Clinical Critical Care

E-ISSN 2774-0048

VOLUME 34 NUMBER 1

JANUARY-DECEMBER 2026



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Clinical Critical Care
eISSN 2774-0048

Clinical Critical Care
Volume 34, Article ID e260021, 10 pages
https://doi.org/10.54205/ccc.v34.280069

ORIGINAL RESEARCH

Effects of nurse-led rehabilitation promotion program on functional capacity and complications in patients with abdominal aortic aneurysm surgery: A quasi-experimental study

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OPEN ACCESS

Citation:
Rutham M, Jansiri U. Effects of nurse-led rehabilitation promotion program on functional capacity and complications in patients with abdominal aortic aneurysm surgery: A quasi-experimental study. Clin Crit Care 2026; 34: e260021.

Received: January 27, 2026
Revised: March 17, 2026
Accepted: June 15, 2026

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Data Availability Statement:
The data and code were available upon reasonable request (Utthawit Jansiri, email address: utthawit_j@payap.ac.th)

Funding:
No external funding was received for this study.

Competing interests:
No potential conflict of interest relevant to this article was reported.

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ABSTRACT:

Background: Recovery after abdominal aortic aneurysm surgery often involves prolonged functional decline and various postoperative complications. Structured nursing interventions during the perioperative period may help patients regain independence more quickly, though research specifically examining this surgical population remains sparse. This study aimed to determine the effects of a nurse-led rehabilitation promotion program on functional capacity and postoperative complications in patients undergoing abdominal aortic aneurysm surgery.

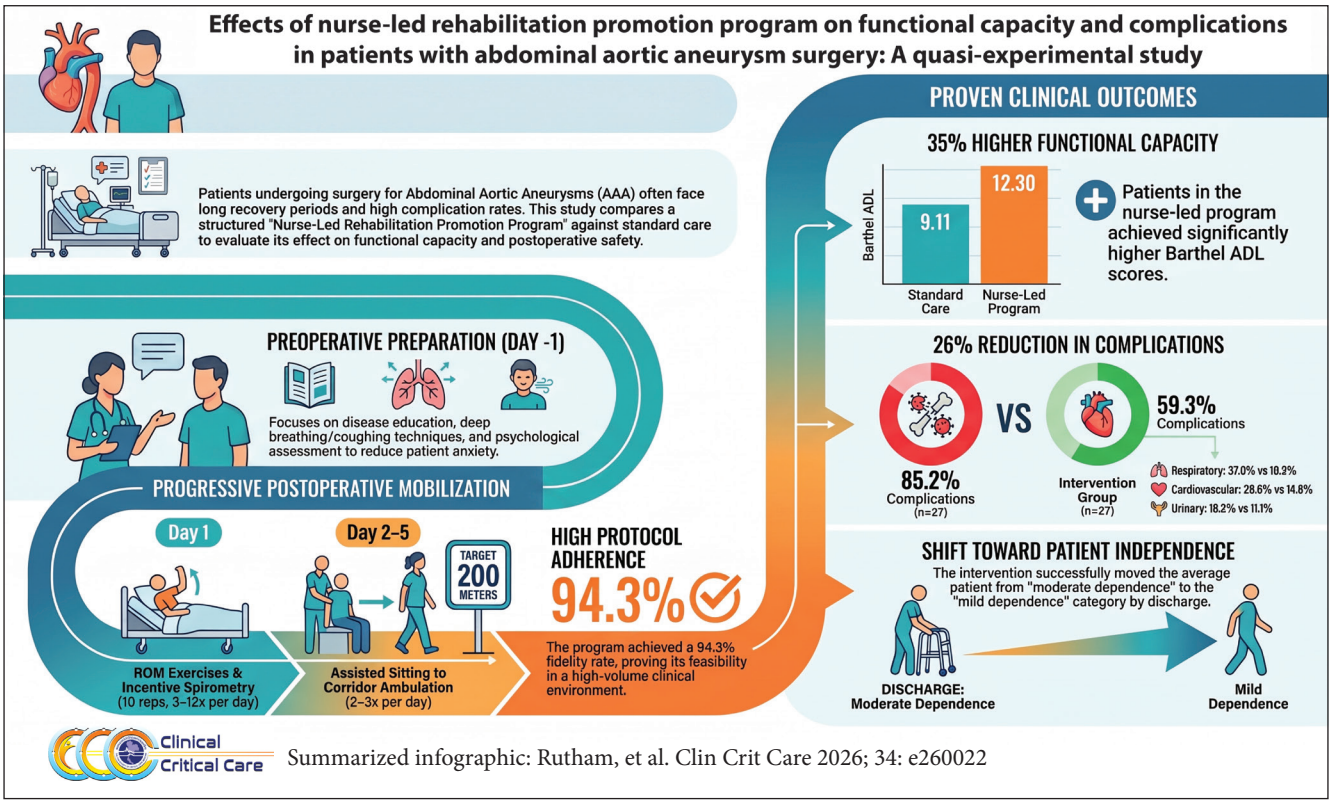
Methods: We conducted a posttest-only quasi-experimental study at Nakornping Hospital from September to December 2025. Fifty-four patients undergoing abdominal aortic aneurysm repair were enrolled and allocated through matched-pairs methodology into either a nurse-led rehabilitation promotion program (n = 27) or standard care (n = 27). The primary outcomes were functional capacity assessed by the Barthel Activities of Daily Living Index on the day of hospital discharge or postoperative day 5, whichever came first, and the occurrence of postoperative complications recorded daily until discharge. We analyzed the data using independent t-tests and chi-square tests.

