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ABSTRACT

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CONSERVATIVE VERSUS RADICAL TREATMENT OF ASCENDING AORTIC DILATION: COMPARATIVE ANALYSIS OF BASELINE CLINICAL DATA FOLLOWING WRAPPING, NO-TOUCH SURGICAL AORTIC VALVE REPLACEMENT, AND THE WHEAT PROCEDURE

Background: The optimal management of ascending aortic dilation in patients undergoing aortic valve replacement (AVR) remains debated. Although replacement of the ascending aorta is widely considered the standard, conservative strategies such as wrapping are still used in selected patients.

Objective: This study aimed to analyze baseline characteristics and etiological patterns in patients treated with wrapping, supracoronary replacement (Wheat procedure), or isolated AVR without intervention on the ascending aorta.

Methods: This retrospective, single-center analysis included 120 patients who underwent AVR in the presence of ascending aortic dilation (>40 mm) between 2016 and 2024. Patients with connective tissue disorders, prior aortic surgery, or acute aortic syndromes were excluded. After propensity score matching, 40 patients were assigned to each group: AVR with wrapping, Wheat procedure, and no-touch AVR. Demographic, clinical, and echocardiographic data were compared to identify factors associated with aortic dilation.

Results: Patients in the No-touch group were significantly older (69.5 ± 5.2 years) compared with the Wheat (51.2 ± 13.7 years) and Wrapping (50.4 ± 13.3 years) groups ($p < 0.001$). Bicuspid valve morphology predominated in the Wheat (72.5%) and Wrapping (62.5%) groups, while tricuspid valves were most frequent in the No-touch group (80%; $p < 0.001$). Ascending aortic diameters were larger in the Wheat and Wrapping groups compared with No-touch ($p < 0.001$). The No-touch cohort showed more advanced ventricular remodeling, higher rates of left ventricular dilation, reduced ejection fraction, and increased pulmonary

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pressures. Neurological events and preoperative atrial fibrillation were also more common.

Conclusion: Distinct etiological profiles exist among patients with ascending aortic dilation undergoing AVR. Wrapping and replacement were used mainly in younger patients with bicuspid valves and larger diameters, whereas the no-touch strategy was applied in older patients with tricuspid valves and ventricular dysfunction. These findings support individualized treatment based on valve phenotype, age, and etiology.

Keywords: Ascending aorta dilatation, Aortic wrapping, Aortic valve replacement, Wheat procedure, Aortic aneurysm.

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КОНСЕРВАТИВНЕ ТА РАДИКАЛЬНЕ ЛІКУВАННЯ ДИЛАТАЦІЇ ВИСХІДНОЇ АОРТИ: ПОРІВНЯЛЬНИЙ АНАЛІЗ ВИХІДНИХ КЛІНІЧНИХ ДАНИХ ПІСЛЯ БАНДАЖУВАННЯ АОРТИ, ІЗОЛЬОВАНОГО ХІРУРГІЧНОГО ПРОТЕЗУВАННЯ АОРТАЛЬНОГО КЛАПАНА ТА КОМБІНОВАНОГО ПРОТЕЗУВАННЯ ВИСХІДНОЇ АОРТИ З ПРОТЕЗУВАННЯ АОРТАЛЬНОГО КЛАПАНУ

Вступ. Оптимальна тактика ведення пацієнтів із дилатацією висхідної аорти під час протезування аортального клапана (ПАК) залишається дискусійною. Хоча заміна висхідної аорти вважається стандартом, консервативні стратегії, такі як бандажування, і надалі застосовуються у відібраних хворих.

Мета роботи – проаналізувати вихідні характеристики та етіологічні особливості пацієнтів, яким виконано бандажування, супракоронарну заміну (операція Wheat) або ізольоване ПАК без втручання на аорті.

