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# Clinical outcomes and quality of life in patients with acute and subacute type B aortic dissection after thoracic endovascular aortic repair

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**Abstract**

**Objective:** Thoracic endovascular aortic repair (TEVAR) is considered the mini-invasive treatment of choice for patients with Stanford type B aortic dissection (TBAD). This study aimed to investigate the clinical outcomes and quality of life (QoL) in patients with acute and subacute TBAD after TEVAR.

**Methods:** From January 2014 until July 2016, 22 acute patients (Group A) and 18 subacute patients received TEVAR (Group B), and 13 patients were managed non-operatively (Group C). The Medical Outcomes Study Short Form-36 was used to assess QoL preoperatively and after TEVAR. Operative techniques and complications were retrospectively analyzed.

**Results:** The role emotion, vitality, and mental health domains scored well preoperatively. Except for role emotion, vitality, and mental health, the remaining domains significantly improved after TEVAR. There was no significant difference in QoL metrics between Groups A and B. In Group C, bodily pain and social functioning domains were improved, and role emotion was decreased, with no improvement in the remaining domains. The 3-year survival rates were 95.5%, 100%, and 85.7% for Groups A, B, and C, respectively.

**Conclusions:** TEVAR may be safe and effective in patients with acute and subacute TBAD with similar and favorable clinical and QoL metrics.

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## Introduction

Aortic dissection is a life-threatening disease of sudden onset, and may be associated with severe complications. An open operation is a challenge and may be associated with a relatively high rate of mortality and morbidity.[1] In patients with acute and subacute Stanford type B aortic dissection (TBAD), thoracic endovascular aortic repair (TEVAR) is considered the treatment of choice. Although previous studies have reported the clinical/technical outcomes and survival rates of TEVAR, assessment of quality of life (QoL) after TEVAR still needs to be examined. TEVAR is mini-invasive, but the effect of other factors on QoL has not been fully evaluated yet. There have only been a few published studies on patients' QoL after TEVAR,[2,3] and postoperative QoL with comparison of acute and subacute TBAD has rarely been considered. Therefore, this study aimed to evaluate the midterm outcomes and QoL in patients with acute and subacute TBAD after TEVAR.

## Methods

### *Selection of patients*

This retrospective study was approved by the Ethics Committee and The Institutional Review Board of Zhengzhou University (Zhengzhou, China) in December 2016. Written informed consent was obtained from all patients before the interventional procedure and the study was performed in accordance with the relevant guidelines and regulations. All patients' data are presented anonymously to ensure the patients' privacy. From January 2014 until July 2016, 40 patients with TBAD received TEVAR, and 13 patients received conservative treatments. Treatment options were provided to all patients, including open aortic repair in the setting of acute type B dissection, and the treatment was chosen by the patients. Indications for TEVAR included persistent chest pain, uncontrolled hypertension, malperfusion, early aortic expansion, and signs of rupture, such as hemothorax. Patients with acute TBAD (<15 days) and TEVAR were enrolled in Group A, patients with subacute TBAD (15–92 days) and TEVAR were enrolled in Group B, and patients who were managed non-operatively were enrolled in Group C.[4,5] American guidelines were used in our daily practice of TEVAR.[6] All patients were asked to answer short form-36 (SF-36) questionnaires and computed tomographic (CT) scanning was performed during routine follow-up.

### *Questionnaires and data collection*

The Medical Outcomes Study Short Form-36 questionnaire (MOS SF-36) was used to assess QoL. SF-36 follow-up was achieved by a telephone call for patients who were unable to show up for follow-up owing to refusing to attend the clinic. Patients who were unable to fill in the MOS SF-36 questionnaires themselves were excluded. All

patients were followed up and had CT scanning performed.

### Statistical analysis

Data are shown as mean ± standard deviation. One-way and two-way analysis of variance was used for continuous variables. The Kruskal–Wallis test was used for a nonparametric test. The chi-square test/Fisher's exact test was used was used to test categorical variables. A $P$ value of $<0.05$ was considered statistically significant. Statistical analysis was performed with Prism 5.0 software (GraphPad Software Inc., San Diego, CA, USA).