Results: Patients in the intervention group achieved higher functional capacity scores (mean = 12.30, SD = 2.95) than those in the control group (mean = 9.11, SD = 5.56); the mean difference was 3.19 points (95% CI: 0.74 to 5.64; t = −2.63, df = 39.52, p = .012). Fewer patients in the intervention group experienced postoperative complications (59.3%) compared to the control group (85.2%); the absolute risk reduction was 25.9% (95% CI: 3.2% to 48.6%; $\chi^2 = 4.52$, p = .033; number needed to treat = 3.86).

Conclusions: A structured nurse-led rehabilitation program was associated with improved functional recovery and lower complication rates in patients after abdominal aortic aneurysm surgery. These findings support the integration of such programs into routine perioperative vascular nursing care.

Trial registration: TCTR20260702010

Keywords: Abdominal aortic aneurysm; Functional capacity; Nurse-led care; Postoperative complications; Rehabilitation nursing



INTRODUCTION

An abdominal aortic aneurysm is a localized enlargement of the abdominal aorta that exceeds 3 centimeters in diameter, and it represents a serious threat to cardiovascular health worldwide [1]. Epidemiological studies estimate that nearly 1% of adults between 30 and 79 years of age have this condition, which translates to approximately 35 million people globally based on 2023 data [2-4]. When the aneurysm reaches a certain size or shows rapid growth, surgical repair becomes necessary to prevent rupture. Both open surgical repair and endovascular aneurysm repair are accepted treatment options, with current guidelines providing recommendations for patient selection [5,6].

The road to recovery following surgical repair of an abdominal aortic aneurysm is often long and difficult. Patients commonly experience a marked decline in their physical abilities, and research suggests that returning to baseline function can take more than a year [7]. Enhanced recovery after surgery protocols have been introduced in many centers and have succeeded in reducing hospital stays and healthcare costs [8]. Nevertheless, a substantial number of patients still struggle with incomplete recovery. One study found that while about two-thirds of patients fully recovered within roughly four months, the remaining third continued to have functional limitations even after nearly three years of follow-up [9]. These limitations frequently affect everyday activities such as walking, driving, and shopping, with some patients requiring assistance for basic mobility [10-12].

Nurses are well positioned to address these recovery challenges through structured interventions. Studies in various surgical settings have shown that nurse-led programs can reduce patient anxiety, improve adherence to rehabilitation activities, and decrease the likelihood of hospital readmission [13-15]. At Nakornping Hospital, a major referral center serving Chiang Mai and neighboring provinces in northern Thailand, the number of abdominal aortic aneurysm surgeries has grown steadily. Accompanying this growth has been a rise in postoperative complications, increasing from 10 cases in 2022 to 12 in 2023 and then to 33 in 2024. This rise paralleled an increase in annual surgical volume and a higher proportion of emergency and elderly cases referred to the hospital, rather than a change in complication-reporting practices.

Previous nurse-led rehabilitation programs in surgical settings have typically focused on cardiac surgery populations, incorporating structured preoperative education, early mobilization protocols, and transitional care coordination [13–15]. However, these programs differ from

KEY MESSAGES:

- Patients who received a nurse-led rehabilitation program that combined preoperative teaching, breathing exercises, and gradual mobilization showed clinically meaningful improvements in their ability to perform daily activities after abdominal aortic aneurysm surgery.
- The rate of postoperative complications dropped by roughly 26 percentage points among patients in the nurse-led program compared with those who received routine care alone.
- These results offer practical evidence for expanding nursing responsibilities in coordinating rehabilitation for patients undergoing complex vascular procedures.

rehabilitation approaches for abdominal aortic aneurysm patients in several important respects. Patients undergoing aortic aneurysm repair face unique challenges, including activity restrictions related to the surgical graft, the risk of graft-specific complications such as endoleak, and prolonged hemodynamic instability. Enhanced recovery after surgery protocols and general physiotherapy-based rehabilitation programs have been applied in vascular surgery, yet most do not incorporate the continuous nursing surveillance and individualized patient education that characterize nurse-led models of care [8,23]. Standard postoperative care for abdominal aortic aneurysm patients at Nakornping Hospital consists of routine vital sign monitoring, wound observation, pain management, and mobilization initiated at the physician's discretion without a structured, nurse-coordinated rehabilitation protocol.

