Am J Transl Res 2022;14(7):5132-5138
www.ajtr.org /ISSN:1943-8141/AJTR0138633

Original Article

Enhanced rehabilitation intervention improves postoperative recovery and quality of life of patients after heart valve replacement surgery

Jinxia Hao

Department of Cardiothoracic, Cangzhou Central Hospital, Hebei Province, China

Received August 27, 2021; Accepted January 28, 2022; Epub July 15, 2022; Published July 30, 2022

Abstract: Objective: To explore the application value of enhanced recovery after surgery (ERAS) for heart valve replacement surgery. Methods: A total of 86 patients with heart valve diseases admitted to our hospital from Jan. 2018 to Mar. 2020 were selected, and randomized into the control group (n=43) with regular nursing care and the observation group (n=43) with ERAS. The postoperative recovery, rate of adverse events, quality of life, visual analogue scale (VAS) score and nursing care satisfaction rate were compared between the two groups. Results: After surgery, the time to first bowel movement and the first flatulence in the observation group were earlier than those in the control group, and the hospital stay of patients in the observation group was shorter than that in the control group. The rate of adverse events in the observation group was 4.65%, which was lower than that in the control group (18.60%). In addition, the observation group obtained higher life quality scores but lower VAS, self-rating anxiety scale (SAS) and self-rating depression scale (SDS) scores than the control group, and the observation group showed lower serum levels of corticotropin and cortisol and exhibited a longer 6-minute walking distance than the control group. Moreover, the nursing care satisfaction rate of the observation group was 95.35%, which was higher than that (76.74%) of the control group (all $P<0.05$). Conclusions: ERAS can reduce adverse events and pain for patients with heart valve replacement and improve their postoperative recovery, quality of life, and nursing care satisfaction.

Keywords: Rapid rehabilitation for surgery, heart valve replacement surgery, postoperative recovery, quality of life

Introduction

Heart valve replacement is usually performed to treat heart valve diseases in clinical practice, but it can induce complications such as nausea, vomiting and hypoglycemia that compromise patients' quality of life [1]. In recent years, accelerated rehabilitation during the perioperative period has gained considerable attention. Enhanced recovery after surgery (ERAS) is a new nursing service mode that is designed to alleviate the post-operative stress response, reduce postoperative complications and shorten hospital stay by optimizing perioperative management measures [2]. ERAS is an important component of perioperative nursing, including preoperative guidance, intraoperative temperature monitoring, early identification and management of complications, postoperative dietary guidance, analgesia and rehabilitation exercise, emphasizing the participation of patients and their families. At the current stage, minimally invasive surgery is preferred for the diagnosis and treatment of heart valve diseases and people have become increasingly interested in ERAS. Implementing ERAS in patients with heart valve replacement surgery has obtained wide recognition [3]. However, there is insufficient research on the effect of ERAS on the postoperative recovery and life quality of patients undergoing heart valve replacement surgery. Accordingly, this study was designed to provide references to improve the prognosis of patients undergoing heart valve replacement surgery in clinical practice by evaluating the application value of ERAS.

Materials and methods

General materials

In this prospective study, patients admitted to our hospital due to heart valve diseases from

Jan. 2018 to Mar. 2020 were selected as research subjects. The patients or their family members signed an informed consent, and this study was approved of by the Ethisc Committee of Cangzhou Central Hospital (Approval No. LW 2018/232).

Inclusion criteria: (1) Patients who met the clinical diagnostic criteria for heart valve diseases [4]; (2) Patients who were scheduled to have heart valve replacement surgery; (3) Patients aged 53-57 years old.

Exclusion criteria: (1) Patients with a history of mental health issues; (2) Patients who had difficulties in communication; (3) Patients who could not actively cooperate with this research.

Finally, 86 patients were enrolled in this research, and divided into the control group (n=43) and the observation group (n=43) by a random number table method. The general data of patients were compared between the two groups, and the difference was not statistically significant, indicating the two groups were comparable (P>0.05).

Methods

Control group: The control group received regular nursing care intervention including basic nursing, pipeline nursing, dietary guidance, activity guidance, and medication guidance, etc.