Методи. У ретроспективний одноцентровий аналіз включено 120 пацієнтів, які перенесли ПАК у присутності дилатації висхідної аорти (>40 мм) у період 2016–2024 рр. Пацієнтів із синдромами сполучної тканини, попередніми операціями на аорті чи гострими аортальними синдромами було виключено. Після парного підбору за методом зіставлення показників схильності було сформовано три групи по 40 пацієнтів: ПАК із бандажуванням, операція Wheat та ізольоване ПАК. Демографічні, клінічні й ехокардіографічні дані порівнювали з метою виявлення чинників, асоційованих із дилатацією аорти.

Результати. Пацієнти групи ізольованого ПАК були достовірно старшими (69,5 ± 5,2 року) порівняно з групами Wheat (51,2 ± 13,7 року) та бандажування (50,4 ± 13,3 року; $p < 0,001$). У групах Wheat (72,5%) і бандажування (62,5%) переважала бікуспідальна морфологія клапана, тоді як у групі ізольованого ПАК найчастіше траплявся трикуспідальний клапан (80%; $p < 0,001$). Діаметри висхідної аорти були більшими у групах Wheat і бандажування, ніж у ізольованого ПАК ($p < 0,001$). У пацієнтів ізольованого ПАК частіше спостерігалося виражене ремоделювання шлуночка, дилатація ЛШ, зниження ФВ та

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підвищений тиск у легеневій артерії. Неврологічні події й передопераційна ФП також відзначалися частіше.

Висновки. Пацієнти з дилатацією висхідної аорти під час ПАК демонструють різні етіологічні профілі. Бандажування та заміна застосовувалися переважно у молодших пацієнтів із бікуспідальними клапанами та більшими діаметрами, тоді як стратегія ізольованого ПАК — у старших із трикуспідальними клапанами та дисфункцією шлуночка. Отримані дані підтверджують доцільність індивідуалізованого підходу, що враховує фенотип клапана, вік і етіологію, а не лише діаметр аорти.

Ключові слова: дилатація висхідної аорти, укутування аорти, протезування аортального клапана, операція Віта, аневризма аорти**.**

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INTRODUCTION

The management of ascending aortic dilation in patients undergoing aortic valve surgery remains one of the most debated issues in contemporary cardiac surgery. Historically, conservative approaches such as aneurysmorrhaphy or external wrapping with synthetic materials were introduced in the early 20th century, first by Matas on the abdominal aorta and later by Tuffier on the thoracic aorta [1]. With advances in surgical techniques and the availability of durable prosthetic materials, complete replacement of the ascending aorta became the standard treatment, offering excellent long-term outcomes and low elective mortality in specialized centers [2]. Nevertheless, operative risk increases significantly in elderly patients and those with multiple comorbidities, with reported early mortality ranging from 4% to 20% [3]. In this population, less invasive procedures may represent a valuable alternative [4].

A significant proportion of patients who undergo aortic valve replacement (AVR) are reported to have a dilated ascending aorta [5]. The optimal surgical strategy in such cases is controversial. On one hand, several observational studies have suggested that untreated dilation may predispose patients to rupture or dissection [6,7]. This prompts practice guidelines to recommend concomitant replacement of the ascending aorta when the diameter is ≥45 mm in patients already undergoing aortic valve surgery, whereas isolated BAV aortopathy typically has higher surgical thresholds unless additional risk factors are present. [8,9]. This position is further supported by evidence that aortopathy in BAV is not exclusively related to hemodynamic burden, but also to intrinsic histological and genetic abnormalities of the aortic wall [10–12].

On the other hand, more recent long-term studies have demonstrated a relatively low incidence of adverse aortic events in patients undergoing isolated valve replacement despite moderate dilation [13–15], challenging the necessity of systematic replacement. Furthermore, large-scale echocardiographic analyses have shown that correction of valvular dysfunction alone may stabilize or even slow the progression of aortic enlargement, with hemodynamic burden identified as the main contributor to dilatation in BAV [16]. These findings suggest that current recommendations should be continuously reevaluated in light of accumulating clinical evidence.

