Self-efficacy is an independent predictor for postoperative 6-minute walk distance after elective open repair of abdominal aortic aneurysm

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Running title: Self-efficacy predicts six-minute walk distance

Abstract

Objectives: Open surgery is performed to treat abdominal aortic aneurysm (AAA), although the subsequent surgical stress leads to worse physical status. Preoperative self-efficacy has been reported to predict postoperative physical status after orthopedic surgery; however, it has not been sufficiently investigated in patients undergoing abdominal surgery. The purpose of the present study is to investigate the correlation between preoperative self-efficacy and postoperative six-minute walk distance (6MWD) in open AAA surgery.

Methods: Seventy patients who underwent open AAA surgery were included. Functional exercise capacity was measured using preoperative and 1week postoperative 6MWD. Self-efficacy was preoperatively measured using self-efficacy for physical activity (SEPA). The correlations of postoperative 6MWD with age, height, BMI, preoperative 6MWD, SEPA, hospital anxiety and depression scale (HADS) score, operative time, and blood loss were investigated using multivariate analysis.

Results: Single regression analysis showed that postoperative 6MWD was significantly correlated with age($r=-0.553, p<0.001$), height($r=0.292, p=0.014$), Charlson comorbidity index($r=-0.268, p=0.025$), preoperative 6MWD($r=0.572, p<0.001$), SEPA($r=0.586, p<0.001$), and HADS-depression($r=-0.296, p=0.013$). Multiple regression analysis showed that age($p=0.002$), preoperative 6MWD($p=0.013$), and SEPA($p=0.043$) score were significantly correlated with postoperative 6MWD.

Conclusions: Self-efficacy was an independent predictor for postoperative 6MWD after elective open AAA surgery. This suggests the importance of assessing not only physical status but also psychological factors such as self-efficacy.

Introduction

Open surgery is performed to treat abdominal aortic aneurysm (AAA), although the patients experience surgical stress. Surgical recovery is a complex construct that comprises multiple dimensions of health [1,2]. Length of stay (LOS) in the hospital is a commonly used indicator of recovery [3], but this may not be an optimal indicator because LOS is influenced by many nonclinical factors such as patients' expectations of the hospital stay, the availability of community and family postoperative support, and surgeons' preferences [4]. On the other hand, functional exercise capacity is a key indicator of surgical recovery [5–7] that is required for patients to return to their normal employment and leisure activities. Six-minute walk distance (6 MWD) has been validated in the context of recovery from several types of surgery [5–13]. There was a positive correlation between the changes in 6 MWD and quality of life [10]. Postoperative 6 MWD after thoracoabdominal surgery is predicted by preoperative physical status such as 6 MWD [6–8], age [7,8], gender [8], surgical type [7,8], occurrence of postoperative complications [7], and comorbidities [8].

Self-efficacy is defined as "the belief that one can successfully execute the course of action to produce the desired outcome" [14]. Several systematic reviews suggest that patients' self-efficacy at baseline is a significant predictor of physical status in osteoarthritis [15], joint replacement [16], heart failure [17], and chronic pain [18]. In perioperative reports, preoperative self-efficacy has been reported to predict postoperative physical status after total joint replacement [19–22]. However, there are only a limited number of studies [19] that show the impact of preoperative self-efficacy on postoperative physical status using objective measures instead of questionnaires. Moreover, these investigations of preoperative self-efficacy are limited to reports after orthopedic surgery [19–24].

The purpose of the present study is to investigate the correlation between preoperative self-efficacy and postoperative 1 week 6 MWD in open AAA surgery.

