DOI: https://doi.org/10.17816/PTORS60339

# Comparative analysis of the quality of life of children with congenital scoliosis after surgical treatment: Extirpation of the hemivertebra from dorsal and combined access

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***BACKGROUND:*** Congenital scoliosis with disorders of the formation of the vertebrae is the most common cause of pronounced deformities of the spine in early childhood. This pathology can be treated surgically using various techniques that differ in invasiveness, severity of the condition in the postoperative period, achieved result of deformity correction, and nature of the long-term prognosis. Numerous studies have assessed the quality of life of patients who underwent surgery for acquired deformities, trauma, and degenerative and neoplastic diseases of the spine in adults. However, features of the child's quality of life following surgical technique for congenital scoliosis have not been sufficiently studied.

***AIM:*** This study aimed to compare the quality of life of children with congenital scoliosis of the thoracolumbar localization after extirpation of the hemivertebra from the dorsal and combined approaches.

***MATERIALS AND METHODS:*** An intergroup prospective analysis of the results of a survey of 60 patients with congenital deformity of the spine against the background of an isolated violation of the formation of the thoracic or lumbar vertebra was carried out. Patients underwent standard surgical treatment. Patients were divided into two groups according to the surgical approach to the abnormal vertebral body: dorsal group ($n$ = 28) and combined group ($n$ = 32). The average age of the patients was 75 (min–max, 26–196) months. The follow-up period was 18 months after surgery. To assess the quality of life, a specialized Russian version of the PedsQL v4.0 questionnaire and a modified visual analog scale were used.

***RESULTS:*** After surgical treatment of congenital spinal deformity, quality of life indicators decreased more than two times than the results of a preoperative survey. At 18 months postoperatively, the physical activity and psychoemotional state were restored to the preoperative level, while patients of the combined group had a higher satisfaction score on the quality of life ($p < 0.05$).

***CONCLUSIONS:*** The combined approach provides the best correction of congenital deformity of the spine and allows maintaining of the achieved result throughout the observation period. In the early postoperative period, the combined group demonstrated a significant decrease in the level of satisfaction with the quality of life, while the pain syndrome was higher than that in the dorsal group. Dynamic observation revealed the leveling of these differences and a subsequent increase in the level of satisfaction with the quality of life of these patients.

**Keywords:** congenital scoliosis; hemivertebra; surgical treatment; children; quality of life assessment; PedsQL v4.0; visual analog scale.

**To cite this article:**
Kokushin DN, Khardikov MA, Vissarionov SV, Sokolova VV, Khusainov NO, Zaletina AV. Comparative analysis of the quality of life of children with congenital scoliosis after surgical treatment: Extirpation of the hemivertebra from dorsal and combined access. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery.* 2021;9(2):153–162. DOI: https://doi.org/10.17816/PTORS60339

**Received:** 08.02.2021 **Accepted:** 11.05.2021 **Published:** 29.06.2021

УДК 616.711-007.55-053.1-089
DOI: https://doi.org/10.17816/PTORS60339

# Сравнительный анализ качества жизни детей с врожденным сколиозом после хирургического лечения: экстирпация полупозвонка из дорсального и комбинированного доступов

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***Обоснование.*** Врожденный сколиоз на фоне нарушения формирования позвонков — наиболее частая причина, приводящая к выраженным деформациям позвоночника уже в раннем детском возрасте. Существует большое количество публикаций, посвященных оценке качества жизни больных, получивших хирургическое вмешательство по поводу приобретенных деформаций и заболеваний позвоночника, преимущественно у взрослых. Однако особенности качества жизни ребенка при врожденном сколиозе изучены недостаточно, что и обосновывает актуальность данного исследования.

***Цель*** — сравнительный анализ качества жизни детей с врожденным сколиозом грудопоясничной локализации после экстирпации полупозвонка из дорсального и комбинированного доступов с учетом эффективности и стабильности достигнутого результата лечения.

***Материалы и методы.*** Проведен межгрупповой проспективный анализ результатов опроса 60 пациентов с врожденной деформацией позвоночника на фоне изолированного нарушения формирования позвонка грудной или поясничной локализации. Пациентам выполняли хирургическое лечение по стандартной методике. В зависимости от хирургического доступа к телу аномального позвонка пациентов разделили на две группы: первую ($n = 28$) — дорсальный доступ, вторую ($n = 32$) — комбинированный доступ. Средний возраст пациентов на момент начала исследования составил 75 мес. (min 26; max 196). Продолжительность наблюдения — 18 мес. после операции. Для оценки качества жизни использовали специализированный русскоязычный опросник PedsQL v4.0. и модифицированную визуально-аналоговую шкалу.

