Chronic pain after inguinal hernia repair in children

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Editor’s key points

- Chronic post-surgical pain after inguinal hernia repair can be a challenging problem in around 10% of adults.
- A few studies in children have found a much lower incidence many years after surgery.
- This current study found that this low incidence appears to be present even after a few years.
- Children may be less likely to suffer from chronic post-surgical pain.
- The mechanisms for this need to be explored further.

Background. The prevalence of moderate-to-severe pain after inguinal hernia repair (IHR) in adults is ~10%. Two studies with very long follow-up periods (16.8 and 49 yr, respectively) have, however, suggested that the risk of developing chronic pain is much lower in children. The purpose of the present study was to examine the prevalence of chronic pain 6–48 months after IHR in children.

Methods. Postal questionnaires were sent to 156 children who had undergone IHR between the age of 6 months and 12 yr. The children were asked to recall the duration of postoperative pain, if necessary with help from their parents, and to describe the intensity and character of their pain, if the pain was still present. Children with chronic pain were offered quantitative sensory testing (QST), and a surgical examination, including ultrasound, in order to exclude hernia recurrence.

Results. Ninety-eight children, mean (SD) age 7.8 (2.6) yr, answered the questionnaire. Their age at the time of surgery was mean (SD) 4.6 (2.4) yr, and the follow-up period was mean (SD) 3.2 (1.3) yr. Five children (5.1%, 95% confidence interval: 0.75–9.5) had pain located in the inguinal region, and three of these children underwent further examination. There was no hernia recurrence, but QST revealed pinprick hyperalgesia and decreased pressure pain thresholds on the operated side in all three children.

Conclusions. The prevalence of chronic pain after IHR in children is 5.1%, which is lower than the prevalence reported after adult hernia repair.

Keywords: child; chronic pain; hernia, inguinal; pain, postoperative

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Chronic postoperative pain is generally accepted as a potential consequence of almost any operation.¹² Prevalence rates vary substantially, depending on the type of surgery; for example, between 50% and 85% of amputees experience phantom pain after amputation, between 20% and 60% report chronic pain after thoracotomy, and up to 30% develop pain after breast cancer surgery.³⁻⁵ The follow-up period in most of the studies dealing with chronic pain after surgery in adulthood is 6 months to 2 yr.

It has been suggested that surgery in childhood is associated with a lower risk of developing chronic pain.⁶⁻⁹ Inguinal hernia repair (IHR) is one of the most common surgical procedures performed worldwide in both adults and children.¹⁰ The prevalence of moderate-to-severe chronic pain after IHR in adults is ~10%, and most of these patients have some degree of functional impairment. Only few studies have dealt with chronic pain after childhood IHR. Aasvang and Kehlet⁸ carried out a nationwide questionnaire study of patients aged 18–19 yr, who had underwent IHR before the age of 5 yr. After a mean follow-up period of 16.8 yr, 13.5% of the 651 patients reported chronic groin pain, but only 2% reported moderate or severe pain.⁹ In another recent study with a median follow-up period of 49 yr, chronic groin pain was reported in 3.2% of the 213 patients who had underwent IHR at a median age of 3.5 yr.³ Thus, the prevalence of chronic pain after IHR seems to be lower when surgery is performed in childhood.

A major limitation of these results is that the follow-up periods were very long in both studies, and therefore, it is possible that the pain had simply dissipated over time. In fact, one study on IHR in adults showed a complete absence of chronic postoperative pain after a follow-up period of 10 yr.¹¹

The aim of the present study was to examine the prevalence of chronic pain 6–48 months after IHR in childhood. In those children with chronic pain, we sought to further
characterize the pain by performing clinical and sensory examination.

