Translated by E.V. Trushina

Case Report

https://doi.org/10.23934/2223-9022-2025-14-1-216-223

Assessment of Quality of Life of a Patient with Acute Type A Aortic Dissection Who Underwent Cardiac Rehabilitation After Surgical Treatment Under Artificial Circulation

***V.V. Vladimirov*[1, 2] ✉, *A.A. Bruikov*[3, 4], *V.S. Selyaev*[1], *L.S. Kokov*[1, 2], *A.V. Redkoborody*[1, 2], *I.V. Ivanov*[1], *R.Sh. Muslimov*[1], *S.V. Zhuravel*[1, 2]**

Department of Cardiac Surgery No. 2
[1] N.V. Sklifosovsky Research Institute for Emergency Medicine
Bolshaya Sukharevskaya Sq. 3, Moscow, Russian Federation 129090
[2] Russian University of Medicine
Dolgorukovskaya, Str. 4, Moscow, Russian Federation 127006
[3] G.R. Derzhavin Tambov State University, Medical Institute
Sovetskaya Str. 93, Tambov, Russian Federation 392024
[4] Lipetsk City Children's Hospital
Gagarin Str. 115/4, Lipetsk, Russian Federation 398020

✉ **Contacts:** Vitaly V. Vladimirov, Candidate of Medical Sciences, Cardiovascular Surgeon, Department of Cardiac Surgery No. 2, Research Fellow, N.V. Sklifosovsky Research Institute for Emergency Medicine. Email: vladimirovvv@sklif.mos.ru

ABSTRACT The article presents a clinical case of treating a 42-year-old patient with acute aortic dissection (type I according to DeBakey classification), who underwent an individual cardiac rehabilitation program in the early postoperative period after surgical treatment in the volume of reconstruction of the thoracic aorta using hybrid technology under conditions of artificial circulation and circulatory arrest. Early rehabilitation after aggressive surgical intervention ensured the most complete restoration of health, psychological status and working capacity of the patient in a minimum period of time.

Keywords: acute aortic dissection, complicated course, indications for surgical treatment, cardiac rehabilitation, hybrid technologies in the treatment for aortic dissection, total aortic arch replacement, descending aortic repair

For citation Vladimirov VV, Bruikov AA, Selyaev VS, Kokov LS, Redkoborody AV, Ivanov IV, et al. Assessment of Quality of Life of a Patient with Acute Type A Aortic Dissection Who Underwent Cardiac Rehabilitation After Surgical Treatment Under Artificial Circulation. *Russian Sklifosovsky Journal of Emergency Medical Care.* 2025;14(1):216–223. https://doi.org/10.23934/2223-9022-2025-14-1-216-223 (in Russ.)

Conflict of interest Authors declare lack of the conflicts of interests

Acknowledgments, sponsorship The study had no sponsorship

Affiliations

Vitaliy V. Vladimirov	Candidate of Medical Sciences, Cardiovascular Surgeon, Department of Cardiac Surgery No. 2, Research Fellow, N.V. Sklifosovsky Research Institute for Emergency Medicine; Associate Professor, Department of Roentgen-Endovascular and Vascular Surgery, Russian University of Medicine; https://orcid.org/0000-0002-4026-8082, vladimirovvv@sklif.mos.ru; 25%, author of the idea, concept and design of the clinical example, literature review, text writing, full support of the article
Aleksey A. Bruikov	Candidate of Biological Sciences, Physical Medicine and Rehabilitation Physician, Head of the Department of Rehabilitation Treatment, City Center of Medical Rehabilitation for Children, Lipetsk City Children's Hospital; Associate Professor, Department of Medical Biology, Medical Institute, G.R. Derzhavin Tambov State University; https://orcid.org/0000-0001-9887-7879, ba73-87@mail.ru; 20%, author of the idea, author of the rehabilitation program, concept and design of the clinical case, literature review, text writing
Vladislav S. Selyaev	Junior Researcher, Department of Emergency Surgery, N.V. Sklifosovsky Research Institute for Emergency Medicine; https://orcid.org/0000-0002-6989-831X, selyaevvs@sklif.mos.ru; 13%, literature review, collection and processing of material, text writing, the patient's attending physician
Leonid S. Kokov	Academician of the RAS, Doctor of Medical Sciences, Head of the Scientific Department of Emergency Cardiology and Cardiovascular Surgery, N.V. Sklifosovsky Research Institute for Emergency Medicine; Head, Department of Roentgen-Endovascular and Vascular Surgery, Russian University of Medicine; https://orcid.org/0000-0002-3167-3692, kokovls@sklif.mos.ru; 12%, scientific consultant, checking of critical content, text editing, approval of the final version of the article

