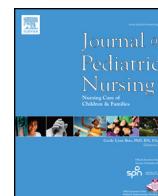




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Factors Associated With Infant Pain Severity Undergoing Immunization Injections

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ABSTRACT

Purpose: Factors influencing infants' behavioral and vocal (cry) response to painful stimuli are explored to improve pain management plans for infants undergoing immunizations.**Design and Methods:** An observational study design was used. Pain responses of 60 to 75 days-old infants (44% male vs 56% female) undergoing two-month immunization injections were videotaped and coded using the Modified Behavioral Pain Scale (MBPS), and duration of total crying time during injection was recorded. The influences of five factors (gender, caregiver attendance, previous experience of nociception (circumcision), mode of delivery), and weight (birth and current) were examined at baseline, during and post-immunization.**Results:** Higher birth weight was the most significant factor that reduced pain responses during ($p = 0.001$) and post-immunization ($p = 0.03$). A higher birth weight reduced full lung crying ($p = 0.04$), which reflects crying during injection as compared to total crying time. Vaginal delivery had a significant effect on behavioral pain responses of infants only post-immunization ($p = 0.006$). Parent's presence in the immunization room significantly reduced total crying time ($p = 0.03$). Uncircumcised male infants had a significant reduction in behavioral pain responses during immunization ($p = 0.01$) compared to circumcised infants.**Conclusions:** The literature well supports the acknowledgement of early pain experience and its psychological consequences. Knowing and controlling for each of mentioned factors early in life during every painful procedure could improve coping mechanisms of infants for any painful procedures later in life.**Practice Implications:** Control of certain factors during early life experiences can modify pain of immunization.

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Introduction

Research has shown that early exposure to environmental stress alters growth and development later in life (Ranger & Grunau, 2014). Infants' pain-related stress, as a result of routinely applied procedures such as immunizations, affects postnatal growth and development. Immunization pain is linked to short and long-term harmful physiological and neurodevelopmental effects in healthy infants. Infants experience frequent procedural pain during the period of physiological and psychological development, which appears to impact their postnatal development, and may activate a downstream cascade of stress signalling influencing later growth (Kassab, Sheehy, King, Fowler, & Foureur, 2012; Vinall et al., 2012).

Early painful experiences, even for a short period, may produce alterations to cellular memory in spinal nociceptive circuitry (Ruda, Ling, Hohman, Peng, & Tachibana, 2000). It has been found that painful

procedures early in life could decrease pain threshold later (Andrews & Fitzgerald, 1994; Piira, Champion, Bustos, Donnelly, & Lui, 2007), heightened distress, and heightened physiological pain responses for later medical procedures (Efe, Dikmen, Altaş, & Boneval, 2013; Peters et al., 2005). Another study found that early painful experience alters postnatal body weight (Vinall et al., 2012). Accordingly, infant's behavioral and vocal responses to painful stimuli vary considerably. While the same painful stimuli provoke a vigorous response of some infants; other infants of same age respond mildly (Stevens et al., 2013). No one exact mechanism could explain this difference; however, several explanations were suggested.

Within clinical immunization settings, some factors (e.g. gender, gestational age, infant disposition, and early painful incidences) may influence behavioral and vocal responses to painful stimuli among infants (Blount, Bunke, & Zaff, 2000; Piira et al., 2007).

In the immunization clinical setting both parents' and nurses' performances were found to be of great bearing on pain outcomes of infants and children (Chambers, Craig, & Bennett, 2002; Piira et al., 2007; Sweet & McGrath, 1999). For example, the distraction method used by parents may operate as a coping mechanism that enables infant's

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adaptive and coping aptitudes during an acute pain experience (Cohen, 2002; Piira et al., 2007; Sweet & McGrath, 1999). Cohen (2002) show that separating infants from their parents in treatment room during immunization could increase infants' pain behavior and associated stress. Sweet and McGrath (1999) stated that research investigating parents' role in reducing infants' pain during immunization is limited.

The responses of neonates (mainly preterm) to acute tissue-damaging stimuli have been described. However, factors that influence these responses, especially among term neonates, have received little attention. The current study sought to investigate possible factors that influence behavioral and vocal pain responses (crying) during and following an immunization injection. This is the first study to identify factors that influence infants' behavioral and vocal (cry) response to immunization pain stimuli.

Methods

Study Design

This observational descriptive study was conducted at mother and child health immunization centres. The examined factors were gender, caregiver attendance, the experience of early nociceptive stimuli (circumcision), mode of delivery and weight (birth and current). Parents who attended immunization clinics for their infants' two-month vaccinations against diphtheria, tetanus and cellular pertussis (DTaP), Haemophilus influenzae type B (Hib) and hepatitis B (HepB) were approached and asked to take part in the study.

