

Table S1 Summary of the underlying mitral valve pathology

Primary author	Approach	N	Myxomatous degeneration (%)	Ischaemic (%)	Infection (%)	Rheumatic (%)	Functional (%)	Other (%)
Chemtob, 2020	Sternotomy	395	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	605	100.0	0.0	0.0	0.0	0.0	0.0
Coyan, 2018	Sternotomy	91	NR	NR	11.0	NR	NR	NR
	Robotic	91	NR	NR	7.7	NR	NR	NR
Folliguet, 2006	Sternotomy	25	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	25	100.0	0.0	0.0	0.0	0.0	0.0
Hawkins, 2018 (unmatched)	Sternotomy	1,352	45.3	1.6	14.9	11.8	NR	14.3
	Robotic	372	80.9	0.8	5.7	7.0	NR	4.8
Hawkins, 2018 (PSM)	Sternotomy	314	78.0	1.0	6.4	7.3	NR	NR
	Robotic	314	79.0	1.0	6.4	7.0	NR	NR
Kam, 2010	Sternotomy	40	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	107	100.0	0.0	0.0	0.0	0.0	0.0
Kesävuori, 2018	Sternotomy	142	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	142	100.0	0.0	0.0	0.0	0.0	0.0
Mihaljevic, 2011	Sternotomy	114	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	261	100.0	0.0	0.0	0.0	0.0	0.0
Seo, 2019	Sternotomy	259	NR	NR	NR	NR	NR	NR
	Robotic	175	NR	NR	NR	NR	NR	NR
Sicim, 2021	Sternotomy	66	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	64	100.0	0.0	0.0	0.0	0.0	0.0
Stevens, 2012	Sternotomy	377	43.8	6.4	8.5	14.9	6.1	20.4
	Robotic	447	80.0	0.9	4.5	3.6	8.5	2.5
Suri, 2011	Sternotomy	95	100.0	0.0	0.0	0.0	0.0	0.0
	Robotic	95	100.0	0.0	0.0	0.0	0.0	0.0
Wang, 2018	Sternotomy	503	NR	NR	NR	NR	NR	NR
	Robotic	503	NR	NR	NR	NR	NR	NR
Woo, 2006	Sternotomy	39	NR	NR	NR	NR	NR	NR
	Robotic	25	NR	NR	NR	NR	NR	NR
Zhao, 2020	Sternotomy	47	17.0	0.0	4.3	76.6	0.0	2.1
	Robotic	47	12.8	0.0	4.3	76.6	0.0	6.4

PSM, propensity score matched cohort; N, number of patients.

Table S2 Pooled baseline characteristics for matched patients only

Variable	Robotic matched (n=1,323)	Sternotomy matched (n=1,323)
Age (years), mean	68.4	68.6
Male, %	65.0	65.3
BMI (kg/m ²), mean	26.2	26.4
Hypertension, %	46.5	45.2
Diabetes, %	6.8	7.1
Cerebrovascular disease, %	3.3	3.6
Respiratory disease, %	4.1	5.4
LVEF, mean	60.1	60.0
Cardiac arrhythmia, %	17.8	19.3
NYHA III/IV, %	26.4	29.5
Valve pathology—myxomatous degeneration, %	87.4	88.0

BMI, body mass index; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association.

