Pro's and Con's of Sternotomy vs Minimally invasive mitral valve surgery

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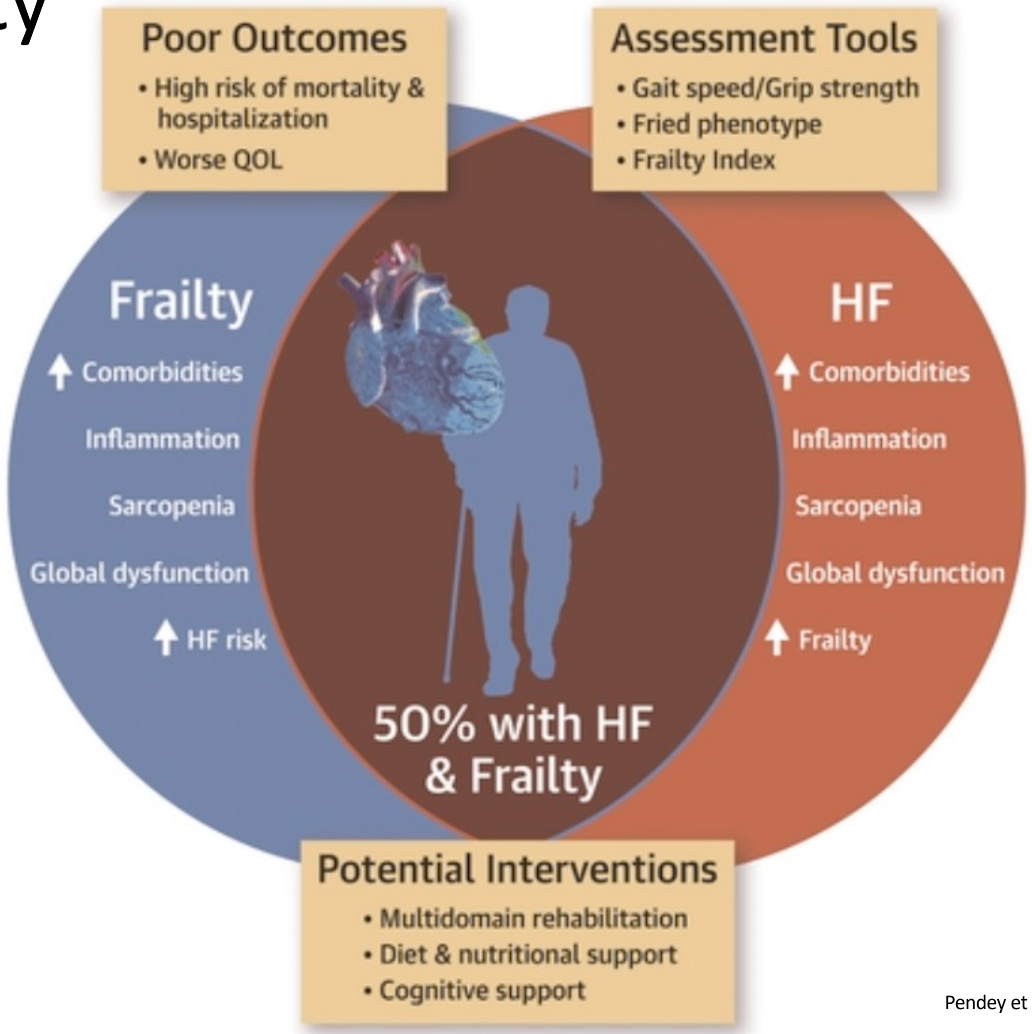
ATCSA2023
Ho Chi Minh city, Vietnam

Mini invasive

The less invasive, the better for the patient,

the more painful for the surgeon???

