Original Article

Short- and mid-term outcomes of the aortic root repair versus root replacement in acute type A aortic dissection

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Background: In patients with acute acute type A aortic dissection (ATAAD) requiring emergency surgery, the use of aortic root repair or replacement remains a topic of controversy. The purpose of this study was to evaluate the early and mid-term clinical outcomes after aortic root repair or replacement, and to provide a theoretical basis for such patients.

Methods: The study included 442 consecutive patients with ATAAD who underwent aortic root repair [n=227, repair group (RG)] or the Bentall procedure [n=215, Bentall group (BG)] at our hospital between December 2018 and December 2021. The indications for aortic root replacement were aortic root sinus diameter of ≥4.5 cm, severe sinotubular junction involvement, unrepairable aortic valvulopathy, severe coronary ostium involvement, connective tissue disease, intimal tear at the aortic root, or dissection involving three aortic sinuses. The primary outcome was the survival rate and incidence of reoperation between the two groups.

Results: The in-hospital and 30-day mortality rates in the RG and BG were 10.1% and 11.6%, respectively. The two groups had no significant difference (P=0.613). Multivariate logistic analysis showed that aortic root surgery did not influence the in-hospital or 30-day mortality rates. The mean follow-up time was 36.8±11.6 months (median, 33.4 months; interquartile range, 27.0–45.2 months). The 5-year survival rates for the RG and BG were 88.1% and 85.9%, respectively (P=0.650). During the follow-up period, only one patient in the BG group underwent proximal aortic reoperation.

Conclusions: Continuous improvement of aortic root repair technology and identification of its indications may help reduce reoperation rates. Aortic root repair can be considered safe and feasible.

Keywords: Aortic root; acute type A aortic dissection (ATAAD); Bentall procedure; root repair

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Introduction

Acute type A aortic dissection (ATAAD) is a life-threatening, catastrophic disease with an estimated incidence of 2.9 cases per 100,000 people per year (1). Aortic dissection has the highest mortality rate within 48 h after symptom onset and requires urgent surgical treatment. ATAAD lesions often manifest with extensive root involvement, resulting in varying degrees of aortic insufficiency (AI), coronary artery involvement, and destruction of the inherent structure of the aortic root.

The treatment principle for the aortic root is restoration of a well-functioning aortic valve, obliteration of the false lumen, and resolution of the coronary malperfusion (2). The ongoing debate centers on determining the optimal that achieves maximum benefits while minimizing associated risks.

Although aortic root replacement (the Bentall procedure) is a standard operation that greatly avoids the risk of secondary surgery (2), patients face the burden of lifelong anticoagulation, risk of bleeding and thrombosis after using mechanical valves, and risk of valve-associated dissection and structural valve degradation caused by biological valves. Therefore, aortic root repair surgery that preserves the valve and reconstructs the anatomical structure of the root is recommended.

Owing to differences in the indications and surgical methods of root repair in different institutions, inconsistent results have been published regarding the long-term durability of root repair (3,4).

This study aimed to compare the early- and mid-term clinical outcomes of root replacement and repair, aiming to consolidate experiences in root surgery and provide clinical evidence for future selection of surgical procedures. We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-56/rc).

Highlight box

Key findings
- The choice of the aortic root surgery method had no effect on perioperative mortality. The mid-term survival rate of root repair surgery was similar to that of root replacement, with no proximal aortic reoperation performed during follow up. The application of improved sandwich technology at our center demonstrated safety and feasibility.

What is known and what is new?
- Aortic root repair improves the quality of life of patients after surgery and is safe and feasible during the perioperative period.
- Aortic root repair has an excellent low reoperation rate during the mid-term follow-up period.

What is the implication, and what should change now?
- We should apply repair as much as possible in patients who meet the indications of aortic root repair. In the future, the technique should be continuously improved and patients should be followed up for a long time.

