

Key Findings

- *Zero 30-day mortality over 11 years of experience in a single institution*
- *Five-year overall survival rate of 76%, with significantly better outcomes in idiopathic cases and worse prognosis in patients with preoperative CHF*

Background and Methods

- **Constrictive pericarditis** is a rare condition in which an inelastic, thickened pericardium impedes cardiac filling, resulting in high mortality if untreated (up to 90%). [1]
- Pericardiectomy offers **definitive treatment** when medical therapy fails, traditionally performed via a sternotomy, phrenic-to-phrenic approach. [2]
- **Robotic-assisted endoscopic pericardiectomy** (**Figure 1**) employs the robotic Endowrist™ epicardial stabilizer off-pump to **remove the entire pericardium sequentially** while skeletonizing and preserving the phrenic nerves.
- Given the lack of existing literature, we sought to investigate the perioperative and long-term outcomes of this procedure at our institution (IRB: IRB18-0742).
- Through a retrospective chart review from 2013-2024, 19 eligible patients were identified, including 17 complete and 2 partial pericardiectomy performed for constrictive or acute recurrent pericarditis of various etiologies (**Table 1 and 2**).
- Key perioperative outcomes include conversion to sternotomy, length of ICU and hospital stay, complications, and 30-day mortality. Primary long-term outcome was overall mortality.

Table 1: Pre-operative patient characteristics

Total number of patients = 19 (Oct 2013- April 2024)			
Female	7 (36%)	Atrial arrhythmia	5 (26%)
Age	58.1 ± 15.7	Hypertension	12 (63%)
BMI	30.2 ± 7.3	Hyperlipidemia	10 (53%)
CHF	9 (47%)	Diabetes	10 (52%)
Prior cardiac surgery	3 (16%)	History of smoking	11 (58%)
Prior MI	5 (26%)	Angina	5 (26%)
Prior PCI	4 (21%)	Hemodialysis	2 (11%)
Poor candidate for open surgery	12 (63%)	Creatine	1.6 ± 1.4

Abbreviations: BMI: body mass index, CHF: congestive heart failure, MI: myocardial infarction, PCI: percutaneous coronary intervention

Table 2: Etiology and underlying diseases

Idiopathic (7)
Prior heart surgery/ablation/PCI (5), including 1 sarcoidosis
Renal failure (2), including 1 systemic lupus erythematosus
Liver failure (2), including 1 alpha-1 antitrypsin deficiency
Tuberculosis (2)
Acute myelogenous leukemia (AML)/chemotherapy (1)
Constrictive pericarditis (18)
Acute recurrent pericarditis (1)

Table 3: Perioperative outcomes

Time in surgery (mins)	265.9 ± 63.3	Post-op CVP (mmHg)	9.1 ± 8.2 (N = 8)
Concomitant surgery	2 (11%) coronary bypass	Chest tube removal (day)	3.6 ± 4.0
Conversion to sternotomy	0	ICU LOS (day)	1.9 ± 1.0
Intraoperative inotropes	3 (16%)	Hospital LOS (day)	4.0 ± 1.6
Transfusion	6 (32 %)	Discharge home	17 (89%)
Extubation in the OR	4 (21%)	Discharge rehab	2 (11%)
Extubation within 6 hours	10 (47%)	30-day complications	Afib (3), pleural effusion (1)
Extubation within 24 hours	17 (89%)	30-day mortality	0

Abbreviations: CVP: central vein pressure, normal 8-12 mm Hg; LOS, length of stay; Afib, atrial fibrillation

Results

Figure 1: Operative setup (L) and intraoperative finding of fibrotic pericardium (R)

