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Efficacy of regional analgesia in prevention of chronic postsurgical pain in children on the PEDSQL General Well-Being Scale and Pediatric Pain Questionnaire

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Introduction. In pediatrics, regional anesthesia is one of the most valuable and safest means of perioperative pain management and chronic pain prevention. Pediatric Quality of Life Inventory 3.0 General Well-Being Scale and Pediatric Pain Questionnaire allow for assessing the impact of pain on children and their families via studying changes in Quality of Life scores for the scales of Present Pain and Worst Pain, General Well-Being and General Health.

The aim of the study was to assess the impact of regional analgesia on the prevention of chronic postsurgical pain using PedsQL™ 3.0 questionnaires.

Materials and methods. Following the inclusion and exclusion criteria, a total of 80 children were enrolled in the study. Among them, there were 60 children who underwent anterior abdominal wall surgery with various types of anesthetic management and were treated at the surgical department of a Communal Non-Profit Enterprise «Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council». All patients were divided into 4 groups. The Group 0, the control group, included 20 children who had no surgical pathology and met inclusion criteria. The Group I comprised 20 children who underwent anterior abdominal wall surgery under general anesthesia using the transversalis fascia plane block combined with the quadratus lumborum block-4 via a single injection. The Group II included 20 children who underwent anterior abdominal wall surgery under general anesthesia using morphine. The Group III comprised 20 children who underwent anterior abdominal wall surgery under general anesthesia using the transversalis fascia plane block.

Results. The prevalence of chronic pain syndrome in children who received conventional analgesia was the highest – 19.81±0.21%. Children who underwent conventional analgesia, while staying in the surgical department, had significantly higher the Face, Legs, Activity, Cry, Consolability scale and Visual Analogue Scale scores as compared to those who received other forms of regional analgesia.

Discussion. Three and six months after surgery, in patients who received conventional analgesia, quality of life significantly reduced ($p<0.001$) on the scales of General Well-Being, General Health, Present Pain, and Worst Pain. This shows the need for using effective minimally invasive regional analgesia techniques in the perioperative period.

Conclusions. Chronic pain syndrome reduces quality of life in children by reducing their general well-being and general health due to high indicators of present and worst pain. Regional analgesia techniques are a priority for the prevention of chronic pain syndrome.

The research was carried out in accordance with the principles of the Helsinki Declaration. The study protocol was approved by the Local Ethics Committee of the participating institution. The informed consent of the patient was obtained for conducting the studies.

No conflict of interests was declared by the author.

Keywords: Chronic Pain, Quality of Life, Children, Regional Analgesia, Prevention

Ефективність регіонарної аналгезії у профілактиці хронічного післяопераційного болю в дітей за оцінкою якості життя PEDS QL General Well-Being scale та Pediatric Pain Questionnaire

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Вступ. Регіональна анестезія в педіатричній практиці – одна з найбільш цінних і безпечних засобів для лікування періопераційного та профілактики хронічного болю. Pediatric Quality of Life Inventory 3.0 General Well-Being Scale та Pediatric Pain Questionnaire дають змогу оцінити вплив болю на дітей і сім'ю шляхом вивчення зміни значень якості життя за шкалами поточного та найсильнішого болю, загального самопочуття і загального здоров'я.

Мета – оцінити вплив регіонарної аналгезії на профілактику хронічного післяопераційного болю за допомогою опитувальників PedsQL™ 3.0.

Матеріали та методи. 80 дітей взяли участь у цьому дослідженні відповідно до критеріїв залучення та вилучення, у 60 з них проведено оперативне втручання на передній черевній стінці з різними варіантами анестезіологічного знеболювання, які перебували на стаціонарному лікуванні в хірургічному відділенні КНП «Івано-Франківська обласна дитяча лікарня Івано-Франківської обласної ради». Діти були поділені на 4 групи. 0 група – група контролю, склали 20 дітей, які не мали хірургічної патології та відповідали критеріям включення. І групу склали 20 дітей, оперованих на передній черевній стінці, під загальним знеболенням із застосуванням регіонарного блоку поперечної фасції живота (TFPB), в поєднанні з блокадою квадратного м'яза попереку (QLB-4) із одного уколу. ІІ групу склали 20 дітей, оперованих на передній черевній стінці під загальним знеболенням із використанням морфіну. ІІІ групу склали 20 дітей, оперованих на передній черевній стінці, під загальним знеболенням із застосуванням регіонарного блоку поперечної фасції живота (TFPB).

Результати. Поширеність хронічного больового синдрому в дітей з групи традиційного знеболювання є найвищою – 19,81±0,21%. Діти групи традиційного знеболювання протягом перебування в хірургічному відділенні мають достовірно вищі показники шкали обличчя, ноги, активність, плач, задоволеність та візуально-аналогової шкали порівняно з дітьми з груп різного регіонарного знеболювання. Якість життя пацієнтів на 3 та 6 місяці після операції на тлі використання традиційних методик знеболювання значно знижувалася ($p<0,001$) за шкалами загального самопочуття, загального здоров'я, поточного та найсильнішого болю. Цей факт вказує на необхідність застосування в періопераційному періоді мініінвазивних, ефективних методик регіонарної аналгезії.

Висновки. Хронічний больовий синдром знижує якість життя дітей, знижуючи загальне самопочуття, загальне здоров'я за рахунок високих показників поточного та найсильнішого болю. Методики регіонарної аналгезії є пріоритетними для профілактики хронічного больового синдрому.

Дослідження виконано відповідно до принципів Гельсінської декларації. Протокол дослідження ухвалено Локальним етичним комітетом зазначеної в роботі установи. На проведення досліджень отримано інформовану згоду батьків дітей.

Автор заявляє про відсутність конфлікту інтересів.

Ключові слова: хронічний біль, якість життя, діти, регіональна анестезія.

Introduction

Chronic postsurgical pain (CPSP) is a public health problem recognized in the pediatric population [36]. CPSP is defined as pain that develops or increases in intensity after a surgical procedure and persists for at least three months [18]. The reported prevalence of CPSP varies in different studies, some studies have reported its prevalence as varying between 11% and 38% [2,17], while, according to other studies, it has been reported to range from 5% to 54% [13,18]. Such prevalence range of CPSP is due to the assessment of pain and surgical procedures of different types performed at various times after surgery. Chronic pain affects the entire nervous system and leads to central sensitization (increased central nervous system response to painful and non-painful stimuli) [16,37]. Untreated chronic pain in children increases the risk of developing mental disorders later in life. Almost 17% of adult chronic pain patients report a history of chronic pain in childhood or adulthood, with close to 80% indicating that pain from childhood continues today [9]. In the USA, adults with chronic pain have lower family income and higher risk of unemployment [11].

