Pain management during vaccination: Recommendations from a Canadian clinical practice guideline

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M Ipp, A Taddio. Pain management during vaccination: Recommendations from a Canadian clinical practice guideline. Paediatr Child Health 2011;16(9):541-543.

Vaccination pain is the most common cause of iatrogenic pain in healthy children, and is a cause of stress for both children and their parents. Despite an abundance of research demonstrating the effectiveness and safety of pharmacological, physical and psychological techniques to reduce pain from vaccine injections, this pain remains undertreated. Health care providers report that a lack of knowledge about feasible and effective interventions is a barrier to vaccination pain management. The present review provides vaccinators with several feasible and evidence-based options that can be implemented in any clinical setting without additional resources. It is expected that managing vaccination pain will not only improve the quality of care delivered to children and their families, but also improve parental and vaccinator satisfaction with the vaccination experience.

Key Words: *Children; Pain management; Vaccination*

La prise en charge de la douleur pendant la vaccination : les recommandations tirées de directives canadiennes de pratique clinique

La douleur de la vaccination est la principale cause de douleur iatrogène chez les enfants en santé, et elle est un facteur de stress à la fois pour les enfants et pour leurs parents. Malgré l'abondance de recherches démontrant l'efficacité et l'innocuité de techniques pharmacologiques, physiques et psychologiques pour réduire la douleur attribuable à l'injection de vaccins, cette douleur demeure sous-traitée. Les dispensateurs de soins déclarent qu'un manque de connaissances sur les interventions faisables et efficaces représente un obstacle à la prise en charge de la douleur de la vaccination. La présente analyse fournit aux vaccinateurs plusieurs possibilités faisables et probantes qui peuvent être adoptées dans tout milieu clinique, sans ajout de ressources. On prévoit que la prise en charge de la douleur attribuable à la vaccination améliorera non seulement la qualité des soins aux enfants et à leur famille, mais également la satisfaction des parents et des vaccinateurs à l'égard de l'expérience de vaccination.

"Am I going to get a shot?"

Every nurse or physician who works with children has entered an examining room to find a cowering child whose first question is related to getting a needle (1). Yet, little attention has been devoted to this childhood expression of angst and to the accumulating evidence supporting methods of minimizing vaccine injection pain. Vaccination is highly effective in preventing serious infectious diseases, yet it is known to be the most common painful medical procedure performed on healthy children worldwide. This makes them a great source of anxiety and distress. In fact, the most common vaccine-related concern of parents is their child's pain (2). The psychological trauma from vaccine injections also leads to needle fears in approximately 10% of individuals, with substantial public health implications including future vaccine noncompliance (3). Therefore, making children more comfortable during vaccine injections is not only humane, but also a scientifically and medically justified preventive health measure.

Currently, pharmacological (eg, topical anesthetics or sugar water) and psychological pain-relieving interventions are mandated in many paediatric institutions (4,5). Similar strategies are effective for reducing vaccination pain (6), yet they are rarely used in clinical practice (7,8). Common reasons given by doctors and nurses for not trying to minimize vaccination pain include "it only hurts for a minute", "infants and children don't remember the pain", "it's only a needle", "I give lots of injections and I just want to get it over with quickly as I don't have time for all this pain management stuff", "children need to learn to cope with pain which is part of life", "they cry anyway so what's the difference" and "analgesic creams cost too much and don't work that well" (3).

One only needs to consider how far we have come over the past two decades in providing evidence for paediatric pain reduction for other common procedures not previously considered worthy of analgesia. Successful paediatric pain prevention has been put into practice for venipuncture (topical anesthetics [9]), circumcision (dorsal nerve block [10]), heel prick for neonatal screening (sugar water [11]) and endotracheal intubation in neonates (opioid analgesia [12]). This list, which is not exhaustive, serves to highlight how remiss we have been in gathering evidence and implementing mechanisms of pain prevention for vaccine injections.

In the present review, our objective is to provide vaccinators with a variety of evidence-based strategies that can be easily implemented in clinical practice to alleviate childhood vaccination pain. The strategies included are derived primarily from an evidence-based clinical practice guideline (CPG) for reducing the pain associated with childhood vaccination recently published in the *Canadian Medical Association Journal* (with an online link to parent and clinician tools, and an educational video) (6). The CPG practice recommendations are divided into five categories: methods to reduce pain specifically in infants, ways of fine-tuning the injection procedure, parent-led distraction strategies, pharmacological techniques and general psychological strategies. Although numerous strategies are included in the CPG, it is not imperative that vaccinators use all of these for every child undergoing a vaccine injection. Instead, it would benefit practitioners if they selected strategies that work best for the children they vaccinate, keeping in mind that combining individual strategies provides optimal pain relief. We review the CPG recommendations according to their timing of implementation relative to vaccine injection. Figure 1 presents a timeline of administration for the various pain-relieving interventions.