***Результаты.*** После хирургического лечения врожденной деформации позвоночника отмечалось снижение показателей качества жизни более чем в два раза по сравнению с результатами опроса перед операцией. Через 18 мес. после операции физическая активность и психоэмоциональное состояние восстанавливались до предоперационного уровня, при этом у пациентов второй группы был более высокий показатель удовлетворенности качеством жизни ($p < 0,05$).

***Заключение.*** Комбинированный доступ обеспечивает лучшую коррекцию врожденной деформации позвоночника и позволяет сохранить достигнутый результат на всем протяжении наблюдения. У пациентов данной группы в раннем послеоперационном периоде наблюдалось достоверно значимое снижение уровня удовлетворенности качеством жизни, при этом болевой синдром был интенсивнее по сравнению с пациентами, оперированными из дорсального доступа. При динамическом наблюдении данные различия уменьшались, уровень удовлетворенности качеством жизни у данных пациентов повышался.

**Ключевые слова:** врожденный сколиоз; полупозвонок; хирургическое лечение; дети; оценка качества жизни; PedsQL v4.0; визуально-аналоговая шкала.

**Как цитировать:**
Кокушин Д.Н., Хардиков М.А., Виссарионов С.В., Соколова В.В., Хусаинов Н.О., Залетина А.В. Сравнительный анализ качества жизни детей с врожденным сколиозом после хирургического лечения: экстирпация полупозвонка из дорсального и комбинированного доступов // Ортопедия, травматология и восстановительная хирургия детского возраста. 2021. Т. 9. № 2. С. 153–162. DOI: https://doi.org/10.17816/PTORS60339

**Рукопись получена:** 08.02.2021 **Рукопись одобрена:** 11.05.2021 **Опубликована:** 29.06.2021

ЭКО•ВЕКТОР

## BACKGROUND

Congenital scoliosis with abnormal vertebral development is the most common cause of severe spinal deformities in early childhood. Early surgical treatment is required due to the steady progression of spinal deformity during the growth and development of the child. Over the past three decades, approaches to surgical correction of congenital scoliosis significantly changed. With an isolated thoracic or lumbar spine hemivertebra, the gold standard of surgical treatment is the removal of the abnormal vertebra with the above- and underlying intervertebral discs in combination with congenital curvature correction with a multi-support surgical hardware. Recently, much attention has been paid to studies focusing on partial hemivertebral resection with an adjacent disk and comparison of long-term results with the classical technique [1–3]. These changes resulted from the development of surgical spinal armamentarium and diagnostic methods, and are due to the process of accumulating knowledge about surgical treatment outcomes. Despite this, consensus is unavailable about the optimal body access of the abnormal vertebra from its localization point of view, surgical intervention injury rate, surgical hardware fixation extent, and its stability in the long-term follow-up period [4, 5].

Patient satisfaction regarding treatment and quality of life assessment became highly relevant in recent decades due to the changing traditional view of disease problem and the patient [6]. A tendency indicates a change in the criteria of treatment efficiency evaluation, namely a shift in the vector of attention from clinical, laboratory, and instrumental studies, which represent only the biological component of the disease and recovery processes, to assess the functional and psychoemotional state of the patient in the treatment and recovery process. Thus, when choosing a treatment approach, patient convenience and comfort are taken into account.

Contemporary literature presents a large number of publications focused on quality of life assessment of patients who received surgical treatment for spinal deformity [7]. In order to objectify the results of surgical treatment of spinal deformity from the patient's point of view, pain severity assessment, as well as functional and general health is often required [8, 9]. Validated questionnaires such as Oswestry Disability Index (ODI), SRS-22, SF-36, Health-related quality of life (HRQOL), and others are tools used to study these indicators. Short-term and long-term effects of treatment can be predicted by comparing the survey data before surgery with the results obtained after surgery [10, 11].

Despite the fact that these questionnaires enable the functional state assessment of patients with various spinal diseases, pediatric patients require more validated specific methods. These questionnaires include Pediatric Quality of Life (PedsQL) v.4.0, which is characterized with the presence of a pediatric and parent versions, which enables the identification of differences in the perception of problems by parents and children [12–14].