Observation group: The observation group received ERAS, covering the following aspects:

① Health education: Before surgery, health education was conducted for patients and their families by distribution of relevant knowledge in brochures and via oral instruction by nursing staff, so that patients could have a certain understanding of the basic knowledge, treatment methods, treatment effects and ERAS concepts of heart valve disease.

② Psychological nursing: Before and after surgery, the adverse emotions of the patient were given attention, and active communication was provided in this regard, and former patients with successful treatment were described, so as to improve the patient's compliance with treatment and enhance their confidence in overcoming the disease.

③ Operating room nursing: During the operation, the patient's condition was closely observed, the temperature and humidity in the operating room were adjusted to an appropriate range in advance to avoid hypothermia of the patient; lung protection was well carried out by timely cleaning of the patient's respiratory tract and oral secretions. The nursing staff cooperated with the doctor to complete the operation smoothly.

④ Diet nursing: Before surgery, the patient was instructed to carry out intestinal management, and the patient was instructed to fast without water for 6 h before surgery, and a glucose solution was given orally when necessary to reduce the occurrence of postoperative hypoglycemia. After surgery, patients were instructed to make a dietary list to ensure nutritional collocation by eating more vegetables, fruits, protein and other foods, and avoiding spicy and stimulating food, so as to promote a rapid recovery.

⑤ Pain nursing: Postoperative multi-mode analgesia program was applied, pain health education and evaluation were carried out for patients, and an analgesia program was formulated and adjusted according to patients' conditions.

⑥ Postoperative rehabilitation nursing: a) Early bedside activity: 24 h after surgery, the patients were assisted to have bedside activity as soon as possible, ranging from passive exercise to active exercise; and then according to the individual differences, the patients were supported in bed exercise, and walking and exercise in the ward. b) Abdominal breathing training: after surgery, the patients were assisted to take a supine position and guided to relax the muscles of the whole body and slowly breathe in through the nose, so the abdomen was expanded, then holding of the breath, followed by and exhale through the mouth, to relax the abdomen. The patients were supervised to exercise every day with repetitions of 20-30 times/set and 2 sets per day.

Outcome measures

(1) The postoperative recovery of patients, including the time to first bowel movement and flatulence, and length of hospital stay, were compared.

Table 1. Comparison of general data of patients between the two groups

Groups	N	Male (n)	Female (n)	Average age ($\bar{x}$±s, Y)
Observation group	43	23	20	53.46±6.71
Control group	43	22	21	53.86±6.24
t/χ^2		0.047		0.286
P-value		0.829		0.775

Table 2. Comparison of postoperative recovery between the two groups ($\bar{x}$±s, d)

Groups	N	The time to first bowel movement	The time to first flatulence	Hospital stay
Observation group	43	1.73±0.51	0.86±0.25	13.36±4.77
Control group	43	2.72±0.63	1.45±0.47	18.53±5.98
t		8.009	7.268	4.432
P-value		<0.001	<0.001	<0.001

(2) The rate of adverse events, including nausea, vomiting, hypoglycemia, and bloating, were compared between the two groups.

(3) The quality of life of patients before surgery and 1 month after surgery was compared. It was scored using the MOS 36-Item Short-Form Health Survey (SF-36) from 4 dimensions including psychological health, physical health, social function and material life, with 100 points for each dimension. A higher SF-36 score indicated a better life quality.

(4) Postoperative pain. Postoperative pain upon waking and 1 d after surgery was evaluated by the visual analogue scale (VAS) with a full score of 10 points. The higher the score, the more severe the pain.

(5) Negative emotions of patients were evaluated using the self-rating anxiety scale (SAS) score and self-rating depression scale (SDS). Lower scores indicated better emotional states.

(6) Stress factors of patients were also compared. Five mL fasting venous blood was collected from each patient before and at 1 month after surgery, and the serum levels of corticotropin and cortisol were detected by radioimmunoassay.

(7) The 6-minute walking distances of patients were compared.