Methods

Study design

From December 2018 to December 2021, 442 patients with ATAAD (352 males and 90 females) underwent Bentall procedure or aortic root repair (modified sandwich technique) at The First Affiliated Hospital of The Air Force Military Medical University. They were diagnosed using computed tomography angiography. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This retrospective study was approved by the Ethics Committee of The First Affiliated Hospital of The Air Force Medical University (No. 20120216-4) and informed consent was taken from all the patients.

Indications

Among the 442 ATAAD patients, 227 were included in the repair group (RG) and 215 in the Bentall group (BG). The indications for aortic root replacement were patients with aortic root sinus diameter of ≥4.5 cm, severe sinotubular junction involvement, unrepairable aortic valvulopathy, severe coronary ostium involvement, connective tissue disease, intimal tear at the aortic root or dissection involving three aortic sinuses; the remaining patients underwent aortic root repair.

Outcomes

Early results were determined based on in-hospital/30-day clinical results. All patients were followed up and evaluated at 1, 3, 6, and 12 months after discharge and annually after that. Postoperative clinical data were obtained through outpatient examinations and telephone interviews. The baseline data, perioperative outcomes, all-cause mortality, and proximal reoperation rates were compared between the two groups.

Operative techniques

Our previous studies introduced details of cerebral perfusion and extracorporeal circulation (5,6). The Bentall procedure was performed using artificial blood vessels combined with biomechanical valves in a standard manner. Aortic root repair surgery was performed using a modified sandwich operation.

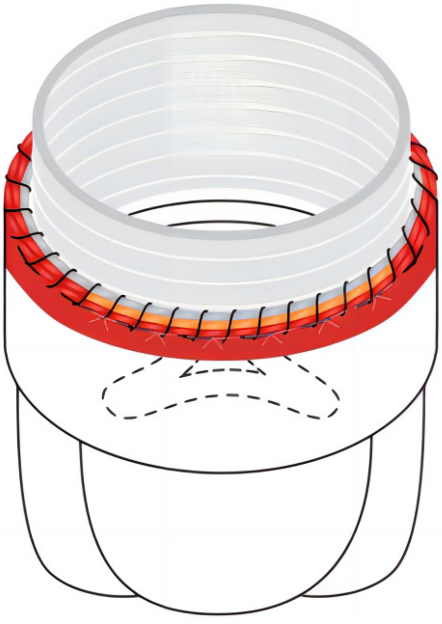

Figure 1 Aortic root repair (sandwich surgery) schematic diagram. The Teflon felt is represented by yellow; the vascular graft and autologous pericardium are represented by gray and red, respectively; the double-layer reinforcement using 5-0 prolene suture line is represented by black; and the interrupted suture using 4-0 prolene suture line is represented by white.

A transverse incision was made above the junction of the aortic sinus tube to sever the aorta, and the thrombus in the proximal end of the junction of the aortic sinus tube was completely removed. After exploring the extent of dissection of the aortic sinus, the Teflon felt was cut to a matching size according to the condition of the dissection involving the aortic sinus, and was placed in the false lumen of the proximal aortic dissection. A vascular graft and autologous pericardium were placed inside and outside the aorta at the sinus tube junction. Two circles were continuously sutured using 5-0 prolene suture for fixation and reinforcement, then intermittent suture was performed with 4-0 prolene on the outer wall of the aorta involved in the dissection. For patients with severe aortic sinus tear, three suspension stitches were passed through the commissure head (using a 5-0 prolene) and suspended. The vascular graft was then everted, and end-to-end anastomosis was performed with the distal graft (*Figure 1*). The standard method for aortic arch repair is total arch replacement combined with stented elephant trunk implantation (7). Coronary artery bypass grafting (CABG) was performed using the great saphenous vein, indications for CABG included: previous bypass graft occlusion, aortic dissection extending to the coronary ostium, coronary artery disease or severe coronary artery calcification. Some patients underwent repairs for foramen ovale, mitral valve, and tricuspid valve. Cerebral oxygenation in the frontal cortex and the identification of potential cerebral hypoperfusion were monitored using near-infrared spectroscopy. The cerebral perfusion pressure was maintained at 60–70 mmHg; the cerebral perfusion flow was approximately 5–10 mL/(kg·min).