This concerning trend motivated us to investigate whether a nurse-led rehabilitation promotion program could improve functional outcomes and reduce complications in this patient population. Therefore, the objective of this study was to determine the effects of a nurse-led rehabilitation promotion program on functional capacity and postoperative complications in patients undergoing abdominal aortic aneurysm surgery at Nakornping Hospital. We hypothesized that patients receiving the nurse-led rehabilitation promotion program would demonstrate higher functional capacity scores and lower incidence of postoperative complications than those receiving standard care.

MATERIALS AND METHODS

Study design and setting

This study was a posttest-only quasi-experimental design with two parallel groups. A pretest was not performed because most patients were admitted with acute symptoms or were transferred urgently for surgical evaluation, leaving insufficient time for reliable preoperative functional assessment; in addition, acute pain and anxiety in this period would have compromised the validity of baseline measurement. The aim was to determine whether a nurse-led rehabilitation promotion program could improve functional capacity and reduce postoperative complications in patients who had undergone abdominal aortic aneurysm surgery. We collected data from September through December 2025 at Nakornping Hospital after receiving approval from the hospital's Human Research Ethics Committee (Approval NKP No. 135/68).

Participants

We recruited patients who had been diagnosed with an abdominal aortic aneurysm and had undergone surgical repair at Nakornping Hospital. To be included in the study, patients had to meet all of the following criteria: a confirmed diagnosis through computed tomography angiography or magnetic resonance angiography; hemodynamic stability within 48 hours after surgery; the ability to communicate in Thai; a Mini Mental State Examination score of 24 or higher, indicating adequate cognitive function; physician approval to participate in rehabilitation activities; and willingness to provide informed consent. We excluded patients who had experienced severe surgical complications, those with serious psychiatric disorders, and those who had medical contraindications to exercise or mobility.

Sample size calculation

We calculated the required sample size using G*Power version 3.1.9.7 software. For an independent samples t-test with a two-tailed hypothesis, we set alpha at 0.05 and power at 0.80. Based on previous research and clinical judgment, we anticipated a large effect size (Cohen's d = 0.8) [16,17]. The calculation indicated that we needed at least 21 participants in each group. To account for a potential dropout rate of 20%, we increased our target to 27 participants per group, for a total of 54 participants [18].

Sampling and group allocation

We used purposive sampling combined with a matched-pairs allocation approach to ensure that the two study groups would be comparable. Although computerized random assignment was applied within each matched pair, the study is classified as quasi-experimental because participants were not drawn from the population through probability sampling, recruitment was restricted to consecutive eligible patients during a defined period, and the matching procedure constrained allocation at the group level. After identifying all patients who met the inclusion criteria during the study period, we created a sampling frame with unique identification codes. We then matched patients based on four key variables: age (within 5-year bands), sex, type of surgical approach (open repair vs. EVAR), and severity of the aneurysm. Aneurysm severity was operationally defined by maximum transverse diameter on preoperative CTA, categorized as small (<4 cm), medium (4–5.4 cm), and large (≥5.5 cm), consistent with the Society for Vascular Surgery classification [5]. Matching was performed after written informed consent had been obtained from all eligible patients. Once matched pairs were established, we used computerized random number generation in SPSS to assign one member of each pair to the intervention group and the other to the control group. Because preoperative functional capacity was not measured in this posttest-only design, we mitigated potential baseline differences through stringent inclusion criteria (hemodynamic stability, MMSE ≥ 24, physician clearance) and matched-pairs allocation on age, sex, surgical approach, and aneurysm severity.

Intervention

Theoretical framework

We developed the nurse-led rehabilitation promotion program based on Clarke's Contemporary Nurse-led Models of Care Framework (2025) [19]. This framework brings together three main elements: theoretical foundations that emphasize patient-centered care, organizational methods that structure how care is delivered, and actual care practices grounded in evidence and holistic nursing principles.

Preoperative phase (Day −1)

On the day before surgery, the research nurse conducted a thorough assessment of each patient in the intervention group. This assessment included evaluating psychological status using the Hospital Anxiety and Depression Scale. The nurse then provided education about the disease and the upcoming surgical procedure, taught deep breathing and effective coughing techniques, demonstrated mobility exercises, and discussed pain management strategies, including both medications and non-drug approaches. The session also covered nutritional guidance and relaxation techniques to help reduce preoperative anxiety.