## Results

### Patients' cohort

Of the total patients, 22 acute patients (Group A) and 18 subacute patients received TEVAR (Group B), and 13 patients were managed non-operatively (Group C). The operative risk profile included arterial hypertension (n = 31, 58.5%), smoking (n = 28, 52.8%), peripheral vascular disease (n = 5, 9.4%), and previous myocardial ischemia (n = 5, 9.4%). Forty-seven patients had the uncomplicated type of TBAD and seven had dissections accompanied by ulcerations and aortic intramural hematoma. Preoperatively, 47 patients complained of pain (thoracalgia, dorsodynia, osphyalgia, and abdominal pain) and 5 patients had chest distress. Demographics of the patients were similar among the three groups (Table 1).

### QoL

The distributions of MOS SF-36 domain scores are shown in Figure 1. SF-36 observation showed that the best-scoring domain was role emotion before TEVAR. The vitality and mental health domains also scored well preoperatively. The worst scoring domain was role physical before the operation. Except for role emotion, vitality, and mental health, all remaining domains were significantly improved after TEVAR compared with before TEVAR (all $P < 0.01$). There was no significant difference in QoL metrics between Groups A and B. In Group C, bodily pain and social functioning were

**Table 1.** Demographics of patients with Stanford type B aortic dissection.

| Variables | Group A | Group B | Group C | $P$ |
|---|---|---|---|---|
| Patients, n | 22 | 18 | 13 | |
| Male sex, n (%) | 19 (86.4) | 16 (88.9) | 11 (84.6) | 0.9388 |
| Mean age (range), years | 54.8 ± 3.2 (32–81) | 46.1 ± 2.9 (28–73) | 55.2 ± 4.1 (29–79) | 0.1122 |
| Type, uncomplicated dissections, n (%) | 21 (95.5) | 15 (83.3) | 11 (84.6) | 0.4206 |
| Course of disease, days | 4.2 ± 0.5 (0.1–7.0) | 29.0 ± 4.1 (15.0–73.0) | 5.0 ± 2.0 (0.2–24.0) | <0.0001 |
| Previous medical history, n (%) | | | | |
| Myocardial ischemia | 1 (4.5) | 2 (11.1) | 2 (15.4) | 0.5452 |
| Peripheral vascular disease | 2 (9.1) | 1 (5.6) | 2 (15.4) | 0.6509 |
| Hypertension | 14 (63.6) | 10 (55.6) | 7 (53.8) | 0.8109 |
| Smoking | 11 (50.0) | 10 (55.6) | 7 (53.8) | 0.9372 |
| Chronic renal insufficiency | 1 (4.5) | 0 (0) | 1 (7.7) | 0.9268 |
| Clinical symptoms, (%) | | | | |
| Pain | 20 (90.9) | 16 (88.9) | 11 (84.6) | 0.8506 |
| Chest distress | 2 (9.1) | 2 (11.1) | 1 (7.7) | 0.9472 |

Values are mean ± standard deviation, range, n, or n (%). Group A: patients with acute Stanford type B aortic dissection and thoracic endovascular aortic repair; Group B: patients with subacute Stanford type B aortic dissection and thoracic endovascular aortic repair; Group C: patients who were managed non-operatively.

