Pain reduction during infant and pediatric phlebotomy

By Dennis J. Ernst, MT(ASCP)

Throughout human history, pain and its alleviation have been at the heart of healthcare. The cruel irony is that sometimes we have to inflict a little pain to prevent an appreciable amount of pain. Such is the case with phlebotomy. When performed on infants, the pain not only affects the patient but also can be distressing to the collector and parents. It is no small wonder then that pain during infant phlebotomy has been so intensely researched and has led to the development of myriad practices, therapies, and devices to minimize it.

Sensitized to pain?

Researchers at the Hospital for Sick Children in Toronto, Ontario, wanted to see if babies subjected to repeat heelsticks would learn to anticipate pain. To measure infant pain, they graded the intensity of grimacing and crying as pain indicators. Babies of diabetic mothers — who were subjected to repeat heelsticks in the first 24 to 36 hours of life because of their mothers’ condition — were used as the study group. The control group was comprised of babies from non-diabetic mothers (i.e., those not subjected to repeat heelsticks). When venipunctures were later performed on both groups, the babies who were subjected to repeat heelsticks demonstrated lower pain scores. The researchers concluded babies learn to anticipate pain. Other researchers have come to similar conclusions.

But forget venipunctures for a moment. Two studies attempted to determine what happens to an infant’s pain response when the number of heelsticks to which he is subjected increases. Does he become sensitized to heelsticks or not? While one study showed infant pain increases proportionately with the number of heelsticks performed (as measured by heart rate and behavioral responses), the other study concluded the frequency of heelsticks may actually lower pain scores.

Oral analgesics

One of the most intensely researched areas of infant pain reduction during phlebotomy has focused on the analgesic effects of pacifiers, oral solutions, and breastfeeding. Several studies prove the use of pacifiers during heelsticks and venipunctures on term and preterm infants reduces pain responses. While pacifiers may be helpful, dozens of studies have measured the benefits of various concentrations of sugar solutions given orally in reducing pain during blood sampling. Research conclusively determined that sucrose, sacrose, and dextrose solutions administered before or during heelsticks and venipunctures significantly reduce pain scores on term and preterm infants. With the exception of one of the studies, the effect of the solutions does not seem to be a function of the type of sugar solution or its concentration, but was found to be universal when administered just minutes before the procedure.

Several studies herald the benefits of breastfeeding during heelsticks and venipunctures as an effective means of reducing infant pain. In one of them, researchers studied the reactions of 180 infants during venipunctures performed by experienced nurses to the dorsal aspect of the infants’ hands. One group was breast fed, one group was held in their mothers’ arms without being fed, one group was given sterile water as a placebo, and a fourth group was given 30% glucose followed by a pacifier. Behaviors associated with pain were measured according to two acute-pain rating scales. The breast-fed group and those bottle-fed with glucose showed a significant reduction in pain-related responses over the other groups.

The nose knows

Is it possible that aromatherapy has benefits?

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when it comes to reducing pain in infants? Researchers at the Gettysburg College in Gettysburg, PA, think so. They exposed healthy preterm newborns to odors while subjecting them to heelsticks and venipunctures. One-third of the infants were exposed to an odor with which they had been familiarized prior to the draw; one-third were presented with an odor with which they had not been familiarized; and one-third were not exposed to an odor at all. Their response to pain as indicated by crying and grimacing was observed. Those exposed to an unfamiliar odor or no odor at all demonstrated significant increases in their pain responses than those exposed to a familiar odor. The researchers stated the results reinforced prior evidence of early memory and olfactory competence in newborns and fetuses.

Topical anesthetics

Topical anesthetics have long been used to manage minor pain. But are they effective in reducing venipuncture pain? Studies show they might be effective — and they might not be.

One of the commonly known pharmaceutical interventions to the pain of venipuncture is a mixture of lidocaine and prilocaine, often marketed under the brand name EMLA (Abaxis Pharmaceuticals). Other topical anesthetics include L.M.X4 (4% lidocaine) (Ferndale Labs), and Ametop (Smith & Nephew Healthcare).

Researchers have found that topical anesthetics such as EMLA are as effective as other forms of topical anesthesia in children (e.g., iontophoresis or 4% amethocaine cream), but phlebotomists may be inconvenienced by the 60-minute waiting period required for EMLA to take effect and the complications that can occur when the venipuncture site is selected by someone other than the person performing the procedure. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.) Some researchers found EMLA to be effective for pediatric and adult venipunctures. Others found it to be no more effective in minimizing the pain of venipunctures and heelsticks on infants than a placebo. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.) Some researchers found EMLA to be effective for pediatric and adult venipunctures. Others found it to be no more effective in minimizing the pain of venipunctures and heelsticks on infants than a placebo. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.) Some researchers found EMLA to be effective for pediatric and adult venipunctures. Others found it to be no more effective in minimizing the pain of venipunctures and heelsticks on infants than a placebo. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.) Some researchers found EMLA to be effective for pediatric and adult venipunctures. Others found it to be no more effective in minimizing the pain of venipunctures and heelsticks on infants than a placebo. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.) Some researchers found EMLA to be effective for pediatric and adult venipunctures. Others found it to be no more effective in minimizing the pain of venipunctures and heelsticks on infants than a placebo. (Because EMLA is a prescription medication, it is usually administered by a nurse, physician, or parent who may not choose the same venipuncture site as would the phlebotomist.)

