Pain prevalence in hospitalized children: a prospective cross-sectional survey in four Danish university hospitals

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Background: Pain management in hospitalized children is often inadequate. The prevalence and main sources of pain in Danish university hospitals is unknown.

Methods: This prospective mixed-method cross-sectional survey took place at four university hospitals in Denmark. We enrolled 570 pediatric patients who we asked to report their pain experience and its management during the previous 24 hours. For patients identified as having moderate to severe pain, patient characteristics and analgesia regimes were reviewed.

Results: Two hundred and thirteen children (37%) responded that they had experienced pain in the previous 24 hours. One hundred and thirty four (24%) indicated moderate to severe pain and 43% would have preferred an intervention to alleviate the pain. In children hospitalized for more than 24 hours, the prevalence of moderate/severe pain was significantly higher compared to children admitted the same day. The single most common painful procedure named by the children was needle procedures, such as blood draw and intravenous cannulation.

Conclusion: This study reveals high pain prevalence in children across all age groups admitted to four Danish university hospitals. The majority of children in moderate to severe pain did not have a documented pain assessment, and evidence-based pharmacological and/or integrative (‘non-pharmacological’) measures were not systematically administered to prevent or treat pain. Thus, practice changes are needed.

Acute pediatric pain treatment and prevention is often inadequate and pain in children admitted to hospitals is common, under recognized and undertreated.1–4 Unrelieved pain in children is associated with physiological, psychological and emotional adverse effects.5–8 Clinicians have an...
obligation to relieve pain as stated by World Health Organization (WHO) and the 2012 guidelines on the pharmacological treatment of persisting pain in children with medical illnesses.9 Our young patients and their families have high expectations toward pain treatment and prevention10–13 and knowledge about evidence-based multimodal pediatric pain management (incl. pharmacological, neuroaxial, interventional, rehabilitative, psychological and integrative ‘non-pharmacological’ modalities) has increased over the last decades.

However, it appears that there is still a gap between what we know and what we do.14 Researchers at large North American hospitals have found a significant number of children in pain (27–64%) during hospital admission.1,3,4,15–18 Due to national and international variation in pediatric pain management practice, the results from these studies may not be entirely generalizable to Danish pediatric departments.

The purpose of this prospective multicenter study is to describe the general pain prevalence and subsequently to identify child- and procedure-associated characteristics, assessment and management related to significant pain as a basis for future interventions aimed to improve pain management in children.

Methods

On a random unannounced weekday, this prospective mixed-method cross-sectional survey took place at four university hospitals in the Capital Region of Copenhagen, Denmark with a general population of 1.789 million people. The university hospitals are the only four hospitals in the Capital Region with associated pediatric departments providing medical care to almost all pediatric inpatients.

The goal was to survey all pediatric patients 0–18 years of age. Children in psychiatric and maternity units and sedated/intubated patients in intensive care units were excluded. Children/parents were also excluded if they were non-Danish or non-English speaking or if they were absent after up to three attempts to locate them throughout the day. We also excluded families in clinical scenarios that deemed too burdensome or inappropriate in the judgment of the interviewer.

Four non-consecutive weekdays in late March/early April 2016 were chosen, representing a typical day at the hospitals thus providing a snapshot of pain prevalence. The survey was approved by The National Board of Health, The Danish Data Protection Agency (2012-58-0004) and by the management of the involved departments. Children older than 5 years gave assent, and parents participated after a verbal and a written consent. In order to limit bias by increased vigilance to pain practices, the study was not announced to the staff. Five to six pairs of interviewers each comprising a nurse practitioner, a pain nurse practitioner, a pain physician or a pediatrician introduced the project to the family addressing the child between the age of 5 and 18 years old directly or addressing one of the parents for younger patients or in case of cognitive disabilities. Patients were identified by lists of pediatric in- and outpatients (including surgical patients) and the interviews were carried out between 8 am and 8 pm.