Patient frailty



Pendey et al, JACC HF 2019;7(12)1001-11

Development of invasive treatment of heart disease

We can personalize and adjust for the specific patient

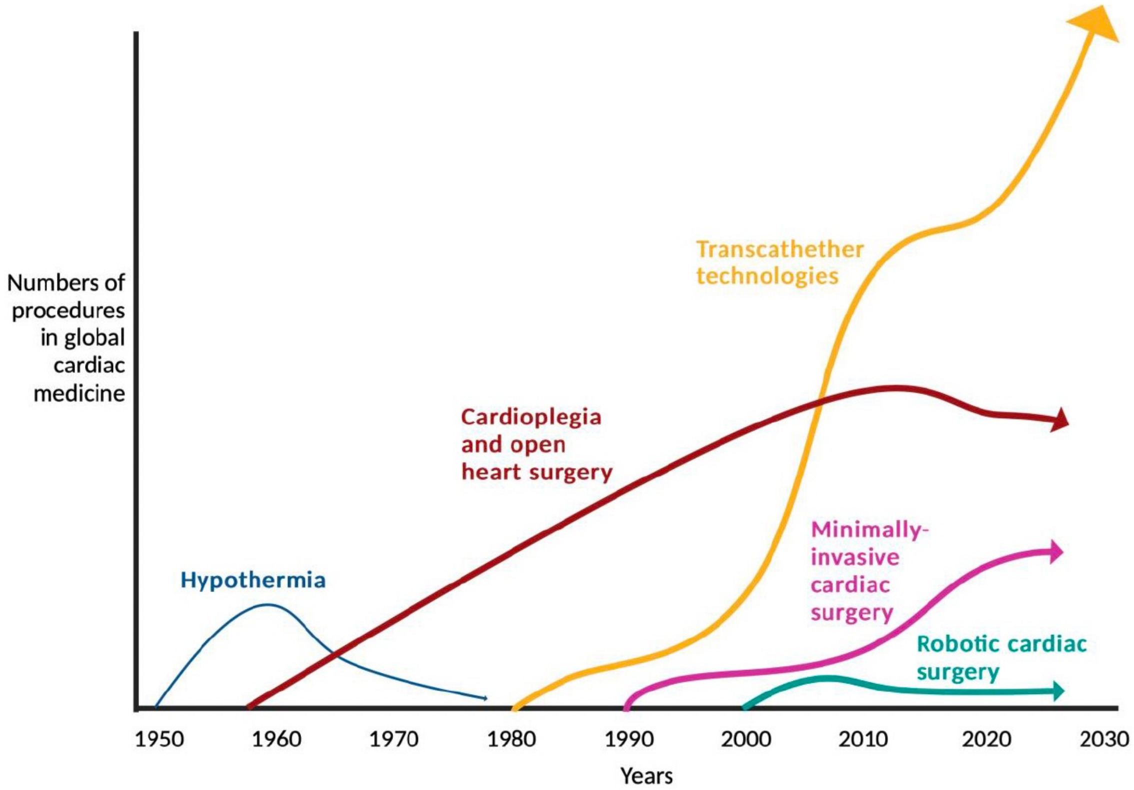
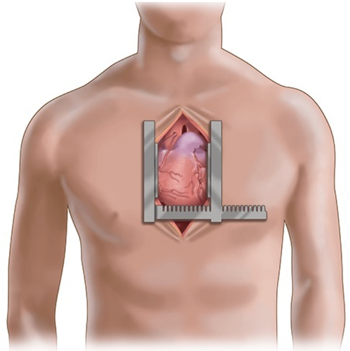


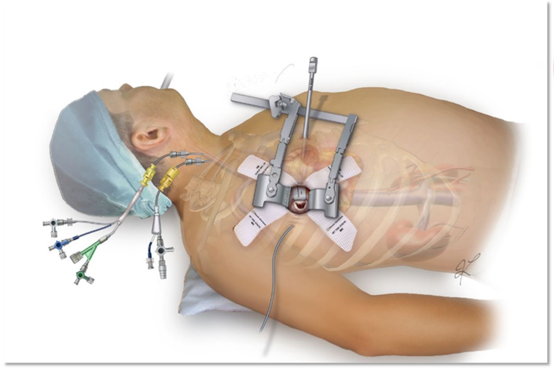
Figure 4. Simplified illustration of the development of the invasive treatment of heart disease with surgical and interventional means over the last 70 years.

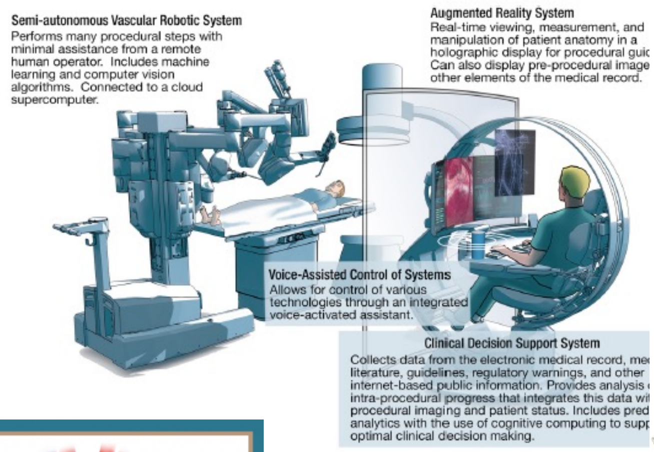
Faerber et al,J Cardiovasc Dev. Dis. 2023; 10:380

