

From [Medscape Pediatrics](#)

## Topical Anesthetics in Children

Published: 02/19/2008

### Introduction

---

Needle sticks are the most common<sup>[1]</sup> and greatest source of procedural pain<sup>[2]</sup> in the world. From quick immunizations or glucose monitoring to venipuncture, laceration repair, dermatologic procedures, and even tattooing (and removal!), needle pain is a growing concern. Fortunately, the past decade has provided numerous solutions. This article will address the rationale for treating needle pain, the options available, and research evaluating these modalities.

While adults are also affected by needle pain, most of the research and product focus is for children. Concern for pain even in children too young to talk is not frivolous: the effects of untreated pain impact medical outcomes<sup>[3]</sup> and are remembered by preverbal children.<sup>[4]</sup> These effects may amplify with age: adolescents avoid medical treatment,<sup>[5]</sup> 16% to 75% of adults surveyed refuse to donate blood,<sup>[6-8]</sup> and geriatric patients refuse flu shots due to fear of needle pain.<sup>[9]</sup> The health implications of needle phobia extend beyond the affected individuals; HIV patients continued to infect others while delaying blood tests,<sup>[10]</sup> and needle phobic parents are less likely to immunize their children.<sup>[11]</sup>

Research yields a distinct, age-related phobia relating to the needle procedure,<sup>[12]</sup> suggesting untreated immunization pain is a significant contributor to needle phobia.<sup>[13-15]</sup> Children now get more than 20 sticks before they are 2 years old. Despite an American Academy of Pediatrics (AAP) recommendation to use pain control "whenever possible,"<sup>[16]</sup> only 2.1 of an estimated 18 million venipunctures each year are done with pain control.<sup>[17]</sup> Familiarity with and utilizing available methods to diminish needle pain for children can have far-reaching effects.

Available analgesic options correspond to the physiology of needle pain. Briefly, fast myelinated A-delta fibers transmit the sensation of the sharp stick. Topical anesthetics (eg, procaine, lidocaine, tetracaine) stop the transmission at the voltage-sensitive Na-positive channels, raising the action potential threshold until the impulse cannot be conducted.<sup>[18]</sup> All local anesthetics contain hydrophilic and hydrophobic ends, wherein lies a conundrum: patients tend to be covered in skin, which prohibits hydrophilic absorption.

Once the sharp pain impulse begins, it combines in the dorsal column in a final common pathway with continuously transmitted mechanoreceptor information: position, temperature, and vibration.<sup>[19]</sup> Through the "gate theory," stimulating these C and A-beta fibers with cold or vibration<sup>[20]</sup> decreases pain, as with running a burn under cold water or rubbing a bumped elbow. One adult case series described using vibrating massagers for dermatologic procedures, with a resulting decrease in or elimination of the need for topical anesthetics.<sup>[20]</sup> A device for this purpose (*Buzzy*, MMJ Labs, Atlanta, Georgia) is currently under investigation in children. Although cold spray (eg, *Painease*, Gebauer, Cleveland, Ohio) has been widely used, research in children is equivocal.<sup>[21,22]</sup>

The cortical reaction to sharp pain can be modulated through voluntary and external distraction.<sup>[23]</sup> Children old enough to watch bubbles, blow pinwheels, or play "I Spy" games don't notice a painful procedure as much. While very effective,<sup>[24]</sup> these methods take time and require props and trained support. The remainder of this review will discuss topical creams, lidocaine delivery devices, and cold spray.

### Topical Anesthetics Under Dressings

---

#### Local Anesthesia for Open Wounds

Open lacerations permit easy absorption, rendering the hydrophilic ester issue moot. The first combinations included tetracaine and cocaine mixed with a vasoconstrictor ("adrenaline") to decrease diffusion. This mix, "TAC," was very

effective with minimal toxicity when placed directly into the wound. TAC essentially obviated the need for injection for many pediatric cuts. The use of the controlled substance cocaine, however, both increased the cost and logistical difficulty of keeping the mix available. In 1995, Ernst and colleagues<sup>[25]</sup> demonstrated that lidocaine, epinephrine, and tetracaine (LET or LAT) were just as effective. This has become the standard of care for pediatric wound repair, either with a single application or with sequential applications.<sup>[26]</sup>

A shred of LET-soaked cotton or LET mixed with methylcellulose is placed directly in the wound prior to cleansing and repair. The solution or gel can be held in place with an occlusive dressing, tape, or bandage, but care must be taken not to put any absorptive surface near the LET, as this will wick the medication away from the wound. The wound edges blanch when numb, usually after 20 minutes. Anesthesia lasts an average of 21 minutes after removal.<sup>[27]</sup> LET alone gives sufficient pain control in 60% of adults,<sup>[28]</sup> 70% to 90% of pediatric facial lacerations,<sup>[27]</sup> and 40% to 75% of extremity wounds.<sup>[29]</sup> In addition, use in children decreased length of stay from 108 to 77 minutes.<sup>[30]</sup>

One study exclusively in pediatric finger lacerations found an efficacy of approximately 50%. They found no cases of digital ischemia, nor did another that left LET on for 15 minutes.<sup>[29,31]</sup> The numbers of patients studied were 67 and 23, respectively; these small numbers are reassuring but do not establish safety. While absorption of lidocaine through mucous membranes is a theoretical concern, the use of LET for oral lacerations is more limited by loss of the pigmentation of the vermilion border from blanching.

