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Стаття надійшла 18.06.2024 р.

DOI 10.26724/2079-8334-2025-2-92-62-67
UDC 616.26–008.13–053.33–09

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EFFICACY OF THORACOSCOPIC SURGERY AND CONVENTIONAL OPEN SURGERY FOR CONGENITAL DIAPHRAGMATIC HERNIA IN NEONATES

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With the purpose of the study was a comparative analysis of the effectiveness of traditional laparotomy and video-assisted thoracoscopic surgery in the treatment of congenital diaphragmatic hernia in newborns 70 newborns (1st group – 44 newborns, operated on using the traditional open method; the 2nd group – 26 newborns, operated on using endosurgery) were observed. According to results, the Apgar score at the 1st minute in the 2nd group was 5.42±0.22 points, and in the 1st group – 5.66±0.17 points ($p=0.3943$). Similar distinctive features in the data were observed in the groups at the 5th minute after birth: 8.35±0.14 and 8.64±0.11 points, respectively ($p=0.1118$). The quality of life of children after surgical treatment of diaphragmatic hernia, both by the total score and by all scales, was significantly higher than before the treatment of the pathology ($p<0.05$), with the exception of the data of the parental form of the Ability to remain alone (ARA) scale ($p>0.05$).

Key words: children, congenital diaphragmatic hernia, open access, thoracoscopy, quality of life.

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ЕФЕКТИВНІСТЬ ТОРАКОСКОПІЧНОЇ І ТРАДИЦІЙНОЇ ВІДКРИТОЇ ХІРУРГІЇ У ЛІКУВАННІ ВРОДЖЕНОЇ ДИФРАГМАЛЬНОЇ ГРИЖІ У ДІТЕЙ РАННЬОГО ГРУДНОГО ВІКУ

З метою дослідження було проведено порівняльний аналіз ефективності традиційної лапаротомії та відеоторакоскопічної хірургії під час лікування вродженої діафрагмальної грижі у новонароджених. Під наглядом перебувало 70 новонароджених (1-ша група – 44 новонароджених, прооперованих традиційним відкритим способом; 2-га група – 26 новонароджених, прооперованих ендохірургічним способом). Згідно з результатами, оцінка за шкалою Апгар на 1-й хвилині у 2-й групі становила 5,42±0,22 бала, а в 1-й групі – 5,66±0,17 бала ($p=0,3943$). Аналогічні відмінні риси в даних спостерігалися в групах на 5-й хвилині після народження: 8,35±0,14 і 8,64±0,11 бала відповідно ($p=0,1118$). Якість життя дітей після хірургічного лікування діафрагмальної грижі, як за загальним балом, так і за всіма шкалами, була достовірно вищою, ніж до лікування патології ($p<0,05$), за винятком даних батьківської форми шкали «Можливість залишатися на самоті» ($p>0,05$).

Ключові слова: діти, вроджена діафрагмальна грижа, відкритий доступ, торакоскопія, якість життя.

Unfortunately, in recent years there has been an increase in one of the severe forms of congenital malformations in children, which is congenital diaphragmatic hernia [5]. Most pediatric surgeons testify to the high relevance and great medical and social significance of this developmental defect in modern medicine [13]. At present, due to the high digital values characterizing the number of cases of postoperative

mortality, they can sometimes reach very large values, surgical treatment of newborns with this pathology remains one of the most difficult tasks for surgeons, anesthesiologists and resuscitators [6, 10].

International studies often talk about the need for clinical monitoring and identification of the most optimal treatment tactics for this pathology. In this regard, specialists involved in this field are asked a question concerning the choice of an effective method for treating congenital diaphragmatic hernia, which is a developmental defect incompatible with the life of an infant without surgical correction. Against the background of an increase in the number of children born with a diaphragmatic defect, in recent decades, due to the favorable results obtained after traditional surgical interventions, in particular, open traditional laparotomy, there have been practically no discussions regarding the transition to new approaches or other forms of surgical intervention [3, 9].

At the same time, if some specialists claim that the traditional method of surgical intervention has been used for a long time and is a proven method that does not require additional research, then other surgeons suggest that the use of endoscopic techniques will not only simplify the course of treatment, but also at the same time make it comparatively safer and more reliable [11]. For this reason, some scientific papers have conducted a comparative analysis of the effectiveness of traditional methods and modern thoracoscopy in the surgical treatment of children with congenital diaphragmatic defects [2].