Many studies focused on the problem of quality of life of assessment in children with idiopathic scoliosis [15, 16], spinal deformity associated with spinal cord injuries, and neuromuscular diseases [17–19]. Works presenting a comparative analysis of the quality of life of pediatric patients with various etiopathogenetic types of spinal deformity, including children with congenital scoliosis were published [20–22]. In addition, any studies analyzing the quality of life of children with congenital scoliosis with different surgical approaches to the abnormal vertebra were not revealed.

**This work aimed** to conduct a comparative analysis of the quality of life in children with congenital scoliosis of the thoracolumbar localization after extirpation of the hemivertebra with dorsal and combined approaches.

## MATERIALS AND METHODS

A prospective comparative intergroup analysis of the examination and treatment data of 60 patients with congenital scoliosis of the thoracic or lumbar spine associated with an isolated vertebral formation disorder was performed. The average age of patients at the start of the study was 75 months (26–196 months). Surgical treatment of congenital spinal deformity was conducted from 2017 to 2019. Surgical treatment method of congenital spinal deformity with the presence of an isolated hemivertebra of the thoracic or lumbar spine included extirpation of the hemivertebra, correction of local spinal deformity, and fixation and stabilization of the deformity using posterior transpedicular hardware. Patients were distributed into comparison groups based on the surgical approach to the body of the abnormal vertebra, thus group 1 included patients (*n* = 28) whose surgical treatment was performed only from the dorsal approach and group 2 consisted of patients (*n* = 32) whose surgical treatment was performed using the combined (anterolateral and dorsal) approach. In the postoperative period, patients used orthotics with a rigid brace to create conditions for full-fledged bone block formation in the surgical area and reduce the risk of surgical hardware destabilization. The duration of wearing a brace in all patients was at least 1 year and 6 months. All patients underwent a comprehensive clinical and radiation examination before and after surgery, as well as in the process of a case follow-up. The follow-up period after the surgery was 1 year and 6 months, and control radiation examination and survey were conducted every 6 months after the surgery.

Based on spinal X-ray performed in standard views, abnormal development of the vertebra variant and its localization were determined before the surgery, and the magnitude of the local scoliotic and kyphotic components of the spinal deformity was assessed by the Cobb method.

Clinical examination included a survey questionnaire using the Russian-language questionnaire on the quality of life of a child PedsQL v4.0. The Russian-language PedsQL v4.0 questionnaire represents a form with 23 five-point scales, indicating the current status of patients, namely the level of physical activity of the child, emotional state of the child, and social role satisfaction (satisfaction with communication with peers), as well as activities in kindergarten/school. The questionnaire consists of two parts which assessed the quality of life by the child himself (5 years old and older) and the quality of life of the child by his legal representative. The task of the child and his parent is to select and mark a figure that reflects the frequency of difficult situations over a certain period of life (for the last week/month), where 0 means never, 1 means almost never, 2 indicates sometimes, 3 implies often, and 4 means almost always.

The number of points was calculated in accordance with the questionnaire key. First, results were reversed and converted to a linear 100-point scale, where 0 indicated 100 points, 1 implied 75, 2 corresponded to 50, 3 indicated 25, and 4 implied 0. Then, survey results were counted. Results of each block point were summarized, and the resulting sum was divided by the number of points in the block. A score above 75 points was considered optimal. At stage 3, the total amount of points for each point of the questionnaire was calculated, and obtained result was divided by the number of points.

Questioning was performed in the preoperative period, early postoperative period, and with case follow-up (6, 12, and 18 months, respectively, after the surgery).

Pain syndrome severity was assessed using a modified visual analog scale of pain (VAS + scale in “faces”) on days 1, 3, 5, and 7 after surgery in both groups [23–25]. The gold standard for pain assessment is the VAS which can be used in children aged 5–6 years and older. To assess the pain syndrome in children aged 3–5 years, a modified scale is used, in which numbers are replaced by drawings in the form of expressions of facial emotions.

**Inclusion criteria.** *Inclusion criteria for study participants* were the presence of an isolated abnormal vertebra in the thoracic or lumbar spine, simultaneous extirpation of the hemivertebra and correction of congenital deformity with a multi-support hardware, absence of neurological disorders, age of patients at the time of surgical treatment of 2–17 years (2–17 years were the boundaries for inclusion of the patient in the study, taking into account the distribution into age groups of the questionnaire itself), and consent from the patient or his/her representative for study participation.

