



January 16, 2026

Intuitive Surgical, Inc.
Emily Hovick
Sr. Regulatory Affairs Specialist
1266 Kifer Road
Sunnyvale, California 94086

Re: K251739

Trade/Device Name: da Vinci Surgical System (IS5000)
Regulation Number: 21 CFR 876.1500
Regulation Name: Endoscope And Accessories
Regulatory Class: Class II
Product Code: NAY
Dated: December 18, 2025
Received: December 19, 2025

Dear Emily Hovick:

We have reviewed your section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (the Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database available at <https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm> identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Additional information about changes that may require a new premarket notification are provided in the FDA guidance documents entitled "Deciding When to Submit a 510(k) for a Change to an Existing Device" (<https://www.fda.gov/media/99812/download>) and "Deciding When to Submit a 510(k) for a Software Change to an Existing Device" (<https://www.fda.gov/media/99785/download>).

Your device is also subject to, among other requirements, the Quality System (QS) regulation (21 CFR Part 820), which includes, but is not limited to, 21 CFR 820.30, Design controls; 21 CFR 820.90, Nonconforming product; and 21 CFR 820.100, Corrective and preventive action. Please note that regardless of whether a change requires premarket review, the QS regulation requires device manufacturers to review and approve changes to device design and production (21 CFR 820.30 and 21 CFR 820.70) and document changes and approvals in the device master record (21 CFR 820.181).

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR Part 803) for devices or postmarketing safety reporting (21 CFR Part 4, Subpart B) for combination products (see <https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products>); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR Part 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR Parts 1000-1050.

All medical devices, including Class I and unclassified devices and combination product device constituent parts are required to be in compliance with the final Unique Device Identification System rule ("UDI Rule"). The UDI Rule requires, among other things, that a device bear a unique device identifier (UDI) on its label and package (21 CFR 801.20(a)) unless an exception or alternative applies (21 CFR 801.20(b)) and that the dates on the device label be formatted in accordance with 21 CFR 801.18. The UDI Rule (21 CFR 830.300(a) and 830.320(b)) also requires that certain information be submitted to the Global Unique Device Identification Database (GUDID) (21 CFR Part 830 Subpart E). For additional information on these requirements, please see the UDI System webpage at <https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/unique-device-identification-system-udi-system>.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to <https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems>.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (<https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance>) and CDRH Learn (<https://www.fda.gov/training-and-continuing-education/cdrh-learn>). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (<https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory->

[assistance/contact-us-division-industry-and-consumer-education-dice](#)) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Mark
Trumbore -S

Digitally signed by
Mark Trumbore -S
Date: 2026.01.16
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Mark Trumbore Ph.D.
Assistant Director
DHT4A: Division of General Surgery Devices
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Infection Control Devices
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

Indications for Use

510(k) Number (if known)
K251739

Device Name
da Vinci Surgical System (IS5000)

Indications for Use (Describe)

The Intuitive Surgical Endoscopic Instrument Control System (da Vinci Surgical System, Model IS5000) shall assist in the accurate control of Intuitive Surgical Endoscopic Instruments including rigid endoscopes, blunt and sharp endoscopic dissectors, scissors, scalpels, forceps/pick-ups, needle holders, endoscopic retractors, electrocautery and accessories for endoscopic manipulation of tissue, including grasping, cutting, blunt and sharp dissection, approximation, ligation, electrocautery, suturing, and delivery and placement of microwave and cryogenic ablation probes and accessories, during urologic surgical procedures, general laparoscopic surgical procedures, gynecologic laparoscopic surgical procedures, and general thoracoscopic surgical procedures. The system is also indicated for selected thoracoscopically-assisted cardiac surgical procedures using the non-force feedback instruments. The system is indicated for adult use.

It is intended to be used by trained physicians in an operating room environment in accordance with the representative specific procedures set forth in the Professional Instructions for Use.

Contraindication: Use of the force feedback needle driver is contraindicated in hysterectomy and myomectomy due to the risk of vaginal bleeding requiring hospital readmission and/or the need for additional procedures. The use of non-force feedback needle drivers is recommended for suturing in these procedures.

Type of Use (Select one or both, as applicable)

Prescription Use (Part 21 CFR 801 Subpart D)

Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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510(k) Summary (21 CFR § 807.92(c))

I. Submitter Information

510(k) Owner: Intuitive Surgical
1266 Kifer Road
Sunnyvale, CA 94085

Contact Person: Emily Hovick
Senior Regulatory Affairs Specialist
Phone: 314-359-8534
Email: Emily.hovick@intusurg.com

Date Summary Prepared: January 16, 2026

II. Subject Device Information

Trade Name: da Vinci Surgical System (IS5000)

Common Name: System, surgical, computer-controlled instrument

Classification: Class II

Regulation: 21 CFR § 876.1500, Endoscope and Accessories

Product Code: NAY

III. Predicate Device Information

Predicate Device: da Vinci Surgical System (IS5000), K232610

Reference Device: da Vinci Xi Surgical System (IS4000), K131861

IV. Device Description

The da Vinci Surgical System (IS5000) is a software-controlled, electromechanical system designed for surgeons to perform minimally invasive surgery. It consists of a Surgeon Side Console (Console), a Patient Side Cart (Robot), and a Vision System Cart (Tower) and is used with an Endoscope, EndoWrist Instruments, and Accessories.

V. Indications for Use

The Intuitive Surgical Endoscopic Instrument Control System (da Vinci Surgical System, Model IS5000) shall assist in the accurate control of Intuitive Surgical Endoscopic Instruments including rigid endoscopes, blunt and sharp endoscopic dissectors, scissors, scalpels, forceps/pick-ups, needle holders, endoscopic retractors, electrocautery and accessories for endoscopic manipulation of tissue, including grasping, cutting, blunt and sharp dissection, approximation, ligation, electrocautery, suturing, and delivery and placement of microwave and cryogenic ablation probes and accessories, during urologic surgical procedures, general laparoscopic surgical procedures, gynecologic laparoscopic surgical procedures, and general thoracoscopic surgical procedures. The system is also indicated for selected thoracoscopically-assisted cardiac surgical procedures using the non-force feedback instruments. The system is indicated for adult use.

It is intended to be used by trained physicians in an operating room environment in accordance with the representative specific procedures set forth in the Professional Instructions for Use.

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Contraindication: Use of the force feedback needle driver is contraindicated in hysterectomy and myomectomy due to the risk of vaginal bleeding requiring hospital readmission and/or the need for additional procedures. The use of non-force feedback needle drivers is recommended for suturing in these procedures.

VI. Technological Characteristics

The da Vinci Surgical System (IS5000) is technologically equivalent to the predicate device, with no changes to its operational principles. This 510(k) pertains exclusively to software and labeling modifications which include the following:

- Instrument compatibility:
 - Atrial Retractor Short Right (PN 470246)
 - Cardiac Probe Grasper (PN 470215)
- Revised indications for use to include:

“The system is also indicated for selected thoracoscopically-assisted cardiac surgical procedures using the non-force feedback instruments.”
- Addition of specific, representative uses:
 - Mitral valve repair
 - IMA mobilization for cardiac revascularization
 - Patent foramen ovale closure
 - Atrial septal defect repair
 - Left atrial appendage closure/occlusion
 - Atrial myxoma excision
 - Mitral valve replacement
 - Tricuspid valve repair
 - Epicardial pacing lead placement

VII. Performance Data

Software Testing

Software verification and validation have been conducted at the unit, integration, and system level to confirm that the subject device continues to meet design requirements and user needs. Software documentation has been provided in accordance with FDA Guidance, “Content of Premarket Submissions for Device Software Functions,” issued on June 14, 2023.

Cadaver and Animal Non-Clinical Testing

Equivalence studies were conducted to compare the surgical performance and safety of the da Vinci Surgical System (IS5000) to the reference da Vinci Xi Surgical System (IS4000) during mitral valve repair and IMA mobilization for cardiac revascularization procedures. The studies involved testing in both cadaveric and live canine models.

Systematic Literature Reviews

Systematic literature reviews were conducted to evaluate clinical outcomes of robotic-assisted procedures performed with a da Vinci Surgical System, including mitral valve repair, coronary artery bypass grafting (CABG), atrial septal defect repair, left atrial appendage closure/occlusion, patent foramen ovale closure, atrial myxoma excision, mitral valve replacement, and tricuspid valve repair.

Findings from these systematic literature reviews demonstrate that the clinical outcomes of robotic-assisted procedures performed with the da Vinci Surgical System are comparable to those of traditional non-robotic approaches, supporting their efficacy and safety across a range of cardiac interventions. Summary data are presented in **Table 1** through **Table 10**.

Real World Data from the Premier Health Database

A retrospective cohort study using the Premier Healthcare Database compared clinical outcomes of robotic and non-robotic mitral valve repair and CABG performed in the United States between 2016 and 2023. The propensity score matched analysis included 1,507 robotic mitral valve repair procedures and 1,507 non-robotic mitral valve repair procedures and 3,893 robotic CABG procedures and 3,893 non-robotic CABG procedures. Results indicate that robotic mitral valve repair and CABG are substantially equivalent to non-robotic procedures. Primary and secondary surgical outcomes are presented in **Table 11** through **Table 16**.

VIII. Conclusion

The subject da Vinci Surgical System (IS5000) has the same intended use as the predicate device, with the addition of more specific indications for use, which includes selected thoroscopically-assisted cardiac surgical procedures, with new specific, representative uses defined in the Professional Instructions for Use. Additionally, the IS5000 system has the same technological characteristics other than a minor software update to enable compatibility with two existing 510(k)-cleared cardiac instruments.

Performance data confirmed that these software and labeling modifications do not raise new or different questions of safety or effectiveness. Therefore, the subject da Vinci Surgical System (IS5000) is substantially equivalent to the cleared predicate device.

Table 1: da Vinci vs. Mini-thoracotomy or Sternotomy MVR Procedure Main Clinical Outcomes

Author / Year	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to sternotomy (%)	Blood transfusion (%)	Number of transfused units (N)	ICU LOS (hours)	Readmission to ICU (%)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-day (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)
1. Albano (2024)	Robotic	98	Median: 259	NR	21	NR	Median: 41	NR	Median: 10	ISI calc. 49	In-hospital: 0	NR	3	NR
	Mini-Thoracotomy	98	Median: 235		15		Median: 45		Median: 11	ISI calc. 47	In-hospital: 0		2	
2. Baccanelli (2024)	Robotic	111	NR								In-hospital: 0	NR		
	Mini-Thoracotomy	205	NR								In-hospital: 0	NR		
3. Barac (2021)	Robotic	128	NR	1.6	NR				5	NR	0	NR	3	NR
	Mini-Thoracotomy	249		1.2	5	0.4	1							
4. Chemtob (2022)	Robotic	605	NR	0	10	NR	Median: 25	NR	5.2 ± 2.9	NR	In-hospital: 0	NR	1.3	Val. Dysf.: 0.66
	Sternotomy	395		NA	17		Median: 27		5.9 ± 2.3		In-hospital: 0		0.51	Val. Dysf.: 0.25
5. Cohan (2018)	Robotic	91	NR				Median: 27.5	3.3	Median: 5	49.5	Operative: 0	8.8	3.3	Val. Dysf.: 0
	Sternotomy	91	NR				Median: 34.0	5.5	Median: 7	53.8	Operative: 2.2	15.4	1.1	Val. Dysf.: 1.1
6. Fujita (2021)	Robotic	169	*MVR (N=118): 201 ± 66	1.2	NR		1.8d ± 0.9	NR	8.1 ± 3.2	NR	0	NR		1.2
	Mini-Thoracotomy	166	*MVR (N=142): 228 ± 49	0.6	1.6d ± 0.8	7.5 ± 1.7	0		0.6					
7. Giroletti (2024)	Robotic	80	Median: 255	NR	21	NR	Median: 32	NR	Median: 10	NR	In-hospital: 0	NR	4	NR
	Mini-Thoracotomy	80	Median: 235		15		Median: 45		Median: 11		In-hospital: 0		1	
8. Hawkins (2018)	Robotic	295	Median: 222	0	15.3	NR	Median: 26	NR	Median: 4	Major: 7.8	Operative: 0.7	10.3	2.7	5
	Mini-Thoracotomy	295	Median: 180	0	4.8		Median: 24		Median: 4	Major: 5.8	Operative: 0.7	6.5	1.4	2
	Robotic	314	Median: 224	0	15.3		Median: 26		Median: 4	Major: 8.6	Operative: 0.6	10.9	2.6	5
	Sternotomy	314	Median: 168	NA	17.8		Median: 31		Median: 5	Major: 8.9	Operative: 2.2	8.9	1.9	4
9. Iyigun (2017)	Robotic	33	NR	5.7	NR	1.41 ± 1.93	NR	1.15d ± 0.62	NR	7.03 ± 2.09	NR			
	Sternotomy	29		NA		2.24 ± 1.75		1.31d ± 0.6		9.03 ± 2.91				
10. Kam (2010)	Robotic	107	238.63	NR			36.66	NR	6.47	Bleeding: 1.8	Operative: 0	NR	2	