Table S3 Procedural details											
Primary Author	Robotic access method	Robotic XC method	Cardioplegia strategy	Replacement—sternotomy	Replacement—robotic	Repair—sternotomy	Repair—robotic	Repair details	Concomitant surgery—robotic	Concomitant surgery—sternotomy	Conversion to sternotomy/thoracotomy
Chemtob	Access ports placed through the right chest, including a 4-cm mini-thoracotomy working port	Transthoracic aortic cross-clamp	Antegrade	4 (1%), 2 were failed repairs	0 (0%)	391 (99%)	605 (100%)	Resectional techniques, artificial chordae, or both along with flexible annuloplasty band	0 (0.0%)	0 (0.0%)	0 (0%)
Coyan	4-cm right lateral mini-thoracotomy and access ports	Transthoracic aortic cross-clamp	NR	17 (18.7%)	13 (14.3%)	74 (81.3%)	78 (85.7%)	NR	TVR/r, closure of ASD, or surgical ablation procedures	TVR/r, closure of ASD, or surgical ablation procedures	0 (0%)
Folliguet	Two ports and a 4–5 cm intercostals lateral incision in the right chest	Transthoracic aortic cross-clamp	Antegrade	0 (0%)	0 (0%)	25 (100%)	25 (100%)	Posterior leaflet resection and open band or a closed annuloplasty ring	NR	NR	1 (4%)—thoracotomy
Hawkins—PSM group	NR	NR	NR	77 (24.5%)	30 (9.5%)	237 (75.5%)	284 (90.5%)	Leaflet resection and/or neochords and ring annuloplasty	LAAL 18 (5.7%)	LAAL 46 (14.7%)	0 (0%)
Hawkins—larger cohort	NR	NR	NR	655 (48.4%)	36 (9.7%)	697 (51.6%)	336 (90.3%)	Leaflet resection and/or neochords and ring annuloplasty	LAAL 21 (5.7%)	LAAL 19 (3.3%)	0 (0%)
Kam	Right thoracotomy (<4 cm) and a number of smaller ports	NR	NR	0 (0%)	0 (0%)	40 (100%)	107 (100%)	NR	0 (0.0%)	0 (0.0%)	NR
Kesävuori	Camera port was placed near the mammilla (4th intercostal space), service port was placed laterally same or adjacent intercostal space, 3 other access ports	Endoaortic balloon primarily, but transthoracic aortic cross-clamp used in some operations	Antegrade and retrograde	3 (2.1%)	2 (1.4%)	139 (97.9%)	140 (98.6%)	Neochord implantation and/or leaflet resection and/or commissuroplasty	AF ablation 35 (24.6%), TVr 6 (4.2%), PFO closure 14 (9.9%), LAAL 32 (22.5%), myxoma excision 1 (0.7%), pericardial cyst excision 1 (0.7%)	AF ablation 30 (21.1%), TVr 17 (12.0%), PFO closure 7 (4.9%), LAAL 26 (18.3%), thymoma excision 1 (0.7%)	14 (9.9%)
Mihaljevic	Mini-thoracotomy fourth intercostal space in the mid-axillary line and other access ports	Endoaortic balloon or transthoracic aortic clamp	Antegrade and retrograde	1 (0.9%)	0 (0%)	113 (99.1%)	261 (100%)	Annuloplasty and leaflet resection or chordal procedure or edge-to-edge repair	ASD or PFO closure 34 (13%), left-sided ablative lesions for AF 22 (8.4%)	ASD or PFO closure 7 (6.1%), Left-sided ablative lesions for AF 31 (27%)	24 (9.1%)
Seo	NR	NR	NR	0 (0%)	0 (0%)	259 (100%)	175 (100%)	NR	0 (0.0%)	0 (0.0%)	4 (2.3%)
Sicim	4-cm anterolateral thoracotomy incision	Transthoracic aortic cross-clamp	Antegrade	66 (100%)	64 (100%)	0 (0%)	0 (0%)	NR	0 (0%)	0 (0%)	NR
Stevens	3- to 4-cm working port in the right inframammary fold through the fourth intercostal space	Transthoracic aortic cross-clamp primarily, endoaortic balloon occlusion used infrequently	Antegrade and/or retrograde	169 (44.8%)	5 (1.1%)	208 (55.2%)	442 (98.9%)	Techniques involving combination or isolated annuloplasty, leaflet resection and chordal procedure	AF ablation 84 (19%)	AF ablation 22 (6%)	NR
Suri	2- to 3-cm working port lateral to the camera port in the right 4th intercostal space	Transthoracic aortic cross-clamp	Antegrade	0 (0%)	0 (0%)	95 (100%)	95 (100%)	Triangular resection for posterior leaflet disease, neochords for anterior leaflet prolapse and all repairs partial annuloplasty band	ASD/PFO closure or Maze/modified Maze procedures	ASD/PFO closure or Maze/modified Maze procedures	0 (0%)
Wang	NR	Endoaortic balloon or transthoracic aortic clamp*	Antegrade and/or retrograde*	49 (9.7%)	8 (1.6%)	454 (90.3%)	495 (98.4%)	Combination or isolated annuloplasty, leaflet resection, sliding plasty, neochords, edge-to-edge repair and chordal procedure	PFO or ASD repair	PFO or ASD repair	NR
Woo	Right chest was entered in the fourth intercostals space and other port access	Endoaortic balloon or transthoracic aortic clamp	Antegrade and retrograde	16 (41%)	8 (32%)	23 (59%)	17 (68%)	Ring annuloplasty and indicated leaflet, chordal, and annular reconstruction	0 (0.0%)	0 (0.0%)	NR
Zhao	NR	NR	NR	Mechanical 33 (70.2%)/bioprosthetic 14 (29.8%)	Mechanical 35 (84.5%)/bioprosthetic 12 (25.5%)	0 (0%)	0 (0%)	NR	NR	NR	NR