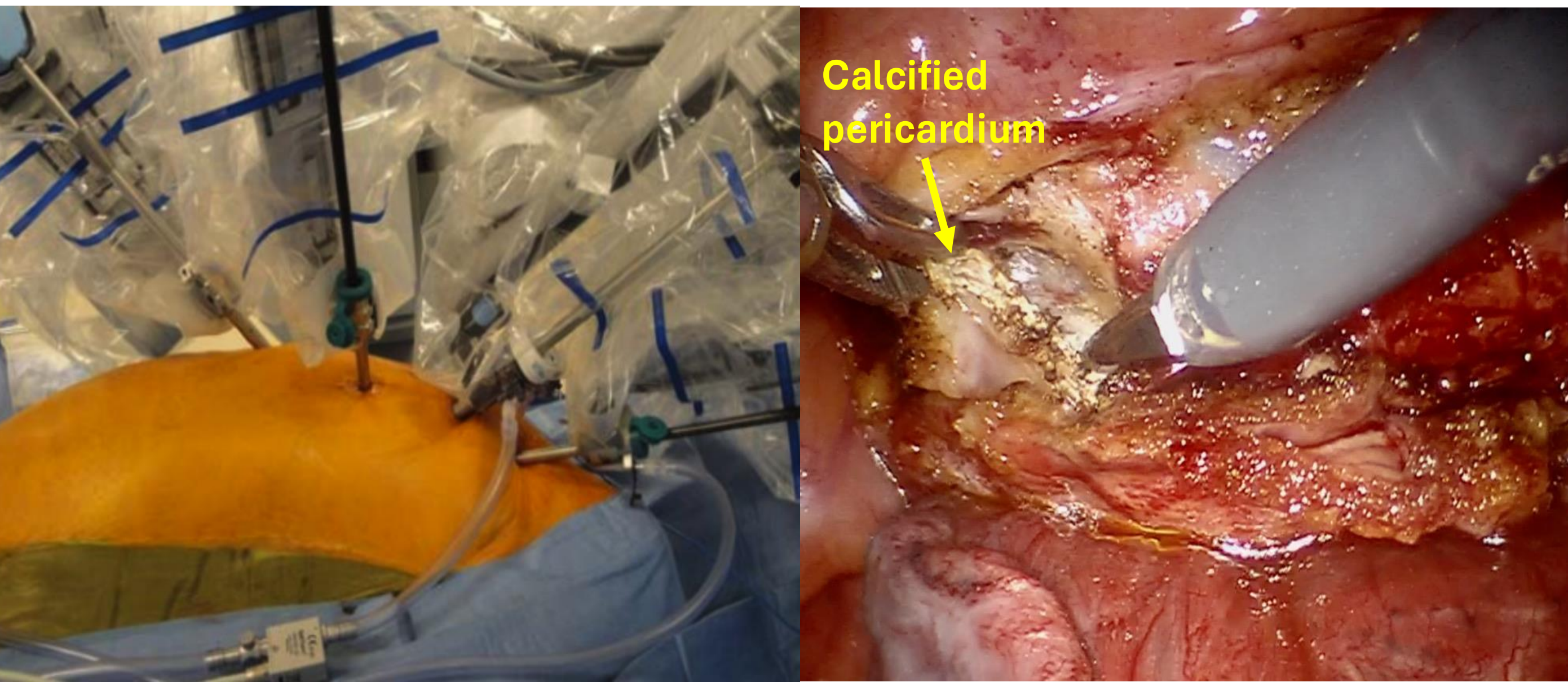