**Methods**

**Patients**

Children were recruited from the Outpatient Clinics at the Department of Anaesthesiology, Aarhus University Hospital, Denmark. Inclusion criteria were open IHR 6–48 months earlier [identification through search on the relevant diagnostic codes (ICD10)], age between 6 months and 12 yr at the time of surgery, and current age of at least 4 yr. The lower limit of 4 yr was chosen as children must be 4 yr or older in order to be able to use a faces pain scale. Children with cognitive disorders, severe systemic disease and inability to understand Danish were not included in the study. A questionnaire with a pre-stamped return envelope was mailed to all eligible children and their parents in January/February 2011. A reminder was sent in the case of no reply. According to the Danish Act on the Scientific Ethical Committee System (Law no. 402, paragraph 8, subsection 3), a formal approval from the local Ethics Committee is not needed for questionnaire studies and clinical follow-up of patients.

All children received propofol and remifentanil for anaesthesia. An ilioinguinal block with ropivacaine was performed after induction of anaesthesia, and the funicular structures were infiltrated with ropivacaine before closure. Since traction of the peritoneum and the funicle is very painful and not expected to be affected by the ilioinguinal block, a very deep anaesthesia was chosen. Postoperative analgesic treatment consisted of paracetamol and diclofenac. Surgery was always performed by gastrointestinal surgeons with special expertise in paediatric surgery.

**Assessment of pain**

The pain questionnaire included questions about pain after IHR, defined as any pain that developed or persisted after surgery and was located in the inguinal region on the operated side. The children were asked to recall the duration of their pain after surgery (<1 week; 1 week–1 month; 1–3 months; 4–6 months; 7–12 months; pain still present). If pain was still present, they were asked to describe the frequency (once a week; 2–5 times per week; daily; constant) and intensity (average during the most recent 7 days) of their pain. The revised Bieri Faces pain scale was used for the rating of pain intensity. Each of the six faces corresponds to a number on a numeric rating scale (NRS, 0–10): the first face corresponds to 0 on the NRS, the second face corresponds to 2 on the NRS, and the sixth face corresponds to 10 on the NRS.12

In addition, the children with present pain were asked to describe the character of their pain by using the following sensory descriptors derived from the Danish version of the McGill Pain Questionnaire: burning, pricking/boring, scaling, pressing, freezing, numbing, itching, shooting, or others.13 They were also asked if their pain was aggravated by daily activities such as climbing stairs, running, bicycling, playing soccer/doing sports, climbing in trees, sitting on a chair for a long time, and urinating. Any consumption of analgesic medication to treat pain in the inguinal region was recorded.

All children, both those with and without present pain, were asked whether they experienced pain or unpleasant sensations (dysesthesia) after pressure or light touch to the inguinal region or after exposure of this area to heat and cold (e.g. hot or cold water during showering or swimming).

Young children have decreased developmental capabilities and may have difficulties in answering questions about past pain and in distinguishing between different word descriptors. Therefore, parents/guardians were encouraged to support the children in filling out the questionnaire. Patient characteristic data and data concerning the IHR were derived from their medical records.

**Clinical examination and quantitative sensory testing**

The children with present pain were offered a clinical examination by a gastrointestinal surgeon with special expertise in paediatric surgery, including ultrasound examination of the painful region, in order to exclude hernia recurrence, and quantitative sensory testing (QST). QST included the determination of areas with hypo- or hyperaesthesia to brush, tactile, and cold stimuli and recording of thermal and mechanical thresholds as follows.

The children were carefully introduced to the different methods used. Both the ipsilateral and the contralateral side were examined. Areas with hypo- or hyperaesthesia to brush (SENSELab™ Brush-05, Somedic AB, Sweden), tactile (pinprick, von Frey Filament 5.88, Stoelting Co., USA), and cold (a thermal roll at 20°C, SENSElab, Somedic AB) stimulation were determined using the vector principle narrowing down the area by moving from the outside (normal sensitivity) towards the scar area. The children were told to look away or to close their eyes during the examination and to say ‘stop’ as soon as they experienced a decrease or increase in the applied stimulus. Thermal thresholds were measured using the Somedic Thermostat (Somedic AB). A Peltier thermode with an area of 12.5 cm² and a baseline temperature of 32°C was applied to the skin. Cut-off limits for warm and cold stimulation were 50°C and 10°C, respectively. Pressure pain threshold was determined using a hand-held electronic pressure algometer (Somedic AB). A circular probe with an area of 1 cm² and a pressure application rate of 20 kPa s⁻¹ was used. The children were instructed to activate a push-button immediately as soon as the sensation of touch changed to a sensation of pain.