In pediatrics, regional anesthesia (RA) is one of the most valuable and safest means of perioperative pain management and CPSP prevention, being an essential part of modern anesthetic practice. Over the past few years, a significant progress has been made in the development of pediatric RA, including the availability of information on safety, nomenclature, and ultrasound prioritization [12]. Novel RA techniques, especially the anterolateral and the posterolateral trunk blocks, are quite promising today. The benefits of RA in children include: accelerated recovery; reduced opioid use; reduced incidence of postoperative nausea and vomiting; reduced postoperative pain intensity; reduced incidence of respiratory complications; reduced healthcare system costs [15].

Ultrasound-guided quadratus lumborum block (QLB) is one of the interfascial plane blocks used for pain relief in abdominal surgeries in children and adults [1]. Clinical trials have shown that it demonstrates opioid effects [3] and longer postoperative pain relief as compared to more conventional procedures such as transversus abdominis plane (TAP) block [4]. There are

variations in the widths of achieved analgesia depending on the number of dermatomes covered by the QLB. In most cases, analgesia is achieved in T7-L1 dermatomes, although there are data on cranial spread to T4-T5 dermatomes and caudal spread to L2-L3 dermatomes [5,8].

The transversalis fascia plane block (TFPB) is a truncal block that targets the L1 nerve branches, namely the ilioinguinal and iliohypogastric nerves, where they emerge from the lateral border of the psoas major muscle, inferior to the 12th rib. The TFPB was first proposed by Hebbard in 2009 [10]. A local anesthetic injected between the transversus abdominis muscle and its deep investing transversalis fascia spreads over the inner surface of the quadratus lumborum muscle and blocks the proximal portions of the T12 and L1 nerves. The block is used during surgeries on inguinal hernia, trephine biopsy of the iliac spine, chronic neuropathic pain in adults. However, the reports on its routine use in pediatric practice are scarce.

The concept of quality of life (QoL) is today an integral part of the healthcare system and clinical, medical, and social research. The term «health-related quality of life» (HRQoL) allowed for identifying the parameters describing the state of health, care for health, and quality of medical care according to the general QoL concept [14,32]. Furthermore, in children with chronic conditions, the effect of the disease and treatment on family functioning, alongside with the role of the family in child's adaptation to the pathological condition is a serious issue [19,28,35]. Understanding the effect of chronic disease on child's parents and family is critical for delivering comprehensive care to those families. However, the relationship between the disease, its clinical course, and its impact on child's parents and family is complex and dynamic. Moreover, negative parental perception of child's health is associated with higher health care utilization.

The Pediatric Quality of Life Inventory (PedsQL™) General Well-Being Scale and Pediatric Pain Questionnaire (PPQ) provide for using multidimensional tools that could be easily integrated into the PedsQL™ Measurement Model [34]. The PedsQL™ Measurement Model includes general HRQoL indicators [26,31,33], disease-specific QoL measurement tools [21,23–25,30], as well as general indicators of fatigue [27], satisfaction with healthcare services [29,22] and assessment of healthcare built environment.

HRQoL has become a commonly used indicator of health and well-being that demonstrates the impact of health on QoL and reflects the desirability of health states relative to perfect health. We attempted to determine the psychometric properties of the PedsQL™ PPQ and General Well-Being Scale, tools designed to assess the impact of pain on children and their families, via studying changes in QoL scores for the scales of Present Pain and Worst Pain, General Well-Being, and General Health.

The purpose of the study – to assess QoL in children by means of PedsQL™ General Well-Being Scale and PPQ when using different RA techniques for prevention of chronic pain.

Materials and methods of the research

The study included 80 (45 boys and 35 girls) children at the age of 7–17 years. Among them, there were 60 children who were treated for inguinal hernia, appendicitis and underwent anterior abdominal wall surgery with different analgesic techniques at the surgical department of a Communal Non-Profit Enterprise «Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council», Ukraine, between January 2020 and July 2022. The control group included 20 children with no surgical pathology.

Inclusion criteria were children with inguinal hernia and appendicitis ASA (American Society of Anesthesiologists) grades I-II at the age of 7–18 years, with the mandatory parental consent to involve their child in clinical research. Exclusion criteria included children less than 7 years of age; those with ASA grade III or higher, mental disorders, neoplasms, or tumors, acute or inflammatory processes of any etiology and localization, sepsis, shock; those who previously underwent surgery on the lower abdomen; those who experienced pain for six months prior to surgery; those who refused to participate in the research; children whose parents refused to give consent and children who gave no consent.

All patients were divided into 4 groups:

The Group 0, the control group, included 20 children who had no surgical pathology and met inclusion criteria;

The Group I comprised 20 children who underwent anterior abdominal wall surgery under general anesthesia using the TFPB combined with the QLB (Quadratus lumborum block)-4 via a single injection;

The Group II included 20 children who underwent anterior abdominal wall surgery under general anesthesia using morphine;

The Group III comprised 20 children who underwent anterior abdominal wall surgery under general anesthesia using the TFPB (Transversalis fascia plane block).

All clinical and laboratory studies were conducted in accordance with the World Medical Association Declaration of Helsinki «Ethical Principles for Medical Research Involving Human Subjects». According to the Law, prior to a subject's participation in the study, a written informed consent form was signed by each subject (parents/adult guardians). The manuscript was approved by the Ethics Committee of the Communal Non-Profit

Table 1
The length of hospital stay, M±m

Indicator	Group I n=20	Group II n=20	Group III n=20
Length of stay in the department	2.1±0.16	3.28±0.24 *,**	2.35±0.11

Notes: *– a significant difference between Group I and Group II (p<0.05); ** – a significant difference between Group II and Group III (p<0.05).

Table 2
Perioperative pain management, M±m

Indicator	Group I n=20	Group II n=20	Group III n=20
Fentanyl, ml	4.86±0.33	8.8±2.41*	6.03±0.57**
Omnopon, ml	–	3.75±0.25	–
Promedol, ml	–	3.167±0.98$^{\Delta}$	1.92±0.36
Morphine, ml	–	3.25±0.75	
Paracetamol, ml	166.63±20.05	392±28.53*,$^{\Delta}$	239.38±47.12**

Notes: *– a significant difference between the Group I and the Group II (p<0.05); ** – a significant difference between the Group I and the Group III (p<0.05); Δ – a significant difference between the Group II and the Group III (p<0.05).

Enterprise «Ivano-Frankivsk Regional Children's Clinical Hospital of Ivano-Frankivsk Regional Council», as evidenced by an Excerpt from the Minute of the Committee Meeting No. 2 dated February 24, 2022.

The authors obtained official permission to use a licensed version of the PedsQL™ General Well-Being Scale and PPQ from the Mapi Research Trust, as evidenced by a corresponding letter.

All patients underwent anterior abdominal wall surgery under general anesthesia. Postoperative pain management included multimodal analgesia. The assessment of acute pain and the quality of pain management was carried out by means of the Visual Analogue Scale (VAS), the Face, Legs, Activity, Cry, Consolability (FLACC) scale, the Behavioral Pain Scale (BPS) (facial expression, upper limb movements, compliance with mechanical ventilation). The VAS, BPS, FLACC scores were determined 12, 72 hours after surgery and at discharge in all children. The DN4 neuropathic pain diagnostic questionnaire and the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) pain scale (Bennett M, 2001) were used to assess the presence of chronic or neuropathic pain.