The recipe is somewhat complicated: lidocaine 20% 100 mL (20 g lidocaine powder, 100 mL normal saline); racemic epinephrine 2.25% 50 mL; tetracaine 2% 125 mL; sodium metabisulfate 315.4 mg; 225 mL sterile water -- yielding a total of 500 mL of LET. This will keep for 3 weeks at room temperature or 5 months refrigerated.

### Local Anesthesia for Intact Skin

The 3 most common anesthetic formulations that absorb through intact skin are *EMLA* (AstraZeneca, Wilmington, Delaware), *LMX-4* (Eloquest Healthcare, Ferndale, Michigan), and tetracaine (eg, *Ametop* gel, Smith & Nephew, Hull, United Kingdom; *Synera*, Endo Pharmaceuticals, Chadds Ford, Pennsylvania).

***EMLA***. One of the first and most studied topical creams is a eutectic mixture of local anesthetics, a prilocaine 2.5% and lidocaine 2.5% cream. When applied for a minimum of 45 to 60 minutes, extensive evidence supports reduction of pain from IV catheter insertion.<sup>[32-37]</sup> In contrast to the other topicals, *EMLA* can be left on up to 4 hours, and its duration of action continues an hour after removal.<sup>[32]</sup> In addition, depth of anesthesia increases up to 6 mm during prolonged application.<sup>[38]</sup>

The perception that *EMLA*'s vasoconstriction<sup>[39,40]</sup> necessitates multiple needle sticks is one barrier to use. Vasoconstriction has been described with all creams and placebos: one adult study found maximal constriction at 1.5 hours, although *EMLA* subsequently increased vein diameter to 148% of baseline at 6 hours.<sup>[41]</sup> With regard to ease of venipuncture, smaller studies in children have shown either no difference<sup>[42]</sup> or improved procedure ease with *EMLA* in outpatient or anesthesia settings.<sup>[34,43]</sup> One abstract found that *EMLA* use resulted in successful cannulation for 53 of 65 children (82%) vs 58 of 89 (65%) venipuncture attempts in untreated skin. Venipuncture success was improved the longer *EMLA* was applied, up to 92% when left on for 2-3 hours.<sup>[44]</sup>

*EMLA* has been found to be safe<sup>[45]</sup> and effective for neonatal circumcisions, even warranting its own Cochrane review.<sup>[4,46]</sup> While conclusively demonstrated to decrease the pain of lumbar punctures (LP) in older children,<sup>[47]</sup> *EMLA* is the only topical anesthetic studied shown to decrease pain in newborn LPs. Kaur and colleagues<sup>[48]</sup> showed decreased pain when compared with placebo, using physiologic parameters and a videotaped coded behavioral scale. *EMLA* decreases immunization pain, with no change in antibody response.<sup>[49,50]</sup> For open wounds, *EMLA*'s efficacy is 40% compared with 74% for LET.<sup>[51]</sup>

Methemoglobinemia is rare side effect more likely in preterm infants lacking the enzyme to reduce it.<sup>[52]</sup> Current recommendations limit *EMLA* to infants of at least 37 weeks gestational age. A purpuric rash of presumed toxic origins

has been described in 1% to 2% of users, particularly in atopic patients.<sup>[53,54]</sup> The cost of *EMLA* is approximately US\$7 for the tube and occlusive dressing.

**LMX-4.** *LMX-4* (previously called *ELA-Max*) is a liposomal delivery system that allows a 4% lidocaine preparation to be rapidly absorbed by the skin.<sup>[55]</sup> It has effect in 20-30 minutes and works as well as *EMLA* for venipuncture pain.<sup>[56,57]</sup> The rapid absorption also results in a rapid dissipation of the drug, with diminishing anesthesia approximately 40-60 minutes after application, although this has not been formally reported.

Taddio and colleagues<sup>[58]</sup> evaluated procedural success and pain relief in a pediatric emergency department using *LMX-4* for venipuncture. They demonstrated improved cannulation success on the first attempt (74% vs 55%,  $P = .03$ ) when compared with placebo. In addition, they noted a decreased mean total procedural duration of 6.7 vs 8.5 minutes ( $P = .04$ ) and significantly lower pain scores.

While *LMX-4* has not been explicitly studied for pain of infant LP, one study found doubled LP success rates for residents when *LMX-4* was used compared with no pain control (odds ratio = 2.2, 95% confidence interval = 1.04-4.6).<sup>[59]</sup> When studied for office-based meatotomy, *LMX-4* for 30 minutes was equivalent to *EMLA* for 45 minutes.<sup>[20]</sup>

*LMX-4* does not carry the risk of methemoglobinemia and is over the counter, diminishing the barrier of requiring a physician's order. Cost is similar, \$6-7 per 1- to 2-g application. If a medical-grade occlusive dressing is not available, both *EMLA* and *LMX-4* can be occluded with Glad *Press-n-Seal*. The product is not sterile, but over unbroken skin this is not an issue. It does not contain latex and has the added benefit of painless removal.