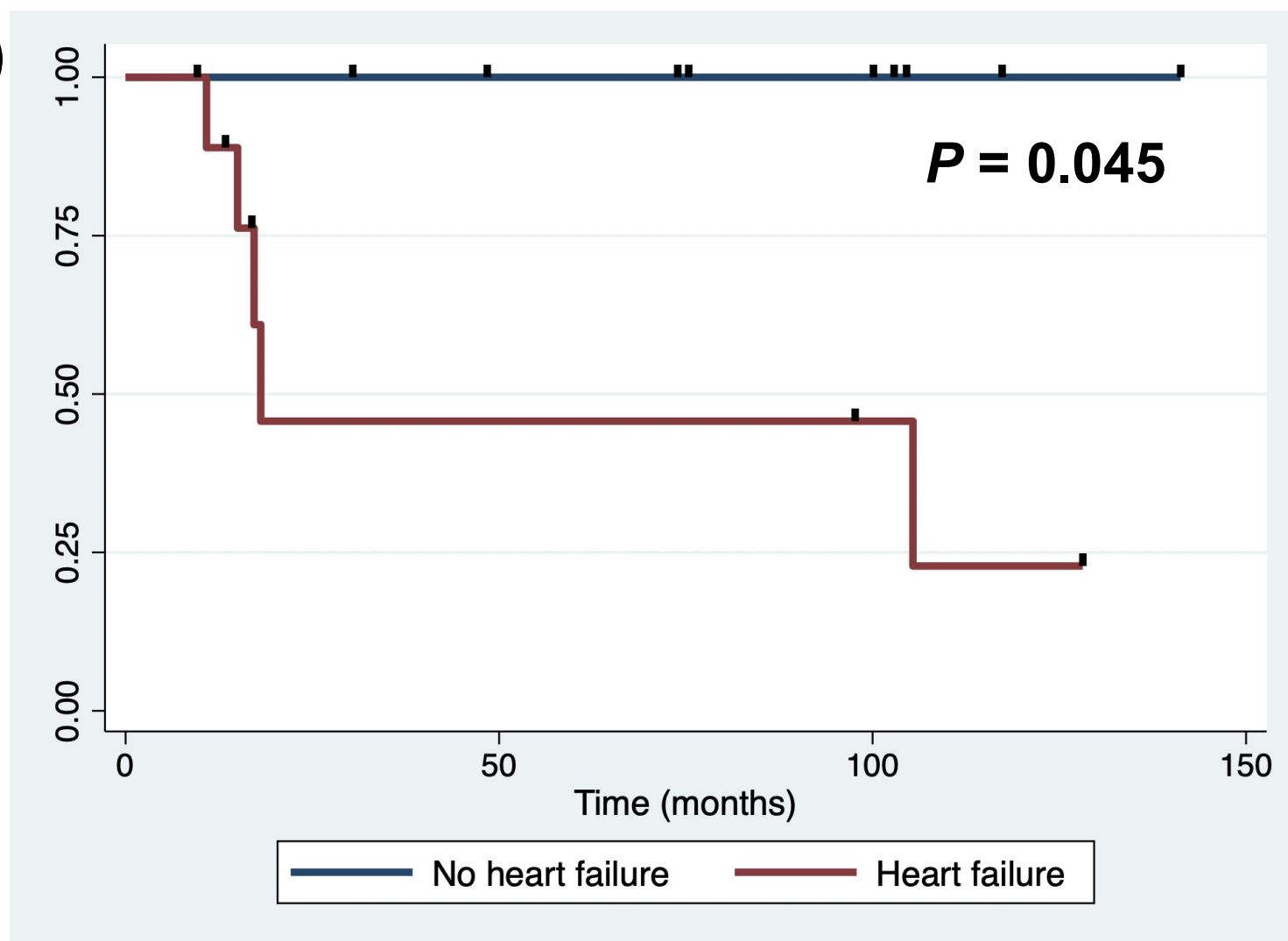