*Exclusion criteria from the study* were congenital spine deformity in presence of multiple developmental vertebral anomalities, staged surgical intervention, patient or his/her legal representative refusal from surgical treatment and survey participation, failure to visit for follow-up examination (6, 12, and 18 months after surgery), presence of neurological deficits, concomitant pathology in the peripheral skeleton, and dysplastic course of congenital spinal deformity, which necessitates a treatment with rigid corrective Chéneau braces.

Statistical analysis was performed using the Microsoft Excel spreadsheet package (Microsoft Office 2007, USA). The arithmetic mean ($M$) and the deviation of the mean ($\pm m$) were calculated. Paired Student’s $t$-test was applied to determine the statistical significance of differences in paired measurements, and significant level was determined as $p < 0.05$. The Pearson correlation test ($r$) was used to identify a linear relationship.

## RESULTS

Table 1 presents the initial values of scoliotic and kyphotic components of congenital spinal deformity, the mean score obtained based on the PedsQL v4.0 questionnaire in Russian in the preoperative period in patients of both groups.

Based on clinical and radiological examination results of patients from both groups by age, the initial value of congenital spinal deformity and the average score characterizing the child’s quality of life in the preoperative period has no statistically significant difference. Thus, study groups according to these indicators were comparable, which enabled the conduction of objective comparative intergroup analysis of indicators after surgical treatment.

During the surgical treatment of congenital spinal deformity, in both groups, radical correction of both local scoliotic and local kyphotic components of the curvature was achieved, which averaged <5° according to Cobb for all parameters (Table 2). When assessing the relative magnitude of the spinal deformity correction in the postoperative period, significant differences were revealed between patients in study and control groups. Thus, the correction of local scoliotic component amounted to 92.3% in patients from group 2 and that of the kyphotic component was 92.2%, whereas 84.7% and 86.9%, respectively, in patients from group 1.

In the long-term follow-up period, the physiological frontal profile of the spine was almost completely restored in both groups. According to the spinal X-ray image in patients from group 1, the progression of the kyphotic component of the deformity was revealed (from 3.7 ± 0.5 to 5.6 ± 0.7). The residual scoliotic component in patients of both groups

**Table 1.** Clinical and radiation characteristics of patients in study groups before surgical treatment

| Group | Number of patients | Average age, months | Local spinal deformity according to Cobb, deg. | | Average score on PedsQL questionnaire v4.0 | | | |
|---|---|---|---|---|---|---|---|---|
| | | | kyphotic component | scoliotic component | child | *n* | parent | *n* |
| 1 | 28 | 75.8 ± 7.3 | 24.3 ± 1.7 | 30.7 ± 0.9 | 86.9 ± 1.2 | 20 | 86.8 ± 1.3 | 28 |
| 2 | 32 | 74.3 ± 6.2 | 25.5 ± 1.7 | 31.3 ± 0.9 | 87.1 ± 1.5 | 23 | 86.8 ± 1.9 | 32 |

**Table 2.** Dynamics of scoliotic and kyphotic spinal deformity magnitude in patients from both groups

| Group | | Local spinal deformity according to Cobb, deg. | | | |
|---|---|---|---|---|---|
| | | before surgery | early postoperative period | amount of spinal deformity correction, % | long-term follow-up |
| Local scoliotic component, $M \pm m$ | 1 ($n = 28$) | 30.7 ± 0.9 | 4.0 ± 0.4* | 86.9 ± 0.6 | 3.5 ± 0.5* |
| | 2 ($n = 32$) | 31.3 ± 0.9 | 2.4 ± 0.4 | 92.3 ± 0.4 | 2.0 ± 0.0 |
| Local kyphotic component, $M \pm m$ | 1 ($n = 28$) | 24.3 ± 1.7 | 3.7 ± 0.5^ | 84.7 ± 0.7 | 5.6 ± 0.7^^ |
| | 2 ($n = 32$) | 25.5 ± 1.7 | 2.0 ± 0.0 | 92.2 ± 0.3 | 2.0 ± 0.0 |

*Note*. Significant differences between groups of patients at different stages of treatment: *$p < 0.01$, **$p < 0.001$ — local scoliotic component; ^$p < 0.01$, ^^$p < 0.001$ — local kyphotic component.

remained stable throughout the follow-up period; however, it was significantly higher in group 1 (4.0 ± 0.4 vs. 2.4 ± 0.4, $p < 0.01$).