The results obtained were statistically processed using the IBM SPSS Statistics Version 26.0 for Windows. Descriptive statistics were determined for each interval variable and presented as the mean (mean) ± standard deviation (SD). To determine whether sample data were normally distributed, the Kolmogorov–Smirnov test was used. To compare the means of two independent groups of patients in case of normal and non-normal distribution of the variables, the Mann–Whitney U test and the Independent Samples t-test were used, respectively. To compare two paired samples in case of non-normal data distribution, we used the Wilcoxon test; to compare two paired samples in case of normal data distribution, the Student's t-test was used. To compare three and more independent variables, the Kruskal–Wallis One-Way MANOVA test was used. Differences were considered statistically significant at p<0.05. The proportions were statistically compared by using a z-test.

Results of the study

The assessment of children's age, body weight, and gender found no difference, indicating a representative sample.

The prevalence of chronic pain syndrome in children of the Group I, the Group II, and the Group III was found to be 9.24±0.35%, 19.81±0.21%, 11.71±0.13%, respectively, with a male predominance.

The analysis of the length of hospital stay in the surgical department revealed that children who underwent conventional anesthesia stayed at the hospital much longer as compared to those who received RA (3.28±0.24 days in the Group II vs 2.1±0.16 and 2.35±0.11 days in the Group I and the Group III, respectively, p<0.05) (Table 1).

During the perioperative period, all patients received anesthesia using opioid and non-opioid analgesics. Thus, the amount of intraoperatively administered fentanyl was the greatest in patients who underwent conventional analgesia (the Group II, p<0.05) and constituted 8.8±2.41 ml vs 4.86±0.33 ml and 6.03±0.57 ml in the Group I and the Group III, respectively (p<0.05). Children who underwent conventional anesthesia required omnopon and morphine injections, while promedol was injected to children of the Group II and the Group III. For non-opioid pain management, paracetamol, as a component of a multimodal analgesic regimen, was in-

Table 3
Acute pain assessment scales, M±m

Indicator		Group I n=20	Group II n=20	Group III n=20
FLACC	12 hours after surgery	4.7±0.17	5.5±0.22*	4.98±0.37
	72 hours after surgery	3.91±0.28	4.92±0.14*	4.73±0.45
	At discharge	3.22±0.22	4.0±0.16*	3.6±0.28
VAS	12 hours after surgery	4.26±0.28	5.36±0.18*,**	4.45±0.11
	72 hours after surgery	3.58±0.28	5.0±0.16*	4.12±0.1
	At discharge	2.85±0.1	4.77±0.12*,**	3.92±0.24

Notes: *– a significant difference between the Group I and the Group II ($p<0.05$); ** – a significant difference between the Group II and the Group III ($p<0.05$).

travenously administered, with significantly greater amounts in children of the Group II and the Group III (392±28.53 ml and 239.38±47.12 ml, respectively) as compared to children who received combined regional anesthetic block (166.63±20.05 ml, $p<0.05$) (Table 2).

On the first, second, and third days of hospital stay, pain intensity on the FLACC scale was greater in the Group II (FLACC – 5.5±0.22, 4.92±0.14, 4.0±0.16, respectively) as compared to the Group I (FLACC – 4.7±0.17, 3.91±0.28, 3.22±0.22, respectively, $p<0.05$) and the Group III (FLACC – 4.98±0.37, 4.73±0.45, 3.6±0.28, respectively, $p<0.05$) (Table 3). The analysis of the scores of acute pain assessment scales in children revealed that children of the Group II, while staying in the surgical department, had significantly higher FLACC and VAS scores as compared to those in the Group I and the Group III. There was determined a statistically significant difference in the VAS score at hospital discharge ($p<0.05$). The Fisher's least significant difference (LSD) test for pairwise comparison of groups found that throughout the entire treatment period the Group I had a significantly lower VAS score as compared to the Group II and the Group III ($p<0.05$). As can be seen from Table 3, in the Group I, the Group II, and the Group III, the VAS score decreased from the first 12 hours following surgery to discharge by 1.49, 1.12 and 1.13 times, respectively. This may indicate that children who receive combined regional anesthetic block better react to analgesia. The following changes in the VAS scores throughout the treatment were observed: 4.26±0.28 twelve hours following surgery, with a tendency to decrease 72 hours after surgery and at discharge (3.58±0.28 and 2.85±0.1, respectively, $p<0.05$).

Children of the Group II also had statistically higher VAS scores throughout the entire treatment period as compared to the Group I and the Group III ($p<0.05$). When monitoring the VAS scores from the first 12 to 72 hours postoperatively, the tendency to their decrease was observed (Table 3). Despite the decrease in acute pain intensity at the time of discharge, normal VAS scores were, however, not observed.

The analysis of changes in acute pain and the quality of pain management in the Group III found a positive effect of pain relief, i.e., a decrease in pain intensity both within the first hours following surgery and after discharge. The VAS score ranged from 4.45±0.11 within the first 12 hours postoperatively to 3.92±0.24 at the time of discharge (Table 3).

The comparison of the studied groups revealed a statistically significant difference in the DN4 indicator six months after surgery and the LANSS pain scale indicator three and six months after surgery ($p<0.001$). The Fisher's LSD test for pairwise comparison of groups found a statistically significant difference in the DN4 indicator six months after surgery between all the studied groups ($p<0.001$). There was a statistically significant difference in the LANSS pain scale indicator three months after surgery between the Group I and the Group II ($p<0.001$), as well as the Group II and the Group III ($p<0.001$). The Fisher's LSD test for pairwise comparison of groups found a statistically significant difference in the LANSS pain scale indicator six months after surgery between all the studied groups ($p<0.001$) (Table 4).

According to the analysis of questionnaires for acute pain assessment in children (DN4 questionnaire, LANSS pain scale), in children of the Group II, the prevalence of chronic pain was greater (30%) as compared to those in the Group I and the Group III (5% and 15%, respectively), which again confirmed the efficacy of the QLB+TFPB for prevention and treatment of acute pain, as well as chronic pain syndrome (Table 4).

When assessing the PedsQL™ General Well-Being Scale and PPQ on the scales of General Well-Being, General Health, Present Pain, Worst Pain, the following results were found.

On the seventh day of the study, QoL indicators on the General Well-Being scale in the Group I, the Group

Table 4
Chronic pain assessment scales, M±m

Indicator		Group I n=20	Group II n=20	Group III n=20
DN4	Three months after surgery	4.85±0.19	4.62±0.18	4.54±0.18
	Six months after surgery	5.46±0.42	13.69±0.38**,Δ	8.69±0.78*
LANSS pain scale	Three months after surgery	6.62±0.66	12.08±0.31**,Δ	7.38±0.76
	Six months after surgery	6.38±0.5	13.54±0.33**,Δ	10.46±0.35*

Notes: * – a significant difference between the Group I and the Group III (p<0.001); ** – a significant difference between the Group I and the Group II (p<0.001); Δ – a significant difference between the Group II and the Group III (p<0.001).