**Tetracaine Products.** Tetracaine gel, formerly known as amethocaine, is available alone and compounded with lidocaine. The 4% formulation works in 30-45 minutes and has a duration of action of 4-6 hours. It has a similar efficacy to *EMLA*.<sup>[60-62]</sup> In a randomized, blinded, crossover study, Bishai and colleagues<sup>[63]</sup> compared the two for *Port-a-Cath* access and found tetracaine worked as well in 30 minutes as *EMLA* did in 60.

In addition to venous access efficacy, tetracaine has also been studied for immunizations. It reduced pain significantly for measles-mumps-rubella vaccine, with no decrease in antibody response.<sup>[62]</sup>

**Synera (Formerly S-Caine Patch).** Tetracaine and lidocaine mixed 7%/7% in a self-contained patch have been studied for venipuncture. The currently available product, *Synera*, is designed to look like a child's bandage and is recommended for children aged 3 years and older. *Synera* contains a heating element that, when activated, enhances absorption, allowing for rapid anesthesia and some degree of vasodilation. A recent adult study found that 73% of adults reported "adequate analgesia" compared with 31% with placebo.<sup>[64]</sup> Cost is approximately \$12 per patch. The mixture was tested as the *S-Caine Patch* without the heating element prior to being licensed to Endo Pharmaceuticals and showed good results in children for venipuncture.<sup>[65]</sup>

**Other Absorbable Topicals.** A mixture of lidocaine, tetracaine, and phenylephrine (tetralidophen) was compared with injected lidocaine for mucous membrane repairs but was not as effective.<sup>[66]</sup> Capsaicin ointment 15%, (*Myolaxin*, Geno, Mumbai) performed favorably against *EMLA* when applied for 60 minutes.<sup>[67]</sup> While described as less expensive, it is not currently available in the United States and does not offer the timing benefits of other products.

## Devices to Enhance Topical Lidocaine Absorption

---

Iontophoresis uses a low-voltage electrical current to drive the positively charged end of lidocaine through the epidermis.<sup>[68]</sup> As the current flows to the negative reservoir, drug in the positive reservoir is carried into the skin. The current flow is noxious to some children, but those who tolerate the device find pain control equivalent and may prefer it. Galinkin and colleagues<sup>[69]</sup> found in a crossover trial that 11 of 22 children preferred iontophoresis, 5 (including 2 who did not tolerate iontophoresis) preferred *EMLA*, and 6 children did not care.

Cost of the method includes the delivery device (ActivaTek [Salt Lake City, Utah], \$290; Iomed [Salt Lake City, Utah],

\$695), and each individual-use lidocaine reservoir packet (from \$5 to \$14; eg, lomed \$64/6). Time of application is at a minimum 10 minutes with newer delivery systems, such as *LidoSite* (Vyteris, Inc., Fair Lawn, New Jersey).

The delivery system is indicated for children over the age of 5 years and is contraindicated in children with pacemakers. It should not be used over broken skin or through mucous membranes, palms, or soles, where the conduction is either enhanced or impeded, respectively. In a placebo-controlled study of 500 subjects with a more rapid device, 1 subject experienced a partial-thickness burn.<sup>[70]</sup>

### Intradermal Lidocaine Delivery

---

Even the few minutes needed to apply creams or run current are a barrier to their use. While the following methods are by definition *not* topical, they should be considered as alternative modalities for venipuncture when time is the reason not to use pain control.

One rapidly effective and well tolerated pain relief method is simply to inject buffered lidocaine using a 30-gauge needle prior to venipuncture.<sup>[71]</sup> Luhmann and colleagues<sup>[71]</sup> found no difference in pain comparing this method with *LMX-4* for pediatric cannulation using 22-gauge needles. Patterson and colleagues<sup>[72]</sup> included unbuffered lidocaine in a comparison with cold spray, *EMLA*, and injected benzyl alcohol and found the former to be cheapest and most effective, though more painful upon application because it was unbuffered. Use of this method is inexpensive, depending on bundled hospital charges for the extra needle, syringe, and buffered lidocaine.

A newer product, the *J-Tip* (National Medical Products, Irvine, California), puts lidocaine under the skin via a jet of compressed carbon dioxide. Early studies found the delivery method less painful than a 25-gauge needle but found the numbing to be less effective.<sup>[34]</sup> Subsequent venipuncture investigations in children have had better results, with better pain relief from *J-Tip* use than *EMLA*. Of note, 81% found *J-Tip* lidocaine administration painless compared with 64% who felt pain with removal of *EMLA*'s occlusive dressing.<sup>[73]</sup> The price for the single-use disposable unit is \$2 to \$4.