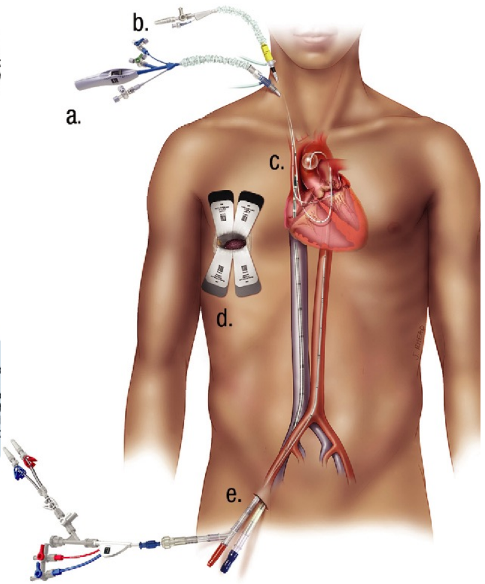
Invasiveness

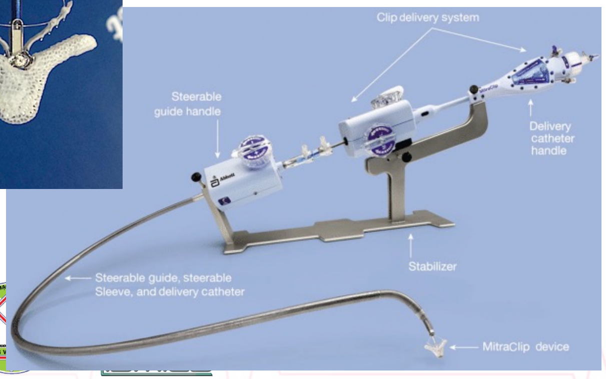
- Open surgery, sternotomy
- Mini invasive, mini thoracotomy
- Endoscopic
- Robotic
- Transcatheteter, TF or TA
- Medical therapy

