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Pediatric Pain Letter

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

Editorial Board

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Introduction

Welcome to the third volume of the *Pediatric Pain Letter*. We are pleased to be continuing this publication with the support of Astra Canada and Astra International, as well as increasing numbers of individual subscriptions. We intend to continue our focus on important controversies and recent articles in pediatric pain, with expert commentary and structured abstracts.

We lead off this year with a commentary on composite measures of pain in infants. Behavioural and physiological responses to pain in newborns and infants are sufficiently complex that it is reasonable to assume that a simple, single-component measurement tool would miss important factors. It is unlikely that a single modality would provide adequate sensitivity or specificity. Consequently, techniques that combine two or more of behavioural, various physiological, facial action, and contextual clues may provide more robust indicators of infant pain.

We also have abstracts of some recent articles, including four articles by Mikkelsson on musculoskeletal pain, and a review of an important new book on sickle cell pain. We hope you enjoy this issue. As always, we request and welcome your suggestions for topics and articles to include in coming issues.

Abstracts

Composite Measures of Pain in Infants

Ambuel, B., Hamlett, K.W., Marx, C.M. & Blumer, J.L. (1992). Assessing distress in pediatric intensive care environments: the COMFORT scale. *Journal of Pediatric Psychology*, 17, 95-109.

Objectives. To develop a non invasive and reliable measure sensitive to subtle signs of neonatal distress suitable for use in pediatric intensive care units (PICU).
Design. Observational survey study.
Setting. PICU in a children's hospital.
Participants. Thirty-seven consecutive admissions to the PICU (mean age=37.1 months; range=0-204 months) who were receiving intermittent mandatory ventilation or continuous positive airway pressure with monitored vital signs. Exclusion criteria were:compromised neurological status, profound mental retardation, recent multiple trauma, altered muscle tone, or contractures. Participants experiencing extreme acute pain were temporarily excluded.
Main Outcome Measures. The COMFORT scale was developed using input from 20 experienced critical care nurses and by reviewing medical and behavioural science literature. It consists of five-point interval rating scales for each of eight physiologic and behavioural variables (alertness, calmness/agitation, respiratory response, physical movement, mean arterial blood pressure, heart rate, muscle tone, facial tension). Using the COMFORT scale and a 10 cm visual analogue scale (VAS) (anchors were 'absolutely calm' and 'extremely distressed'), each child was assessed after two minutes of observation by three independent raters: an investigator; a research assistant trained in use of the COMFORT scale; and an experienced intensive care nurse not familiar with the scale.
Results. COMFORT scale variable means were all near the midpoint (1.9-3.0) and trained raters used nearly the full range of scores. Pearson correlations for inter-rater reliability were 0.84 for total COMFORT score (n=50; $p<0.01$) and 0.51 to 0.75 for individual scale factors (n=50; $p<0.01$) (heart rate and mean arterial pressure were lowest). Internal consistency was 0.90, and the individual scales were all correlated with the adjusted total score (0.60-0.90; $p<0.05$), with the exception of muscle tone (0.30). Correlation between total COMFORT scores and VAS ratings by experienced clinical nurses was 0.75.
Conclusions. The COMFORT scale has proven to be a valid and reliable scale for assessing distress. It allows for both high and low distress ratings, is quick and easy to administer, and allows for time sampling in research. Further research should address age differences and the low inter-rater reliability for heart rate and blood pressure. For clinical use muscle tone could be eliminated.

Krechel, S.W. & Bildner, J. (1995). CRIES: a new neonatal postoperative pain measurement score. Initial testing of validity and reliability. *Paediatric Anaesthesia*, 5, 53-61.

Objectives. To establish the reliability and validity of a neonatal postoperative pain measure (CRIES).
Design. Repeated measures.
Setting. Neonatal or pediatric intensive care units, Missouri, USA.
Participants. Twenty-four postoperative infants (14 females; mean gestational age=44 weeks; range 32-60 weeks) admitted to the NICU or pediatric units.
Main Outcome Measures. For each infant two nurses conducted hourly assessments over a 24-72 hour period recording presence or absence of pain subjectively and rating physiological and behavioural pain responses using the Objective Pain Scale (OPS; Hannallah et al., 1987) and CRIES (ie. crying, oxygenation, vital signs, facial expression, and sleeplessness). After each assessment a third nurse reviewed the scores to determine if analgesia was required. A total of 1382 observations were made.
Results. Validity, as indicated by Spearman Rank Correlation Coefficients, was 0.73 between CRIES and OPS (n=1382; $p<0.0001$) and 0.49 between the subjective pain ratings and either measure (n>1300; $p<0.0001$). Both CRIES and OPS had a median score of 0 when subjective ratings indicated no pain and 4 when pain was reported as present. Significant declines in both the CRIES (3.0 units; n=74; $p<0.0001$) and OPS (3.4 units; n=77; $p<0.0001$) scores were observed for the hour immediately following analgesia administration. Adequate inter-rater reliability (Spearman correlation) was achieved for both CRIES ($r=0.72$; n=680; $p<0.0001$) and the OPS ($r=0.73$; n=659; $p<0.0001$) and subjective ratings were in agreement 94% of the time. CRIES was preferred by 73% of nurses compared to 24% for the OPS.
Conclusions. The CRIES is a valid and reliable measure of pain in neonates as young as 32 weeks, preferred by nurses,

and is easy to use. Limitations of the CRIES and other pain measures were discussed. Further research is required to differentiate distress versus pain responses.