Materials and Methods

Participants

A total of 70 consecutive patients undergoing open AAA surgery from April 2014 to March 2016 at Nagoya University Hospital were included in the study. Patients undergoing combined surgery or emergency aneurysm repairs were excluded. Open AAA surgery was performed under general and epidural anesthesia. A transperitoneal approach using a midline incision was applied in all cases. After systemic heparinization, clamps were placed distally over the iliac arteries. Proximal clamps were placed either inferior or superior to the renal arteries depending on the anatomy of the aneurismal neck. Straight or bifurcated knitted Dacron grafts were selected and anastomosed for in situ repair. The abdomen was closed following retroperitoneal repair. Patients spent their first postoperative days in the intensive care unit (ICU) or on our general ward depending on their need for intensive care. Patients without any need for intensive care went to the general ward on the 2nd postoperative day and were started on oral intake. Patients were received examination such as laboratory tests and blood collection, perioperative parenteral administration, diagnostic imaging such as X-ray, computed tomography, and nuclear scanning, medication, pathology assessment, rehabilitation, and psychiatric care. This study was approved by the Ethics Committee of Nagoya University Hospital (No. 2016-0065). Information about the patients was collected through a review of electronic medical records.

Measures

Medical assessments were conducted for all patients. Demographic characteristics, intraoperative data such as operating time, blood loss, surgical procedure, pre- and post-operative physical status, and laboratory values were extracted from the patients' medical records. Demographic data including age, sex, height, and body mass index (BMI) were collected. The Charlson comorbidity index was used to score comorbid conditions uniformly [25]. Laboratory values including serum levels of white blood cell count (WBC) and C-reactive protein (CRP) were collected. Acute renal dysfunction was defined with modifications detailed in a previous report concerning open AAA surgery [26,27]; data regarding the presence of renal failure, 200% increase in creatinine or cystatin C, oliguria <0.5 ml/kg/h for 24 h, and anuria were extracted from the patients' medical records.

Functional exercise capacity was examined by preoperative and 1 week postoperative 6 MWD. The 6 MWD assessment was performed with a standardized procedure [28]. Briefly, patients were instructed to walk the length of a predetermined course at their own pace while attempting to cover as much ground as possible in 6 min. Standardized encouragement was given each minute during the test. At the end of the 6 min, patients were instructed to stop walking, and the distance covered was measured to the nearest meter.

Self-efficacy was measured preoperatively using the self-efficacy for physical activity (SEPA) scale. The SEPA scale has been examined and shown reliability and validity [29–32]. A set of 4 scales at 5 different intensity items for each measure self-perceived ability to carry out the following activities: (1) walking from 20 to 120 or more minutes, (2) climbing stairs for distances ranging from 2 to 6 flights of stairs, (3) lifting objects weighting from 5 to 25 kg (11 to 55 pounds), and (4) performing push-ups ranging from 1 to 20 or more times. Patients were asked to indicate whether or not they thought they could perform a given level of activity, and to record their level of confidence in this judgement on a scale which ranged from 0 (not completely certain) to 100 (completely certain). The average score of 20 items is used, which ranged from 0 to 100. Lower scores indicate poorer levels of SEPA, and higher scores indicate better SEPA.

The Hospital Anxiety and Depression Scale (HADS), measured preoperatively, is designed to assess two dimensions, anxiety and depression. The HADS consists of 14 items: anxiety and depression subscales of seven items each. A four-point response scale (from 0, representing absence of symptoms, to 3, representing maximum symptoms) is used, with possible scores for each subscale ranging from 0 to 21 [33,34].

Statistical analysis

All continuous data are expressed as the medians and interquartile ranges (IQR). The correlations between 1 week postoperative 6 MWD and the variables of interest were analyzed by Pearson's r rank test. Multiple regression analysis was used to investigate the pre- and intra-operative variables showing $p < 0.2$ in the single regression analysis. The data were analyzed with SPSS software (version 23.0 for Microsoft Windows; SPSS, Chicago, IL). A value of $P<0.05$ was considered statistically significant.

Results

The patient characteristics are shown in Table 1. Of the 70 patients, 65 (92.8%) were male. The median age was 67.5 years old (range, 56–84; IQR, 66–73). The median postoperative hospital stay was 10 days (range, 9–25; IQR, 9–12). The median preoperative and 1 week postoperative 6 MWD were 500 m (range, 125–675; IQR, 450–556), and 405 m (range, 90–620; IQR, 336-500), respectively. The 6 MWD could be measured in all patients. Perioperative complications had been recovered within 1 week and included acute renal dysfunction (n=8, 11%) and delirium (n=7, 10%). Other perioperative complications such as myocardial infarction, respiratory failure, and ischemic colitis were not occurred. Thirty-day mortality rate was zero.

