

Baylor
College of
Medicine

The Effects of Modern Robotic Technology on Clinical Outcomes of Coronary Artery Bypass Grafting

Katherine Nordick (1), Zachary Gray (1), Alexis Shafii (2), Gabriel Loor (2), Todd Rosengart (2), Kenneth K. Liao (2)

(1) Baylor College of Medicine, Houston, TX, (2) Baylor College of Medicine, Baylor St. Luke's Medical Center, Texas Heart Institute, Houston, TX



Background

Current **robotic surgery** outcomes have been equivalent and even superior to **conventional surgical approaches** in many surgical specialties. The adaptation of robotic **cardiac surgery** has been slow due to **mixed outcomes** from previous studies involving **older technology**. The purpose of this study was to compare the clinical outcomes of patients who had **robotic (Rob) CABG** using current robotic technology (**4th generation, da Vinci Xi System**) with those who had conventional CABG at our institution.



Figures 1 (left) and 2 (right): Da Vinci Xi Surgical System

Methods

Inclusion criteria

All CABG cases at Baylor St. Luke’s Medical Center from 1/2019-7/2022 were analyzed. **Rob CABG** patients were chosen based on the following coronary pathology: **sole LAD lesion** requiring LIMA to LAD bypass, **sole LAD lesion plus proximal OM lesion** not amenable to stenting requiring **bilateral IMA** bypass, or multi-vessel disease requiring **hybrid approach** with staged LIMA to LAD and stenting. These patients were compared to a general cohort of **conventional CABG** patients.



Figure 3: Post-Rob CABG showing mini-thoracotomy incision and trocar sites

References

1. Harky A, Hussain SMA. Robotic Cardiac Surgery: The Future Gold Standard or An Unnecessary Extravagance? Braz J Cardiovasc Surg. 2019 Aug 27;34(4):XII-XIII. doi: 10.21470/1678-9741-2019-0194. PMID: 31454191; PMCID: PMC6713378.
2. Brouwers C, Hooftman B, Vonk S, Vonk A, Stoker W, Te Gussinklo WH, Wesselink RM, Wagner C, de Bruijne MC. Benchmarking the use of blood products in cardiac surgery to stimulate awareness of transfusion behaviour : Results from a four-year longitudinal study. Neth Heart J. 2017 Mar;25(3):207-214. doi: 10.1007/s12471-016-0936-1. PMID: 27987079; PMCID: PMC5313448.

Methods

Analysis

Average **Society of Thoracic Surgeons (STS) risk scores** were used to compare the patient groups preoperatively (unpaired t-test). **STS performance metrics** and **blood transfusion** data were used to compare clinical outcomes (two-sided Fisher’s exact test). STS metrics included **operative mortality**, **permanent stroke**, **reoperation**, **prolonged ventilation**, **renal failure**, **deep sternal wound (DSW) infection**, **short length of stay (LOS)**, and **composite morbidity and mortality** calculated as **event rate** percentage. Transfusion data was calculated as **average units of red blood cells (RBCs)** given per case and percentage of cases that required transfusion.