Lawrence J., Alcock, D., McGrath, P.J., Kay, J., MacMurrary, S.B. & Dulberg, C. (1993). The development of a tool to assess neonatal pain. *Neonatal Network*, 12, 59-66.

Objectives. To establish psychometric characteristics of a neonatal behavioural measure of pain, and to investigate the association of pain scores with infant characteristics.
Design. Repeated measures.
Setting. Neonatal Intensive Care Unit (NICU) in a children's hospital.
Participants. Thirty-eight infants (20 males; 27 preterm; mean gestational age at birth=33.5 weeks; mean Apgar scores at 1 and 5 minutes were 5.6 and 7.6 respectively) admitted to NICU to undergo standard capillary, venous, or arterial punctures. Infants receiving analgesia 3 hours prior to the procedure or for whom procedures were not completed in the first attempt were excluded.
Main Outcome Measures. Infants were videotaped for 2 min before, 5 min during, and 3 min after procedures. A research assistant coded facial expression, cry, breathing patterns, arm movement, leg movement, and state of arousal from videotapes using the Neonatal Infant Pain Scale (NIPS). A random sample of 20 procedures was independantly coded by one of the investigators. Two nurses rated pain every minute before, during, and after 27 randomly selected procedures using a 10cm visual analogue scale (VAS).
Results. Ninety procedures were videotaped (10 infants multiple times for one procedure; 17 infants for multiple procedures). Mean NIPS score (before 1.1, during 4.8, and after 2.0; range=0-7 for each time period) changed significantly over time ($p<0.001$) indicating construct validity. Inter-rater reliability for the 20 procedures also coded by an investigator ranged from 0.92-0.97 for the first two minutes across all time periods (Pearson correlations; $p<0.05$). For concurrent validity, Pearson correlations between the research assistant's NIPS scores and each of the nurse's VAS scores ranged from 0.53-0.84 across time periods, which is less variable than the correlations between the two VAS scores (0.42-0.91). High internal consistency of the component scores were reported for the NIPS with Cronbach's alphas of 0.95 for measures taken before, 0.87 during, and 0.88 after the procedure. No significant relations were found between responsiveness to pain (NIPS score change from before to during the procedure) and gestational age or Apgar scores.
Conclusions. The NIPS provides a more objective measure of pain intensity in neonates and has adequate psychometric properties. The NIPS should be used in conjunction with consideration of the overall status of the neonate and his/her environment. It was noted that measuring pain intensity with the NIPS during events involving longer term pain (e.g., post-operative pain) requires further evaluation. The clinical applications of the NIPS were discussed.

Stevens, B., Johnston, C., Petryshen, P. & Taddio, A. (1996). Premature infant pain profile: development and initial validation. *The Clinical Journal of Pain*, 12, 13-22.

Objective. To utilize the existing data on pain responses in premature infants to develop a pain measure with clinical and research relevance.
Design. Incorporated both retrospective and prospective designs using 4 existing data sets to test against indicators outlined in existing literature.
Setting. Neonatal Intensive Care Units (NICU) and a nursery.
Participants. Infants (gestational age range=32-40 weeks) making up 4 independent data sets (n's=124, 39, 48, 27).
Main Outcome Measures. Indicators considered for inclusion in the Premature Infant Pain Profile (PIPP) were physiological responses (cardiovascular/respiratory and endocrine/metabolic), behavioural responses (facial action, cry characteristics and body activity) and modifying factors (gestational age, behavioural state and health status). To be considered sensitive, indicators had to be present at least 50% of the time following a pain event, and to be considered specific, indicators had to be present less than 20% of the time during nonpainful events.
Results. Three factors with eigenvalues >1 accounted for 78.3% of the variance; upper facial activity (brow bulge, eye squeeze and nasolabial furrow), physiological activity (heart rate and oxygen saturation) and state activity (behavioural state). Internal consistency of the PIPP indicators was in the moderate range (Cronbach's alpha 0.76-0.59; standardized item alpha=0.71). Construct validity was assessed using 3 of the existing data sets. Paired *t*-tests indicated that the PIPP could discriminate between painful and nonpainful responses across 3 gestational age groups (32-34 weeks, $p<0.0001$; 28-30 weeks, $p<0.02$; and 37-40 weeks, $p<0.02$).

Conclusion. Development and initial validation of the PIPP is the first step in the direction of improving the clinical assessment of infant pain. Not only is further research required to evaluate the validity and reliability of the measure, but additional prospective research will be needed in order to determine the practicality of clinical use.

Commentary

The complex nature of pain suggests that multidimensional assessment may be preferable to assessing pain with a single indicator or unitary approach. Multidimensional assessment can be achieved by combining subjective and objective approaches or by utilizing a composite measure that includes physiologic, behavioural and contextual indicators within one instrument. Composite measures are particularly appropriate for infants and preverbal children when self-report is not possible.

