Real-World Outcomes of Mechanical, Porcine, and Long-Lasting Valves in Severe Aortic Stenosis: Survival, Reintervention, and Early Mortality Analysis

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BACKGROUND

Aortic valve replacement (AVR) is the standard treatment for severe aortic stenosis (AS). Post-pandemic nationwide comparative data on survival and early mortality across valve types remain limited.
Three prosthesis types are used clinically:
Mechanical Valve (MV): durable; requires lifelong anticoagulation.
Porcine Valve (PV): biological tissue; avoids long-term anticoagulation but subject to structural deterioration
Durable Valve (DV): next-generation bioprosthesis with enhanced longevity (including Bovine valve, porcine root and dry valve), as categorized according to the National Health Insurance Administration (NHIA) classification.

OBJECTIVES

To evaluate, in a nationwide real-world cohort (2014–2023):
Early (≤30-day) postoperative mortality and its cause-specific mechanisms by valve type
Long-term all-cause survival across MV, PV, and DV
Patient risk-profile differences driving differential outcomes

METHODS

Study Design
Retrospective nationwide cohort; aggregated NHI data (Year 2014-2023).
Population (CCI, Charlson Comorbidity Index)
•MV: N = 3,213 | Mean age 54.4 y | CCI 2.03
•PV: N = 3,227 | Mean age 69.9 y | CCI 3.05
•DV: N = 4,713 | Mean age 65.3 y | CCI 2.40
Outcomes
• All-cause survival (primary)
• ≤30-day postoperative mortality + cause-specific analysis
Statistics
• Kaplan–Meier + log-rank test

RESULTS — Baseline & Mortality

Figure 1. Patient Distribution by Valve Type

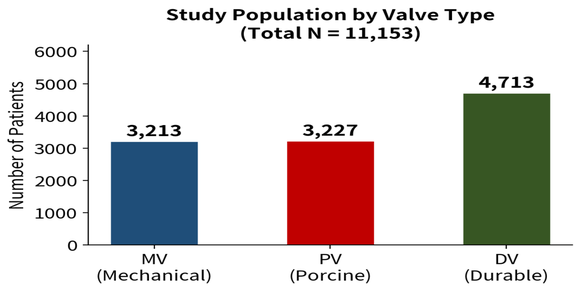


Figure 2. Age & Comorbidity Index at Time of AVR

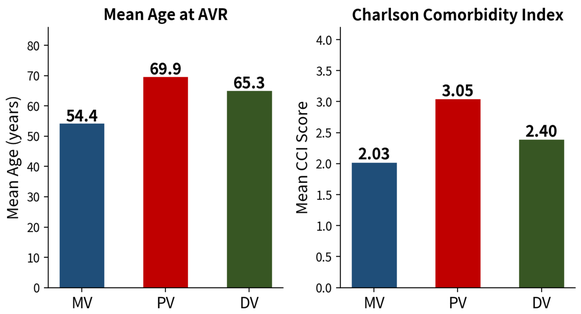
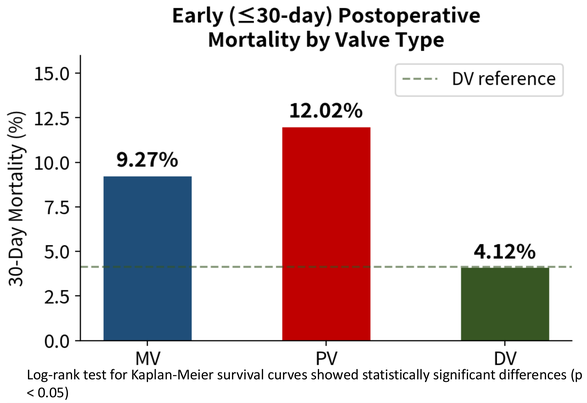


