

The first experience of radical corrections of total anomalous pulmonary vein return by "sutureless technique" in the Republic of Kazakhstan

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Abstract

Total anomalous pulmonary vein return is a critical heart defect with 4 anatomic forms. It belongs to the severe category of complexity of the STAD scale with an incidence of about 0.013% among all newborns, most of them requiring urgent surgical treatment in the first days and hours of life. Currently, there are many surgical techniques for its correction. The present work presents a comparative assessment of two groups of patients with earlier classic and "sutureless" method of surgery with the results of reduction of myocardial ischemia by an average of 14 minutes, artificial circulation by 33 minutes. We proved that "sutureless technique" has a number of advantages in comparison with the previously performed methods, the main ones being reduction of myocardial ischemia time, artificial circulation and universalism in application to any form of malformation.

Key words: total anomalous pulmonary venous return, "sutureless technique", congenital heart defect (CHD), critical congenital heart disease (CCHD), heart surgery

Introduction

Total anomalous pulmonary vein return (TAPVR) is a congenital heart defect (CHD) presenting as a complete absence of pulmonary vein (PV) flow into the left atrium, with multivariate forms of atypical drainage. TAPVR can be isolated or combined with other heart defects. The incidence is as high as 13 per 100,000 newborns [1]. Almost always TAPVR occurs from the first days of life with high pulmonary hypertension, extremely aggravating the course of severe malformation. The main causes of surgical mortality after radical correction of TAPVR are pulmonary hypertension and postoperative PV obstruction [2]. "Sutureless technique" in TAPVR correction was initially developed for patients with postoperative PV stenosis [3]. Today, the technique has

become a standard part of primary radical correction of TAPVR in many centers [4-6]. The plasty can be called universal as an application to any type of TAPVR, including its complex mixed forms [7]. The advantages of this method become obvious. It has been observed that in comparison with traditional surgery, the "sutureless technique" was associated with lower incidence of postoperative PV obstruction (4.6% vs 13.5%) and reoperation (3.4% vs 12.4%) [8], and the torsion of venous sinus system and reactive process of noncontact anastomosis zone are minimized [9]. TAPVR is a grade 4 of 5 critical heart defect according to the STAD (The Society of Thoracic Surgeons-European Association for Cardio-Thoracic Surgery) scale analysis of mortality risk associated with congenital heart disease surgery [10].

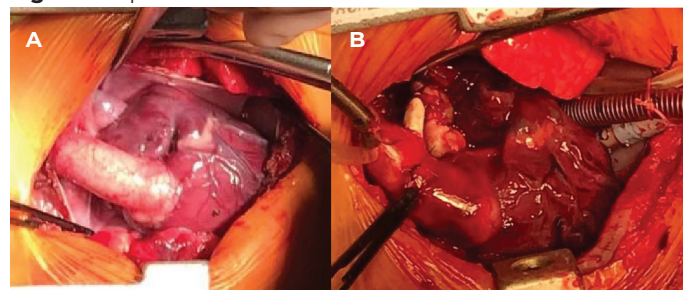
Most patients require emergency surgery during the newborn period and sometimes in the first hours of life. "Sutureless technique" significantly reduces the time of surgery and artificial circulation, with the consequent known positive aspects, which is especially important when several CHDs need to be corrected simultaneously [7]. The method is universal, since we have managed to perform this technique to correct almost all types of TAPVR.

Case-presentation

71 patients with isolated TAPVR without concomitant CHD were hospitalized on the bases of the National Scientific Medical Center Nur-Sultan, Center of Modern Medicine "Mediterra" and Center of Perinatology and Pediatric Cardiosurgery in Almaty during the period from 2004 to 2021. The patients were distributed between two groups. In the control group of the study, surgery was performed using the technique of anastomosis between the left atrium and PV collector through incision accesses: right atrium (RA) - interatrial septum - posterior wall of the left atrium (LA) - PV collector (64 patients); in the experimental group correction was performed using the "sutureless technique" (7 patients) who were operated on between July 2020 and July 2021 (Table 1). When carrying out operations by this technique, we did not use circulatory arrest, all operations were carried out in conditions of moderate hypothermia in 33°C.

which statistically reliably reduces the aortic occlusion time by at least one third. Thus, such complications of artificial circulation as: fatal arrhythmias correlated with electrolyte disturbances, vasoconstriction due to changes in viscosity properties, coagulation disorders, renal and metabolic disorders, as well as central nervous system lesions are minimized [11, 12]. "Sutureless technique" allowed us to perform correction of almost all types of TAPVR, including its most complex mixed forms, and one patient successfully performed the first and second stages of the most highly lethal CHD - combination of TAPVR with single ventricle and atresia of pulmonary artery heterotaxy syndrome (Figure 1A, B).

Figure 1 - Specific characteristics of case



A - intraoperative preoperative view, B - postoperative view: sutureless TAPVR plasty, dilating LA bifurcation plasty, central systemic pulmonary anastomosis

Table 1 Summary data

Minimum score	Group	
	Second (7)	Control (64)
Myocardial ischemia, min	53	67
Cardiopulmonary bypass, min	98	131
Operation, min	179	211

In the experimental group there was one fatal outcome: the child from birth was on artificial ventilation, on the 6th day of life was admitted in an emergency severe decompensated condition. Against the background of poly-segmental pneumonia, periventricular hemorrhage, surgery was performed, which ended with ECMO and lethal outcome after 2 weeks.

