

Pediatric Pain Letter

Abstracts and Commentaries on Pain in Infants, Children, and Adolescents

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Table of Contents

Introduction	1
Abstracts	
Child Temperament and Pain	2
Clinical Evidence for Long-Term Effects of Pain in Neonates	5
Recent Articles	8
Announcements	11

Introduction

We are excited to be starting the second volume of the *Pediatric Pain Letter*, with an increasing list of subscribers and more interesting topics to review. We also are delighted to welcome Astra Pain Control as international sponsors to assist in distribution of the *Letter* to forty countries around the world, as Astra Canada has been doing here in Canada.

Many factors modify the perception and expression of pain. Many of us have been struggling for years to educate our colleagues and the families of our patients about simple pharmacological and behavioural techniques for pain management. That was probably the right place to start, but it is becoming apparent that there are more complex issues to be faced, particularly in those factors that may reduce or exacerbate pain perception or expression. In this issue, we look at two topics that influence the way we understand a child's pain behaviour and the steps we can take to prevent pain.

Clinicians and parents frequently make judgements about the effect of temperament on pain behaviour and these judgements may also affect the way care-givers interpret and treat a child's symptoms. A "good" child is often one who doesn't complain, and is thus assumed to have no pain. However, there has been relatively little research on the area. We review some of the work that has been done, but there is clearly a need to incorporate measures of temperament into further research and clinical

management.

One of the most exciting findings of the last few years is the realization that early experiences of pain may affect later perception and sensitivity. Research in this area is of profound importance - it is the application of basic laboratory research to clinical practice at its most fascinating. The implications for care of newborns and infants are profound.

We hope you enjoy this issue. We look forward to your comments and suggestions.

Abstracts

Child Temperament and Child Pain Behaviour

Grunau, R. V. E., Whitfield, M. F. & Petrie, J. H. (1994). Pain sensitivity and temperament in extremely low-birth-weight premature toddlers and preterm and full-term controls. *Pain*, 58, 341-346.

Objective. To determine if extremely low-birth-weight (ELBW) toddlers show different parental sensitivity ratings to everyday pain compared to heavier preterm and full-birth-weight (FBW) toddlers and to examine these ratings in relation to child temperament and parenting style.

Design. Case-control.

Setting. Children's hospital.

Participants. ELBW children who were recruited to the study comprised two groups: <801 g (n=49) and 801-1001 g (n=75) who were followed by the Neonatal Follow-Up Programme of the BC Children's Hospital. Controls included a group of heavier preterm children (1500-2499 g; n=42) and a group of FBW children (>2499 g; n=29). All controls, except 3 who were children of employees of the BC Children's Hospital, were participants in a multicenter trial on threatened preterm labour. Inclusion criteria for all children were Bayley Scale Mental Developmental Index (MDI) at or above 85 (i.e., 1 SD below the mean or higher) and no major sensory or motor impairment.

Main Outcome Measures. Bayley MDI was used to assess cognitive development. The Home Screening Questionnaire (HSQ; based on the Home Observation for Measurement of the Environment (HOME) Inventory), was used to measure parenting style. Buss and Plomin's (1984) 20-item measure

of child temperament was also used, assessing child emotionality, activity, sociability, and shyness using a 5-point rating scale. An additional item tapping pain sensitivity was added to this scale (e.g., "Child is very sensitive to pain of bumps or cuts or other common hurts"). All measures were completed by the mother.

Results. MDI scores differed significantly across groups ($p=0.0001$). Significant differences in pain sensitivity ratings were noted across groups ($p=0.005$) with both ELBW groups rated as less sensitive to pain than control groups. Overall, boys were rated as less sensitive than girls ($p=0.04$). Temperament was not related to pain sensitivity in the lower ELBW group (<801 g), moderately related in the higher ELBW group ($p=0.0004$) and in the heavier preterm group ($p=0.0005$), and strongly related in the FBW group ($p=0.00001$). No significant relation was noted between parenting style and pain sensitivity.

Conclusions. Based on parental ratings, ELBW children were less sensitive to pain than heavier preterm or full term children. Temperament was related to sensitivity to pain, but not for the group with the lowest birth weight.

Jacobson, D. & Melvin, N. (1995). A comparison of temperament and maternal bother in infants with and without colic. *Journal of Pediatric Nursing*, 10 (3), 181-188.

Objective. To compare the temperament of infants with a previous history of colic with the temperament of same age peers with no history of colic.

Design. Retrospective case-control.

Setting. A private pediatric practice.

Participants. A convenience sample of 53 mothers (predominantly white; mean age = 28.8 years, SD = 5.04) of 55 children (two sets of twins included). There were 25 infants with colic (12 males; 4 - 8 months old) and 30 infants without colic (11 males; 4 - 8 months old). Colic was diagnosed by infant's physician using Wessel et al.'s (1954) definition. The participation rate for the colic group was 50.0%, and for the non-colic group was 33.0%.

Main Outcome Measures. Mothers rated their infants' temperament with the Revised Infant Temperament Questionnaire (RITQ; Carey & McDevitt, 1978), a 95-item questionnaire which asks the respondent to rate the frequency of certain behaviours on a 6-point Likert scale. Mothers rated their own emotional reaction to the infant's temperament with the Millor Bother Scale (Millor, 1991). This measure requires respondents to rate, on a similar scale, their emotional reaction to each of the items on the RITQ.

Results. Differences were found between the colic and non-colic groups in temperament activity and temperament mood ($t(53) = 2.27, p = 0.03$; $t(53) = 2.07, p = 0.04$, respectively). Mothers rated infants with a history of colic as being more active and having more negative moods than the mothers of infants with no history of colic. The negative moods bothered the mothers of infants with colic significantly more than the mothers of infants without colic. Of the seven remaining temperament factors, there were no other differences between mothers.