*, one operation (robotic) performed beating heart and four (3 robotic and 1 sternotomy) performed utilising fibrillatory arrest. NR, not reported; TVR/r, tricuspid valve replacement/repair; ASD, atrial septal defect; PFO, patent foramen ovale; LAAL, left atrial appendage ligation; AF, atrial fibrillation.

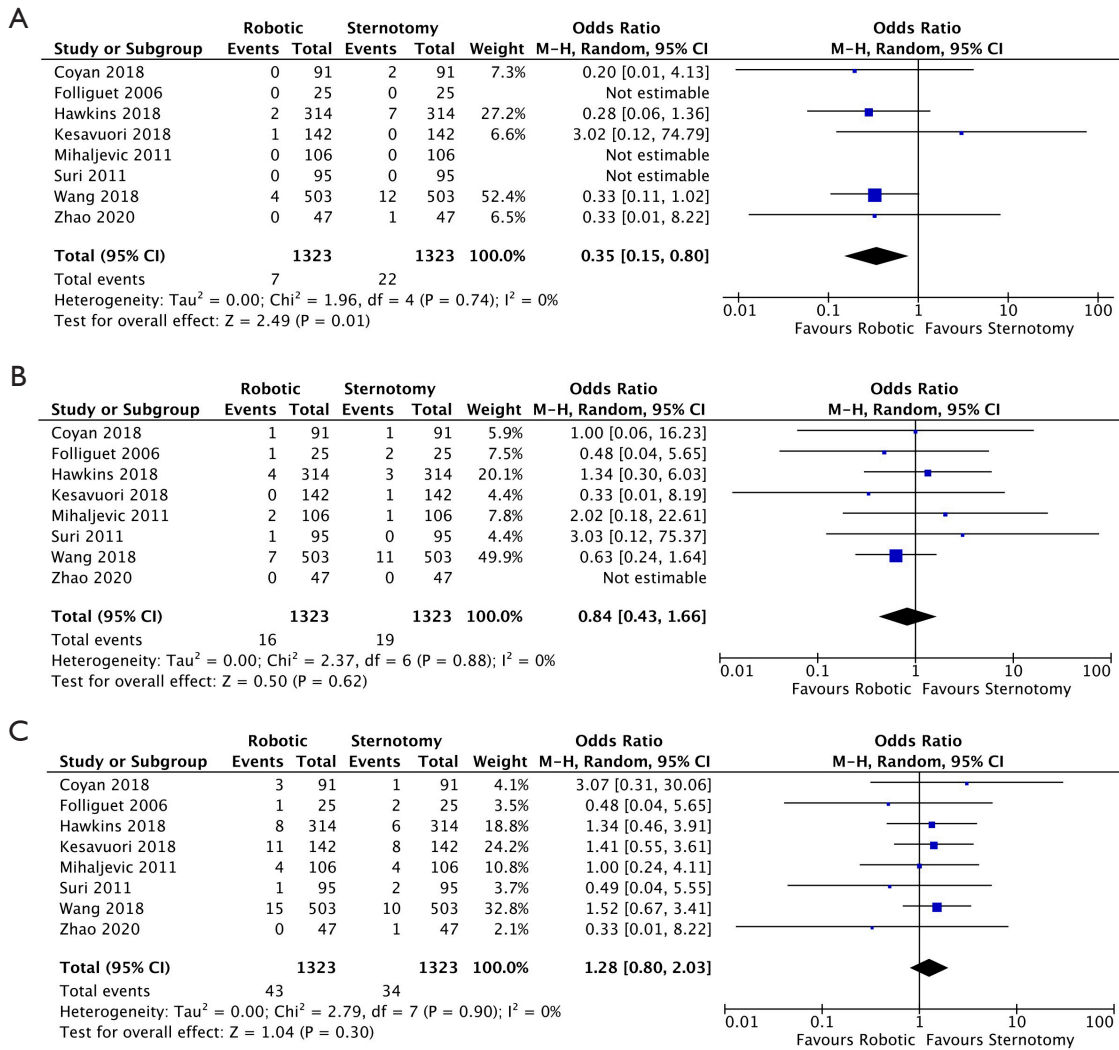


Figure S1 Forrest plot of OR of matched cohort studies for all-cause mortality (A), CVA (B), and re-operation