Postoperative phase (Days 1–5)

During the first day after surgery, the focus was on close monitoring. The nurse assessed the patient's level of consciousness, evaluated pain, examined the surgical wound, tracked fluid intake and output, initiated gentle range-of-motion exercises of the upper and lower extremities (performed three times daily, 10 repetitions per session), and encouraged deep breathing exercises using an incentive spirometer (10 repetitions every two hours during waking hours). Deep breathing was performed at a rate of 6–8 breaths per minute, with 3 seconds of inspiratory hold per repetition. On the second and third postoperative days, patients progressed to more advanced mobility activities, beginning with assisted sitting at the bedside for 15 to 30 minutes twice daily, progressing to standing with support, and then walking short distances of 10 to 50 meters in the corridor at least twice daily as tolerated. The nurse also advanced the diet as tolerated and began discharge education. By days four and five, patients had usually moved from the intensive care unit to the general ward. During this phase, the nurse continued monitoring, provided advanced mobility training with a target walking distance of 100 to 200 meters three times daily, completed comprehensive discharge teaching, and scheduled follow-up appointments.

Intervention fidelity

A single research nurse, who had completed a two-week structured training on the protocol, delivered all intervention sessions to ensure consistency. Adherence to each scheduled component was recorded daily on a fidelity checklist; overall protocol adherence was 94.3%, with the most frequent deviations involving postponed afternoon mobilization due to scheduled investigations.

Control group

Patients in the control group received the standard postoperative care that Nakornping Hospital provides to all patients after abdominal aortic aneurysm surgery. This included routine vital sign monitoring, observation for symptoms and signs of complications, and nursing interventions as clinically indicated.

Research instruments

Demographic and medical data form

We developed a 35-item questionnaire to collect information about participants. The questionnaire had three sections: personal information (15 items covering age, sex, education, income, and similar variables), medical history (15 items about the aneurysm, other health conditions, and surgical details), and support systems (5 items about family and social resources). Completing this questionnaire took approximately 15 to 20 minutes.

Barthel activities of daily living index

We measured functional capacity using the Barthel Activities of Daily Living Index, which Mahoney and Barthel originally developed in 1965 [20]. We used the Thai version that Chawalee translated and validated in 1995 [21]. The 20-point scoring system was selected because it is the standard version routinely used in Thai clinical practice and in the Thai national geriatric assessment, allowing comparability with national benchmark data; its broader item gradations are also better suited to detect early functional changes in the immediate postoperative period than the 100-point version, which is more sensitive to subtle changes typically observed in rehabilitation rather than acute surgical settings. This instrument evaluates ten areas of daily function: eating, grooming, bathing, dressing, using the toilet, controlling the bladder, controlling the bowels, transferring from bed to chair, walking, and climbing stairs. We used the 20-point scoring system, in which scores from 0 to 4 indicate total dependence, 5 to 8 indicate severe dependence, 9 to 11 indicate moderate dependence, 12 to 19 indicate mild dependence, and a score of 20 indicates complete independence.

Postoperative complications assessment form

We created a 16-item form to record postoperative complications across five categories: cardiovascular problems (4 items), respiratory problems (3 items), wound

Table 1. Nurse-led rehabilitation program components by phase.

Phase	Component	Frequency / Dosage
Preoperative (Day −1)	HADS assessment; disease & surgery education; deep breathing & coughing technique; mobility demonstration; pain management counseling; nutritional & relaxation guidance	One 45–60 min session
POD 1	Consciousness/pain/wound assessment; I/O monitoring; ROM exercises; incentive spirometry	ROM: 10 reps × 3/day; spirometry: 10 reps every 2 h while awake
POD 2–3	Assisted bedside sitting → standing → corridor ambulation; diet advancement; discharge teaching initiation	Sitting: 15–30 min × 2/day; ambulation: 10–50 m × ≥2/day
POD 4–5	Continued monitoring; advanced ambulation; comprehensive discharge teaching; follow-up scheduling	Walking: 100–200 m × 3/day

and infection issues (3 items), urinary system problems (3 items), and other complications (3 items). For each item, we recorded whether the complication was present (scored as 1) or absent (scored as 0).

Instrument validity and reliability

Five experts reviewed all three instruments - the Demographic and Medical Data Form, the Barthel Activities of Daily Living Index (Thai version), and the Postoperative Complications Assessment Form for content validity. We calculated Cronbach's alpha coefficients and found values of 0.84 for the Barthel Activities of Daily Living Index and 0.89 for the Postoperative Complications Assessment Form, both of which exceed the commonly accepted threshold of 0.70 for adequate internal consistency. Content validity was evaluated for all three instruments, whereas reliability testing was performed for the Barthel Index and the Complications Assessment Form, as the Demographic and Medical Data Form collects factual information that does not require internal consistency assessment.