Conclusions. The authors noted that it is important to study the parent-infant relationship to better understand the emotional and activity-related patterns of their interaction. Future research should include studies of colic, temperament, and maternal bother in different ethnic groups and a focus on the negative impact that colic has on the psychological well-being of both the parent and child.

Lee, L. W. & White-Traut, R. C. (1996). The role of temperament in pediatric pain response. *Issues in Comprehensive Pediatric Nursing, 19, 49-63.*

Objective. To investigate the relation between children's temperament on venipuncture pain response.

Design. Survey.

Setting. Outpatient laboratories of one community hospital and two medical centres.

Participants. 137 children, free from acute illness, who were scheduled for elective outpatient surgery which required preoperative blood tests were recruited. A final sample of 126 participants (76 male, aged 3 to 7 years, mean age=5.5 years) completed the study.

Main Outcome Measures. Participants' physiological reactions to venipuncture were evaluated using pulse rate and oxygen saturation. The Wong-Baker Faces Pain Rating Scale (WBFPRS; Wong & Baker, 1988) was used to measure the child's self-report of pain. Also, the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS; McGrath et al., 1985), a behavioural measure of distress, and the Revised Behavioral Pain Rating Scale (RBPRS; Jacobsen et al., 1990), a behavioural scale assessing the correlates of pain and anxiety were used. The Child's Pain Expectancy Survey (CPES) was used to collect demographic data and data related to a child's previous pain experience, previous pain responses, pain behaviours, and parental behaviours during venipuncture. The Behavioral Style Questionnaire (BSQ; McDevitt & Carey, 1978) served as a parent-report measure of child temperament; this measure provides scores along 9 dimensions of temperament and was used to classify

children as either "easy", "intermediate", "slow-to-warm-up", or "difficult".

Results. Children with "difficult" temperaments displayed more distress from venipuncture on measures of pulse rate and oxygen saturation. Pulse rate was correlated positively and oxygen saturation was correlated negatively with CHEOPS scores. CHEOPS and RBPRS were significantly correlated throughout the venipuncture procedure. Children with lower pain thresholds reported higher levels of pain from the procedure.

Conclusions. Child temperament was shown to have a modest and significant relation to responses to venipuncture. Individual differences in past pain situations were also related to children's pain perception. The importance of preparing children for painful procedures and considering temperament and usual pain response prior to painful procedures was advocated. The authors suggested that, by tailoring procedural timing and approach to a child's temperament, pain-related stress may be minimized.

Oberklaid, F., Amos, D., Lui, C., Jarman, F., Sanson, A. & Prior, M. (1997). "Growing pains": Clinical and behavioral correlates in a community sample. *Developmental and Behavioral Pediatrics, 18, 102-106.*

Objectives. To determine the prevalence and the clinical and behavioural correlates of growing pains in a community sample of 8-year-old children.

Design. Case control.

Setting. Various communities representative of Australia.

Participants. 183 children (previously enrolled in a 1605 member community based cohort study of chronic illness in Australia) identified by their parents as having "pain in arms, legs, or joints during the previous 12 months"; complete data were available for 160 children (mean age=8.5 years; 51% girls). The comparison group consisted of 160 children without pain, randomly selected from the cohort.

Main Outcome Measures. Parents completed the Child Health Questionnaire, a detailed questionnaire concerning various health conditions, their age of onset, and impact on daily functioning, as well as a detailed questionnaire about "growing pains". Parents also completed Thomas & Chess's (1977) 9-dimension measure of child temperament and an 18-item questionnaire about their child's behaviour. Teachers completed similar measures of temperament and behaviour as well as a 30-item questionnaire concerning functioning at school.

Results. The prevalence of growing pains in this sample was 11.4%. The mean age of affected children was 8.5 years; no significant difference was observed in the prevalence between boys and girls. The mean duration of pain was 2.9 years (range = 1 month - 7 years). The pains were described as “deep seated”, in the lower limbs, and described in vague or non-specific terms. The children with growing pains were more likely to have abdominal pain, headaches, chronic illness, negative mood, and behaviour problems (though not clinically significant), and be aggressive, anxious, and hyperactive as rated by their parents. There were no differences between the groups on teacher ratings.

Conclusions. Children with “growing pains” are rated by their parents, but not their teachers, as having different temperamental and behavioural profiles than controls. The authors present these findings as evidence, in part, for a psychosocial contribution to growing pains.

Bournaki, M. C. (1997). Correlates of pain-related responses to venipunctures in school-age children. *Nursing Research, 46*(3), 147-154.

Objective. To examine relations among age, gender, previous painful events, temperament, child-rearing practices, general, and medical fears, and the behaviour, heart rate, and subjective responses of school-age children during and immediately after venipuncture.

Design. Survey.

Setting. Three outpatient clinics.

Participants. 94 healthy children, aged 8 to 12 years (mean age = 10.3 years), accompanied by a female caregiver to an outpatient clinic and expecting to receive a venipuncture. All children had overall cognitive abilities in the normal range. Of the 121 who were initially approached, 10 refused, and 17 agreed but were excluded for various reasons (e.g., not accompanied by female caregiver (n=2), cognitive deficit (n=4), no venipuncture required (n=7), not enough time to complete measures (n=4)).