Andrey V. Redkoborody	Candidate of Medical Sciences, Leading Researcher, Department of Emergency Cardiac Surgery, Assisted Circulation and Heart Transplantation, N.V. Sklifosovsky Research Institute for Emergency Medicine; Associate Professor, Department of Roentgen-Endovascular and Vascular Surgery, Russian University of Medicine; https://orcid.org/0000-0002-6534-3595, redkoborodiyav@sklif.mos.ru; 10%, text editing, operating surgeon, scientific consultant
Ivan V. Ivanov	Candidate of Medical Sciences, Senior Researcher, Scientific Department of Anesthesiology, N.V. Sklifosovsky Research Institute for Emergency Medicine; https://orcid.org/0000-0002-6648-9385, ivanoviv@sklif.mos.ru; 8%, collection of material in accordance with the study design, patient supervision
Rustam Sh. Muslimov	Candidate of Medical Sciences, Leading Researcher, Department of Radiology, N.V. Sklifosovsky Research Institute for Emergency Medicine; https://orcid.org/0000-0002-5430-8524, muslimovrs@sklif.mos.ru; 8%, collection and processing of material, text writing, article design
Sergey V. Zhuravel	Doctor of Medical Sciences, Head of the Scientific Department of Anesthesiology, N.V. Sklifosovsky Research Institute for Emergency Medicine; https://orcid.org/0000-0002-9992-9260, zhuravelsv@sklif.mos.ru; 4%, text writing and editing

ES — emotional state
MH — mental health
MSCT — multispiral computed tomography
PH — physical health
PF — physical functioning
RF — role functioning
SF — social functioning
TG — therapeutic gymnastics
VA — vital activity

INTRODUCTION

Type A aortic dissection is a fatal disease, the surgical treatment of which is one of the most difficult areas of cardiovascular surgery. From the moment of the first symptoms of the disease without surgical intervention, the mortality rate is 2% for each hour [1]. Despite enormous accumulated experience in aortic surgery, early postoperative mortality according to the literature is 5.3–25.7% [2–8]. In recent years, diagnostic methods and surgical techniques have improved, and survival rates for surgical treatment of aortic dissection have increased significantly; however, mid-term results and quality of life for patients in the postoperative period remain unsatisfactory [9]. One of the reasons is the lack of a generally accepted rehabilitation program for this group of patients.

In connection with the development of endovascular surgery and the accumulation of experience, hybrid methods are becoming increasingly widespread — one-stage, delayed (within 2 weeks) ones — showing significantly better results in aortic remodeling and freedom from the risk of repeated operations [10–12], and also opening up wide opportunities in terms of early rehabilitation of patients in this group.

Rehabilitation of patients with cardiac pathology is understood as a system of measures of a medical, physical, psychological, educational and social nature that ensure the most complete restoration of patients' health, psychological status, and ability to work [13].

Our **aim** was to evaluate the quality of life after cardiac rehabilitation in the late postoperative period of a patient after surgical treatment of type A acute aortic dissection.

Clinical observation

Patient L., 42 years old, was admitted to the N.V. Sklifosovsky Research Institute for Emergency Medicine in January 2023 with complaints of aching pain behind the sternum. On admission to the hospital, the patient's condition was objectively severe. Respiratory rate was 18 per minute. Heart sounds were muffled; on auscultation, rhythm was correct with heart rate of 62 beats per minute; blood pressure was 130/67 mm Hg; no pathological noises upon auscultation. No edema. Diuresis was maintained and adequate. Height 178 cm, weight 115 kg. Body surface area 2.38 m2.

History: long-term history of arterial hypertension, receives combined hypotensive therapy. On the day of hospitalization, after bending the body, a pressing pain appeared behind the sternum. Upon arrival of the

ambulance team, the electrocardiogram showed no abnormalities. Urgently delivered to a medical facility at the place of residence for examination and treatment. During further examination, type I aortic dissection according to DeBakey was verified. He was urgently transferred to the N.V. Sklifosovsky Research Institute for Emergency Medicine to receive specialized medical care.