Statistical analyses

SPSS23.0 was used to analyze the data. Qualitative data were expressed by cases and percentage and analyzed by χ^2. Quantitative data were expressed as ($\bar{x}$±s), and tested by the pair-sample t test for intra-group comparison and independent sample t test for inter-group comparison. P<0.05 indicated a statistic significance.

Results

Comparison of general data

There were 45 males and 41 females enrolled in this study, and their average age was 53.75±6.44 years old. No statistically significant difference was observed between the two groups. See **Table 1**.

Comparison of postoperative recovery between the two groups

The time to first bowel movement, the time of first flatulence, and hospital stay in the observation group were all shorter than those in the control group (all P<0.0.5). See **Table 2**.

Comparison of the incidence of adverse events between the two groups

The incidence of adverse events in the observation group was lower than that in the control group (6.98% *vs.* 20.93%, P<0.05). See **Table 3**.

Comparison of life quality between the two groups

The observation group experienced a higher life quality than the control group at 1 month after surgery (P<0.05). See **Table 4**.

Comparison of VAS scores between the two groups

The VAS scores of the observation group upon waking after surgery and 1 day after surgery were all lower than that of the control group (P<0.05). See **Table 5**.

Table 3. Comparison of the rate of adverse events between the two groups (n)

Groups	N	LCOS	PV	VTE	IE	Total occurrence (n, %)
Observation group	43	1	1	1	0	3 (6.98)
Control group	43	3	2	3	1	8 (20.93)
X^2						3.486
P						0.031

Note: LCOS = Low cardiac output syndrome; PVL = perivalvular leakage; VTE = Venous thromboembolic events; IE = Infective endocarditis.

Table 4. Comparison of quality-of-life scores between the two groups ($\bar{x}$±s, points)

Groups	N	Before surgery	1 month after surgery
Observation group	43	76.22±12.58	91.16±4.38
Control group	43	78.15±14.06	85.37±11.55
t		0.671	3.074
P-value		0.504	0.003

Table 5. Comparison of postoperative VAS scores between the two groups ($\bar{x}$±s, points)

Groups	n	Wake up	1 day after surgery
Observation group	43	1.59±0.52	2.16±0.65
Control group	43	1.28±0.64	2.36±0.61
t		2.465	3.678
P-value		0.016	<0.001

Comparison of negative emotions between the two groups

Before treatment, the two groups were not significantly different in the scores of SAS and SDS (both P>0.05); after treatment, SAS and SDS scores of both groups decreased, and the scores of the observation were lower than those of the control group (both P<0.05). See **Figure 1**.

Comparison of stress factors between the two groups

Before treatment, the serum levels of corticotropin and cortisol were comparable between the two groups (P>0.05); after treatment, the levels in both groups increased, and the levels in the observation group were lower than those in the control group (both P<0.05). See **Figure 2**.

Comparison of 6-minute walking distance between the two groups

Before treatment, the 6-minute walking distance was comparable between the two groups (P>0.05); after treatment, the distance of the two groups increased, and the distance of the observation group was longer than that of the control group (P<0.05). See **Figure 3**.

Discussion

Heart valve diseases are a common type of heart disease [5] mainly triggered by infection and rheumatic fever. They are common among the elderly [6, 7], with their incidence increasing as the aging population grows in China [8].

Heart valve diseases mainly involve the aortic valve, pulmonary valve, mitral valve and tricuspid valve, which can cause life-threatening heart failure [9, 10]. Heart valve replacement surgery is the clinical cure for heart valve diseases. It mainly replaces stenotic or incompetence valves with artificial heart valves to improve heart function [11]; however, it is not beneficial to the short term prognosis of patients due to the relatively poor postoperative recovery [12, 13]. Therefore, perioperative nursing care plays an important role in improving the recovery of patients after heart valve replacement surgery.