Outcome measurement and assessor blinding

Functional capacity was assessed using the Barthel Activities of Daily Living Index on the day of hospital discharge or on postoperative day 5, whichever came first. Postoperative complications were recorded daily from postoperative day 1 through discharge based on standardized clinical criteria and extracted from the medical record by the research nurse; each event was independently verified by the attending vascular surgeon. Multiple complications per patient were possible; for the primary binary outcome, a patient was classified as having a complication if at least one event occurred, and the incidence of each specific complication is presented separately in Table 4. We acknowledge that the outcome assessor was not blinded to group allocation, as the research nurse who delivered the intervention also collected outcome data. This limitation introduces a risk of observer bias, and future studies should employ independent, blinded assessors to strengthen the validity of the findings.

Ethical considerations

We conducted this study in accordance with the ethical principles outlined in the Declaration of Helsinki. The Nakornping Hospital Human Research Ethics Committee reviewed and approved the study protocol. Before enrolling any participant, we explained the study purpose, procedures, potential risks and benefits, and the voluntary nature of participation. All participants provided written informed consent. We protected confidentiality by assigning identification codes rather than using names and by storing data securely. We will maintain these records for five years as required by institutional policy.

Statistical analysis

Data was analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) with α set at .05. Descriptive statistics summarized participant characteristics, and normality was assessed using the Shapiro–Wilk test. Between-group comparisons used independent samples t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Effect sizes were reported as Cohen's d with 95% CI for continuous outcomes and as absolute risk reduction with number needed to treat for binary outcomes. Because two primary outcomes were tested, the Bonferroni-adjusted threshold was set at α = .025. Paired t-tests and McNemar's tests served as sensitivity analyses for the matched-pairs design and yielded consistent results; ANCOVA was not feasible because preoperative functional capacity was not measured.

RESULTS

Flow diagram

Figure 1 Presents the flow diagram of participant progression. Of the 68 patients screened for eligibility, 14 were excluded (severe surgical complications, n = 7; cognitive impairment, n = 4; declined to participate, n = 3). The remaining 54 patients were enrolled into 27 matched pairs and allocated to the control or intervention group. All participants completed the study with no dropouts.

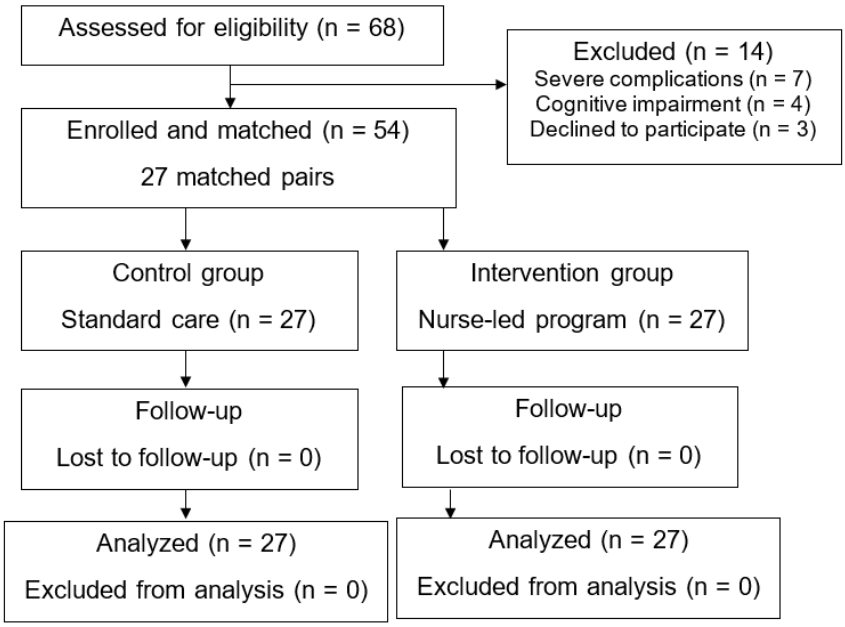


Figure 1. Flow diagram.

Table 2. Demographic and clinical characteristics by study group (N = 54).

