

Comparison of Mechanical, Biologic Handmade Root, and Dry- Stored Biologic Root and Valve Conduits in Bentall Procedures with STS Risk Stratification

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INTRODUCTION

The Bentall procedure remains a cornerstone operation for aortic root and valve pathology. Despite excellent outcomes, the optimal choice of conduit among mechanical, handmade biologic, and dry stored biologic options such as the Konect remains debated.

The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Risk Calculator provides individualized perioperative risk prediction, but its role in Bentall outcome stratification has not been fully defined.

Recent advances in biologic conduit technology, including preassembled dry stored grafts, offer potential benefits in operative efficiency and hemostasis but require validation of their safety and outcomes compared with traditional methods.

This study compared short term outcomes among conduit types and evaluated how median based STS risk stratification identifies predictors of complications and length of stay.

METHODS

Study Design

Retrospective single center study of adults aged 18 years or older undergoing Bentall procedures from January 1, 2020 through December 31, 2024.

Cohort Grouping

Dry stored biologic root and valve conduits (n = 66)

Biologic handmade roots (n = 10)

Mechanical (n = 29)

Risk Stratification

STS predicted risks for operative mortality, morbidity and mortality, stroke, renal failure, reoperation, prolonged stay greater than 14 days, and short stay less than 6 days were dichotomized at the median.

Study Outcomes

Primary outcomes included in hospital mortality, stroke, postoperative arrhythmia, dialysis, readmission within 30 days, and total length of stay. Secondary endpoints included duration of intensive care unit stay, postoperative ventilation time, and reoperation for bleeding.

Statistical Analysis

Logistic regression assessed associations between high-risk designations and observed outcomes.

Primary outcomes included mortality, stroke, dialysis, arrhythmia, readmission, and length of stay. Significance was defined as p less than 0.05.

RESULTS

A total of 105 patients met inclusion criteria. Baseline characteristics were similar between groups with no differences in predicted STS risk profiles.

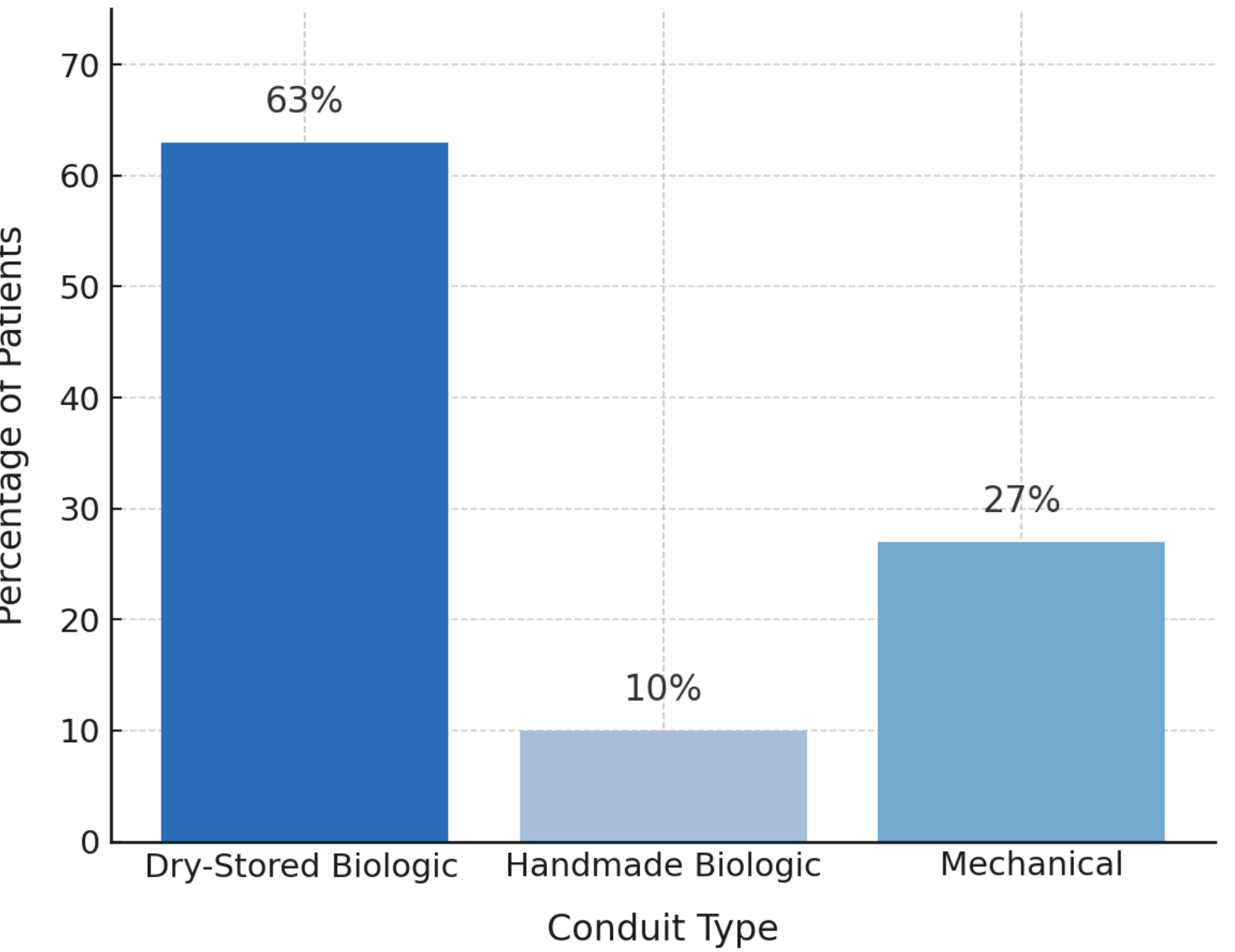
Table 1. Patient Demographics and Baseline Characteristics