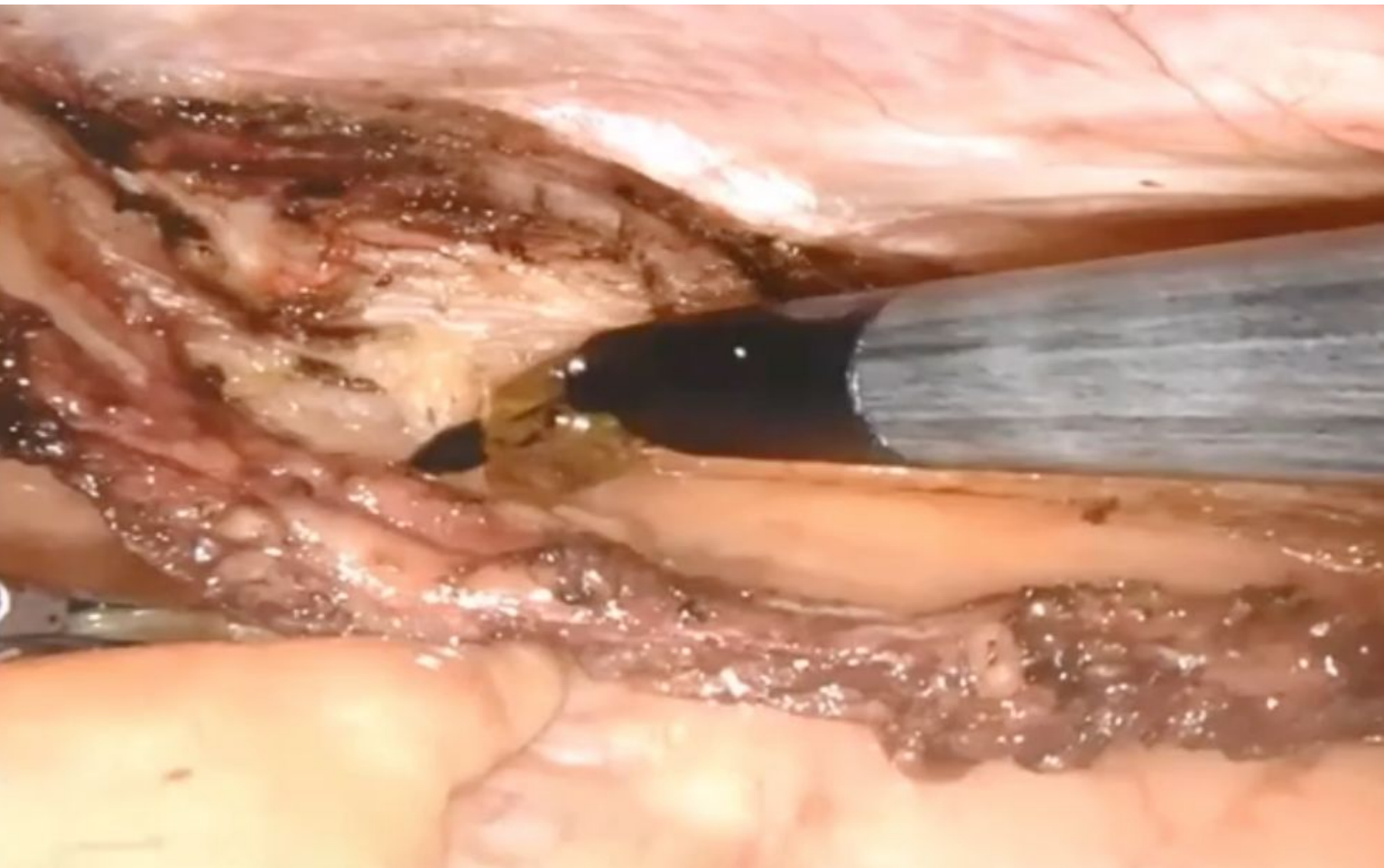


Figure 4: Robotic LIMA dissection