Characteristics	Total (N = 54)	Control (n = 27)	Intervention (n = 27)	p-value
Sex, n (%)				.484[a]
Male	44 (81.5)	23 (85.2)	21 (77.8)	
Female	10 (18.5)	4 (14.8)	6 (22.2)	
Age, n (%)				.902[b]
<65 years	7 (13.0)	3 (11.1)	4 (14.8)	
65–74 years	32 (59.3)	17 (63.0)	15 (55.6)	
75–84 years	15 (27.8)	7 (25.9)	8 (29.6)	
Marital status, n (%)				.393[a]
Married	35 (64.8)	16 (59.3)	19 (70.4)	
Single/Widowed/Divorced	19 (35.2)	11 (40.7)	8 (29.6)	
Education level, n (%)				.393[a]
Primary school	35 (64.8)	16 (59.3)	19 (70.4)	
Secondary school or higher	19 (35.2)	11 (40.7)	8 (29.6)	
Monthly income, n (%)				.467[b]
<15,000 THB	45 (83.3)	24 (88.9)	21 (77.8)	
≥15,000 THB	9 (16.7)	3 (11.1)	6 (22.2)	
Aneurysm location, n (%)				.508[a]
Infrarenal	42 (77.8)	22 (81.5)	20 (74.1)	
Juxtarenal/Suprarenal	12 (22.2)	5 (18.5)	7 (25.9)	
Aneurysm size, n (%)				1.000[a]
Small (<4 cm)	14 (25.9)	7 (25.9)	7 (25.9)	
Medium (4–5.4 cm)	16 (29.6)	8 (29.6)	8 (29.6)	
Large (≥5.5 cm)	24 (44.4)	12 (44.4)	12 (44.4)	
Type of surgery, n (%)				1.000[a]
EVAR	24 (44.4)	12 (44.4)	12 (44.4)	
Open repair	30 (55.6)	15 (55.6)	15 (55.6)	
Surgery urgency, n (%)				1.000[a]
Elective	28 (51.9)	14 (51.9)	14 (51.9)	
Emergency	26 (48.1)	13 (48.1)	13 (48.1)	
Comorbidities				
Hypertension	42 (77.8)	21 (77.8)	21 (77.8)	1.000[a]
Diabetes mellitus	15 (27.8)	8 (29.6)	7 (25.9)	.765[a]
Dyslipidemia	28 (51.9)	13 (48.1)	15 (55.6)	.584[a]
Chronic kidney disease	10 (18.5)	6 (22.2)	4 (14.8)	.484[a]
Coronary artery disease	12 (22.2)	7 (25.9)	5 (18.5)	.508[a]
COPD	8 (14.8)	5 (18.5)	3 (11.1)	.702[b]

[a]Chi-square test; bFisher's exact test. **Abbreviations**: EVAR: endovascular aneurysm repair; THB: Thai Baht.

Table 3. Comparison of functional capacity scores between groups (N = 54).

Variable	Total (N = 54)	Control (n = 27)	Intervention (n = 27)	Mean Difference (95% CI)	Cohen's d (95% CI)	t (df)	p-value
Barthel ADL Index Score, (20-point), Mean ± SD	10.70 ± 4.63	9.11 ± 5.56	12.30 ± 2.95	3.19 (0.74 to 5.64)	0.72 (0.16 to 1.27)	−2.63 (39.52)	.012*

*p < .05. **Abbreviations**: ADL: Activities of Daily Living; SD: standard deviation.

Table 4. Comparison of postoperative complications between groups (N = 54).

Complications	Control (n = 27) n (%)	Intervention (n = 27) n (%)	ARR (95% CI)	RR (95% CI)	χ^2	p-value
No complications	4 (14.8)	11 (40.7)			4.52	.033*
Complications occurred	23 (85.2)	16 (59.3)	25.9% (3.2 to 48.6)	0.70 (0.50 to 0.97)		

*NNT = 3.86 (95% CI: 2.05 to 31.25). *p < .05.

Table 5. Incidence of specific postoperative complications by category and study group (N = 54).

Complication Category	Control n (%)	Intervention n (%)
Cardiovascular		
Arrhythmia	8 (29.6)	4 (14.8)
Hypotension requiring vasopressors	6 (22.2)	3 (11.1)
Deep vein thrombosis	2 (7.4)	0 (0.0)
Myocardial ischemia	1 (3.7)	1 (3.7)
Respiratory		
Atelectasis	10 (37.0)	5 (18.5)
Pneumonia	4 (14.8)	2 (7.4)
Prolonged mechanical ventilation (>48 h)	3 (11.1)	1 (3.7)
Wound and infection		
Surgical site infection	3 (11.1)	2 (7.4)
Wound dehiscence	1 (3.7)	0 (0.0)
Graft infection	0 (0.0)	0 (0.0)
Urinary		
Urinary retention	5 (18.5)	3 (11.1)
Urinary tract infection	3 (11.1)	1 (3.7)
Acute kidney injury	2 (7.4)	1 (3.7)
Other		
Paralytic ileus	6 (22.2)	3 (11.1)
Delirium	2 (7.4)	1 (3.7)
Falls during mobilization	0 (0.0)	1 (3.7)

Demographic and clinical profile

Table 2 presents the demographic and clinical characteristics of participants in both groups. The majority of participants were male, comprising 85.2% of the control group and 77.8% of the intervention group. Most participants fell within the 65 to 74 year age range (59.3% overall). Regarding marital status, 64.8% were married. Educational attainment was relatively low, with 64.8% having completed only primary school. The majority (83.3%) reported monthly incomes below 15,000 Thai Baht.