According to the data of multispiral computed tomography (MSCT) of the aorta with bolus contrast enhancement (BCE): signs of type I aortic dissection according to DeBakey with fenestration at the level of the lesser curvature of the aortic arch opposite the orifice of the left subclavian artery. The dissection extends to the left renal and both iliac arteries. There is a pronounced compression of the true lumen by the false one, with dimensions less than 1/3 of the total diameter of the aorta (Fig. 1).

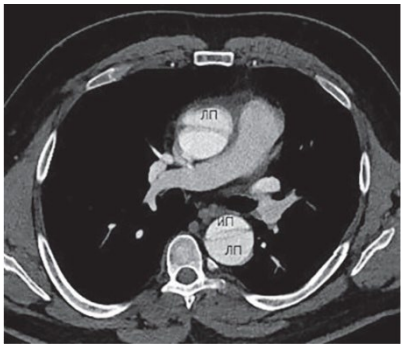

Fig. 1. Chest-level CT scan with contrast enhancement (axial section). Dissection of the thoracic and abdominal aorta with the formation of true (ИП) and false (ЛП) lumens is determined

According to echocardiography data: the aorta is thickened, the sinus of Valsalva is 33 mm, the ascending section is 50 mm, a mobile structure (intima) with partial thrombosis of the false canal is located in the lumen. Arch — 30 mm. Aortic valve is tricuspid, without features. Regurgitation — up to grade I. Heart chambers are not dilated. Left ventricular ejection fraction — 60%. Local contractility of the left ventricle myocardium: not impaired. Atrioventricular valves without features.

The calculated risk of perioperative 30-day mortality according to the GERAADA score was 16.4%.

Given the direct threat to life, the patient was urgently sent to the operating room 3 hours after admission to the hospital for surgical treatment under artificial circulation.

From the operation protocol:

Arterial connection to the right axillary artery using a vascular prosthesis.

Median sternotomy. The vessels of the aortic arch are bluish in the initial sections, further they are of physiological color. The pericardium was opened, 300 ml of hemorrhagic fluid was released from the pericardial cavity under pressure. The epicardial fat of the heart base and along the pulmonary artery is imbibed with blood. The pulmonary artery is not tense.

The ascending aorta is dissected circularly, no intimal defects in the ascending aorta are detected. The aortic valve is tricuspid, the cusps are thin, the coaptation of the cusps is satisfactory. Resuspension of the commissures of the aortic valve, the valve is considered competent.

Aortic wall plastic surgery using the sandwich technique at the sinotubular junction level.

At a temperature of 27°C, circulatory arrest was initiated, bilateral antegrade perfusion of the brain was started. The aortic arch is dissected circularly. Behind the left subclavian artery, along the lesser curvature, a fenestration with jagged edges is determined, measuring 2.5 × 1.0 cm.

A hybrid vascular graft — Thoraflex Hybrid 26/28 12×8×10×10×150 mm — was inserted into the descending aorta via a guidewire.

Anastomoses with the left common carotid artery, brachiocephalic trunk, and proximal anastomosis with previously performed plastic repair of the aortic wall were successively applied.

In the left subclavian region, the left axillary artery is mobilized. An end-to-side anastomosis was formed between the artery and the vascular graft. The graft is inserted through the 1st intercostal space and connected to the distal branch of the multi-branch prosthesis.

On the 3rd day after the surgical intervention, the trachea was extubated. On the 8th day, the patient was transferred to the cardiac surgery department to continue treatment in the early postoperative period.

According to the control MSCT of the aorta with contrast enhancement on the 10th day, there is a pronounced positive dynamics, thrombosis of the false lumen along the entire length of the implanted stent graft, there is contrasting of the false lumen distal to the hybrid prosthesis with partial thrombosis to the level of the diaphragm. The diameter of the true lumen at this level is about 45% of the total one (Fig. 2).

