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Topical Anesthetics in Children

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Introduction

Needle sticks are the most common[1] and greatest source of procedural pain[2] 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[3] and are remembered by preverbal children.[4] These effects may amplify with age: adolescents avoid medical treatment,[5] 16% to 75% of adults surveyed refuse to donate blood,[6-8] and geriatric patients refuse flu shots due to fear of needle pain.[9] The health implications of needle phobia extend beyond the affected individuals; HIV patients continued to infect others while delaying blood tests,[10] and needle phobic parents are less likely to immunize their children.[11]

Research yields a distinct, age-related phobia relating to the needle procedure,[12] suggesting untreated immunization pain is a significant contributor to needle phobia.[13-15] 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,"[16] only 2.1 of an estimated 18 million venipunctures each year are done with pain control.[17] 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.[18] 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.[19] Through the "gate theory," stimulating these C and A-beta fibers with cold or vibration[20] 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.[20] 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.[21,22]

The cortical reaction to sharp pain can be modulated through voluntary and external distraction.[23] Children old enough to watch bubbles, blow pinwheels, or play "I Spy" games don't notice a painful procedure as much. While very effective,[24] 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.