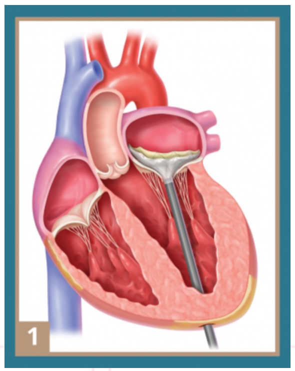


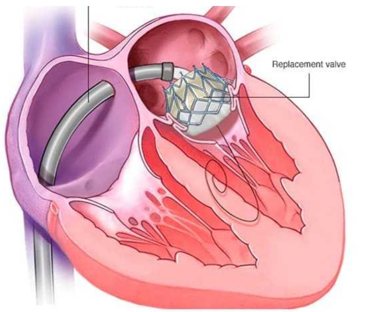












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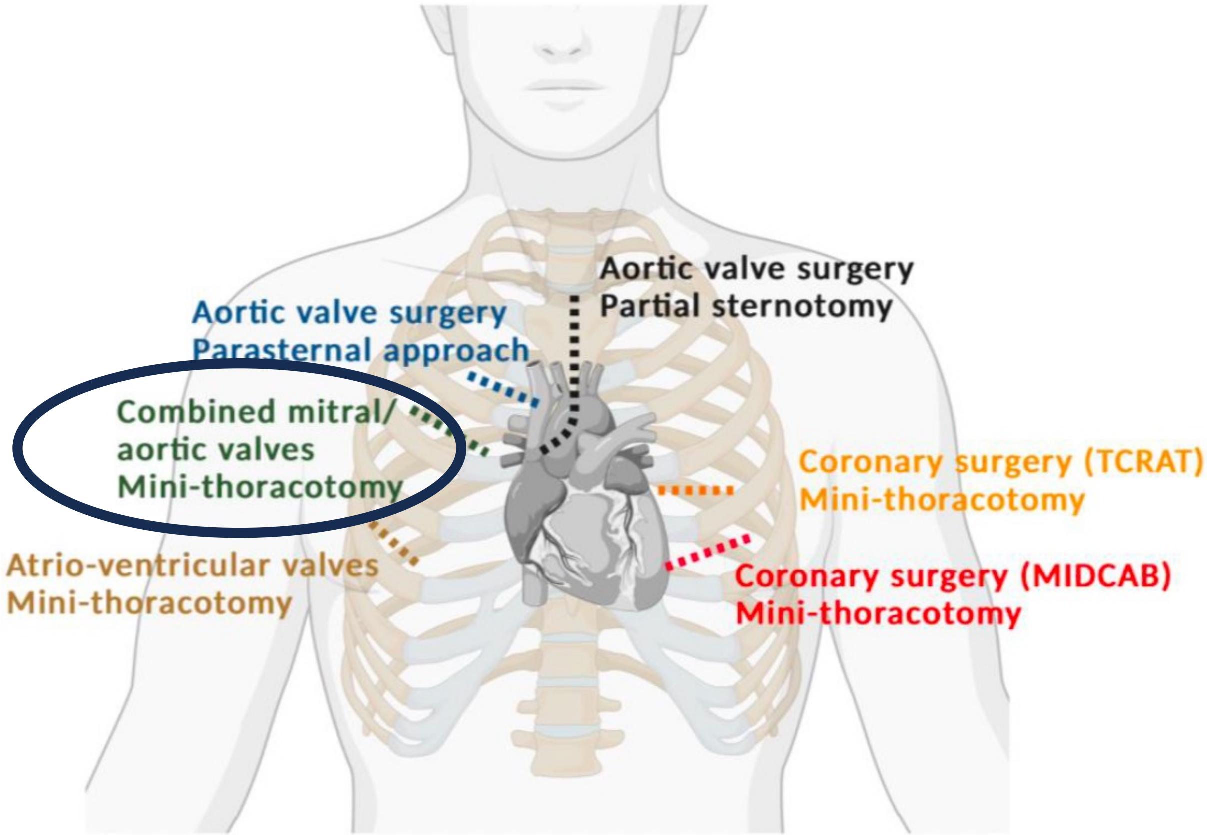
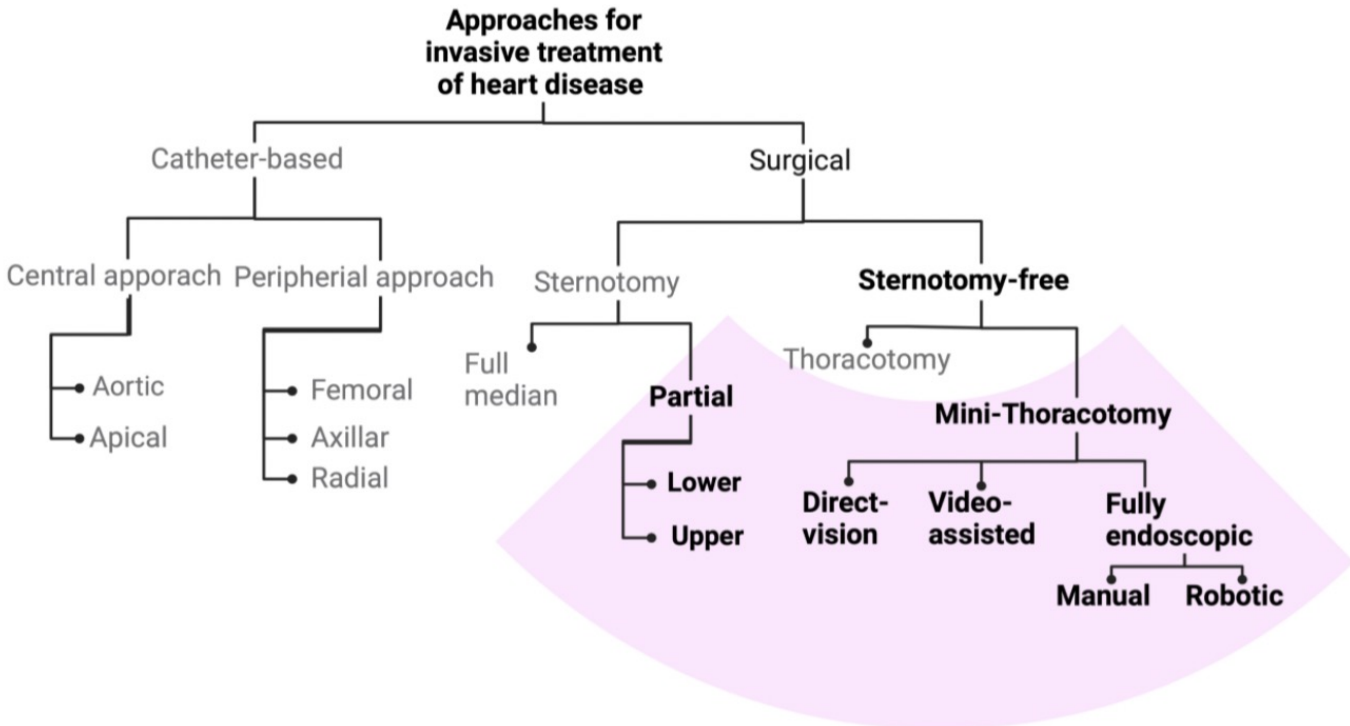
Focus on Mini thoracotomy