Several products enhance absorption of *LMX-4*, decreasing time until efficacy. One product, *Sonoprep* (Sontra Medical Corporation, Franklin, Massachusetts), improved pain control vs placebo by pretreating with ultrasound for 15 seconds, then applying *LMX-4* for 5 minutes.<sup>[74]</sup> A low-power erbium:YAG laser (*Epiture Easytouch*, Norwood Abbey, Frankston, Victoria, Australia) was tested with 10 seconds of laser vs sham laser prior to 5-minute *LMX-4* application. The \$2500 laser significantly reduced pain of cannulation in the 47 children randomized to the laser group.<sup>[75]</sup>

Finally, a disposable product approved for children in 2007 uses compressed air to puff lidocaine through the skin in a 1-cm area.<sup>[76]</sup> The devices, which will be marketed as *Zingo* (Anesiva, South San Francisco, California), will cost between \$12 and \$15 per use. As with the other devices, if the prepared area is not subsequently used, the cost recurs in a newly chosen site.

### Cold Spray

---

The idea of cold for pain is as old as the ice pack. Applying cold spray (*Painease*) directly to the penetration site has been used in hospitals for needle sticks, but placebo-controlled, randomized trials have produced varying results. Whereas Mawhorter and colleagues<sup>[77]</sup> found cold spray effective for adult immunizations, others found *increased* distress in small children<sup>[22]</sup> and adults prior to venipuncture.<sup>[72]</sup> The cold also causes veins to shrink, making inserting an intravenous cannula difficult.<sup>[22]</sup> Results with cold spray for pediatric immunization have been mixed,<sup>[21]</sup> most likely because the spray is subfreezing and can injure children's more delicate tissues (LL Cohen, personal communication, 2007). Cold spray is appealing because it costs pennies per application and can be used at another site instantly if the intended location for venipuncture needs to change. *Painease* was removed from the market in 2006 due to the discovery of mold in the cans, but Gebauer reports on its Web site that the product should be back on the market in early 2008.

In sum, needle pain is important and has broad and lasting effects, but it can be relieved.

#### Comparison of Options for Venipuncture

	<b>EMLA</b>	<b>LMX-4</b>	<b>Synera</b>	<b>Cold Spray</b>	<b>Iontophoresis</b>	<b>SQ Lidocaine</b>	<b>J-Tip</b>
Time to use (minutes)	60	20-30	20	1	5-10	1	1
Duration	4 hours	1 hour	3 hours	15 seconds	2 hours	1 hour	1 hour
Issues	Vasoconstricts unless on >1.5 hour, purpura	<i>Tegaderm</i> hurts to remove	Warming patch may burn	Burns < 12 years	Noxious to some users	Extra needle preparation	Waste of disposable unit
Cost	\$5-7	\$5-7	\$12	\$0.25	\$10 + unit	< \$2	\$3

SQ = *subcutaneous*

**Table 1.** Comparison of Options for Venipuncture

---

#### References

#### References

1. Schechter NL, Zempsky WT, Cohen LL, McGrath PJ, McMurtry CM, Bright NS. Pain reduction during pediatric immunizations: evidence-based review and recommendations. *Pediatrics* 2007;119:e1184-1198.
2. Cummings EA, Reid GJ, Finley GA, McGrath PJ, Ritchie JA. Prevalence and source of pain in pediatric inpatients. *Pain*. 1996;68:25-31. [Abstract](#)
3. Anand KJ, Sippell WG, Aynsley-Green A. Randomised trial of fentanyl anaesthesia in preterm babies undergoing surgery: effects on the stress response. *Lancet*. 1987;1:62-66. [Abstract](#)
4. Taddio A, Stevens B, Craig K, et al. Efficacy and safety of lidocaine-prilocaine cream for pain during circumcision. *N Engl J Med*. 1997;336:1197-1201. [Abstract](#)
5. Vika M, Raadal M, Skaret E, Kvale G. Dental and medical injections: prevalence of self-reported problems among 18-yr-old subjects in Norway. *Eur J Oral Sci*. 2006;114:122-127. [Abstract](#)
6. Harrington M, Sweeney MR, et al. What would encourage blood donation in Ireland? *Vox Sang*. 2007;92:361-367.
7. Grossman B, Watkins AR, Fleming F, Debaun MR. Barriers and motivators to blood and cord blood donations in young African-American women. *Am J Hematol*. 2005;78:198-202. [Abstract](#)
8. Wiwanitkit V. Knowledge about blood donation among a sample of Thai university students. *Vox Sang*. 2002;83:97-99. [Abstract](#)
9. Allsup SJ, Gosney MA. Difficulties of recruitment for a randomized controlled trial involving influenza vaccination in healthy older people. *Gerontology*. 2002;48:170-173. [Abstract](#)
10. Spielberger CD, Gorsuch PL, Lushene RE. Manual for the State-Trait Anxiety Inventory. Palo Alto, Calif: Consulting Psychologist Press; 1970.
11. Froehlich H, West DJ. Compliance with hepatitis B virus vaccination in a high-risk population. *Ethn Dis*.

