

REHABILITATION OF PATIENTS AFTER CARDIAC SURGERY

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Background. *Patients undergoing cardiac surgery are under a high risk of post-operative reductions in respiratory muscle strength and pulmonary function as well as lowered functional capacity. In-hospital physical inactivity and inappropriate rehabilitation increases the chances for development of these complications and affects patients' future independence in daily routine. Cardiac rehabilitation is crucial in preventing complications and assisting the early function recovery. However, despite the evidences for its benefits and strong guideline recommendations, the uptake of cardiac rehabilitation remains poor.*

Objective. *this study is aimed at promotion of cardiac rehabilitation and sharing successful experience of using it.*

Methods. *Post-surgical treatment and rehabilitation of 387 patients with cardiovascular pathology in the Department of Vascular and Cardiac Surgery of Municipal Non-Commercial Enterprise "Ternopil Regional Clinical Hospital" of Ternopil Regional Council has been analysed.*

Results. *The experience of successful post-surgical treatment and rehabilitation allowed establishing the basic approaches to perioperative management of patients with cardiovascular surgical pathology. Key principles include minimized ICU stay and artificial ventilation time, early verticalization and beginning of physical activities, early removed drainage tubes, tracheobronchial tree drainage, nutritional balance, lymphatic drainage massage, application of elastic jersey on the lower extremities, early transferring to the surgery ward and returning to the regular daily activities, circumstantial health education, complex work of a multidisciplinary team.*

Conclusions. *This set of rehabilitation measures helps prevent complications after cardiac surgery as well as provide a faster patient's daily routine.*

KEYWORDS: cardiac surgery; cardiac rehabilitation; exercise; recovery of function; health education.

Introduction

The increasing prevalence of risk factors such as age, obesity, diabetes, hypertension and dyslipidaemia in patients undergoing cardiac surgery causes a significant rise of possible complications [1]. Those patients commonly experience reductions in respiratory muscle strength and pulmonary function [2-3]. These complications lead to longer hospital stay, higher rehospitalisation risk, reduced health-related quality of life and higher costs for healthcare [4-6]. Also, makeable reduction in functional capacity can occur, which only gets worse if patients spend the majority of their time sitting or in a supine position due to the inappropriate care [7-8]. In-hospital physical inactivity causes muscle weakness and aerobic capacity decrease, which can seriously affect patients' independence in daily routine [9-10].

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Cardiac rehabilitation is crucial in prevention of these complications and assisting the early function recovery [11]. Cardiac rehabilitation is a complex intervention that includes post-operative management, exercise training, physical activity promotion, health education and psychological support [12]. Special emphasis in the latest guidelines is made on involving a multidisciplinary team to the rehabilitation complex [13]. In addition to cardiac surgeons and ICU anaesthesiologists it should include cardiologists, nursing specialists, physiotherapists, nutritionists and psychologists, trained in the core competencies of a comprehensive cardiac rehabilitation programme. However, despite the evidence for its benefits and strong guideline recommendations, the uptake of cardiac rehabilitation is poor [14]. Therefore, nowadays promotion of cardiac rehabilitation and sharing the successful experience in this field is essential, as the success of heart surgery depends not only on its type or the patient's

health before the surgery, but also on proper rehabilitation, both in the early and late post-operative period.

Methods

Post-surgical treatment and rehabilitation of 387 patients with cardiovascular pathology in the Department of Vascular and Cardiac Surgery of Municipal Non-commercial Enterprise "Ternopil Regional Clinical Hospital" of Ternopil Regional Council has been analysed in this study.

Results

The experience of successful post-surgical treatment and rehabilitation allowed establishing the basic approaches to perioperative management of patients with cardiovascular surgical pathology. We are supporters of the fast and early activation concept or "Fast Track". During the ICU stay we adhere to the following principles: time of intubation and artificial ventilation is minimized; physical activity usually begins 12-15 hours after the surgery. The patients are verticalized – helped to sit and stand under doctor's supervision. At the same time, we help patients to perform a small walk on place. This improves blood flow to the right heart chambers. Walking also helps to restore motor function of the intestine. Verticalization of the patient helps to restore vascular tone, and is also one of the mechanisms of hypertension correction. Tracheobronchial tree drainage is performed by hyperventilation of the patient, as well as by forced coughing along with vibrating chest massage. This improves oxygenation and pulmonary function.

After the first activity session the stability of haemostasis in the chest is checked and if no signs of bleeding are observed, drainage tubes are immediately removed. Delay in this can lead to the patient's prolonged ICU stay, immobilization in bed, respiratory function limitations and development of arrhythmias caused by irritation of the heart reflex zones.

One more vital thing is the nutritional balance. Thus, before the operation, the patient's diet includes high-calorie food rich in protein, vitamins and microelements that provide a good "pool" for rapid recovery of the patient in the post-operative period and high reparative potential for wound healing. In the postoperative period along with the restoration of peristalsis, the patient begins to drink, and after a short time to eat liquid, easily digestible food. This contributes to the full recovery of the gastro-

intestinal tract and improves the overall psycho-emotional state of the patient.