In terms of clinical characteristics, infrarenal aneurysms were most common, accounting for 77.8% of cases. When classified by size, 25.9% of aneurysms were small (less than 4 cm), 29.6% were medium (4 to 5.4 cm), and 44.4% were large (5.5 cm or greater). Open surgical repair was performed in 55.6% of cases, while the remaining 44.4% underwent endovascular repair. The distribution of elective versus emergency surgeries was nearly equal at 51.9% and 48.1%, respectively.

Statistical testing revealed no significant differences between the control and intervention groups for any demographic or clinical variable (all p-values > .05). This confirms that our matching procedure was successful in creating comparable groups. Demographic variables such as marital status, education level, and monthly income were documented because previous research has identified these factors as potential confounders of postoperative functional recovery [10–12]. Comorbidity data are also presented in Table 2; no significant differences between groups were observed for any variable, supporting the comparability of the two groups.

Functional capacity outcomes

The comparison of functional capacity between groups appears in Table 3. Patients in the intervention group had a mean Barthel ADL Index score of 12.30 (SD = 2.95), while patients in the control group had a mean score of 9.11 (SD = 5.56). The independent samples t-test showed

that this difference was statistically significant (t = −2.63, df = 39.52, p = .012). In practical terms, the intervention group's average score falls within the mild dependence category, whereas the control group's average score falls within the moderate dependence category. The mean difference in Barthel ADL Index scores between the intervention and control groups was 3.19 points (95% CI: 0.74 to 5.64), corresponding to a Cohen's d of 0.72 (95% CI: 0.16 to 1.27), indicating a moderate-to-large effect.

Postoperative complications

Table 4 shows the comparison of postoperative complications between groups. In the intervention group, 16 patients (59.3%) experienced at least one complication, while in the control group, 23 patients (85.2%) had complications. Conversely, 11 patients (40.7%) in the intervention group remained free of complications compared to only 4 patients (14.8%) in the control group. The chi-square test confirmed that this difference was statistically significant ($\chi^2 = 4.52$, p = .033). For postoperative complications, the absolute risk reduction was 25.9 percentage points (95% CI: 3.2% to 48.6%), corresponding to a number needed to treat of 3.86 (95% CI: 2.05 to 31.25). Subgroup analyses by surgical approach (EVAR vs. open repair) and urgency (elective vs. emergency) were not performed because further stratification of 27 participants per group would yield subgroups too small for meaningful comparison.

Complications were defined using standardized clinical criteria. Cardiovascular complications were identified based on continuous hemodynamic monitoring and electrocardiographic findings. Respiratory complications were diagnosed through clinical assessment, chest radiography, and arterial blood gas analysis. Wound complications were determined by clinical inspection using established wound assessment criteria, and urinary complications were identified through urinalysis, urine culture, and fluid balance monitoring. Both major and minor events were recorded, which accounts for the relatively high overall complication rates observed in this study. Regarding intervention-related adverse events, one patient (3.7%) in the intervention group experienced a fall during assisted mobilization on postoperative day 3; the fall did not result in injury and did not require modification of the rehabilitation protocol. No other intervention-related adverse events were observed.

DISCUSSION

This study found that a nurse-led rehabilitation promotion program was associated with significantly higher functional capacity and a lower incidence of postoperative complications in patients who had undergone abdominal aortic aneurysm surgery. Because the two groups were well matched on demographic and clinical characteristics at baseline, the observed differences are unlikely to be fully explained by preexisting between-group differences, although unmeasured confounders cannot be ruled out.

The finding that intervention patients achieved higher functional capacity scores has important practical implications. The difference of approximately 3 points on the Barthel Index may seem modest numerically, but it corresponds to meaningful improvements in activities that matter greatly to patients—being able to feed oneself, bathe independently, or walk without assistance. We also noted that scores in the control group varied considerably (as reflected in the larger standard deviation), suggesting that without structured rehabilitation support, recovery trajectories are less predictable. Better functional status at discharge has downstream benefits: patients can return home sooner, family members face less caregiving burden, and healthcare resources may be used more efficiently.

These results are consistent with what other researchers have found in related surgical populations. Yılmaz and colleagues [22] reported that a nurse-led transitional care model improved functional autonomy and quality of life in elderly patients after open heart surgery. Premkumar and colleagues [14] showed that nurse-led cardiac rehabilitation enhanced physical activity levels and medication adherence after coronary interventions. While those studies focused on cardiac patients, who differ from abdominal aortic aneurysm patients in age profile and extent of vascular disease, the underlying principle appears to hold: structured nursing interventions that begin before surgery and continue through the early recovery period can accelerate functional restoration. The somewhat larger effect we observed might reflect the specific design of our intervention, which addressed concerns particular to vascular surgery patients such as wound care, activity restrictions related to the surgical graft, and signs of complications that patients should watch for at home.