Statistical analysis

SPSS 25.0 (SPSS, Inc., Chicago, IL, USA) and Python 3.10 were used for statistical analyses. Continuous variables were presented as mean ± standard deviation. Categorical variables are expressed as absolute numbers and proportions. Kaplan-Meier analysis was used to evaluate survival. Differences in categorical variables were analyzed using the χ^2 test. Differences in continuous variables were tested using the Student's *t*-test or Mann-Whitney *U*-test. Multivariate analysis was performed using a binary logistic regression model to identify independent risk factors for in-hospital/30-day mortality. Statistical significance was established at values of P<0.05.

Results

Baseline characteristics and preoperative aortic dimensions

The preoperative demographic data are listed in *Table 1*. The average age of all patients was 51 [interquartile range (IQR), 44–57] years, and most of the patients were male individuals and those with hypertension. The RG included a higher proportion of patients with hypertension (88.1% *vs.* 59.1%) (P<0.001). Data including body mass index, diabetes history, smoking history, previous cardiogenic shock, and organ hypoperfusion were similar between the two groups (P>0.05). Significant differences were observed in preoperative aortic size between the two groups (P<0.05). The diameters of the ascending aorta, aortic sinus, and aortic annulus were significantly larger and the number of patients with moderate and the aforementioned aortic regurgitation was significantly higher in the BG than in the RG (P<0.05). In addition, patients in the BG had a lower preoperative creatinine level than that of patients in the RG (P=0.003). Furthermore, none of the patients in either group had Marfan syndrome or other connective tissue diseases.

Table 1 Demographics and preoperative outcomes

Characteristics	Entire cohort (n=442)	RG (n=227)	BG (n=215)	P values
Female sex	90 (20.4)	51 (22.5)	39 (18.1)	0.26
Age (years)	51 [44–57]	52 [45–58]	49 [41–56]	0.44
Body mass index (kg/m^2)	25.2±3.7	25.4±3.8	25±3.6	0.21
Hypertension	327 (74.0)	200 (88.1)	127 (59.1)	<0.001
Diabetes	40 (9.0)	21 (9.3)	19 (8.8)	0.88
Smoking habit	231 (52.3)	123 (54.2)	108 (50.2)	0.41
Previous cardiac surgery	7 (1.6)	1 (0.4)	6 (2.8)	0.04
Previous cerebrovascular accident/cerebral infarction	33 (7.5)	24 (10.6)	9 (4.2)	0.01
Cardiogenic shock	20 (4.5)	12 (5.3)	12 (5.6)	0.89
Preoperative creatinine (μmol/L)	101.1±78.7	111.8±69.9	88±86.9	0.003
Aortic insufficiency ≥ moderate	234 (52.9)	102 (44.9)	132 (61.4)	0.001
Ejection fraction (%)	56.4±4.7	57.2±4.6	55.3±4.8	0.001
Ascending aortic diameter (mm)	45.4±8.6	43.3±6.5	48.4±10.2	<0.001
Sinuses of Valsalva diameter (mm)	42.1±7.4	38.9±4.9	46.7±7.9	<0.001
Aortic annulus diameter (mm)	23.4±2.6	22.8±2.4	24.3±2.7	<0.001
Type of malperfusion syndrome				0.56
Cerebral	29 (6.6)	16 (7.0)	13 (6.0)	
Coronary	24 (5.4)	17 (7.5)	7 (3.3)	
Renal	30 (6.8)	14 (6.2)	16 (7.4)	
Mesenteric	17 (3.8)	11 (4.8)	6 (2.8)	
Spinal cord	2 (0.5)	1 (0.4)	1 (0.5)	
Iliofemoral	75 (17.0)	46 (20.3)	29 (13.5)	

Data are presented as median [interquartile range] or mean ± SD for continuous data and n (%) for categorical data. SD, standard deviation; RG, repair group; BG, Bentall group.