Against this background, different strategies have been adopted in clinical practice, ranging from isolated surgical AVR with no intervention on the ascending aorta ("no-touch" strategy), to conservative techniques such as ascending aortic wrapping (AAW) [17,18], and more radical procedures such as supracoronary ascending aortic replacement (the Wheat procedure). Each approach carries potential benefits and limitations in terms of operative risk, durability, and protection against long-term complications. However, comparative data on baseline clinical characteristics and outcomes remain limited.

The present study aims to provide a systematic evaluation of patients undergoing these three strategies. By analyzing baseline clinical data across groups, we sought to clarify the patient selection profile for each approach and to contribute to the ongoing debate regarding the optimal management of ascending aortic dilation associated with aortic valve disease.

PATIENTS AND METHODS

This retrospective, single-center study included patients who underwent aortic valve replacement in the presence of ascending aortic dilation in a period between January 2016 and December 2024. Eligible patients were between 18 and 80 years of age and had a confirmed dilation of the ascending aorta greater than 40 mm on preoperative imaging. Only patients with concomitant cardiovascular conditions not requiring additional surgical interventions were considered for inclusion. Written informed consent was obtained from all patients prior to enrollment.

Exclusion criteria comprised connective tissue disorders such as Marfan or Loeys–Dietz syndromes or other genetic conditions associated with an increased risk of aortic rupture, end-stage renal, hepatic, or pulmonary failure, ascending aortic diameters <40 mm, history of acute aortic syndromes including dissection or rupture, and previous operations on the ascending aorta or aortic valve.

A total of 120 patients fulfilled the inclusion and exclusion criteria. To minimize potential selection bias and ensure comparability across treatment arms, a propensity score matching analysis was performed using age, sex, body surface area, comorbidities, and baseline aortic dimensions. Following matching, 40 patients were included in each treatment group.

The study population was divided into three groups according to the surgical strategy applied: AVR with ascending aortic wrapping (Wrapping group), AVR combined with supracoronary replacement of the ascending aorta (Wheat group) and isolated AVR without any intervention on the ascending aorta (No-touch group).

Baseline demographic, clinical, and echocardiographic characteristics were collected for all patients. The analysis focused on identifying etiological and clinical factors associated with the presence and extent of ascending aortic dilation in this population.

Statistical Analysis

Data are presented as mean ± standard deviation (SD) for continuous variables and as number with percentage for categorical variables. Differences between the three groups were compared using standard statistical tests for continuous and categorical data. A p value <0.05 was considered statistically significant. To reduce selection bias, propensity score matching was performed prior to analysis. Matching variables included age, sex, body surface area, comorbidities, and baseline aortic dimensions. A 1:1 matching ratio was applied, resulting in 40 patients per group. All analyses were performed using the R programming language (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

A total of 120 patients were included in the analysis, with 40 patients in each group: AVR with wrapping of the ascending aorta, the Wheat procedure, and isolated AVR with no-touch aorta. Baseline demographic and clinical characteristics are summarized in **Table 1**. Patients in the no-touch group were significantly older compared with those in the Wheat and wrapping cohorts (69.5 ± 5.2 years vs. 51.2 ± 13.7 and 50.4 ± 13.3 years, respectively; $p < 0.001$). Male sex predominated in all groups, with the highest proportion observed in the Wheat group (92% vs. 72% in the wrapping group; $p = 0.036$). Anthropometric parameters including height, weight, body mass index (BMI), and body surface area (BSA) were comparable among groups.