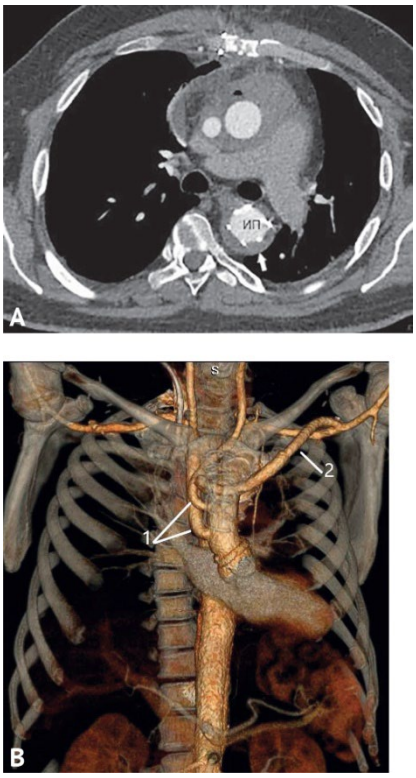

Fig. 2. Postoperative CT scans. A — axial section: a portion of a hybrid prosthesis of sufficient diameter is identified in the true lumen (ИП) of the descending aorta. The false lumen at the level of the prosthesis is thrombosed (arrow); B — three-dimensional reconstruction: vascular branches to the brachiocephalic vessels and left common carotid artery (1), an extraanatomical shunt to the left axillary artery (2) are identified

On the 17th day after surgery, the patient was discharged home in satisfactory condition under outpatient observation by a cardiologist at his place of residence, with a subsequent recommendation to undergo the 3rd stage of rehabilitation.

Based on the work of M.G. Bubnova and D.M. Dronov (2020), an individual cardiac rehabilitation program was compiled [13]. When compiling it, a comprehensive approach was taken into account, which included the following aspects: medical (taking medications), physical (use of exercise therapy depending on the stages of the individual cardiac rehabilitation program, physical training, both in a medical facility and at home), educational (training in the features of diaphragmatic breathing, monitoring blood pressure, changing lifestyle), psychological (necessary for the patient to adapt to his physiological state) and professional factors (implies the resumption of work activity, or retraining depending on the functional state of the body).

An individual rehabilitation program was developed for the patient, which included 3 stages (Fig. 3).

At the 1st stage, rehabilitation activities were carried out in the intensive care unit. The purpose of this stage was to explain to the patient the tasks of cardiac rehabilitation, its stages and teach adapted methods of breathing exercises, passive exercises for the upper and lower extremities. The duration of the sessions at this stage was 10-15 minutes. The goal of this stage was achieved, and before transfer to the cardiac surgery department, the patient could sit independently with his lower limbs down.

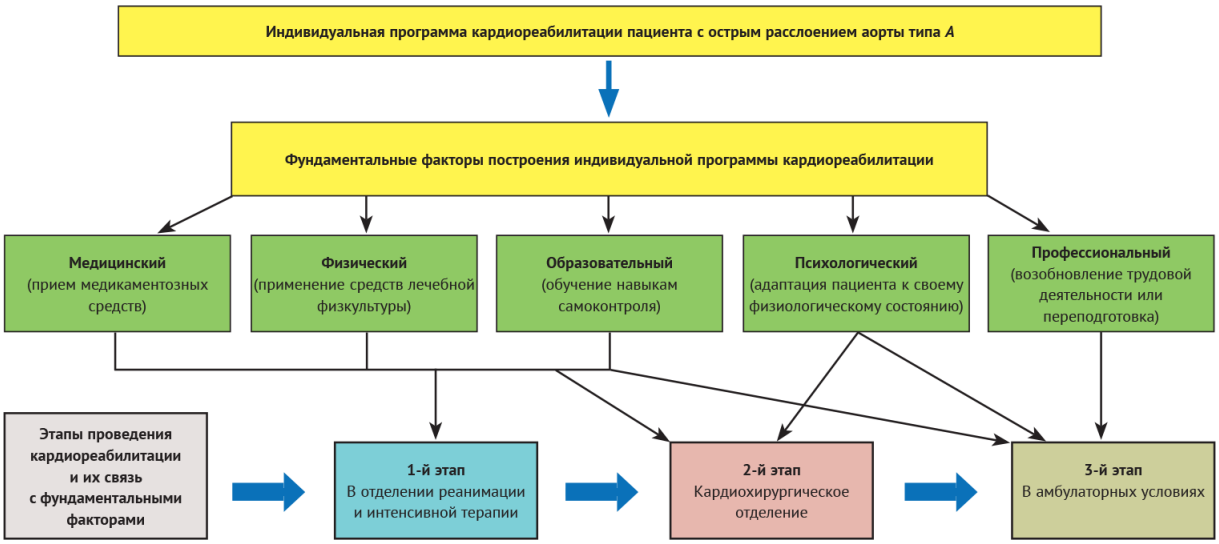

Fig. 3. Algorithm for constructing an individual cardiac rehabilitation program for a patient with acute type A aortic dissection after aortic arch replacement and descending aortic repair