The correlations of postoperative 6 MWD with independent variables are shown in Table 2 and Figure 1. Regarding the pre- and intra-operative variables, age ($r=-0.553$, $p<0.001$), height ($r=0.292$, $p=0.014$), Charlson comorbidity index ($r=-0.268$, $p=0.025$), preoperative 6 MWD ($r=0.572$, $p<0.001$), SEPA ($r=0.586$, $p<0.001$), and HADS-depression ($r=-0.296$, $p=0.013$) showed a significant correlation with postoperative 6 MWD. The post-operative complications showed no significant correlation with postoperative 6 MWD.

The results of the multiple regression analysis are shown in Table 3. Seven pre- and intra-operative variables with $p < 0.2$ (i.e., age, height, Charlson comorbidity index, preoperative 6 MWD, SEPA, HADS-depression, and operative time) were entered in the multiple regression analysis. Multicollinearity was checked in pre- and intra-operative variables ($r < 0.700$). Age ($p=0.002$), preoperative 6 MWD ($p=0.013$), and SEPA ($p=0.043$) were selected as independent variables in the multiple regression model of postoperative 6 MWD.

Discussion

The present study showed that age, preoperative 6 MWD, and SEPA predicted postoperative 1 week 6 MWD in the early stages after open AAA surgery. Age and preoperative 6 MWD were independent variables of postoperative 6 MWD, consistent with previous reports [6–8]. This study is the first to show that self-efficacy is an independent predictor for postoperative 6 MWD after elective open AAA surgery.

The correlations of preoperative self-efficacy with postoperative physical status are mostly investigated using questionnaires [20–24]. Postoperative physical status is predicted by preoperative self-efficacy after orthopedic surgery [20–22]; however, some studies have shown that preoperative self-efficacy is not predictive [23,24]. Only a few reports show that postoperative physical status is predicted by preoperative self-efficacy in patients undergoing orthopedic surgery using objective measures [19]. The current study shows for the first time that self-efficacy is a significant preoperative predictor of postoperative objective physical status in patients receiving abdominal surgery. Self-efficacy is influenced by four mechanisms: mastery experience, vicarious experience, social persuasion and interpretations of somatic and emotional states [14]. It can be strengthened through the provision of information and the experiences of task performance and goal attainment in rehabilitation settings [21]. Moreover, a self-monitoring approach using pedometers increases exercise maintenance, self-efficacy, and physical activity [35]. The present study suggests that poor preoperative self-efficacy is a risk factor for poor postoperative physical status. Thus, treatment for preoperative self-efficacy might be useful in patients undergoing abdominal surgery.

The present study aimed to identify preoperative predictors, therefore self-efficacy was measured preoperatively and not during the postoperative recovery period. Although the patients in their study underwent orthopedic surgery, van den Akker-Scheek et al. reported that short-term postoperative self-efficacy was a better predictor of long-term postoperative physical status than preoperative self-efficacy [19]. Performance accomplishments are considered the most dependable source of self-efficacy [14]. Although the impact of short-term postoperative self-efficacy in patients undergoing open AAA surgery has not been investigated, a self-efficacy intervention might be useful in postoperative periods [21].

The present study showed for the first time that the postoperative recovery of physical status after open AAA surgery measured by the 6 MWD was 84 meters less (-17.2%) 1 week post-operation than the corresponding preoperative figure. The postoperative 6 MWD compared to the preoperative 6 MWD was reported to be as follows: 34 meters less (-7.2%) 10 days after laparoscopic or laparotomy gastrointestinal cancer surgery [9], 150 meters less (-27.7%) 2 weeks after liver donation [10], 48 meters less (-10.2%) 3 weeks after elective colon resection surgery [6], 25 meters less (-5.8%) 4 weeks after colorectal resection surgery [7], and 30 meters less (-5.5%) 4 weeks after liver or kidney donation [8,9]. Surgical stress encompasses many elements, such as fasting, tissue damage, hemorrhage, hypothermia, fluid shifts, pain, hypoxia, bed rest, ileus, anxiety and cognitive imbalance [36]. Metabolically healthy patients lose between 40 and 80 g of nitrogen after elective open abdominal operations, which is equivalent to 1.2–2.4 kg of wet skeletal muscle [37]. In addition, bed rest reduces skeletal muscle strength, cardiac output, and VO_2 max at a rate of approximately 1% every 2 days. [36]. Completing rehabilitation for postoperative recovery of functional exercise capacity and muscle strength is required for patients.