Lymphatic drainage massage, application of elastic jersey on the lower extremities has a good therapeutic effect on the swelling caused by congestive heart failure.

If no major complications take place by the middle of the first post-operation day the patient is transferred from the ICU to the surgery ward. It also helps motivate our patients for early returning to their regular daily activities. They are trained to do exercises and are informed about all the restrictions for protection of the breastbone during physical activities and sleep time. Also, we provide some health education consultations in order to inform the patients about their state and the following rehabilitation programme, which may last up to 6 months.

Discussion

The efficacy and safety of complex cardiac rehabilitation in patients provided with different kinds of surgical procedures was evaluated in the study. A short-term impact of different procedures on patients might differ significantly, as valvular surgery, CABG, surgery on thoracic aorta and their various combinations are provided in our clinic. Post-isolated CABG patients might therefore respond differently to the rehabilitation complex compare to those who underwent a complicated combined surgical procedure. We tried to develop a unified complex of rehabilitation measures according to the International Guidelines and our own experience. Not separating and analyzing patients as separate groups might therefore be a limitation to this study.

While current guidelines of the European Society of Cardiology [15] emphasize mainly on exercise-based cardiac rehabilitation after heart surgery, our findings coincide more with the Cochrane systematic review by Abraham et al., who recognized that rehabilitation interventions complex may also need to include breathing and coughing exercises and vocational evaluation advice in addition to the physical exercises [16].

Conclusions

Key principles include minimized ICU stay and artificial ventilation duration, early verticalization and beginning of physical activities, early removed drainage tubes, tracheobronchial tree drainage, nutritional balance, lymphatic drainage massage, application of elastic jersey

on the lower extremities, early transferring to the surgery ward and returning to the regular daily activities, circumstantial health education, complex work of a multidisciplinary team. This set of rehabilitation measures helps prevent complications after cardiac surgery as well as provide faster patient's daily routine.

Conflict of Interests

Authors declare no conflict of interests.

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Author's Contributions

Volodymyr Moroz, Taras Romaniuk – conceptualization, methodology, formal analysis, writing – original draft, writing – reviewing and editing; *Sofiia Maslii, Zoriana Vivchar* – data curation, writing – reviewing and editing, investigation, formal analysis.

ОСОБЛИВОСТІ РЕАБІЛІТАЦІЇ ПАЦІЄНТІВ ПІСЛЯ КАРДІОХІРУРГІЧНОЇ ОПЕРАЦІЇ

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ТЕРНОПІЛЬСЬКИЙ НАЦІОНАЛЬНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ ІМЕНІ І. Я. ГОРБАЧЕВСЬКОГО МОЗ УКРАЇНИ, ТЕРНОПІЛЬ, УКРАЇНА

Вступ. *Пацієнти, які перенесли операцію на серці, мають високий ризик післяопераційного зниження сили дихальних м'язів і функції легень, а також зниження функціональних резервів. Відсутність належної фізичної активності у ранньому післяопераційному періоді та невідповідна реабілітація збільшують ймовірність розвитку цих ускладнень і впливають на майбутні можливості пацієнтів щодо їх повсякденної діяльності. Вирішальну роль у попередженні ускладнень та сприянні ранньому відновленню функцій організму відіграє кардіологічна реабілітація. Однак, незважаючи на її доказові переваги і сильні рекомендації світової гайдлайнів, якість кардіологічної реабілітації залишається слабкою.*

Мета. *Метою цієї роботи є популяризація кардіологічної реабілітації та обмін успішним досвідом у цій сфері.*

Методи. *Проаналізовано післяопераційне лікування та реабілітацію 387 пацієнтів із кардіохірургічною патологією відділення судинної хірургії з кардіохірургією Комунального некомерційного підприємства «Тернопільська обласна клінічна лікарня» Тернопільської обласної ради.*

Результати. *Проведений аналіз успішного досвіду післяопераційного лікування та реабілітації пацієнтів із кардіохірургічною патологією дозволив нам встановити основні принципи їх післяопераційного ведення. Вони включають мінімізацію часу штучної вентиляції легень та перебування у реанімаційному відділенні, ранню вертикалізацію та початок фізичних навантажень, раннє видалення дренажних трубок, дренаж трахеобронхіального дерева, збереження нутритивного балансу, лімфодренажний масаж, накладення еластичного трикотажу на нижні кінцівки, раннє переведення в палату хірургічного відділення та повернення до звичайних повсякденних справ, ретельне навчання пацієнтів, комплексна робота багатопрофільної команди.*

Висновки. *Цей комплекс реабілітаційних заходів допомагає запобігти ускладненням після кардіохірургічних операцій, а також забезпечити швидке повернення пацієнта до нормального життя*

КЛЮЧОВІ СЛОВА: *кардіохірургія; кардіологічна реабілітація; фізичні вправи; відновлення функції; медична освіта.*