Five published composite measures for assessing pain in infants include: (a) NIPS - The Neonatal Infant Pain Scale (Lawrence et al., 1993); (b) CRIES - Crying, Requires O2 for saturation above 95, Increased vital signs (heart rate and blood pressure), Expression, and Sleepless (Krechel and Bildner, 1995); (c) PIPP - The Premature Infant Pain Profile (Stevens et al., 1996); (d) PAT - The Pain Assessment Tool (Hodgkinson et al., 1994); and (e) DSVNI - The Distress Scale for Ventilated Newborn Infants (Sparshott, 1996). There is also one composite measure for infant distress which encompasses all behaviours of negative affect associated with pain, anxiety and fear (Ambuel et al., 1992).

These measures have all been developed to assess acute pain in infants, although the source of pain and gestational age of the infant at birth may vary. The psychometric properties and clinical utility of these measures have been established to varying degrees. Content validity was established for all composite measures. Criterion validity is difficult to establish as a "gold standard" for pain does not exist. Criteria independent of actual pain score ratings (e.g., such as VAS ratings by independent raters) have been correlated with the pain scores to establish concurrent criterion-related reliability (Ambuel et al., 1992; Krechel & Bildner, 1995; Lawrence et al., 1993). Construct validity is the most difficult to establish as it is not established with one experiment but rather accumulates over time. Construct validity was frequently reported on a single study where pain scores in divergent known groups were compared (Lawrence et al., 1993; Krechel & Bildner, 1995). More extensive construct validation was performed by Stevens et al., (1996) using three retrospective data sets for infants of varying gestational ages undergoing different painful procedures and for VLBW infants (Ballantyne et al, 1996; Walden, 1997).

In composite measures, internal consistency provides support for the multidimensionality of the measure. This is important as it justifies the multidimensional versus the unidimensional approach to measurement. Moderate levels of association suggest that the indicators provide different but complementary information about the underlying mechanisms. A moderate correlation was found among the different indicators of the PIPP (Stevens et al., 1996) while Lawrence et al. (1993) and Ambuel et al. (1992) found high internal consistency in their measures. High levels of internal consistency suggest limited multidimensionality. Inter-rater reliability was established in most of the composite measures but intra-rater reliability only was assessed in the PIPP (Ballantyne et al., 1994). As acute pain is an ever changing phenomenon, test retest reliability is impossible to re-assess at a later time. The majority of composite measures for infants have been developed for research purposes and therefore, there is limited evidence of clinical utility except for the CRIES (Krechel and Bildner, 1995), PIPP (Ballantyne et al., 1996) and DSVNI (Sparshott, 1996).

Although there is a growing number of composite measures for assessing pain in infants, no one composite measure is optimal for all situations, types of pain or gestational age groups. Further research is required to support the psychometric properties and clinical utility of existing measures. However, the development of new measures should be directed to infants with chronic pain, persistent acute pain, or infants who are developmentally, physically, mechanically or pharmacologically compromised, or infants who are very low birth weight and/ or critically ill.

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Recent Articles

Editor's note: The first four abstracts report on a particularly important and well done study of musculoskeletal pain in a cohort of children in Finland.

Mikkelsson, M., Salminen, J.J. & Kautiainen, H. (1998). Non-specific musculoskeletal pain in preadolescents. Prevalence and 1-year persistence. *Pain*, 73, 29-35.

Objective. To assess, in third- and fifth-grade children, the prevalence and persistence of musculoskeletal pain and wide-spread pain (WSP), and the extent to which musculoskeletal pain interferes with daily activities
Design. Epidemiologic survey with 1-year follow-up.
Setting. Nineteen primary schools in Lahti, Finland.
Participants. A total 867 third-graders (444 female; mean age=9.8 years) and 889 fifth-graders (450 female; mean age=11.8 years) were initially recruited. 1656 (92.7%) children participated at follow-up.
Main Outcome Measures. A structured pain questionnaire, designed for the study, assessed the occurrence and frequency of musculoskeletal symptoms (ie. regional pains and aches, headaches) over the past 3 months. A subjective disability index and school absences were used to assess the extent to which children were disrupted by their pain.
Results. At baseline, 32.1% (95% CI, 29.9-34.4) of the children reported pain at least once a week. At 1-year follow-up, 52.4% of these children were experiencing persistent pain. Highest persistence was found for neck pain, and more so for girls than for boys (p=0.001). There was no significant difference between grades in persistence of pain. WSP was evident in 7.5% of the children, persisting in approximately 33% at 1-year follow-up. The WSP group had the highest mean disability index (1.8) and had the greatest number of children who missed school due to pain (43.2%) when compared to children experiencing regional and combined pain symptoms.
Conclusion. Musculoskeletal pain is common in preadolescents, and persistence is common in approximately 50%. Although pain did not appear to interfere significantly with daily activities, school absences as a result of pain, and increased disability indices were most characteristic of those children experiencing pain in more than one region. Evidence for the persistence of pain suggests the need for more longitudinal studies assessing the chronicity of pain with age.

Mikkelsson, M., Sourander, A., Piha, J. & Salminen, J.J. (1997). Psychiatric symptoms in preadolescents with musculoskeletal pain and fibromyalgia. *Pediatrics*, 100(2), 220-227.