The quality of life of 28 patients (20 children and 28 parents) from group 1 and 32 patients (23 children and 32 parents) from group 2 was assessed. Different number of respondents of children and their parents is due to the fact that in group of 2–4 years old, only the parent's response was taken into account, since objective assessment and condition description is often difficult for a child at this age. Results of filling out the PedsQL v4.0 questionnaire before the surgery, in the early postoperative period, and during the follow-up surveys in the follow-up period are presented in Table 3.

Table 3 demonstrates that patients from the main and control groups were largely satisfied with the quality of life (86.9 ± 1.2/86.8 ± 1.3 and 87.1 ± 1.5/86.8 ± 1.9 points, respectively) before surgery, indicating a high physical activity and stability of the psychoemotional state of patients. Main factors influencing the assessment of the quality of life in patients under study were rapid fatigability during physical exertion and recurrent pain after prolonged exertion.

In a comparative analysis of results of completing the PedsQL v4.0 questionnaire in the early postoperative period, indicators of general physical health and psychoemotional state decreased by more than two times compared to the preoperative survey results for both groups, which was associated with postoperative pain syndrome and functional limitations. An intergroup comparison of the quality of life revealed statistically significant differences in the survey results between patients from groups 1 and 2, where the average score was higher in group 1 according to the survey

**Table 3.** Results of patients filling out the PedsQL v4.0 questionnaire for the quality of life assessment (points, $M \pm m$)

| Group | Average score of the respondent | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | before surgery | | early postoperative period | | 6 months after surgery | | 18 months after surgery | |
| | child | parent | child | parent | child | parent | child | parent |
| 1 ($n = 28$) | 86.9 ± 1.2 ($n = 20$) | 86.8 ± 1.3 ($n = 28$) | 45.2 ± 0.8 ($n = 20$)* | 39.8 ± 0.7 ($n = 28$)* | 57.7 ± 0.9 ($n = 20$) | 56.6 ± 0.9 ($n = 28$) | 82.0 ± 0.5 ($n = 20$)* | 79.1 ± 0.9 ($n = 28$)* |
| 2 ($n = 32$) | 87.1 ± 1.5 ($n = 23$) | 86.8 ± 1.9 ($n = 32$) | 38.5 ± 0.4 ($n = 23$) | 35.0 ± 0.6 ($n = 32$) | 56.1 ± 1.3 ($n = 23$) | 56.5 ± 1.2 ($n = 32$) | 87.1 ± 0.8 ($n = 23$) | 84.2 ± 0.6 ($n = 32$) |

*$p < 0.01$ — significant differences between groups of patients.

**Table 4.** Pain syndrome changes in time in the postoperative period

| Period after surgery, months | Severity of pain syndrome, MVAS score | | Significance, $p$ |
|---|---|---|---|
| | main group ($n = 20$) | control group ($n = 23$) | |
| 1 | 7.8 ± 0.2 | 8.4 ± 0.2 | 0.04 |
| 3 | 6.3 ± 0.4 | 7.4 ± 0.3 | 0.03 |
| 5 | 4.6 ± 0.2 | 5.6 ± 0.3 | 0.01 |
| 7 | 1.9 ± 0.3 | 3.1 ± 0.4 | 0.02 |

*Note*. MVAS — modified visual analog scale of pain.

results of the children (45.2 ± 0.8 vs. 38.5 ± 0.4, $p < 0.01$) and according to the survey questionnaire results of their parents (39.8 ± 0.7 vs. 35.0 ± 0.6, $p < 0.01$).

After discharge, patients underwent repeated interviews with case follow-up with a frequency of 1 time per 6 months for 1.5 years. At the control examination 1, 6 months after the surgical treatment, a tendency toward functional state restoration of operated children and an increase in satisfaction indicators of the quality of life were observed. Patients of both groups had results close to satisfactory; the average score for both groups was 56, whereas no statistically significant differences were found between the survey results of patients in comparison groups. This indicates the leveling of differences in the quality of life at this stage of follow-up.