for bleeding (C) for robotic versus conventional sternotomy mitral valve surgery. OR, odds ratio; CI, confidence interval; CVA, cerebrovascular accidents; M-H, Mantel-Haenszel test.

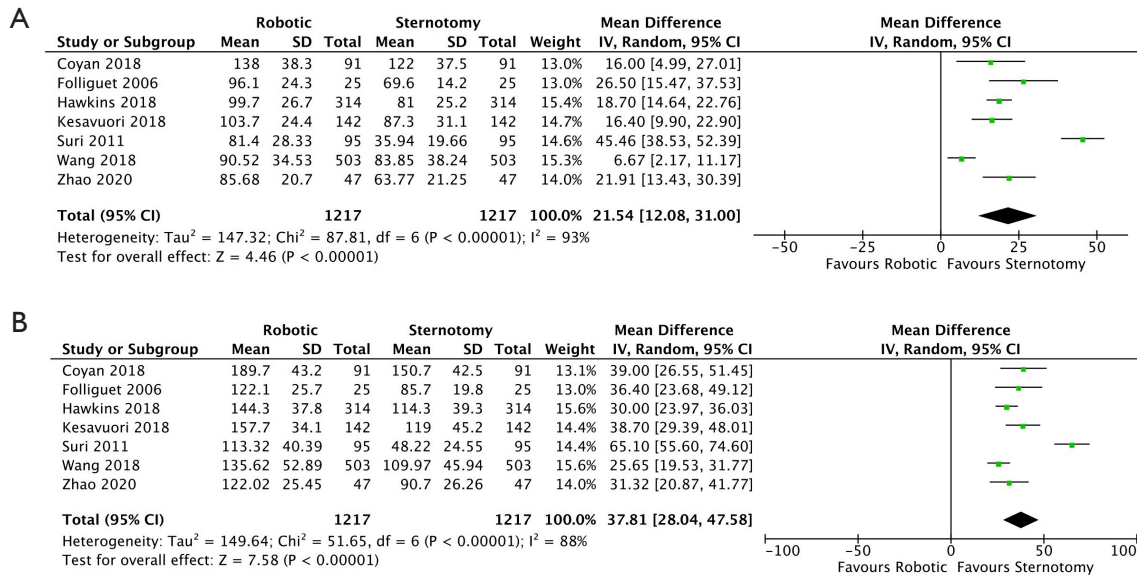


Figure S2 Forrest plot of MD of matched cohort studies for cross clamp (A), and CPB times (B) for robotic versus conventional sternotomy mitral valve surgery. MD, mean difference; CPB, cardiopulmonary bypass; CI, confidence interval.