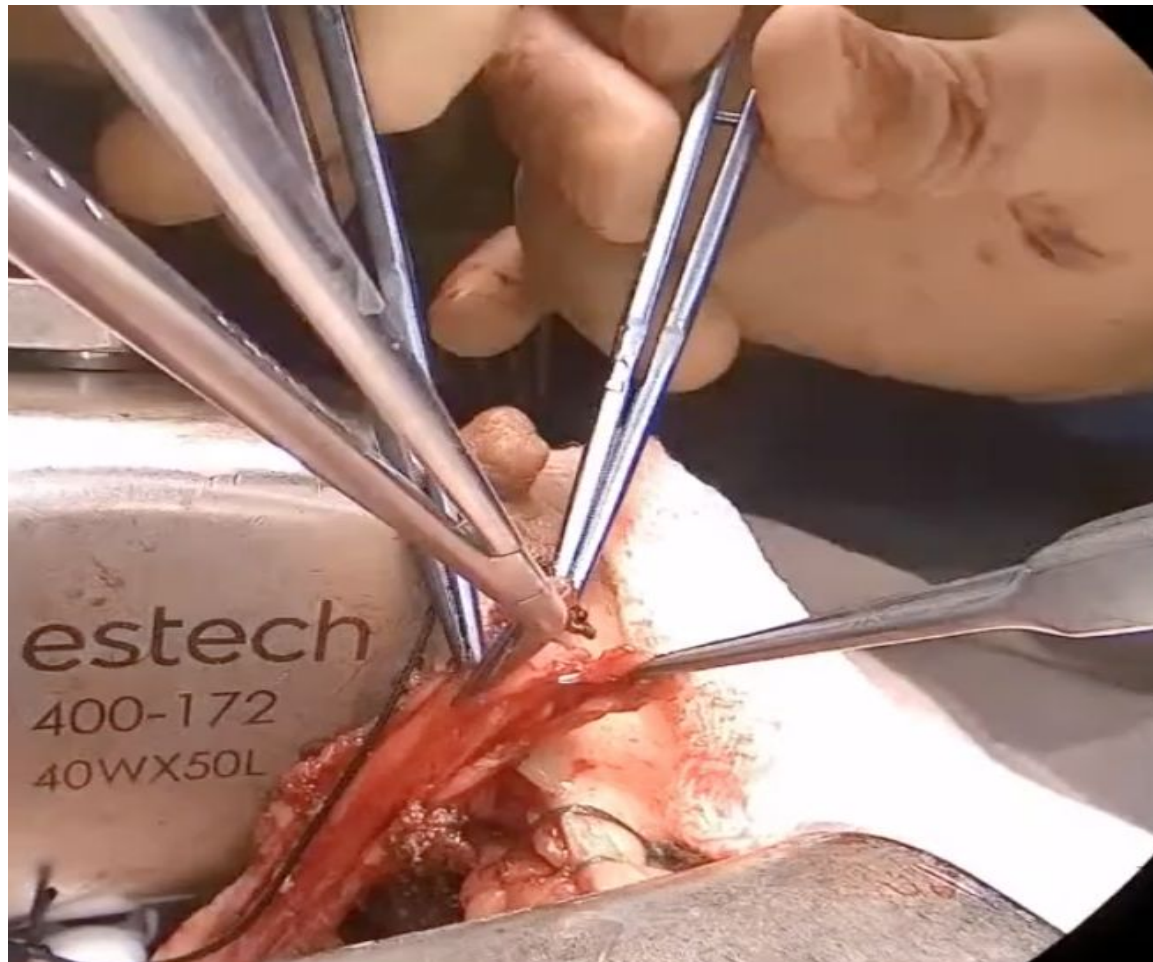


Figure 5: Robotic LIMA preparation

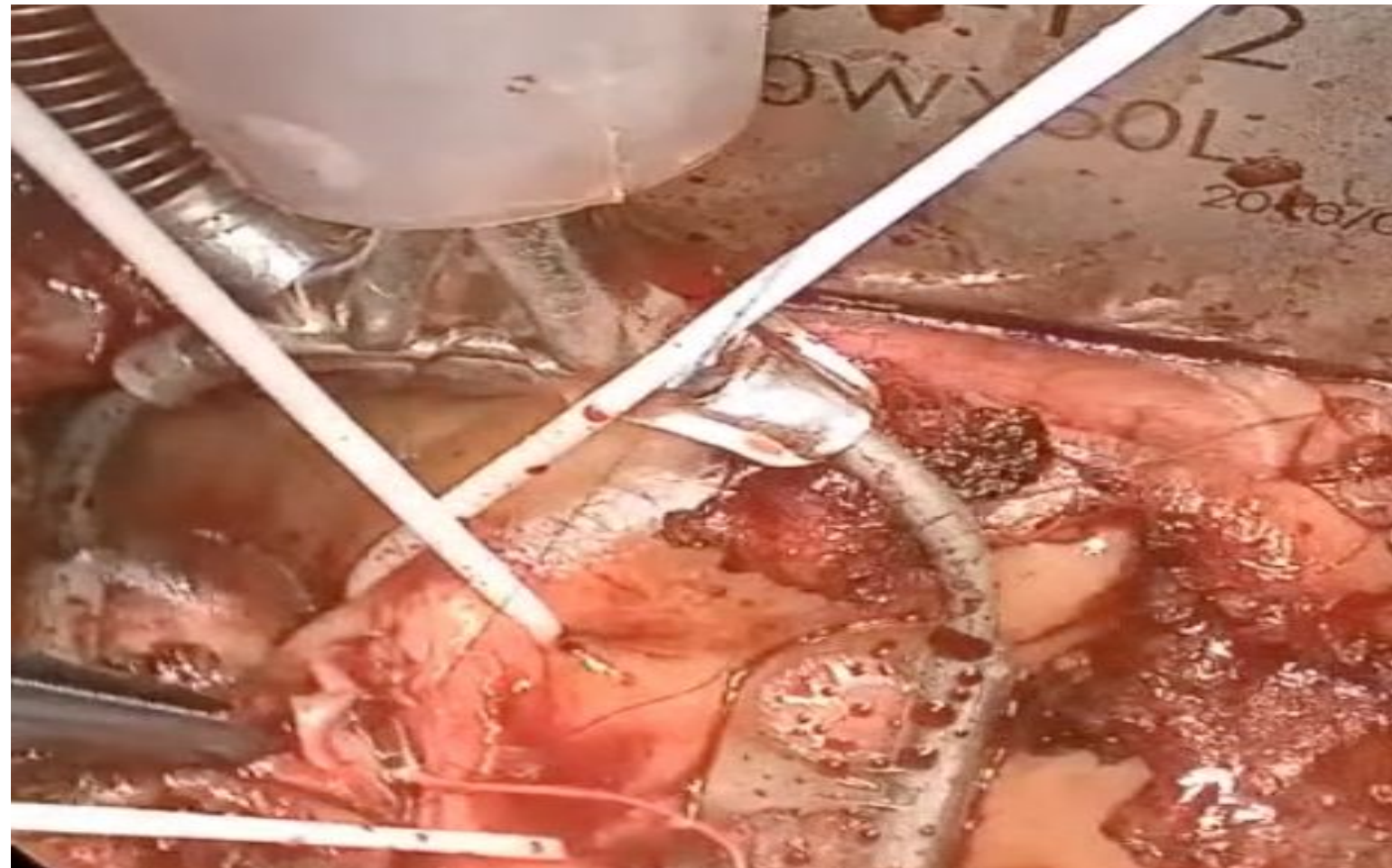


Figure 6: Robotic LIMA-LAD anastomosis with intracoronary shunt and myocardial stabilizer