Main Outcome Measures. Caregivers reported their experiences with their child’s past hospitalization(s) and painful procedures. Children’s temperament was assessed on 3 dimensions (distractibility, intensity, threshold) using Hegvik, McDevitt, & Carey’s (1982) Middle Childhood Temperament Questionnaire. Children’s fear of medical procedures was assessed using the Child Medical Fears Scale (Broome et al., 1988) and their fear of more general experiences was assessed using the Revised Fear Survey Schedule for Children (Ollendick, 1983). Children’s behaviour was assessed using the Observed Child Distress Scale (Jacobsen et al., 1990), and heart rate was monitored

every 10 seconds during the procedure. Pain was measured using the Adolescent Pediatric Pain Tool (Savendra et al., 1992), a 100 mm word graphic rating scale, and a 67 word checklist of affective and sensory descriptors.

Results. Children displayed pain behaviour and had heart rate increases during venipuncture. Children who had greater changes in heart rate were found to have higher distractibility, lower threshold, and higher general and medical fears. They also endorsed more of the pain checklist items, and had a more vigorous behavioural response. However, the author performed multiple correlations and did not correct for type I error. Canonical correlation revealed that age and threshold were related to pain quality, heart rate change, and behavioural responses which accounted for 12% of the variance. Age, medical fears, distractibility, and threshold were related to pain quality and heart rate magnitude, which accounted for 5.7% of the variance.

Conclusions. Older children and children with higher sensory threshold had lower behavioural response to pain, used fewer words to describe pain, and had lower heart rate changes than younger children or children with lower sensory threshold. These findings may have been related to increased development of emotional and behavioural processes and a better understanding of procedures.

Commentary

Despite the recent increase in the study of children’s pain, we still do not have a good understanding of the factors accounting for the variability in pain behaviour, nor can we adequately assess and relieve children’s pain (Bernstein, Schechter, Hickman, & Beck, 1991; Hester & Foster, 1991). Increasing our understanding of the many interacting factors involved in pain perception and response may allow us to improve these skills. Individual differences in temperament have been recognized as an important variable which may contribute to the etiology, outcome, and management of pain. Temperament is a physiologically-based, individual difference variable composed of a group of related traits, such as sociability, rhythmicity, and difficultness, and is believed to reflect behavioural tendencies rather than specific behavioural acts (Goldsmith et al., 1987). There have been few studies relating temperament to pain. Moreover, the existing studies vary considerably in their conceptualization and measurement of temperament, and in their assessment of pain.

For example, Grunau, Whitfield, and Petrie (1994) used parental report (over 90% mothers) via questionnaire to assess temperament in extremely low birth-weight

infants

(480-800g or 801-1000 g), heavier preterm infants (1500-2499 g), and full birth weight infants (>2500 g), at 18 months corrected age. They found that a composite score of temperament was related to global parental ratings of child sensitivity to everyday pain on a 1- to 5-point scale in the full birth weight, heavier preterm, and 801-1000 g groups, but unrelated in the 480-800 g group. Among full birth weight children, there was also a trend for the most emotionally reactive children to be the most responsive to everyday pain.

Jacobson and Melvin (1995) used maternal report via questionnaire to assess temperament in a group of 4- to 8-month-old infants previously diagnosed with colic, and a group of infants of similar age without colic. They found that infants with past colic were rated by their mothers as being significantly more active and more likely to have negative moods than infants without colic.

Lee and White-Traut (1996) used parental report via questionnaire to assess temperament in 3- to 7-year-old children undergoing preoperative blood tests by venipuncture. They found that children with lower temperamental thresholds had higher self-reports of pain during venipuncture on a 6-point faces scale. Difficult children also displayed more behavioural distress (e.g., crying, facial expressions, verbalizations, torso movements, touching, leg movements, flinches, muscular rigidity) than other children during preparation and during venipuncture. They also had lower oxygen saturations and higher pulse rates than other children during the venipuncture.

Oberklaid, Amos, Liu, Jarman, Sanson, and Prior (1997) used parental and teacher reports via questionnaires to assess temperament in children identified as having "growing pains" (mean age 8.5 years), and a comparison group of children without pain. They found that children identified by parents as having "pain in arms, legs, or joints during the previous 12 months" were more likely to have negative moods, and to be more intense than children without pain, based on parental report. There were no relations between teacher ratings of child temperament and the presence of child pain.

Finally, Bournaki (1997) used female caregivers' reports of temperament via questionnaire to assess temperament in children aged 8 to 12 years undergoing venipuncture. She found that lower threshold was related to the use of more pain descriptors (based on a list of 67 words describing pain quality), and to behavioural ratings of pain (e.g., verbalizations, cries/screams, compliance, muscular rigidity, the need for physical restraint). Higher distractibility and lower threshold were also related to greater changes in heart rate during pain.

Across these studies, the characteristics associated with difficulty and reactivity (e.g., low threshold, emotional reactivity, negative mood, high activity, high intensity) were consistently related to increased pain behaviour. Although further exploration in this area is needed, and not all studies showed relations between all measures of temperament and all types of pain, the consistency of this pattern should be considered significant in light of the variety of age ranges, questionnaires assessing temperament, types of pain, and measures of pain present across these studies. Despite this consistency, in practical terms, temperamental difficulty and reactivity are rarely considered in the assessment and management of children's pain. Future studies should address how measures of child temperament can be effectively incorporated into a program of pain assessment and management, and whether behaviourally reactive children are more likely to provide cues of their pain than are less reactive children, who may minimize their pain.

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Clinical Evidence for Long-Term Effects of Pain in Neonates

Taddio, A., Katz, J., Iersich, A. L., & Koren, G. (1997). Effect of neonatal circumcision on pain response during subsequent routine vaccination, *Lancet*, 349, 599-603.

Objective. To determine whether neonatal circumcision altered pain response at 4- or 6-month vaccination compared with the response in uncircumcised infants, and whether pretreatment of circumcision pain with lidocaine-prilocaine cream (EMLA) affects pain response during vaccination.

Design. Prospective cohort.