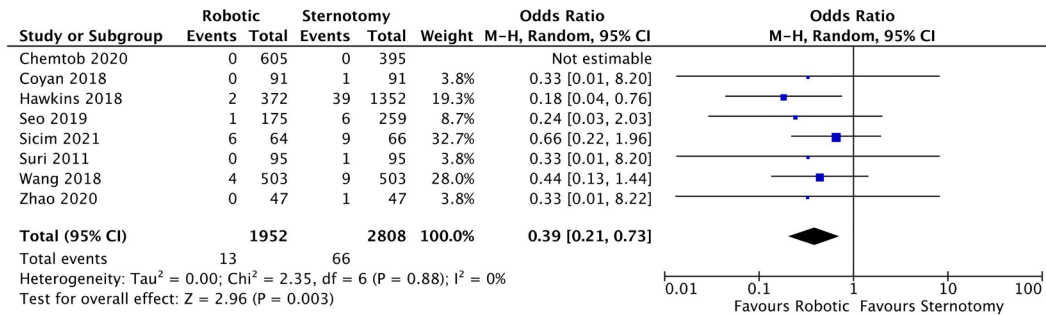


Figure S3 Forrest plot of OR for post-operative renal insufficiency for robotic versus conventional sternotomy mitral valve surgery. OR, odds ratio; CI, confidence interval; M-H, Mantel-Haenszel test.

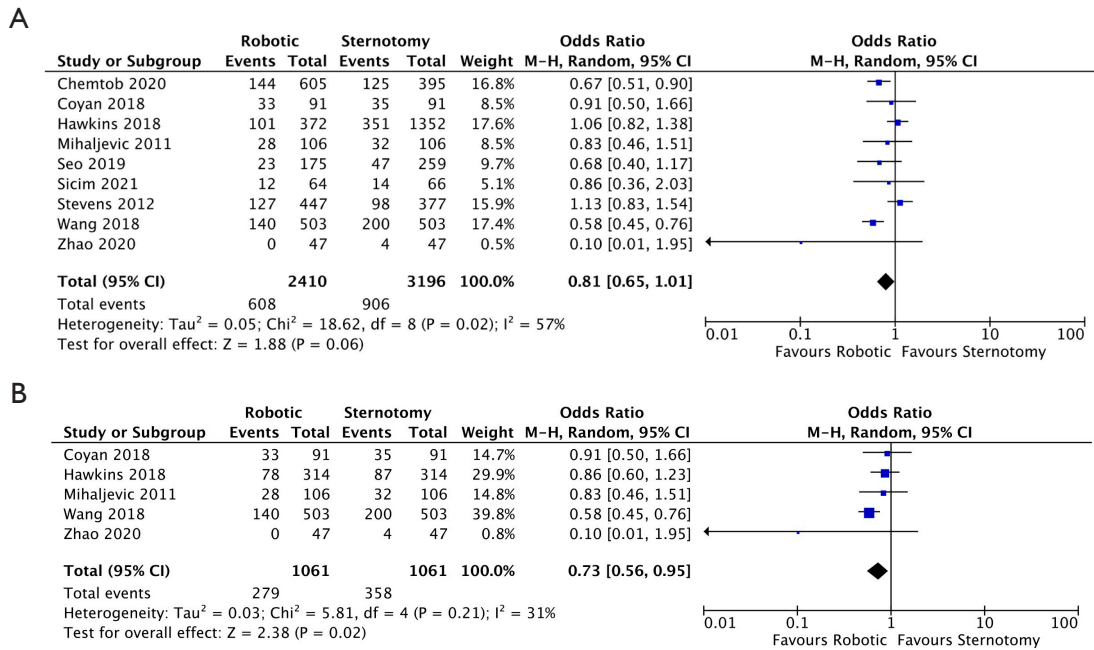


Figure S4 Forrest plot of OR for POAF in all studies (A) and POAF in matched patient cohorts (B) for robotic versus conventional sternotomy mitral valve surgery. POAF, post-operative atrial fibrillation; OR, odds ratio; CI, confidence interval; M-H, Mantel-Haenszel test.