At the 2nd stage, cardiac rehabilitation activities included passive-active, active exercises, elements of breathing exercises, which were carried out in the conditions of the cardiac surgery department. The patient was taught the peculiarities of perceiving his well-being after surgery, adequately perceiving the instructions of the attending physician, the technique of productive cough, diaphragmatic (abdominal) breathing, which contributes to less trauma to the chest, verticalization taking into account the functional capabilities of the body. The goal of this stage was achieved; and on the 5th day of treatment in the cardiac surgery department, the patient could independently, under the supervision of a therapeutic physical education instructor, go out into the corridor and walk up to 30 meters, and on the 8th day - up to 100 meters, with the mastery of climbing and descending one flight of stairs. The duration of the classes was from 15 to 30 minutes.

On the 17th day after the surgery, the patient was transferred to the 3rd stage of cardiac rehabilitation in an outpatient setting. On the first day of stay at this stage, the patient underwent testing: assessment of quality of life using the 36-Item Short Form Survey (SF-36) and a 6-minute walk test. Retesting was conducted after 45 days. All SF-36 items were formed into scales reflecting physical functioning (PF), role functioning (RF), emotional state (ES), vital activity (VA), social functioning (SF), physical health (PH) and mental health (MH).

The medical rehabilitation physician developed a program of exercises that included mechanotherapy procedures and individual therapeutic exercise (TE) classes, with subsequent transfer of the patient to daily independent exercises at home using self-monitoring - keeping a diary of exercises, monitoring blood pressure, pulse oximetry, following the recommendations of a medical psychologist. Individual TE classes included a set of exercises performed in the following initial positions: standing, sitting on a chair, lying on the back, and aimed at developing the muscles of the trunk, upper and lower extremities. On the 5th day of the outpatient stage, squats with support for the wall bars, and exercises to develop coordination abilities with a gradual complication of the coordination of movements were included. Walking with a change in pace (acceleration alternated with deceleration) under the control of cardiovascular system indicators.

During mechanotherapy sessions, an exercise bike, a treadmill with a variable angle of the running surface, which simulated walking uphill and downhill, and a stepper machine were used. A consultation was conducted by a psychotherapist who recommended sessions with a medical psychologist twice a week in the amount of 10 sessions. Weekly monitoring of the functional state of the patient's body and adjustment of the individual program was carried out by a medical rehabilitation physician.

The results of the questionnaire, before and after the 3rd stage of cardiac rehabilitation, are presented in Fig. 4. The patient showed an increase in all the parameters studied. Thus, the PF indicators after the end of the 3rd stage of rehabilitation increased by 45.3%, RF - by 53%, ES - by 43%, VA - by 47%. A 2-fold increase in the SF, PH, MH indicators was noted.

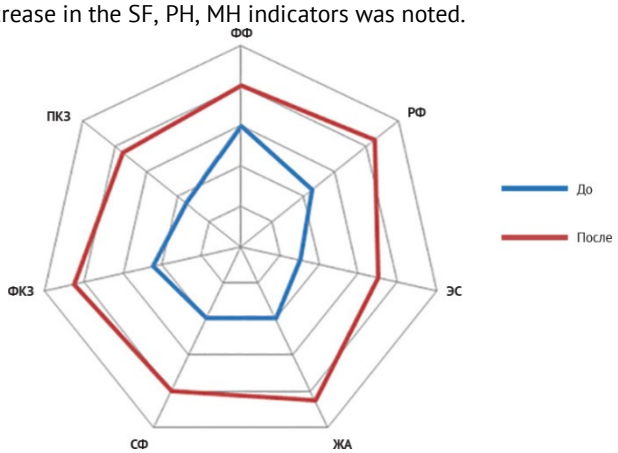

Fig. 4. Assessment of the patient's quality of life before and after the third stage of cardiac rehabilitation

Notes: ЖА — vital activity; ПКЗ — mental health; РФ — role functioning; СФ — social functioning; ФКЗ — physical health; ФФ — physical functioning; ЭС — emotional state

Before the third stage of rehabilitation, the 6-minute test was 187 meters, which corresponded to functional class III. Dyspnea was observed, which corresponded to the "severe" degree on the Borg scale. After 45 days, when the 6-minute test was repeated, this indicator was 452 meters, which allowed the patient to be classified as functional class I. The distance covered increased 3 times. Dyspnea on the Borg scale corresponded to the degree of "very mild".