Table 5
Quality of life on General Well-Being scale at different study periods

Study periods	Control group	Group I	Group II	Group III
Seven days after surgery	93.75±3.94	54.17±5.89$^{\Delta,CG}$	55.21±7.75$^{\Delta,CG}$	53.54±7.31$^{\Delta,CG}$
Three months after surgery		94.17±5.47*,GII;*GIII	71.04±9.12$^{\Delta,CG;\Delta,GIII;*,GI}$	80.21±6.47$^{\Delta,CG;\Delta,GII;*GIII}$
Six months after surgery		94.58±4.89*,GII	73.33±7.33$^{\Delta,CG;*,GI;*,GIII}$	92.08±5.22*,GII

Notes: CG – control group; GI – the Group I; GII – the Group II, GIII – the Group III; Δ – p<0.01; * – p<0.001 – a statistically significant difference in relation to the corresponding groups.

II, and the Group III reduced significantly, by 42.22%, 41.11% and 42.89%, respectively, as compared to the control group (p<0.01). The indicators in the Group I did not differ significantly from those in the Group II and the Group III (p>0.05). There was no significant difference between the indicators in the Group II and the Group III (p>0.05).

Three months after surgery, QoL indicators on the General Well-Being scale in the Group I did not differ significantly from those in the control group (p>0.05). At the same time, QoL indicators on the General Well-Being scale in the Group II and the Group III reduced significantly, by 24.22% and 14.44%, respectively, as compared to the control group (p<0.01). Moreover, the indicators in the Group I increased significantly, by 24.56% and 14.82%, as compared to the Group II and the Group III, respectively (p<0.001). In the Group III, QoL indicators on the studied scale reduced slightly, by 12.9%, as compared to the Group II (p<0.01).

Six months after surgery, QoL indicators on the General Well-Being scale in the Group I and the Group III did not differ significantly from those in the control group (p>0.05). The indicators in the Group II reduced significantly, by 21.78%, as compared to the control group (p<0.01). There was no significant difference between the indicators in the Group I and the Group III (p>0.05). QoL indicators on the studied scale in the Group I increased significantly, by 22.47%, as compared to the Group II (p<0.001). In the Group II, the indicators reduced significantly, by 25.57%, as compared to the Group III (p<0.001) (Table 5).

On the seventh day of the study, QoL indicators on the General Health scale in the Group I, the Group II, and the Group III reduced significantly, by 36.99%, 35.62%, 36.99%, respectively, as compared to the control group (p<0.01). The indicators in the Group I did not differ significantly from those in the Group II and the Group III (p>0.05). In the Group II, QoL indicators on the General Health scale did not differ significantly from those in the Group III (p>0.05).

Three months after surgery, QoL indicators on the General Health scale in the Group I did not differ significantly from those in the control group (p>0.05). At the same time, QoL indicators on the studied scale in the Group II and the Group III reduced slightly, by 19.18% and 9.59%, respectively, as compared to the control group (p<0.05). There was no significant difference between the indicators in the Group I and the Group III (p>0.05). Moreover, the indicators in Group I increased significantly, by 21.33%, as compared to the Group II (p<0.01). There was no significant difference between the indicators in the Group II and the Group III (p>0.05).

Six months after surgery, QoL indicators on the General Health scale in the Group I and the Group III did not differ significantly from those in the control group (p>0.05). The indicators in the Group II reduced slightly, by 9.59%, as compared to the control group (p<0.01). There was no significant difference between the indicators in the Group I and the Group III (p>0.05). QoL indicators on the General Health scale in the Group I increased slightly, by 10.81%, as com-

Table 6
Quality of life on General Health scale at different study periods

Study periods	Control group	Group I	Group II	Group III
Seven days after surgery	91.25±14.68	57.5±16.42$^{\Delta,CG}$	58.75±14.68$^{\Delta,CG}$	57.5±16.42$^{\Delta,CG}$
Three months after surgery		93.75±13.75$^{\Delta,GII}$	73.75±22.18$^{\Delta,CG;\Delta,GI}$	82.5±18.32^{*,CG}
Six months after surgery		92.5±11.75^{*,GII}	82.5±18.32$^{*,GI;*,GIII;\Delta,CG}$	95±10.26^{*,GII}

Notes: CG – control group; GI – the Group I; GII – the Group II, GIII – the Group III; * – p<0.05; Δ – p<0.01; – a statistically significant difference in relation to the corresponding groups.

Table 7
Quality of life on Present Pain scale at different study periods

Study periods	Control group	Group I	Group II	Group III
Seven days after surgery	7.75±4.59	65.3±8.52$^{\Delta,CG}$	65.45±8.85$^{\Delta,CG}$	65.05±8.86$^{\Delta,CG}$
Three months after surgery		7.05±4.19$^{*,GII;*,GIII}$	49.15±6.2$^{\Delta,CG;*,GI;*,GIII}$	25.4±5.81$^{\Delta,CG;*,GI;*,GII}$
Six months after surgery		7.95±4.25^{*,GII}	45.2±5.39$^{\Delta,CG;*,GI;*,GIII}$	10.1±4.2^{*,GII}

Notes: CG – control group; GI – the Group I; GII – the Group II, GIII – the Group III; Δ – p<0.01; * – p<0.001 – a statistically significant difference in relation to the corresponding groups.

Table 8
Quality of life on Worst Pain scale at different study periods

Study periods	Control group	Group I	Group II	Group III
Seven days after surgery	10.95±4.37	75.85±10.86$^{\Delta,CG}$	77.15±10.56$^{\Delta,CG}$	76.25±11.72$^{\Delta,CG}$
Three months after surgery		10.2±4.81$^{*,GII;*,GIII}$	60.2±8.43$^{\Delta,CG;*,GI;*,GIII}$	36.05±6.75$^{\Delta,CG;*,GI;*,GII}$
Six months after surgery		10.9±4.64^{*,GII}	57.65±6.85$^{\Delta,CG;*,GI;*,GIII}$	13.15±4.82^{*,GII}

Notes: CG – control group; GI – the Group I; GII – the Group II, GIII – the Group III; Δ – p<0.01; * – p<0.001 – a statistically significant difference in relation to the corresponding groups.