It is important to note that due to the high level of development of the medical industry, or rather medical materials science in this area, operations performed using thoracoscopic technology, which has also proven itself to be a highly informative diagnostic tool, are currently becoming increasingly used in surgery [4, 15].

Along with the implementation of high-quality and prompt diagnostics, as well as the use of an effective method of surgical intervention, which is ensured by the increased therapeutic effectiveness of the corresponding latest technologies, especially in infants with the pathological condition under study, often associated with pulmonary hypoplasia, pulmonary aplasia, cardiac and respiratory failure, etc., cannot but please specialists and the patients themselves.

The purpose of the study was to conduct a comparative analysis of the effectiveness of traditional laparotomy and video-assisted Thoracoscopic surgery in the treatment of congenital diaphragmatic hernia in newborns.

Materials and methods. The study was carried out in the basic clinic of the Azerbaijan State Advanced Training Institute for Doctors in 2020–2022. This article presents the results of studying anamnestic data, medical history of infant patients, i.e. newborns burdened with congenital diaphragmatic defect and subjected to surgical intervention, their preoperative diagnostics, comparative analysis of treatment results of newborns by open (traditional) and minimally invasive endoscopic methods, determination of efficiency in the postoperative period, comparison of complication rates. The clinic admitted 70 newborns with pathology.

Depending on the method of surgical intervention, the children were divided into 2 groups. The 1st group consisted of 44 newborns with congenital diaphragmatic hernia, operated on by the traditional open method. The 2nd main group included 26 newborns with similar pathology, operated on using a minimally invasive new type of surgical technique – endo-surgery. Concomitant malformations, weight and growth indicators of newborns, assessment of the condition according to the Apgar scale at the 1st and 5th minutes were analyzed. In the first control group of patients, preference was given to laparotomy.

In the laparotomic approach, a subcostal incision is made on the corresponding half from the side of the defect. After incision of the skin, subcutaneous fat, superficial fascia and muscles, access to the abdominal organs is obtained. All organs were gradually brought down into the abdominal cavity through the diaphragm defect and positioned correctly in accordance with their anatomical location, after which the diaphragm was revised. Starting from the medial edge of the defect, 7–9 non-absorbable sutures of silk or Etibond suture material were applied. The outermost (lateral) suture is applied through the adjacent rib to avoid suture rupture and potential relapse. Before the layer-by-layer "anatomical" suturing of the laparotomic defect, a silicone drainage tube is left in the chest cavity. In case of large defects, due to possible significant tension of the wound edges and possible complications (rupture of sutures and high risk of hernia recurrence), synthetic materials were used to strengthen the hernia defect area during its suturing, in particular, synthetic monofilament thread – polypropylene. Previously used polypropylene materials (despite the fact that they can be used for tissue restoration, it was often noted that they subsequently form adhesions with the adjacent internal organs of the abdominal cavity) were later replaced by synthetic hernia implants made of porous polytetrafluoroethylene. After the operation, the wound was covered with a sterile dressing.

Thoracoscopy began with the patient positioned on the operating table on his side (depending on the side of the defect). A 3 mm trocar was inserted alternately along the posterior axillary line, and a trocar

with a diameter of 3 and 5 mm was inserted into the 6th intercostal space along the subcapsular line. Then, under thoracoscopic control, the organs that have penetrated the chest cavity through the diaphragm defect are brought down into the abdominal cavity. Then, starting from the medial edge of the defect, about 7-9 non-absorbable silk or Etibond sutures are placed. All knots are tied intracorporeally. The last lateral suture is placed through the edges of the diaphragm defect using fixation around the nearby rib to avoid suture rupture and potential relapse. A pleural drainage tube is inserted into the chest cavity through a 5 mm port opening. When suturing other trocar openings, intradermal sutures were applied with vicryl thread – VICRYL 5/0 suture material. After the operation, the wound was covered with a sterile dressing. For diagnostic purposes, the most informative instrumental and physical examination methods were used: ECG, ultrasound of the brain, abdominal organs and pleural cavity on both sides, as well as plain chest radiography.

One of the main objectives of this work was to study the characteristics of the quality of life (QoL) of children before and after surgery. The QoL was studied using the QUALIN scale (S. Manificat, 1997) – a questionnaire for assessing the quality of life of children aged 3 months to 3 years.