Setting. Primary care physician's office.

Participants. 87 healthy, full-term, male, newborn infants, who had participated in a randomized, placebo-controlled, clinical trial that had examined the safety and efficacy of EMLA cream for neonatal circumcision. All infants were aged 5 days or less at time of circumcision.

Main Outcome Measures. The Neonatal Facial Action Coding System was used by a blind, trained rater to code facial actions from videotape. Cry duration was also measured from videotape. Visual analogue scale (VAS) ratings of infant pain were also made using a "pain ruler".

Results. Univariate ANOVAs showed significant main effects for all outcome measures, $p < 0.05$. Higher difference scores were found for circumcised infants with placebo than uncircumcised infants for percentage facial action, percentage cry duration, and VAS pain scores. A significant linear trend in all three outcome measures was seen; pain scores increased from uncircumcised infants to those circumcised with EMLA, to those circumcised with placebo.

Conclusions. Circumcised infants showed a stronger pain response at subsequent 4-month or 6-month vaccination when compared to uncircumcised infants. EMLA cream used during circumcision was associated with lower pain response to vaccination among the circumcised infants. The authors recommended pretreatment and postoperative management of neonatal circumcision pain.

Fitzgerald, M., Millard, C., & McIntosh, N. (1989). Cutaneous hypersensitivity following peripheral tissue damage in newborn infants and its reversal with topical anaesthesia. *Pain*, 39, 31-36.

Objective. To determine whether peripheral tissue damage results in an altered pain threshold as measured by the flexion reflex threshold and to test whether EMLA application affects the threshold.

Design. Double-blind, placebo-controlled trial.

Setting. Special care baby unit.

Intervention. Heel lances were performed every 4 hours (or multiples of 4 hours) as per routine care on only one foot. Treatment groups consisted of: 1) untreated control (n=4); 2) treated with placebo (n=6); 3) treated with EMLA (n=7). The EMLA or placebo cream was applied to the lanced heel at each 4 hour "all-care" procedure, even if a heel-lance was not performed at the time, for about a 2 week period.

Participants. 17 newborn infants of both sexes (27-32 weeks post-menstrual age) who were new admissions to the special care baby unit, were not in critical condition, and whose parents consented to participate were included.

Outcome Measures. The threshold for the flexor reflex was

determined using calibrated von Frey hairs (force of 0.01-150 g) on the plantar surface of the foot near the heel, to measure the force required to evoke the flexion withdrawal of the limb. Tests were conducted at the same time of day and when infants were quietly awake or lightly sleeping.

Results. Control values for flexor reflex threshold from the unlanced foot were unaffected by treatment group. The total mean threshold values were: 1.47 g (n=96 tests, 17 subjects) for controls (all 3 groups combined); 0.76 g (n=39, 11 subjects) for the heel-lanced foot of control and placebo groups (no significant difference between groups); and 1.28 g (n=57, 7 subjects) for the heel-lanced foot of EMLA group. Longitudinal analysis of threshold values for individual infants showed that for control and placebo groups, values for the heel-lanced foot were always less than or occasionally equal to but never greater than the intact side. For the EMLA group, values for the heel-lanced foot were frequently equal to or greater than the intact side.

Conclusions. Infants are susceptible to hypersensitivity to tissue damage similar to tenderness or hyperalgesia in adults. EMLA application resulted in reversal of this hypersensitivity as measured by an observed increase in flexion reflex threshold. Results suggest that the newborn central nervous system can produce a pain response to repeated local injury akin to chronic pain which can be reduced by local anaesthetic.

Johnston, C.C. & Stevens, B.J. (1996). Experience in a neonatal intensive care unit affects pain response.

Pediatrics, 98(5), 925-930.

Objective. To examine differences in reactions to a heel stick procedure between infants 4 days old and 4 weeks old, when both groups are at 32 weeks post-conceptual age.

Design. Case control.

Setting. Neonatal intensive care units (NICU) of two university teaching hospitals.

Participants. 89 infants at 32 weeks post-conceptual age were included: 36 infants were born at a mean of 27.3 weeks gestational age, were examined at 4 weeks post-natal age, and had remained in the NICU during the post-natal period; 53 infants were born at a mean of 32.3 weeks gestational age and were examined 4 days following birth. All were free from major congenital abnormalities, none had had surgery or severe birth asphyxia. 11% of parents who were asked to participate refused.

Main Outcome Measures. Heart rate and minimum oxygen saturation were assessed during a 60 second baseline period prior to the procedure, for 60 seconds during the heel warming period, for 15 seconds during the heel lance, and for 30 seconds during the heel squeeze. Facial responses (brow bulge, eye squeeze, nasolabial

furrow) were coded using the Neonatal Facial Action Coding System.

Results. The two groups differed significantly in weight, and the severity of illness approached statistical significance. Earlier-born infants, assessed at 4 weeks post-natal age, had significantly higher heart rates and significantly lower oxygen saturation (typically below 90%) during all phases of the procedure, than did the group assessed at 4 days post-natal age. Overall, the infants assessed at 4 days post-natal age displayed significantly more facial actions during the procedure than did the earlier born infants.

Conclusions. Results suggested that the earlier-born infants showed a depressed pattern of facial actions in response to pain than the newly born infants, and, consistent with previous literature, earlier-born infants showed a poorer physiological response to pain. The total number of invasive procedures explained the most variance for the facial actions.

Grunau, R.V.E., Whitfield, M.F., Petrie, J.H. & Fryer, E.L. (1994). Early pain experience, child and family factors, as precursors of somatization: a prospective study of extremely premature and full-term children. *Pain*, 56, 353-359.