Objective. To determine the extent to which varying degrees of musculoskeletal pain is associated with emotional and behavioural problems, particularly depression.
Design. Group comparison study.
Setting. Primary schools in Lahti, Finland.
Participants. A group of 1756 third- and fifth-graders were given a pain questionnaire, those indicating a frequency of pain of at least once per week were sorted into 2 groups: a wide-spread pain (WSP) group (n=124; mean age=10.7 years) and a neck pain (NP) group (n=108; mean age=11.1 years). Children indicating occurrences of pain as seldom or never formed the control group (n=131; mean age= 10.7). Fibromyalgia was diagnosed for 17.7% (n=22) of the WSP group.
Main Outcome Measures. Evaluations were completed by the children, their parents and their teachers. Children completed the Children's Depression Inventory (CDI), as a measure of emotional state, and the Sleep Questionnaire, as a measure of disturbed sleep pattern. Parents completed the Child Behavior Checklist (CBCL) which assesses behavioural problems across the dimensions of externalizing (e.g. aggression and disorderly conduct) and internalizing (e.g. depression and anxiety). Teachers completed a similar report, the Teachers Report Form (TRF), designed to assess problem behaviour in the classroom.
Results. Of the children with WSP, 29.8% displayed high CDI scores compared to 17.7% of the children with NP and 1.5% of the controls. The difference in depression scores

between the 3 groups was significant ($p < 0.001$). Depression and sleep scores for the WSP sub-group with fibromyalgia were significantly higher than the other 3 groups ($p = 0.001$). Children with WSP and children with NP had significantly higher external and internal scores on the CBCL, as rated by their parents, although there was no significant difference between the 2 groups - nor was there a significant difference in parental evaluations between the WSP group and the fibromyalgia subgroup. Teachers' ratings on the TRF yielded similar assessments.

Conclusion. Musculoskeletal pain, particularly fibromyalgia, appears to be highly correlated with depressive symptoms. Pain and depression in children must be recognized and treated quickly and effectively in order to prevent the disability that is typically associated with chronic pain.

Mikkelsson, M., Salminen, J.J. & Kautiainen, H (1996). Joint hypermobility is not a contributing factor to musculoskeletal pain in pre-adolescents. *Journal of Rheumatology*, 23(11), 1963-1967.

Objective. To determine the prevalence of hypermobility in preadolescents and compare the prevalence of musculoskeletal symptoms between hypermobile and nonhypermobile preadolescents.

Design. Case comparison study.

Setting. Primary schools in Lahti, Finland.

Participants. Students from third grade (n=807; 415 female; mean age=9.8 years) and fifth grade (n=830; 420 female; mean age=11.8 years).

Main Outcome Measures. Beighton's method was used to assess hypermobility. This method yields a score of 0-9, where 1 point is given for each side of the body for tests A -D (passive dorsiflexion of little finger beyond 90°, passive apposition of thumbs to flexor aspects of forearm, hyperextension of elbows beyond 10°, and hyperextension of knees beyond 10°), and 1 point for test E (forward flexion of trunk with knees straight and palms resting on floor). A cutoff point of ≥ 6 determines hypermobility. A structured questionnaire assessed musculoskeletal symptoms, including region and frequency, over the past 3 months. A subjective disability index determined the extent to which pain interrupted normal daily functioning

Results. According to the Beighton criteria, 7.8% (95% CI, 6.6-9.2) of the children exhibited hypermobility. There were no differences between hypermobile and nonhypermobile children with respect to musculoskeletal pain. Musculoskeletal pain was experienced at least once a week by 29% of the hypermobile children (95% CI, 22.3-38.8) and 32.3% of the nonhypermobile children (95% CI, 29.9-34.7). Children with hypermobility did not have more pain due to injuries, nor were their regions of hypermobility associated with pain in those areas. Disability caused by musculoskeletal pain did not correlate with Beighton scores.

Conclusion. Although hypermobility and musculoskeletal pain appear to be common in preadolescents, there was no association found between hypermobility and musculoskeletal pain, thus raising questions about the proper cut-off point for hypermobility syndrome. No long-term effects could be drawn from this study because of the similarity with which hypermobile and nonhypermobile children experienced musculoskeletal pain symptoms. Long-term follow-up would appear to be required.

Mikkelsson, M., Salminen, J.J., Sourander, A. & Kautiainen, H. (1998). Contributing factors to the persistence of musculoskeletal pain in preadolescents: a prospective 1-year follow-up study. *Pain*, 77, 67-72.

Objective. To investigate predictive factors for the persistence of childhood musculoskeletal pain.

Design. Epidemiologic survey with 1-year follow-up.

Setting. Primary schools in Lahti, Finland.

Participants. Third-grade (n=867; mean age=9.8 years) and fifth-grade students (n=889; mean age=11.8 years) from 19 primary schools were surveyed for the occurrence of pain incidents during the three months prior to this study. At the initial phase of data collection, 32.1% (n=564; 273 male; mean age=10.8 years) reported musculoskeletal pain at least once a week. One year later, 515 (91.3%) of these children provided follow-up data of which 452 provided enough data to be included in regression analysis.

Main Outcome Measures. A structured pain questionnaire was administered that queried pain frequency, pain location, and psychosomatic symptoms (pain as a result of injury was excluded.) A subjective disability index was then calculated using these questions. Tests for joint hypermobility at the little finger, thumb, elbow, knee, and trunk were also carried out at baseline using Beighton's method.

Results. Logistic regression analysis indicated that the variables with significant predictive value for the persistence of musculoskeletal pain were: gender - girls were at higher risk than boys ($p=0.006$); daytime tiredness ($p=0.01$); and subjective disability index scores ($p=0.005$).

