

Automated Titanium Fastener Use in Low-Risk Patients Undergoing Minimally Invasive Mitral Valve Repair

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Background

Minimally invasive mitral valve repair (MIMVr) has revolutionized the treatment of mitral valve disease, offering a less invasive alternative to traditional sternotomy-based approaches. Using titanium fasteners (TFs) to secure annular suture in place of hand-tied (HT) knots may further enhance these benefits by facilitating a faster and more reliable operation.

Methods

We identified 618 low-risk patients (STS-PROM <4) who underwent MIMVr via a right anterolateral thoracotomy at our institution between 2011 and 2024. Patients were stratified based on suture securement method: TFs (n=423) or HT (n=195). Preoperative characteristics, intraoperative variables, and postoperative outcomes were compared between the two groups.

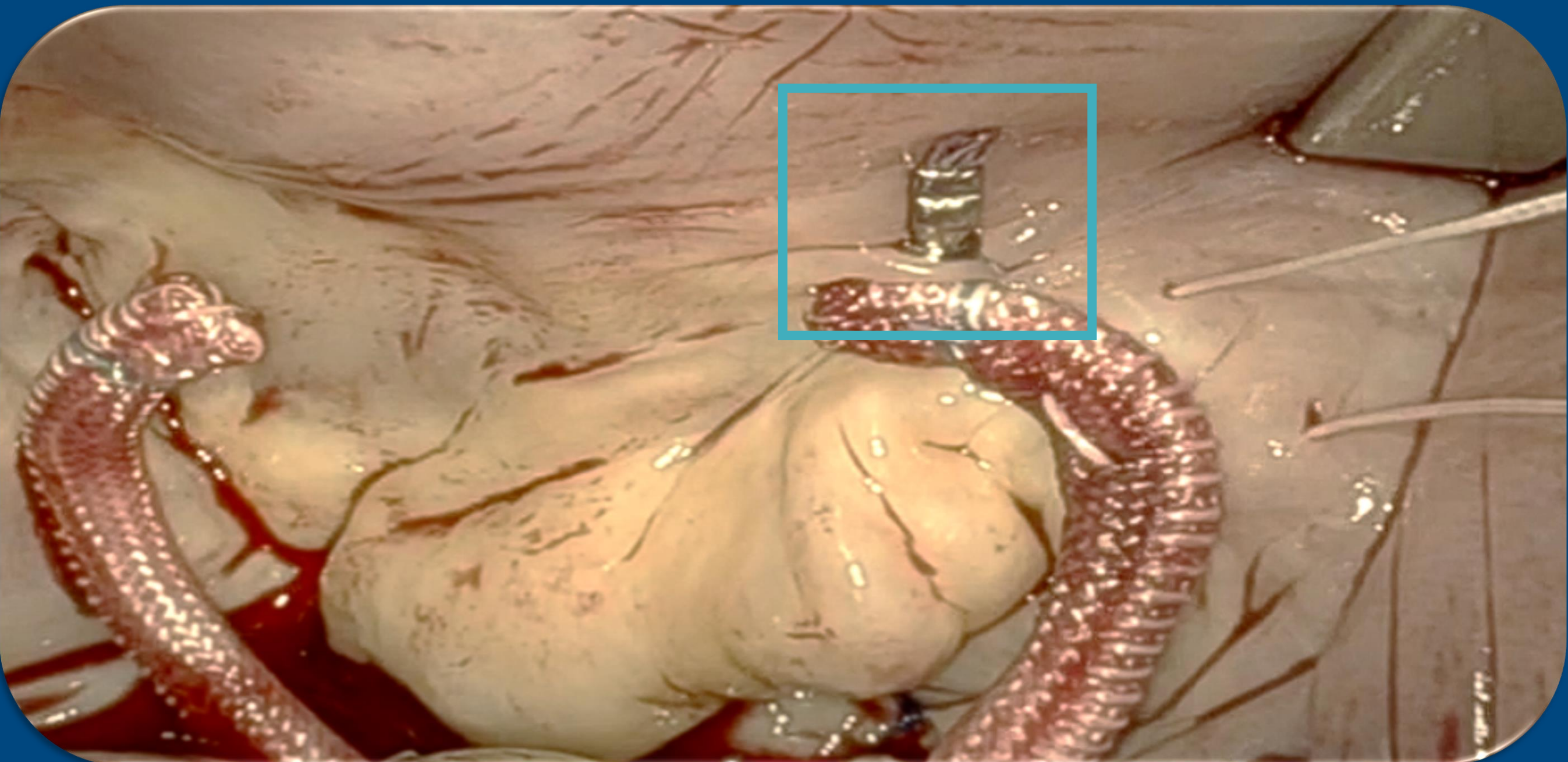


Figure 1. Intraoperative image of a titanium fastener securing a horizontal mattress annuloplasty suture.

Results

Preoperative characteristics were similar between groups aside from slightly higher age of patients in the HT cohort (65.49 years vs. 63.00; P = 0.012). Patients in the TF group experienced a significant reduction in aortic cross-clamp time (74.00 min vs. 83.87 min; P < 0.001) and cardiopulmonary bypass time (102.50 min vs. 120.36 min; P < 0.001). Patients in the TF group also had a lower rate of reoperation for bleeding (0.5% vs. 2.6%; P = 0.035) and shorter postoperative length of stay (5.37 days vs. 6.15 days; P = 0.032) without any increases in complications, readmission, or mortality.