The data obtained were processed and calculations were performed using MS Excel version 2010 spreadsheets and the SPSS Statistics 20 statistical package (a sophisticated piece of software used by social scientists). Quantitative variables are given as the mean value (M)±standard error of the mean (m). To compare independent samples and determine the reliability of quantitative differences, Student's t-test was used. Values were considered reliable at $p<0.05$.

Results of the study and their discussion. At the initial stage of the study, preoperative parameters were analyzed, including body weight, age at the time of surgery, presence of concomitant pathologies, as well as early and late postoperative complications.

The average birth weight of children in the control group was 3832.0±307.77 g (2400.0–9000.0 g). The age at the time of surgery was 200.2±43.45 days (1.0–1020.0 days). The average birth weight of children in the main group was 3400.0±387.18 g (2400.0–8500.0 g), and the average age was 95.0±51.49 days (1.0–1140.0 days). The intergroup differences in the above indicators were statistically insignificant – $p>0.05$, with the exception of differences in the data characterizing the length of stay of children in the neonatal intensive care unit and hospital ($p=0.0036$) (Table 1).

Table 1

Results of comparative intergroup analysis of some intra- and postoperative parameters

Indicators	Patients groups		p (1–2)	t
	Main group (2nd), N=26	Control group (1st), N=44		
Gender (male)	73.1±8.70	65.9±7.15		
Gender (female)	26.9±8.70	34.1±7.15	0.5325	0.39
Age (days)	95.0±51.49 (1.0–1140.0)	200.2±43.45 (1.0–1020.0)	0.1319	1.53
Bed days	12.5±0.83 (4.0–20.0)	15.9±0.69 (10.0–28.0)	0.0036	3.02
Weight, g	3400.0±387.18 (2400.0–8500.0)	3832.0±307.77 (2400.0–9000.0)	0.3910	0.86
Apgar 1 min	5.42±0.22 (4.0–7.0)	5.66±0.17 (4.0–8.0)	0.3943	0.86
Apgar 5 min	8.35±0.14 (7.0–9.0)	8.64±0.11 (7.0–10.0)	0.1118	1.61

Note: statistical significance of intergroup differences in pre-treatment parameters – p. Differences were considered statistically significant at $p<0.05$.

As in the case of statistical intergroup analysis of data on the weight of newborns, their assessment on the Apgar scale and the obtained indicators also did not differ statistically significantly depending on their belonging to a particular examination group ($p>0.05$). Thus, the assessment on the Apgar scale at the 1st minute in the main group was 5.42±0.22 points, and in the control group – 5.66±0.17 points ($p=0.3943$). Similar distinctive features in the data were observed in the groups and at the 5th minute after birth: 8.35±0.14 and 8.64±0.11 points, respectively ($p=0.1118$).

Thus, statistically significant differences in the Apgar scale in newborns with the pathology under study in the general cohort were not recorded. A more detailed comparative analysis of the data before the start of treatment depending on the gender indicators of newborns also did not reveal statistically significant differences ($p=0.5325$). The study showed that, in the opinion of both parents and pediatricians, the quality of life of the examined children before treatment was significantly lower for all indicators of the QUALIN scale than the data before treatment – $p<0.05$. QUALIN consists of 2 blocks – for parents. Each block, in turn, includes 2 forms – for parents and for pediatricians. The block for children under 1-year-old includes

33 questions and 6 answer options. The questionnaire contains scales describing the most important aspects of the functional state of the child: “Behavior and Communication” (BC), “Ability to Stay Alone” (ARA), “Family Environment” (FE), “Psychological and somatic well-being” (PSWB).

After analyzing the responses, a calculation is made using a point system (from 0 to 5 points); the higher the score, the better the quality of life. Along with the total score for all parameters of the questionnaire, the average score for each scale is calculated. The questionnaire was completed separately by one of the parents and the attending physician to exclude influence of each other on the answers.

In children of the first year of life of the main group, based on the parents' responses before the start of the surgical intervention, very low indicators of the quality of life were established both by the overall score and by different scales of the questionnaire. The parents rated the child's ability to remain alone relatively low. As for the doctor's opinion regarding the preoperative condition of the child, his opinion basically corresponded to the opinion of the parents. However, although the doctor rated the quality of life of the examined infants low by all scales, just like the parent, he indicated their insufficient neuropsychological development and physical health as the lowest indicator (Table 2).