- 2001;11:548-553. [Abstract](#)
12. Goodenough B, Thomas W, Champion GD, et al. Unravelling age effects and sex differences in needle pain: ratings of sensory intensity and unpleasantness of venipuncture pain by children and their parents. *Pain*. 1999;80:179-190. [Abstract](#)
  13. Hamilton JG. Needle phobia: a neglected diagnosis. *J Fam Pract*. 1995;41:169-175. [Abstract](#)
  14. Taddio A, Manley J, Potash L, Ipp M, Sgro M, Shah V. Routine immunization practices: use of topical anesthetics and oral analgesics. *Pediatrics*. 2007;120:e637-643. [Abstract](#)
  15. Kleinknecht RA. Acquisition of blood, injury, and needle fears and phobias. *Behav Res Ther*. 1994;32:817-823. [Abstract](#)
  16. American Academy of Pediatrics. Committee on Psychosocial Aspects of Child and Family Health; Task Force on Pain in Infants, Children, and Adolescents. The assessment and management of acute pain in infants, children, and adolescents. *Pediatrics*. 2001;108:793-797. [Abstract](#)
  17. Zingo Commercialization Plan October 2007. Available at: [http://www.anesiva.com/wt/page/prod\\_zingo](http://www.anesiva.com/wt/page/prod_zingo). Accessed January 22, 2008.
  18. Gilman AG, Rall TW, Nies AS, Taylor P, eds. *The Pharmacological Basis of Therapeutics*. 8th ed. New York: Pergamon Press; 1990.
  19. Melzack R, Wall PD. Pain mechanisms: a new theory. *Science*. 1965;150:971-979. [Abstract](#)
  20. Smith DP, Gjellum M. The efficacy of LMX versus EMLA for pain relief in boys undergoing office meatotomy. *J Urol*. 2004;172:1760-1761. [Abstract](#)
  21. Cohen Reis E, Holubkov R. Vapocoolant spray is equally effective as EMLA cream in reducing immunization pain in school-aged children. *Pediatrics*. 1997;100:E5.
  22. Ramsook C, Kozinetz CA, Moro-Sutherland D. Efficacy of ethyl chloride as a local anesthetic for venipuncture and intravenous cannula insertion in a pediatric emergency department. *Pediatr Emerg Care*. 2001;17:341-343. [Abstract](#)
  23. Cohen LL. Reducing infant immunization distress through distraction. *Health Psychol*. 2002;21:207-211. [Abstract](#)
  24. Cohen LL, MacLaren JE, Fortson BL, et al. Randomized clinical trial of distraction for infant immunization pain. *Pain*. 2006;125(1-2):165-171.
  25. Ernst AA, Marvez E, Nick TG, Chin E, Wood E, Gonzaba WT. Lidocaine adrenaline tetracaine gel versus tetracaine adrenaline cocaine gel for topical anesthesia in linear scalp and facial lacerations in children aged 5 to 17 years. *Pediatrics*. 1995;95:255-258. [Abstract](#)
  26. Gaufberg SV, Walta MJ, Workman TP. Expanding the use of topical anesthesia in wound management: sequential layered application of topical lidocaine with epinephrine. *Am J Emerg Med*. 2007;25:379-384. [Abstract](#)
  27. Resch K, Schilling C, Borchert BD, Klatzko M, Uden D. Topical anesthesia for pediatric lacerations: a randomized trial of lidocaine-epinephrine-tetracaine solution versus gel. *Ann Emerg Med*. 1998;32:693-697. [Abstract](#)
  28. Adler AJ, Dubinisky I, Eisen J. Does the use of topical lidocaine, epinephrine, and tetracaine solution provide sufficient anesthesia for laceration repair? *Acad Emerg Med*. 1998;5:108-112.
  29. White NJ, Kim MK, Brousseau DC, Bergholte J, Hennes H. The anesthetic effectiveness of lidocaine-adrenaline-tetracaine gel on finger lacerations. *Pediatr Emerg Care*. 2004;20:812-815. [Abstract](#)
  30. Priestley S, Kelly AM, Chow L, Powell C, Williams A. Application of topical local anesthetic at triage reduces treatment time for children with lacerations: a randomized controlled trial. *Ann Emerg Med*. 2003;42:34-40. [Abstract](#)
  31. Chale S, Singer AJ, Marchini S, McBride MJ, Kennedy D. Digital versus local anesthesia for finger lacerations: a randomized controlled trial. *Acad Emerg Med*. 2006;13:1046-1050. [Abstract](#)
  32. Buckley MM, Benfield P. Eutectic lidocaine/prilocaine cream. A review of the topical anaesthetic/analgesic efficacy of a eutectic mixture of local anaesthetics (EMLA). *Drugs*. 1993;46:126-151. [Abstract](#)
  33. Chen BK, Cunningham BB. Topical anesthetics in children: agents and techniques that equally comfort patients, parents, and clinicians. *Curr Opin Pediatr*. 2001;13:324-330. [Abstract](#)