Interviews lasted approximately 10 min and the answers were recorded on-line using a survey program (SurveyXact®) on an electronic tablet. The survey tool was based on Taylor and Friedrichsdorf’s audits.1,4 If the child had been pain free during the current admission (up to 24 h), the interview was discontinued. In case of pain during the previous 24 h in hospital, we continued the survey with questions about hospital length, primary reasons for admission and procedures undertaken. Respondents, children (≥5 years) or parents (children <5 years), were asked to indicate any pain during the interview and worst pain during the previous 24 h using a visual analog scale (VAS)(0–10), (no pain = 0, mild pain > 0 ≤ 4, moderate pain > 4 ≤ 7, severe pain>7).19,20 In order to personalize the pain intensity, we asked if the level of pain, according to the respondent, indicated a need for action to alleviate the pain. Information about pain assessment, management and overall satisfaction with pain management was recorded. A medical chart review of pain assessment and pain documentation was conducted for all patients who reported moderate to severe pain. Pharmacological pain management was recorded by a chart review. The use of non-pharmacological modalities for
pain modulation was studied by asking children and parents about strategies used to manage pain. Finally, we asked the families about overall satisfaction as well as effective and less effective staff members’ interventions regarding pain management.

**Statistical analysis**

Pain prevalence was reported as a percentage with 95% confidence interval. We used the chi-square test to compare the prevalence of pain according to specific patient characteristics and the Kruskal–Wallis test to compare pain scores for different painful conditions/procedures. We specifically compared pain scores for needle pokes with other painful conditions/procedures with the Mann–Whitney’s Test. We used SAS statistical software (Version 9.4; SAS Institute Inc, Cary, NC, USA) and \( P \)-values < 0.05 were considered significant.

**Results**

**Demographics**

Eight hundred fifty-four children (0–18 years) were on the lists of in- and outpatients and 570 patients were located and interviewed (response rate of 66.7%) (Fig. 1). Patient characteristics are shown in Table 1. Two hundred seventy-five (49%) of the children gave self-report, and in the remaining information was gathered by the caregivers. The primary respondent for children < 5 years was the mother (75%). Ninety-two percent of respondents had Danish as their primary language and 7 percent of the interviews were completed in Danish despite not being primary language of the interviewed. In 1%, the interviews were completed in English. No interviews were cancelled due to linguistic barriers.

**General pain prevalence in the previous 24 hours**

Sixty-three percent of the hospitalized children experienced no pain (VAS = 0) in the previous 24 hours according to themselves or their caregivers (Fig. 2). Two hundred and thirteen children (37%) responded that they had experienced pain (VAS > 0) during the hospital admission in the previous 24 h (95% confidence interval 33.5–41.4%). One hundred and thirty four (24%) indicated moderate or severe pain (VAS > 4) (Fig. 2). Forty three percent of patients in pain would have preferred an intervention to alleviate the pain and 69 of the 570 children in the survey (12%) had pain during the interview rating the pain 4.4 (0–10). Thirty percent of the children described recurrent pain during a 3-month period before admission. Overall satisfaction with pain treatment was high and rated 8.2 on a 10-point scale (0 = not satisfied at all, 10 = very satisfied) and 79% of the respondents answered that the staff members listened to them, when confronted with questions or worries about pain management.

**Sources of pain**

The main reason for pain in the previous 24 h was an invasive procedure: Seventy-seven indicated needle pokes (36%) followed by other invasive procedures (20%) as the primary painful event (Table 2). Although needle pokes and other invasive procedures were reported to be the main cause of pain, the pain scores for procedural pain were recalled significantly lower than the scores for other painful procedures \( (P = 0.001) \).

**Specific patient characteristics related to moderate/severe pain prevalence**

In children hospitalized for more than 24 h, the prevalence of moderate/severe pain was significantly higher compared to children admitted the same day \( (P < 0.001) \)(Table 3). We found no significant correlation between moderate/severe pain and gender or age.

In children with moderate/severe pain and a documented pain assessment, we found a staff members’ underestimation of children’s pain (median patient score of 8 compared to staff members score of 6).

Pain assessment in the 134 children with moderate/severe pain was documented in the charts of 61 children (46%). This was done by an institution-approved pain score (FLACC score (0-10)/VAS (0-10) in four children, narratively in 40 children and narratively combined with pain scoring in 17 children. We found no pain
assessment after intervention for moderate/severe pain. Median worst pain in previous 24 h score assessed by children was 8/10 (5–10) and by medical staff documented was 6/10 (0–9).