Objective. To examine prospectively the roles of prior pain experience, child temperament and personality, mother-child interaction and parenting style, and family relations, in the development of somatization in premature versus full-term children.

Design. Prospective case-control.

Setting. Children's hospital.

Participants. 36 children with extremely low-birth-weight (ELBW; ≤ 1000 g; 18 boys) recruited from a neonatal follow-up clinic and 36 children born at full-term (≥ 2500 g; 18 boys) recruited through community health units matched on age (corrected for prematurity), gender, and mother's education. All children were seen at age 3 years and 4.5 years. Inclusion criteria: composite IQ at 3 years above 84 (1 SD below the mean), and no major sensory or motor handicap.

Main Outcome Measures. Psychological assessment was carried out at 3 years and 4.5 years to assess intelligence; mother-child interaction was observed and rated immediately following assessment at 3 year visit with six 5-point rating scales. Mothers completed the 45-item Home Screening Questionnaire (HSQ; Frankenburg & Coons, 1986). Three of the five scales were pertinent to the study and included: Acceptance, Involvement, and Responsivity. Temperament (shyness, emotionality, sociability, and

activity) was measured with a 20-item, 5-point rating scale (Buss & Plomin, 1984). Two items were added to this measure to assess pain sensitivity. At the 4.5-year visit, the short form (280 items) of the Personality Inventory for Children (PIC; Wirt et al., 1977) was completed by the mother.

Results. Somatization scores were significantly higher for the ELBW group (mean=57.53, SD=13.11) than the full-term group (mean=50.64, SD=7.16) ($F(1,68)=7.55$, $p=0.008$). No significant differences were noted for gender, nor for the group by gender interaction. In the ELBW group, 9 of 36 (25%) had somatization scores above the PIC clinical cut-off. None of the full-term group reached this cut-off level. The 9 children with high somatization scores did not differ significantly from the remaining ELBW children in terms of number of medical problems. A combination of child factors such as avoidance of touch and temperamental emotionality and sociability, maternal factors such as low sensitivity to child cues at 3 years, gratification from interaction with the child, and family factors such as maternal Involvement and Responsivity successfully predicted group membership. Child personality traits such as depression and anxiety were not related to somatization.

Conclusion. ELBW children who had lengthy stays in the NICU showed significantly higher somatization. Child temperament was related to somatization for the full-term group, but not for the ELBW group. Maternal involvement was significantly correlated with somatization in the ELBW group which suggests that parenting strategies contribute to development of childhood pain. Findings support that prior pain experiences may contribute to the development of pain syndromes, but with a multi-dimensional etiology.

Commentary

Until recently, the treatment of pain in the newborn infant has been a neglected topic of study. This is at least partially due to the misbelief that any pain experienced by the newborn has no long-lasting effects on his/her development. This belief persists because infants who experience pain at a young age do not recall their pain later on in life. This belief also has contributed to a lack of research of analgesics in this population. Evidence from animal and human studies suggests that untreated pain has long-lasting effects. Peripheral and central nervous system injury can produce persisting changes in the nervous system's response to subsequent somatosensory inputs. The exact mechanisms responsible for producing these changes are not yet known; both structural and functional changes

are thought to be involved. The phenomenon of 'central sensitization' (a state of hyperexcitability of dorsal horn neurons) changes in neuronal innervation maturation and density, central terminal sprouting and reorganized somatotopic maps may all contribute to chronic pain states observed both in animals (e.g., autotomy) and in adults (e.g., phantom limb pain) (Coderre & Katz, 1997).

The potential to induce changes may be greatest in early life when brain development is most rapid. Several recent clinical studies have demonstrated that infants who experienced pain in the neonatal period differ in their behaviours from those of their peers. In a study of infant pain responses during routine vaccination, male infants who had been circumcised without analgesia displayed significantly more pain than uncircumcised infants while neonates who received a topical anesthetic (EMLA) during circumcision had an intermediate response (Taddio et al., 1997). A study of sensory threshold performed in premature neonates subjected to repeated heel lancing demonstrated a decrease in sensory threshold in the injured heel that could be prevented with chronic administration of EMLA (Fitzgerald et al., 1989). Another study comparing two groups of premature infants receiving routine heel lancing showed that 4-week-old infants who had been born at 28 weeks gestation differed in their pain responses when compared with newly born 32-week gestation infants (Johnston & Stevens, 1996). The former group had been hospitalized since birth and subjected repeatedly to painful stimuli. Children who had been hospitalized during the neonatal period due to premature birth had a higher tendency to somatize and to perceive the pain from medical procedures to be greater than children who were born full-term (Grunau et al., 1996; Grunau et al., 1994b - see page 2 for abstract).

These data suggest that untreated neonatal pain can have persisting effects, and that the use of analgesics may prevent these consequences. However, the quality of the evidence prevents us from drawing definite conclusions. All of the studies were observational and lacked randomization. In addition, those which investigated the effects of prolonged hospitalization could not discriminate the effects of pain from the effects of any illness, prematurity, and changes in development due to premature delivery. Further research may verify that the changes are due to pain. Animal models may help to delineate the mechanisms which are involved.

The results from these studies have significant implications for current pain management practices. Clinicians should place importance on preventing neonatal pain. Guidelines and institutional protocols should be developed to ensure that a minimum standard for pain

management will be practiced. Noxious stimuli should be avoided whenever possible and analgesics should be used to ameliorate painful procedures. The pharmacology of analgesics is not well studied in neonates and a concerted research effort in this population is needed.

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Recent Articles

Pederson, C. (1995). Effect of imagery on children's pain and anxiety during cardiac catheterization. *Journal of Pediatric Nursing*, 10(6), 365-374.

Objective. To determine the effect of imagery (i.e., directed focusing on images) in reducing children's pain and anxiety during cardiac catheterization.