Faerber et al,J Cardiovasc Dev. Dis. 2023; 10:380

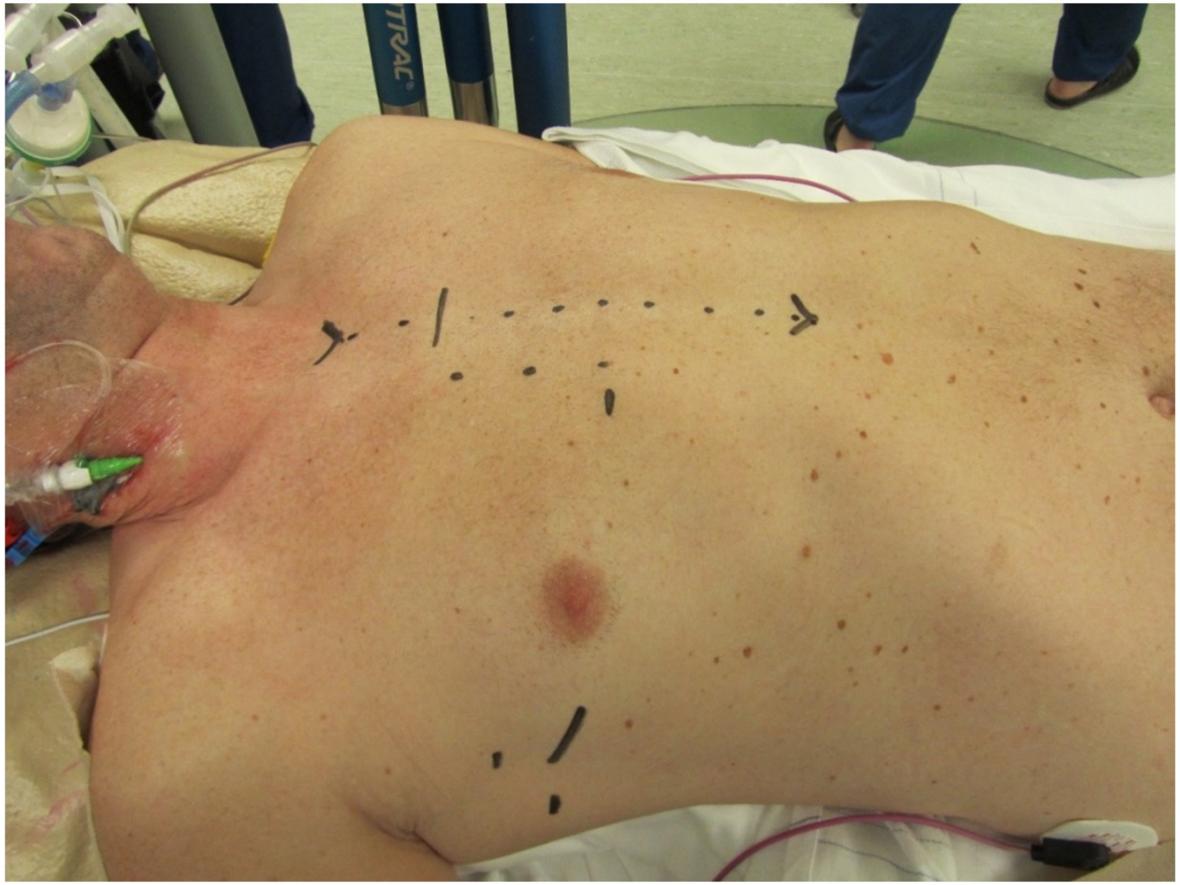
Approaches for invasive treatment of heart disease



Faerber et al,J Cardiovasc Dev. Dis. 2023; 10:380

Planning is crucial

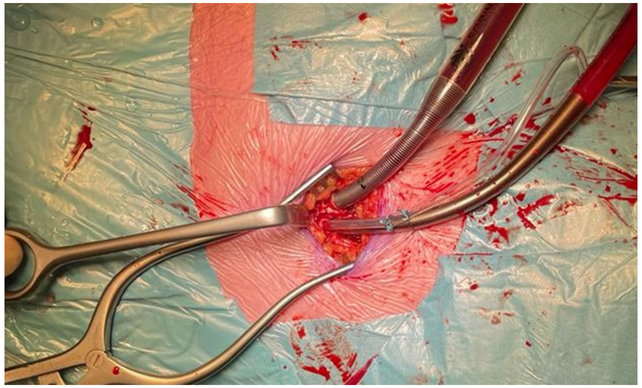
Not all patients are ideal for the minimally invasive access



J. Clin. Med. 2022, 11, 5993. https://doi.org/10.3390/jcm11205993

Limitations of minimally invasive surgery

- Potentially higher stroke rate
- Groin complications after cannulation
- Aortic dissection
- Longer CPB time
- Aortic occlusion
- Demanding technique with longer learning curve
- Limited concomittant surgery
- Some limitation in patient selection



J. Clin. Med. 2022, 11, 5993. https://doi.org/10.3390/jcm11205993

European Journal of Cardio-Thoracic Surgery 2023, 64(4), ezad336
https://doi.org/10.1093/ejcts/ezad336 Advance Access publication 9 October 2023

ORIGINAL ARTICLE

Cite this article as: Cresce GD, Berretta P, Fiore A, Wilbring M, Gerdisch M, Pitsis A *et al.* Neurological outcomes in minimally invasive mitral valve surgery: risk factors analysis from the Mini-Mitral International Registry. Eur J Cardiothorac Surg 2023; doi:10.1093/ejcts/ezad336.