Table 2

Indicators of quality of life of children in the main group according to the survey of doctors and parent form of the QUALIN questionnaire

Aspects of QoL	Main (2nd) group (n=26)	
	Before treatment	After treatment
Parents		
Behavior and communication (BC),	4.09±0.08	4.44±0.06 p<0.05
Ability to remain alone (ARA)	3.85±0.13	3.96±0.13 p>0.05
Family environment (FE)	4.41±0.04	4.71±0.08 p<0.05
Psychological and somatic well-being (PSWB)	3.78±0.05	4.39±0.03 p<0.001
The total score (TS)	3.98±0.03	4.39±0.03 p<0.001
Doctors		
Behavior and communication (BC),	3.78±0.10	4.26±0.07 p<0.001
Ability to remain alone (ARA)	3.70±0.09	4.04±0.04 p<0.001
Family environment (FE)	4.42±0.06	4.85±0.02 p<0.001
Psychological and somatic well-being (PSWB)	3.72±0.04	4.56±0.03 p<0.001
The total score (TS)	3.82±0.03	4.40±0.04 p<0.001

Note: p–statistical significance of intergroup differences in pre-treatment parameters. Differences were considered statistically significant at p <0.05.

Comparing the assessment of the children's quality of life given by parents and doctors after surgical treatment using the thoracoscopic technique, we obtained results that significantly exceeded the initial data noted by all scales of the questionnaire before the treatment. At the same time, the parents rated the quality of life of the children higher than the doctors only by some parameters of the questionnaire. As can be seen from the tabular data presented in the article, the most pronounced differences between them concerned the Behavior and communication (BC) and Psychological and somatic well-being (PSWB) scales.

Thus, a comparison of the questionnaire indicators obtained on the basis of the responses of parents and doctors showed that the quality of life of children after surgical treatment of diaphragmatic hernia, both by the total score and by all scales, was significantly higher than before the treatment of the pathology (p<0.05), with the exception of the data of the parental form of the Ability to remain alone (ARA) scale (p>0.05). In conclusion, it should be noted that minimally invasive treatment of diaphragmatic hernia, in particular, using safe and effective endoscopic methods, remains a problem for many specialists due to the complexity of mastering such technologies.

Important postnatal predictors and criteria for the functional state of children are their body weight at birth and the assessment of the newborn's body condition using the Apgar scale, which is also emphasized by some foreign authors [15].

A retrospective observation of history of 45 infants born with CDH between 2021 and 2022 was conducted by Gilley J, et al (2025). The following variables were identified: need for swallow study,

stomach location, defect type, need for anti-reflux therapy, need for nasogastric tube or gastric tube at time of discharge, poor growth, and frequency of respiratory infections during the first 12 months of life. The results revealed that the differences in outcomes based on defect type suggest that early identification and targeted interventions for feeding and swallowing issues may improve long-term growth and respiratory outcomes for CDH patients. The authors noted that further studies are warranted to develop standardized dysphagia management guidelines for this population [8].

In another study the comparative analysis was performed on various parameters including basic clinical data, surgical methods, operation time, intraoperative blood loss, transfusion status, postoperative pain, postoperative mechanical ventilation time, chest tube drainage time, length of hospital stay, incidence of complications, and follow-up information between groups with and without video-assisted thoracoscopic surgery (VATS). Results found out that VATS group had better outcomes in terms of intraoperative blood loss, transfusion status, postoperative pain, postoperative mechanical ventilation time, chest tube drainage time, and length of hospital stay ($p<0.05$) [7].

A thorough statistical analysis of the data we obtained demonstrated certain advantages of minimally invasive thoracoscopic surgery over traditional methods of open surgery. The videothoracoscopy used in these studies, i.e. the method of minimally invasive surgery, allows us to eliminate some risks typical of traditional surgery and significantly improve the quality of life of children, which is confirmed by the data of previously conducted scientific studies [1, 12].

Thus, the need to make large incisions with less blood loss and less intense postoperative pain is eliminated. It is necessary to simultaneously note the lower risk of infection, unrivaled cosmetic effect against the background of minimal traces of sutures, faster postoperative recovery of patients, reduction in the terms of the rehabilitation period and improvement of remote results of treatment. The results of the conducted studies indicate the benefits of choosing minimally invasive video-assisted thoracoscopic surgery in the treatment of congenital diaphragmatic hernias in newborns.