Design. Randomized controlled trial.

Setting. Cardiac catheterization room of a 567-bed hospital.

Participants. 24 children (mean age = 13.0 years; range 9 - 17 years; 12 male) of which 1 was Native American and the remaining were Caucasian, who were scheduled to undergo cardiac catheterization. Seven had previously experienced the procedure. Pre-existing conditions included syncope (n=8), tachycardia (n=5), Wolff-Parkinson-White syndrome (n=4), coarctation of the aorta (n=2), one child with aortic stenosis and one with pulmonary stenosis. Exclusion criteria were inability to speak English, previous experience with imagery or hypnosis, or a learning impairment.

Intervention: Participants were randomly assigned to 1 of 3 groups: the control group in which the child underwent the routine procedure; the presence group in which a

member of the research team sat near the child's head during the procedure using eye contact, conversation, and touch to establish rapport and communicate empathy; the imagery group in which a member of the research team stayed with the child during the procedure making suggestions to promote relaxation and guiding the child's imagery based on their favourite places and activities which had been identified before the procedure.

Main Outcome Measures. The State-Trait Anxiety Inventory for Children (STAIC; Spielberger et al., 1973) was used to measure anxiety. Pain measures included: the Observational Scale of Behavioral Distress (OSBD; Jay et al., 1983); nurse Visual Analogue Scales (VAS) used immediately after the procedure; child VAS used 1 hour after; salivary cortisol samples were taken 30 minutes before, during, and a baseline measure 1 week after.

Results. Although the Imagery group had the lowest OSBD scores and the Presence group had the lowest scores for the child's VAS, neither of these differences were statistically significant (ANOVA, $p=0.08$ for OSBD and $p=0.26$ for VAS). The control group had a significantly lower physiological response to pain based on the cortisol measures ($p=0.02$). The children's VAS correlated with the STAIC State ($r=0.34$, $p=0.05$), Trait ($r=0.35$, $p=0.05$) anxiety scores, the nurses' VAS ($r=0.61$, $p=0.001$), and the OSBD scores ($r=0.39$, $p=0.001$). Children's ratings were significantly higher than nurses' ratings (t-test, $p=0.05$). Nurses' VAS ratings were correlated with OSBD scores ($r=0.86$, $p=0.001$) and number of analgesic and sedative doses administered ($r=0.69$, $p<0.001$).

Conclusions. Imagery did not significantly reduce children's pain and anxiety during catheterization, however, the sample size was small (8 per group), and these null findings may be an artifact of lack of power. Imagery may have helped children cope with their anxiety. Nurses should rely on a child's self-report of pain, given the finding that nurses' ratings of pain tend to be lower than children's self-report ratings. If nurses rely on behavioural distress to indicate pain, children who are quiet and withdrawn may receive inadequate pain treatment.

Abbott, K. & Fowler-Kerry, S. (1995). The use of topical refrigerant anesthetic to reduce injection pain in children. *Journal of Pain and Symptom Management*. 10(8), 584-589.

Objective. To assess the efficacy of a refrigerant topical anesthetic in reducing injection pain in preschool-aged children receiving routine diphtheria-pertussis-tetanus (DPT) vaccines.

Design. Randomized, double-blind, placebo-controlled trial.

Setting. Various community health clinics.

Participants. 90 children (51 boys; age range=48-66 months, mean=52.42, SD=4.67 months), and their parents, identified and approached through immunization programs at 5 western Canadian community health clinics. Eligibility criteria: age 4-5.5 years, English-speaking, not hospitalized within the past year, no known skin allergies or skin condition, experienced routine immunization injections in the past, and demonstrated an understanding of the concept of pain as assessed by three vignettes.

Interventions. Children were randomly assigned to one of three groups: (1) refrigerant topical anesthetic spray; (2) placebo topical spray; (3) no spray (control). Group assignment was not known to the clinic nurse, parent, child, or research assistant. Both sprays were administered by spraying a sterile cotton ball, and holding it against the injection site for 10 seconds. The clinic nurse administered the injection as soon as the cotton ball was removed.

Main Outcome Measures. Child rating of pain using a 4-point pain-rating scale comprised of four white boxes of equal size and distances apart on an anchored line on a grey background. Box 1 represented "no pain/hurt", box 2 represented "a little pain/hurt", box 3 represented "a lot of pain/hurt", and box 4 represented "the worst pain/hurt ever". Parents rated their own anxiety associated with needles using a horizontal 10 cm visual analogue scale (VAS; "no anxiety" to "most anxiety ever"). Parents also predicted their child's pain using a horizontal 10 cm VAS ("no pain" to "worst pain ever").

Results. Children who received the refrigerant topical anesthetic spray reported significantly less pain from the injection than children who did not receive any spray. Children who received the placebo spray reported significantly less pain from the injection than children who did not receive any spray. There was no significant difference however, between ratings of children who received treatment or placebo. Pearson correlations showed a positive relation between age and injection pain ($r=0.24$, $p=0.01$). Observation of the data showed that older children ($n=28$, 54-66 months, mean pain score=1.79) reported more injection pain than younger children ($n=62$, 48-53 months, mean pain score=1.53). Older boys ($n=17$, 54-66 months, mean pain score=1.71) reported more injection pain than younger boys ($n=34$, 48-53 months, mean pain score=1.18) but younger girls ($n=28$, 48-53 months, mean pain score=1.96) reported more injection pain than older girls ($n=11$, 54-66 months, mean pain score=1.91). Due to limited power, formal statistical analyses were not conducted. Parental ratings of anxiety and children's pain

rating were not significantly related ($r=0.02$, $p=0.41$). Parental predictions of their children's pain and children's injection pain ratings were not significantly related ($r=0.02$, $p=0.16$).