**Statistical analysis**

Data were entered into an Access database and analysed using the software package NCSS (Number Cruncher Statistical System, McGraw-Hill Companies, Kaysville, UT, USA). Descriptive statistics were used. The results are presented as mean (SD).
Results

Questionnaires were sent out to 156 children who were eligible for the study. Ninety-eight children (73 boys and 25 girls) returned the questionnaire (response rate 64%; Fig. 1). Their present age was 7.8 (2.6) yr and their age at the time of IHR was 4.6 (2.4) yr; thus, the mean follow-up period was 3.2 (1.3) yr [mean, (SD)]. Pain after IHR disappeared within 1 month after surgery in 81 of 98 children (83%); in seven children the pain lasted up to 12 months.

Only five children (5.1%, 95% confidence interval: 0.75–9.5) reported present pain related to the IHR (Table 1). These five children had only one unilateral IHR performed and none had undergone reoperation. Four of the five children had pain with intervals of days or weeks, and one child had constant pain (child A). The average pain intensity varied from 2 to 8 on the revised Bieri Faces pain scale. Pain was aggravated by everyday activities in all five children. The word descriptors most often used were itchy, pricking/boring, burning, and pressing (Table 2). One child used acetaminophen once a week due to pain in the inguinal region (child B). Three of the five children with present pain (children A, B, and E) consented to undergo clinical examination, ultrasound, and QST. Clinical examination and ultrasound revealed no cases of recurrence, but one child (patient B) was referred to the Outpatient Orthopaedic Clinic on suspicion of an orthopaedic disorder. The orthopaedic examination, including X-ray of the pelvis, showed no pathology.

The QST results from the three children are shown in Table 3 and Figure 2. A consistent finding was pinprick hyperalgesia and decreased pressure pain thresholds on the operated side.

Three out of the five children with present pain and nine out of the 93 children without present pain reported pain or unpleasant sensations after pressure (nine children), light touch (three children), or both of the inguinal region and/or after exposure of the inguinal region to heat (two children) or cold (two children).

Discussion

The present study is the first to examine the prevalence of pain located to the inguinal region 6–48 months after

| Table 1 Patient characteristics and recalled duration of pain after IHR (n=98). *Eight of the 95 children with unilateral hernia repair had undergone reoperation, and two of the three children with bilateral IHR had undergone reoperation |
|-----------------------------------------------|----------------|----------------|
| Gender (M/F)                                | 73/25          |                |
| Ethnicity (Caucasian/other)                  | 88/10          |                |
| Side of surgery (right/left/bilateral)*      | 63/32/3        |                |
| Age (yr) at the time of surgery [mean (SD)]  | 4.6 (2.4)      |                |
| Age (yr) at the time of answering the        | 7.8 (2.6)      |                |
| questionnaire [mean (SD)]                   |                |                |
| Time (yr) since surgery [mean (SD)]         | 3.2 (1.3)      |                |
| Recalled duration of postoperative pain      |                |                |
| <1 week                                      | 52             |                |
| 1 week–1 month                              | 27             |                |
| 1–3 months                                   | 3              |                |
| 4–6 months                                   | 3              |                |
| 7–12 months                                  | 1              |                |
| Pain still present                           | 5              |                |
| Do not remember                              | 7              |                |