Neurological outcomes in minimally invasive mitral valve surgery: risk factors analysis from the Mini-Mitral International Registry

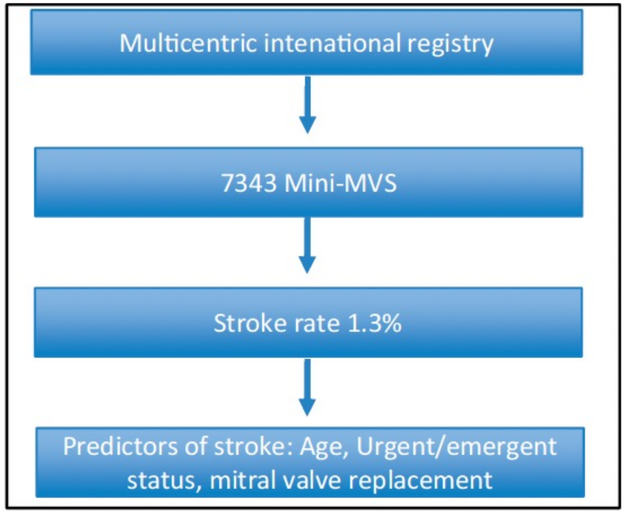
Giovanni Domenico Cresce[a,*], Paolo Berretta[b], Antonio Fiore[c], Manuel Wilbring[d], Marc Gerdisch[e], Antonios Pitsis[f], Mauro Rinaldi[g], Nikolaos Bonaros[h], Jorg Kempfert[i], Tristan Yan[j], Frank Van Praet[k], Hoang Dinh Nguyen[l], Carlo Savini[m], Joseph Lamelas[n], Tom C. Nguyen[o], Pierluigi Stefano[p], Gloria Färber[q], Loris Salvador[a] and Marco Di Eusanio[b]

Actually stroke rate is not high

Neurological outcomes in minimally invasive mitral valve surgery: risk factors analysis from the Mini Mitral International Registry (Mini-Mitral-IR)

Summary

A total of 7343 patients undergoing minimally invasive mitral valve surgery from 17 Heart Valve Centers were enrolled.
Stroke rate was 1.3%. Age, urgent/emergent status and mitral valve replacement emerged as independent predictors of stroke
Preoperative CT-scan affected surgical cannulation strategy and did not led to improved neurological outcomes.



Legend: Mini-MVS = minimally invasive mitral valve surgery

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Concomittant procedures

European Journal of Cardio-Thoracic Surgery 2022, 62(3), ezac167
https://doi.org/10.1093/ejcts/ezac167 Advance Access publication 29 March 2022

ORIGINAL ARTICLE

Cite this article as: Paparella D, Margari V, Santarpino G, Moscarelli M, Guida P, Fattouch K *et al.* Comparison of a full sternotomy with a minimally invasive approach for concomitant mitral and tricuspid valve surgery. Eur J Cardiothorac Surg 2022; doi:10.1093/ejcts/ezac167.

Comparison of a full sternotomy with a minimally invasive approach for concomitant mitral and tricuspid valve surgery

Domenico Paparella [a,b,*], Vito Margari [a], Giuseppe Santarpino[c], Marco Moscarelli [c], Pietro Guida[d], Khalil Fattouch [e], Alberto Albertini [f], Luigi Martinelli[g], Elisa Mikus[f], Renato Gregorini[h] and Giuseppe Speziale[c]

Key question

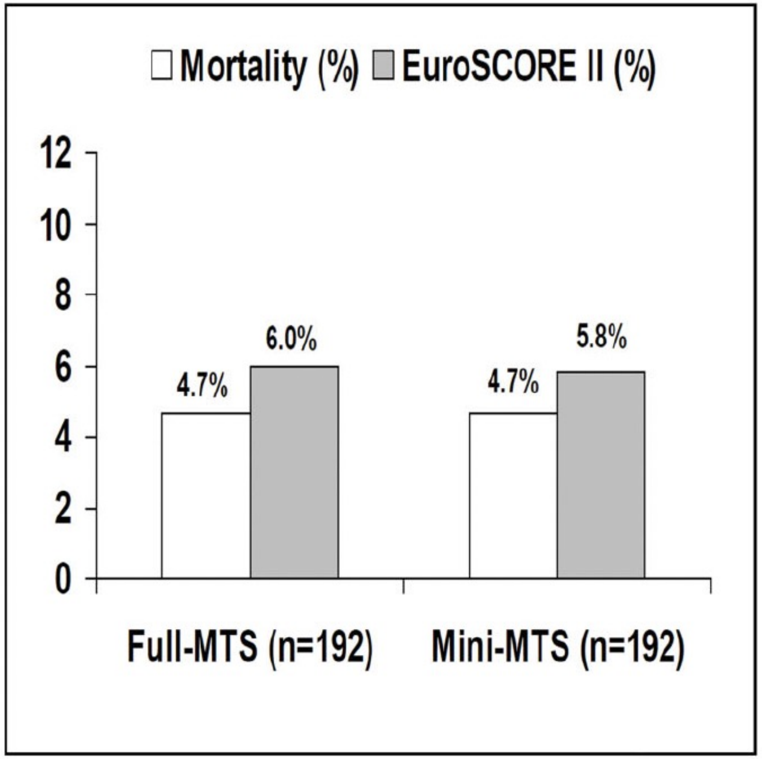
Does minimally invasive approach for combined mitral and tricuspid surgery increasesurgical risk?