In children with moderate/severe pain, 93 (69%) did not receive any paracetamol, NSAID’s or opioids. Paracetamol was administered to 25 children (19%) with moderate/severe pain. NSAID’s were administered to 12 children (9%) and these drugs were mostly given round-the-clock. Opioids were given to three children prn (pre re nata = as needed) and to one child scheduled round-the-clock (Table 4).

Adjuvant analgesics were used in three children in the group of children with moderate/severe pain (low-dose tricyclic anti-depressants, gabapentinoids, clonidine and/or a muscle relaxant).

Non-pharmacological management of pain

Strategies used to manage the most painful procedures/conditions in the previous 24 hours are summarized in Fig. 3. The medical staff members took advantage of several modalities
including a variety of non-pharmacological measures. The parents appreciated non-pharmacological interventions and 89 percent of the parents in our study answered that they would embrace these interventions. We encouraged the family to comment on positive and less positive actions by the staff members. We categorized these statements into main themes in Tables 5 and 6.

**Discussion**

**Pain prevalence**

This study is, to the best of our knowledge, the first European cross-sectional survey to benchmark prevalence, assessment and management of pain in hospitalized children. Our response rate of 66.7% in pediatric patients admitted to university hospitals in the Capital Region of Denmark is comparable with international pain surveys of hospitalized children (64%, Friedrichsdorf, 66% Birnie). The number of respondents was considerably higher compared to other surveys.

The results obtained by child/parent interview revealed that of the 570 children included in this study, 63% experienced no pain in the previous 24 h. We found a pain prevalence of 37%, and 24% of the cohort experienced moderate to severe pain (VAS > 4) during the last 24 h. Sixty-nine children reported pain during the interview. Our results are similar to previous studies. In a study by Groenewald, 27% of children experienced moderate to severe pain. Stevens, Ellis, Shomaker and Cummings reported 20–33% prevalence rate of clinically significant pain and in a recent study by Friedrichsdorf, 20% experienced moderate and 30% severe pain in the 24-h time period. Taylor reported almost 64% of in patients experiencing moderate/severe pain at some time in the previous 24 h and 23% experiencing significant pain during the interview. We also found that in children being hospitalized for more than 24 h, the prevalence of moderate/severe pain was significantly higher compared to children admitted the same day. This may be due to children, admitted to hospital (vs. outpatients) generally having more severe morbidity, experience more procedures and consequently

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**Table 2** The most painful procedure/condition in children in the previous 24 h

<table>
<thead>
<tr>
<th>Procedure/Condition</th>
<th>N = 213 (VAS&gt;0)</th>
<th>Worst pain score *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle pokes</td>
<td>77 (36%)</td>
<td>3.8 (2.7–6.8)</td>
</tr>
<tr>
<td>Other invasive procedures†</td>
<td>43 (20%)</td>
<td>4.4 (2.7–6.5)</td>
</tr>
<tr>
<td>Accident/injury, other medical</td>
<td>42 (20%)</td>
<td>6.5 (5.0–7.3)</td>
</tr>
<tr>
<td>Acute illness</td>
<td>27 (13%)</td>
<td>7.5 (5.1–8.3)</td>
</tr>
<tr>
<td>Known disease</td>
<td>16 (8%)</td>
<td>6.3 (4.4–8.1)</td>
</tr>
<tr>
<td>Surgery</td>
<td>8 (4%)</td>
<td>6.5 (4.9–9.1)</td>
</tr>
</tbody>
</table>

*Median (25–75% range). Significantly different among groups (P = 0.0001. Kruskal–Wallis Test). Needle pokes and other invasive procedures significantly lower score than other groups combined, P = 0.001. †Bladder catheterization, gastric tube insertion and non-skin breaking procedures.