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Accepted for publication April 29, 2011

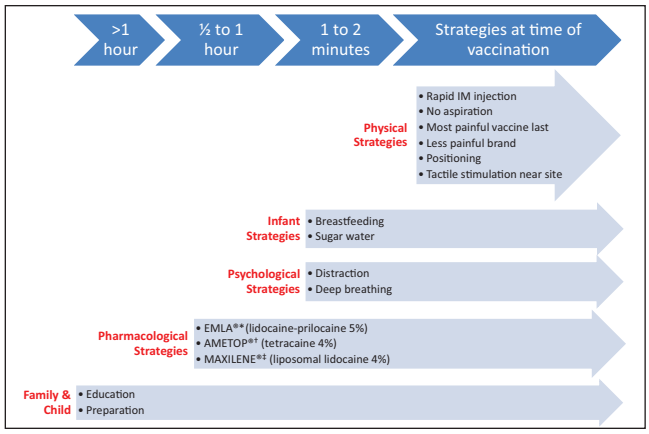

Figure 1) *Timeline for pain-relieving strategies before and during vaccine injection: physical, psychological and pharmacological strategies. Manufacturers: *AstraZeneca Canada Inc; †Smith & Nephew Inc, Canada; ‡RGR Pharma Ltd, Canada. IM Intramuscular*

STRATEGIES THAT CAN BE IMPLEMENTED AT THE TIME OF VACCINE INJECTION

Several pain-relieving strategies can be used during the injection. They do not require any planning, any cost or any additional resources.

Rapid intramuscular injection without aspiration

Administering intramuscular injections rapidly without previous aspiration causes less pain than slow intramuscular injections with previous aspiration (13). Aspiration (pulling back on the plunger before injection) is not required for intramuscular vaccine injections. The aspiration technique was initially proposed for safety reasons to prevent inadvertent penetration of blood vessels during injection. It is now recognized that there are no major blood vessels in the two suggested injection sites for vaccination (anterolateral thigh in infants, and deltoid area in toddlers and older); aspiration is, therefore, no longer recommended (14). There have not been any reported cases of injection of a vaccine into a blood vessel in humans at these injection sites. Slow injection of the vaccine was initially recommended to minimize pain from sudden distention of the tissues by vaccine material. That hypothesis and recommendation, however, was based on expert opinion alone without being subjected to scientific study (15,16).

Order of injections

When multiple injections are given during the same visit, it is recommended that the most painful vaccine be administered last to decrease vaccination pain (17). From currently available evidence, vaccines known to be more painful than others are M-M-R* II (Merck Canada Inc) and Prevnar 13 (Wyeth, Canada [owned by Pfizer Canada Inc]). When these vaccines are coupled with other vaccines, they should be given last (17-19). The pain associated with injection of these vaccines may be related to physical or chemical factors such as lower pH, osmolality, adjuvants and excipients.

Brand of vaccine

Some vaccines that are marketed by different manufacturers are considered to be therapeutically interchangeable. The amount of pain they cause when injected, however, may differ. Currently, the pain associated with two brands of measles-mumps-rubella vaccine – Priorix (GlaxoSmithKline Inc, Canada) and M-M-R* II – has been compared in trials involving children (18,19). Less pain was reported by children who received the Priorix brand; thus, Priorix should be used rather than M-M-R* II where possible and when available (18,19).

Child position and tactile stimulation

Other strategies for decreasing vaccine pain and distress that can be implemented relate to child positioning and the use of tactile stimulation. The best position for young infants and children before and during vaccination is to be held in the caregiver's arms (this provides comfort and security) or to have the child sit upright (rather than lying on the examination table) (6). Lying supine has been shown to result in more pain than sitting upright or being held by the caregiver, presumably because it is associated with higher anxiety. Tactile stimulation, provided by rubbing or stroking the skin near the injection site immediately before and during the injection, has also been shown to reduce pain felt by children receiving a vaccination (6). The tactile stimulation approach is believed to involve competition between the sensation of touch and pain evoked by the injection (20).

STRATEGIES THAT CAN BE IMPLEMENTED WITH SOME PREVIOUS PLANNING

Parent and child preparation

Before administering the vaccine, it is important to encourage parents to remain calm because their actions and words can, in fact, influence their child's reaction, even in very young infants. A calm and soothing or normal voice will help the child feel that everything is okay. High-anxiety words like 'pain', 'needle' or 'shot' should be avoided. In addition, apologizing phrases like "I'm sorry you have to go through this", "I know it hurts" or "this is going to hurt me more than you", reassuring words like "it will be over soon" or criticizing words like "don't be a baby" or "you are such a suck" should be avoided. These words (and the way they are said) make children anxious and focus their attention on the procedure. Also, parents are encouraged not to say that 'it won't hurt' because it is an ineffective strategy and promotes distrust.

Moreover, parents can be encouraged to take an active role in preparing children ahead of time and coaching them through the procedure. Parents can tell children what is going to happen: "You will be getting a medicine called a vaccine which will be given in your arm in order to keep you healthy" and "there may be a pinch or pushing pressure that will last for a few seconds". In addition, parents can engage children in the process of selecting and implementing coping strategies: "Which arm would you like to use?" and "What toy do you want to bring with you?" Children (and families) can be instructed and encouraged to come to vaccine appointments with distraction strategies (such as toys or bubbles) and coping techniques. Finally, parents can coach children during the injection, keeping them focused on distraction strategies and congratulating them on getting through the procedure.