Author / Year	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to sternotomy (%)	Blood transfusion (%)	Number of transfused units (N)	ICU LOS (hours)	Readmission to ICU (%)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-day (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	
	Sternotomy	40	201.76				45.46		8.76	Bleeding: 0	Operative: 0			0	
11. Kesavuori (2018)	Robotic w/ learning curve	142	Median: 254	9.2	NR	≥2 units: 28.9	Median: 1d	NR	Median: 7	NR	0.7	NR	7.7	ISI calc.: 12.7	
	Sternotomy	142	Median: 217	NA		≥2 units: 26.8	Median: 1d		Median: 7		0		5.6	ISI calc.: 7	
	Robotic w/o learning curve	112	Median: 250	NR		NR	Median: 1d		Median: 7		NR		NR	NR	
12. Mihaljevic (2011)	Robotic	106	Median: 387	NR			NR			0: 92 1: 2.8 2: 1.9 >3: 2.8	ISI calc. Median: 4.2	8.5	0	3.8	NR
	Sternotomy	106	ISI calc. Median: 278							0: 85 1: 8.5 2: 5.7 >3: 0.94	ISI calc. Median: 5.2	9.4	0	3.8	
	Robotic	223	Median: 387							0: 89 1: 4.5 2: 3.1 >3: 3.1	ISI calc. Median: 4.2	11	0	4.5	
	Partial Sternotomy	223	ISI calc. Median: 277							0: 91 1: 4.9 2: 4.0 >3: 0.45	ISI calc. Median: 5.8	9.9	0	4.9	
	Robotic	113	Median: 387							0: 89 1: 4.4 2: 1.8 >3: 4.4	ISI calc. Median: 4.2	12	0	6.2	
	Mini-Thoracotomy	113	ISI calc. Median: 327							0: 95 1: 2.7 2: 0.88 >3: 1.8	ISI calc. Median: 5.1	2.7	0	18	
13. Mori (2024)	Robotic	5540	375 ± 101	NR	Intraop: 13 Postop: 15	NR	48 ± 62	1.6	5.00 ± 3.59	In-hospital: 31	Operative: 0.8	6.6	NR	3.1	
	Mini-Thoracotomy	5540	332 ± 88		Intraop: 12 Postop: 13		51 ± 87	1.5	5.57 ± 3.54	In-hospital: 34	Operative: 0.8	7.1		2.6	
	Robotic	6962	374 ± 96		Intraop: 13 Postop: 15		46 ± 59	1.6	4.95 ± 3.47	NR	Operative: 0.7	6.1		2.9	
	Sternotomy	6962	305 ± 81		Intraop: 17 Postop: 17		53 ± 65	2	6.21 ± 4.07		Operative: 0.6	6.8		2.7	
14. Orde (2020)	Robotic	115	3.4 ± 1	NR					4.1 ± 2	NR					
	Sternotomy	43	3.2 ± 1						4.4 ± 2						
15. Paul (2015)	Robotic	631	NR						Median: 4	37.4	In-hospital: <10	NR			

Author / Year	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to sternotomy (%)	Blood transfusion (%)	Number of transfused units (N)	ICU LOS (hours)	Readmission to ICU (%)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-day (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	
	Sternotomy + Mini-thoracotomy	631								Median: 6	34.4	In-hospital: <10			
16. Rao (2022)	Robotic	62	NR	0	NR				6.3 ± 0.5	NR			0	ISI calc.: 3.2	
	Mini-Thoracotomy	62		0					6.0 ± 0.3				0	ISI calc.: 4.8	
17. Rufa (2023)	Robotic	52	NR	1.9	NR		Median: 20.5	NR	Median: 8	NR	0	NR	1.9	3-yr: 0	
	Mini-Thoracotomy	52		1.9					Median: 22		Median: 9		0	5.8	3-yr: 1
18. Seo (2019)	Robotic	175	349 ± 13	2.20	Intraop: 35 Postop: 15	NR	84 ± 63	NR	6.5 ± 3.2	30	0.6	5	2	Other than for bleeding: 0.6	
	Sternotomy	259	312 ± 121	NA	Intraop: 50 Postop: 27		144 ± 126		9.9 ± 7.2	46	3	14	1	Other than for bleeding: 2	
19. Stevens (2012)	Robotic	447	NR			Postop: 18	NR		MVR* Median: 4	NR		1.1	12	3	NR
	Mini-Thoracotomy	481				Postop: 43			MVR* Median: 5			2.1	11	4	
	Sternotomy	377				Postop: 63			MVR* Median: 5			3.8	11	5	
20. Suri (2011)	Robotic	95	NR	0	ISI calc. Postop: 12.6	≥2: 10.53	31.29 ± 107.61	NR	4.46 ± 6.38	Any: 6.31 Major: 4.21	0	NR	1.05	Failed repair: 0	
	Sternotomy	95		NA	ISI calc. Postop: 18.9	≥2: 18.95	25.92 ± 20.20		5.34 ± 1.67	Any: 6.31 Major: 5.26	0		2.1	Failed repair: 1.05	
21. Suri (2013) All	Robotic	185	NR			≥2 RBC: 7	NR		NR		STS: 3.8	NR		0	Val. Dysf.: 0.5
	Sternotomy	185				≥2 RBC: 16.2					STS: 3.2			1.6	Val. Dysf.: 0.5
Pre-July 2009 Post-July 2009	Robotic	66	NR				24.7	NR	4	NR		Early: 0	NR		
	Sternotomy	111					26.7		5.6			Early: 0			
	Robotic	119					13.7		3.7			Early: 0			
	Sternotomy	74					27.8		5.7			Early: 0			
22. Wang (2018)	Robotic	503	NR		Intraop: 20.48	Intraop: 1.84 ± 2.09 Postop: 2.23 ± 2.69	41.96 ± 46.91	NR	5.26 ± 2.88	NR		NR	2.98	Val. Dysf.: 0	
	Sternotomy	503			Intraop: 35.19	Intraop: 1.49 ± 1.43 Postop: 1.86 ± 1.56	61.81 ± 61.40		6.92 ± 3.54				Operative: 1.19 In-hospital: 1.19 30-d: 1.4	1.99	Val. Dysf.: 0.4

Author / Year	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to sternotomy (%)	Blood transfusion (%)	Number of transfused units (N)	ICU LOS (hours)	Readmission to ICU (%)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-day (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)
23. Watanabe (2024)	Robotic	577	Median: 192	0.2	32.1	NR	Median: 2d	NR	Median: 8	NR	0.2	NR	1.2	NR
	Mini-Thoracotomy	577	Median: 232	NR	44.2		Median: 2d		Median: 9		0		0.9	
24. Wei (2020)	Robotic	121	NR	0.8	64.5	NR	3.6d ± 2.7	NR	NR	NR	0.8	NR	0	Early failure: 2.5
	Mini-Thoracotomy	113		0	52.2		2.8d ± 2.3				0.9		0.9	Early failure: 0.9
25. Zheng (2022)	Robotic	69	NR	1.4	1.4	NR	NR	NR	Median: 4	NR	Operative: 0	13	0	Val. Dysf.: 0
	Mini-Thoracotomy	69		1.4	2.9				Median: 4		Operative: 0	11.6	1.4	Val. Dysf.: 2.9

* Study reports data for overall cohort and mitral valve repair separately.

Table 2: da Vinci vs. Mini-thoracotomy or Sternotomy MVR Procedure Secondary Clinical Outcomes

Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Atrial fibrillation (%)	MI 30-day (%)	Cardiac arrest 30-day (%)	Stroke 30-day (%)	Renal failure 30-day (%)	Discharge to nursing facility / rehab (%)
1. Albano (2024)	Robotic	98	Median: 165	Median: 91	Median: 3	9	NR	22	NR	NR	NR	Dialysis: 0	10
	Mini-Thoracotomy	98	Median: 137	Median: 99	Median: 6	21		12				Dialysis: 0	41
2. Baccanelli (2024)	Robotic	111	NR										
	Mini-Thoracotomy	205	NR										
3. Barac (2021)	Robotic	128	275 ± 56	152 ± 38	NR	NR	NR	21	NR	NR	0	NR	NR
	Mini-Thoracotomy	249	195 ± 56	119 ± 36				24			0		
4. Chemtob (2022)	Robotic	605	123 ± 33	73 ± 20	NR	NR	NR	New-onset: 25	NR	NR	0.5	0	NR
	Sternotomy	395	74 ± 25	55 ± 19				New-onset: 34			1	0	
5. Cohan (2018)	Robotic	91	Median: 162	Median: 108	NR	NR	NR	36.3	NR	0	Permanent: 0	0	NR
	Sternotomy	91	Median: 124	Median: 98				38.5		2.2	Permanent: 0	1	
6. Fujita (2021)	Robotic	169	MVR* (N=118): 119 ± 51	MVR* (N=118): 81 ± 35	NR	NR	NR	0.6	NR	NR	0	0.6	NR
	Mini-Thoracotomy	166	MVR* (N=142): 121 ± 34	MVR* (N=142): 84 ± 22				0			0	1.2	
	Robotic	80	Median: 163	Median: 89				Median: 2			NR	Home: 90	

Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Atrial fibrillation (%)	MI 30-day (%)	Cardiac arrest 30-day (%)	Stroke 30-day (%)	Renal failure 30-day (%)	Discharge to nursing facility / rehab (%)
7. Giroletti (2024)	Mini-Thoracotomy	80	Median: 140	Median: 100	Median: 6	NR							Home: 63
8. Hawkins (2018)	Robotic	295	Median: 139	Median: 97	NR	3.1	Pneumonia: 1	26.4	NR	Cardiac arrest: 0.3	Permanent: 1.4	0.3	Facility: 5.4
	Mini-Thoracotomy	295	Median: 130	Median: 86		3.1	Pneumonia: 0.3	17.6		Cardiac arrest: 0	Permanent: 1	0	Facility: 5.8
	Robotic	314	Median: 140	Median: 97		4.1	Pneumonia: 1.6	24.8		Cardiac arrest: 0.3	Permanent: 1.3	0.6	Facility: 7.0
	Sternotomy	314	Median: 112	Median: 81		5.7	Pneumonia: 1.6	27.7		Cardiac arrest: 1	Permanent: 1	0.3	Facility: 14.8
9. Iyigun (2017)	Robotic	33	157.92 ± 60.31	94.36 ± 45.63	NR	NR							
	Sternotomy	29	123.85 ± 50.19	83.81 ± 40.82									
10. Kam (2010)	Robotic	107	126.39	94.93	6.17 (N=87)	NR							Inpatient rehab: 4.7
	Sternotomy	40	93.72	73.14	6.61 (N=32)	NR							Inpatient rehab: 10
11. Kesavuori (2018)	Robotic with learning curve	142	Median: 157	Median: 104	Median: 15	NR	Pneumonia: 3.5	NR	0.7	NR	0	Dialysis: 2.1	NR
	Sternotomy	142	Median: 112	Median: 86	Median: 13		Pneumonia: 0		2.1		Dialysis: 2.1		
	Robotic w/o learning curve	112	Median: 151	Median: 101	Median: 14		NR		NR		NR	NR	
12. Mihaljevic (2011)	Robotic	106	Median: 116	Median: 85	NR	>24h: 1.9	Pleural effusion: 0	26	NR	1.9	NR	NR	
	Sternotomy	106	ISI calc. Median: 74	ISI calc. Median: 57		>24h: 2.8	Pleural effusion: 8.5	30		0.94			
	Robotic	223	Median: 116	Median: 85		>24h: 4.9	Pleural effusion: 1.8	22		2.7			
	Partial Sternotomy	223	ISI calc. Median: 76	ISI calc. Median: 59		>24h: 2.2	Pleural effusion: 8.5	35		3.1			
	Robotic	113	Median: 116	Median: 85		>24h: 3.5	Pleural effusion: 1.8	19		1.8			
	Mini-Thoracotomy	113	ISI calc. Median: 106	ISI calc. Median: 66		>24h: 0.88	Pleural effusion: 1.8	26		0			
13. Mori (2024)	Robotic	5540	145 ± 57	95 ± 37	7.7 ± 33.9	3.1	Pneumonia: 0.7	22	NR	Permanent: 1.2	0.8	NR	
	Mini-Thoracotomy	5540	136 ± 54	94 ± 36	8.8 ± 38.8	3.1	Pneumonia: 0.8	25		Permanent: 1	0.6		
	Robotic	6962	143 ± 55	93 ± 36	7.4 ± 34.6	2.9	Pneumonia: 0.6	22		Permanent: 1.1	0.7		
	Sternotomy	6962	104 ± 45	79 ± 35	9.3 ± 42.6	3.2	Pneumonia: 0.8	30		Permanent: 1	0.7		
14. Orde (2020)	Robotic	115	80 ± 22	51 ± 17	5.5 ± 3	NR							
	Sternotomy	43	49 ± 20	49 ± 19	8.5 ± 11								
15. Paul (2015)	Robotic	631	NR				30.6	NR			3.5	NR	Non-routine: 65.1

Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Atrial fibrillation (%)	MI 30-day (%)	Cardiac arrest 30-day (%)	Stroke 30-day (%)	Renal failure 30-day (%)	Discharge to nursing facility / rehab (%)
	Sternotomy + Mini-thoracotomy	631					27.1				2.4		Non-routine: 60.2
16. Rao (2022)	Robotic	62	148	148 ± 37	NR	1.6	NR	NR	NR	NR	3.2	0	NR
	Mini-Thoracotomy	62	133	133 ± 42		4.8					4.8	0	
17. Rufa (2023)	Robotic	52	Median: 181	Median: 99	Median: 6	NR	Pneumonia: 5.8 Pleural effusion: puncture 9.6, drainage 7.7	44.2	Postop + treated with PCI: 1.9 3-yr: 0	NR	Postop CVA: 0 3-yr stroke: 0	1.9	NR
	Mini-Thoracotomy	52	Median: 166	Median: 101	Median: 6		Pneumonia: 0 Pleural effusion: puncture 7.7, drainage 3.8	50	Postop + treated with PCI: 1.9 3-yr: 0		Postop CVA: 1.9 3-yr stroke: 0	0	
18. Seo (2019)	Robotic	175	NR	133 ± 47	NR	NR	Pneumonia: 1	13	NR	Cardiac arrest: 1 (0.6%)	1 (0.6%)	1 (0.6%)	NR
	Sternotomy	259		115 ± 52			Pneumonia: 1	18		Cardiac arrest: 8 (3%)	3 (1%)	6 (2%)	
19. Stevens (2012)	Robotic	447	164 ± 40	125 ± 31	NR	NR	NR	28	NR	NR	0.7	NR	NR
	Mini-Thoracotomy	481	141 ± 51	87 ± 42				20			1.2		
	Sternotomy	377	122 ± 51	86 ± 34				26			3.4		
20. Suri (2011)	Robotic	95	113.32 ± 40.39	81.40 ± 28.33	14.07 ± 88.92	>48h: 1.05	NR	Permanent: 0	3.16	NR	Permanent: 1.05	0	NR
	Sternotomy	95	48.22 ± 24.55	35.94 ± 19.66	8.13 ± 6.25	>48h: 1.05		Permanent: 0	0		Permanent: 0	1.05	
21. Suri (2013) All	Robotic	185	NR	NR	NR	>48h: 0.5	NR	In hospital: 18.4	1.1	NR	0.50	0.50	NR
	Sternotomy	185				>48h: 0		In hospital: 30.3	0		0	0.50	
Pre-July 2009 Post-July 2009	Robotic	66	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Sternotomy	111											
	Robotic	119											
	Sternotomy	74											
22. Wang (2018)	Robotic	503	135.62 ± 52.89	90.52 ± 34.53	NR	2.58	Pneumonia: 0.99 Pulm. thromboembolism: 66.67 - corrected to 0.3	27.83	NR	Cardiac arrest: 0.8	Permanent: 0.99	0.8	NR
	Sternotomy	503	109.97 ± 45.94	83.85 ± 38.24		4.77	Pneumonia: 7 (1.39%) Pulm. thromboembolism: 0 (0%)	39.76		Cardiac arrest: 1.39	Permanent: 1.79	1.79	

Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Atrial fibrillation (%)	MI 30-day (%)	Cardiac arrest 30-day (%)	Stroke 30-day (%)	Renal failure 30-day (%)	Discharge to nursing facility / rehab (%)
23. Watanabe (2024)	Robotic	577	Median: 130	Median: 80	NR	0.7	NR	5.9	0	NR	1.2	0.2	NR
	Mini-Thoracotomy	577	Median: 150	Median: 103		0.3		5.2	0.2		0.7	0	
24. Wei (2020)	Robotic	121	123.8 ± 34.9	84.9 ± 24.3	14.6 ± 4.4	NR	Pleural effusion w/ pleurocentesis: 1.7 Pleural effusion w/ pleurocentesis: 0.9	NR					
	Mini-Thoracotomy	113	153.2 ± 25.6	111.8 ± 23.0	10.5 ± 6.6								
25. Zheng (2022)	Robotic	69	Median: 85	Median: 57	NR	1.4	Pleural effusion requiring drainage: 0 Pneumothorax: 0 Pneumonia: 0	24.6	NR				
	Mini-Thoracotomy	69	Median: 88	Median: 47		0		Pleural effusion requiring drainage: 4.3 Pneumothorax: 2.9 Pneumonia: 1.4					

* Study reports data for overall cohort and mitral valve repair separately

Table 3: da Vinci vs. Non Robotic-Assisted CABG Main Clinical Outcomes

Author	Study Arms	Study Size (N)	Operating Time (minutes)	Conversion to Sternotomy (%)	Blood Transfusion (%)	Number of Transfused Units (n)	ICU Stay (days)	LOS (days)	Postoperative Complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Reoperation for revascularization 30-d (%)
1. Algoet (2024)	Robotic	54	364.0 ± 71.0	NR	In-hospital: 16.7	NR	0.78 ± 1.70	6.78 ± 2.4	NR	0	0	NR	3.7	TVR: 1.9
	Open	54	286.1 ± 45.8		In-hospital: 38.9		1.91 ± 1.01	8.01 ± 2.5		0	0		9.3	TVR: 1.9
2. Bachinsky (2012)	Robotic	25	386 ± 49.4	NR	12	0.24 ± 0.72	28.50h ± 13.9h	5.10 ± 2.8	NR	0	NR			0
	Open	27	261 ± 36.8		67	1.78 ± 2	57.89h ± 84.7h	8.19 ± 5.4		4	0			
3. Basman (2020)	Robotic	100	NR	0	NR			5.7 ± 7.5	NR	0	NR			
	Open	100		NA	7.5 ± 3.4	0								
4. Cavallaro (2014)	Robotic	2582	NR		16.4	NR		6.3 ± 5.6	Cardiac: 11.6	0.6	NR			
	Open	48156	31.3	9.0 ± 6.7	Cardiac: 10.8	1.8								
5. Dokollari (2023)	Robotic	267	5.5h ± 1.1h	NR	Intraop: 3.4 Postop: 15.4	NR	Median: 31.2h	Median: 5	NR	0.4	9.0	0.8	NR	PCI: 1.5
	Open	267	6.2h ± 1.4h		Intraop: 36.7 Postop: 50.2		Median: 65.0h	Median: 7		0	3.4	0.4		PCI: 0.8
6. Ezelsoy (2015)	Robotic	35	186.93	0	NR	0.23 ± 0.55	1.09 ± 0.28	6.63 ± 1.03	NR	0	NR			

Author	Study Arms	Study Size (N)	Operating Time (minutes)	Conversion to Sternotomy (%)	Blood Transfusion (%)	Number of Transfused Units (n)	ICU Stay (days)	LOS (days)	Postoperative Complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Reoperation for revascularization 30-d (%)	
	Open	35	NR	NA		0.60 ± 0.91	1.66 ± 0.97	7.80 ± 2.29		0					
7. Ezelsoy (2016)	Robotic	50	NR					1.3	5.62	NR	0	NR			
	Open	50					2.1	7.96		0					
8. Giambruno (2018)	Robotic	144	NR	5	In-hospital: 14	NR	1.0 ± 0.8	4.5 ± 2.1	NR	0	NR	2.8	NR	PCI or CABG: 3.5	
	Open	546		NA	In-hospital: 25		1.7 ± 2.3	6.7 ± 4.7		1.3		1.7		PCI or CABG: 0.6	
9. Gianoli (2024)	Robotic	79	NR	2.5	RBC: 3.8	NR	0.6 ± 0.7	4.0 ± 2.0	NR	0	To ICU: 0	NR	Rethoractomy: 3.8	NR	
	Open (ON)	158		NA	RBC: 4.4		1.0 ± 0.4	4.8 ± 2.7		0	To ICU: 2.5		Rethoractomy: 3.2		
	Robotic	80		2.5	RBC: 3.7		0.6 ± 0.7	4.0 ± 2.0		0	To ICU: 0		Rethoractomy: 3.7		
	Open (OFF)	149		NA	RBC: 4.0		1.1 ± 0.7	5.3 ± 3.6		0	To ICU: 2.0		Rethoractomy: 2.0		
10. Gong (2016)	Robotic	71	220.8 ± 23.1	4.2	15.5	NR	30.6h ± 8.7h	7.8 ± 3.0	NR	0	NR	1.4	NR		
	MCAB	61	185.5 ± 49.3	3.3	18.0		35.2h ± 9.4h	9.2 ± 3.8		1.6		1.6			
11. Hage (2019)	Robotic	143	NR	5	In-hospital: 15	NR	1.0 ± 0.8	4.5 ± 2.1	NR	In-hospital: 0	NR	3.5	NR	PCI or CABG: 3.4	
	Open	201		NA	In-hospital: 28		1.8 ± 1.3	8.1 ± 5.8		In-hospital: 1		1.5		PCI or CABG: 0	
12. Halkos (2014)	Robotic	26	210 ± 54	NR	30.8	0.3 ± 0.8	30.4h ± 19.8h	4.2 ± 1.3	NR	0	NR	0	NR		
	Open	28	274 ± 79		71.4	1.5 ± 1.4	35.8h ± 25.7h	5.6 ± 1.8		0		0			
13. Jegaden (2011)	Robotic	59	3.4h ± 0.7h	0	NR		0.96 ± 0.8	5.5 ± 1.6	NR	1.7	NR	8.5	6.8	NR	
	Open	48	3.2h ± 0.6h	NA			1.7 ± 2.7	7.0 ± 3.0		0		2.0	0		
14. Kiaii (2019)	Robotic	147	NR		14	NR	1.0 ± 0.8	4.5 ± 2.1	NR	0	NR	2.8	NR		
	Open	682		25	1.7 ± 2.3		6.7 ± 4.7	1.3		1.7					
15. Kofler (2017)	Robotic	134	NR			Median RBC: 0	39.0h ± 77.0h	8.4 ± 4.8	NR	0	NR	5.2	NR		
	Open	134			Median RBC: 0	40.8h ± 58.6h	7.8 ± 4.3	1.5		2.2					
16. Leyvi (2014)	Robotic	150	3.7h ± 1.1h	0.67	Intraop: 6.00 Postop: 10.67	NR		Median: 6	2.67	0	NR	1.33	0	NR	
	Open	1619	4.8h ± 1.2h	NA	Intraop: 20.30 Postop: 21.28		Median: 9	11.54	2.04	2.72		1.48			
17. Leyvi (2016)	Robotic	141	3.51h ± 0.11h	1.33	12.77%	NR	Median: 31h	Median: 6	4.26	0	8.51	1.42	0	NR	
	Open	141	4.66h ± 0.13h	NA	34.75%		Median: 52h	Median: 7	13.48	1.42	4.26	3.55	0.71		