Figure 3. Early (≤30-day) Mortality by Valve Type

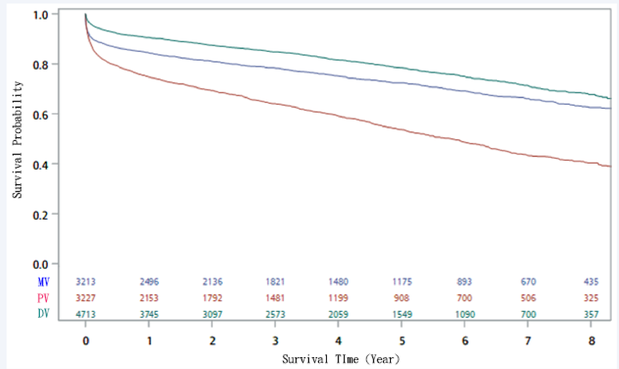


Log-rank test for Kaplan-Meier survival curves showed statistically significant differences ($p < 0.05$)

DV vs MV : $p < 0.001$: DV vs PV : $p < 0.001$: MV vs PV : $p < 0.001$

RESULTS — Survival & Cause of Death

Figure 4. Kaplan–Meier Overall

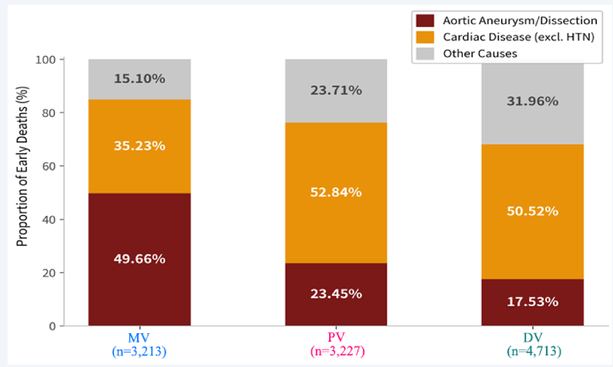


MV vs PV (REF): HR=0.536 (0.493-0.582). p<0.0001

DV vs MV (REF): HR=0.735 (0.671-0.806). p<0.0001

DV vs PV (REF): HR=0.394 (0.363-0.427). p<0.0001

Figure 5. Cause-Specific Early Mortality Distribution (≤30-days)



Key finding: In MV recipients, 49.66% of early deaths were due to aortic aneurysm/dissection vs. only 17.53% in DV ($p < 0.05$). PV early deaths were driven by older age, higher CCI, and infective endocarditis.

DISCUSSION

Early Mortality Mechanisms
The 30-day mortality differed markedly: PV 12.02% > MV 9.27% > DV 4.12%, highlighting valve-type-specific risk pathways:
MV recipients — aortic complications:
Aortic aneurysm/dissection comprised 49.66% of early deaths in MV vs. 17.53% in DV, suggesting peri-operative aortic trauma associated with mechanical implantation technique or pre-existing aortopathy.
PV recipients — patient-level risk burden:
Higher mean age (69.9y), greater CCI (3.05), elevated infective endocarditis prevalence, and co-existing native coronary artery disease. These reflect preferential use of PV in elderly, high-comorbidity patients.

Long-Term Survival
DV demonstrated significantly superior survival compared with PV or MV, which may be associated with improved biomaterial durability and reduced structural valve degeneration.

Limitation
- Coding practices may have included Bentall patients in valve cohorts, influencing group comparisons.
- Retrospective design; residual confounding possible
- Administrative data — limited LVEF / gradient detail
- DV group has shorter follow-up duration

CONCLUSIONS

DV group exhibited the lowest 30-day mortality rate at 4.12%, compared to 9.27% in the MV group and 12.02% in the PV group, with superior short-term outcome.

Excess early mortality in MV recipients was predominantly attributed to aortic aneurysm and dissection (49.66%), whereas PV recipients showed a patient-profile-driven mortality pattern (advanced age, IE, coronary disease).

Patient-centered valve selection should integrate anatomical risk assessment for MV, infectious/coronary workup for PV, and DV as preferred option in eligible patients.

Prospective studies and longer follow-up are warranted to confirm durability benefits of DV.

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