

ANNOTATION

of the dissertation work Adilbekova Akkerbez Bakirqyzy
on the topic: "Clinical and Epidemiological Aspects and Prognostic Factors in the
Treatment of Interventricular Septal Defects in Kazakhstan,"
submitted for the degree of Doctor of Philosophy (PhD)
in the specialty 8D10102 – "Medicine."

Relevance

Congenital heart defects (CHD) remain one of the leading causes of mortality among newborns and young children. The average percentage of live births with CHD is 0.8–1% (8–10 per 1000 live births for full-term infants), while this figure is significantly higher in premature infants, reaching 8.3%. In Kazakhstan, approximately 3,000 children with CHD are born annually, and they account for the highest mortality rate in early childhood. The most common CHD is the ventricular septal defect (VSD), which makes up about 20–30% of all congenital heart defects. Currently, there are three main surgical methods for treating ventricular septal defects (VSD): 1. Surgical treatment using cardiopulmonary bypass (CPB). 2. Interventional closure of the VSD via percutaneous puncture. 3. Hybrid surgery, performed without the use of CPB. Hybrid surgery was proposed and has gained significant popularity as it allows for VSD closure without cardiopulmonary bypass, without stopping the heart, and through a mini-sternotomy of 2–4 cm in length. This method is widely used in China. However, there is currently insufficient information about the effectiveness and safety of this technique, as well as its specific application in young children in Europe and Central Asia. Moreover, there is no standardized clinical protocol for performing this procedure for VSD closure. Thus, the above-mentioned issues highlight the relevance of our research topic.

Purpose of the Study: Based on the assessment of clinical and epidemiological data and prognostic factors, to develop and apply methods of clinical observation that allow for a reasoned conclusion about the most effective surgical treatment method for ventricular septal defect in children in the Republic of Kazakhstan.

Research Objectives:

1. To study the regional epidemiological features, trends in morbidity, and mortality from ventricular septal defect in children.
2. To assess the effectiveness of surgical treatment methods for this pathology.
3. To identify prognostic factors that influence early and long-term surgical outcomes.
4. To examine the criteria determining prognosis in patients and to develop an algorithm for patient selection for the hybrid method.

Object of the Study: The study included 500 patients with ventricular septal defect (aged from birth to 18 years).

Research Methods: I. To study the epidemiological aspect, the following research methods were used:

1. Content analysis method (analysis of bibliographic sources, governmental and statistical data);
2. Descriptive analysis method (processing and systematization of data for clear presentation in tables and graphs);
3. Statistical methods using Microsoft 365 and SPSS.

II. For the study of clinical material, the following methods were used:

1. The study was combined—cohort and bidirectional. A) Initially retrospective cohort. B) Subsequently prospective cohort.

Practical Significance:

For the first time, the epidemiological features of ventricular septal defect in children in Kazakhstan have been defined at the regional level. The spatial and temporal characteristics of mortality in children from ventricular septal defect in various medico-geographical regions of Kazakhstan have been established.

Based on the results of our study, the understanding of the safety and efficacy of the hybrid method for closing ventricular septal defects has been enhanced. An algorithm for selecting patients for this type of surgical intervention has been developed.

The obtained data have been successfully integrated into the clinical practice of the cardiac surgery department for congenital heart defects at the National Scientific Medical Center. The results of our work have also been utilized in preparing presentations at various medical conferences in Kazakhstan and abroad, as well as in publications on pediatric cardiac surgery. The materials of the dissertation may be useful for the development of educational manuals and methodological recommendations.

Key Points for Defense:

1. Trends in morbidity and mortality from ventricular septal defects are influenced by demographic and age factors. Trends in morbidity indicate an increase in this pathology. The study of mortality from ventricular septal defects in various medico-geographical zones revealed regional characteristics in children. The map indicates regions of high, medium, and low mortality levels.
2. The hybrid method for closing ventricular septal defects demonstrates a higher level of safety compared to the traditional method in young children.
3. In the early postoperative period, the hybrid method for closing ventricular septal defects showed better results compared to traditional correction.

4. The application of the patient selection algorithm for the hybrid method of closing ventricular septal defects increases the effectiveness and safety of surgical treatment for patients with this condition.

Approval of the Dissertation:

Key Findings of the Dissertation Work:

1. Mortality rates of ventricular septal defect in children in Kazakhstan: spatio-temporal epidemiological appraisal (article). *Congenital Heart Disease*. 2023; 18(4): 447-459. CiteScore in the Scopus database: 72.
2. Hybrid versus traditional method closure of ventricular septal defects in children (article). *Journal of Thoracic and Cardiovascular Surgery Techniques*. 2024; 24: 137-144. CiteScore in the Scopus database: 44.
3. Evolution of surgery for ventricular septal defect closure (literature review). *Journal of Clinical Medicine of Kazakhstan*. 2022; 19(5): 4–8.
4. Mid-term outcome of the hybrid method of ventricular septal defect closure in children (article). *Journal of Clinical Medicine of Kazakhstan*. 2024; 21(2): 66-72.
5. Mortality of children from ventricular septal defect in Kazakhstan: a spatio-temporal epidemiological assessment. This work was presented as an article at the XIV International Scientific and Practical Conference “Science and Education in the Modern World: Challenges of the 21st Century.” 2023, Vol. 1, p. 18. Astana, Kazakhstan.
6. Fragments of the work were presented as a thesis titled “Transthoracic device closure of ventricular septal defect without cardiopulmonary bypass” at the International Scientific and Practical Conference of Students and Young Scientists “Science and Youth: Discoveries and Perspectives.” p. 71, April 12-13, 2023. Astana, Kazakhstan.
7. Fragments of the work were presented as a thesis titled “Transventricular closure of ventricular septal defects on a beating heart” at the 64th International Scientific and Practical Conference of Students and Young Scientists “Medical Science, Education, Practice: Problems and Solutions.” p. 369, April 11-12, 2022. Astana, Kazakhstan.
8. Fragments of the work were presented as a thesis titled “Minimally invasive closure of ventricular septal defect on a beating heart – our six-year experience” at the XI International Forum of Cardiologists and Therapists. p. 4, March 22-24, 2022. Moscow, Russia.
9. Fragments of the work were presented as a thesis titled “Minimally invasive ventricular septal defect closure without cardiopulmonary bypass: our center experience” at the International Conference of Cardiologists and Cardiac Surgeons. p. 62-64, 2023. Taraz, Kazakhstan.
10. Fragments of the work were presented as a thesis titled “Mortality of children from ventricular septal defect in Kazakhstan: a spatio-temporal epidemiological assessment” at the International Scientific and Practical

- Conference “Advances in Science and Technology.” p. 23, October 31, 2023. Moscow, Russia.
11. Fragments of the work were presented as a thesis titled “Minimally Invasive Ventricular Septal Defect Closure on a Beating Heart: Experience in Our Center” at the International Scientific Conference of the University of Latvia. p. 143, 2022. Riga, Latvia.
 12. Fragments of the work were presented as a thesis titled “Mid-term results of minimally invasive closure of VSD on a beating heart in children” at the XXVII Annual Session of the A.N. Bakulev National Medical Research Center of Cardiovascular Surgery with the All-Russian Conference of Young Scientists and the First All-Russian Cardiac Surgery Summit. May 26-28, 2024. Moscow, Russia.
 13. Presentation at the International Scientific and Practical Conference “80th International Scientific Conference of the University of Latvia.” “Minimally Invasive Ventricular Septal Defect Closure on a Beating Heart: Experience in Our Center.” 2022. Riga, Latvia.
 14. Presentation at the Congress of Cardiologists of the Republic of Kazakhstan. “Minimally invasive closure of ventricular septal defect on a beating heart — our six-year experience.” June 2, 2023. Almaty, Kazakhstan.
 15. Certificate of registration in the state register of rights for copyright-protected objects dated September 23, 2022, No. 28998. Title of the object: Clinical, epidemiological, and prognostic factors in the treatment of ventricular septal defect in children in Kazakhstan.
 16. Certificate of registration in the state register of rights for copyright-protected objects dated February 8, 2023, No. 32458. Title of the object: Questionnaire for parents of children with congenital heart defects “ventricular septal defect” after surgical treatment.
 17. Act of implementation of research results at the base of the National Scientific Medical Center in Astana. Title of the object: “Transventricular closure method for ventricular septal defect on a beating heart,” No. 5, 2023.

CONCLUSIONS

1. In Kazakhstan, the average number of congenital heart defects (CHD) per 1,000 live births ranges from 2,981 to 3,414 cases during the period from 2011 to 2020, with 30% attributed to ventricular septal defects (VSD). A significant portion of deaths from VSD occurs in infants (under 1 year) - 82.6%, and in children aged 1 to 2 years - 11.5%. The infant mortality rate from VSD decreased by 56% by 2020. The mortality map from VSD by region is the most objective and indicative guide for conducting medical and social activities regarding this disease.
2. The hybrid method for closing VSD has demonstrated high effectiveness at a rate of 93.2%, with a conversion rate of 6.4% and a mortality rate of 0.4%.
3. The hybrid method for closing VSD ensures significantly less intraoperative blood loss ($\mu=27$ ml), with an operation time of 84 minutes (31;160),

preoperative stay of $\mu=3.12$ days, postoperative stay of $\mu=6.76$ days, time in the intensive care unit of $\mu=1.03$ days, and total hospital stay, including the first stage of rehabilitation, of $\mu=9.88$ days, compared to traditional correction.

4. An algorithm for patient selection for the hybrid method of closing VSD has been developed to achieve maximally effective results in the surgical treatment of VSD.

Practical Recommendations:

1. When detecting perimembranous VSD with an aortic rim >2 mm, it is preferable to use the hybrid method.
2. For muscular VSD, a muscular occluder should be used.
3. If intraoperative rhythm and conduction disturbances persist after the intervention, conversion to traditional surgery is recommended.
4. If a residual shunt of 3 mm or more remains after hybrid closure of the VSD, conversion to traditional surgery should be performed.
5. For closing perimembranous VSD, it is recommended to choose an occluder size that is 1 mm larger than the diameter of the VSD.
6. For closing low-positioned apical defects of the ventricular septum, it is recommended to use left-sided mini-thoracotomy in the 4th intercostal space along the midclavicular line.

Volume and Structure of the Dissertation:

The dissertation is presented in 116 pages of computer text, illustrated with 25 figures, and contains 15 tables. It consists of an introduction, a literature review, materials and methods, three chapters presenting the research results, conclusions, practical recommendations, an algorithm for selecting patients for the hybrid method of closing ventricular septal defects, and a list of references, including 177 items.