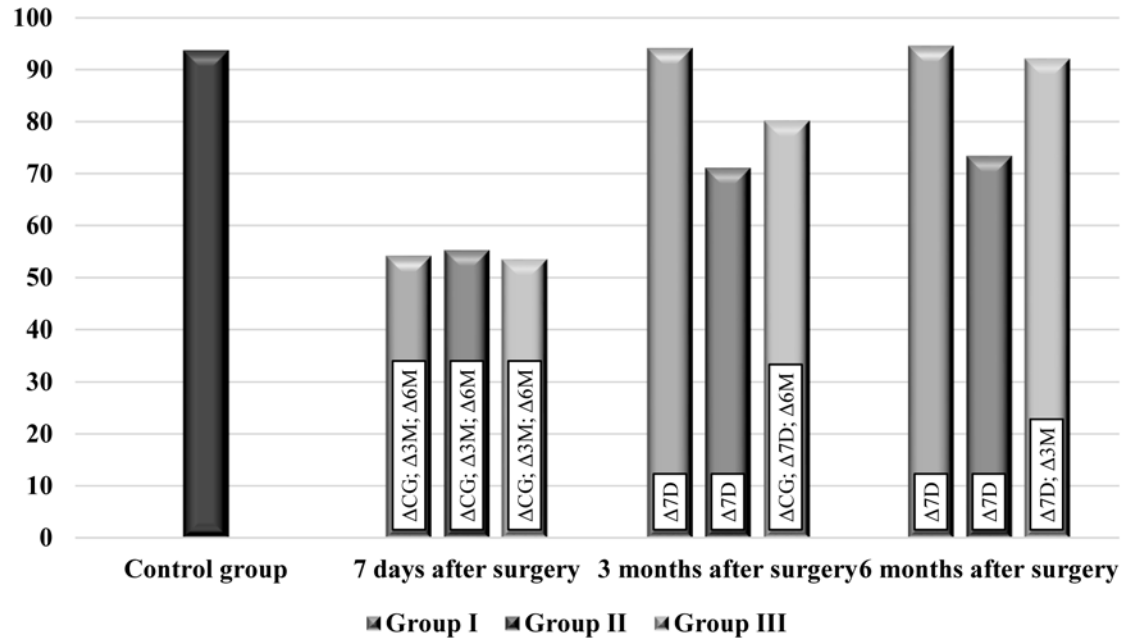
pared to the Group II (p<0.05). In the Group II, the indicators reduced slightly, by 15.15%, as compared to the Group III (p<0.05) (Table 6).

On the seventh day of the study, QoL indicators on the Present Pain scale in the Group I, the Group II, and the Group III increased significantly, by 742.58%, 744.52%, 739.35%, respectively, as compared to the control group (p<0.01). The indicators in the Group I did not differ significantly from those in the Group II and the Group III (p>0.05). There was no significant difference between QoL indicators on the Present Pain scale in the Group II and the Group III (p>0.05).

Three months after surgery, QoL indicators on the Present Pain scale in the Group I did not differ significantly from those in the control group (p>0.05). QoL indicators on the studied scale in the Group II and the Group III increased significantly, by 534.19% and 227.74%, respectively, as compared to the control group (p<0.01). Moreover, the indicators in the Group I reduced significantly as compared to the Group II and the Group III – by 597.16% and 260.28%, respectively (p<0.001). In the Group II, QoL indicators on the studied scale increased significantly, by 48.32%, as compared to the Group III (p<0.001).

Six months after surgery, QoL indicators on the Present Pain scale in the Group I and the Group III did not differ significantly from those in the control group (p>0.05). The indicators in the Group II increased significantly, by 483.23%, as compared to the control group (p<0.01). There was no significant difference between the indicators in the Group I and the Group III (p>0.05). QoL indicators on the Present Pain scale in the Group I reduced significantly, by 468.55%, as compared to the Group II (p<0.001). In the Group II, the indicators increased significantly, by 77.65%, as compared to the Group III (p<0.001) (Table 7).

On the seventh day of the study, QoL indicators on the Worst Pain scale in the Group I, the Group II, and the Group III increased significantly, by 592.69%, 604.57%, 596.35%, respectively, as compared to the control group (p<0.01). At the same time, the indicators in the Group I did not differ significantly from



Notes: CG – control group; 7D – 7 days after surgery; 3M – 3 months after surgery; 6M – 6 months after surgery; Δ – p<0.01 – a statistically significant difference in relation to the indicated study periods.

Fig. 1. QoL changes on the General Well-Being scale

those in the Group II and the Group III (p>0.05). There was no significant difference between QoL indicators on the Worst Pain scale in the Group II and the Group III (p>0.05).

Three months after surgery, QoL indicators on the Worst Pain scale in the Group I did not differ significantly from those in the control group (p>0.05). QoL indicators on the studied scale in the Group II and the Group III increased significantly, by 449.77% and 229.22%, respectively, as compared to the control group (p<0.01). The indicators in the Group I reduced significantly as compared to the Group II and the Group III – by 490.2% and 253.43%, respectively (p<0.001). In the Group II, QoL indicators on the studied scale increased significantly, by 40.12%, as compared to the Group III (p<0.001).

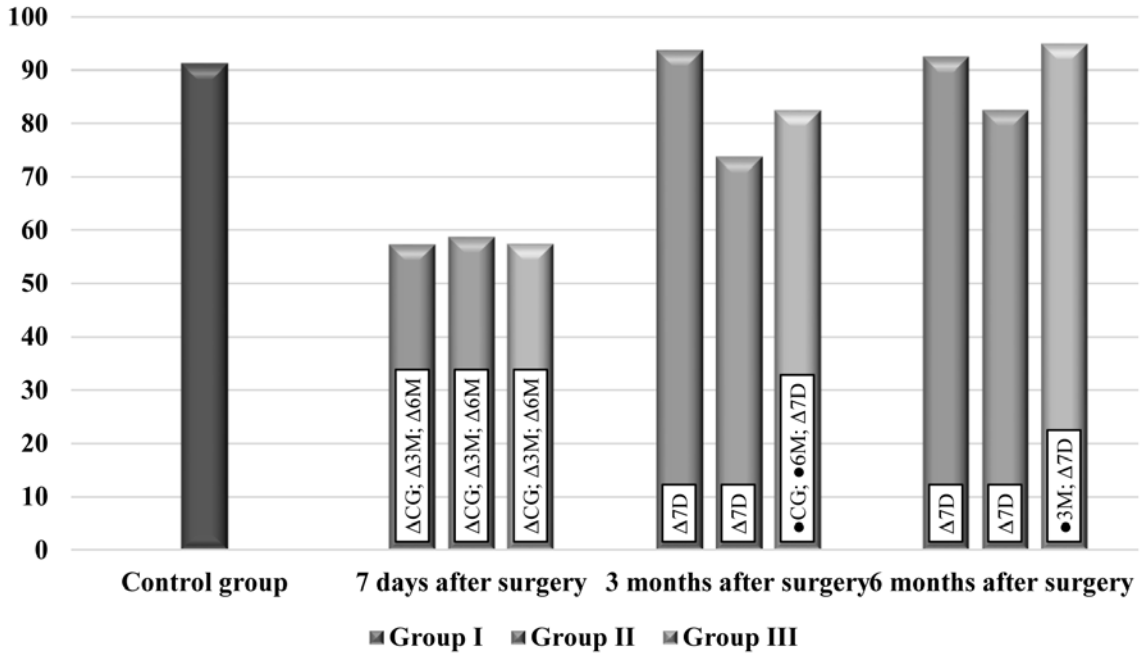
Six months after surgery, QoL indicators on the Worst Pain scale in the Group I and the Group III did not differ significantly from those in the control group (p>0.05). The indicators in the Group II increased significantly, by 426.48%, as compared to the control group (p<0.01). There was no significant difference between the indicators in the Group I and the Group III (p>0.05). QoL indicators on the studied scale in the Group I reduced significantly, by 428.9%, as compared to the Group II (p<0.001). In the Group II, the indicators increased significantly, by 77.19%, as compared to the Group III (p<0.001) (Table 8).