Psychological interventions

At the time of vaccine administration, distraction techniques that involve taking the child's attention away from the procedure can reduce pain experienced by children of all ages (6). The distraction can be provided either by the parent, the health care provider or the child (if old enough). For infants, providing toys, bubbles, singing and directing the baby's attention to something else in the room are effective. For toddlers, vaccinators may also use pop-up books, cell phone/electronic devices or party blowers. For school-age children, providing stories, videos, books, jokes, music, electronic devices and talking about something else are effective. For teenagers, most of the distractions mentioned above may be effective, as well as the use of MP3 players. Deep breathing for children three years of age or older is also an effective psychological pain-relieving technique – this can be facilitated with bubbles or toys (see section on parent and child preparation, above).

Breastfeeding or sugar water for infants

When it comes to pain relief specifically for infants (up to 12 months of age), breastfeeding during the vaccination procedure has been

shown to be highly effective (6). There are several explanations for this beneficial effect including the feeling of protection and safety experienced by the infant being held by its mother, the comfort and warmth of skin-to-skin contact and the taste of chemicals, such as lactose, in the breast milk. For mothers who feel uncomfortable breastfeeding their infant during the vaccination or unable to secure an adequate latch before injection, or for mothers who are bottle feeding their infants, a sweet tasting solution (sugar water) can be used (6). A commercial sugar water solution, TootSweet (Natus Medical Incorporated, USA), has recently been approved and is being sold to hospitals across Canada. Currently, there are no commercial preparations available for sale to the general public. However, this solution is simple and inexpensive to prepare, and can be made by mixing one sachet (approximately 1 teaspoon [5 mL]) of sugar with two teaspoons (10 mL) of water (makes a sugar water solution of approximately 25% strength). Up to 10 mL of the solution can be given to the infant with a syringe or pacifier 1 min to 2 min before the needle is injected. Parents need to be informed that sugar water is indicated for pain relief rather than general comfort or as a food replacement.

Topical anesthetics

Topical anesthetics (EMLA [AstraZeneca Canada Inc], Maxilene [RGR Pharma Ltd, Canada] and Ametop [Smith & Nephew Inc, Canada]) have been shown, in numerous well-conducted randomized, controlled studies, to significantly reduce vaccination pain (6). Topical anesthetics are mandated in academic paediatric institutions (as is the use of sucrose solutions) where it is generally accepted that iatrogenic pain is neither 'normal' nor 'acceptable' (4,5). They are available for purchase without a prescription in drugstores. Depending on the product, they must be applied 20 min to 1 h before the procedure, either at home or on arrival to the doctor's office. In infants <12 months of age, they should be applied to the anterolateral thigh, and in toddlers and children ≥12 months of age, to the deltoid area. Because most children will be receiving two (or more) vaccinations at each designated vaccine visit, the topical anesthetic needs to be applied to two different sites. It is important to explain to parents that temporary changes in skin colour (redness or whitening) may occur, and that these resolve fairly quickly after the topical anesthetic is wiped off the skin. The development of sensitization reactions are uncommon/rare following repeated use. Health care providers and parents should not expect a 100% reduction in pain from topical anesthesia alone – no pain-relieving intervention results in complete and reliable analgesia in all patients. In conjunction with other strategies, however, the effects can be very significant.

SUMMARY

Vaccination pain is a ubiquitous and universal issue. There are many inexpensive and safe strategies that can be used to mitigate vaccination pain including specific injection and psychological techniques, as well as pharmacological techniques. All of the strategies reviewed in the present article have been piloted in ambulatory and public health vaccination settings. Most strategies have been found to be feasible and effective, and parents and children certainly appreciate the efforts made to reduce pain associated with vaccination (21). It is time for children to benefit from the wealth of published data regarding this topic. Preventing pain during a medical procedure, such as vaccination, also has the potential to prevent the development of long-term needle fears observed in older children and adults. We challenge all health care professionals who administer childhood vaccinations to begin to apply some of the strategies outlined above, and to begin to experience the satisfaction that comes with adopting a child- and family-centred (rather than procedure-centred) approach to vaccinations. Reducing vaccine injection pain is not a waste of time. It is mostly cost free, easily implemented, effective and humane.

DISCLOSURES/COMPETING INTERESTS: Dr Moshe Ipp has received unrestricted research grants from Sanofi and GlaxoSmithKline. He has been a consultant for Wyeth, Merck, GlaxoSmithKline and Sanofi. He has received honoraria from Novartis, GlaxoSmithKline and Sanofi. Anna Taddio has received unrestricted research grants from Gebauer and Ferndale Laboratories, and study supplies from Ferndale Laboratories, Hawaii Medical and Gebauer.

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