Table 4: Long-term outcomes: survival analysis

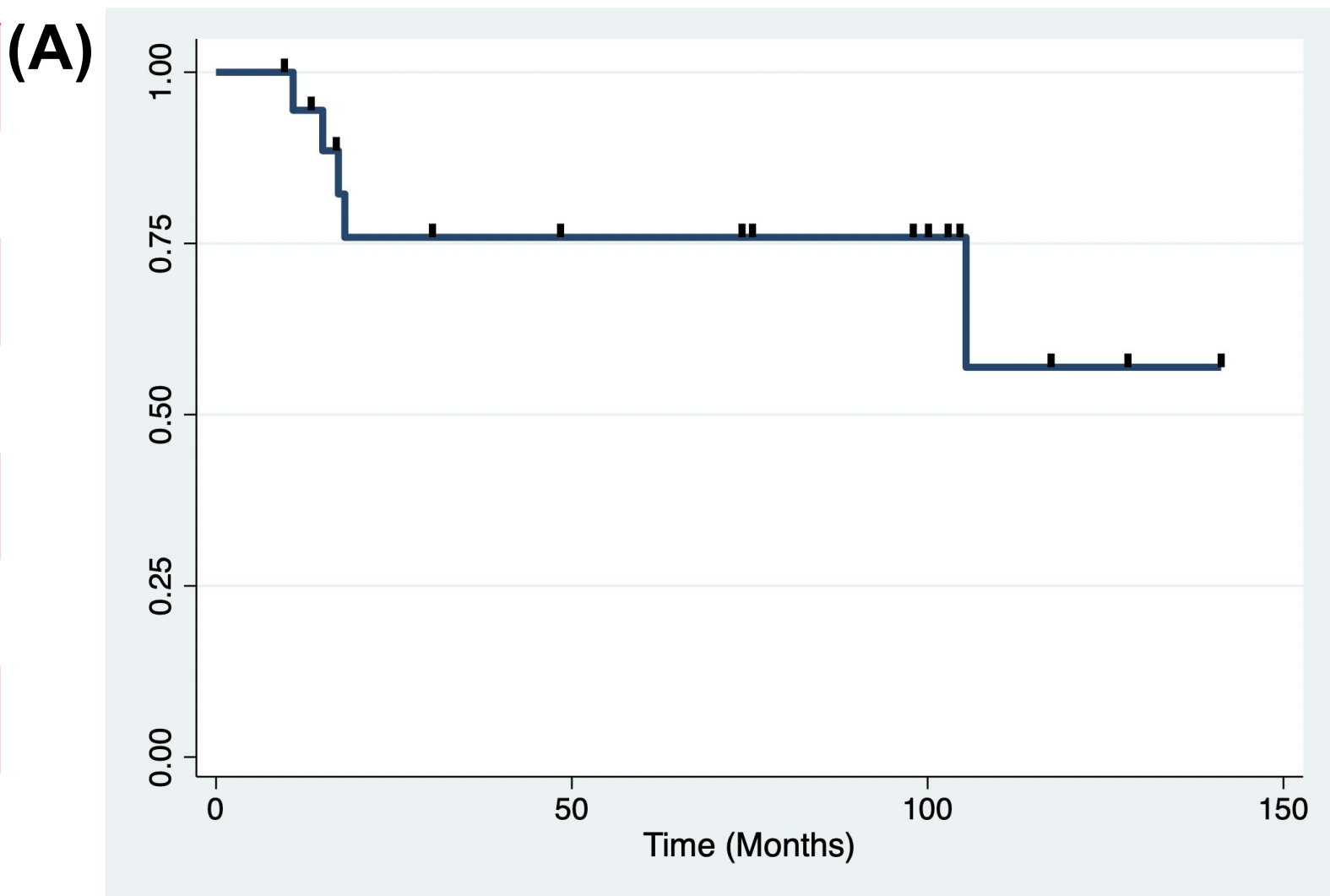
Mean follow up time	64.4 ± 46.5 months
Reoperation	0
6-month mortality	0
Overall mortality	5 (26%)
1-year survival	94%
5-year survival	76%
10-year survival	57%
Median survival before death	17.1 months

(B)