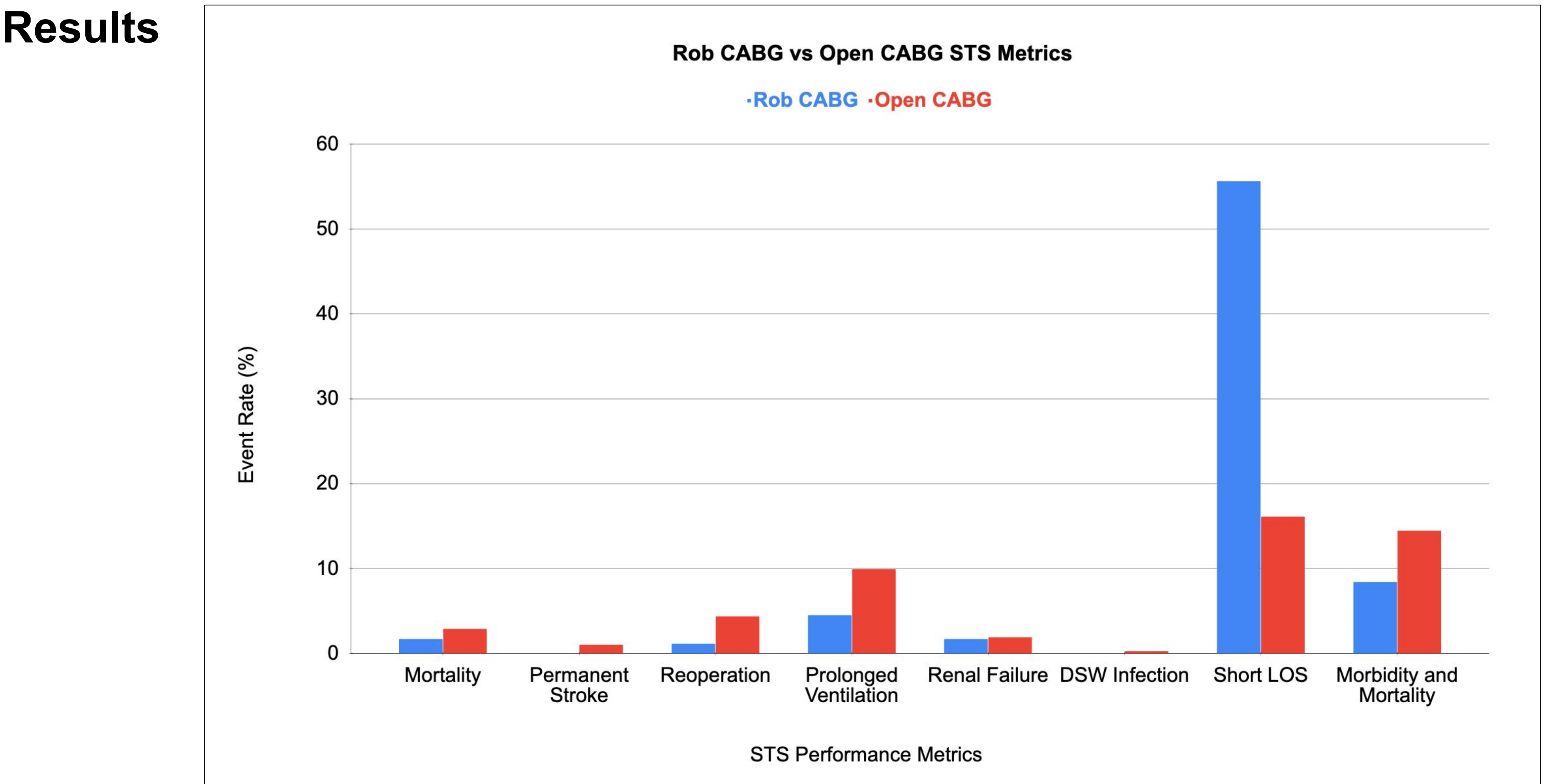


Figure 7: Graphical comparison of STS metrics

Results

1325 patients

Robotic (N = 178)
STS = 2.17±4.12%

Pre-op STS Risk
p = 0.38

Conventional (N = 1147)
STS = 2.54±4.35%

Table 1: STS Metrics	Rob CABG (N=178) % (#Events/Total)	Conventional CABG (N=1147) % (#Events/Total)	p-value
Mortality	1.7 (3/178)	2.9 (33/1147)	0.4645
Permanent Stroke	0 (0/178)	1.0 (12/1147)	0.3867
Reoperation	1.1 (2/178)	4.4 (50/1147)	0.0368
Prolonged Ventilation	4.5 (8/178)	9.9 (114/1147)	0.0174
Renal Failure	1.7 (3/178)	1.9 (22/1147)	0.9999
DSW Infection	0 (0/178)	0.3 (3/1147)	0.9999
Short LOS	55.6 (99/178)	16.1 (185/1147)	< 0.0001
Composite Morbidity and Mortality	8.4 (15/178)	14.5 (166/1147)	0.0339

Table 2: Transfusion	Rob CABG	Conventional CABG
Average units RBCs per case	2.4	3.4
Rate (%)	19.10%	52.73%

Conclusions

Compared to conventional CABG, **Rob CABG** demonstrated better clinical outcomes in all STS metrics with significant reductions in **reoperation**, **ventilation time**, **hospital LOS**, and **composite morbidity and mortality**. Furthermore, the transfusion rate for the robotic cases was **19%**, significantly below the national average (approx. 40-50%). The value of modern robotic technology in cardiac surgery should be reevaluated and advocated.