Operative data

Table 2 details surgical procedures in both groups. No significant differences between the BG and RG were observed in terms of cardiopulmonary bypass (CPB) time, aortic cross-clamping time, or hypothermic circulatory arrest time (P>0.05). In addition, in the RG group, 3.9% of patients underwent valve repair (n=9), and 41% of patients underwent valve resuspension (n=93).

Postoperative data and complication

In the BG, 9 of the 215 patients received bioprosthetic valve composite grafts. A total of 48 patients in the two groups died during the perioperative period, and the in-hospital and 30-day mortality rates of patients in the RG and BG were 10.1% and 11.6%, respectively (P>0.05). No significant differences in prolonged ventilation ≥48 h, the need for tracheostomy, pneumonia, re-exploration for excessive bleeding, new-onset cerebrovascular accident, hemiplegia, paraplegia, new-onset renal failure, new-onset renal failure requiring continuous renal replacement therapy, sepsis, extracorporeal membrane oxygenation, and total length of hospital and intensive care unit stays were observed between the two groups (P>0.05) (*Table 3*).

Follow up

We evaluated the postoperative mortality and complications in 442 patients during hospitalization. The mean clinical

Table 2 Intraoperative outcomes

Characteristics	Entire cohort (n=442)	RG (n=227)	BG (n=215)	P value
Distal aorta				0.20
No arch replacement	33 (7.5)	12 (5.3)	21 (9.8)	
Hemiarch replacement	2 (0.5)	1 (0.4)	1 (0.5)	
Total arch replacement	407 (92.1)	214 (94.3)	193 (89.8)	
Concomitant operations				
CABG	23 (5.2)	14 (6.2)	9 (4.2)	0.35
Foramen ovale repair	25 (5.7)	14 (6.2)	11 (5.1)	0.63
MV	7 (1.6)	3 (1.3)	4 (1.9)	0.65
TV	9 (2.0)	3 (1.3)	6 (2.8)	0.27
CPB time (min)	204.7±31.8	202.7±30.0	206.9±33.7	0.23
Crossclamp time (min)	95.9±19.5	95.1±18.3	96.5±20.4	0.55
HCA time (min)	33.3±5.8	33.6±5.5	33.0±6.2	0.31

Data are presented as mean ± SD for continuous data and n (%) for categorical data. SD, standard deviation; CABG, coronary artery bypass grafting; MV, mitral valve; TV, tricuspid valve; CPB, cardiopulmonary bypass; RG, repair group; BG, Bentall group; HCA, hypothermic circulatory arrest.

Table 3 Perioperative outcome characteristics

Characteristics	Entire cohort (n=442)	RG (n=227)	BG (n=215)	P value
Prolonged ventilation ≥48 h	104 (23.5)	51 (22.5)	53 (24.7)	0.59
Need for tracheostomy	29 (6.6)	14 (6.2)	15 (7.0)	0.73
Pneumonia	23 (5.2)	11 (4.8)	12 (5.6)	0.73
Re-exploration for excessive bleeding	6 (1.4)	3 (1.3)	3 (1.4)	0.95
New-onset cerebrovascular accident	25 (5.7)	10 (4.4)	15 (7.0)	0.24
Hemiplegia	2 (0.5)	1 (0.4)	1 (0.4)	0.97
Paraplegia	1 (0.2)	1 (0.4)	0	0.25
New-onset renal failure	36 (8.1)	15 (6.6)	21 (9.8)	0.23
New-onset renal failure requiring CRRT	43 (9.7)	18 (7.9)	25 (11.6)	0.19
Sepsis	1 (0.2)	0	1 (0.4)	0.23
ECMO	4 (0.9)	1 (0.4)	3 (1.4)	0.28
Total length of stay (d)	16.8±7.3	16.8±7.0	16.9±7.6	0.91
ICU stay (d)	5.8±4.6	5.7±4.6	5.9±4.7	0.82
In-hospital/30 days mortality	48 (10.9)	23 (10.1)	25 (11.6)	0.61
Residual aortic regurgitation (> moderate)	8 (1.8)	3 (1.3)	5 (2.3)	0.43
2-year aortic regurgitation (> moderate)	15 (3.4)	6 (2.6)	9 (4.2)	0.86