Waking up during the night was almost significant (p=0.092). Musculoskeletal pain persistence risk increased 1.2 times for each year of age increase. School absence due to pain was reported in 114 children (25.2%) at baseline and 70 (15.5%) at follow-up, of which only 35 had also reported absence at baseline. Doctor visits due to long-lasting medical problems were reported by 85 children (18.8%) for: atopia (5.3%), asthma (3.1%), headache or migraine (3.1%), abdominal pain or constipation (1.5%), recurrent respiratory infections (1.5%), lactose intolerance (1.1%), and arthralgia (1.1%).
Conclusions. The results of this study lend support to previous findings that musculoskeletal pain tends to be higher in girls and that this pain appears to be more prevalent in older children. These results also suggest the importance of psychological factors in these children's pain experiences. Children's subjective reports of pain and their reported deficits in daily activities resulting from pain should be taken as valid predictors of pain persistence.

McGrath, P.J., Rosmus, C., Camfield, C., Campbell, M.A. & Hennigar, A. (1998). Behaviours caregivers use to determine pain in non-verbal, cognitively impaired individuals. *Developmental Medicine & Child Neurology*, 40, 340-343.

Objective. To generate a list of behaviours that caregivers use when deciding whether non-verbal, cognitively impaired individuals are in pain.
Design. Retrospective survey.
Setting. Children's hospital.
Participants. The primary caregivers (18 mothers, 1 set of parents, 1 nurse) of 20 non-verbal individuals (13 male; mean age=14.5 years; age range=6-29 years) seen during routine visits to a pediatric neurology clinic. Ten of the non-verbal individuals had severe mental retardation and 10 had profound mental retardation. The most common diagnosis was epilepsy and spastic quadriplegia or hemiparesis (18/20).
Main Outcome Measures. A semi-structured interview was administered. Descriptions of two incidents of short, sharp pain and two incidents of longer-lasting pain were sought from each caregiver. Each caregiver also completed the MacArthur Communicative Development Inventory: Words and Gestures.
Results. The communicative age equivalents for the non-verbal subjects ranged from 8 to 15 months (mean=10 months). Two of the authors reviewed transcribed interviews and developed a list of 31 items in 7 categories: Vocal, Eating/Sleeping, Social/Personality, Facial Expression, Activity, Body and Limbs, and Physiological Signs. The checklist was applied to the interviews by a coder who was not involved in deriving the checklist. The data from a second independent coder indicated good interrater reliability (n=8; kappa=0.77). Each category was used by at least 70% of the caregivers.
Conclusions. The 31 items generated in this study provide a preliminary indication of the pain behaviours exhibited by those who cannot communicate their pain verbally. Further studies are necessary to validate the checklist.

Jacobson, S.J., Kopecky, E.A., Prashant, J. & Babul, N. (1997). Randomised trial of oral morphine for painful episodes of sickle-cell disease in children. *The Lancet*, 350, 1358-1361.

Objective. To determine the dose equivalence, clinical efficacy and safety of oral controlled-release morphine, in children experiencing severe sickle-cell pain, as an alternative to parenteral opioid therapy. A secondary objective was to assess the reliability of self-report and behavioural measures of pain.
Design. Randomised, double-blind, parallel-group design.
Setting. Children's hospital emergency department.
Participants. Fifty children (28 male; mean age=11.2 years), presenting with painful sickle-cell episodes, requiring admission and parenteral opioid therapy.
Interventions. All patients were given a loading dose of open-label intravenous morphine (up to 0.15 mg/kg) and then were randomly assigned to either (a) controlled-release morphine tablets (1.9 mg/kg every 12 hours) plus intravenous placebo (n=24), or (b) continuous intravenous morphine (0.04 mg/kg/hour) plus placebo tablets (n=26).
Main Outcome Measures. At four hour intervals from 0900 to 2100 hours pain was assessed using the faces pain scale, the Oucher scale, the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS), and a clinical pain assessment scale (five points: none, mild, moderate, severe, and very severe). All physiological parameters (temperature, respiratory rate, blood pressure, and degree of consciousness (Glasgow coma scale)) were assessed at four hour intervals except O_2 saturation and endtidal CO_2 which were recorded at the time of pain assessment. Adverse events were recorded daily with a non-directed questionnaire.
Results. The ratio of mean daily doses for both treatments (oral, 2.99 mg/kg; intravenous, 0.81 mg/kg) approached the target oral to intravenous dose ratio (4). Mean duration

of pain requiring opioid analgesia in days was 5.4 for the intravenous group and 4.2 for the oral group (p=0.059). Correlations between pain scores were significant (r=0.5865-0.8980, p=0.0001). There were no significant differences between the two treatment groups for: pain scores, physiological parameters, rescue analgesia rate and frequency by time of day, and frequency and severity of adverse events.
Conclusions. Efficacy and safety of oral controlled-release morphine was similar to continuous intravenous morphine suggesting that after initial assessment in the emergency department and an adequate intravenous loading dose of morphine, children might also be managed at home with an oral controlled-release morphine. Caution is advised regarding follow-up, dosing adjustments, and parent and patient education.

Phipps, S., Fairclough, D., Tyc, V. & Mulhern, R.K. (1998). Assessment of coping with invasive procedures in children with cancer: state-trait and approach-avoidant dimensions. *Children's Health Care*, 27(3), 147-156.