Infants were excluded if any of their parents did not accompany them, if they were premature babies, receiving any medication before attending clinic such as paracetamol, were exposed to methadone (during the antenatal period), or had a neuromuscular disease that may modify their responses to painful stimuli. Human Research Ethics Committee approved the research protocol at University institution and the study immunization clinics.

Procedure

Behavioral pain responses including body and facial responses as well as vocal responses were videotaped on a Panasonic 2510 VCR (with real-time counter) throughout all study phases starting at 30 s prior, during and 3 min following the immunization injections. Parents participating in the study were asked to fill and sign a consent form before the start of videotaping and immunization procedure. Infants were placed in supine position on the examination table with the parent holding the infant's leg during injections, as per routine clinical practice at the immunization clinic. All infants attending their 2-month immunization received the same two vaccines (Diphtheria, Tetanus, Pertussis (DTaP), Haemophilus Influenzae type b (Hib)) consecutively without any delay at two different sites. One of the parents was asked to stay beside infant during immunization injections to cuddle and touch to tailor coping promoting vocalizations to suit their infant (e.g., sing songs that their infant is likely to enjoy). Attendee parent was asked to start coping-promoting statements at 30 s before the infant injection, during and until the end of the procedure.

The same nurse performed all immunization injections for all infants in the study. The standard protocol for administering injections involved swabbing the site of injection with distilled water, folding the skin of the thigh, and giving immunization intramuscularly by the nurse. After that, the parents were asked to use a pacifier or breastfeed their child as a comfort measure.

Data Collection

Behavioral pain responses were recorded using the Modified Behavioral Pain Scale (MBPS) (Kitamura & Burnham, 2003) during and after immunization. The scale ranges from 0 (no pain) to 10 (maximum

pain) and measures the following behavioral parameters of pain: facial expression, cry, and body movements. Infants were evaluated before the start of immunization procedure to detect those who were crying prior to the procedure and establishing a baseline for comparison during and after the immunization. MBPS has been validated with infants up to 18 months of age. The MBPS has good construct validity (Lindh, Wiklund, & Blomquist, 2003) and inter-rater reliability has been found to range between 0.88 and 0.94 (Lindh et al., 2003).

Behavioral and vocal pain measures were recorded at three stages: baseline (15 s preceding the injection), during injection (the first 15 s after the needle penetrates the skin) and post-immunization, which is also considered as the recovery phase (the next 3 min following the vaccine injection). Within each stage, MBPS scores were collected and then summed together to provide a total score for each phase ranging between 0 and 10.

Vocal pain responses were measured as total cry duration in seconds from the audio stream of the video recording and defined as the interval from the initiation of cry until a quiet interval of at least 5 s after immunization. Full-lung cry, defined as extreme crying during immunization, was also measured as a vocal pain response. Total crying measures both pain and stress responses and describes the length of crying before, during and after the procedure. The full-lung crying measures intensity of crying as a result of painful stimuli. The total number of invasive procedures experienced in the first four days of life was documented from medical records. Sucking including breastfeeding, use of a pacifier, sucking on a thumb or fist was not permitted during the immunization and after. Comfort was defined as any cuddling, patting, or verbal interaction between infant and parent. Gestational age (days), birth weight (g), current weight (unit), and gender of the infant were collected from the infant's medical record.

Statistical Analysis

Continuous variables were presented as mean and 95% CI, while categorical variables were presented as numbers and percentages. Both Kolmogorov-Smirnov Z and Shapiro-Wilk tests were used to test for normality of continuous variables. The differences between groups were examined using Mann Whitney (continuous variables), Spearman's correlation coefficient (Spearman's rho r) was computed to examine the relationship between severity of pain and the weight of participants (birth and current). Statistical significance was set at p -value ≤ 0.05 . All analysis was carried out using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 20.

Results

The sample consisted of 150 infant-parent dyads. Infants taking part in the current study were 60 to 75 days old (67.56 ± 8.43). More than half of the infants were females (56%, 84/150). About 80% of infants were accompanied by their mothers only, and three-quarters of them (71.3%) were born vaginally. The demographic characteristics are shown in Table 1.

Table 1
Demographic details of infants.

Characteristics	Infants ($n = 150$)
Gender	
Male	66 (44%)
Female	84 (56%)
Infants' Age	67.56 ± 8.43
Caregiver	
Mother only	119 (79.3%)
Both parents	31 (20.7%)
Delivery	
Vaginal	107 (71.3%)
Caesarean	43 (28.7%)

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