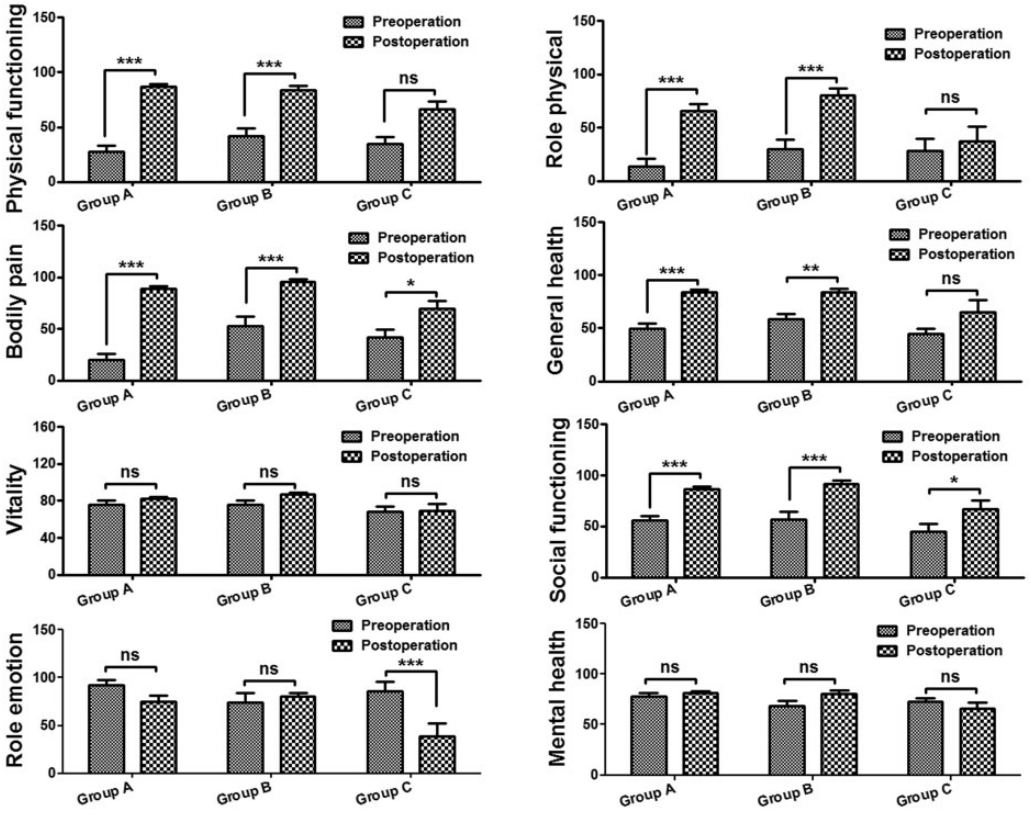


**Figure 1.** Distributions of Medical Outcomes Study Short Form-36 domain scores before repair and during follow-up.

significantly improved (both $P < 0.05$), and role emotion was decreased ($P < 0.001$) after treatment compared with before treatment, and the remaining domains were not changed. The majority of patients responded that their condition was significantly improved after repair compared with 1 year previously ($P < 0.0001$).

## *Operative details*

Endovascular procedures consisted of sole TEVAR in 31 (77.5%) patients and TEVAR combined with bypass of the left subclavian artery and left common carotid artery bypass in 4 (10%) patients. TEVAR with chimney stenting of the left subclavian artery was performed in three (7.5%) patients. TEVAR combined with peripheral artery stenting was performed in two (5.0%) patients, including one stent for left femoral artery occlusion in Group A and one renal artery stent in Group B. The mean distance between dissection and the left subclavian artery was $20.5 \pm 1.7$ mm (range: 5–30 mm), and 13 patients had to receive left subclavian artery coverage. The operative data were not significantly different between Groups A and B (Table 2). Reperfusion of the false lumen was found in 10 (25.0%) patients, which ceased without treatment of TEVAR, except for one who received additional cuff implantation.

**Table 2.** Operative techniques in patients with Stanford type B aortic dissection.

| | Group A | Group B | Total |
|---|---|---|---|
| Type of TEVAR | 22 | 18 | 40 |
| Sole TEVAR, n (%) | 18 (81.8) | 13 (72.2) | 31 (77.5) |
| TEVAR + bypass, n (%) | 1 (4.5) | 3 (16.7) | 4 (10.0) |
| TEVAR + chimney stent, n (%) | 2 (9.1) | 1 (5.6) | 3 (7.5) |
| TEVAR + peripheral artery stent, n (%) | 1 (4.5) | 1 (5.6) | 2 (5.0) |
| Left subclavian artery coverage, n (%) | 9 (40.9) | 4 (22.2) | 13 (32.5) |
| Distance between dissection and the left subclavian artery, mm | 21.1 ± 2.2 (5–30) | 19.3 ± 3.0 (10–30) | 20.5 ± 1.7 (5–30) |
| Size of the covered stent for the thoracic aorta, mm | | | |
| Proximal diameter of the stent | 33.7 ± 0.6 (30–36) | 34.6 ± 0.9 (30–44) | 34.2 ± 0.5 (30–44) |
| Distal diameter of the stent | 30.8 ± 0.6 (26–36) | 31.3 ± 1.3 (22–44) | 31.0 ± 0.7 (22–44) |
| Length of the stent | 171.7 ± 5.0 (140–200) | 175.0 ± 5.1 (150–200) | 173.2 ± 3.5 (140–200) |
| Perioperative complications, n (%) | 5 (22.7) | 4 (22.2) | 9 (22.5) |
| Reverse tear of dissection | 0 (0) | 1 (5.6) | 1 (2.5) |
| Hematopericardium | 0 (0% | 1 (5.6) | 1 (2.5) |
| Pleural effusion | 1 (4.5) | 1 (5.6) | 2 (5.0) |
| Postoperative delirium | 2 (9.1) | 0 (0) | 2 (5.0) |
| Arterial blood flow blocked | 0 (0) | 1 (5.6) | 1 (2.5) |
| Respiratory suppression | 1 (4.5) | 0 (0) | 1 (2.5) |
| Left internal jugular vein thrombosis | 1 (4.5) | 0 (0) | 1 (2.5) |