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References

1. Hartog J, Blokzijl F, Dijkstra S, Dejongste M, Reneman M, Dieperink W et al. Heart Rehabilitation in patients awaiting Open heart surgery targeting to prevent Complications and to improve Quality of life (Heart-ROCQ): study protocol for a prospective, randomised, open, blinded endpoint (PROBE) trial. *BMJ Open*. 2019;9(9):e031738.
<https://doi.org/10.1136/bmjopen-2019-031738>
2. Westerdahl E, Lindmark B, Bryngelsson I, Tenling A. Pulmonary function 4 months after coronary artery bypass graft surgery. *Respiratory Medicine*. 2003;97(4):317-322.
<https://doi.org/10.1053/rmed.2002.1424>
3. Kristjánssdóttir Á, Ragnarsdóttir M, Hannesson P, Beck H, Torfason B. Respiratory movements are altered three months and one year following cardiac surgery. *Scandinavian Cardiovascular Journal*. 2004;38(2):98-103.
<https://doi.org/10.1080/14017430410028492>
4. Koster S, Hensens A, Schuurmans M, van der Palen J. Consequences of Delirium After Cardiac Operations. *The Annals of Thoracic Surgery*. 2012;93(3):705-711.
<https://doi.org/10.1016/j.athoracsur.2011.07.006>
5. Iribarne A, Chang H, Alexander J, Gillinov A, Moquete E, Puskas J et al. Readmissions After Cardiac Surgery: Experience of the National Institutes of Health/Canadian Institutes of Health Research Cardiothoracic Surgical Trials Network. *The Annals of Thoracic Surgery*. 2014;98(4):1274-1280.
<https://doi.org/10.1016/j.athoracsur.2014.06.059>
6. Kosuma P, Wachirasrisirikul S, Jedsadayanmata A. Attributable Costs of Postoperative Atrial Fibrillation among Patients Undergoing Cardiac Surgery. *Cardiology Research and Practice*. 2018;2018:1-5.
<https://doi.org/10.1155/2018/3759238>
7. van der Peijl I, Vliet Vlieland T, Versteegh M, Lok J, Munneke M, Dion R. Exercise therapy after coronary artery bypass graft surgery: a randomized comparison of a high and low frequency exercise therapy program. *The Annals of Thoracic Surgery*. 2004;77(5):1535-1541.
<https://doi.org/10.1016/j.athoracsur.2003.10.091>
8. Bots M, van Dis I, Koopman C, Vaartjes I, Visseren F. Hart- en vaatziekten in Nederland, 2014, cijfers over kwaliteit van leven, ziekte en sterfte. Den Haag: Hartstichting; 2014. <https://adoc.pub/queue/cijfers-over-kwaliteit-van-leven-ziekte-en-sterfte-hart-en-v.html> Accessed December 2014.
9. Kortebein P, Symons T, Ferrando A, Paddon-Jones D, Ronsen O, Protas E et al. Functional Impact of 10 Days of Bed Rest in Healthy Older Adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. 2008;63(10):1076-1081.
<https://doi.org/10.1093/gerona/63.10.1076>
10. Convertino V, Hung J, Goldwater D, DeBusk R. Cardiovascular responses to exercise in middle-aged men after 10 days of bedrest. *Circulation*. 1982;65(1):134-140.
<https://doi.org/10.1161/01.cir.65.1.134>
11. Westerdahl E, Lindmark B, Eriksson T, Friberg Ö, Hedenstierna G, Tenling A. Deep-Breathing Exercises Reduce Atelectasis and Improve Pulmonary Function After Coronary Artery Bypass Surgery. *Chest*. 2005;128(5):3482-3488.
<https://doi.org/10.1378/chest.128.5.3482>
12. Richardson C, Franklin B, Moy M, Jackson E. Advances in rehabilitation for chronic diseases: improving health outcomes and function. *BMJ*. 2019;l2191.
<https://doi.org/10.1136/bmj.l2191>
13. Ambrosetti M, Abreu A, Corrà U, Davos C, Hansen D, Frederix I et al. Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. *European Journal of Preventive Cardiology*. 2020;28(5):460-495.
<https://doi.org/10.1177/2047487320913379>
14. Taylor R, Dalal H, McDonagh S. The role of cardiac rehabilitation in improving cardiovascular outcomes. *Nature Reviews Cardiology*. 2021.
<https://doi.org/10.1038/s41569-021-00611-7>
15. Pelliccia A, Sharma S, Gati S, Bäck M, Börjesson M, Caselli S, Collet JP, Corrado D, Drezner JA, Halle M, Hansen D, Heidbuchel H, Myers J, Niebauer J, Papadakis M, Piepoli MF, Prescott E, Roos-Hesse-link JW, Graham Stuart A, Taylor RS, Thompson PD, Tiberi M, Vanhees L, Wilhelm M; ESC Scientific Document Group. 2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease. *Eur Heart J*. 2021;42(1):17-96.
<https://doi.org/10.1093/eurheartj/ehaa605>
16. Abraham LN, Sibilitz KL, Berg SK, Tang LH, Risom SS, Lindschou J, Taylor RS, Borregaard B, Zwisler A-D. Exercise-based cardiac rehabilitation for adults after heart valve surgery. *Cochrane Database of Systematic Reviews*. 2021;5. Art. No.: CD010876.
<https://doi.org/10.1002/14651858.CD010876.pub3>

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