Conclusions

1. The Apgar score at the 1st minute in the main group was 5.42±0.22 points, and in the control group – 5.66±0.17 points ($p=0.3943$). Similar distinctive features in the data were observed in the groups and at the 5th minute after birth: 8.35±0.14 and 8.64±0.11 points, respectively ($p=0.1118$). Thus, statistically significant difference in the Apgar scale in newborns with the studied pathology in the general cohort was not recorded.

2. The quality of life of children after surgical treatment of diaphragmatic hernia, both by the total score and by all scales, was significantly higher than before the treatment of the pathology ($p<0.05$), with the exception of the data of the parental form of the Ability to remain alone (ARA) scale ($p>0.05$).

If we interpret the obtained data characterizing the course of the postoperative period and the quality of life of children in the first year, we can conclude that early diagnosis and surgical treatment of congenital diaphragmatic hernias in newborns using modern thoracoscopic techniques can significantly improve the results of surgical treatment compared to the traditional open method.

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Стаття надійшла 14.06.2024 р.

DOI 10.26724/2079-8334-2025-2-92-67-72
UDC 616.12-007.2-053.2

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IN-HOSPITAL AND LATE OUTCOMES OF SURGICAL VERSUS ENDOVASCULAR REPAIR OF SEVERE AORTIC STENOSIS IN NEWBORNS AND INFANTS

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With the purpose to present in-hospital and late results of balloon aortic valvuloplasty versus surgical aortic valvotomy in newborns and infants with severe aortic valve stenosis 58 consecutive newborns and infants with severe aortic valve stenosis. 47 (81 %) patients underwent balloon aortic valvuloplasty (Group I); 11(19 %) patients – surgical aortic valvotomy (Group II) were enrolled. Initial aortic systolic pressure gradient in Group I comprised 67.6±19 mm Hg; in Group II – 69±23 mm Hg. Both groups were compared with regard to the persistence or recurrence of postoperative aortic pressure gradients, valve insufficiency and necessity for valve-related re-interventions. Late outcomes studied on 36 months. Following balloon aortic valvuloplasty and surgical aortic valvotomy procedures were revealed significant decline of aortic systolic pressure gradient, and increase of left ventricular ejection fraction in both groups. On 12 months following endovascular balloon aortic valvuloplasty aortic pressure gradient increased in most patients, and aortic insufficiency began to increase.

Key words: aortic valve stenosis, surgical aortic valvulotomy, balloon valvuloplasty, infants.

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ГОСПІТАЛЬНІ ТА ВІДДАЛЕНІ РЕЗУЛЬТАТИ ХІРУРГІЧНОГО ТА ЕНДОВАСКУЛЯРНОГО ВІДНОВЛЕННЯ ТЯЖКОГО АОРТАЛЬНОГО СТЕНОЗУ В НОВОНАРОДЖЕНИХ І НЕМОВЛЯТ

З метою виявлення госпітальних і віддалених результатів балонної пластики аортального клапана порівняно з хірургічною вальвулопластикою аорти в новонароджених і немовлят із тяжким стенозом аортального клапана, у дослідження було включено 58 новонароджених і немовлят із тяжким стенозом аортального клапана. 47 (81 %) пацієнтам було виконано балонну пластику аортального клапана (група I); 11 (19 %) пацієнтам – хірургічну вальвулопластику аорти (група II). Початковий градієнт систолічного тиску в аорті в групі I становив 67,6±19 мм рт. ст.; у групі II – 69±23 мм рт. ст. Обидві групи порівнювали за збереженням або рецидивуванням післяопераційних градієнтів тиску в аорті, недостатністю клапана і необхідністю повторних втручань на клапані. Віддалені результати вивчалися через 36 місяців. Після балонної аортальної вальвулопластики і хірургічної аортальної вальвулопластики було виявлено значне зниження градієнта систолічного тиску в аорті і збільшення фракції викиду лівого шлуночка в обох групах. Через 12 місяців після ендоваскулярної балонної аортальної вальвулопластики градієнт тиску в аорті збільшився у більшості пацієнтів, і аортальна недостатність почала наростати.

Ключові слова: стеноз аортального клапана, хірургічна аортальна вальвулопластика, балонна вальвулопластика, немовлята.

Congenital aortic valve stenosis (AVS) is among the more common congenital heart diseases (CHD), accounting for 6 % of all CHD. When the stenosis is severe, it requires emergency intervention during the neonatal life or early infancy. This is undertaken either with a balloon aortic valvuloplasty (BAV) or surgical aortic valvotomy (SAV). Both options manifest a palliative approach with frequent necessity of re-interventions [5, 6].