34. Cooper JA, Bromley LM, Baranowski AP, Barker SG. Evaluation of a needle-free injection system for local anaesthesia prior to venous cannulation. *Anaesthesia*. 2000;55:247-250. [Abstract](#)
35. Fetzer SJ. Reducing the pain of venipuncture. *J Perianesth Nurs*. 1999;14:95-101, 112. [Abstract](#)
36. Young SS, Schwartz R, Sheridan MJ. EMLA cream as a topical anesthetic before office phlebotomy in children. *South Med J*. 1996;89:1184-1187. [Abstract](#)
37. Rogers TL, Ostrow CL. The use of EMLA cream to decrease venipuncture pain in children. *J Pediatr Nurs*. 2004;19:33-39. [Abstract](#)
38. Wahlgren CF, Quiding H. Depth of cutaneous analgesia after application of a eutectic mixture of the local anesthetics lidocaine and prilocaine (EMLA cream). *J Am Acad Dermatol*. 2000;42:584-588. [Abstract](#)
39. Bahruth AJ. Peripherally inserted central catheter insertion problems associated with topical anesthesia. *J Intraven Nurs*. 1996;19:32-34. [Abstract](#)
40. Wilder-Smith E, Chow A. Water immersion and EMLA cause similar digit skin wrinkling and vasoconstriction. *Microvasc Res*. 2003;66:68-72. [Abstract](#)
41. Bjerring P, Andersen PH, Arendt-Nielsen L. Vascular response of human skin after analgesia with EMLA cream. *Br J Anaesth*. 1989;63:655-660. [Abstract](#)
42. Hallen B, Uppfeldt A. Does lidocaine-prilocaine cream permit pain-free insertion of IV catheters in children? *Anesthesiology*. 1982;57:340-342.
43. Moller C. A lignocaine-prilocaine cream reduces venipuncture pain. *Ups J Med Sci*. 1985;90:293-298. [Abstract](#)
44. Baxter AL, Ewing PH, Evans N, Manworren R, Ware A, Mix A. EMLA application in ED triage increases venipuncture success. *PAS*. 2005;57:2902 (a).
45. Law RM, Halpern S, Martins RF, Reich H, Innanen V, Ohlsson A. Measurement of methemoglobin after EMLA analgesia for newborn circumcision. *Biol Neonate*. 1996;70:213-217. [Abstract](#)
46. Taddio A, Ohlsson K, Ohlsson A. Lidocaine-prilocaine cream for analgesia during circumcision in newborn boys. *Cochrane Database Syst Rev*. 2000(2):CD000496.
47. Halperin DL, Koren G, Attias D, Pellegrini E, Greenberg ML, Wyss M. Topical skin anesthesia for venous, subcutaneous drug reservoir and lumbar punctures in children. *Pediatrics*. 1989;84:281-284. [Abstract](#)
48. Kaur G, Gupta P, Kumar A. A randomized trial of eutectic mixture of local anesthetics during lumbar puncture in newborns. *Arch Pediatr Adolesc Med*. 2003;157:1065-1070. [Abstract](#)
49. Halperin SA, McGrath P, Smith B, Houston T. Lidocaine-prilocaine patch decreases the pain associated with the subcutaneous administration of measles-mumps-rubella vaccine but does not adversely affect the antibody response. *J Pediatr*. 2000;136:789-794. [Abstract](#)
50. Halperin BA, Halperin SA, McGrath P, Smith B, Houston T. Use of lidocaine-prilocaine patch to decrease intramuscular injection pain does not adversely affect the antibody response to diphtheria-tetanus-acellular pertussis-inactivated poliovirus-Haemophilus influenzae type b conjugate and hepatitis B vaccines in infants from birth to six months of age. *Pediatr Infect Dis J*. 2002;21:399-405. [Abstract](#)
51. Singer AJ, Stark MJ. LET versus EMLA for pretreating lacerations: a randomized trial. *Acad Emerg Med*. 2001;8:223-230. [Abstract](#)
52. Taddio A, Ohlsson A, Einarson TR, Stevens B, Koren G. A systematic review of lidocaine-prilocaine cream (EMLA) in the treatment of acute pain in neonates. *Pediatrics*. 1998;101:E1.
53. de Waard-van der Spek FB, Oranje AP. Purpura caused by Emla is of toxic origin. *Contact Dermatitis*. 1997;36:11-13. [Abstract](#)
54. Neri I, Savoia F, Guareschi E, Medri M, Patrizi A. Purpura after application of EMLA cream in two children. *Pediatr Dermatol*. 2005;22:566-568. [Abstract](#)
55. Goldman RD. ELA-max: a new topical lidocaine formulation. *Ann Pharmacother*. 2004;38:892-894. [Abstract](#)
56. Eichenfield LF, Funk A, Fallon-Friedlander S, Cunningham BB. A clinical study to evaluate the efficacy of ELA-Max (4% liposomal lidocaine) as compared with eutectic mixture of local anesthetics cream for pain reduction of venipuncture in children. *Pediatrics*. 2002;109:1093-1099. [Abstract](#)
57. Koh JL, Harrison D, Myers R, Dembinski R, Turner H, McGraw T. A randomized, double-blind comparison study of EMLA and ELA-Max for topical anesthesia in children undergoing intravenous insertion. *Paediatr Anaesth*. 2004;14:977-982. [Abstract](#)