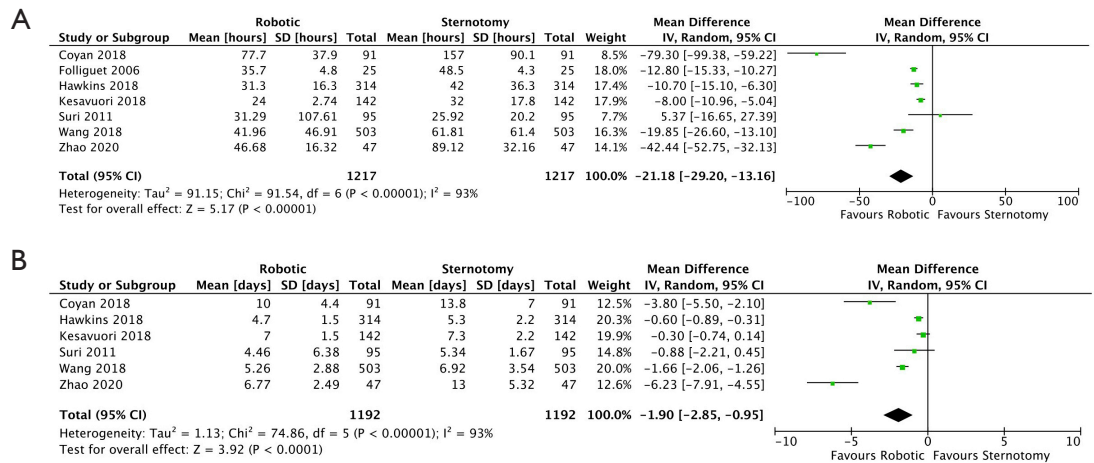


Figure S5 Forrest plot of MD of matched cohort studies for (A) intensive care unit stay (hours), and (B) length of hospital stay (days) for robotic versus conventional sternotomy mitral valve surgery. MD, mean difference; CI, confidence interval.

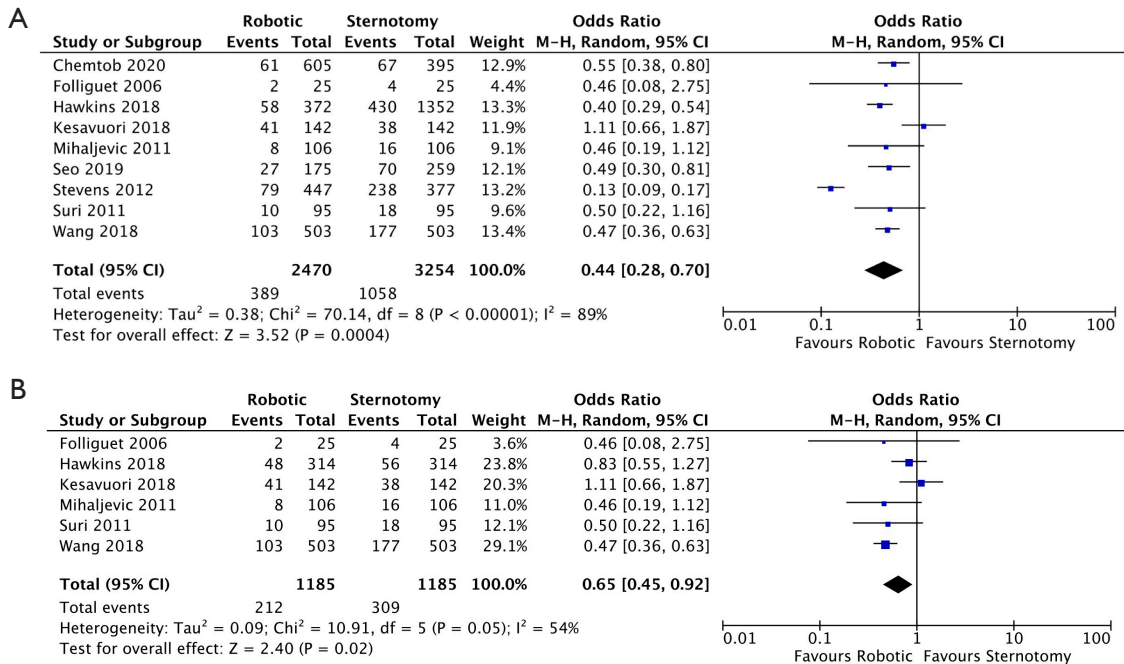


Figure S6 Forrest plot of OR for RBC transfusion in all studies (A) and RBC transfusion in matched patient cohorts (B) for robotic versus conventional sternotomy mitral valve surgery. RBC, red blood cell; OR, odds ratio; CI, confidence interval; M-H, Mantel-Haenszel test.