Discussion

The results of our study confirmed that inadequate perioperative analgesia and neglecting the principles of multimodal analgesia could result in the development of chronic pain syndrome [6,7,38]. According to QoL questionnaires, in patients with pain in the early postoperative period, the indicators on some scales reduced significantly as compared to children without pain. This shows the need for using effective minimally invasive regional analgesia techniques in the perioperative period, which, according to our results, allow for reducing pain intensity and, consequently, prevent a child from stress.

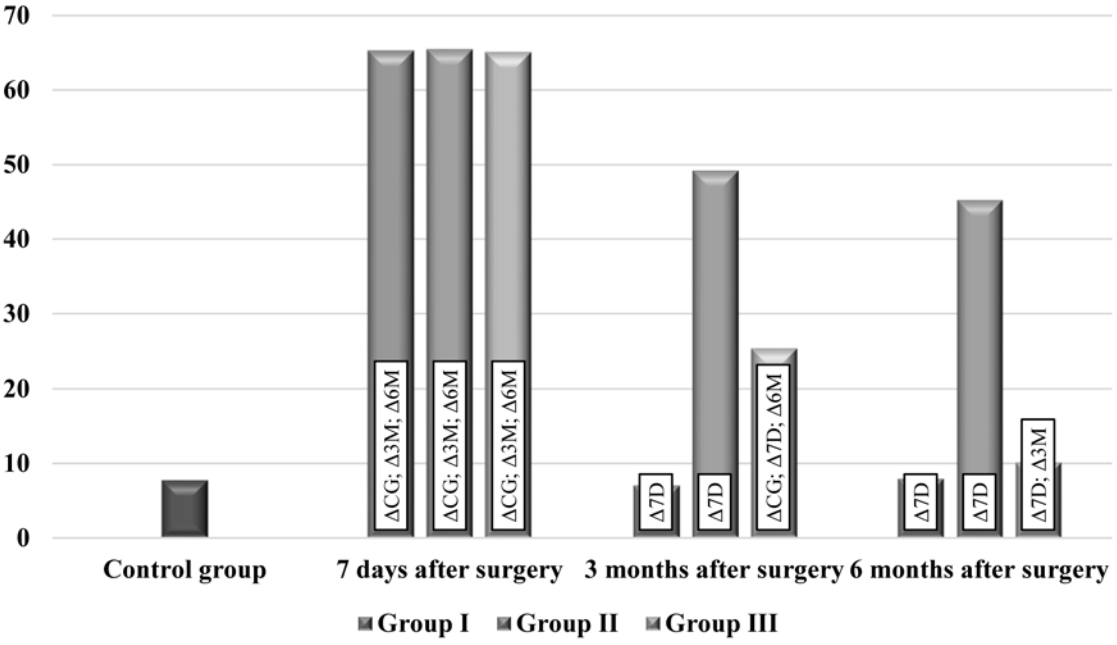
On the seventh day of the study, QoL indicators on the General Well-Being scale in the Group I, the Group II, and the Group III reduced significantly, by 42.22%, 41.11%, and 42.89%, respectively, as compared to the control group (p<0.01). Three and six months after surgery, QoL indicators on the studied scale in the Group I did not differ significantly from those in the control group (p>0.05), while in children of the Group II and the Group III, the indicators reduced by 24.22% and 14.44%, respectively, (p<0.01) three months after surgery and in children of the Group II, they reduced by 21.78% six months after surgery (Fig. 1).

On the seventh day of the study, QoL indicators on the General Health scale in the Group I, the Group II, and the Group III reduced significantly, by 36.99%, 35.62%, and



Notes: CG – control group; 7D – 7 days after surgery; 3M – 3 months after surgery; 6M – 6 months after surgery; ● – p<0.05; Δ – p<0.01 – a statistically significant difference in relation to the indicated study periods.

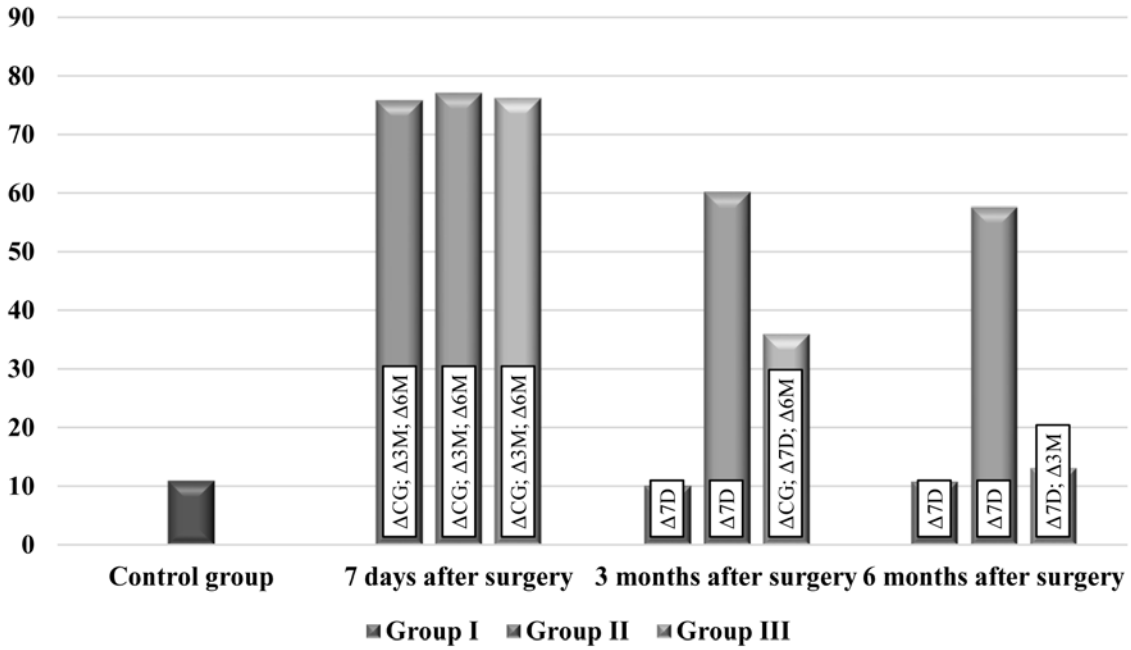
Fig. 2. QoL changes on the General Health scale



Notes: CG – control group; 7D – 7 days after surgery; 3M – 3 months after surgery; 6M – 6 months after surgery; Δ – p<0.01 – a statistically significant difference in relation to the indicated study periods.