Data are presented as mean ± SD for continuous data and n (%) for categorical data. SD, standard deviation; CRRT, continuous renal replacement therapy; ECMO, extracorporeal membrane oxygenation; ICU, intensive care unit; RG, repair group; BG, Bentall group.

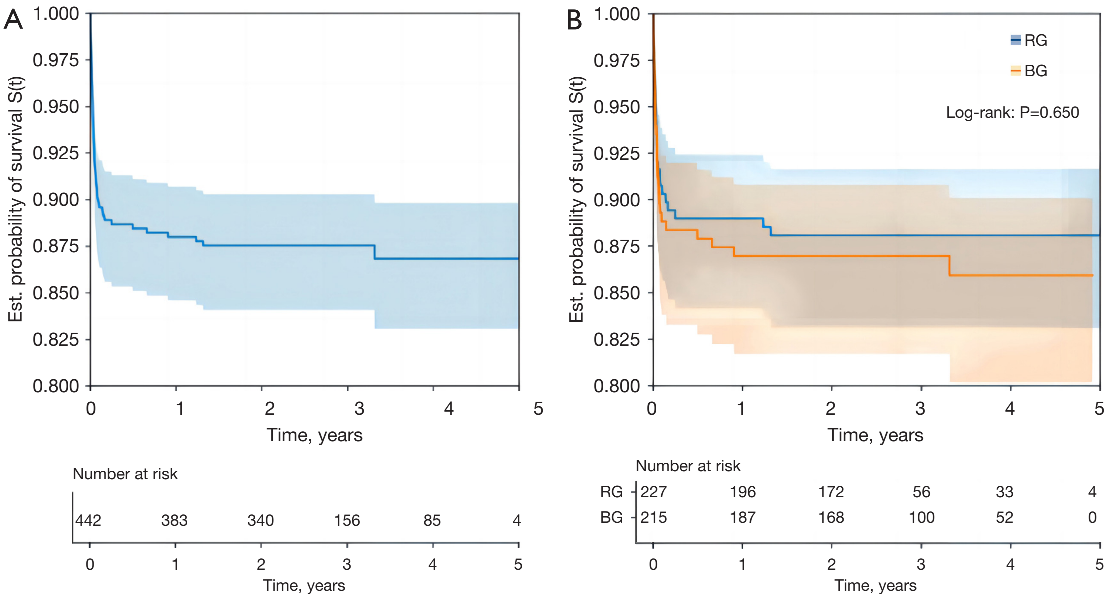

Figure 2 Long-term survival (Kaplan-Meier analysis) of patients with ATAAD after RG and BG. (A) Whole cohort; (B) separate subcohorts. BG, Bentall group; RG, repair group; ATAAD, acute type A aortic dissection.

Table 4 Multivariate analysis of risk factors associated with mortality

Characteristics	B	SE	Wald-χ^2	P value	OR	95% CI
Root surgery	0.421	0.353	1.417	0.23	1.523	0.762–3.044
Arch surgery	0.739	0.535	1.909	0.16	2.094	0.734–5.973
CABG	0.229	0.452	0.256	0.61	1.257	0.518–3.049
Preoperative creatinine	–0.005	0.002	8.080	0.004	0.995	0.991–0.998
Cerebral malperfusion	–1.615	0.421	14.711	<0.001	0.199	0.087–0.454
CPB time	–0.013	0.003	15.461	<0.001	0.987	0.981–0.994

B, regression coefficient; SE, standard error; OR, odds ratio; CI, confidence interval; CABG, coronary artery bypass grafting; CPB, cardiopulmonary bypass.

follow-up duration for 394 patients who survived was 36.8±11.6 months (median, 33.4 months; IQR, 27.0–45.2 months), the follow-up rate was 100%. According to the results of the Kaplan-Meier analysis, the 5-year survival rate of the entire cohort was 86.8%, and the 5-year survival rates of the RG and BG were 88.1% and 85.9%, respectively (*Figure 2*) (P=0.65). During the follow-up period, only one patient in the BG underwent reoperation, involving Bentall and CABG surgery, at an interval of 3.6 years (P=0.431).