Author	Study Arms	Study Size (N)	Operating Time (minutes)	Conversion to Sternotomy (%)	Blood Transfusion (%)	Number of Transfused Units (n)	ICU Stay (days)	LOS (days)	Postoperative Complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Reoperation for revascularization 30-d (%)	
18. Lin (2021)	Robotic	281	NR				5.4 ± 10.8	11.2 ± 12.7	NR	In-hospital: 2.5	NR				
	Open	235					11.4 ± 14.5	17.4 ± 11.9		In-hospital: 7.3					
19. Patel (2018)	Robotic	207	NR	0.7	RBC: 14.0	NR		7.1 ± 8.0	NR	0.5	NR	4.3	NR	0.5	
	Open	207		NA	RBC: 28.5			8.4 ± 5.7		0.5		3.4		1.0	
20. Raad (2016)	Robotic	142	NR		6.0	NR		5.0 ± 3.8	NR		16	0.7	NR		
	Open	142			23			6.7 ± 3.8			15	2.1			
21. Spanjersberg (2022)	Robotic	102	NR		8.8	NR		Median: 5	NR	0	NR			Resternotomy 48h: 2	
	Open	102			6.9			Median: 7		0				Resternotomy 48h: 2	
22. Su (2018)	Robotic	139	NR	0	NR		Median: 3	Median: 9	NR	1.4	NR				
	Open	147		NA			Median: 7	Median: 15		10.2					
23. Torregrossa (2022a) Robotic-assst	Robotic	273	Median: 6.00h	NR	Intraop: 13.2 Postop: 33.0	NR	Median: 46.1h	Median: 5	NR	Operative: 1.47	10.3	0.73	NR	0	
	Open	273	Median: 5.38h		Intraop: 32.2 Postop: 54.9		Median: 49.8h	Median: 6		Operative: 1.47	11.4	0.37		0.37	
24. Torregrossa (2022b) Robotic hybr	Robotic	31	Median: 5.97h	NR	Intraop: 6.5 Postop: 25.8	NR	Median: 28.1h	Median: 4	NR	Operative: 3.23	12.90	0	NR	0	
	Open	31	Median: 5.40h		Intraop: 19.4 Postop: 54.8		Median: 48.9h	Median: 6		Operative: 0	6.45	0		0	
25. Torregrossa (2022c) Hybrid rob	Robotic	181	Median: 5.80h	NR	Intraop: 10.5 Postop: 33.7	NR	Median: 45.3h	Median: 5	NR	Operative: 1.66	11.6	1.10	NR	0	
	Open (ON)	138	Median: 6.73h		Intraop: 82.6 Postop: 63.0		Median: 72.6h	Median: 7		Operative: 2.17	15.2	1.45		0	
	Open (OFF)	412	Median: 5.43h		Intraop: 35.4 Postop: 60.0		Median: 52.2h	Median: 6		Operative: 0.73	10.4	0.49		0.24	
26. Whellan (2016)	Robotic	9862	NR					Median: 4	Major: 10.2	NR	Operative: 1.2 Discharge: 1.0	NR	2.3	NR	
	Non-Robotic	956349						Median: 5	Major: 13.5		Operative: 1.5 Discharge: 1.2		2.0		
27. Wu (2019)	Robotic	22	12.7h ± 1.7h	NR		In-hospital PRBC: 2.1 ± 2.0	4.8 ± 3.5	21.0 ± 8.8	In-hospital: 18.2	0	NR				
	Open	22	8.5h ± 1.5h			In-hospital PRBC: 1.4 ± 2.2	5.0 ± 3.3	24.4 ± 14.0	In-hospital: 27.8	0					
28. Yasar (2023)	Robotic	158	NR	9.5	NR				0	NR					
	MCAB	116		9.5					0.86						

Author	Study Arms	Study Size (N)	Operating Time (minutes)	Conversion to Sternotomy (%)	Blood Transfusion (%)	Number of Transfused Units (n)	ICU Stay (days)	LOS (days)	Postoperative Complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Reoperation for revascularization 30-d (%)
29. Yokoyama (2021)	Robotic	7330	NR	NR	11.0	NR	NR	7.3 ± 6.2	NR	In-hospital: 1.1	NR	NR	NR	NR
	Non-Robotic	7330			24.3			9.3 ± 6.6		In-hospital: 2.1				
30. Yusuf (2024)	Robotic	104	NR	1.92	NR	0.69 ± 1.29	2.82 ± 0.76	4.69 ± 0.93	NR	Operative: 1.92	NR	NR	NR	NR
	Open	104		NA		0.79 ± 1.13	3.41 ± 1.27	8.01 ± 1.98		Operative: 2.88				
31. Zaouter (2015)	Robotic	38	NR	2.6	26	Median RBC: 2	Median: 21h	Median: 8	NR	In-hospital: 0	NR	0	NR	Graft failure: 5
	Open	33		NA	58	Median RBC: 2	Median: 45h	Median: 12		In-hospital: 0		0		Graft failure: 0

Table 4: da Vinci vs. Non Robotic-Assisted CABG Secondary Clinical Outcomes

Author	Study Arms	Study Size (N)	CPB Time (if on-pump) (min)	XC Time (min)	Ventilation Time (h)	Prolonged Ventilation Time (%)	Atrial Fibrillation (%)	MI 30-d (%)	Angina 30-d (%)	Stroke 30-d (%)	Renal Failure 30-d (%)	Ejection Fraction (%)	MACE (%)	Discharge Location (%)
1. Algoet (2024)	Robotic	54	NR	NR	NR	NR	31.5	STEMI: 0 NSTEMI: 0	NR	0	NR	NR	1.9	NR
	Open	54					20.4	STEMI: 1.9 NSTEMI: 1.9		1.9			0	
2. Bachinsky (2012)	Robotic	25	NR	NR	NR	NR	16	Q-wave: 0 Non-Q-wave: 60	NR	0	NR	NR	NR	NR
	Open	27					30	Q-wave: 0 Non-Q-wave: 92		0				
3. Basman (2020)	Robotic	100	NR	NR	NR	NR	NR	0	NR	0	0	NR	NR	NR
	Open	100						0		0				
4. Cavallaro (2014)	Robotic	2582	NR	NR	NR	NR	NR	NR	NR	0.4	6.1	NR	NR	NR
	Open	481546								0.9	11.5			
5. Dokollari (2023)	Robotic	267	NR	NR	NR	>24h: 1.5	17.6	NR	NR	0.8	Renal failure: 0.4 Dialysis: 0	NR	NR	NR
	Open	267				>24h: 5.6	30.3			0.8	Renal failure: 1.9 Dialysis: 1.1			
6. Ezelsoy (2015)	Robotic	35	NA	NA	4.69 ± 1.20	NR	Arrhythmia: 14	NR	NR	0	62.657	NR	NR	NR
	Open	35	31.49 ± 6.32	15.74 ± 4.83	5.23 ± 0.97		Arrhythmia: 17			6	NR			
7. Ezelsoy (2016)	Robotic	50	NR	NR	NR	NR	NR	NR	NR	NR	NR	60.78	NR	NR
	Open	50										NR		

Author	Study Arms	Study Size (N)	CPB Time (if on-pump) (min)	XC Time (min)	Ventilation Time (h)	Prolonged Ventilation Time (%)	Atrial Fibrillation (%)	MI 30-d (%)	Angina 30-d (%)	Stroke 30-d (%)	Renal Failure 30-d (%)	Ejection Fraction (%)	MACE (%)	Discharge Location (%)
8. Giambruno (2018)	Robotic	144	NR			>24h: 0.7	12	1.4	NR	2.1	Dialysis: 0	NR		
	Open	546				>24h: 2.0	15	1.1		2.4	Dialysis: 0.4			
9. Gianoli (2024)	Robotic	79	104.0 ± 11.6	NA	NR	0	11.4	0	NR	NR	Renal failure: 0 Dialysis: 0	NR	1.3	NR
	Open (ON)	158	74.4 ± 26.9	47.2 ± 18.3		0.6	13.3	0.6			Renal failure: 0.6 Dialysis: 0		1.3	
	Robotic	80	104.0 ± 11.6	NA		0	11.2	0			Renal failure: 0 Dialysis: 0		1.2	
	Open (OFF)	149	NA	NA		3.3	12.1	1.3			Renal failure: 1.3 Dialysis: 0		2.6	
10. Gong (2016)	Robotic	71	NR			>12h: 1.4	Arrhythmia: 2.8	1.4	NR	1.4	NR			
	MCAB	61				>12h: 4.9	Arrhythmia: 14.7	3.3		3.3				
11. Hage (2019)	Robotic	143	NR			>24h: 0.7	In-hospital: 12	In-hospital: 1.4	NR	In-hospital: 2.1	Dialysis: 0	NR		
	Open	201				>24h: 4.0	In-hospital: 19	In-hospital: 0.5		In-hospital: 1.0	Dialysis: 0.5			
12. Halkos (2014)	Robotic	26	NR		4.4 ± 4.5	>24h: 0	NR	0	NR	0	NR			
	Open	28			15.8 ± 17.6	>24h: 10.7		0		0				
13. Jegaden (2011)	Robotic	59	NA	NA	4.6 ± 2.4	NR		3.4	NR	0	NR			
	Open	48	52 ± 15	34 ± 15	8.0 ± 4.0			2.0		2				
14. Kiaii (2019)	Robotic	147	NR			0.7	NR	1.4	NR	2.13	Dialysis: 0	NR		
	Open	682				2.0		1.1		2.40	Dialysis: 0.4			
15. Kofler (2017)	Robotic	134	111.9 ± 99.6	68.3 ± 54.1	15.5 ± 58.4	NR	14.2	0	NR	0.7	Dialysis: 2.2	NR		
	Open	134	66.8 ± 48.5	37.9 ± 27.3	16.3 ± 37.6		18.5	2.2		0	Dialysis: 1.5			
16. Leyvi (2014)	Robotic	150	NR			0.67	12.67	NR		<24h: 0.67 >24h: 0.67	Dialysis: 0	NR	Facility: 16.00	
	Open	1619				4.79	17.84			<24h: 1.17 >24h: 0.99	Dialysis: 1.24		Facility: 25.83	
17. Leyvi (2016)	Robotic	141	NR					Q-wave: 0	NR	Permanent: 0	Dialysis: 0.71	NR	Facility: 16.31	
	Open	141						Q-wave: 0		Permanent: 1.42	Dialysis: 0.71		Facility: 19.15	
18. Lin (2021)	Robotic	281	NR											
Open	235													
19. Patel (2018)	Robotic	207	NA	NA	NR	>24h: 3.9	NR	0	NR	0.5	0.5	NR		