Objective. To examine coping strategies used by children undergoing invasive medical procedures. In particular, the relation between coping behaviours and personality traits in situations involving painful procedures was studied. Additionally, this study served to develop and explore the psychometric properties of the Procedural Coping Questionnaire (PCQ).
Design. Survey.
Setting. Pediatric oncology centre.
Participants. Sixty-eight children being treated for cancer and one parent of each child were recruited. Of the children recruited, 66 took part in the study (56% male). Of the parents that participated, 83% were mothers. Children were divided into three age groups: 6 to 8, 9 to 11, and 12 to 15 years (overall mean age=9.95 years). The children were primarily being treated for acute leukemia (84%) and the remaining children suffered from either non-Hodgkin's lymphoma, Ewing's sarcoma, or neuroblastoma.
Main Outcome Measures. The Children's Behavioral Style Scale (CBSS) was used to assess trait-dependent coping styles. This measure presents four stress-invoking scenarios which are followed by responses involving monitoring and blunting behaviours. The Procedural Coping Questionnaire (PCQ) was administered to each child and parent in order to examine the state-dependent coping styles used by the children. This questionnaire contains seven items related to approach behaviours, seven items related to avoidant behaviours, and six items related to affective expression. Children were also asked to rate distress severity before, during, and after the procedure on a scale of one to five.
Results. PCQ results showed that children reported using significantly more coping behaviours than parents reported them using (means of 9.7 versus 7.88; p<0.001). Reports by parents and children were significantly correlated on 10 of the 20 items on the PCQ (Kendall's τ=0.27-0.58; p's<0.05) of which 8 showed a higher number of coping behaviours reported by children than by parents. Due to low Cronbach's alphas (0.46 to 0.53), factor analysis was carried out for PCQ items, resulting in a three factor solution. Factor I showed some relation to approach behaviours, Factor II appeared related to strategies that were largely avoidant, and Factor III was related to two items examining preference for sedation. Factor II was significantly correlated with CBSS monitoring (r=0.25; p<0.05) and blunting (r=0.38; p<0.01) scores but Factors I and III were not. The distress scores reported by the children were positively correlated to Factor II (r=0.28; p<0.05) and to total number of PCQ items endorsed (r=0.41; p<0.001). Distress scores of parents and children did not differ at any of the time intervals measured.
Conclusions. It appears that in this study no single coping strategy or group of coping strategies was clearly more effective in reducing procedure related distress. Children appeared to use a variety of coping strategies with varied success to deal with highly painful procedures. The results suggest that the PCQ may be a helpful assessment measure for studying children's coping styles. The PCQ Factors found in the present study show an acceptable level of reliability and this measure appears comparable to other coping behaviour measures. Caregivers who better understand a child's preferred coping styles may then be able to take steps to help the child modify and optimize these strategies.

Rauch, D.A. (1998). Use of ketamine in a pain management protocol for repetitive procedures. *Pediatrics*, 102(2), 404.

Objective. Reports on the use of ketamine for anesthesia/analgesia with a patient undergoing repetitive painful procedures.
Design. Case report.
Setting. Pediatrics department.
Patient. Five-year-old boy who was hit by a car and suffered a fracture of the femur and full thickness soft

tissue loss from mid-thigh to ankle of the left leg and partial soft tissue loss from mid-thigh to knee of the right leg.

Intervention. Initially treated with morphine (0.1 mg/kg) for pain and before dressing changes and debridements. Due to increasing patient distress, treatment changed to pre-procedure administration of a combination of ketamine (1 mg/kg), atropine (0.01 mg/kg), midazolam (0.05 mg/kg) and morphine (0.1 mg/kg). All medications were administered intravenously in a step-down unit by pediatric staff.

Results. When treated only with morphine the patient: screamed during procedures, requested more analgesic, and became withdrawn. After ketamine, atropine and midazolam were included in treatment the patient: was conscious but did not scream during procedures; complained of pain less often; was more easily distracted; required less medication between procedures; and was more sociable and interactive. 15 doses of ketamine were administered over 21 days with no side effects or complications.

Conclusions. In this case ketamine was integral to successful pain management. In combination with morphine, satisfactory analgesia was provided and with midazolam sufficient sedation was achieved to minimize procedural trauma. This combination should be considered in the pain management of repetitive painful procedures involving children if it can be administered in a monitored setting by pediatricians and nurses trained in its use.

von Baeyer, C.L., Baskerville, S. & McGrath, P.J. (1998). Everyday pain in three- to five-year-old children in day care. *Pain Research and Management*, 3(2), 111-116.

Objective. To investigate everyday pain incidents in a daycare using the Dalhousie Everyday Pain Scale in order to: replicate the results of a previous study (Fearon, I., McGrath, P.J., and Achat, H., 1996); develop a system for categorizing incidents into several common types; and improve the generalizability of the Scale for research and applied use.

Design. Observational, event sampling study.

Setting. Six urban day care centres in Saskatoon, Saskatchewan, Canada.

Patients. Fifty children (28 male; mean age=52.6 months; range 36.8-67.8 months) whose parents consented to having their children observed.