The reduction in postoperative complications we observed also carries clinical significance. Complications after abdominal aortic aneurysm surgery increase the risk of death, prolong hospitalization, and add substantially to healthcare costs. In our study, the complication rate dropped from 85.2% in the control group to 59.3% in the intervention group—a difference of about 26 percentage points. The relatively high complication rates in both groups reflect our broad operational definition, which captured minor events such as transient urinary retention and mild atelectasis alongside major complications. The high proportion of emergency cases (48.1%) and the predominantly elderly population further contributed to these rates. Future studies should employ a validated severity grading system such as the Clavien-Dindo classification to facilitate cross-study comparisons. For the predominantly elderly patients who undergo this type of surgery, avoiding complications also means less disruption to their lives and less burden on the family members who would otherwise need to provide extended care.

Our findings align with reports on enhanced recovery after surgery protocols, which have shown that structured perioperative approaches can reduce adverse events [8]. A recent systematic review by Sakashita and colleagues [15] found that nurse-led transitional care interventions lowered hospital readmission rates, particularly when follow-up extended beyond the first few weeks after discharge. The comprehensive nature of our program—which combined preoperative education, respiratory training, progressive mobilization, and ongoing nursing surveillance—may explain why we saw benefits in both functional capacity and complication rates. Each component addresses a different aspect of recovery, and their combined effect may be greater than any single intervention alone. Unlike physiotherapy-based programs that focus primarily on physical

exercise, our nurse-led approach addresses the full perioperative spectrum, including psychological preparation, graft-specific precautions, respiratory training tailored to abdominal surgery, and family education. This comprehensive scope may partly explain the concurrent improvements in both functional capacity and complication rates. The program required approximately 30 to 45 additional minutes of nursing time per patient per day. Although formal workload and satisfaction measurements were beyond the scope of this study, future research should evaluate these aspects to determine the program's long-term feasibility.

Several features of this study strengthen our confidence in the findings. First, the matched-pairs allocation procedure successfully equalized the two groups on key characteristics that could have influenced outcomes. Second, we used the Barthel Index, a well-established measure of functional capacity that has been validated in Thai populations and showed good reliability in our pilot testing. Third, our intervention was grounded in a recognized theoretical framework and incorporated evidence-based practices rather than ad hoc components.

Several limitations should be considered when interpreting these findings. First, the single-center setting limits generalizability. Second, the sample size, while adequate for detecting large effects, precluded subgroup analyses by surgical approach or urgency. Third, the quasi-experimental design without true randomization leaves residual confounding possible, particularly from unmeasured aspects of disease severity. Fourth, the posttest-only design precluded verification of equivalent baseline functional capacity. Fifth, the research nurse delivered the intervention and assessed outcomes, introducing a risk of observer bias that likely inflated the observed effect. Sixth, because both groups were cared for in the same units, contamination between groups cannot be ruled out. After Bonferroni correction (adjusted $\alpha = .025$), the complication outcome ($p = .033$) did not remain statistically significant. Finally, follow-up was limited to the immediate postoperative period.

Future studies should employ multi-center randomized controlled trials with blinded outcome assessment, pretest–posttest measurement, and stratified analyses by surgical approach and urgency. Longer follow-up is needed to determine whether early functional gains are sustained, and component-level studies could identify the most effective elements of the program. Economic evaluations, together with assessment of nursing workload, protocol adherence, and staff satisfaction, would inform sustainability. Implementation studies in resource-limited settings should also examine task-sharing models that integrate the program into existing ward staffing to determine whether comparable effects can be achieved without dedicated research personnel.

CONCLUSION

This study showed that a nurse-led rehabilitation promotion program improved functional capacity and reduced postoperative complications in patients after abdominal aortic aneurysm surgery at Nakornping Hospital. The findings provide evidence to support incorporating structured nurse-led rehabilitation into perioperative care for patients undergoing vascular surgery

CONFIDENTIALITY

All data were de-identified, securely stored in a password-protected system accessible only to the research team, and analyzed in aggregate form. Confidentiality and privacy were strictly maintained, and all records will be retained for five years in accordance with institutional policy and securely destroyed thereafter.

ACKNOWLEDGEMENT

The authors express appreciation to the nursing staff of Nakornping Hospital for their contributions to study implementation. Gratitude is also extended to expert panel members who participated in instrument validation procedures.

AUTHORS' CONTRIBUTIONS

(I) Conceptualization: M.R., U.J.; (II) Data curation: M.R.; (III) Formal analysis: M.R., U.J.; (IV) Methodology: M.R., U.J.; (V) Project administration: M.R.; (VI) Visualization: M.R.; (VII) Writing – original draft: M.R.; (VIII) Writing – review & editing: M.R., U.J.; (IX) Supervision: U.J.

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