Key finding(s)

Minimally invasive approach in combined mitral and tricuspid surgery offers short-term results comparable to traditional full sternotomy surgery

Take-home message

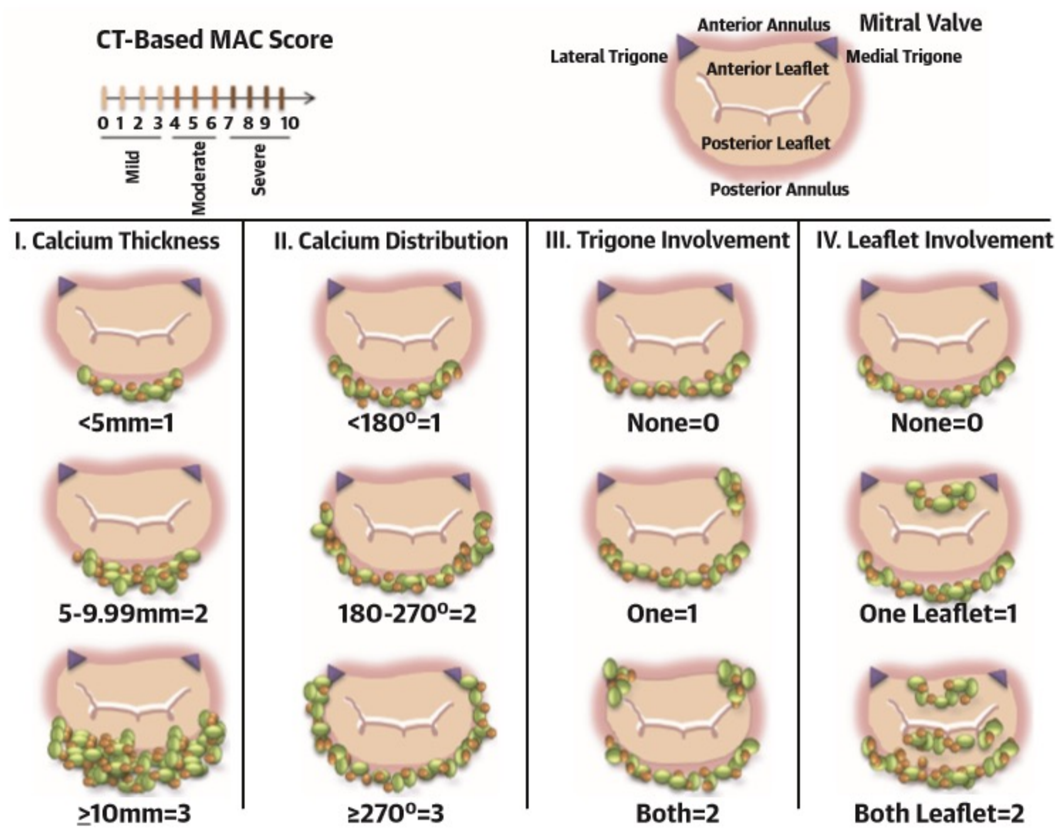
Both surgical accesses seem to be equally efficacious on the short term. Minimally invasive approach does not increase surgical risk.



Other may be problematic concomittant procedures

- CABG (in thoracotomy)
- AVR
- AF ablation

MAC may be a problem in minimally invasive approach, though TMVI may be good



Calcium thickness	Calcium distribution	Trigone involvement	Leaflet involvement

Guerro et al, JACC Imaging , 2020;13(9) :1945-57

Relative contraindications for minimally access

Significant Aortic, Iliac, or Femoral Disease That Prevents Safe Retrograde Arterial Perfusion
Left ventricular ejection fraction < 25%
Severe right ventricular dysfunction
Pulmonary artery pressure > 70 mmHg
Aorta > 4 cm if endo-aortic balloon being used
Significant mitral annular calcification
Patients with more than mild aortic regurgitation
Kyphoscoliosis and pectus excavatum
Morbidly obese and extremely muscular patients
Previous right thoracotomy or expected adhesions in the right chest
Advanced renal- or liver disease, significant pulmonary disease

Table derived from Ailawadi et al. 2016 [33].