At the control examination 1.5 years after the surgical treatment, physical activity, functional, and psychoemotional state recovered to the preoperative level. In addition, a statistically significant difference was revealed between the survey results of patients from groups 1 and 2, whereas the average score was higher in group 2 according to the survey results of children themselves (82.0 ± 0.5 vs. 87.1 ± 0.8, $p < 0.01$) and according to the survey questionnaire results of their parents (79.1 ± 0.9 vs. 84.2 ± 0.6, $p < 0.01$).

In the early postoperative period, pain was the main complaint of patients in both groups, which was assessed using a modified visual analog scale of pain. Pain syndrome regression changes in time are presented in Table 4.

Pain severity in the postoperative period in patients operated with the combined approach was significantly higher than that of patients operated with only dorsal approach ($p < 0.05$).

The child was verticalized as the condition stabilized, and pain syndrome was completely relieved. In the study main group, patients were verticalized on average on day 5.3 ± 0.4 after surgery and on average on day 6.8 ± 0.3 in the control group ($p = 0.01$). These differences in the timing of verticalization were associated with a greater intraoperative injury rate of combined approach compared to the dorsal one and, as a consequence, more pronounced pain syndrome ($p < 0.05$).

When assessing the correlation between the quality of life satisfaction and the bed rest duration, an inverse correlation was established with a moderate strength of connection for children ($r = -0.45$) and with a significant strength of connection for parents ($r = -0.53$), which indicates an earlier activation in the postoperative period of children with higher quality of life indicators according to the PedsQL v4.0 questionnaire (Figure).

## DISCUSSION

Extirpation of the hemivertebra and subsequent radical correction of spinal column deformity represent the optimal treatment for children with isolated hemivertebra of the thoracic or lumbar spine, preventing further progression

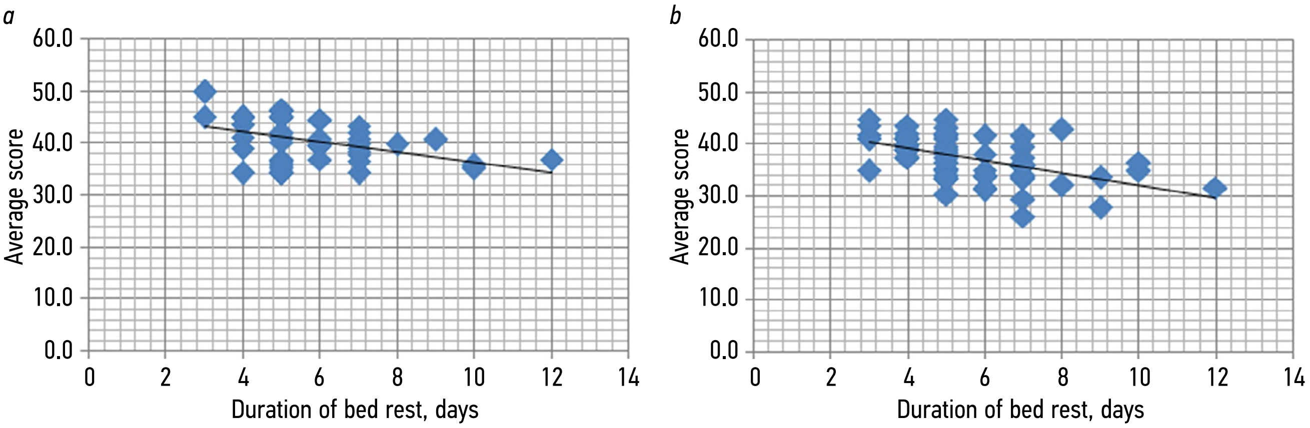

**Figure.** Correlation relationship between the quality of life satisfaction and the bed rest duration: *a* — for children ($r = -0.45$); *b* — for parents ($r = -0.53$)

of the deformity and creating favorable conditions for the spinal column development as a whole during the child's growth [1–3]. Creating optimal conditions for the formation of a full-fledged bone block of 360° between the vertebral bodies adjacent to the abnormal one was possible due to the combined access to the body of the abnormal vertebra, which maintained the stability of the achieved correction of the spinal deformity throughout the follow-up period. The progression of local kyphotic deformity in patients of the main group is associated with the impossibility of creating a full-fledged stable bone block with an autologous bone at the level of the anterior and middle supporting columns of the vertebrae from the dorsal approach only. In a number of patients, this led to the correction loss of the kyphotic component of the curvature achieved during the surgery [5].