Postoperative 6 MWD was correlated with the length of postoperative hospital stay in the present study. Physical status is a key indicator of surgical recovery [5–7]. However, postoperative physical status is a single indicator of surgical recovery, which may suggest that it cannot cover the complete construct. The postoperative quality of recovery is required to be assessed using multiple facets [38]. Postoperative complications have an impact on postoperative recovery [7]. The present study excluded the patients underwent combined surgery or emergency aneurysm repairs, therefore the incidence of postoperative complications was low. The standard definitions of recovery outcomes after surgery should be investigated [1,2].

Study Limitations

There are several limitations to this study. First, the present study investigated only the early postoperative period; these findings should be considered preliminary in open AAA surgery, although several studies have considered 6 MWD in the early period [5–12]. Second, patients undergoing AAA surgery are instructed to refrain from strenuous exercise until the operation, and therefore these patients avoided exercising during the preoperative period. Preoperatively, patients might have had a fear of exercise. Further investigation is required in patients undergoing various types of surgery. Finally, we included only a small number of participants from a single medical center. Thus, our observations must be interpreted with caution.

Conclusions

Self-efficacy is an independent predictor for postoperative 6 MWD after elective open AAA surgery. This suggests the importance of assessing not only physical status but also psychological factors such as self-efficacy. These findings may contribute to future perioperative rehabilitation processes in abdominal surgery patients.

Conflict of interest statement

The authors certify that no affiliation or financial involvement exists between them and any organization with a direct interest in the subject matter or materials discussed in the article.

References

1. Lee L, Tran T, Mayo NE, Carli F, Feldman LS. What does it really mean to "recover" from an operation? *Surgery* 2014;155:211–6.
2. Feldman LS, Lee L, Fiore J Jr. What outcomes are important in the assessment of Enhanced Recovery After Surgery (ERAS) pathways? *Can J Anaesth* 2015;62:120–30.
3. Neville A, Lee L, Antonescu I, Mayo NE, Vassiliou MC, Fried GM, et al. Systematic review of outcomes used to evaluate enhanced recovery after surgery. *Br J Surg* 2014;101:159–70.
4. Carli F, Mayo N. Measuring the outcome of surgical procedures: what are the challenges? *Br J Anaesth* 2001;87:531–3.
5. Antonescu I, Scott S, Tran TT, Mayo NE, Feldman LS. Measuring postoperative recovery: what are clinically meaningful differences? *Surgery* 2014;156:319–27.
6. Moriello C, Mayo NE, Feldman L, Carli F. Validating the six-minute walk test as a measure of recovery after elective colon resection surgery. *Arch Phys Med Rehabil*

2008;89:1083–9.

7. Pecorelli N, Fiore JF Jr, Gillis C, Awasthi R, Mappin-Kasirer B, Niculiseanu P, et al. The six-minute walk test as a measure of postoperative recovery after colorectal resection: further examination of its measurement properties. *Surg Endosc*. in press.

8. Fiorina C, Vizzardi E, Lorusso R, Maggio M, De Cicco G, Nodari S, et al. The 6-min walking test early after cardiac surgery. Reference values and the effects of rehabilitation programme. Eur J Cardiothorac *Surg* 2007;32:724–9.

9. Hara T, Kubo A. The perioperative changes in physical function and physique of patients with gastrointestinal cancer. *J Phys Ther Sci* 2015;27:693–5.

10. Hsieh CB, Tsai CS, Chen TW, Chu HC, Yu JC, Chen DR. Correlation between SF-36 and six-minute walk distance in liver donors. *Transplant Proc* 2010;42:3597–9.