Variable	Dry Stored Biologic (n=66)	Handmade Biologic (n=10)	Mechanical (n=29)	p value
Age, years (mean ± SD)	59.3 ± 10.8	61.2 ± 11.4	60.1 ± 9.6	0.72
Male sex, n (%)	47 (71)	7 (70)	22 (76)	0.88
BMI, kg/m ² (mean ± SD)	28.5 ± 4.2	27.9 ± 3.9	28.2 ± 4.1	0.91
Hypertension, n (%)	58 (88)	9 (90)	26 (90)	0.97
Diabetes mellitus, n (%)	18 (27)	3 (30)	9 (31)	0.94
Ejection fraction, % (mean ± SD)	56 ± 8	54 ± 9	55 ± 7	0.77
Preoperative creatinine, mg/dL (mean ± SD)	1.1 ± 0.4	1.2 ± 0.5	1.1 ± 0.3	0.82
Prior cardiac surgery, n (%)	12 (18)	1 (10)	4 (14)	0.76

Figure 1. Conduit Type Distribution

Bar chart showing proportions of conduit types used in Bentall procedures at MUSC from 2020 to 2024.

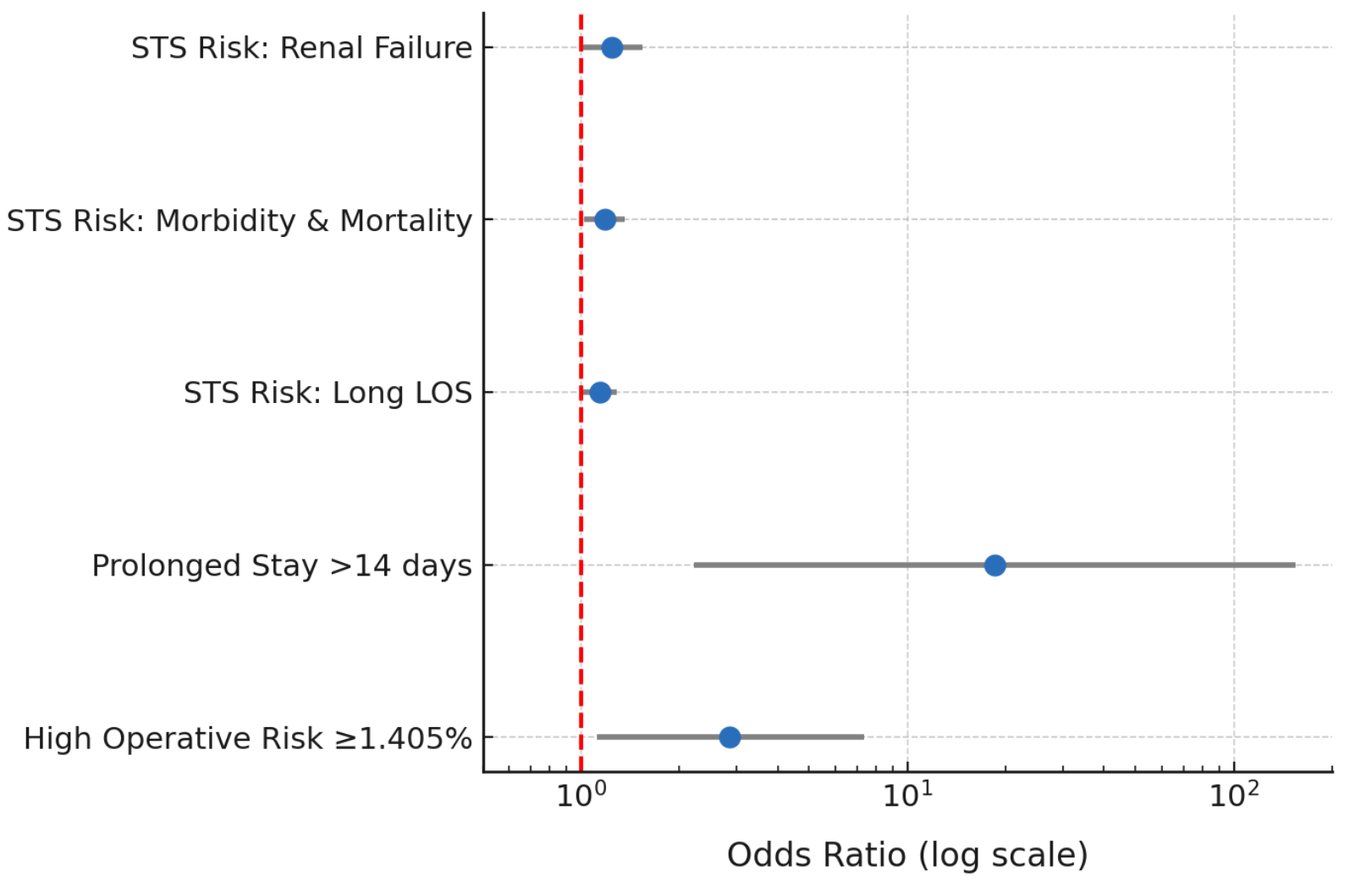
Dry-stored biologics accounted for 63 percent, handmade biologic roots for 10 percent, and mechanical for 27 percent.



No significant differences in early postoperative complications or length of stay were observed across conduit types (all p greater than 0.05).

Figure 2. Forest Plot of Statistically Significant Predictors

Odds ratios with 95% confidence intervals for key predictors of postoperative complications.



High operative risk increased odds of arrhythmias (OR 2.9). Prolonged stay >14 days was associated with dialysis and stroke (OR 18.5 and 10.5, respectively). STS predicted long LOS, renal failure, and morbidity and mortality were independently associated with in hospital mortality. All models demonstrated excellent discrimination (ROC AUC > 0.85).

RESULTS