Outcome Variables	Titanium Fasteners n= 423	Hand-Tied Knots n= 195	P-Value
CPB Time (min)	102.50 (29.80)	120.36 (42.45)	<0.001
Cross-Clamp Time (min)	74.00 (20.52)	83.87 (25.19)	<0.001
Mortality (30d)	2 (0.5%)	1 (0.5%)	1.000
Readmission	27 (6.4%)	20 (10.3%)	0.091
Reoperation for Bleeding	2 (0.5%)	5 (2.6%)	0.035
LOS (days)	5.37 (4.19)	6.15 (4.27)	0.032
Mitral Regurg. (>mod)	3 (0.7%)	1 (0.5%)	1.000
Surgical Site Infection	0 (0.0%)	0 (0.0%)	N/A
Post-Op A-Fib	91 (21.5%)	33 (16.9%)	0.185
Renal Failure	1 (0.2%)	0 (0.0%)	1.000
Prolonged Ventilation	8 (1.9%)	7 (3.6%)	0.259

Data presented as Mean (SD) or count (%)

Conclusions

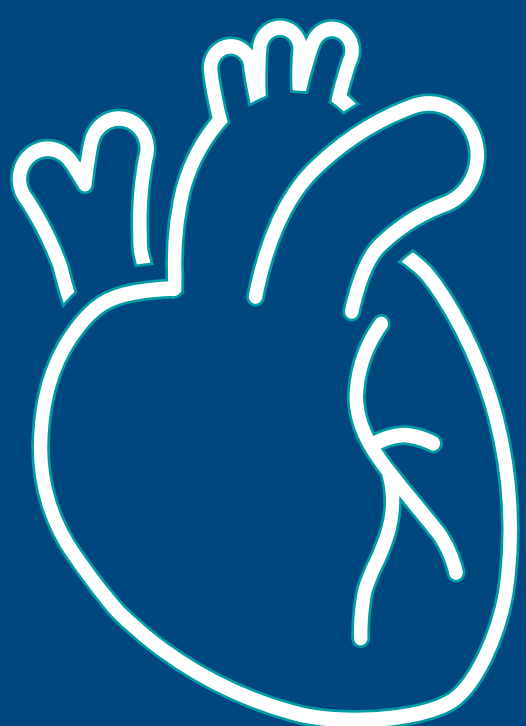
The use of TFs in MIMVr is associated with significantly reduced operative times, lower rates of reoperation for bleeding, and shorter postoperative hospital stays compared to HT knots, without compromising safety or increasing complications. These findings suggest that TFs have the potential to enhance surgical efficiency while also contributing to improved patient outcomes, making them a valuable tool in advancing minimally invasive cardiac surgery.

Shorter
Procedure
Times



CPB
ACC ↓ 14.8%
11.8%

Less
Bleeding



Reop
Rate ↓ 60.0%

Reduced
Hospital
LOS



Postop
LOS ↓ 12.7%