One intriguing study showed EMLA to be effective, however, when inserting 20-gauge needles into the back of the hands of newborns. No explanation was given for the use of 20-gauge needles as opposed to the significantly smaller 23-gauge needles, which are more likely to be used for newborn venipunctures.

Ferndale Laboratories offers a non-prescription EMLA competitor: L.M.X4 (formerly ELA-Max), claiming activation within 15 to 30 minutes. Studies have shown no difference in effectiveness between the two; some report faster onset with L.M.X4. Due to additional side effects of both lidocaine products, however, researchers suggest more studies are necessary to determine their safety and effectiveness. Others suggest the absence of prilocaine in L.M.X4, which rarely causes methemoglobinemia, gives it the edge for neonatal use.

Researchers in Wales found Ametop gel (4% amethocaine) to be more effective than EMLA in minimizing venipuncture pain in pediatrics between one and 15 years old. Another study found Ametop effective in reducing the pain of venipunctures in the newborn but not for heelsticks.

Finally, tetracaine is also being studied as a topical anesthetic during venipuncture. Two journals published independent studies showing a significant reduction in pain in children using a tetracaine patch when venipuncture was performed 30 minutes after its application compared to a placebo patch. If a phlebotomist does not have the luxury of waiting for an anesthetic cream to take effect or if lathering up the patient with an ointment is
difficult, one of the several available spray-on anesthetic products might be considered. Such products instantly numb the surface of the skin, but how do they compare to the alternatives? One study showed that children upon whom a skin-chilling ethyl-chloride spray was used reported less pain than when Ametop gel was used. Others found an ethyl-chloride spray significantly reduced the pain of venipuncture, but not as much as intradermal lidocaine. In a third study, researchers let children and teens ages three to 18 rate the pain they felt after being administered a spray-on form of either isopropyl alcohol or ethyl alcohol. The differences were insignificant.

But how do topical anesthetics compare to orally administered sugar solutions? Researchers in Sweden gave a nod to the sweet. When measuring the pain-reducing effects of oral glucose vs. that of EMLA, the sugar solution decreased pain by 42% as opposed to 19% for the topical anesthetic. Those infants who were given oral glucose not only demonstrated lower pain responses but also the duration of their crying was significantly lessened. Since crying in newborns is associated with temporary elevations in white-blood-cell counts, administering oral glucose (under nursing supervision) is a practical way to minimize this pre-analytical effect, which can present an erroneous picture to the physician.

**Iontophoresis**

A significant decrease in the time it takes anesthetics to become effective against venipuncture pain can be accomplished with electrical stimulation through iontophoresis. When an anesthetic like lidocaine is delivered — not by the application of an ointment, but by a low-voltage electrical current — the result is a faster and deeper topical numbing. Physicians at Atlanta’s Egleston Children’s Hospital, along with researchers at the nearby Emory University School of Medicine, found lidocaine iontophoresis led to a threefold reduction in pain compared with placebo when applied prior to IV catheter placement. Products that utilize this technology for needle insertion include Numby Stuff (Iomed, www.iomed.com), Li-dosite (B. Braun, www.bbraun.com), and Needle-Buster (Life-Tech, www.life-tech.com). Some iontophoresis devices are not recommended for children under five years of age. It has been reported that younger children do not tolerate the tingling sensation such devices produce on the skin. A fourth company, AlgoRx Pharmaceuticals, markets ALGRX 3268, a needle-free injection system for accelerating lidocaine into the tissue using helium gas and a triggering device.

Many studies have compared pain responses in infants undergoing heelsticks vs. those elicited during venipuncture. The research conclusively shows venipunctures elicit lower pain responses than heelsticks.

**Parental involvement and distraction**

The role parents play in minimizing pain during infant and pediatric blood sampling is becoming increasingly obvious. Asking the parent how their child reacts to stimuli similar to a venipuncture, such as a pinched finger, can be helpful. Australian researchers concluded that those who make this inquiry are likely to identify pediatrics who will experience the greatest distress during the venipuncture. They also speculated that parents might choose to downplay venipuncture pain to their children in advance of the procedure. For a child who responds strongly to sudden sharp pain, this might help to prevent him from making a scene.

Halfway around the world, researchers at the St. James’s University Hospital in Leeds, West Yorkshire, England, found significant reductions in pain and fear when various forms of psychological interventions were implemented during pediatric venipuncture procedures. Researchers there reviewed the literature and found that...
pain and fear ratings decrease with age, and that girls over eight years old are more likely than boys to describe needles as "unpleasant" whereas boys prefer "intensely painful." Predictably, parental factors, including parental anxiety, correlated highly with child distress. The authors reported that parents who were taught and encouraged to use distraction and comforting techniques were more satisfied with the care their child received than those who were present but not taught such techniques. Children who were newly diagnosed with a chronic illness reported higher pain and more fear than those who had a long-term chronic illness. Procedural cues (i.e., seeing samples of blood, hearing blood collection personnel) seemed to heighten anxiety in pediatric patients.