11. Bergman S, Feldman LS, Mayo NE, Carli F, Anidjar M, Klassen DR, et al. Measuring surgical recovery: the study of laparoscopic live donor nephrectomy. *Am J Transplant* 2005;5:2489–95.

12. Oliveira GU, Oliveira Carvalho V, de Assis Cacau LP, de Araújo Filho AA, de Cerqueira Neto ML, da Silva WM Jr et al. Determinants of distance walked during the six-minute walk test in patients undergoing cardiac surgery at hospital discharge. *J Cardiothorac Surg* 2014;31;9:95.

13. Hansen N, Hardin E, Bates C, Bellatorre N, Eisenberg D. Preoperative change in 6-minute walk distance correlates with early weight loss after sleeve gastrectomy. *JSLS* 2014;18:e2014.00383.

14. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol*

Rev 1977;84:191–215.

15. Benyon K, Hill S, Zadurian N, Mallen C. Coping strategies and self-efficacy as predictors of outcome in osteoarthritis: a systematic review. *Musculoskeletal Care* 2010;8:224–36.

16. Magklara E, Burton CR, Morrison V. Does self-efficacy influence recovery and well-being in osteoarthritis patients undergoing joint replacement? A systematic review. *Clin Rehabil* 2014;28:835–46.

17. Rajati F, Sadeghi M, Feizi A, Sharifirad G, Hasandokht T, Mostafavi F. Self-efficacy strategies to improve exercise in patients with heart failure: A systematic review. *ARYA Atheroscler* 2014;10:319–33.

18. Jackson T, Wang Y, Wang Y, Fan H. Self-efficacy and chronic pain outcomes: a meta-analytic review. *J Pain* 2014;15:800–14.

19. van den Akker-Scheek I, Stevens M, Groothoff JW, Bulstra SK, Zijlstra W. Preoperative or postoperative self-efficacy: which is a better predictor of outcome after total hip or knee arthroplasty? *Patient Educ Couns* 2007;66:92–9.

20. Wylde V, Dixon S, Blom AW. The role of preoperative self-efficacy in predicting outcome after total knee replacement. *Musculoskeletal Care* 2012;10:110–8.

21. Dohnke B, Knäuper B, Müller-Fahrnow W. Perceived self-efficacy gained from, and health effects of, a rehabilitation program after hip joint replacement. *Arthritis Rheum* 2005;53:585–92.

22. Orbell S, Johnston M, Rowley D, Davey P, Espley A. Self-efficacy and goal importance in the prediction of physical disability in people following hospitalization: a prospective study. *Br J Health Psychol* 2001;6:25–40.

23. Hartley SM, Vance DE, Elliott TR, Cuckler JM, Berry JW. Hope, self-efficacy, and

functional recovery after knee and hip replacement surgery. *Rehabil Psycho* 2008;53:521–9.

24. Riddle DL, Wade JB, Jiranek WA, Kong X. Preoperative pain catastrophizing predicts pain outcome after knee arthroplasty. *Clin Orthop Relat Res* 2010;468:798–806.

25. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;40:373–83.

26. Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P. Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group. *Crit Care* 2004;8:R204–12.

27. Tallgren M, Niemi T, Pöyhiä R, Raininko E, Railo M, Salmenperä M, et al. Acute renal injury and dysfunction following elective abdominal aortic surgery. *Eur J Vasc Endovasc Surg* 2007;33:550–5.

28. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med* 2002;166:111–7.

29. Fletcher JS, Banasik JL. Exercise self-efficacy. *Clin Excell Nurse Pract* 2001;5:134–43.

30. Bandura A. Self-efficacy mechanism in human agency. *Am Psychol* 1982;37:122–47.

31. Oka K. Exercise adherence-promote of physical activity and exercise, in Sakano Y, Maeda M (eds): *Clinical Psychology of Self-Efficacy*. Kyoto, Kitaouji Syobo; 2002.

pp 218–34.

32. Izawa KP, Watanabe S, Omiya K, Hirano Y, Oka K, Osada N, et al. Effect of the self-monitoring approach on exercise maintenance during cardiac rehabilitation: a randomized, controlled trial. *Am J Phys Med Rehabil* 2005;84:313–21.

33. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67:361–70.