Multivariate analysis

In the multivariate logistic regression analysis, preoperative creatinine level, preoperative cerebral malperfusion, and CPB time were identified as independent predictors of surgical mortality (P<0.05). The mortality rates were not significantly associated with the specific surgical methods employed for the aortic root and arch or whether CABG was performed (P>0.05) (*Table 4*).

Discussion

ATAAD is an immediately life-threatening disease associated with high mortality, and surgery is challenging. ATAAD often leads to aortic valve insufficiency and retrograde aortic root dissection, destroying the original physiological structure. Emergency surgery is the gold standard treatment for patients with ATAAD. Root surgery, such as Bentall's procedure, has become the standard procedure and has improved the long-term prognosis of many patients, particularly those with Marfan syndrome or aortic root aneurysms. Considering that in most patients, the dissection does not involve the aortic annulus and aortic valve and often involves the non-coronary sinus rather than the left and right coronary sinus, the aortic root can be treated conservatively through new intimal reconstruction and aortic valve re-suspension, which may address the risks of aortic valve replacement-related complications including prosthetic valve endocarditis and lifelong anticoagulation. Many techniques have been developed for aortic valve preservation, such as aortic valvuloplasty and valve-sparing aortic root replacement, including remodeling (Yacoub surgery) and reimplantation (David surgery) (8,9). The long-term durability of this technology has been recognized; however, its complexity hinders its widespread promotion (10). Different repair techniques, such as the adventitial inversion technique (11), direct suture technique (12), patch neointima technique (13), and other methods, including sandwich technology, are the most widely used, and their effects have been recognized (14). This study used an improved sandwich technology that is simple and easy to implement.

In this study, the RG and BG's in-hospital and 30-day mortality rates were relatively close at 10.1% and 11.6%, respectively. Brown *et al.* (4) reported 11.6% and 10.4% in-hospital mortality rates for root repair and replacement, respectively. Yang *et al.* (15) reported 30-day mortality rates of 6.2% and 8.2% in the two groups, and Xue *et al.* (16) reported 30-day mortality rates of 8.1% and 7.0%, respectively. In contrast, some studies suggested that root repair yields better outcomes than root replacement. For instance, Bojko *et al.* (3) reported that the hospital and 30-day mortality rates for root repair and replacement were 11.8% and 18.3%, respectively. Theoretically, aortic root replacement involves coronary artery separation and reimplantation, which may increase operative time and complexity. However, in this study, the CPB time and aortic occlusion time in the RG and BG were relatively similar, which may be attributed to the lack of proficiency of the surgical technicians. The reduction of the difficulty of the operation and the operation time through the application of new technology may be a gradual process. Other postoperative complications such as tracheotomy, secondary thoracotomy for hemostasis, neurological complications, and kidney injury were similar between the two groups, indicating that aortic root repair was safe and effective during the perioperative period.