In this study, the time to first bowel movement, the time to first flatulence, and hospital stay in the observation group were all shorter than those in the control group. The observation group showed a lower rate of adverse events than the control group and experienced a higher quality of life than the control group. In addition, the VAS, SAS, and SDS scores of the observation group were all lower than those of the control group, and the observation group showed lower serum levels of corticotropin and cortisol than the control group, and experienced a longer 6-minute walking distance than the control group. In a vast majority of studies on rapid recovery, readmission was adopted as a secondary outcome [14, 15]. A previous study similarly demonstrated a reduction in readmission rate by employing ERAS in patients undergoing laparoscopic colorectal surgery [16]. This is likely related to standardization in care and specific elements of ERAS such

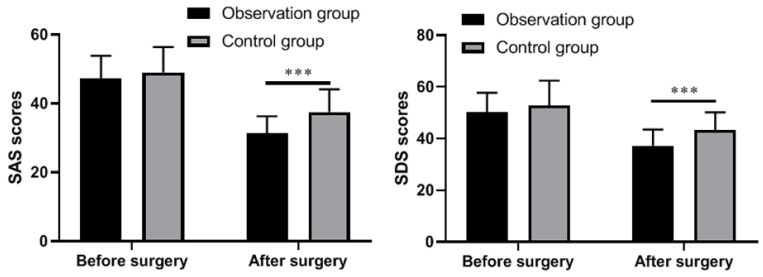

Figure 1. Comparison of negative emotions between the two groups. ***indicates P<0.001 by independent sample t test between groups.

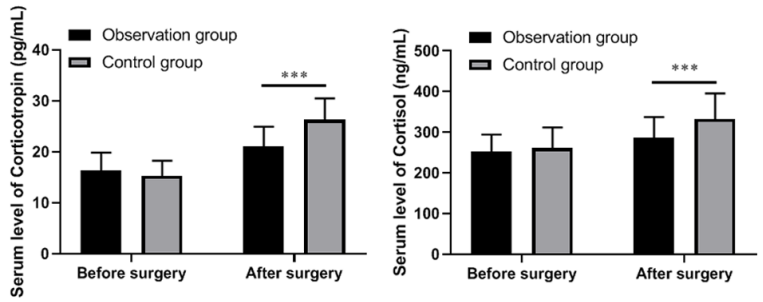

Figure 2. Comparison of stress factors between the two groups. ***indicates P<0.001 by independent sample t test between groups.

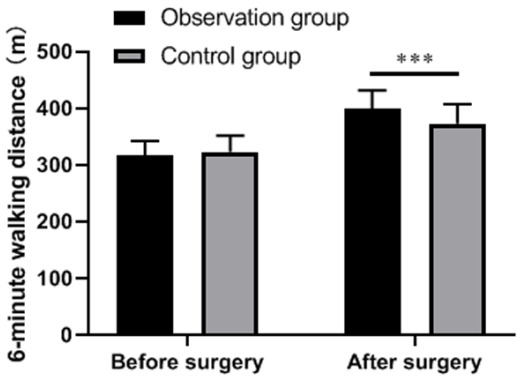

Figure 3. Comparison of 6-minute walking distance between the two groups. ***indicates P<0.001 by independent sample t test between groups.

as the positive psychological and rapid nursing. ERAS, first proposed by Danish scholar Henrik Kehle, aims to optimize the traditional perioperative diagnosis and treatment model by adopting a series of effective measures based on evidence-based medicine, to reduce surgical trauma, block the stress response caused by surgery, and thus reduce complications and speed up recovery [17]. ERAS is now being implemented in a wide range of fields, including urology, orthopedics, breast surgery, and colorectal surgery. Relevant experiments have confirmed that the application of ERAS nursing measures can help improve the prognosis of patients undergoing cardiac surgery [18, 19]. With the core concept of accelerated recovery, ERAS can boost postoperative recovery [20]. Under this nursing mode, nurses evaluate the perioperative nursing risk factors for patients undergoing heart valve replacement surgery, and improve strategies to ensure the recovery of patients [21]. The concept of ERAS is widely adopted in the perioperative period and has delivered good clinical outcomes [22]. ERAS takes the patient's condition, physiology, psychology and other factors into account, and collaborates across disciplines. For example, mental health professionals provide psychological counseling in the presence of anxiety, fear and other psychological burdens that occur in patients, to promote the appetite and improve sleep of patients; the anesthesiologist provides effective pain relief; and nurses help patients get out of bed early after surgery to improve self-care ability. The application of systemic perioperative nursing in patients can improve the cardiac rehabilitation and recovery speed, thus improving the quality of life [23].