34. Matsudaira T, Igarashi H, Kikuchi H, Kano R, Mitoma H, Ohuchi K, et al. Factor structure of the Hospital Anxiety and Depression Scale in Japanese psychiatric outpatient and student populations. *Health Qual Life Outcomes* 2009;17;7:42.

35. Izawa KP, Watanabe S, Omiya K, Hirano Y, Oka K, Osada N, et al. Effect of the self-monitoring approach on exercise maintenance during cardiac rehabilitation: a randomized, controlled trial. *Am J Phys Med Rehabil* 2005;84:313–21.

36. Scott MJ, Baldini G, Fearon KC, Feldheiser A, Feldman LS, Gan TJ, et al. Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 1: pathophysiological considerations. *Acta Anaesthesiol Scand* 2015;59:1212–31.

37. Schricker T, Lattermann R. Strategies to attenuate the catabolic response to surgery and improve perioperative outcomes. *Can J Anaesth* 2007;54:414–9.

38. Gornall BF, Myles PS, Smith CL, Burke JA, Leslie K, Pereira MJ, et al. Measurement of quality of recovery using the QoR-40: a quantitative systematic review. *Br J Anaesth* 2013;111:161–9.

Figure legend

Figure 1.

Correlation between preoperative SEPA and postoperative 6 MWD.

SEPA, self-efficacy for physical activity; 6 MWD, 6-min walking distance

Preoperative SEPA correlated with postoperative 6 MWD. These data were analyzed using Pearson's r rank test. The significance level was set at less than 5%. *Significant correlation.

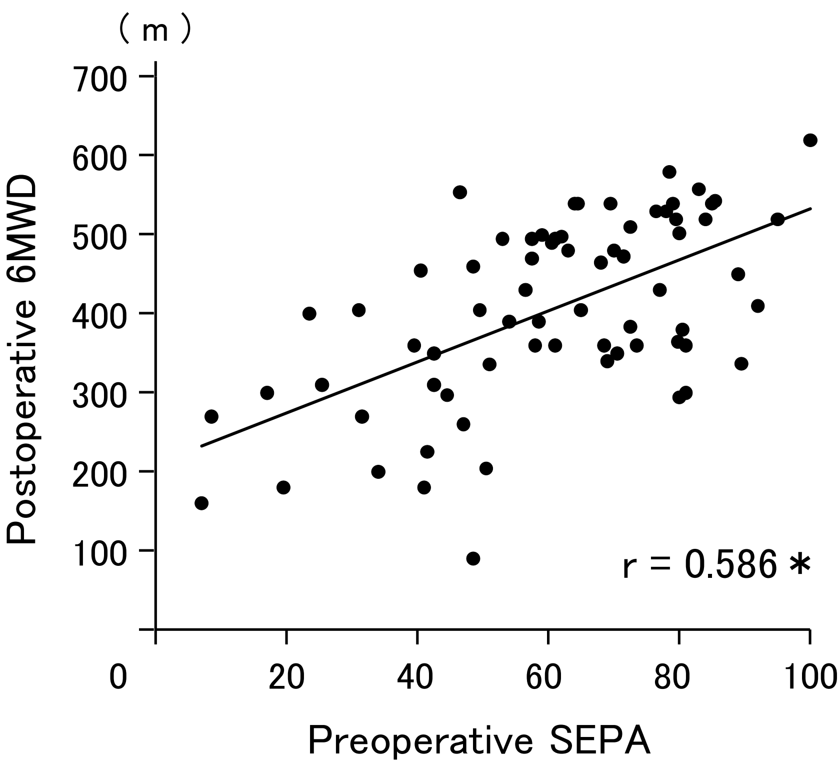
(m)
700
600
500
400
300
200
100
0
20
40
60
80
100
Postoperative 6MWD
Preoperative SEPA
r = 0.586 *