Fig. 3. QoL changes on the Present Pain scale

36.99%, respectively, as compared to the control group (p<0.01). Three and six months after surgery, QoL indicators on the studied scale in the Group I did not differ significantly from those in the control group (p>0.05). Three months postoperatively, in children of the Group II and the Group III, the indicators reduced by 19.18% and 9.59%, respectively (p<0.01). Six months after surgery, only in children of the Group II, QoL indicators on the General Health scale reduced significantly, by 9.59%, as compared to the control group (p<0.01) (Fig. 2).



Notes: CG – control group; 7D – 7 days after surgery; 3M – 3 months after surgery; 6M – 6 months after surgery; Δ – p<0.01 – a statistically significant difference in relation to the indicated study periods.

Fig. 4. QoL changes on the Worst Pain scale

The analysis of QoL indicators on the Present Pain scale in the Group I, the Group II, and the Group III seven days after surgery found their increase, by 742.58%, 744.52%, and 739.35%, respectively, as compared to the control group. Three and six months after surgery, QoL indicators on the studied scale in the Group I did not differ significantly from those in the control group (p>0.05). In children of the Group II and the Group III, they were high. Six months postoperatively, in children of the Group II, QoL indicators on the Present Pain scale exceeded those in the control group by 483.23%, while in children of the Group III, they did not differ from the QoL indicators in the control group (p<0.01) being slightly higher as compared to the Group I (Fig. 3).

The analysis of QoL indicators on the Worst Pain scale in the Group I, the Group II, and the Group III on the seventh day after surgery found their increase, by 592.69%, 604.57%, and 596.35%, respectively, as compared to the control group. Three and six months after surgery, QoL indicators on the studied scale in the Group I did not differ significantly from those in the control group (p>0.05). Three months postoperatively, in children of the Group II and the Group III, QoL indicators on the Worst Pain scale exceeded those in the control group by 449.77% and 229.22%, respectively. Six months postoperatively, in children of the Group II, QoL indicators on the Worst Pain scale exceeded those in the control group by 426.48%, while in children of the Group III, they did not differ from the QoL indicators in the control group being slightly higher as compared to the Group I (Fig. 4).

The results of multivariate analysis of variance (MANOVA) for comparing QoL indicators according to the PedsQL™ 3.0 General Well-Being Scale three months after surgery showed that the chosen method of postoperative analgesia significantly affected QoL indicators on the questionnaire scales (General Well-Being, General Health – F (2.37) = 7.764; p=0.00152; Wilk's Λ = 0.704). Six months after surgery, the results of multivariate analysis of variance demonstrated the positive effect of the chosen postoperative analgesia method on QoL indicators on the questionnaire scales (F (2.37) = 44.594; p<0.0001; Wilk's Λ = 0.293).

The results of multivariate analysis of variance (MANOVA) for comparing QoL indicators according to the PedsQL™ 3.0 PPQ three months after surgery showed that the chosen method of postoperative analgesia significantly affected QoL indicators on the questionnaire scales (Present Pain, Worst Pain – F (2.37) = 76.364; p<0.0001; Wilk's Λ = 0.195). Six months after surgery, the results of multivariate analysis of variance demonstrated the positive effect of the chosen postoperative analgesia method on QoL indicators on the questionnaire scales (F (2.37) = 297.713; p<0.0001; Wilk's Λ = 0.059).

It is worth noting that the reliability of the differences in the studied QoL indicators increased with time depending on the chosen method of postoperative analgesia.

Conclusions

Chronic pain syndrome in children who underwent anterior abdominal wall surgery is a quite common phenomenon and prevails in the group of conventional anesthesia as compared to children who receive RA.

The application of RA techniques (the QLB+TFPB via a single injection) allows for:

- shortening the length of hospital stay;
- reducing the need for opioid analgesics intra- and postoperatively;
- providing adequate acute pain control in the postoperative period;
- reducing the incidence of CPSP in children.

Chronic pain syndrome reduces QoL in children after anterior abdominal wall surgery by reducing the indicators on the scales of General Well-Being, General Health and increasing the indicators on the scales of Present Pain and Worst Pain.

No conflict of interests was declared by the author.