Conclusions. Refrigerant topical anesthetic spray significantly reduced injection pain in children, but no difference was found between its effectiveness and that of a placebo spray. Further research should examine the effects of gender and age on pain response in preschool aged children.

Palermo, T. M. & Drotar, D. (1996). Prediction of children's postoperative pain: The role of presurgical expectations and anticipatory emotions. *Journal of Pediatric Psychology*, 21 (5), 683-698.

Objective. To examine whether demographic characteristics, surgical characteristics, or expectancies of children and their parents predict postoperative pain in children.

Design. Prospective survey.

Setting. Children's hospital.

Participants. 28 children aged 7 to 17 years (mean= 12.4 years) scheduled for moderate to severely painful elective surgery.

Main Outcome Measures. One week before surgery children used labeled, graphically represented numerical scales ranging from 0 to 10 and anchored by descriptions (e.g., not anxious to really anxious) to rate: their expected postoperative pain, their anticipatory anxiety, and their expectations for the helpfulness of postoperative analgesics. Parents used the same scales to rate their perception of their child's expectations for the same three items. After surgery, children rated their pain on a graphically represented numerical scale anchored by 0 (no pain) and 10 (worst pain ever) for up to three days. Three ratings were collected for all children on surgery day (9 a.m., 1 p.m., 5 p.m.); an average of one rating per day was collected for the two subsequent days.

Results: Children's and parents' ratings of anticipatory anxiety were negatively correlated, while their expected surgery pain ratings were positively correlated. A negative correlation was found between children's age and reported surgery day pain. Children's and parents' expectations of surgery pain and helpfulness of medication were not related to surgery day pain. A hierarchical regression analysis revealed age to be a significant predictor of surgery day pain ratings. The amount of analgesic administered and level of anticipatory anxiety were positive predictors of pain ratings on surgery day, when controlling for age. Separate hierarchical regressions conducted for the two

subsequent postoperative days indicated that only total analgesics administered predicted pain ratings for these days.

Conclusions: Children's ratings of anticipatory anxiety may be useful in predicting pain experienced shortly after surgery. The fact that parents' and children's ratings were inversely related suggested that children's self-report is the more accurate measure of anticipatory anxiety.

Koetting O'Byrne, K., Peterson, L. & Saldana, L. (1997). Survey of pediatric hospitals' preparation programs: Evidence of the impact of health psychology research. *Health Psychology*, 16(2), 147-154.

Objective. To assess the dissemination and implementation of research-based prehospitalization preparation techniques for various nonchronic-care procedures (e.g., venipuncture) in pediatric hospitals. This research also examined whether educational background and information source could predict the effectiveness of medical procedures.

Design. Survey.

Setting. Nonchronic-care pediatric hospitals

Participants. A total of 70 hospitals of 123 initially contacted responded to the survey after either the first or second request. Surveys were completed by an additional 24 hospitals after telephone calls or a third mailing, to make the final response rate 75%. Surveys were intended for the person in charge of the psychological preparation of the child prior to the medical procedure, hospital administrators, and nursing directors. Actual respondents included child life specialists (28%), child life directors (17.2%), directors of nursing (17.2%), nursing staff (11.8%), administrators (7.6%), doctors (3.3%), directors of social work (1.1%) or "other position" (10.8%).

Main Outcome Measures. Respondents reported on a survey checklist of nine preparation procedures (no preparation, printed material, tour, play therapy, narrative preparation, puppet preparation, film, relaxation, and coping instruction) for each of four acute medical procedures (fingerprick and venipunctures; special procedures; oncology procedures; and surgery). The weights of each type of preparation were determined by seven child preparation experts who ranked each preparation technique according to their relative support in the literature for each medical procedure. The respondents reported on who most actively provided preparation for the child, how involved the child was in the preparation, the percentage of children who usually receive the preparations, whether the parent, child, or both received the preparation, whether the medical procedures were

evaluated by the hospital, knowledge of preparation types, and where information on preparation types was obtained. **Results.** Play therapy (59.1%) and narrative preparation (78.5%) were the most common types of preparation reported for fingerpricks and venipunctures. Printed material (73.9%), play therapy (73.9%) and narrative preparation (83.7%) were used most for special procedures, while relaxation (58.1%), play therapy (57%), and narrative preparation (69.9%) were used most for oncology procedures. The type of preparation reported most for surgery was narrative preparation (89.2%), followed by tours (87.1), and play therapy (86%). Agents responsible for preparing children for hospitalization and medical procedures were nursing staff (84.9%), child life workers (81.7%), parents (67.7%), and pediatric surgeons (44.1%). The most frequent sources of preparation information used for practice were pediatric research journals (38%), psychological research journals (29.3%), and commercial material or teaching settings (29.3%).

Conclusions. Research influences, to some extent, the choices made by medical staff in preparing children for medical procedures. The authors noted that considerable progress has been made in using methods of preparation that have some empirical support. Future research should empirically address how to most effectively increase the rate of use of research-based preparations, and should examine how to improve dissemination of research findings into clinical practice.

Blass, E. M. (1997). Milk-induced hypoalgesia in human newborns. *Pediatrics*, 99(6), 825-829.

Objective. To examine whether milk or its components reduce crying in newborn infants during and immediately following heel lance.

Design. Randomized, blind, placebo-controlled trial.

Setting. Community hospital.

Participants. 72 healthy infants (42 female) between 22 and 40 hours old.

Interventions. Four minutes before blood collection, the infants were given 2 ml of one of the following solutions through a plastic syringe for 2 minutes: sucrose, water, protein, lactose, diluted fat, concentrated fat, fat and lactose, commercial formula, or formula fabricated for the experiment according the percentage of each component in breast milk. All fluids were warmed to body temperature.