Table 1. Demographic characteristics

Characteristics	Wrapping group n=40	Wheat group n=40	No-touch group n=40	ρ^1-value	ρ^2-value
Age, y	50.4 (±13.3)	51.2 (±13.7)	69.48 (±5.16)	0.791	0.0
Height, cm	175.4 (±8.8)	177.6 ((±7.9)	172.2 (±6.8)	0.242	0.072
Weight, kg	86.9 (±17.9)	90.6 (±20.2)	82.0 (±11.5)	0.388	0.149
Sex, male, n (%)	29 (72%)	37 (92%)	33 (82,5%)	0.036	0.284
Body Mass Index, kg/m2	28.1 (±4.9)	28.6 ((±5.8)	27.6 ((±3.7)	0.678	0.608
Body Surface Area, m2	2.05 (±0.24)	2.1 (±0.26)	1.98 (±0.16)	0.374	0.129

ρ^1 – comparison between the Wrapping Group and the Wheat Group
ρ^2 – comparison between the Wrapping Group and the No-touch Group

The distribution of aortic valve morphology differed markedly between groups. Bicuspid valves were the predominant phenotype in the Wheat (72.5%) and wrapping (62.5%) groups, while tricuspid morphology was overwhelmingly more frequent in the no-touch group (80%; $p < 0.001$). The type of valve dysfunction (stenosis, regurgitation, or combined lesions) did not significantly differ between cohorts (**Table 2**).

Table 2. Aortic valve morphology and pathology

Characteristics	Wrapping group n=40	Wheat group n=40	No-touch group n=40	ρ^1-value	ρ^2-value
Aortic phenotype, n (%)					
• Bicuspid valve	25 (62.5%)	29 (72.5%)	8 (20.0%)	0.339	<0.001
• Tricuspid valve	15 (37.5)	11 (27.5%)	32 (80%)		
Aortic valve disease, n (%)					
• Aortic valve stenosis	18 (45.0%)	19 (47.5%)	20 (50.0%)	0.942	0.288
• Aortic valve regurgitation	16 (40.0%)	16 (%40%)	10 (25.0%)		
• Combined aortic valve pathology	6 (15.0%)	5 (12.5%)	10 (25.0%)		
Aortic valve regurgitation severity, n (%)					
• None	9 (22.5%)	7 (17.5%)	10 (25.0%)	0.655	0.677
• Mild	8 (20.0%)	5 (12.5%)	11 (27.5%)		
• Moderate	7 (17.5%)	7 (17.5%)	8 (20.0%)		
• Severe	16 (42.5%)	21 (52.5%)	11 (27.5%)		
Aortic valve stenosis severity, n (%)					
• None	14 (35.0%)	14 (35.0%)	10 (25.0%)	0.309	0.685
• Mild	1 (2.5%)	5 (12.5%)	2 (5.0%)		
• Moderate	8 (20.0%)	9 (22.5%)	7 (17.5%)		
• Severe	17 (42.5%)	12 (30.0%)	21 (52.5%)		

ρ^1 – comparison between the Wrapping Group and the Wheat Group
ρ^2 – comparison between the Wrapping Group and the No-touch Group

Patients in the Wheat and wrapping groups demonstrated significantly larger ascending aortic diameters compared with the no-touch group (50.1 ± 5.5 mm and 48.7 ± 4.9 mm vs. 43.5 ± 3.5 mm; $p < 0.001$). Aortic root and annulus dimensions did not differ significantly across groups. Distribution analysis showed that the majority of patients in the no-touch group had diameters between 40 and 45 mm, whereas the Wheat and wrapping groups more frequently presented with diameters in the 45–55 mm range (**Table 3**).

Table 3. Aortic dimensions

Characteristics	Wrapping group n=40	Wheat group n=40	No-touch group n=40	ρ^1-value	ρ^2-value
Aortic annulus, mm	25.4 (±2.64)	25.6 (±2.6)	24.6 (±2.3)	0.733	0.152
Aortic root, mm	40.8 (±5.3)	41.0 (±5.0%)	39.2 (±5.0)	0.862	0.168
• <40 mm	19 (47.5%)	18 (45.0%)	26 (65.0%)	0.809	0.296
• 40-45 mm	11 (27.5%)	13 (32.5%)	10 (25.0%)		
• 45-50 mm	7 (17.5%)	8 (20.0%)	2 (5.0%)		
• 50-55mm	2 (5.0%)	1 (2.5%)	2 (5.0%)		
• >55mm	1 (2.5%)	0 (0%)	0 (0%)		
Ascending aorta, mm	48.7 (±4.9)	50.1 (±5.5)	43.5 (±3.5)	0.233	0.0
• 40-45 mm	10 (25%)	5 (12.5%)	23 (57.5%)	0.095	0.003
• 45-50 mm	18 (45.0%)	14 (35.0%)	15 (37.5%)		
• 50-55mm	11 (27.5%)	15 (37.5%)	1 (2.5%)		
• >55mm	1 (2.5%)	6 (15.0%)	1 (2.5%)		
Aortic arch, mm	35.8 (±6.9)	37.7 (±4.5)	34.9 (±5.5)	0.149	0.520