Author	Study Arms	Study Size (N)	CPB Time (if on-pump) (min)	XC Time (min)	Ventilation Time (h)	Prolonged Ventilation Time (%)	Atrial Fibrillation (%)	MI 30-d (%)	Angina 30-d (%)	Stroke 30-d (%)	Renal Failure 30-d (%)	Ejection Fraction (%)	MACE (%)	Discharge Location (%)
	Open	207	88.7 ±24.6	63.1 ±25.0		>24h: 3.4		0.5		1.0	1.9			
20. Raad (2016)	Robotic	142	NR		7.3 ± 20	>24h: 3.5	NR			0	Dialysis: 0	NR		
	Open	142			10.5 ± 10	>24h: 6.3				2.8	Dialysis: 0.4			
21. Spanjersberg (2022)	Robotic	102	NR				19.6	NR						Home within 5-d: 51
	Open	102					27.5							Home within 5-d: 20
22. Su (2018)	Robotic	139	NR											
	Open	147												
23. Torregrossa (2022a) Robotic-asst	Robotic	273	NR			>24h: 4.03	16.8	NR		1.47	AKI: 1.83 Dialysis: 0.37	NR	Home: 69.2 Rehab: 30.8	
	Open	273				>24h: 5.86	25.6			0.37	AKI: 4.40 Dialysis: 1.83		Home: 65.6 Rehab: 34.4	
24. Torregrossa (2022b) Robotic hybr	Robotic	31	NR			>24h: 0	9.68	NR		3.23	AKI: 0 Dialysis: 0	NR	Home: 77.4 Rehab: 22.6	
	Open	31				>24h: 3.23	22.6			0	AKI: 0 Dialysis: 0		Home: 74.2 Rehab: 25.8	
25. Torregrossa (2022c) Hybrid rob	Robotic	181	NR			>24h: 2.21	15.5	NR		1.10	AKI: 0.55 Dialysis: 0	NR		
	Open (ON)	138				>24h: 16.70	29.0			1.45	AKI: 2.17 Dialysis: 0			
	Open (OFF)	412				>24h: 5.58	24.5			0.24	AKI: 3.64 Dialysis: 1.46			
26. Whellan (2016)	Robotic	9862	Median: 88	Median: 63	NR	>24h: 5.6	NR	1.1	NR	Permanent (>24h): 0.5	2.2%	NR		
	Non-Robotic	956349	Median: 90	Median: 63		>24h: 8.6		0.9		Permanent (>24h): 1.1	2.9%			
27. Wu (2019)	Robotic	22	123.9 ± 96.2	NR	2.2d ± 1.8d	NR		In-hospital: 0	NR	In-hospital: 0	NR			
	Open	22	131.4 ± 59.8		2.3d ± 2.3d			In-hospital: 0		In-hospital: 0				
28. Yasar (2023)	Robotic	158	72.1 ± 25.8	39.6 ± 19.7	NR									
	MCAB	116	135.4 ± 45.2	64.2 ± 24.9										
29. Yokoyama (2021)	Robotic	7330	NR							1.0	AKI: 12.3 Dialysis: 0.8	NR	Routine: 45.0 Nursing	

Author	Study Arms	Study Size (N)	CPB Time (if on-pump) (min)	XC Time (min)	Ventilation Time (h)	Prolonged Ventilation Time (%)	Atrial Fibrillation (%)	MI 30-d (%)	Angina 30-d (%)	Stroke 30-d (%)	Renal Failure 30-d (%)	Ejection Fraction (%)	MACE (%)	Discharge Location (%)	
	Non-Robotic	7330									1.3	AKI: 15.8 Dialysis: 0.8			facility: 13.4 Home: 40.0 Routine: 39.7 Nursing facility: 22.4 Home: 34.5
30. Yusuf (2024)	Robotic	104	NR		9.42 ± 3.99					NR					
	Open	104			15.46 ± 10.22										
31. Zaouter (2015)	Robotic	38	NR				18	0		NR	0	Renal replacement therapy: 0	NR		
	Open	33	NR				9	0		NR	3	Renal replacement therapy: 0			

Table 5: da Vinci Robotic-Assisted Defect Closure Main Clinical Outcomes

Cardiac procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. ejection fraction (%)
ASD	1. Liu (2023) Comparative retro.	Robotic	101	190.4 ± 12.68	NR	3/101	NR	18.2h ± 4.6h	8 ± 1.9	NR	1/101	NR	1/100	NR	
		Sternotomy	162	181.4 ± 12.3		10/162		23.5h ± 5.6h	10 ± 1.5		0/162		2/162		
		p-value R/S		<0.05		<0.05		<0.05	<0.05		NS		NS		
MVR + LAA	2. Chickwe (2023) Comparative retro. Excluding concomitant cyromaze	MVr + LAA	431	NR				Median 5 (IQR 4-6)	NR	0	5.6	0.5	Valve dysfunction: 0	NR	
		MVr	333	Median 5 (IQR 4-6.5)	0.9	3.9	3	Valve dysfunction: 1.2							
		p-value MVr/MVr+LAA			0.6	0.1	0.29	0.008		0.04					
Isolated MVR	13. Chemtob (2022) Comparative pro.	Robotic	605	NR	0	Postop RBC: 10	NR	25 (IQR 21-51)	5.2 ± 2.9	NR	In-hospital: 0	NR	1.3	0.66	NR
		Sternotomy	395		NA	Postop RBC: 17		27 (IQR: 21-66)	5.9 ± 2.3		In-hospital: 0		0.51	0.25	
		p-value R/S			NA	0.0008		0.001	<0.0001		NA		0.2	0.4	

Cardiac procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. ejection fraction (%)	
Isolated MVr	14. Seo (2019) Comparative retro.	Robotic	175	349 ± 13	2.2	Intraop: 35 Postop: 15	NR	84 ± 63	6.5 ± 3.2	30	0.6	5	2	Other than bleeding: 0.6	54 ± 8	
		Sternotomy	259	312 ± 121	NA	Intraop: 50 Postop: 27		144 ± 126	9.9 ± 7.2	46	3	14	1	Other than bleeding: 2	52 ± 12	
		p-value R/S		0.001	NA	0.003 0.004		<0.001	<0.001	0.001	0.105	0.001	0.89	0.157	0.176	
Isolated MVr	15. Stevens (2012) Comparative retro.	Robotic	447	NR	NR	18	NR	NR	4 (IQR 4-6)	NR	1.1	12	3	NR	NR	
		Mini-Thoracotomy	481			43			5 (IQR 4-7)		2.1	11	4			
		Sternotomy	377			63			5 (IQR 4-7)		3.8	11	5			
		p-value R/MT/S				<0.001			<0.001 0.016		0.042	0.711	0.674			
MVR concomitant with PFO	16. Mihaljevic (2011) Comparative retro. Matched	Robotic	106	Median: 387	NR	0: 98 (92%) 1: 3 (2.8%) 2: 2 (1.9%) >3: 3 (2.8%)	NR	NR	ISI calc. Median 4.2	8.5	0	NR	NR	NR	NR	
		Sternotomy	106	ISI calc. Median: 278		0: 90 (85%) 1: 9 (8.5%) 2: 6 (5.7%) >3: 1 (0.94%)			ISI calc. Median 5.2	9.4	0					3.8
		p-value R/S		<0.0001		0.1			<0.001	0.8	NA					1
		Robotic	223	Median: 387		0: 199 (89%) 1: 10 (4.5%) 2: 7 (3.1%) >3: 7 (3.1%)			ISI calc. Median 4.2	11	0					4.5
		Partial Sternotomy	223	ISI calc. Median: 277		0: 202 (91%) 1: 11 (4.9%) 2: 9 (4.0%) >3: 1 (0.45%)			ISI calc. Median 5.8	9.9	0					4.9

Cardiac procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. ejection fraction (%)
		p-value R/PS		<0.0001			0.2		<0.001	0.8	NA		0.8		
		Robotic	113	Median: 387			0: 101 (89%) 1: 5 (4.4%) 2: 2 (1.8%) >3: 5 (4.4%)		ISI calc. Median 4.2	12	0		6.2		
		Mini-Thoracotomy	113	ISI calc. Median: 327			0: 107 (95%) 1: 3 (2.7%) 2: 1 (0.88%) >3: 2 (1.8%)		ISI calc. Median 5.1	2.7	0		1.8		
		p-value R/MT		<0.0001			0.5		<0.001	0.006	NA		0.09		
MVR concomitant with PFO	17. Mori (2024) Database	Robotic	5540	375 ± 101	NR	Intraop: 13 Postop: 15	NR	48 ± 62	5 ± 3.59	In-hospital: 31	Operative: 0.8	6.6	NR	3.1	NR
	Matched	Mini-Thoracotomy	5540	332 ± 88		Intraop: 12 Postop: 13		51 ± 87	5.57 ± 3.54	In-hospital: 34	Operative: 0.8	7.1		2.6	
		p-value R/MT		<0.001		0.3 <0.001		0.0366	<0.001	0.011	>0.9	<0.001		0.076	
		Robotic	6962	374 ± 96		Intraop: 13 Postop: 15		46 ± 59	4.95 ± 3.47	NR	Operative: 0.7	6.1		2.9	
		Sternotomy	6962	305 ± 81		Intraop: 17 Postop: 17		53 ± 65	6.21 ± 4.07		Operative: 0.6	6.8		2.7	
		p-value R/S		<0.001		<0.001 <0.001		<0.001	<0.001			0.2		<0.001	
MVR concomitant with PFO	18. Suri (2011) Comparative retro.	Robotic	95	NR	0	ISI calc. Postop: 12	≥2: 10.53	31.29 ± 107.61	4.46 ± 6.38	Any: 6.31 Major: 4.21	0	NR	1.05	0	NR
	Matched	Sternotomy	95		NA	ISI calc. Postop: 18	≥2: 18.95	25.92 ± 20.20	5.34 ± 1.67	Any: 6.31 Major: 5.26	0		2.1	1.05	
		p-value R/S			NA	ISI calc. 0.308	0.1	<0.001	<0.001	1.00 1.00	NA		1	1	
MVR concomitant with PFO	19. Suri (2013) Comparative retro.	Robotic	185	NR	NR	NR	≥2 RBC: 7	NR	NR	STS: 3.8	NR	NR	0	Valve dysfunction: 0.5	NR
	All Pre-July	Sternotomy	185				≥2 RBC: 16.2			STS: 3.2			1.6	Valve dysfunction: 0.5	
		p-value R/S					0.009			>0.99			0.25	>0.99	

Cardiac procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. ejection fraction (%)							
	2009 Post-July 2009	Robotic	66	NR	NR	NR	NR	24.7	4	NR	Early: 0	NR	NR	NR	NR							
		Sternotomy	111					26.7	5.6		Early: 0											
		p-value R/S						0.006	<0.001		NA											
		Robotic	119					13.7	3.7		Early: 0											
		Sternotomy	74					27.8	5.7		Early: 0											
		p-value R/S						<0.001	<0.001		NA											
MVR concomitant with PFO	20. Wang (2018) Database Matched	Robotic	503	NR	NR	NR	NR	Intraop: 20.48	Intraop: 1.84 ± 2.09 Postop: 2.23 ± 2.69	NR	Operative: 0.6 In-hospital: 0.2 30-d: 0.6	NR	NR	NR	2.98	Valve dysfunction: 0						
		Sternotomy	503					Intraop: 35.19	Intraop: 1.49 ± 1.43 Postop: 1.86 ± 1.56		Operative: 1.19 In-hospital: 1.19 30-d: 1.4				1.99	Valve dysfunction: 0.4						
		p-value R/S						<0.0001	0.20 0.72		0.32 0.06 NR				0.31	0.16						
MVR concomitant with PFO	21. Zheng (2022) Comparative retro. Matched	Robotic	69	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	1.4	1.4	4 (IQR 3-4)	Operative: 0	13	0	Valve dysfunction: 0
		Mini-Thoracotomy	69													1.4	2.9	4 (IQR 4-6)	Operative: 0	11.6	1.4	Valve dysfunction: 2.9
		p-value R/MT														>0.99	>0.99	0.003	NR	0.8	>0.99	>0.99

Table 6: da Vinci Robotic-Assisted Defect Closure Secondary Clinical Outcomes

Cardiac procedure name	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Atrial septal leakage (%) or Postoperative residual flow (%)
ASD		Robotic	101	69.3 ± 7.8	0										0