The conducted study showed that in patients with type A acute aortic dissection after aortic arch replacement and endoprosthetic replacement of the descending aorta, with a comprehensive approach to building and following the stages of an individual rehabilitation program, it is possible to achieve a significant improvement in the quality of life in a minimum amount of time.

DISCUSSION

In many clinics, the most well-developed techniques are supracoronary replacement of the ascending aorta and proximal part of the aortic arch, as the simplest and fastest operation in the conditions of emergency surgical care [14]. These techniques are accompanied by remote proximal and distal complications, primarily due to the functioning false lumen of the aorta [4, 15, 16], which can subsequently affect rehabilitation and quality of life.

With the development of hybrid technologies for surgical treatment of acute type A dissection, the results of aortic remodeling in the absence of repeated operations have improved significantly [10–12] and allow for the early development of a rehabilitation program for patients in this group.

On the control MSCT of the aorta with contrast after hybrid surgical treatment, the patient has thrombosis of the false lumen at the level of the stent graft and expansion of the true lumen, which indicates the success of the operation.

Cardiac rehabilitation was performed under the control of aortic computed tomography with contrast, 1 month and 3 months after surgical treatment for aortic pathology. The results obtained during the aortic diameter monitoring correspond to the data obtained in the early postoperative period. The aortic diameter retains its initial values.

The effects of cardiac rehabilitation are well known in patients with chronic heart failure, coronary artery disease and after cardiac surgery. However, international guidelines limit recommendations for cardiac rehabilitation for patients after surgical treatment for aortic pathology. The 2010 ACCF/AHA guidelines [17] and the 2014 ESC guidelines for the diagnosis and treatment of aortic diseases [18] do not include cardiac rehabilitation. Both guidelines recommend maintaining physical activity and regular aerobic exercise, but they do not provide a set of interventions and treatment strategies for healthcare professionals. The only recommendations are to avoid static loads, intense lifting, pushing and jerking (evidence level III), as this may lead to an increase in intrathoracic and systolic pressure, which may lead to the development of aortic-associated complications. The 2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease classify risks and recommend avoiding high-intensity, very high-intensity, contact and strength sports [19]. Unfortunately, no recommendations are provided on how to resume other types of exercise. The 2014 Canadian Cardiovascular Society Heart Failure Management Guidelines Update [20] first mentioned cardiac rehabilitation as a safe treatment option for patients following thoracic aortic surgery that could reduce mortality. However, no formal recommendations or treatment regimens have been formulated due to the lack of evidence base.

Recent studies indicate that there is an urgent need for cardiac rehabilitation in patients after thoracic aortic surgery [21–25]. Patients experience severe limitations in exercise that impair daily functioning and quality of life [22]. Growing evidence questions the need for exercise restrictions and suggests that they may do more good than harm [21, 23]. Restrictions lead to a sedentary lifestyle, while physical activity makes a major contribution to the emotional component of this group of patients [21, 24].

In our observation, the patient underwent surgical treatment using hybrid technologies, which allows for the simultaneous exclusion of the most dangerous in terms of aorta-associated complications of the ascending and descending thoracic aorta; as well as the initiation of a rehabilitation program in the shortest possible time, with subsequent increase in the intensity of the load and the number of sessions. Early patient activation improved the quality of life, which was assessed using the SF-36 Survey. The results tend to be 80% or more after completing the 3rd stage of rehabilitation.

Also, after completing the 3rd stage of rehabilitation, the patient showed an increase in tolerance to physical activity; in our observation, the 6-minute walk indicator was 452 meters, which allowed us to classify the patient as functional class I.

Improving physical activity through cardiac rehabilitation must of course be safe, but this seems possible if the following safety recommendations are applied: 1) early initiation; 2) strict blood pressure control; 3) specific training instructions; 4) strict limitation of competitive sports and static loads [19].