*Eight of the 95 children with unilateral hernia repair had undergone reoperation, and two of the three children with bilateral IHR had undergone reoperation.
open IHR in children. Five out of 98 children (5.1%) reported pain after a mean follow-up period of 3.2 yr. Only one child had constant pain, another had pain several times a week, while the remaining three had pain less frequently. Only one child used medication for his pain. Thus, our results are in accordance with two other studies with long-term chronic pain after childhood IHR. In

Table 2 Characteristics of pain in five children with chronic pain after IHR. *Bieri Faces pain scale-revised, each of the six faces corresponds to a number on an NRS (0–10): the first face corresponds to a pain intensity of 0 on the NRS, the second face corresponds to 2 on the NRS, and the sixth face corresponds to a pain intensity of 10 on the NRS. **Self-reported, four options are given; pressure, light touch, cold, or warm stimuli (e.g. cold or warm water)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Frequency of pain</th>
<th>Age at the time of surgery</th>
<th>Present age</th>
<th>Pain intensity during last week (FPS-R)*</th>
<th>Self-reported pain/dysaesthesia**</th>
<th>Aggravation of pain by activities</th>
<th>Pain descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>F</td>
<td>Constant</td>
<td>6 yr 4 months</td>
<td>10 yr 5 months</td>
<td>4</td>
<td>Pressure Cold water</td>
<td>Running Climbing trees Playing soccer</td>
<td>Burning Pricking/boring Itchy</td>
</tr>
<tr>
<td>B</td>
<td>M</td>
<td>2–5 times per week</td>
<td>7 yr 4 months</td>
<td>11 yr 4 months</td>
<td>4</td>
<td>Pressure</td>
<td>Walking stairs Running Playing soccer</td>
<td>Pricking/boring Numbing Itchy Tugging (other)</td>
</tr>
<tr>
<td>C</td>
<td>F</td>
<td>Once a week</td>
<td>7 yr 4 months</td>
<td>9 yr 7 months</td>
<td>8</td>
<td>Pressure</td>
<td>Cycle Running Climbing trees Playing soccer Urinating</td>
<td>Burning Pricking/boring Scalding Itchy</td>
</tr>
<tr>
<td>D</td>
<td>F</td>
<td>Once a week</td>
<td>5 yr 8 yr 4 months</td>
<td></td>
<td>4</td>
<td>None</td>
<td>Urinating</td>
<td>Pressing Numbing Itchy</td>
</tr>
<tr>
<td>E</td>
<td>M</td>
<td>Once a month</td>
<td>7 yr 10 yr 2 months</td>
<td></td>
<td>2</td>
<td>None</td>
<td>Sitting on a chair for a long time</td>
<td>Pressing Shooting</td>
</tr>
</tbody>
</table>

Table 3 Results from QST in three children with chronic pain after IHR

<table>
<thead>
<tr>
<th>Patient</th>
<th>Cold detection threshold (°C) (contralateral/pain area)</th>
<th>Warm detection threshold (°C) (contralateral/pain area)</th>
<th>Cold pain threshold (°C) (contralateral/pain area)</th>
<th>Heat pain threshold (°C) (contralateral/pain area)</th>
<th>Pressure pain threshold (kPa) (contralateral/pain area)</th>
<th>Brush allodynia</th>
<th>Brush hypoesthesia</th>
<th>Cold allodynia</th>
<th>Cold hypoesthesia</th>
<th>Pinprick hyperalgesia</th>
<th>Pinprick hypoesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>29.7/29.2</td>
<td>36.7/36.5</td>
<td>21.1/10</td>
<td>46.0/47.9</td>
<td>157/68</td>
<td>+</td>
<td>–</td>
<td>+</td>
<td>–</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>B</td>
<td>30.7/30.3</td>
<td>34.6/34.8</td>
<td>26.1/26.6</td>
<td>40.0/38.4</td>
<td>157/94</td>
<td>–</td>
<td>–</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>E</td>
<td>30.5/31.0</td>
<td>35.2/35.6</td>
<td>10.1/18.4</td>
<td>43.0/39.8</td>
<td>87/41</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tbody>
</table>