In this study, the 5-year survival rates in the RG and BG were 88.1% and 85.9%, respectively. The mid-term survival rates were similar between the two groups, consistent with the findings of previous studies (3,16). Whether aortic root repair increases the risk of long-term reoperation has always been debated. The main reason for reoperation is to avoid aortic regurgitation caused by aortic sinus dilatation, dissection, or pseudoaneurysm (17,18). Another risk factor includes the use of gelatin-resorcinol-formaldehyde bioglue that may lead to aortic wall injury, as reported by Kirsch *et al.* and Izutani *et al.* (19,20). Additionally, Bojko *et al.* (3) reported that aortic sinus diameter of ≥45 mm and the presence of connective tissue disease are risk factors for proximal aortic reoperation. Castrovinci *et al.* (21) reported that root replacement reduces the need for proximal reoperation and should, therefore, be used in cases of intimal tears in the aortic root. Nishida *et al.* (22) reported that dissection involving two or more aortic sinuses is associated with late-stage aortic root repair requiring reoperation. In addition, we observed that performing conservative treatment is exceedingly challenging when the dissection severely damages the sinotubular junction. Because of the differences in indications and methods, reoperation rates in the middle and late stages of root repair differ among different centers. Rylski *et al.* (14) reported 10- and 15-year free proximal reoperation rates of 92%±2% and 89%±4%, respectively, using traditional sandwich techniques. Tang *et al.* (23) using the modified sandwich technique, reported that none of the patients required proximal aortic reintervention surgery in the past 5 years. Continuous improvements in root repair techniques may help reduce the rate of reoperations in the middle and late stages. Irimie *et al.* found that no patient had valve/root reintervention (>2+)-related insufficiency within an average follow-up of 70±50 months after aortic root repair (24). This study used a modified sandwich technique to insert a suitable Teflon felt after carefully removing the false thrombus lumen. Vascular grafts and autologous pericardium were placed on the inner and outer walls of the root to eliminate the false lumen and prevent long-term tearing. During the follow-up period, patients in the RG did not require proximal aorta reoperation and achieved excellent mid-term outcomes.

Limitations

This single-center retrospective observational study analyzed longitudinal data, different cerebral perfusion methods, improved sandwich techniques different from other centers, and the evolution of the surgeon's surgical experience, may have affected the results. Secondly, the patient's selective bias directly or indirectly affects the final result. For example, there were significant differences in ascending aortic diameter, aortic root and ring diameter, and the number of patients with preoperative moderate AI between the two groups due to different inclusion criteria. Patients who have undergone cardiac surgery also tend to undergo Bentall surgery; the perioperative risk of such patients is significantly higher. Finally, the sample size and follow-up time were limited, thereby restricting the universality of the results.

Conclusions

The choice of the aortic root surgery method had no effect on perioperative mortality. The mid-term survival rate of root repair surgery was similar to that of root replacement, with no proximal aortic reoperation performed during follow up. The application of improved sandwich technology at our center demonstrated safety and feasibility.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This retrospective study was approved by The Ethics Committee of the First Affiliated Hospital of The Air Force Medical University (No. 20120216-4) and informed consent was taken from all the patients.

References

1. Mészáros I, Mórocz J, Szlávi J, et al. Epidemiology and clinicopathology of aortic dissection. Chest 2000;117:1271-8.
2. Malaisrie SC, Szeto WY, Halas M, et al. 2021 The American Association for Thoracic Surgery expert consensus document: Surgical treatment of acute type A aortic dissection. J Thorac Cardiovasc Surg 2021;162:735-758.e2.
3. Bojko MM, Assi R, Bavaria JE, et al. Midterm outcomes and durability of sinus segment preservation compared with root replacement for acute type A aortic dissection. J Thorac Cardiovasc Surg 2022;163:900-910.e2.
4. Brown JA, Zhu J, Navid F, et al. Preservation versus replacement of the aortic root for acute type A aortic dissection. J Thorac Cardiovasc Surg 2024;167:2037-2046.e2.
5. Sun J, Xue C, Zhang J, et al. Extra-anatomic revascularization and a new cannulation strategy for preoperative cerebral malperfusion due to severe stenosis