Values are mean ± standard deviation, range, n, or n (%). Group A: patients with acute Stanford type B aortic dissection and TEVAR; Group B: patients with subacute Stanford type B aortic dissection and TEVAR; TEVAR: thoracic endovascular aortic repair.

### *Early outcomes*

One patient died of aortic rupture after successful repair in Group A and no deaths occurred in Group B during the observational period. There was a variety of minor complications after TEVAR, including postoperative delirium, hematopericardium, and pleural effusion. Patients who suffered from pleural effusion required pleural drainage (n = 2, 5.0%). Open operational repair was performed in Group B in one patient because of a reverse tear of TBAD 11 days after TEVAR (Table 2).

### *Late outcomes*

All patients were followed up, except for one patient who was lost to follow-up in Group B. None of the patients died after repair due to complications, such as rupture of the aorta, low cardiac output, multiple organ failure, or bleeding. However, four patients died in Group C, including two who died of rupture of the aorta after admission to hospital, one who died of an advanced tumor, and one who died of bleeding after being discharged from hospital. Two patients in Group C underwent interventional repair because of enlargement of dissection after 1 and 3 months. One patient in Group B showed recurrent dissection 2 years later and underwent a second TEVAR. The 3-year survival rates were 95.5%, 100%, and 85.7% for Groups A, B, and C, respectively.

## Discussion

Acute TBAD may enlarge and even rupture, and potentially cause death. An open operation in patients with TBAD is a challenge and may be associated with a relatively high rate of mortality and morbidity.[1]

Currently, TEVAR is considered the minimally invasive treatment of choice for TBAD.

The SF-36 questionnaire has been used for measurement of QoL after thoracic aortic surgery,[7–9] including patients with acute type A aortic dissection who receive open repair[2,3] and aortic surgery,[10] as well as patients with abdominal aortic aneurysm repair.[11,12] Two studies examined QoL following TEVAR with and without coverage of the left subclavian artery,[13,14] and one study investigated QoL by the Swedish Health-Related Quality of Life Survey questionnaire for patients with conservatively treated acute TBAD.[15] However, there have been no studies of QoL in patients with TBAD after TEVAR. Therefore, our study mainly focused on QoL after TEVAR. In our study, the role emotion, vitality, and mental health domains scored well preoperatively. Except for role emotion, vitality, and mental health, all remaining domains were significantly improved after TEVAR. There were no significant differences in domains between Groups A and B. In Group C, bodily pain and social functioning were improved, and role emotion was decreased after treatment compared with before treatment. The remaining domains did not change after treatment in Group C. The majority of patients responded that their condition was greatly improved after repair compared with 1 year previously.

The main limitation of this retrospective study is the single-center approach with a small sample size, which does not allow for prospective randomization. A registry for TEVAR could produce more precise data on QoL. Therefore, further studies involving a larger population are required. Patients undergoing chimney stent bypass + TEVAR vs. TEVAR alone may have led to different results.

In conclusion, TEVAR may be safe and effective in patients with acute and subacute TBAD with similar and favorable clinical and QoL metrics.

## Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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