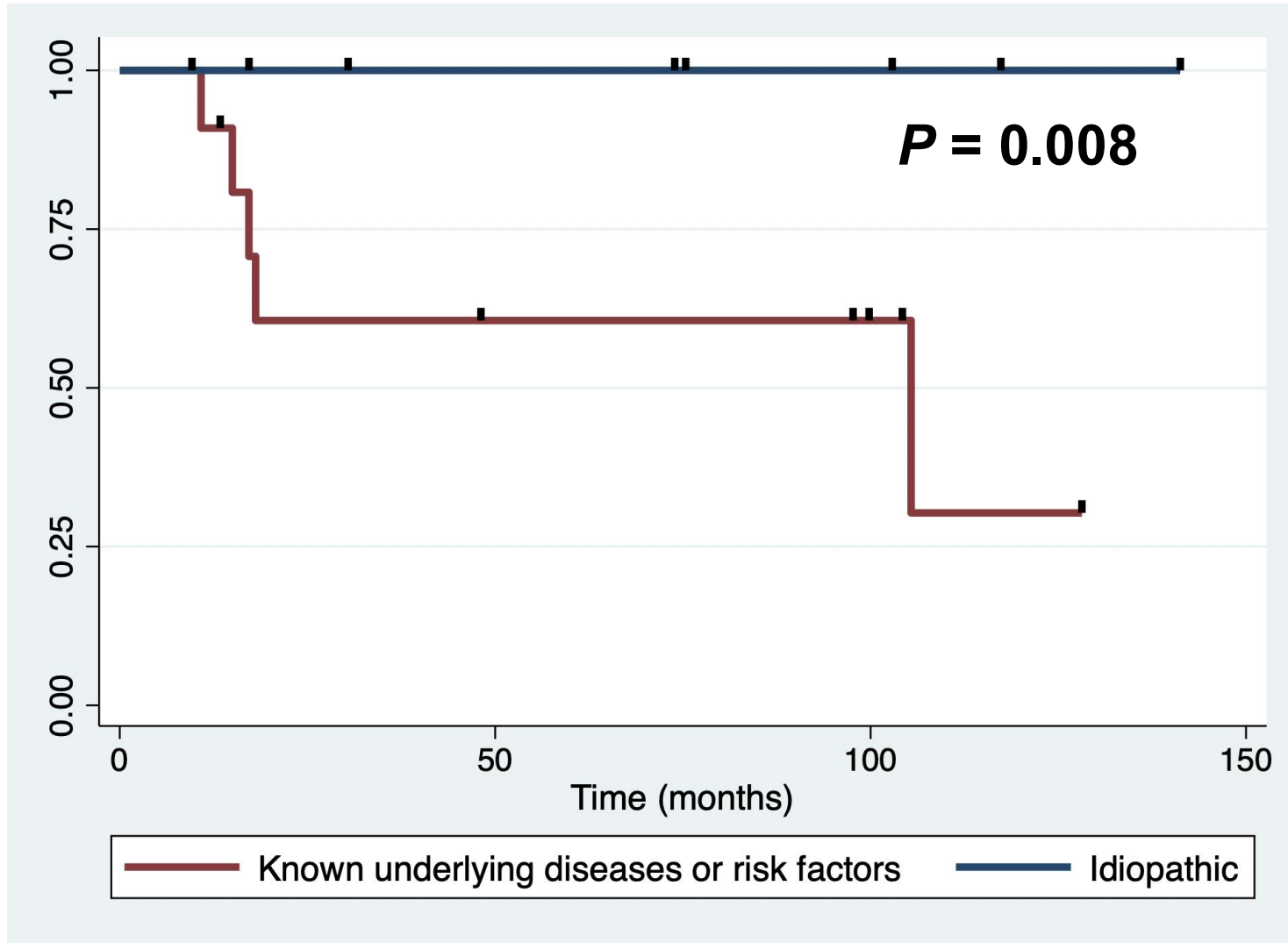


Cause of death: liver failure + aspiration pneumonia, hepatic encephalopathy + cardiorenal syndrome, AML, cardiogenic shock, and heart failure

Figure 2: Kaplan-Meier survival analysis



(C)



Discussion

- Robotic-assisted endoscopic off-pump pericardiectomy affords smaller incisions and faster recovery, and showed excellent early outcomes with **zero perioperative mortality** and an **average hospital stay of 4 days** (**Table 3**); in contrast, historical perioperative mortality ranges from 0 to 14% [3]
- Despite pre-operative co-morbidities (63% of cohort had known etiologies for pericarditis), the long-term outcomes are comparable to traditional open pericardiectomy (**Table 4**), with a **76% 5-year survival** on par with historical data (ranging from 46 to 94.5%), and **median survival was not reached (NR)** during the follow-up period (**Figure 2A**) [3]
- When stratified by pre-operative CHF diagnosis, **patients with CHF had significantly higher mortality than patients without CHF** (**Figure 2B**, 18.1 vs. NR, $P = 0.008$), suggesting early surgical intervention for constrictive pericarditis could improve survival.
- When stratified by etiology, **patients with isolated, idiopathic pericarditis had significantly more favorable outcome** than patients with known underlying diseases and risk factors (**Figure 2C**, NR vs.105.4 months, $P = 0.045$), demonstrating excellent outcomes and that robotic pericardiectomy is a safe, viable option for those with suboptimal response to medical therapy.

Conclusion

- Robotic endoscopic off-pump pericardiectomy demonstrated outcomes comparable to those reported for traditional surgery.
- This approach enables superior visualization, allowing for complete resection of the pericardium, including the posterior aspect. It is a promising option for all patients, including those deemed high-risk by traditional approach.

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Reference: [1] Murashita et al., Ann Thorac Surg (2017). [2] Villavicencio et al., Oper Tech Thorac Cardiovasc Surg (2008). [3] Liu et al., J. Cardiothorac. Vasc. Anesth (2021)