Complex treatment relevant task of patients with spinal deformity consist a quality of life assessment after surgical treatment and in the process of functional recovery. For these purposes, specialized questionnaires are used (ODI, SRS-22, SF-36, HRQOL, etc.), which cover many aspects of human activity, including meeting daily needs, individual pain stimulus reactions, subjective assessment of one's own health, and opportunities in professional activity. These questionnaires enable the assessment not only in health recovery degree, but also the ability of life-sustaining activity in general. In addition, disadvantage of these questionnaires is their low validity in relation to pediatric patients. Specialized quality of life questionnaires for children take into account a wide range of daily activities of the child; therefore, it can be used as an additional standardized clinical indicator for the restoration of the operated spine functions. Assessment combination of the quality of life and clinical data provides a complete idea of disease impact and its treatment outcomes on the overall well-being of the child [26].

The PedsQL v4.0 questionnaire was used on the quality of life for children. This questionnaire has high validity due to the possibility of its application in different age periods, namely period 1 from 2 to 4 years, period 2 from 5 to 7 years, period 3 from 8 to 13 years, and period 4 from 14 to 17 years. Representativeness of results is achieved by the fact that the survey involves not only the patients, but also their parents [14]. Based on the obtained data, the child's general physical activity and psychoemotional state at the time of the survey are assessed, and, as a result, satisfaction with the quality of life in general.

Our study revealed that patients with congenital scoliosis of the thoracic or lumbar spine associated with an isolated hemivertebra before surgery had a high level of satisfaction with the quality of life. The main factor affecting the decrease in the quality of life was rapid fatigue during daily activities. Patients were subject mainly to a decrease in overall health; however, no significant social and emotional impairments were found. A number of researchers also emphasize the absence of a significant influence of psychoemotional and social factors on the overall quality of life assessment of children with congenital spinal deformity, especially in patients of the young age group [20, 21].

The average age of patients under study was 75 months. For patients of this age group, a decrease in the psychoemotional component of the quality of life due to dissatisfaction with their appearance because of the absence of pronounced spinal and chest deformity is uncharacteristic. After surgery, a regular decrease was found in the quality of life satisfaction of patients in both groups; however, in the process of dynamic follow-up, a tendency to functional state restoration of the operated children was revealed, and patients of the control group had better indicators compared to that of the main group. In our opinion, this circumstance is due to the possibility of combined approach to completely eliminate the local spinal deformity, minimize the length of fixation of the spinal hardware, and preserve the achieved treatment result in the long-term follow-up period, thereby reducing movement limitations in the spine and eliminating the loss of deformity correction obtained during the surgery. When assessing pain syndrome in the early postoperative period, its greater severity in patients of group 2 is noteworthy, leading to increased bed rest duration. This is primarily due to the greater injury rate caused by the use of two approaches for abnormal vertebra in patients of the control group compared with patients operated with dorsal approach only. In addition, an inverse correlation was revealed between quality of life satisfaction and bed rest duration.

## CONCLUSION

Therefore, combined access to the abnormal vertebra provides better correction of all components of congenital deformity of the thoracic and lumbar spine and enables the maintenance of result achieved throughout the follow-up period. In patients of this group, the satisfaction level with the quality of life significantly decreased in the early postoperative period, whereas pain syndrome was more intense than in patients operated with dorsal approach. With case follow-up, these differences decreased, and the level of quality of life satisfaction in patients operated with combined access increased at the end of the follow-up period.

## ADDITIONAL INFORMATION

**Funding.** The study had no external funding.

**Conflict of interest.** Authors declare no conflict of interest.

**Ethical considerations.** This study was discussed and approved by the ethics committee of the H. Turner National Medical Research Center for Children's Orthopedics and Trauma Surgery of the Ministry of Health of Russia (protocol No. 4 of November 27, 2018). Patients and their representatives provided informed consent to participate in the study and publish personal data.

**Author contributions.** *D.N. Kokushin* developed the concept and design of the study and performed the staged editing of the article text. *M.A. Khardikov* collected and analyzed the data, wrote the text of the article, and designed the article. *S.V. Vissarionov* performed surgical treatment for patients, stated aims, and performed staged and final editing of the article text. *V.V. Sokolova* wrote the text of the article and designed the article. *N.O. Khusainov* reviewed the literature. *A.V. Zaletina* performed staged editing of the article text.

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