References/Література

1. Baidya DK, Maitra S, Arora MK, Agarwal A. (2015). Quadratus lumborum block: an effective method of perioperative analgesia in children undergoing pyeloplasty. J Clin Anesth. 27 (8): 694–696. doi: 10.1016/j.jclinane.2015.05.006.
2. Batoz H, Semjen F, Bordes–Demolis M, Bénard A, Nouette–Gaulain K. (2016). Chronic postsurgical pain in children: prevalence and risk factors. A prospective observational study. Br J Anaesth. 117 (4): 489–496. doi: 10.1093/bja/aew260.
3. Blanco R, Ansari T, Girgis E. (2015). Quadratus lumborum block for post-operative pain after caesarean section: a randomised controlled trial. Eur J Anaesthesiol. 32 (11): 812–818. doi: 10.1097/EJA.0000000000000299.
4. Blanco R, Ansari T, Riad W, Shetty N. (2016). Quadratus lumborum block versus transversus abdominis plane block for postoperative pain after cesarean delivery: a randomized controlled trial. Reg Anesth Pain Med. 41 (6): 757–762. doi: 10.1097/AAP.0000000000000495.
5. Dam M, Moriggl B, Hansen CK, Hoermann R, Bendtsen TF, Børglum J. (2017). The pathway of injectate spread with the transmuscular quadratus lumborum block: a cadaver study. Anesth Analg. 125 (1): 303–312. doi: 10.1213/ANE.0000000000001922.
6. Dmytriiev D, Dmytriiev K, Stoliarchuk O, Semenenko A. (2019). Multiple organ dysfunction syndrome: What do we know about pain management? A narrative review. Anaesth Intensive Care. 23 (1): 84–91.
7. Dmytriiev D. (2018). Assessment and treatment of postoperative pain in children. Anaesth Intensive Care. 22 (3): 392–400.
8. Elsharkawy H, Ahuja S, DeGrande S, Maheshwari K, Chan V. (2019). Subcostal approach to anterior quadratus lumborum block for pain control following open urological procedures. J Anesth. 33 (1): 148–154. doi: 10.1007/s00540–018–02605–1.
9. Hassett AL, Hilliard PE, Goesling J, Clauw DJ, Harte SE, Brummett CM. (2013). Reports of chronic pain in childhood and adolescence among patients at a tertiary care pain clinic. J Pain. 14: 1390–1397. doi: 10.1016/j.jpain.2013.06.010.
10. Hebbard P. (2009). Transversalis fascia plane block, a novel ultrasound-guided abdominal wall nerve block. Can J Anesth. 56 (8): 618–620. doi: 10.1007/s12630–009–9110–1.
11. Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. (2010). The prevalence of chronic pain in United States adults: results of an internet-based survey. J Pain. 11: 1230–1239. doi: 10.1016/j.jpain.2010.07.002.
12. Jöhr M. (2015). Regional anaesthesia in neonates, infants and children: an educational review. Eur J Anaesthesiol. 32: 289–297. doi: 10.1097/EJA.0000000000000239.
13. Kristensen AD, Ahlburg P, Lauridsen MC, Jensen TS, Nikolajsen L. (2012). Chronic pain after inguinal hernia repair in children. Br J Anaesth. 109 (4): 603–608. doi: 10.1093/bja/aes250.
14. Matza LS, Swensen AR, Flood EM, Secnik K, Leidy NK. (2004). Assessment of health-related quality of life in children: a review of conceptual, methodological, and regulatory issues. Value Health. 7 (1): 79–92. doi: 10.1111/j.1524–4733.2004.71273.x.
15. Merella F, Canchi–Murali N, Mossetti V. (2019). General principles of regional anesthesia in children. BJA Educ. 19 (10): 342–348. doi: 10.1016/j.bjae.2019.06.003.
16. Mossetti V, Boretsky K, Astuto M, Locatelli BG, Zurakowski D, Lio R et al. (2018). Persistent pain following common outpatient surgeries in children: a multicenter study in Italy. Paediatr Anaesth. 28 (3): 231–236. doi: 10.1111/pan.13321.
17. Rosenbloom BN, Pagé MG, Isaac L, Campbell F, Stinson JN, Wright JG et al. (2019). Pediatric chronic postsurgical pain and functional disability: a prospective study of risk factors up to one year after major surgery. J Pain Res. 12: 3079–3098. doi: 10.2147/JPR.S210594.
18. Schug SA, Lavand'homme P, Barke A, Korwisi B, Rief W, Treede R et al. (2019). The IASP classification of chronic pain for ICD-11: chronic postsurgical or posttraumatic pain. Pain. 160 (1): 45–52. doi: 10.1097/j.pain.0000000000001413.
19. Thompson RJ, Gustafson KE. (1996). Adaptation to chronic childhood illness. American Psychological Association. doi: 10.1037/10188–000.
20. Ueshima H, Otake H, Lin JA. (2017). Ultrasound-guided quadratus lumborum block: an updated review of anatomy and techniques. Biomed Res Int. 2752876. doi: 10.1155/2017/2752876.
21. Uzark K, Jones K, Burwinkle TM, Varni JW. (2003). The Pediatric Quality of Life Inventory™ in children with heart disease. Prog Pediatr Cardiol. 18: 141–148.
22. Varni JW, Burwinkle TM, Dickinson P, Sherman SA, Dixon P, Ervice JA et al. (2004). Evaluation of the built environment at a children's convalescent hospital: development of the Pediatric Quality of Life Inventory parent and staff satisfaction measures for pediatric health care facilities. J Dev Behav Pediatr. 25 (1): 10–20. doi: 10.1097/00004703–200402000–00002.
23. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. (2003). The PedsQL in type 1 and type 2 diabetes: reliability and validity of the Pediatric Quality of Life Inventory Generic Core Scales and type 1 Diabetes Module. Diabetes Care. 26 (3): 631–637. doi: 10.2337/diacare.26.3.631.
24. Varni JW, Burwinkle TM, Katz ER, Meeske K, Dickinson P. (2002). The PedsQL in pediatric cancer: reliability and validity of the Pediatric Quality of Life Inventory Generic Core Scales, Multidimensional Fatigue Scale, and Cancer Module. Cancer. 94 (7): 2090–2106. doi: 10.1002/cncr.10428.
25. Varni JW, Burwinkle TM, Rapoff MA, Kamps JL, Olson N. (2004). The PedsQL in pediatric asthma: reliability and validity of the Pediatric Quality of Life Inventory Generic Core Scales and Asthma Module. J Behav Med. 27 (3): 297–318. doi: 10.1023/b:jobm.0000028500.53608.2c.
26. Varni JW, Burwinkle TM, Seid M, Skarr D. (2003). The PedsQL 4.0 as a pediatric population health measure: feasibility, reliability, and validity. Ambul Pediatr. 3 (6): 329–341. doi: 10.1367/1539–4409(2003)003<0329:tpaapp>2.0.co;2.
27. Varni JW, Burwinkle TM, Szer IS. (2004). The PedsQL Multidimensional Fatigue Scale in pediatric rheumatology: reliability and validity. J Rheumatol. 31 (12): 2494–2500.
28. Varni JW, Katz ER, Colegrove R, Dolgin M. (1996). Family functioning predictors of adjustment of children with newly diagnosed cancer: a prospective analysis. J Child Psychol

Psychiat. 37 (3): 321–328. doi: 10.1111/j.1469–7610.1996.tb01409.x.
29. Varni JW, Quiggins DJL, Ayala GX. (2000). Development of the Pediatric Hematology/Oncology Parent Satisfaction survey. Child Health Care. 29 (4): 243–255. doi: 10.1207/s15326888chc2904_2.
30. Varni JW, Seid M, Knight TS, Burwinkle TM, Brown J, Szer IS. (2002). The PedsQL in pediatric rheumatology: reliability, validity, and responsiveness of the Pediatric Quality of Life Inventory Generic Core Scales and Rheumatology Module. Arthritis Rheum. 46 (3): 714–725. doi: 10.1002/art.10095.
31. Varni JW, Seid M, Knight TS, Uzark K, Szer IS. (2002). The PedsQL 4.0 Generic Core Scales: sensitivity, responsiveness, and impact on clinical decision-making. J Behav Med. 25 (2): 175–193. doi: 10.1023/A:1014836921812.
32. Varni JW, Seid M, Kurtin PS. (1999). Pediatric health-related quality of life measurement technology: a guide for health care decision makers. JCOM. 6: 33–44.
33. Varni JW, Seid M, Kurtin PS. (2001). PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. Med Care. 39 (8): 800–812. doi: 10.1097/00005650–200108000–00006.
34. Varni JW, Seid M, Rode CA. (1999). The PedsQL™: measurement model for the Pediatric Quality of Life Inventory. Med Care. 37 (2): 126–139. doi: 10.1097/00005650–199902000–00003.
35. Varni JW, Wallander JL. (1988). Pediatric chronic disabilities. In: Handbook of Pediatric Psychology. Edited by Routh DK: 190–221.
36. Williams G, Howard RF, Liossi C. (2017). Persistent postsurgical pain in children and young people: prediction, prevention, and management. Pain Rep. 2 (5): e616. doi: 10.1097/PR9.0000000000000616.
37. Woolf CJ. (2011). Central sensitization: implications for the diagnosis and treatment of pain. Pain. 152: 2–15. doi: 10.1016/j.pain.2010.09.030.
38. Woolf CJ. (2020). Capturing novel non-opioid pain targets. Biol Psychiatry. 87 (1): 74–81. doi: 10.1016/j.biopsych.2019.06.017.

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