This study also has some limitations. First, the limitation of the before-and-after study design might introduce some selection bias, and there were no demographic differences between the two groups of patients enrolled consecutively. Therefore, ongoing efforts are needed to further improve the validity of the results.

In summary, implementing ERAS in patients after heart valve replacement surgery can reduce the incidence of adverse events and the postoperative pain and improve the recovery process as well as life quality.

Disclosure of conflict of interest

None.

Address correspondence to: Jinxia Hao, Department of Cardiothoracic, Cangzhou Central Hospital, Hebei Province, China. Tel: +86-18531708022; E-mail: 8171644@qq.com

References

[1] Beale R, Beale C, DeNofrio D, Gordon P, Levine D, Sodha N, Yousefzai R and Apostolidou E. Transcatheter aortic valve replacement of a bicuspid aortic valve in a heart transplant recipient. JACC Case Rep 2020; 2: 716-720.

[2] Biaggi P, Sager DF, Külling J, Küest S, Wyss C, Hürlimann D, Reho I, Bühler I, Noll G, Huber M, Gämperli O, Wenaweser PM and Corti R. Potential value of fusion imaging and automated three-dimensional heart segmentation during transcatheter aortic valve replacement. J Am Soc Echocardiogr 2020; 33: 516-517, e511.

[3] Thiem A, Cremer J and Lutter G. Percutaneous valve replacement: weird or wonderful? Minerva Cardioangiol 2006; 54: 23-30.

[4] Brescia A, Tomassini F, Berardi G, Sebastiani C, Pezzatini M, Dall'Oglio A, Laracca GG, Apponi F and Gasparrini M. Development of an enhanced recovery after surgery (ERAS) protocol in laparoscopic colorectal surgery: results of the first 120 consecutive cases from a university hospital. Updates Surg 2017; 69: 359-365.

[5] Cai Q, Beckles DL and Ahmad M. Three-dimensional echocardiography assessment of carcinoid valvular heart disease: images of each and all. Echocardiography 2020; 37: 791-793.

[6] Thongprayoon C, Cheungpasitporn W and Kashani K. The impact of frailty on mortality after transcatheter aortic valve replacement. Ann Transl Med 2017; 5: 144.

[7] Essop-Adam A, Houchen-Wolloff L, Vaishya R and Mangwani J. The need for a paradigm shift in the rehabilitation of elective foot and ankle reconstructive surgery patients? An annotation. J Clin Orthop Trauma 2020; 11: 369-374.

[8] Edwards TA, Prescott RJ, Stebbins J, Wright J and Theologis T. What is the functional mobility and quality of life in patients with cerebral palsy following single-event multilevel surgery? J Child Orthop 2020; 14: 139-144.

[9] Halkin H. A commentary on "ischemic stroke and systemic embolism in warfarin users with atrial fibrillation or heart valve replacement exposed to dicloxacillin or flucloxacillin". Clin Pharmacol Ther 2020; 108: 26-27.

[10] Murphy SP, Ibrahim NE and Januzzi JL Jr. Heart failure with reduced ejection fraction: a review. JAMA 2020; 324: 488-504.

[11] Houchen-Wolloff L, Essop-Adam A, Calver R, Dudson C and Mangwani J. Post-operative rehabilitation in ankle and hindfoot/midfoot fusion and reconstruction surgery - a scoping survey of UK foot and ankle surgeons and allied health professionals. J Clin Orthop Trauma 2020; 11: 471-473.

[12] Dams OC, van den Akker-Scheek I, Diercks RL, Wendt KW, Zwerver J and Reininga IHF. Surveying the management of Achilles tendon ruptures in the Netherlands: lack of consensus and need for treatment guidelines. Knee Surg Sports Traumatol Arthrosc 2019; 27: 2754-2764.