CONCLUSION

The study showed that in patients with acute type A aortic dissection after open hybrid surgical treatment, with a comprehensive approach and adherence to the stages of building an individual rehabilitation program, it is possible to achieve a significant increase in the quality of life in a minimum time period. Cardiac rehabilitation may be a promising strategy to improve daily life activities and patient quality of life in this group of patients. According to the literature, the rehabilitation period for these groups of patients is at least 6 months.

REFERENCES

1. Alli O, Jacobs L, Amanullah AM. Acute aortic syndromes: pathophysiology and management. *Rev Cardiovasc Med*. 2008;9(2):111–124. PMID: 18660732.
2. Belov YuV, Gens AP, Stepanenko AB, Charchyan ER, Saviche DD. Surgical treatment of patients with acute aortic dissection. *Angiology and Vascular Surgery. Journal named After Academician A.V. Pokrovsky*. 2006; 12(1):103–110. (In Russ.).
3. Mukharyamov MN, Dzhordzhikiya RK, Vagizov II. Surgical treatment of acute aortic dissection experience type a in technical evolution and surgical risk factors modifying context. *The Bulletin of Contemporary Clinical Medicine*. 2014; 7(Suppl 2):126–129. (In Russ.).
4. Fattouch K, Sampognaro R, Navarra E, Caruso M, Pisano C, Coppola G, et al. Long-term results after repair of type a acute aortic dissection according to false lumen patency. *Ann Thorac Surg*. 2009;88(4):1244–1250. PMID: 19766814. https://doi.org/10.1016/j.athoracsur.2009.06.055.
5. Wei J, Chen Z, Zhang H, Sun X, Qian X, Yu C. In-hospital major adverse outcomes of acute Type A aortic dissection. *Eur J Cardiothorac Surg*. 2019;55(2):345–350. PMID: 30657909. https://doi.org/10.1093/ejcts/ezy269.
6. Schneider SR, Dell'Aquila AM, Akil A, Schlarb D, Panuccio G, Martens S, et al. Results of "elephant trunk" total aortic arch replacement using a multi-branched, collared graft prosthesis. *Heart Vessels*. 2016;31(3):390–396. PMID: 25491933. https://doi.org/10.1007/s00380-014-0612-6.
7. Westaby S, Saito S, Katsumata T. Acute type A dissection: conservative methods provide consistently low mortality. *Ann Thorac Surg*. 2002;73(3):707–713. PMID: 11899170. https://doi.org/10.1016/s0003-4975(01)03449-x.
8. Russo CF, Mariscalco G, Colli A, Santè P, Nicolini F, Miceli A, et al. Italian multicentre study on type A acute aortic dissection: a 33-year follow-up†. *Eur J Cardiothorac Surg*. 2016;49(1):125–131. PMID: 25721818. https://doi.org/10.1093/ejcts/ezv048
9. Goldfinger JZ, Halperin JL, Marin ML, Stewart AS, Eagle KA, Fuster V. Thoracic aortic aneurysm and dissection. *J Am Coll Cardiol*. 2014;64(16):1725–1739.
10. Belov YuV, Charchian ÉR, Stepanenko AB, Gens AP, Khachatryan ZR. Surgical treatment of DeBakey type 1 aortic dissection. *Pirogov Russian Journal of Surgery*. 2018;(7):8–17. (In Russ.) https://doi.org/10.17116/hirurgia201878
11. Preventza O, Olive JK, Liao JL, Orozco-Sevilla V, Simpson K, Rodriguez MR, et al. Acute type I aortic dissection with or without antegrade stent delivery: Mid-term outcomes. *J Thorac Cardiovasc Surg*. 2019;158(5):1273–1281. PMID: 30955955. https://doi.org/10.1016/j.jtcvs.2018.11.145.
12. Chernyavsky AM, Lyashenko MM, Syrota DA, Khvan DS, Kozlov BN, Panfilov DS, et al. Hybrid technology in the surgical treatment of proximal aortic dissection. *Russian Journal of Cardiology*. 2018;(11):8–13. (In Russ.) https://doi.org/10.15829/1560-4071-2018-11-8-13
13. Bubnova MG, Aronov DM. Cardiac rehabilitation: stages, principles and international classification of functioning (ICF). *Russian Journal of Preventive Medicine*. 2020;23(5):40–49. (In Russ.) https://doi.org/10.17116/profmed20202305140
14. David TE. Surgery for acute type A aortic dissection. *J Thorac Cardiovasc Surg*. 2015;150(2):279–283. PMID: 26204863. https://doi.org/10.1016/j.jtcvs.2015.06.009
15. Rylski B, Beyersdorf F, Blanke P, Boos A, Hoffmann I, Dashkevich A, et al. Supracoronary ascending aortic replacement in patients with acute aortic dissection type A: what happens to the aortic root in the long run? *J Thorac Cardiovasc Surg*. 2013;146(2):285–290. PMID: 22841905. https://doi.org/10.1016/j.jtcvs.2012.07.013
16. Kimura N, Itoh S, Yuri K, Adachi K, Matsumoto H, Yamaguchi A, et al. Reoperation for enlargement of the distal aorta after initial surgery for acute type A aortic dissection. *J Thorac Cardiovasc Surg*. 2015;149(2 Suppl):S91–S98.e1. PMID: 25224548 https://doi.org/10.1016/j.jtcvs.2014.08.008
17. Hiratzka LF, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE Jr, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guidelines for the diagnosis and management of patients with Thoracic Aortic Disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. *Circulation*. 2010;121(13):e266–e369. PMID: 20233780. https://doi.org/10.1161/CIR.0b013e3181d4739e Erratum in: Circulation. 2010;122(4):e410.
18. Erbel R, Aboyans V, Boileau C, Bossone E, Bartolomeo RD, Eggebrecht H, et al. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). *Eur Heart J*. 2014;35(41):2873–2926. PMID: 25173340. https://doi.org/10.1093/eurheartj/ehu281. Erratum in: Eur Heart J. 2015;36(41):2779. https://doi.org/10.1093/eurheartj/ehv178
19. Pelliccia A, Sharma S, Gati S, Bäck M, Börjesson M, Caselli S, et al. 2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease. *Eur Heart J*. 2021;42(1):17–96. PMID: 32860412. https://doi.org/10.1093/eurheartj/ehaa605. Erratum in: Eur Heart J. 2021;42(5):548–549. https://doi.org/10.1093/eurheartj/ehaa835.
20. Boodhwani M, Andelfinger G, Leipsic J, Lindsay T, McMurtry MS, Therrien J, et al. Canadian Cardiovascular Society position statement on the management of thoracic aortic disease. *Can J Cardiol*. 2014;30(6):577–589. PMID: 24882528. https://doi.org/10.1016/j.cjca.2014.02.018