Table 2. Logistic Regression of Statistically Significant Predictors

Outcome	Predictor	OR (95% CI)	p value
Arrhythmias	High Operative Risk ≥1.405%	2.86 [1.12–7.35]	0.029
Dialysis	Prolonged Stay >14 days	18.48 [2.21–154.60]	0.007
Stroke	Prolonged Stay >14 days	10.47 [1.17–93.35]	0.035
In Hospital Mortality	STS Risk Ventilation	1.23 [1.03–1.47]	0.020
	STS Risk Stroke	3.88 [1.21–12.47]	0.023
	STS Risk Long LOS	1.14 [1.01–1.29]	0.036
	STS Risk Renal Failure	1.24 [1.00–1.54]	0.047
	STS Risk Morbidity and Mortality	1.18 [1.02–1.36]	0.028
	STS Risk Reoperation	1.49 [1.06–2.11]	0.024
Prolonged LOS	High Operative Risk ≥1.405%	3.54 [1.12–11.21]	0.032
	High Morbidity and Mortality ≥17.5%	3.92 [1.24–12.40]	0.020
	High Predicted LOS ≥11.65%	4.90 [1.56–15.43]	0.007
Short LOS (<6 days)	High Operative Risk ≥1.405%	0.19 [0.05–0.75]	0.018

CONCLUSIONS

- Conduit type whether mechanical, handmade biologic, or dry stored biologic did not affect short term mortality or major morbidity after Bentall procedures.
- Median based STS risk stratification effectively identified predictors of arrhythmia, dialysis, stroke, and mortality.
- High STS predicted risk profiles correlated with prolonged length of stay and early mortality.
- Integrating individualized STS modeling into perioperative planning and patient counseling may improve outcome prediction.
- Dry stored biologic conduits appear safe and effective for Bentall replacement in appropriately selected patients.

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