**Table 3** Relationship between patient characteristics and moderate/severe pain prevalence.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N = 570</th>
<th>Moderate/severe pain; N = 134</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>314</td>
<td>74 (55%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Female</td>
<td>256</td>
<td>60 (45%)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant (&lt;2)</td>
<td>157</td>
<td>45 (34%)</td>
<td>0.30</td>
</tr>
<tr>
<td>Child (2 to &lt;6)</td>
<td>104</td>
<td>22 (16%)</td>
<td></td>
</tr>
<tr>
<td>Child (6 to &lt;11)</td>
<td>141</td>
<td>30 (22%)</td>
<td></td>
</tr>
<tr>
<td>Teenager (≥11)</td>
<td>168</td>
<td>37 (28%)</td>
<td></td>
</tr>
<tr>
<td>Time in hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤24 h</td>
<td>454</td>
<td>80 (60%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>&gt;24 h</td>
<td>116</td>
<td>54 (40%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4** Pharmacological pain management in children with moderate/severe pain

<table>
<thead>
<tr>
<th>Regime</th>
<th>N = 134 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>7 (5)</td>
</tr>
<tr>
<td>NSAID’s</td>
<td>18 (13%)</td>
</tr>
<tr>
<td>Opioids</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Continuous infusion</td>
<td>1 (1)</td>
</tr>
<tr>
<td>None of these</td>
<td>93 (69)</td>
</tr>
</tbody>
</table>

Prn, pre re nata (‘as needed’); NSAID’s, non-steroidal anti-inflammatory drugs.
are more prone to pain. According to Bernie et al., being admitted to hospital constitutes a risk factor for significant pain and should be a target for vigorous assessment and management.17

Pain assessment in children with moderate/severe pain

During the 24-h study period, the majority of children (54%) experiencing moderate/severe pain had no documented pain assessment (numerical or narrative). This is in contrast to hospital-policy stating pain assessment as a quality-indicator of good medical practice. Whether pain was never assessed, pain was assessed but not documented, or the child, parents or medical staff members found no reason for assessment, the infrequent documentation of pain contravenes local as well as international recommendations.22 Taylor et al. recognized adequacy of pain assessment as the cornerstone of pain management and its documentation important to make the pain problem more visible. 4

In a subsequent Canadian study, 68.4% of the children in significant pain had a pain assessment documented at least once in a 24-h period, higher than 45% of the children in our study. This can be explained by our study population of both in- and out patients compared to the Canadian population of only children.
hospitalized for more than 24 h thus excluding outpatients. In the study by Friedrichsdorf, 58% of children had pain assessment and management documented during a 24-h period in a study population of both in- and outpatients, with pain documentation for painful needle procedures usually missing. Among reasons for children to be admitted on an outpatient basis is a medical consultation or diagnostic setup in which cases’ pain assessment perhaps is less relevant.

Pain management

Pharmacological pain management with paracetamol and/or NSAID’s was used in 18%/9% of children with moderate/severe pain and opioid’s in only four children. These results are in accordance with results of Groenewald where scheduled paracetamol and/or NSAID’s were used in 22%/11% of the children in moderate/severe pain. In our study, the intention was to describe pain prevalence in a general pediatric population of in- and out-patients. We did not intend to study pain assessment and management in children with well controlled analgesia (VAS ≤ 4) and we consider it positive that 63% of patients in the survey had no pain.

The families also pointed out room for improvement (Tables 5 and 6). A small number of parents complained about physical restraint of their child during painful events. Restraining is associated with serious consequences for the child (and the parents) and an institutional policy to prohibit restraining for elective painful procedures, as it was implemented with the ‘Comfort Promise: We do everything possible to prevent and treat pain’ at Children’s Hospitals and Clinics of Minnesota [www.childrensMN.org/comfortpromise] should have highest priority. The parental remarks are important contributions to medical professionals when trying to adjust personal and organizational behaviors in order to improve pain management in a context of the interaction between child, parent and staff members. It is interesting and noteworthy that pharmacological measures represent only a small fraction of strategies reported though not rated by parents in managing the most painful event (Fig. 3). In our opinion, it confirms that pain is a subjective and complex feeling and should be assessed and managed in a broader bio-psycho-social context by pharmacological-in combination with non-pharmacological measures in particular.