Main Outcome Measures. Percentage of time crying during blood collection (from squeezing of the heel to application of a bandage) was rated from videotape. Reduction in crying during recovery (3 minutes after bandage application) was also rated from tape. Both the

nurse who collected blood and the rater of the tapes were blind to condition.

Results. Relative to infants given water, only those given sucrose or commercial formula cried less during blood collection. Those given the specially fabricated formula cried marginally less than those given water. During recovery, all infants displayed reductions in crying, except those given water, commercial formula, or lactose. The infants in these 3 groups displayed increases in crying.

Conclusions. Milk and sweet flavour reduced crying in newborn infants during a heel lance. Fat and proteins may help reduce crying after heel lance, when the pain is less acute. It is unlikely that lactose contributes to reduction of infants' distress during or after heel lance.

A nnouncements

Meetings

May 7-9, 1998: 1st International Conference on Research in Palliative Care, Bethesda, Maryland, USA. This program is intended for health care professionals who are interested and/or involved in the palliative care of patients with chronic and advanced or terminal diseases. Contact: Conference Secretary, Imedex USA, Inc., 70 Technology Dr., Alpharetta, GA, USA, 30005-3969, tel (770) 751-7332; fax (770) 751-7334. email: meetings@imedex.com; website: <http://www.imedex.nl>

May 28-30, 1998: Canadian Pain Society 1998 Annual Conference, Hotel Saskatchewan - Radisson Plaza, Regina Saskatchewan, Canada. "Canadian Achievements in a Global Context". Featuring keynote speakers Dr. Harold Merskey and Dr. Patrick Wall, along with plenary sessions by Dr. T. Coderre, Dr. K. Kluch, Dr. K. Craig, and Dr. D. Cassidy. For more information contact: Dr. Gordon J. G. Asmundson, Chair Scientific Programme Committee, tel (306) 766-5384; fax (306) 766-5530; email: gasmundson@reginahealth.sk.ca, or on the world wide web see: <http://www.usask.ca/~vonbaeye/cps-98/>

September 24 -27, 1998: 2nd Biennial International Forum on Pediatric Pain, White Point Beach Resort, White Point, Nova Scotia, Canada. The topic for the meeting will be chronic and recurrent pain, and it will again be a

focussed, research-based conference, with many distinguished international faculty including Tony Dickenson (UK), Sunny Anand (USA), Anna Taddio (Canada), Gunnar Olsson (Sweden), Bo Larsson (Sweden), Neil Schechter (USA), Navil Sethna (USA), and Patrick McGrath (Canada). Registration is limited to 120 participants. Further information is available on the world wide web. See: <http://is.dal.ca/~pedpain/pedpain.html>
 Contact: Conventional Wisdom via email at katefin@chebucto.ns.ca; fax (902) 423-5232; or tel (902) 453-4664. Mailing address: CONVENTIONAL WISDOM, 6496 Liverpool St., Halifax, NS, B3L 1Y4, Canada.

Other

Teaching Module: The Network Project Teaching Module on the Management of Cancer Pain in Children. Prepared by John J. Collins, Charles B. Berde, and Maura E. Byrnes, these educational materials contain a comprehensive lecture with references and over 50 colour slides. Cost: \$225.00 (US dollars, make cheque payable to "The Network Project, CC5112/F7062"). For further information contact the Network Project, Memorial Sloan-Kettering Cancer Center, Box 421, 1275 New York Ave, New York, NY, 10021, USA. Tel: (212) 583-3042; Fax: (212) 230-1953.

Currently Available from IASP Press: *Measurement of Pain in Infants and Children, Progress in Pain Research and Management, Volume 10*, G. A. Finley & P. J. McGrath (Eds.), IASP Press, Seattle, 1998, 290 pages, \$67.00 US funds (\$43.55 US for IASP members; hardbound). ISBN 0-931092-20-5. This book brings together some of the most productive investigators from Europe, North America, and Australia to share their understanding of different approaches to the field. Basic and clinical science are represented, as are different disciplines of clinical practice in psychology, nursing, and medicine. To receive detailed information about ordering this book, contact IASP Press, 909 NE 43rd St., Suite 306, Seattle, WA, 98105, USA. Fax (206) 547-1703.

Now Available: We are currently offering *Pediatric Pain Letter* binders for sale to protect your 5 issues of Volume 1. Each 1½ inch binder comes with a subject and author index for Volume 1 to allow easy referencing, for a cost of \$10.00 CDN in Canada and \$10.00 US in all other countries (includes shipping). To order, send payment to Pediatric Pain Letter, Attention: Beth Currie-Special Binder Offer, Psychology Department, Dalhousie University, Halifax, NS, B3H 4J1, Canada. Orders can also

be sent via fax (902-494-6585) or email (bcurrie@is.dal.ca). Cheque (payable to Dalhousie University), Visa, or MasterCard (include expiry date for credit card orders) accepted.

Short announcements on pediatric pain will be published gratis.

If you would like to participate

Your participation in abstracting and writing commentaries for the Pediatric Pain Letter is welcomed. Please send submissions according to the specifications outlined in our Author's Kit. An Author's Kit can be obtained from Julie Goodman, Managing Editor, Pediatric Pain Letter, Psychology Department, Dalhousie University, Halifax, Nova Scotia, B3H 4J1; email jgoodman@is2.dal.ca; requests can be made in writing or by email. Abstracts and commentaries on any aspect of pain in infants, children, and/or adolescents are appropriate. We will attempt to use abstracts and commentaries but the editors reserve the right to edit or reject contributions.

Supported by an educational grant from



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