Outcome Measures. Observations were made using the four sections of the Dalhousie Everyday Pain Scale: 1) incident description (ie. observer's perception of severity, body part identification); 2) subject's response (ie. Faces Pain Scale, pain behaviour checklist, duration); 3) adult response; and 4) behavioural context description (ie. activity level, emotional tone). From August to October, 20 trained observers (15 female) scored pain incidents for up to 5 children at a time for 1-2 hour periods (ie. 10:00-11:30 and 15:00-17:00) when children tended to be actively playing on the playground (88% occurred outdoors). For 76% of the observation hours, 2 independent observers collected data simultaneously. In addition observers wrote a brief description of each incident for content analysis of injury causes.

Results. Fifty-one incidents were observed during 135.7 hours (21 children (42%) did not get hurt; range 0-4 incidents/child; median rate=0.310 and mean rate=0.413 incidents/child/hour). Twenty-one incidents with 16 different children were recorded simultaneously by 2 observers. Inter-rater reliabilities were: for categorical variables reflecting behavioural context, setting and adult response Kendall's τ ranged from 0.17 to 0.87 and for variables reflecting subject response to pain the range was 0.01 to 1.00; Pearson correlations for number of different pain responses, duration of response, and Faces Pain Scale scores were 0.91, 0.50, and 0.92 respectively. In contrast to Fearon et al. (1996), gender was only significant for the display of anger and with opposite results, anger was recorded for 22% of incidents for boys but with none for girls ($p<0.03$). For children hurt 3 or 4 times, incidents were more likely to involve an object (eg. balls, shovels, etc.) than for children hurt 2 or less times ($p<0.05$). Extent of adult response was strongly associated with Faces Pain Scale scores ($p<0.001$). Categories derived from content analysis and percentage of incidents in each were: self-imposed (60%) with 32% equipment related; other-imposed (40%) which were either accidental or deliberate (20% each); overall 8% were due to retaliation and 12% due to initiation.

Conclusions. With limited observer training adequate to excellent reliability was achieved for child response variables. However, possibly due to the restricted range of the scales, most contextual variables had poor reliability which may explain inconsistencies with the results of Fearon et al. (1996). Overall the results indicate the potential usefulness of the Dalhousie Everyday Pain Scale for future studies of everyday pain and injury prevention.

Review Articles

The *Pediatric Pain Letter* briefly notes the following recent review articles:

Anderson, B.J., McKenzie, D.R., Persson, M.A. & Garden, A.L. (1998). Safety of postoperative paediatric analgesia. *Acute Pain*, 1(3), 14-20.

Carlson, K.L. (1998). Selected resources on pediatric pain. *Journal of Pediatric Nursing*, 13(1), 64-66.

Committee on Injury and Poison Prevention & Committee on Sports Medicine and Fitness. (1998). In-line skating injuries in children and adolescents. *Pediatrics*, 101(4), 720-722.

Kauffman, R.E. (1998). Commentary - Reye's Syndrome and salicylate use and National patterns of aspirin use and Reye Syndrome reporting, United States, 1980 to 1985. *Pediatrics*, 102(1), 259-262.

Lloyd-Thomas, A.R. (1998). Pre-emptive analgesia - relevant to children? *Acute Pain*, 1(2), 20-26.

Lucassen, P.L.B.J., Assendelft, W.J.J., Gubbels, J.W., van Eijk, J.T.M., van Geldrop, W.J. & Knuistingh Neven, A. (1998). Effectiveness of treatments for infantile colic: systematic review. *BMJ*, 316, 1563-1569.

Book Review

Ballas, S.K. (1998). *Sickle Cell Pain. Progress in pain research and management,* volume 11. Seattle, WA: IASP Press.

Sickle cell disease (SCD) is a recessively transmitted group of disorders directly affecting hemoglobin, involving a single-base mutation in the gene on chromosome 11, with a prevalence of 1 in 400 to 500 among African Americans. The sickling disorders can also occur in other groups from regions where malaria is endemic. Pain is the most prominent feature of SCD, however frequency and severity of recurrent pain episodes range across and within individuals from absent or very mild, to frequent and severe, requiring hospitalization. In addition to acute painful episodes, chronic pain syndromes are common.

As Dr. Ballas points out in *Sickle Cell Pain*, the pain associated with SCD is underappreciated and frequently misunderstood even among health care professionals with experience treating the disease. This book is timely for those in centres in the early stages of establishing a service for sickle cell patients, and informative for those in centres with a long history of work with these patients.

Samir Ballas is a physician and researcher working in Philadelphia who has published extensively in the area of sickle cell disease. His goal with this volume is to describe sickle cell disease from the perspective of its major symptom, pain. He succeeds in his goal, and in so doing, has compiled a body of information that is unique and useful, integrating research and clinical experience to provide insight into the nature of pain in sickle cell disease, and guidelines for clinical practice.

Sickle Cell Pain is organized in five parts. The first section of the book provides background on the history, general characteristics, and haematology of SCD. Dr. Ballas outlines the unique features of sickle cell pain. It would have been interesting to have had some information about the experience with sickle cell pain in other countries, such as India, with a high incidence of the sickle allele. The author makes the point that whereas the prevalence of pain with advanced or terminal cancer is about 74%, it is greater than 95% in sickle cell anemia (the most severe form of SCD). The haematology of SCD is clearly described, and the classification of haemaglobinopathies is outlined.