ρ^1 – comparison between the Wrapping Group and the Wheat Group
ρ^2 – comparison between the Wrapping Group and the No-touch Group

No-touch patients exhibited more advanced functional impairment compared with the other groups. Left ventricular dilation was most frequent in the no-touch group (77.5%) compared with Wheat (67.5%) and wrapping (52.5%; p = 0.019). Left ventricular ejection fraction (LVEF) was significantly lower in the no-touch group (52.5 ± 10.7% vs. 58–59% in Wheat and wrapping; p = 0.002), with a greater proportion of patients having reduced LVEF below 50% (p = 0.007). Pulmonary artery pressures were also higher in the no-touch group, with 40% of patients presenting values between 50–70 mmHg compared with 10–15% in the Wheat and wrapping cohorts (p < 0.001) (**Table 4**).

Table 4. Cardiac function and hemodynamics

Characteristics	Wrapping group n=40	Wheat group n=40	No-touch group n=40	ρ[1]-value	ρ[2]-value
Peak preassure gradient, mmHG	52.2 (±36.8)	47.6 (±35.5)	67.9 (±40.1)	0.571	0.071
Mean preassure gradient, mmHG	30.1 (±22.3)	28.2 (±22.5)	39.6 (±24.1)	0.705	0.071
Pulmonary artery preassure, mmHG	38.4 (±20.0)	38.8 (±25.6)	45.7 (±13.15)	0.938	0.058
• <30 mmHG	14 (35.0%)	12 (30.0%)	1 (2.5%)	0.906	<0.001
• 30-50 mmHG	21 (52.5%)	21 (52.5%)	22 (55.0%)		
• 50-70 mmHG	4 (10%)	6 (15.0%)	16 (40.0%)		
• >70 mmHG	1 (2.5%)	1 (2.5%)	1 (2.5%)		
End-systolic volume, ml	71.3 (±35.2)	73.8 (±35.6)	81.8 (±42.8)	0.752	0.234
End-diastolic volume, ml	166.2 (±58.0)	173.0 (±63.8)	167.8 (±68.0)	0.619	0.910
LV dilation, n (%)	21 (52.5%)	27 (67.5%)	31 (77.5%)	0.170	0.019
LV hypertrophy, n (%)	23 (57.5%)	31 (77.5%)	30 (75.0%)	0.056	0.097
LV Ejection Fraction, %	59.1 (±8.3)	58.7 (±7.9)	52.5 (±10.7)	0.825	0.002
• >50%	36 (90.0%)	35 (87.5%)	26 (65.0%)	1.0	0.007
• 50-40%	3 (7.5%)	4 (10.0%)	8 (20.0%)	0.540	0.012
• 40-30%	0	1 (2.5%)	6 (15.0%)		
• <30%	1 (2.5%)	0 (0%)	0 (0%)		

LV – left ventricle
ρ^1 – comparison between the Wrapping Group and the Wheat Group
ρ^2 – comparison between the Wrapping Group and the No-touch Group

Arterial hypertension was common across groups (65–82.5%), with a trend toward higher prevalence in the Wheat group, though not statistically significant. Diabetes, chronic lung disease, and hepatic disease were rare. A history of neurological events was more frequent in the no-touch group (20%) compared with the wrapping group (5%; p = 0.042). Preoperative atrial fibrillation was also significantly more common in the no-touch group (27.5%) than in the Wheat (10%) or wrapping (5%) cohorts (p = 0.006). Smoking prevalence was high across all groups (60–77.5%), without significant differences (**Table 5**).