This author concludes that not enough specimen-collection personnel are properly trained to employ psychological interventions on pediatric patients. Proposed solutions include:

- assessing the child’s prior experiences. Inquire as to the child’s past needle experiences and the circumstances surrounding them that might have been traumatic (e.g., the needle sensation, restraint, the tourniquet, bruising, and so forth).
- preparing the pediatric patient. Articulate the actual steps of the procedure to both child and parent(s) prior to performing the venipuncture. Explaining what the child might feel, sense, smell, see, and hear was believed to be a critical component of preparation including an accurate account of what the sensation of needle insertion will be. This author cautions against the use of topical anesthetics, arguing that the mere application of the anesthetic may generate anxiety, serving as an early warning of an imminent venipuncture. The anticipatory effect may outweigh the potential pain relief the pharmaceutical provides.
- involving the parent. Invite the parent to provide support and distraction.
- allowing the patient to participate in the procedure. Depending on the age of the child, engineer the procedure to be a partnership with the child rather than for the procedure to be something to which the child is subjected. Suggested participation could include having the child choose the cleanse site, sit up or lie down, and similar choices.
- giving the child permission to cry. Such approval was seen to result in less stress than if the child was told to “be brave.”

This author does not recommend keeping pediatric outpatients in the drawing area for a prolonged period prior to the procedure. The environment exposes the child to related cues that serve as reminders of the imminent procedure, and affords the child time to dwell on prior traumatic needle experiences.

A study published in the Journal of Holistic Nursing reviewed what had been reported on the effect of parental involvement on the pain, fear, and distress children experience when undergoing venipuncture procedures. The study’s conclusion? Parents who demonstrate high coping skills have children who feel less distress, while highly distressed parents lead to children who cope poorly with the procedure. Also reported in this study was that forcing a child to lie flat during a venipuncture procedure was likely to lead to crying, panicking, and struggling. Positioning the child in a secure parental hug (i.e., with close physical contact), however, promoted the child's sense of control and required fewer assistants.

To determine the effectiveness of parental positioning and distraction on pediatric pain, fear, and distress, the researchers observed 43 pediatric patients between the ages of four and 11 undergoing venipuncture or IV insertion. Children in the control group were only provided with parental presence and an explanation of the procedure. Parents of children in the study group were coached on positioning and distracting techniques to employ during the procedure. Children in the latter group were able to choose between one of three distraction techniques: a kaleidoscope, a book with hidden pictures in multiple graphic designs, and a book requiring the child to open flaps to find hidden objects.

Parents in the study group were instructed to engage the child in questions related to the chosen distraction from the moment the tourniquet was applied until the bandage was placed on the puncture site. Researchers concluded that children whose parents used a positioning-distraction strategy showed less fear. Although not statistically significant, those children reported that they felt less pain and were less fearful than did the children of parents who did not employ positioning-distraction techniques. Another study found the use of a kaleidoscope not to be an effective distraction. It comes as no surprise to most mothers that television is a better analgesic than parental distraction. A study reported in the Archives of Diseases in Childhood found that children watching cartoons on television during venipuncture procedures felt less pain than those whose mothers distracted them during the procedure. A second study reinforced the anesthetizing nature of television by reporting that passive distraction provided by movies was more effective in reducing pain during pediatric venipunctures than an interactive toy distraction.

Researchers in Thailand tested the effects of four kinds of non-pharmacologic interventions on pain responses in infants undergoing heelsticks. The clear winner: swaddling. Holding the child tightly wrapped in a blanket during the procedure was found to be highly effective in minimizing pain scores.

Even leg massage has been found to be effective. Researchers at the University of Calgary found that a gentle massage of the leg prior to heelstick in preterm infants was safe, and decreased their pain responses. A skin-to-skin positioning of the baby in the mother’s arms called “Kangaroo Care” was also found to be effective analgesic for preterm infants undergoing heelsticks. When measured against pain responses in infants placed in a warmer without skin contact, the mother’s touch proved superior.

With the wide variety of infant and pediatric pain-reduction strategies, laboratories can lessen the cruel irony of healthcare that requires the infliction of pain in order to prevent suffering. Since negative early-childhood experiences with sharps can lead to a lifelong phobia of needles, healthcare professionals who draw from pediatric patients are in a powerful position to prevent unpleasant experiences resulting in a young patient’s future avoidance of medical procedures that might seriously affect his health. Employing a combination of pain-reduction strategies helps bring infants and young patients into a kinder, gentler healthcare environment. 

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References


Cover Story

Touch therapy

Many holistic therapists already know the power of the human touch. But can physical contact be a tool in reducing pain during infant phlebotomy?

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