Part II is devoted to the pain syndromes associated with sickle cell disease. Here the signs, symptoms, clinical course, and pathophysiological mechanisms of both acute painful episodes or crises and chronic pain syndromes are reviewed. Diagnostic work-ups are outlined, complicating factors are described, and management issues are discussed. This is a thorough section that should prove useful to clinicians.

Part III discusses pharmacological management of sickle cell pain. The pharmacology of analgesics and adjuvants is reviewed and an extensive chapter discussing the pharmacologic management of sickle cell patients follows. It was refreshing to see developmental issues considered in the section on assessment of pain. Outpatient management of pain, management of pain in the emergency room, and management of acute painful episodes requiring hospital admission are described. He

notes that meperidine is the most frequently prescribed opioid analgesic in sickle cell disease, but only briefly mentions the controversy surrounding this issue. Guidelines for specific treatment protocols are provided, and the findings from major studies of analgesic pain management in sickle cell disease are presented in tabular form and discussed in the body of the text. As well as outlining problems and issues with pain management, the author makes practical suggestions for patient management and organization of health care delivery.

The fourth section examines alternatives to pharmacologic therapy in pain management. In the context of considering neurobehavioural status as a factor in the efficacy of non-pharmacologic therapy, two studies reporting neuropsychological deficits in children with SCD, and one reporting cognitive deficits in adults with SCD are mentioned. The focus of this brief section is not clear, and important recent work in this area is not cited. However, the author goes on to provide a review of behavioural and alternative interventions including biofeedback, hypnosis, support groups, and spiritual interventions. The final chapter in this section describes the recent developments in fetal hemoglobin induction therapies including the use of hydroxyurea. The status of curative therapies including allogenic bone marrow transplantation and gene therapy is mentioned. Future directions are discussed. The fifth and final section of the book, Miscellaneous Aspects of Sickle Cell Pain, raises interesting and important issues concerning management of difficult patients, patients' rights, institutional and systemic issues such as race and income, and patient advocacy.

Sickle Cell Pain is well written and comprehensive. Tables, figures, colour plates, and case illustrations are utilized throughout the book and aid in effective communication of information. A glossary of terms is included, and a Sickle Cell Knowledge Self-Assessment for Medical Personnel, organized in a question-and-answer format, is included as an appendix. This enhances the value of this text for continuing education, and as a pedagogical tool. *Sickle Cell Pain* is the definitive clinical reference source in this area, and should be required reading for health care professionals in hematology and emergency services, and for those in family or community health who may come in contact with sickle cell patients.

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Announcements

Meetings

March 25-26, 1999: *Interdisciplinary Group for the Prevention of Back Pain (GILL) and the French Association for the Prevention of Rheumatism (AFLAR) International Congress: The Spine in Children and Teenagers - Prevention of Back Pain, Grenoble-France, Atria Europole*. The scientific program will include conferences, thematic sessions, and individual speeches. Simultaneous French/English translation will be available. For more information contact Geneviève Bicaïs: (tel/fax) 04-76-63-71-69, email: gbicais@ujf-grenoble.fr

May 13-16, 1999: *Annual meeting of the Canadian Pain Society (IASP Chapter)* to be held in St. John's, Newfoundland, Canada. For further information, please contact S. Lefort: (fax) 709-753-6266, or via the Internet at http://www.medicine.dal.ca/gorgs/cps

August 22-27, 1999: *9th World Congress on Pain, Vienna, Austria, the triennial scientific meeting of the International Association for the Study of Pain*. The Congress is open to those working in or interested in any aspect of pain, including research and treatment, and features leading world experts in each field. Contact the IASP, 909 NE 42nd Street, Suite 306, Seattle, Washington, 98105, USA, (tel) 206-547-6409, (fax) 206-547-1703, e-mail: IASP@locke.hs.washington.edu
Internet: http://www.halcyon.com/iasp

June 18-21, 2000. *5th International Symposium on Pediatric Pain* to be held in London, UK. This meeting is sponsored by the Special Interest Group on Pain in Childhood. For further information, please contact Dr. A. Goldman, Symptom Care Team, Great Ormond Street Hospital for Children, Great Ormond Street, London, WC1N 3JH, United Kingdom, (fax) 44-171-813-8588, email: a.goldman@ich.ucl.ac.uk

September 28 - October 1, 2000. *3rd Biennial International Forum on Pediatric Pain*, White Point Beach Resort, Nova Scotia, Canada. The topic of the meeting will be acute pain. More information can be obtained from Kate Finlayson of Conventional Wisdom at (tel) 902-453-4664, (fax) 902-423-5232, email: katefin@chebucto.ns.ca

Publications

The Management of Pain, Ashburn, M.A. & Rice, L.J. (Eds.), Churchill Livingstone Inc., New York, 1998, 714 pages. This recent comprehensive text on pain management contains four chapters on pediatric pain. Chapters include: pain measurement, acute pain management, chronic pain management and procedure pain management.

Handbook of Pain Syndromes: Biopsychosocial Perspectives, Block, A.R., Kremer, E.F. & Fernandez, E, LEA, Mahwah, N.J., 1999, 688 pages. This handbook has a chapter on chronic and recurrent pain in children and a chapter on sickle cell disease pain.

Short announcements on pediatric pain events will be published free of charge.

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 Jill Hatchette, Editorial Assistant, Pediatric Pain Letter, Psychology Department, Dalhousie University, Halifax, Nova Scotia, B3H 4J1; email jhatchet@is.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.

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