[13] Kampaktsis PN, Vavuranakis M, Choi DY, Sherifi I, Christofi A, Triantafyllou D, Siasos G, Salemi A, Tousoulis D, Wong SC and Devereux RB. Prognostic role of diastolic dysfunction in patients undergoing transcatheter aortic valve replacement. Catheter Cardiovasc Interv 2020; 95: 1024-1031.

[14] Karthikeyan G, Connolly SJ, Ntsekhe M, Benz A, Rangarajan S, Lewis G, Yun Y, Sharma SK, Maklady F, Elghamrawy AE, Kazmi K, Cabral TTJ, Dayi H, Changsheng M, Gitura BM, Avezum A, Zuhlke L, Lwabi P, Haileamlak A, Ogah O, Chillo P, Paniagua M, ElSayed A, Dans A, Gondwe-Chunda L, Molefe-Baikai OJ, Gonzalez-Hermosillo JA, Hakim J, Damasceno A, Kamanzi ER, Musuku J, Davletov K, Connolly K, Mayosi BM and Yusuf S; INVICTUS Investigators. The INVICTUS rheumatic heart disease research program: rationale, design and baseline characteristics of a randomized trial of rivaroxaban compared to vitamin K antagonists in rheumatic valvular disease and atrial fibrillation. Am Heart J 2020; 225: 69-77.

[15] Luengsupabul S, Methavigul K and Methavigul R. Optimal INR level in patients with atrial fibrillation with EHRA type 2 valvular heart disease receiving warfarin. J Arrhythm 2020; 36: 425-429.

[16] Hilgendorf W, Monfared S, Monfared SHB, Athanasiadis DI, Selzer D, Choi JN, Banerjee A and Stefanidis D. Can a brief assessment of social support predict outcomes after bariatric surgery? Clin Obes 2021; 11: e12419.

[17] Mezzani A. Cardiopulmonary exercise testing: basics of methodology and measurements. Ann Am Thorac Soc 2017; 14: S3-S11.

[18] Oberbach A, Schlichting N, Friedrich M, Lehmann S, Kullnick Y, Pichlmaier M, Hagl C and Bagaev E. Quantification of multiple bacteria in calcified structural valvular heart disease. Semin Thorac Cardiovasc Surg 2020; 32: 255-263.

[19] Price BA, Bednarski BK, You YN, Manandhar M, Dean EM, Alawadi ZM, Bryce Speer B, Gottumukkala V, Weldon M, Massey RL, Wang X, Qiao W and Chang GJ. Accelerated enhanced recovery following minimally invasive colorec-

tal cancer surgery (RecoverMI): a study protocol for a novel randomised controlled trial. BMJ Open 2017; 7: e015960.

[20] Tian Z, Li T and Ma S. Impact of leaflet thrombosis on hemodynamics and clinical outcomes after bioprosthetic aortic valve replacement: a meta-analysis. Clin Cardiol 2020; 43: 468-474.

[21] Vo NM, Leung M, van Rosendael PJ, Goedemans L, van Wijngaarden SE, Prihadi EA, van der Bijl P, Ajmone Marsan N, Delgado V and Bax JJ. Characteristics and prognosis of patients with nonvalvular atrial fibrillation and significant valvular heart disease referred for electrical cardioversion. Am J Cardiol 2020; 128: 84-91.

[22] Gimpel D, Shanbhag S, Srivastava T, MacLeod M, Conaglen P, Kejriwal N, Odom N, Lin Z, McCormack DJ and El-Gamel A. Early discharge from intensive care after cardiac surgery is feasible with an adequate fast track, stepdown unit: Waikato experience. Heart Lung Circ 2019; 28: 1888-1895.

[23] Zhang XY, Sun ZK, Wei WJ, Qiu ZL, Shen CT, Song HJ, Shi ZM and Luo QY. A preliminary study of ankle single photon emission computed tomography/computed tomography in patients with bony impingement syndrome: association with the visual analogue scale pain score. J Foot Ankle Surg 2019; 58: 434-440.