%)	
Minutes between local analgesic and start of LP, median (min–max)	145 (85–213)	2 (1–6)	
Amount of lidocaine, mL, median (min–max)	–	2 (1.5–3.0)	
Number of lidocaine sticks, median (min–max)	–	1 (1–3)	
LP needle sticks, median (min–max)	1 (1–3)	1 (1–5)	
Required more 1 LP needle stick	2 (20%)	2 (20%)	
Resident involvement in lumber puncture	2 (20%)	3 (30%)	1.00
Signs of pain with local analgesia Increase in heart rate Movement	0 (0%)	5 (50%) 1 4	0.03
Wong-Baker Faces Pain Rating Scale Scores			
Baseline, pre-LP Any reported pain (WBS > 0) Pre-LP, median (min–max)	 0 (0%) 0 (0–0)	 0 (0%) 0 (0–0)	
30–60 minutes post-LP Any reported pain (WBS > 0) 30–60 minutes post-LP, median (min–max)	 0 (0%) 0 (0–0)	 0 (0%) 0 (0–0)	
24 hours post-LP Any reported pain (WBS > 0) 24 hours post-LP, median (min–max)	 2 (20%) 0 (0–8)	 3 (30%) 0 (0–8)	 1.00 0.79
PRN pain medication 24 hours post-LP			
Acetaminophen Any reported pain, *n* (%) mg, median (min–max)	 1 (10%) 0 (0–325)	 2 (20%) 0 (0–1290)	 1.00 0.18
Opioid Any reported pain, *n* (%) mg, median (min–max)	 0 (0%) 0 (0–0)	 1 (10%) 0 (0–5.325)	 1.00 0.32

Abbreviations: LP, lumbar puncture; PRN, pro re nata; WBS, Wong-Baker FACES Pain Rating Scale.

agreed upon the final manuscript content. This manuscript has not been submitted elsewhere nor been previously published.

All authors declare that there are no financial interests, or other relationships of a commercial nature to disclose.

Funding

No sponsorship or funding received.

Conflict of Interest

None declared.

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