Cardiac procedure name	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Atrial septal leakage (%) or Postoperative residual flow (%)
	1. Liu (2023) Comparative retro.	Sternotomy	162	60.3 ± 7.8	0										0
		p-value R/S		<0.05	NS										NR
MVR + LAA	2. Chickwe (2023) Comparative retro. Excluding concomitant cyromaze	MVR + LAA	431	113 (IQR 101-126)	72 (IQR 63-83)	NR			0.5	NR	31.8	Req. dialysis: 0.2	0.5	NR	1.4
		MVR	333	131 (IQR 113-154)	87 (IQR 72-108)				0.6		25.2	Req. dialysis: 1.2	2.1		4.2
		p-value MVR/MVR+LAA		<0.0001	<0.0001				1		0.047	0.34	0.046		0.02
Isolated MVR	13. Chemtob (2022) Comparative pro.	Robotic	605	123 ± 33	73 ± 20	NR					25	0	0.5	NR	
		Sternotomy	395	74 ± 25	55 ± 19						34	0	1		
		p-value R/S		NR	NR						0.003	NA	0.3		
Isolated MVR	14. Seo (2019) Comparative retro.	Robotic	175	NR	133 ± 47	NR	1	0.6	NR	13	0.6	0.6	NR		
		Sternotomy	259		115 ± 52		1	3		18	2	1			
		p-value R/S			<0.001		0.725	0.071		0.164	0.157	0.53			
Isolated MVR	15. Stevens (2012) Comparative retro.	Robotic	447	164 ± 40	125 ± 31	NR					28	NR	0.7	NR	
		Mini-Thoracotomy	481	141 ± 51	87 ± 42						20		1.2		
		Sternotomy	377	122 ± 51	86 ± 34						26		3.4		
		p-value R/MT/S		<0.001	<0.001						0.008		0.008		
MVR concomitant with PFO	16. Mihaljevic (2011) Comparative retro. Matched	Robotic	106	Median: 116	Median: 85	NR	>24h: 1.9	Pleural effusion: 0	NR	26	NR	1.9	NR		
		Sternotomy	106	ISI calc. Median: 74	ISI calc. Median: 57		>24h: 2.8	Pleural effusion: 8.5		30		0.94			
		p-value R/S		0.007	<0.0001		0.6	0.002		0.5		0.6			
		Robotic	223	Median: 116	Median: 85		>24h: 4.9	Pleural effusion: 1.8		22		2.7			
		Partial Sternotomy	223	ISI calc. Median: 76	ISI calc. Median: 59		>24h: 2.2	Pleural effusion: 8.5		35		3.1			
		p-value R/PS		0.007	<0.0001		0.1	0.001		0.002		0.8			

Cardiac procedure name	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Atrial septal leakage (%) or Postoperative residual flow (%)		
		Robotic	113	Median: 116	Median: 85		>24h: 3.5	Pleural effusion: 1.8			19		1.8				
		Mini-Thoracotomy	113	ISI calc. Median: 106	ISI calc. Median: 66		>24h: 0.88%	Pleural effusion: 1.8			26		0				
		p-value R/MT		0.007	<0.0001		0.2	1			0.3		0.2				
MVR concomitant with PFO	17. Mori (2024) Database Matched	Robotic	5540	145 ± 57	95 ± 37	7.7 ± 33.9	3.1	Pneumonia: 0.7	NR		22	0.8	Permanent: 1.2	NR			
		Mini-Thoracotomy	5540	136 ± 54	94 ± 36	8.8 ± 38.8	3.1	Pneumonia: 0.8			25	0.6	Permanent: 1				
		p-value R/MT		<0.001	0.3	NR	>0.9	0.8			0.002	0.2	0.4				
		Robotic	6962	143 ± 55	93 ± 36	7.4 ± 34.6	2.9	Pneumonia: 0.6			22	0.7	Permanent: 1.1				
		Sternotomy	6962	104 ± 45	79 ± 35	9.3 ± 42.6	3.2	Pneumonia: 0.8			30	0.7	Permanent: 1				
		p-value R/S		<0.001	<0.001	NR	0.2	0.4			<0.001	>0.9	0.8				
MVR concomitant with PFO	18. Suri (2011) Comparative retro. Matched	Robotic	95	113.32 ± 40.39	81.40 ± 28.33	14.07 ± 88.92	>48h: 1.05	NR		3.16	Permanent: 0	0	1.05	NR			
		Sternotomy	95	48.22 ± 24.55	35.94 ± 19.66	8.13 ± 6.25	>48h: 1.05			0	Permanent: 0	1.05	0				
		p-value R/S		<0.001	<0.001	<0.001	1			0.25	NA	1	1				
MVR concomitant with PFO	19. Suri (2013) Comparative retro. All Pre-July 2009 Post-July 2009	Robotic	185	NR	NR	NR	>48h: 0.5	NR		1.1	In hospital: 18.4	0.5	0.5	NR			
		Sternotomy	185				>48h: 0			0	In hospital: 30.3	0.5	0				
		p-value R/S					>0.99			0.5	0.01	>0.99	>0.99				
		Robotic	66	NR													
		Sternotomy	111	NR													
		p-value R/S		NR													
		Robotic	119	NR													
Sternotomy	74	NR															
p-value R/S		NR															
MVR concomitant with PFO	20. Wang (2018) Database Matched	Robotic	503	135.62 ± 52.89	90.52 ± 34.53	NR	2.58	Pneumonia: 0.99 Pulm. Thromboembolism: 0.3	0.8	NR	27.83	0.8	Permanent: 0.99	NR			
		Sternotomy	503	109.97 ± 45.94	83.85 ± 38.24		4.77	Pneumonia: 1.39 Pulm.	1.39		39.76	1.79	Permanent: 1.79				

Cardiac procedure name	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Atrial septal leakage (%) or Postoperative residual flow (%)
								Thromboembolism: 0							
		p-value R/S		<0.0001	<0.0001		0.06	0.56 0.11	0.36		<0.0001	0.16	0.28		
MVR concomitant with PFO	21. Zheng (2022) Comparative retro.	Robotic	69	85 (IQR 73-105)	57 (IQR 48-67)	NR	1.4	Pleural effusion req. drainage: 0 Pneumothorax: 0 Pneumonia: 0	NR	NR	24.6	NR	NR	NR	NR
	Matched	Mini-Thoracotomy	69	88 (IQR 75-108)	47 (IQR 37-58)		0	Pleural effusion req. drainage: 4.3 Pneumothorax: 2.9 Pneumonia: 1.4			34.8				
	p-value R/MT		0.27	<0.001	>0.99		0.25 0.5 >0.99	0.19							

Table 7: da Vinci Robotic-Assisted Extirpative Main Clinical Outcomes

Cardiac Procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. Ejection Fraction (%)
Myxoma Excision	8. Kesavuori (2015) Comparative retro.	Robotic	9	226 ± 39	0	RBC: 44	RBC: 1.67 ± NR	1 (IQR 0)	5.8 ± 1	NR	0	NR	NR	NR	56.8 ± 8.3
		Sternotomy	18	139 ± 33	NA	RBC: 72	RBC: 2 ± NR	1 (IQR 0)	7 ± 1.6		0				50.9 ± 6.3
		p-value R/S		<0.001	NA	0.219	0.403	0.495	0.023		NA				0.235
Myxoma Excision	9. Li (2017) Comparative retro.	Robotic	53	NR	NR	NR	NR	NR	NR	7/53	NR	NR	NR	NR	NR
		Sternotomy	84							11/84					
		Mini-thoracotomy	10							2/10					
		p-value R/S/MT								0.835					
Myxoma Excision	10. Liu (2023) Comparative retro.	Robotic	31	225.39 ± 33.83	0	64.5	Total: 3 (IQR 0-4)	20h (IQR 19h-41h)	9 (IQR 8-11)	In-hospital: 0	NR	NR	NR	NR	NR
		Mini-thoracotomy	15	297.13 ± 98.7	0	66.7	Total: 3.5 (IQR 0-4.5)	39h (IQR 38h-44h)	9 (IQR 8-13)	In-hospital: 0					
		p-value R/T		0.015	NA	0.886	0.725	0.006	0.422	NA					
Myxoma Excision	11. Liu (2024)	Robotic	30	226.4 ± 33	0	NR	3.5 (IQR 0-4)	20h (IQR 18.8h-41h)	9 (IQR 8-11.3)	NR	0	NR	0	NR	

Cardiac Procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. Ejection Fraction (%)
	Comparative retro.	Sternotomy	64	227.41 ± 35.88	0		3.5 (IQR 2-4)	21h (IQR 18h-41.5h)	10 (IQR 8-14)		1.6		0		
		p-value R/S		0.897	NA		0.39	0.556	0.04		1		NA		
Myxoma Excision	12. Shilling (2012) Comparative retro.	Robotic	16	2.7h ± 0.3h	NR	13	NR	30.9h ± 18.4h	3.6 ± 0.8	NR	0	NR	0	0	NR
		Sternotomy	29	3.5h ± 0.9h		26		47.7h ± 52.1h	6.2 ± 5.1		0		3		
		p-value R/S		0.02		0.3		0.15	0.05		NA		NA	0.44	

Table 8: da Vinci Robotic-Assisted Extirpative Secondary Clinical Outcomes

Cardiac Procedure	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Myxoma recurrence (%)	
Myxoma Excision	8. Kesavuori (2015) Comparative retro.	Robotic	9	124 ± 30	67 ± 21	14.6 ± 5	NR	Pneumonia: 0	NR	0	NR	0	0	NR	0	
		Sternotomy	18	54 ± 21	34 ± 15	9 ± 3		Pneumonia: 0		6					0	0
		p-value R/S		<0.001	<0.001	0.001		1		1					1	NA
Myxoma Excision	9. Li (2017) Comparative retro.	Robotic	53	72.9 ± 26.7	37.9 ± 15.1	NR	NR	Thoracic: 2/53	NR	NR	Arrhythmia: 4/53	NR	NR	NR	NR	
		Sternotomy	84	65.1 ± 21.9	37.1 ± 16.2			Thoracic: 1/84			Arrhythmia: 5/84					
		Mini-thoracotomy	10	87.4 ± 23.2	45.3 ± 17.5			Thoracic: 0/10			Arrhythmia: 2/10					
		p-value R/S/MT		0.008	0.266			0.645			0.212					
Myxoma Excision	10. Liu (2023) Comparative retro.	Robotic	31	97.9 ± 24.48	55 (IQR 44-69.5)	6 (IQR 3-15)	>24h: 0	Pneumonia: 6.5	NR	NR	19.4	0	3.2	NR		
		Mini-thoracotomy	15	118.27 ± 38.82	70 (IQR 51-78)	13 (IQR 5-19)	>24h: 6.7	Pneumonia: 0			13.3	6.7	0			
		p-value R/T		0.035	0.124	0.035	0.326	1			0.928	0.326	1			
Myxoma Excision	11. Liu (2024) Comparative retro.	Robotic	30	99.93 ± 22.3	57.8 ± 20.27	4.8 (IQR 2.8-12)	>24h: 0	Pneumonia: 6.7	NR	NR	16.7	0	3.3	NR	0	
		Sternotomy	64	76.28 ± 24.92	47.89 ± 18.1	8 (IQR 6-16)	>24h: 4.7	Pneumonia: 6.3			18.8	1.6	0		0	
		p-value R/S		<0.001	0.019	0.005	0.549	1			0.807	1	0.319		NA	
Myxoma Excision	12. Shilling (2012) Comparative retro.	Robotic	16	Perfusion: 91.3 ± 45.2	49.4 ± 37.6	NR	NR	>24h: 6	Pneumonia: 0 Pulmonary embolism: 0	NR	NR	0	0	0	NR	
		Sternotomy	29	Perfusion: 96.8 ± 42.1	52.1 ± 39.6			>24h: 11	Pneumonia: 4 Pulmonary embolism: 0			17	10	0		
		p-value R/S		0.68	0.82			1	1			0.14	0.54	NA		