Analysis shows that the Wheat and wrapping groups were characterized predominantly by bicuspid aortopathy as the underlying etiology of ascending aortic dilation. In contrast, the no-touch cohort consisted mainly of older patients with tricuspid aortic valves, smaller ascending aortic diameters, and advanced ventricular remodeling, consistent with post-stenotic dilation as the principal mechanism of aortic enlargement in this population.

DISCUSSION

The surgical management of ascending aortic dilation in patients undergoing aortic valve replacement has been a subject of debate for decades. Complete replacement of the ascending aorta provides definitive treatment and is recommended by current guidelines when operative criteria are met [19; 20], but conservative alternatives such as wrapping remain in selective use. One of the main criticisms of wrapping has been its potential to cause structural changes in the aortic wall. Histological analyses have demonstrated thinning of the reinforced aorta, loss of its normal layered structure, and infiltration consistent with a foreign-body reaction [21; 22]. Proposed mechanisms include chronic external compression, compromise of the vasa vasorum, and inflammatory response [21]. Despite these microscopic findings, clinical reports have

not shown an increased risk of rupture or dissection after wrapping [23].

Indications for wrapping have generally been restricted to patients with moderate dilation (40–50 mm), often in the setting of bicuspid aortic valve, when the operative risk of replacement is considered high [5; 24; 25, 26, 27, 28]. Conversely, replacement is considered the treatment of choice for patients with larger aneurysms (>55 mm), connective tissue disorders, or diffuse tubular dilation [29; 30]. The debate is particularly intense in patients with moderate enlargement. In this group failing to address the ascending aorta carries a risk of progressive dilation and reoperation, while aggressive replacement may expose patients to unnecessary surgical risk.

Table 5. Comorbidities and risk factors

Characteristics	Wrapping group n=40	Wheat group n=40	No-touch group n=40	ρ^1-value	ρ^2-value
NYHA III-IV, n (%)	23 (57.5%)	26 (65.0%)	30 (75%)	0.491	0.097
Arterial hypertension, n (%)	26 (65.0%)	33 (82.5%)	31 (77.5%)	0.075	0.216
Diabetes mellitus, n (%)	0 (0.0%)	4 (10%)	3 (7.5%)	0.115	0.240
Lung disease, n (%)	1 (2.5%)	1 (2.5%)	4 (10%)	1.0	0.358
Hepatic disease, n (%)	1 (2.5%)	0 (0%)	1 (2.5%)	1.0	1.0
Neurological events, n (%)	2 (5.0%)	4 (10%)	8 (10%)	0.675	0.042
Thyroid disease, n (%)	1 (2.5%)	1 (2.5%)	3 (7.5%)	1.0	0.615
Peripheral artery disease, n (%)	9 (22.5%)	7 (17.5%)	11 (27.5%)	0.576	0.605
Chronic kidney disease, n (%)	1 (2.5%)	2 (5%)	3 (7.5%)	1.0	0.615
Dialysis, n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
Smoking, n (%)	24 (60%)	28 (70%)	31 (77.5%)	0.348	0.091
Preoperative AF, n (%)	2 (5.0%)	4 (10%)	11 (27.5%)	0.675	0.006
AV-blockage III, n (%)	1 (2.5%)	0 (0%)	1 (2.5%)	1.0	1.0
Pacemaker, n (%)	1 (2.5%)	0 (%)	1 (2.5%)	1.0	1.0
Previous cardiac procedures, n (%)	3 (7.5%)	1 (2.%)	3 (7.5%)	0.615	1.0

ρ^1 – comparison between the Wrapping Group and the Wheat Group
ρ^2 – comparison between the Wrapping Group and the No-touch Group

Our analysis of 120 patients highlights distinct etiological patterns that influenced surgical decision-making. Patients undergoing the Wheat procedure and wrapping most frequently presented with bicuspid aortic valves (72.5% and 62.5%, respectively), supporting the concept that bicuspid aortopathy was the predominant driver of dilation in these cohorts. In contrast, the no-touch group consisted mainly of older patients with tricuspid valves (80%), smaller ascending aortic diameters, and more advanced ventricular remodeling. This suggests post-stenotic dilation as the principal mechanism in this population.