58. Taddio A, Soin HK, Schuh S, Koren G, Scolnik D. Liposomal lidocaine to improve procedural success rates and reduce procedural pain among children: a randomized controlled trial. *CMAJ*. 2005;172:1691-1695. [Abstract](#)
59. Baxter AL, Fisher RG, Burke BL, Goldblatt SS, Isaacman DJ, Lawson ML. Local anesthetic and stylet styles: factors associated with resident lumbar puncture success. *Pediatrics*. 2006;117:876-881. [Abstract](#)
60. Lawson RA, Smart NG, Gudgeon AC, Morton NS. Evaluation of an amethocaine gel preparation for percutaneous analgesia before venous cannulation in children. *Br J Anaesth*. 1995;75:282-285. [Abstract](#)
61. O'Brien L, Taddio A, Lyszkiewicz DA, Koren G. A critical review of the topical local anesthetic amethocaine (Ametop) for pediatric pain. *Paediatr Drugs*. 2005;7:41-54. [Abstract](#)
62. Borland M, Jacobs I, King B, O'Brien D. A randomized controlled trial comparing intranasal fentanyl to intravenous morphine for managing acute pain in children in the emergency department. *Ann Emerg Med*. 2007;49:335-340. [Abstract](#)
63. Bishai R, Taddio A, Bar-Oz B, Freedman MH, Koren G. Relative efficacy of amethocaine gel and lidocaine-prilocaine cream for Port-a-Cath puncture in children. *Pediatrics*. 1999;104:e31.
64. Curry SE, Finkel JC. Use of the Synera patch for local anesthesia before vascular access procedures: a randomized, double-blind, placebo-controlled study. *Pain Med*. 2007;8:497-502. [Abstract](#)
65. Sethna NF, Verghese ST, Hannallah RS, Solodiuk JC, Zurakowski D, Berde CB. A randomized controlled trial to evaluate S-Caine patch for reducing pain associated with vascular access in children. *Anesthesiology*. 2005;102:403-408. [Abstract](#)
66. Smith GA, Strausbaugh SD, Harbeck-Weber C, Cohen DM, Shields BJ, Powers JD. Tetracaine-lidocaine-phenylephrine topical anesthesia compared with lidocaine infiltration during repair of mucous membrane lacerations in children. *Clin Pediatr (Phila)*. 1998;37:405-412. [Abstract](#)
67. Agarwal A, Yadav G, Gupta D, Tandon M, Dhiraaj S, Singh PK. Comparative evaluation of myolaxin and EMLA cream for attenuation of venous cannulation pain: a prospective, randomised, double blind study. *Anaesth Intensive Care*. 2007;35:726-729. [Abstract](#)
68. Zempsky WT, Parkinson TM. Lidocaine iontophoresis for topical anesthesia before dermatologic procedures in children: a randomized controlled trial. *Pediatr Dermatol*. 2003;20:364-368. [Abstract](#)
69. Galinkin JL, Rose JB, Harris K, Watcha MF. Lidocaine iontophoresis versus eutectic mixture of local anesthetics (EMLA) for IV placement in children. *Anesth Analg*. 2002;94:1484-1488. [Abstract](#)
70. Zempsky WT, Sullivan J, Paulson DM, Hoath SB. Evaluation of a low-dose lidocaine iontophoresis system for topical anesthesia in adults and children: a randomized, controlled trial. *Clin Ther*. 2004;26:1110-1119. [Abstract](#)
71. Luhmann J, Hurt S, Shootman M, Kennedy R. A comparison of buffered lidocaine versus ELA-Max before peripheral intravenous catheter insertions in children. *Pediatrics*. 2004;113:e217-220. [Abstract](#)
72. Patterson P, Hussa AA, Fedele KA, Vegh GL, Hackman CM. Comparison of 4 analgesic agents for venipuncture. *AANA J*. 2000;68:43-51. [Abstract](#)
73. Jimenez N, Bradford H, Seidel KD, Sousa M, Lynn AM. A comparison of a needle-free injection system for local anesthesia versus EMLA for intravenous catheter insertion in the pediatric patient. *Anesth Analg*. 2006;102:411-414. [Abstract](#)
74. Becker BM, Helfrich S, Baker E, Lovgren K, Minugh PA, Machan JT. Ultrasound with topical anesthetic rapidly decreases pain of intravenous cannulation. *Acad Emerg Med*. 2005;12:289-295. [Abstract](#)
75. Berkowitz D, Cohen IT. Laser assisted anesthesia prior to intravenous cannulation; acceptability and effectiveness in children. *E-PAS*. 2007;61:4. [Abstract]
76. Tansey B. Needle pain device OKd for children. *San Francisco Chronicle*. August 18, 2007.
77. Mawhorter S, Daugherty L, Ford A, Hughes R, Metzger D, Easley K. Topical vapocoolant quickly and effectively reduces vaccine-associated pain: results of a randomized, single-blinded, placebo-controlled study. *J Travel Med*. 2004;11:267-272. [Abstract](#)

## Authors and Disclosures

As an organization accredited by the ACCME, Medscape, LLC requires everyone who is in a position to control the content of an education activity to disclose all relevant financial relationships with any commercial interest. The ACCME

defines "relevant financial relationships" as financial relationships in any amount, occurring within the past 12 months, including financial relationships of a spouse or life partner, that could create a conflict of interest.