Our experience with the "sutureless technique" objectively demonstrates a number of advantages. The results of the study showed that the average time of myocardial ischemia using this technique was more than 20% shorter than that of the previously used method. As the experience accumulates, the time of myocardial ischemia will decrease even more. The need for deep hypothermia, which takes a significant part of the total duration of the operation, is eliminated. The operation technique itself is simple, without opening the right sections,

Conclusion

We have proved that the "sutureless technique" significantly reduces the time of myocardial ischemia, artificial circulation and surgery, avoids the negative effect of deep hypothermia, is universal in relation to correction of almost any type of TAPVR including its complex mixed forms. All advantages of this technique incline many surgeons to choose it as the primary correction of TAPVR.

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References

1. Mai CT, Isenburg JL, Canfield MA, et al. for the National Birth Defects Prevention Network. National population-based estimates for major birth defects, 93 2010-2014. *Birth Defects Res.* 2019; 1– 16. <https://doi.org/10.1002/bdr2.1589>
2. Shi G., Zhu F., Wen C., Qiu L., Zhang H., Zhu Z. et al. Single-institution outcomes of surgical repair of infracardiac total anomalous pulmonary venous connection [Electronic resource]. *J. Thorac. Cardiovasc. Surg.* 2021; 161(4):1408-1417.e2. <https://doi.org/10.1016/j.jtcvs.2020.06.023>
3. White B.R., Ho D.Y., Faerber J.A., Katcoff H., Glatz A.C., Mascio C.E. et al. Repair of Total Anomalous Pulmonary Venous Connection: Risk Factors for Postoperative Obstruction [Electronic resource]. *Ann. Thorac. Surg.* 2019; 108(1):122-129. <https://doi.org/10.1016/j.athoracsur.2019.02.017>

4. Mueller C, Dave H, Prêtre R. Primary correction of total anomalous pulmonary venous return with a modified sutureless technique. *Eur J Cardiothorac Surg*. 2013; 43(3):635-40. <https://doi.org/10.1093/ejcts/ezs376>
5. Teplov P.V., Titov A.M., Miller A.Yu., Sakovich V.A., Drobot D.B., Morozov A.A. Comparison of direct anastomosis and "sutureless" technique for radical correction of total anomaly drainage of pulmonary veins [In Russian]. *Clinical and Experimental Surgery. Petrovsky Journal*. 2021; 9(3):33-6. <https://doi.org/10.33029/2308-1198-2021-9-3suppl-33-36>
6. Yoshimura, N., Fukahara, K., Yamashita, A. et al. Surgery for total anomalous pulmonary venous connection: primary sutureless repair vs. conventional repair. *Gen Thorac Cardiovasc Surg*. 2017; 65:245–251. <https://doi.org/10.1007/s11748-017-0769-x>
7. Honjo O, Atlin CR, Hamilton BC, Al-Radi O, Viola N, Coles JG, Van Arsdell GS, Caldarone CA. Primary sutureless repair for infants with mixed total anomalous pulmonary venous drainage. *Ann Thorac Surg*. 2010;90(3):862-8. 118. <https://doi.org/10.1016/j.athoracsur.2010.05.007>
8. Wu, Y., Xin, L., Zhou, Y. et al. Is Sutureless Technique Beneficial in the Primary Repair of Total Anomalous Pulmonary Venous Connection? A Systematic Review and Meta-Analysis. *Pediatr Cardiol*. 2019; 40:881–891. <https://doi.org/10.1007/s00246-018-1948-y>
9. Kim H., Sung S.C., Choi K.H., Lee H.D., Kim G., Ko H. Primary Sutureless Repair of Total Anomalous Pulmonary Venous Connection: Suture-and-Open Technique [Electronic resource]. *Ann. Thorac. Surg*. 2018; 106(5):e273-e276. <https://doi.org/10.1016/j.athoracsur.2018.05.026>
10. Jacobs ML, Jacobs JP, Thibault D, Hill KD, Anderson BR, Eghtesady P, Karamlou T, Kumar SR, Mayer JE, Mery CM, Nathan M, Overman DM, Pasquali SK, St Louis JD, Shahian D, O'Brien SM. Updating an Empirically Based Tool for Analyzing Congenital Heart Surgery Mortality. *World J Pediatr Congenit Heart Surg*. 2021;12(2):246-281. <https://doi.org/10.1177/2150135121991528>
11. Conolly S., Arrowsmith J.E., Klein A.A. Deep hypothermic circulatory arrest. *Contin. Educ. Anaesth. Crit. Care Pain*. 2010; 10(5):138-142
12. Hanley F.L. Religion, politics ... deep hypothermic circulatory arrest. *J. Thorac. Cardiovasc. Surg*. 2005; 130(5):1236.e1-e8. <https://doi.org/10.1016/j.jtcvs.2005.07.047>