Fig 1

Table 1. Patients' characteristics

Preoperative data	
Age (years)	67.5 [66.0–73.0]
Male / female (n)	65 / 5
Height (cm)	167 [161–171]
BMI (kg/m2)	23.2 [21.5–25.7]
Smoking history (n)	62 (88%)
Engaging in regular physical activity (n)	31 (44%)
Hyper tension (n)	32 (45%)
Diabetes mellitus (n)	11 (15%)
Dyslipidemia (n)	13 (18%)
COPD (n)	3 (4%)
Coronary artery disease (n)	16 (22%)
Chronic kidney disease (n)	3 (4%)
Cerebrovascular disease (n)	2 (2%)
Charlson comorbidity index	0 [0–1]
6MWD (m)	500 [450–556]
SEPA	62.5 [46.8–78.6]
HADS–anxiety	4 [2–7]
HADS–depression	4 [2–7]
Intraoperative data	
Operative time (min)	242 [202–291]
Blood loss (ml)	857 [308–1499]
Suprarenal aortic cross–clamping (n)	9 (12%)
Postoperative data	
6MWD (m)	405 [336–500]
Acute renal dysfunction (n)	8 (11%)
Delirium (n)	7 (10%)
Max CRP (mg/dl)	19.1 [13.8–22.6]
Max WBC (mg/dl)	11.3 [9.4–13.6]
Time to independence in walking (days)	2 [2–3]
Time to resuming diet (days)	2 [2–3]
Length of hospital stay (days)	10 [9–12]

BMI body mass index; COPD chronic obstructive pulmonary disease; 6MWD 6-min walking distance; SEPA self-efficacy for physical activity; HADS hospital anxiety and depression scale; CRP C-reactive protein; WBC white blood cell counts
Data of sex, comorbidities, operative procedure are number and (%) of patients. Data of age, height, BMI, Charlson comorbidity index, 6MWD, SEPA, HADS, operative time, blood loss, laboratory values, and time to recovery are medians and interquartile ranges (IQR).

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Table 2. Correlation of postoperative 6MWD with variables

Preoperative data					
Age (years)	r =	-0.553	p <	0.001	*
Height (cm)	r =	0.292	p =	0.014	*
BMI (kg/m2)	r =	0.082	p =	0.497	
Charlson comorbidity index	r =	-0.268	p =	0.025	*
6MWD (m)	r =	0.572	p <	0.001	*
SEPA	r =	0.586	p <	0.001	*
HADS-anxiety	r =	-0.046	p =	0.702	
HADS-depression	r =	-0.296	p =	0.013	*
Intraoperative data					
Operative time (min)	r =	-0.158	p =	0.190	
Blood loss (ml)	r =	-0.127	p =	0.295	
Postoperative data					
Max CRP (mg/dl)	r =	0.073	p =	0.551	
Max WBC (mg/dl)	r =	0.024	p =	0.841	
Time to independence in walking (days)	r =	-0.543	p <	0.001	*
Time to resuming diet (days)	r =	0.006	p =	0.959	
Length of hospital stay (days)	r =	-0.264	p =	0.027	*

*p<0.05, BMI body mass index; 6MWD 6-min walking distance; SEPA self-efficacy for physical activity; HADS hospital anxiety and depression scale; CRP C-reactive protein; WBC white blood cell counts

These data were analyzed Pearson r rank test. The age, height, Charlson comorbidity index, preoperative 6MWD, SEPA, HADS-depression, time to independent in walking, and length of hospital stay showed a significant correlation with postoperative 6MWD.

Table 3. Multiple regression analysis

Dependent variables	Independent variables	B	(S.E.)	β	p value	R^2
Postoperative 6MWD	Age (years)	-6.506	2.006	-0.325	0.002	0.492
	Preoperative 6MWD (m)	0.325	0.127	0.292	0.013	
	SEPA	1.366	0.662	0.247	0.043	

B nonstandard regression coefficient; SE standard error; β standardized regression coefficient; R^2 multiple correlation coefficient adjusted for the degrees of freedom; 6MWD 6-min walking distance; SEPA self-efficacy for physical activity

Seven preoperative and intraoperative variables with $p < 0.2$ (i.e., age, height, Charlson comorbidity index, preoperative 6MWD, SEPA, HADS-depression, and operative time) were entered into the multiple regression analysis. The age, preoperative 6MWD, and SEPA were selected as independent variables in a multiple regression model for the postoperative 6MWD.