Fig 2 Eleven-year-old girl (patient A) with chronic pain after IHR. Areas of brush-evoked allodynia, cold allodynia, and pinprick hyperalgesia are delineated with solid lines.

the study by Aasvang and Kehlet, the prevalence of substantial pain (defined as pain occurring often or always and rated > 3 on a 10-point visual analogue scale) was 2%, and pain mainly occurred during sports or other leisure activities.
In the study by Zendejas and colleagues,9 the prevalence was 3.2%, and in most cases, the pain was mild.

The follow-up period in the present study is similar to the follow-up periods in most of the studies on chronic pain after IHR in adults.16–18 Therefore, it is likely that low prevalence rates of pain found in the two other studies on chronic pain after IHR in children with very long-term follow-up periods cannot simply be explained by a dissipation of pain over time. The results from our study suggest that the risk of developing chronic pain is indeed lower after IHR in childhood.

The lower prevalence of chronic pain after IHR in children may have various explanations. The surgical procedure is simpler in children and their recovery is faster. Stewart and colleagues19 prospectively followed 105 children who underwent tonsillectomy, orchidopexy, or IHR. Children who underwent IHR (n=31) resumed normal activities after 4 days, and after 6 days, all children had no pain.

The risk of developing chronic pain after surgery may increase with higher age. The mean age of the 98 children in the present study was 4.6 yr at the time of surgery, but the five children with chronic pain were slightly older at the time of surgery (5, 6, 7, 7, and 7 yr old, respectively). Although the number of children with pain is low, this finding is in line with the findings in our previous study on chronic pain in adults after thoracotomy in childhood. In that study, the prevalence of chronic pain was 3.2% in children aged 0–6 yr at the time of surgery and 19.4% in children aged 7–12 yr at the time of surgery.7

The pain descriptors most often used by the five children with chronic pain (itchy, pricking/boring, burning, and pressing) suggest that their pain may be of neuropathic origin. Three of the five children with chronic pain underwent QST. All children had sensory abnormalities in the painful area, including pinprick hyperalgesia, and lowered pressure pain thresholds. However, there was no consistent lowering of detection threshold to cold or warmth which would be consistent with nerve damage in the painful area.

In the present study, 12 children reported abnormal evoked sensations (pain/unpleasantness) in the inguinal region after pressure, light touch, and/or after exposure to heat or cold. Only three of these children had chronic pain. It is likely that abnormal hypo- and hyperphenomena are common after IHR, but the specificity for chronic pain may be low. In fact, a study of 72 adults who underwent QST 6–12 months after IHR showed mechanical hypoesthesia and tactile allodynia in 51% of the patients, but QST revealed no differences between patients with (n=20) and without (n=52) pain, except for a small increase in pain response after repetitive brush and von Frey filament stimulation.20

Some limitations of the present study should be considered. First of all, it is a retrospective study. Therefore, information about the duration of pain after surgery may be susceptible to recall bias. It is likely that the children had difficulties in remembering the exact duration of pain, even with help from their parents, although some studies suggest that even young children can recall previously experienced pain for months and years.21 Secondly, the cognitive ability to understand the meaning of the questions and the purpose of the study may vary in this age group. Thirdly, we do not know to what extent the children were supported by their parents in answering the questionnaire. Finally, information about abnormal, evoked sensations in the inguinal region was based on self-reports in most of the children; only three children underwent QST. QST is necessary in order to obtain more reliable data on sensory abnormalities.

In conclusion, this study suggests that the prevalence of chronic pain after IHR is lower in children compared with adults. Prospective studies with a long-term follow-up, including QST, are needed to increase our knowledge about the prevalence of chronic pain after surgery in children.

Declaration of interest
None declared.

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References