Aortic diameters were significantly larger in the Wheat and Wrapping groups compared with the No-touch group. It consistent with the data that bicuspid aortopathy is associated with more aggressive aortic enlargement [10; 11; 12]. By contrast, the no-touch patients had more frequent left ventricular dilation, lower ejection fractions, and higher pulmonary pressures, reflecting the chronic hemodynamic burden of longstanding tricuspid aortic stenosis. Neurological events and preoperative atrial fibrillation were also more common in this group, further underlining their older age and comorbidity profile.

In our cohort wrapping and replacement were selected primarily in younger patients with bicuspid valves and larger ascending aortic diameters, where aortopathy was the underlying pathology. The no-touch strategy was chosen for older, comorbid patients with tricuspid valves and post-stenotic fusiform dilation. This etiological stratification supports the selective use of conservative or radical techniques according to valve phenotype, age, and risk profile, rather than diameter thresholds alone.

LIMITATIONS

Its retrospective, single-center design inherently carries the risk of selection bias, even though propensity score matching was applied to balance baseline characteristics between groups. The sample size, although equally distributed across the three cohorts, was relatively small, which may limit the statistical power to detect subtler differences. The analysis

focused exclusively on baseline characteristics and etiological factors; operative details, perioperative outcomes, and long-term follow-up data were not included, which restricts the ability to draw conclusions regarding durability or clinical effectiveness of each surgical strategy.

CONCLUSION

This study demonstrates distinct etiological profiles among patients with ascending aortic dilation undergoing AVR. Wrapping and replacement were primarily used in younger patients with bicuspid valves and larger aortic diameters, consistent with bicuspid aortopathy as the underlying mechanism. The no-touch strategy was applied in older patients with tricuspid valves, smaller diameters, and advanced ventricular dysfunction, consistent with post-stenotic dilation. These findings support an individualized approach to ascending aortic dilation that considers valve phenotype, patient age, and etiology rather than relying solely on diameter thresholds.

PROSPECTS FOR FUTURE RESEARCH

Follow-up studies should correlate preoperative phenotypes and risk factors with long-term outcomes such as aortic redilation, dissection, or the need for reoperation. Establishing these associations would help refine risk stratification and identify which patient subgroups benefit most from conservative versus radical approaches. Such data could ultimately strengthen current guideline thresholds, moving from diameter-based decision-making toward an integrated model that incorporates valve morphology, ventricular function, comorbidities, and the underlying etiology of dilation.

AUTHOR CONTRIBUTIONS

All authors contributed significantly.

- Conceptualization and study design: Zelenchuk O., Todurov B.
- Data collection and curation: Nechai I., Mokryk I., Stetsiuk I., Demyanchuk V.
- Statistical analysis: Nechai I., Mokryk I.
- Drafting of the manuscript: Nechai I., Stetsiuk I.
- Critical revision for important intellectual content: Zelenchuk O., Todurov B.
- Final approval of the version to be published: All authors

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CONFLICT OF INTEREST

The authors declare no conflicts of interest related to the research, authorship, or publication of this article.

ARTIFICIAL INTELLIGENCE DISCLOSURE

Artificial intelligence tools (Grammarly Inc., San Francisco, CA, USA) were used only to support language editing and formatting of the manuscript. All scientific content, data interpretation, and conclusions were independently developed and verified by the authors.

ETHICAL CONSIDERATIONS

Written informed consent was obtained from all patients prior to enrollment.

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