Medscape, LLC encourages Authors to identify investigational products or off-label uses of products regulated by the US Food and Drug Administration, at first mention and where appropriate in the content.

---

## Author(s)

---

**Amy L Baxter, MD**

Staff Physician, Department of Emergency Medicine, Scottish Rite Hospital, Atlanta, Georgia

Disclosure: Amy L. Baxter, MD, has disclosed that she is a member of MMJ Labs LLC, a company that holds patents to medical devices.

Medscape Pediatrics © 2008 Medscape, LLC

---

### Contents of *Topical Anesthetics in Children* [<http://cme.medscape.com/viewprogram/8767>]

1. Topical Anesthetics in Children  
[<http://cme.medscape.com/viewarticle/570327>]

## CME/CE Information

**CME/CE Released: 02/19/2008; Valid for credit through 02/19/2009**

**This activity has expired.**

The accredited provider can no longer issue certificates for this activity. Medscape cannot attest to the timeliness of expired CME activities.

## Target Audience

---

This activity is intended for pediatricians, primary care and emergency department clinicians, nurses, and other healthcare professionals who provide services to children and adolescents.

## Goal

---

The goal of this activity is to provide a review of current guidelines to help physicians provide safe and effective topical anesthesia in pediatric patients.

## Learning Objectives

---

Upon completion of this activity, participants will be able to:

1. Review techniques for safe and effective application of topical anesthetics in pediatric patients
2. Review the rationale for treating needle pain
3. List acceptable topical medications and devices used in children to minimize anxiety and suffering

## Credits Available

---

**Physicians** - maximum of 0.5 *AMA PRA Category 1 Credit(s)*<sup>™</sup>

**Nurses** - 0.5 *nursing* (0.5 contact hours are in the area of pharmacology)


All other healthcare professionals completing continuing education credit for this activity will be issued a certificate of participation.

Physicians should only claim credit commensurate with the extent of their participation in the activity.

## Accreditation Statements

---

### For Physicians

 Medscape, LLC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

Medscape, LLC designates this educational activity for a maximum of 0.5 **AMA PRA Category 1 Credit(s)**<sup>™</sup>. Physicians should only claim credit commensurate with the extent of their participation in the activity.

[Contact This Provider](#)

### For Nurses

This Activity is sponsored by Medscape Continuing Education Provider Unit.

Medscape is an approved provider of continuing nursing education by the New York State Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.

Awarded 0.5 contact hour(s) of continuing nursing education for RNs and APNs; 0.5 contact hours are in the area of pharmacology.

Provider Number: 6FDKKC-PRV-05

[Contact This Provider](#)

For questions regarding the content of this activity, contact the accredited provider for this CME/CE activity noted above. For technical assistance, contact [CME@medscape.net](mailto:CME@medscape.net)

## Instructions for Participation and Credit

---

There are no fees for participating in or receiving credit for this online educational activity. For information on applicability and acceptance of continuing education credit for this activity, please consult your professional licensing board.

This activity is designed to be completed within the time designated on the title page; physicians should claim only those credits that reflect the time actually spent in the activity. To successfully earn credit, participants must complete the activity online during the valid credit period that is noted on the title page.

Follow these steps to earn CME/CE credit\*:

1. Read the target audience, learning objectives, and author disclosures.
2. Study the educational content online or printed out.
3. Online, choose the best answer to each test question. To receive a certificate, you must receive a passing score as designated at the top of the test. Medscape encourages you to complete the Activity Evaluation to provide feedback for future programming.

You may now view or print the certificate from your CME/CE Tracker. You may print the certificate but you cannot alter

it. Credits will be tallied in your CME/CE Tracker and archived for 6 years; at any point within this time period you can print out the tally as well as the certificates by accessing "Edit Your Profile" at the top of your Medscape homepage.

\*The credit that you receive is based on your user profile.

### Hardware/Software Requirements

---

Medscape requires version 4.x browsers or higher from Microsoft or Netscape. Certain educational activities may require additional software to view multimedia, presentation or printable versions of their content. These activities will be marked as such and will provide links to the required software. That software may be: [Macromedia Flash](#), [Apple Quicktime](#), [Adobe Acrobat](#), [Microsoft Powerpoint](#), [Windows Media Player](#), and [Real Networks Real One Player](#).

Developed and funded by

**Medscape**