21. Chaddha A, Eagle KA, Braverman AC, Kline-Rogers E, Hirsch AT, Brook R, et al. Exercise and Physical Activity for the Post-Aortic Dissection Patient: The Clinician's Conundrum. *Clin Cardiol.* 2015;38(11):647–651. PMID: 26769698. https://doi.org/10.1002/clc.22481.
22. Pasadyn SR, Roselli EE, Artis AS, Pasadyn CL, Phelan D, Blackstone EH. From Court to Couch: Exercise and Quality of Life after Acute Type A Aortic Dissection. *Aorta (Stamford)*. 2021;9(5):171–179. PMID: 34610642. https://doi.org/10.1055/s-0041-1731403
23. Spanos K, Tsilimparis N, Kölbel T. Exercise after Aortic Dissection: to Run or Not to Run. *Eur J Vasc Endovasc Surg.* 2018;55(6):755–756. PMID: 29615314. https://doi.org/10.1016/j.ejvs.2018.03.009
24. Schwaab B, Rauch B, Völler H, Benzer W, Schmid JP. Beyond randomised studies: recommendations for cardiac rehabilitation following repair of thoracic aortic aneurysm or dissection. *Eur J Prev Cardiol*. 2022;28(17):e17–e19. PMID: 32646302. https://doi.org/10.1177/2047487320936782
25. Acosta S, Kumlien C, Forsberg A, Nilsson J, Ingemansson R, Gottsäter A. Engaging patients and caregivers in establishing research priorities for aortic dissection. *SAGE Open Med*. 2019;7:2050312118822632. PMID: 30637104. https://doi.org/10.1177/2050312118822632.

Received on 09/04/2024
Review completed on 06/05/2024
Accepted on 24/12/2024