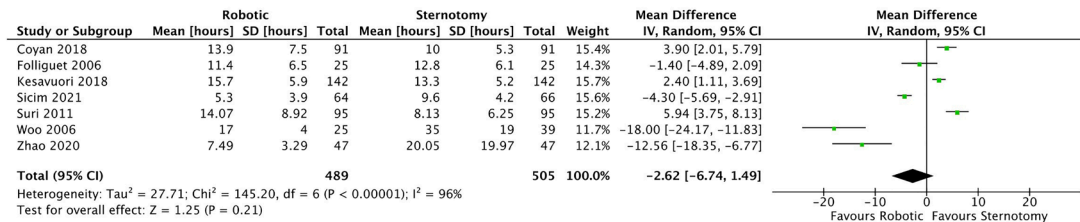


Figure S7 Forrest plot of MD for ventilation time (hours) for robotic versus conventional sternotomy mitral valve surgery. MD, mean difference; CI, confidence interval.

Table S4 Echocardiography results post-operatively

Primary author	Approach	In-hospital/early follow-up					Latest follow-up				
		None (%)	Trace (%)	Mild (%)	Moderate (%)	Severe (%)	None (%)	Trace (%)	Mild (%)	Moderate (%)	Severe (%)
Chemtob, 2020	Sternotomy	92.9	7.1	0.0	(0.0	NR	NR	NR	NR	NR	NR
	Robotic	86.3	13.6	0.1	0.0	NR	NR	NR	NR	NR	NR
Coyan, 2018	Sternotomy	100.0	0.0	0.0	0.0	NR	NR	NR	NR	NR	NR
	Robotic	100.0	0.0	0.0	0.0	NR	91%*	NR	NR	NR	NR
Folliguet, 2006	Sternotomy	92.0	0.0	0.0	8.0	0.0	NR	NR	NR	NR	NR
	Robotic	92.0	0.0	0.0	8.0	0.0	NR	NR	NR	NR	NR
Hawkins, 2018	Sternotomy	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Robotic	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Kam, 2010	Sternotomy	82.1	17.9	0.0	0.0	0.0	NR	NR	NR	NR	NR
	Robotic	82.1	14.2	2.8	0.9	0.0	NR	NR	NR	NR	NR
Kesävuori, 2018	Sternotomy	NR	NR	NR	NR	NR	NR	84.7	NR	5.1	0.8
	Robotic	NR	NR	NR	NR	NR	NR	86.3	NR	7.6	1.5
Mihaljevic, 2011	Sternotomy	NR	99.0	NR	1.0	NR	NR	NR	NR	NR	NR
	Robotic	NR	98.1	NR	1.9	NR	NR	NR	NR	NR	NR
Seo, 2019	Sternotomy	78.7	15.7	4.7	0.9	58.2*	27.8*	NR	12.7*	1.3*	NR
	Robotic	74.4	19.8	5.2	0.6	39.5*	31.6*	NR	21.1*	7.9*	NR
Sicim, 2021	Sternotomy	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Robotic	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Stevens, 2012	Sternotomy	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Robotic	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Suri, 2011	Sternotomy	82.1	16.8	1.1	0.0	NR	NR	NR	NR	NR	NR
	Robotic	82.1	17.9	0.0	0.0	NR	NR	NR	NR	NR	NR
Wang, 2018	Sternotomy	48.2	35.4	9.8	4.3	1.2	NR	NR	NR	NR	NR
	Robotic	45.3	38.2	14.7	1.2	0.6	NR	NR	NR	NR	NR
Woo, 2006	Sternotomy	82.6	8.7	8.7	0.0	0.0	NR	NR	NR	NR	NR
	Robotic	82.4	0.0	17.6	0.0	0.0	NR	NR	NR	NR	NR
Zhao, 2020	Sternotomy	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Robotic	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

*, one year follow-up data. NR, not reported.