Table 9: da Vinci Robotic-Assisted Valve Repair Main Clinical Outcomes

Cardiac procedure	Author	Study Arms	Study Size (N)	Operating time (minutes)	Conversion to open surgery (%)	Blood transfusion (%)	Number of transfused units, n	ICU LOS (days)	LOS (days)	Postop. complications 30-d (%)	Mortality 30-d (%)	Readmission 30-d (%)	Reoperation for bleeding 30-d (%)	Reoperation for any reason 30-d (%)	Postop. ejection fraction (%)	
MVR+TVr	3. Arslanhan (2021) Comparative retro. Not matched	Robotic MVr	226	NR	NR	12.8	NR	25.1 ± 27.1	7.7 ± 2.5	NR	2.2	NR	NR	1.8	NR	
		Robotic MVr + TVR	59			13.6		28.4 ± 26.5	7.8 ± 1.4		5.1			3.4		
		p-value MVr/MVr+TVr						0.831	0.577		0.108			0.369		0.607
	Age and gender matched	Robotic MVr	63			14.3		29.6 ± 39.6	7.7 ± 2.5		4.8			4.8		
		Robotic MVr + TVR	34			11.8		29.3 ± 29.6	7.8 ± 1.3		2.9			2.9		
		p-value MVr/MVr+TVr						>0.999	0.066		0.231			>0.999		>0.999
MVR+TVr	4. Rowse (2024) Comparative retro.	Robotic MVr	19	NR	0	NR	NR	21.5h (IQR 18h-31.75h)	4 (IQR 3-5)	NR	Operative: 0	To ICU: 5.3	NR	5.3	NR	
		Robotic MVr + TVR	57		1.8			22.3h (IQR 15.3h-25.7h)	4 (IQR 3-5)		Operative: 0			To ICU: 5.2		0
		p-value MVr/MVr+TVr						NR	0.27		0.2			NA		NR
MVRReplacement	5. Liu (2023) Comparative retro.	Robotic	27	217.7 ± 14.6	NR	27/27	NR	34.3h ± 3.8h	8.3 ± 1.8	NR	0/27	NR	0/27	NR	NR	
		Sternotomy	262	205.7 ± 13.6		192/262		36.7h ± 4.2h	12.1 ± 2.1		0/262		2/262			
		p-value R/S		<0.05		<0.05		<0.05	<0.05		NS		NS			
MVRReplacement	6. Sicim (2021) Comparative retro.	Robotic	64	NR	NR	NR	0.4 ± 0.3	1.6 ± 0.8	7.9 ± 2.9	NR	3.1	NR	NR	4.6	NR	
		Sternotomy	66				0.9 ± 1.2	2.6 ± 1	9.4 ± 3.1		3			6		
		p-value R/S						0.014	0.006		0.003			0.97		0.73
MVRReplacement	7. Yan (2023) Comparative retro. Adjusted	Robotic	186	237 ± 51	NR	NR	NR	Intraop: 1.1 ± 0.8 Postop: 2.3 ± 1.7	27.3h ± 7.6h	9.6 ± 3.3	NR	Operative: 0.5	NR	2.7	NR	
		Sternotomy	372	179 ± 39				Intraop: 1.3 ± 0.7 Postop: 2.5 ± 1.6	28.9h ± 7.9h	10.4 ± 3.6		Operative: 1.3		3.8		
		p-value R/S		<0.001				0.003 0.173	0.023	0.011		0.663		0.509		

Table 10: da Vinci Robotic-Assisted Valve Repair Secondary Clinical Outcomes

Cardiac procedure	Author	Study Arms	Study Size (N)	CPB time (minutes)	XC time (minutes)	Ventilation time (hours)	Prolonged mechanical ventilation (%)	Pulmonary complications (%)	Cardiac arrest (%)	Myocardial infarction (%)	New-onset atrial fibrillation (%)	Renal failure (%)	Stroke (%)	Discharge location (%)	Tricuspid regurgitation (%)	Mitral regurgitation (%)
MVR+TVr	3. Arslanhan (2021) Comparative retro. Not matched	Robotic MVR	226	128.4 ± 45.7	82.4 ± 31.2	NR	0.5	Pleural effusion: 2.2 Pneumonia: 0.9	NR	NR	26/226	Acute: 0	CVE: 0.4	NR	NR	NR
		Robotic MVR + TVR	59	150.1 ± 38.2	99.2 ± 23.9		5.2	Pleural effusion: 1.7 Pneumonia: 0			6/59	Acute: 1.7	CVE: 1.7			
		p-value MVR/MVR+TVr		<0.001	<0.001		0.029	0.793 0.879			0.831	0.108	0.372			
	Age and gender matched	Robotic MVR	63	128.0 ± 43.4	78.1 ± 26.7		0	Pleural effusion: 1.6			7/63	Acute: 0	CVE: 0			
		Robotic MVR + TVR	34	158.4 ± 37.2	99.8 ± 24.6		5.9	Pleural effusion: 2.9			3/34	Acute: 0	CVE: 2.9			
		p-value MVR/MVR+TVr		0.001	<0.001		0.128	0.763			0.365	NA	0.351			
MVR+TVr	4. Rowse (2024) Comparative retro.	Robotic MVR	19	85 (IQR 60.5-98.5)	55.4 (IQR 43.5-66)	NR					47	Dialysis: 0	NR	Severe: 1.75	NR	
		Robotic MVR + TVR	57	130.6 (IQR 117-143)	91 (IQR 81-99)						19.2	Dialysis: 0		Severe: 0		
		p-value MVR/MVR+TVr		<0.0001	<0.0001						0.04	NA		NR		
MVRReplacement	5. Liu (2023) Comparative retro.	Robotic	27	160.2 ± 18.9	114.6 ± 16.5	NR										
		Sternotomy	262	133.2 ± 17.9	93.6 ± 16.1											
		p-value R/S		<0.05	<0.05											
MVRReplacement	6. Sicim (2021) Comparative retro.	Robotic	64	204 ± 45.8	143 ± 27.4	5.3 ± 3.9	>24h: 15.6	Pneumonia: 3.1	NR	NR	Arrhythmia: 18	Dysfunction: 9.3	1.5	NR		
		Sternotomy	66	98 ± 17.8	69 ± 15.2	9.6 ± 4.2	>24h: 13.2	Pneumonia: 4.5			Arrhythmia: 21	Dysfunction: 13.6	3			
		p-value R/S		<0.001	<0.001	0.001	0.437	0.67			0.72	0.52	0.58			
MVRReplacement	7. Yan (2023) Comparative retro. Adjusted	Robotic	186	155 ± 42	98 ± 31	NR					24.2	4.3	1.6	NR		
		Sternotomy	372	106 ± 21	78 ± 18						26.1	3.8	2.2			
		p-value R/S		<0.001	<0.001						0.722	0.631	0.758		0.914	

Table 11: MVR Primary Outcomes

Variable mean (SD) [95% CI] N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 1,507	Not Robotic N = 19,252	P-Value	Robotic N = 1,507	Not Robotic N = 1,507	P-Value
Operating time, minutes	378.8 (72.9) [375.1, 382.5]	321.7 (84.9) [320.5, 322.9]	<0.001	378.8 (72.9) [375.1, 382.5]	321.8 (87.5) [317.4, 326.2]	<0.001
Length of hospital stay, days	5.7 (5.2) [5.5, 6.0]	7.8 (6.5) [7.7, 7.9]	<0.001	5.7 (5.2) [5.5, 6.0]	7.0 (7.1) [6.7, 7.4]	<0.001
Intensive care unit length of stay, days	2.3 (2.6) [2.2, 2.5]	2.9 (4.0) [2.9, 3.0]	<0.001	2.3 (2.6) [2.2, 2.5]	2.8 (5.1) [2.6, 3.1]	<0.001
Blood transfusion	161 (10.7%) [9.2%, 12.4%]	3,309 (17.2%) [16.7%, 17.7%]	<0.001	161 (10.7%) [9.2%, 12.4%]	208 (13.8%) [12.1%, 15.7%]	0.009
Mortality, in hospital	7 (0.5%) [0.2%, 1.0%]	120 (0.6%) [0.5%, 0.7%]	0.45	7 (0.5%) [0.2%, 1.0%]	8 (0.5%) [0.2%, 1.1%]	0.80
Mortality, within 30 days	7 (0.5%) [0.2%, 1.0%]	157 (0.8%) [0.7%, 1.0%]	0.14	7 (0.5%) [0.2%, 1.0%]	10 (0.7%) [0.3%, 1.3%]	0.47
Readmission, within 30 days	95 (6.3%) [5.2%, 7.7%]	1,443 (7.5%) [7.1%, 7.9%]	0.089	95 (6.3%) [5.2%, 7.7%]	96 (6.4%) [5.2%, 7.8%]	0.94
Reoperation for any reason, within 30 days	15 (1.0%) [0.6%, 1.7%]	275 (1.4%) [1.3%, 1.6%]	0.17	15 (1.0%) [0.6%, 1.7%]	19 (1.3%) [0.8%, 2.0%]	0.49

¹P-values calculated using Wilcoxon rank sum test for continuous variables and Pearson's Chi-squared test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if $< 0.05/8 = 0.00625$, as per the Bonferroni multiplicity adjustment method.

Table 12: MVR Secondary Outcomes, Index Hospitalization

Variable, N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 1,507	Not Robotic N = 19,252	P-Value	Robotic N = 1,507	Not Robotic N = 1,507	P-Value
Infection	0 (0.0%) [0.0%, 0.3%]	26 (0.1%) [0.1%, 0.2%]	0.26	0 (0.0%) [0.0%, 0.3%]	0 (0.0%) [0.0%, 0.3%]	>0.99
Respiratory failure	106 (7.0%) [5.8%, 8.5%]	1,569 (8.1%) [7.8%, 8.5%]	0.13	106 (7.0%) [5.8%, 8.5%]	99 (6.6%) [5.4%, 8.0%]	0.61
Prolonged mechanical ventilation	29 (1.9%) [1.3%, 2.8%]	663 (3.4%) [3.2%, 3.7%]	0.002	29 (1.9%) [1.3%, 2.8%]	39 (2.6%) [1.9%, 3.6%]	0.22
Dialysis	15 (1.0%) [0.6%, 1.7%]	346 (1.8%) [1.6%, 2.0%]	0.022	15 (1.0%) [0.6%, 1.7%]	17 (1.1%) [0.7%, 1.8%]	0.72
Discharge to home	1,424 (94.5%) [93.2%, 95.6%]	17,030 (88.5%) [88.0%, 88.9%]	<0.001	1,424 (94.5%) [93.2%, 95.6%]	1,372 (91.0%) [89.5%, 92.4%]	<0.001
Acute myocardial infarction	6 (0.4%) [0.2%, 0.9%]	37 (0.2%) [0.1%, 0.3%]	0.13	6 (0.4%) [0.2%, 0.9%]	5 (0.3%) [0.1%, 0.8%]	0.76
New onset atrial fibrillation	234 (15.5%) [13.8%, 17.5%]	3,631 (18.9%) [18.3%, 19.4%]	0.001	234 (15.5%) [13.8%, 17.5%]	301 (20.0%) [18.0%, 22.1%]	0.001
Cardiac arrest	0 (0.0%) [0.0%, 0.3%]	12 (0.1%) [0.0%, 0.1%]	>0.99	0 (0.0%) [0.0%, 0.3%]	0 (0.0%) [0.0%, 0.3%]	>0.99
Heart failure	39 (2.6%) [1.9%, 3.6%]	476 (2.5%) [2.3%, 2.7%]	0.78	39 (2.6%) [1.9%, 3.6%]	39 (2.6%) [1.9%, 3.6%]	>0.99
Pleural effusion	77 (5.1%) [4.1%, 6.4%]	1,384 (7.2%) [6.8%, 7.6%]	0.002	77 (5.1%) [4.1%, 6.4%]	96 (6.4%) [5.2%, 7.8%]	0.14
Pneumonia	23 (1.5%) [1.0%, 2.3%]	285 (1.5%) [1.3%, 1.7%]	0.89	23 (1.5%) [1.0%, 2.3%]	14 (0.9%) [0.5%, 1.6%]	0.14
Pneumothorax requiring chest tube	14 (0.9%) [0.5%, 1.6%]	261 (1.4%) [1.2%, 1.5%]	0.16	14 (0.9%) [0.5%, 1.6%]	17 (1.1%) [0.7%, 1.8%]	0.59
Renal failure	97 (6.4%) [5.3%, 7.8%]	1,814 (9.4%) [9.0%, 9.8%]	<0.001	97 (6.4%) [5.3%, 7.8%]	102 (6.8%) [5.6%, 8.2%]	0.71
Stroke	18 (1.2%) [0.7%, 1.9%]	227 (1.2%) [1.0%, 1.3%]	0.96	18 (1.2%) [0.7%, 1.9%]	17 (1.1%) [0.7%, 1.8%]	0.86

¹P-values calculated using the Pearson's Chi-squared test or Fisher's exact test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if < 0.05 .