Procedure-related pain

Procedure-related pain is continuously a challenge for children admitted to hospitals. A majority of children in our study reported that worst pain was caused by procedural pain like needle pokes and other invasive procedures (120 of the 213 children reporting pain (VAS > 0) in the previous 24 h). This is similar to what was reported by Friedrichsdorf and Bernie (42-56%). Although an invasive procedure was reported to be the main cause of pain, the child’s pain assessment was significantly lower than during other conditions/procedures, which is also found by others. Pain and anxiety is closely linked in children. Therefore, to decrease the child’s anxiety and to avoid restraint during procedures the use of non-pharmacological interventions is crucial. A number of non-pharmacological interventions can be used in neonates and children to manage pain associated with painful procedures. The most established evidence is for non-nutritive sucking, swaddling/facilitated tucking and rocking/holding. We found little documentation in our survey of these interventions. Possibly non-pharmacological measures were not used or more likely used to some extent but not documented.

A simple 4-point intervention for needle pokes includes (1) topical anesthetic applied on the skin, (2) sucrose or breast-feeding for infants <12 months, (3) age-appropriate distraction and (4) positioning (including swaddling for infants and sitting upright without being held down for children >6 months) and represents evidence-based management of procedural pain. A deferral process should be readily available (including pediatric pain team specialists, integrative measures, nitrous gas for mild sedation or alternatively moderate to deep sedation) if the four mentioned measures prove insufficient in comforting the child.

Guiding parents in how to best support their child during procedures seems important and should be incorporated into clinical practice.
Clinical implications

To improve the quality of pain management provided to hospitalized children, focus on recognition of pain, age-related assessment of pain intensity, access to safe and suitable interventions and evaluation of the efficacy of any intervention are targets for future improvement efforts. It is essential that interventions are adapted to each child and include a multimodal approach, combining both non-pharmacological and pharmacological interventions.33–35 Even in academic hospitals in Denmark, despite good intentions and increasing knowledge about pharmacological and non-pharmacological measures, there seem to be a significant number of children suffering pain demonstrating inadequate or insufficient application of available knowledge and skills. Pain assessment needs to be integrated into routine pediatric pain practice. In our institution, our clinical assessment tools are Comfort Neo for neonates, the FLACC scale for minors, Wong-Baker faces pain scale and VAS or NRS for self-measuring pain in older children. Our study has, in accordance with other studies, shown that health professionals and parents have a tendency to underestimate children’s pain prevalence.1,36 Thus, the low documentation rate could be explained by the medical staff members estimating the child not to be in pain or the pain being so insignificant that assessment (and subsequent intervention) was not necessary or relevant in their setting. Narrative documentation was used more often than scoring, maybe because the staff members found a narrative assessment and documentation easier or more operational. The consequences of narrative pain assessment alone or in addition to scoring are uncertain in terms of quality of assessing the pain experience in children.29 Self-assessment is recommended if possible depending of age and cognitive abilities of the child. In order to personalize the pain intensity and pain treatment threshold, recent studies have introduced an alternative assessment concept by considering the pain threshold at which each child desires intervention.19,37 To improve the quality of pain management, focus on recognition of pain, age-related pain assessment, access to safe and suitable interventions and evaluation of the intervention are all targets for future improvement efforts.

The purpose of this study was to describe pain prevalence in children admitted to university hospitals in Denmark and to identify the main sources of pain experience. What we did not intend to uncover was the pharmacologic and integrative (‘non-pharmacologic’) pain management of the large group of well-managed children, the prevalence and main source of pain in the subgroup of children coming to the hospital for sole purpose of an elective invasive procedure vs. children admitted for other reasons, the correlation between pain intensity and the respondent (caregiver gender) and finally the correlation between pain intensity and previous pain experience.

In conclusion, this study has revealed high pain prevalence in children across all age groups admitted to four Danish university hospitals. The majority of children in moderate to severe pain did not have a documented pain assessment and did not have evidence-based pharmacological analgesia administered to treat or prevent pain. In addition, integrative (‘non-pharmacological’) therapies were not commonly utilized. The most common painful procedure named by the children was needle procedures.

A multidisciplinary approach is deemed sharing ownership, taking ongoing educational initiatives, involving parents and implementing both appropriate quality-controls as well as evidence-based guidelines into routine practice at all pediatric units.14,38

References