or occlusion of supra-aortic branch vessels in acute type A aortic dissection. Heliyon 2023;9:e18251.
6. Yang C, Hou P, Wang D, et al. Serum Myoglobin Is Associated With Postoperative Acute Kidney Injury in Stanford Type A Aortic Dissection. Front Med (Lausanne) 2022;9:821418.
7. Sun L, Qi R, Zhu J, et al. Total arch replacement combined with stented elephant trunk implantation: a new "standard" therapy for type a dissection involving repair of the aortic arch? Circulation 2011;123:971-8.
8. Kunihara T, Neumann N, Kriechbaum SD, et al. Aortic root remodeling leads to good valve stability in acute aortic dissection and preexistent root dilatation. J Thorac Cardiovasc Surg 2016;152:430-436.e1.
9. Sievers HH, Richardt D, Diwoky M, et al. Survival and reoperation after valve-sparing root replacement and root repair in acute type A dissection. J Thorac Cardiovasc Surg 2018;156:2076-2082.e2.
10. Holubec T, Rashid H, Hecker F, et al. Early- and longer-term outcomes of David versus Florida sleeve procedure: propensity-matched comparison. Eur J Cardiothorac Surg 2022;62:ezac104.
11. Takeuchi Y, Suzuki R, Kurazumi H, et al. Fate of dissected arch vessels by adventitial inversion technique for acute type A aortic dissection repair. Interact Cardiovasc Thorac Surg 2022;35:ivac185.
12. Yang B, Malik A, Waidley V, et al. Short-term outcomes of a simple and effective approach to aortic root and arch repair in acute type A aortic dissection. J Thorac Cardiovasc Surg 2018;155:1360-1370.e1.
13. Dai XF, Fang GH, Yan LL, et al. Patch Neointima Technique in Acute Type A Aortic Dissection: Midterm Results of 147 Cases. Ann Thorac Surg 2021;112:75-82.
14. Rylski B, Bavaria JE, Milewski RK, et al. Long-term results of neomedia sinus valsalva repair in 489 patients with type A aortic dissection. Ann Thorac Surg 2014;98:582-8; discussion 588-9.
15. Yang B, Norton EL, Hobbs R, et al. Short- and long-term outcomes of aortic root repair and replacement in patients undergoing acute type A aortic dissection repair: Twenty-year experience. J Thorac Cardiovasc Surg 2019;157:2125-36.
16. Xue Y, Zhou Q, Pan J, et al. Root reconstruction for proximal repair in acute type A aortic dissection. J Thorac Dis 2019;11:4708-16.
17. Yang J, Li X, Wu M, et al. Early and midterm results of valve-sparing aortic root reconstruction with a bovine pericardium patch for patients with acute type a aortic dissection. Front Cardiovasc Med 2022;9:1009171.
18. Vendramin I, Lechiancole A, Piani D, et al. Type A acute aortic dissection with ≥40-mm aortic root: results of conservative and replacement strategies at long-term follow-up. Eur J Cardiothorac Surg 2021;59:1115-22.
19. Kirsch M, Ginat M, Lecerf L, et al. Aortic wall alterations after use of gelatin-resorcinol-formalin glue. Ann Thorac Surg 2002;73:642-4.
20. Izutani H, Shibukawa T, Kawamoto J, et al. Devastating late complication for repair of type A acute aortic dissection with usage of gelatin-resorcinol-formalin glue. Interact Cardiovasc Thorac Surg 2007;6:240-2.
21. Castrovinci S, Pacini D, Di Marco L, et al. Surgical management of aortic root in type A acute aortic dissection: a propensity-score analysis. Eur J Cardiothorac Surg 2016;50:223-9.
22. Nishida H, Tabata M, Fukui T, et al. Surgical Strategy and Outcome for Aortic Root in Patients Undergoing Repair of Acute Type A Aortic Dissection. Ann Thorac Surg 2016;101:1464-9.
23. Tang Y, Liao Z, Han L, et al. Long-term results of modified sandwich repair of aortic root in 151 patients with acute type A aortic dissection. Interact Cardiovasc Thorac Surg 2017;25:109-13.
24. Irimie V, Atieh A, Kucinoski G, et al. Long-term outcomes after valve-sparing anatomical aortic root reconstruction in acute dissection involving the root. J Thorac Cardiovasc Surg 2020;159:1176-1184.e1.

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