Table 13: MVr Secondary Outcomes, within 30 Days Post Index Hospitalization Discharge

Variable, N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 1,501	Not Robotic N = 19,189	P-Value	Robotic N = 1,501	Not Robotic N = 1,501	P-Value
Acute myocardial infarction	12 (0.8%) [0.4%, 1.4%]	104 (0.5%) [0.4%, 0.7%]	0.20	12 (0.8%) [0.4%, 1.4%]	5 (0.3%) [0.1%, 0.8%]	0.089
New onset atrial fibrillation	377 (25.1%) [23.0%, 27.4%]	5,372 (28.0%) [27.4%, 28.6%]	0.016	377 (25.1%) [23.0%, 27.4%]	438 (29.2%) [26.9%, 31.6%]	0.012
Cardiac arrest	1 (0.1%) [0.0%, 0.4%]	32 (0.2%) [0.1%, 0.2%]	0.51	1 (0.1%) [0.0%, 0.4%]	1 (0.1%) [0.0%, 0.4%]	>0.99
Heart failure	131 (8.7%) [7.4%, 10.3%]	1,729 (9.0%) [8.6%, 9.4%]	0.71	131 (8.7%) [7.4%, 10.3%]	124 (8.3%) [6.9%, 9.8%]	0.65
Pleural effusion	201 (13.4%) [11.7%, 15.2%]	2,572 (13.4%) [12.9%, 13.9%]	0.99	201 (13.4%) [11.7%, 15.2%]	173 (11.5%) [10.0%, 13.3%]	0.12
Pneumonia	39 (2.6%) [1.9%, 3.6%]	452 (2.4%) [2.1%, 2.6%]	0.55	39 (2.6%) [1.9%, 3.6%]	23 (1.5%) [1.0%, 2.3%]	0.040
Pneumothorax	25 (1.7%) [1.1%, 2.5%]	316 (1.6%) [1.5%, 1.8%]	0.96	25 (1.7%) [1.1%, 2.5%]	20 (1.3%) [0.8%, 2.1%]	0.45
Renal failure	106 (7.1%) [5.8%, 8.5%]	2,032 (10.6%) [10.2%, 11.0%]	<0.001	106 (7.1%) [5.8%, 8.5%]	133 (8.9%) [7.5%, 10.4%]	0.069
Stroke	22 (1.5%) [0.9%, 2.2%]	302 (1.6%) [1.4%, 1.8%]	0.75	22 (1.5%) [0.9%, 2.2%]	23 (1.5%) [1.0%, 2.3%]	0.88

¹P-values calculated using the Pearson's Chi-squared test or Fisher's exact test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if < 0.05.

Table 14: CABG Primary Outcomes

Variable mean (SD) [95% CI] N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 3,893	Not Robotic N = 238,165	P-Value	Robotic N = 3,893	Not Robotic N = 3,893	P-Value
Operating time, minutes	320.6 (83.5) [318.0, 323.2]	317.0 (79.5) [316.7, 317.3]	0.77	320.6 (83.5) [318.0, 323.2]	316.6 (79.2) [314.1, 319.1]	0.81
Length of hospital stay, days	7.4 (6.1) [7.2, 7.6]	8.8 (5.9) [8.7, 8.8]	<0.001	7.4 (6.1) [7.2, 7.6]	8.3 (6.0) [8.1, 8.5]	<0.001
Intensive care unit length of stay, days	3.0 (3.9) [2.9, 3.1]	3.2 (3.8) [3.2, 3.2]	<0.001	3.0 (3.9) [2.9, 3.1]	3.1 (3.7) [3.0, 3.3]	<0.001
Blood transfusion	391 (10.0%) [9.1%, 11.0%]	43,312 (18.2%) [18.0%, 18.3%]	<0.001	391 (10.0%) [9.1%, 11.0%]	691 (17.7%) [16.6%, 19.0%]	<0.001
Mortality, in hospital	29 (0.7%) [0.5%, 1.1%]	2,784 (1.2%) [1.1%, 1.2%]	0.014	29 (0.7%) [0.5%, 1.1%]	40 (1.0%) [0.7%, 1.4%]	0.18
Mortality, within 30 days	39 (1.0%) [0.7%, 1.4%]	3,421 (1.4%) [1.4%, 1.5%]	0.023	39 (1.0%) [0.7%, 1.4%]	53 (1.4%) [1.0%, 1.8%]	0.14
Readmission, within 30 days	350 (9.0%) [8.1%, 9.9%]	18,896 (7.9%) [7.8%, 8.0%]	0.016	350 (9.0%) [8.1%, 9.9%]	291 (7.5%) [6.7%, 8.4%]	0.015
Reoperation for any reason, within 30 days	54 (1.4%) [1.1%, 1.8%]	3,972 (1.7%) [1.6%, 1.7%]	0.17	54 (1.4%) [1.1%, 1.8%]	65 (1.7%) [1.3%, 2.1%]	0.31

¹P-values calculated using Wilcoxon rank sum test for continuous variables and Pearson's Chi-squared test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if < 0.05/8 = 0.00625, as per the Bonferroni multiplicity adjustment method.

Table 15: CABG Secondary Outcomes, Index Hospitalization

Variable, N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 3,893	Not Robotic N = 238,165	P-Value	Robotic N = 3,893	Not Robotic N = 3,893	P-Value
Infection	14 (0.4%) [0.2%, 0.6%]	873 (0.4%) [0.3%, 0.4%]	0.94	14 (0.4%) [0.2%, 0.6%]	15 (0.4%) [0.2%, 0.7%]	0.85
Respiratory failure	420 (10.8%) [9.8%, 11.8%]	27,162 (11.4%) [11.3%, 11.5%]	0.23	420 (10.8%) [9.8%, 11.8%]	439 (11.3%) [10.3%, 12.3%]	0.49
Prolonged mechanical ventilation	121 (3.1%) [2.6%, 3.7%]	9,472 (4.0%) [3.9%, 4.1%]	0.006	121 (3.1%) [2.6%, 3.7%]	121 (3.1%) [2.6%, 3.7%]	>0.99
Dialysis	118 (3.0%) [2.5%, 3.6%]	8,006 (3.4%) [3.3%, 3.4%]	0.26	118 (3.0%) [2.5%, 3.6%]	108 (2.8%) [2.3%, 3.4%]	0.50
Discharge to home	3,424 (88.0%) [86.9%, 89.0%]	196,209 (82.4%) [82.2%, 82.5%]	<0.001	3,424 (88.0%) [86.9%, 89.0%]	3,229 (82.9%) [81.7%, 84.1%]	<0.001

Acute myocardial infarction	14 (0.4%) [0.2%, 0.6%]	1,015 (0.4%) [0.4%, 0.5%]	0.53	14 (0.4%) [0.2%, 0.6%]	11 (0.3%) [0.1%, 0.5%]	0.55
New onset atrial fibrillation	642 (16.5%) [15.3%, 17.7%]	48,740 (20.5%) [20.3%, 20.6%]	<0.001	642 (16.5%) [15.3%, 17.7%]	796 (20.4%) [19.2%, 21.8%]	<0.001
Cardiac arrest	10 (0.3%) [0.1%, 0.5%]	355 (0.1%) [0.1%, 0.2%]	0.085	10 (0.3%) [0.1%, 0.5%]	7 (0.2%) [0.1%, 0.4%]	0.47
Heart failure	27 (0.7%) [0.5%, 1.0%]	3,247 (1.4%) [1.3%, 1.4%]	<0.001	27 (0.7%) [0.5%, 1.0%]	46 (1.2%) [0.9%, 1.6%]	0.025
Pleural effusion	290 (7.4%) [6.7%, 8.3%]	14,892 (6.3%) [6.2%, 6.4%]	0.002	290 (7.4%) [6.7%, 8.3%]	247 (6.3%) [5.6%, 7.2%]	0.054
Pneumonia	95 (2.4%) [2.0%, 3.0%]	5,786 (2.4%) [2.4%, 2.5%]	0.97	95 (2.4%) [2.0%, 3.0%]	77 (2.0%) [1.6%, 2.5%]	0.17
Pneumothorax requiring chest tube	30 (0.8%) [0.5%, 1.1%]	2,519 (1.1%) [1.0%, 1.1%]	0.082	30 (0.8%) [0.5%, 1.1%]	30 (0.8%) [0.5%, 1.1%]	>0.99
Renal failure	290 (7.4%) [6.7%, 8.3%]	29,244 (12.3%) [12.1%, 12.4%]	<0.001	290 (7.4%) [6.7%, 8.3%]	480 (12.3%) [11.3%, 13.4%]	<0.001
Stroke	35 (0.9%) [0.6%, 1.3%]	3,149 (1.3%) [1.3%, 1.4%]	0.022	35 (0.9%) [0.6%, 1.3%]	49 (1.3%) [0.9%, 1.7%]	0.12

¹P-values calculated using the Pearson's Chi-squared test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if < 0.05.

Table 16: CABG Secondary Outcomes, within 30 Days Post Index Hospitalization Discharge

Variable, N (%) [95% CI]	Unmatched			Matched		
	Robotic N = 3,893	Not Robotic N = 238,163	P-Value	Robotic N = 3,893	Not Robotic N = 3,893	P-Value
Infection	14 (0.4%) [0.2%, 0.6%]	873 (0.4%) [0.3%, 0.4%]	0.94	14 (0.4%) [0.2%, 0.6%]	14 (0.4%) [0.2%, 0.6%]	>0.99
Respiratory failure	420 (10.8%) [9.8%, 11.8%]	27,162 (11.4%) [11.3%, 11.5%]	0.23	420 (10.8%) [9.8%, 11.8%]	434 (11.1%) [10.2%, 12.2%]	0.61
Prolonged mechanical ventilation	121 (3.1%) [2.6%, 3.7%]	9,472 (4.0%) [3.9%, 4.1%]	0.006	121 (3.1%) [2.6%, 3.7%]	129 (3.3%) [2.8%, 3.9%]	0.61
Dialysis	118 (3.0%) [2.5%, 3.6%]	8,006 (3.4%) [3.3%, 3.4%]	0.26	118 (3.0%) [2.5%, 3.6%]	126 (3.2%) [2.7%, 3.9%]	0.60
Discharge to home	3,424 (88.0%) [86.9%, 89.0%]	196,208 (82.4%) [82.2%, 82.5%]	<0.001	3,424 (88.0%) [86.9%, 89.0%]	3,241 (83.3%) [82.0%, 84.4%]	<0.001
Acute myocardial infarction	14 (0.4%) [0.2%, 0.6%]	1,015 (0.4%) [0.4%, 0.5%]	0.53	14 (0.4%) [0.2%, 0.6%]	12 (0.3%) [0.2%, 0.6%]	0.69
New onset atrial fibrillation	642 (16.5%) [15.3%, 17.7%]	48,740 (20.5%) [20.3%, 20.6%]	<0.001	642 (16.5%) [15.3%, 17.7%]	789 (20.3%) [19.0%, 21.6%]	<0.001
Cardiac arrest	10 (0.3%) [0.1%, 0.5%]	355 (0.1%) [0.1%, 0.2%]	0.085	10 (0.3%) [0.1%, 0.5%]	8 (0.2%) [0.1%, 0.4%]	0.64
Heart failure	27 (0.7%) [0.5%, 1.0%]	3,247 (1.4%) [1.3%, 1.4%]	<0.001	27 (0.7%) [0.5%, 1.0%]	41 (1.1%) [0.8%, 1.4%]	0.088
Pleural effusion	290 (7.4%) [6.7%, 8.3%]	14,892 (6.3%) [6.2%, 6.4%]	0.002	290 (7.4%) [6.7%, 8.3%]	248 (6.4%) [5.6%, 7.2%]	0.061
Pneumonia	95 (2.4%) [2.0%, 3.0%]	5,786 (2.4%) [2.4%, 2.5%]	0.97	95 (2.4%) [2.0%, 3.0%]	85 (2.2%) [1.8%, 2.7%]	0.45
Pneumothorax requiring chest tube	30 (0.8%) [0.5%, 1.1%]	2,519 (1.1%) [1.0%, 1.1%]	0.082	30 (0.8%) [0.5%, 1.1%]	31 (0.8%) [0.6%, 1.1%]	0.90
Renal failure	290 (7.4%) [6.7%, 8.3%]	29,244 (12.3%) [12.1%, 12.4%]	<0.001	290 (7.4%) [6.7%, 8.3%]	471 (12.1%) [11.1%, 13.2%]	<0.001
Stroke	35 (0.9%) [0.6%, 1.3%]	3,149 (1.3%) [1.3%, 1.4%]	0.022	35 (0.9%) [0.6%, 1.3%]	53 (1.4%) [1.0%, 1.8%]	0.054

¹P-values calculated using the Pearson's Chi-squared test for categorical variables.

²95% confidence intervals calculated using Wilson method.

*P-values considered significant if < 0.05.