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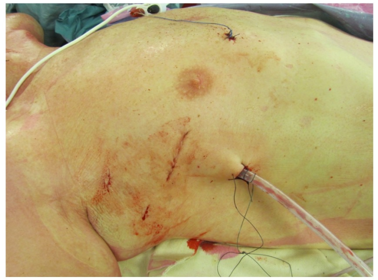
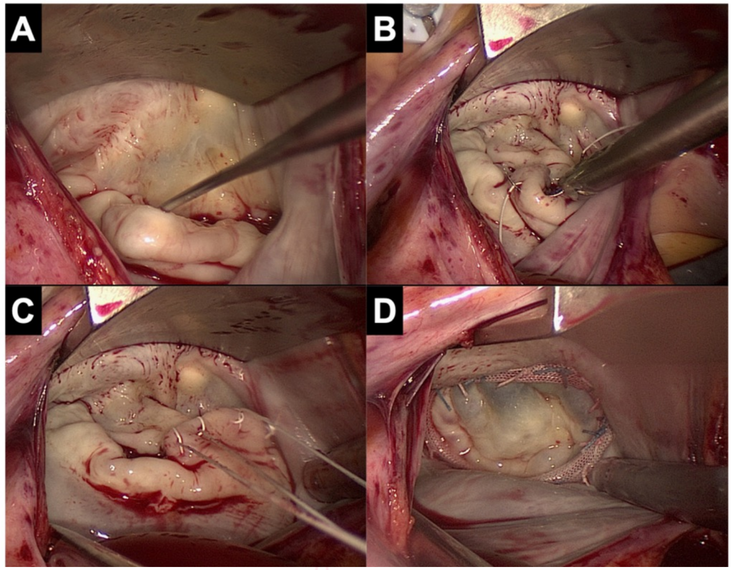
Benefits of mini invasive access



- Better view of the mitral
- Faster recovery?
- Decreased bleeding and blood product tra
- Less atrial fibrillation
- Less sternal wound infection
- Less scar dissatisfaction
- Reduced ventilation time
- Better in redo-mitral



J. Clin. Med. 2022, 11, 5993. https://doi.org/10.3390/jcm11205993

RMT-randomized trials

Author	Journal/ Year	Valve	Comparison	Number of Randomized Observations	Result	Mortality
Rodríguez-Caulo et al. [28]	STCVS 2021	Aortic	Sternotomy vs. MICS	100	Better QOL at 1 year in MIC arm	No difference
Vukovic et al. [29]	JCS 2019	Aortic	Sternotomy vs. MICS	100	Lower hospital stay in MICS arm	No difference
Hancock et al. [30]	BMJ 2021	Aortic	Sternotomy vs. MICS	270	Equal transfusions rate	No difference
Dalen et al. [27]	ICVTS 2018	Aortic	Sternotomy vs. MICS	40	Higher postoperative TAPSE in MICS arm	No difference
Feldman et al. [31]	NEJM 2011	Mitral	Sternotomy vs. MitraClip	279	Less re-do surgeries and residual MR in surgical arm	No difference
Nasso et al. [22]	Cardiology 2014	Mitral	Sternotomy vs. MICS	160	Longer operative, bypass and cross-clamp times, but shorter ventilation, ICU and in-hospital stay in MICS arm	No difference
Akowuah et al. [23]	2023	Mitral	Sternotomy vs. MICS	330	No difference in QOL in 3 months	Lower in MICS

Faerber et al,J Cardiovasc Dev. Dis. 2023; 10:380

Research

JAMA | Original Investigation

Minithoracotomy vs Conventional Sternotomy for Mitral Valve Repair
A Randomized Clinical Trial

Enoch F. Akowuah, MD; Rebecca H. Maier, MSc; Helen C. Hancock, PhD; Ehsan Kharatikoopaei, PhD;
Luke Vale, PhD; Cristina Fernandez-Garcia, PhD; Emmanuel Ogundimu, PhD; Janelle Wagnild, PhD;
Ayesha Mathias, BSc; Zoe Walmsley, MSc; Nicola Howe, PhD; Adetayo Kasim, PhD; Richard Graham, MBChB;
Gavin J. Murphy, MD; Joseph Zacharias, MD; for the UK Mini Mitral Trial Investigators

JAMA. 2023;329(22):1957-1966. doi:10.1001/jama.2023.7800

- Minithoracotomy is not superior to sternotomy in recovery
- Minithoracotomy achieves high quality of valve repair and has similar safety outcomes at one year to sternotomy

Key Points

Question Is m… improving physical function at 12 weeks than conventional sternotomy mitral valve repair for degenerative mitral regurgitation?

Findings In this randomized clinical trial involving 330 patients, minimally invasive repair was not superior to sternotomy as determined by recovery of physical function at 12 weeks. Both techniques achieved high-quality and durable valve repair at 1 year with similar postoperative complications.

Meaning Minimally invasive mitral valve repair does not improve physical function at 12 weeks compared with sternotomy, but outcomes at 1 year show minimally invasive repair is as safe and effective as sternotomy for degenerative mitral regurgitation. These findings can inform shared decision-making and treatment guidelines.

Figure 1. Patient Selection, Allocation, and Flow in the UK Mini Mitral Trial

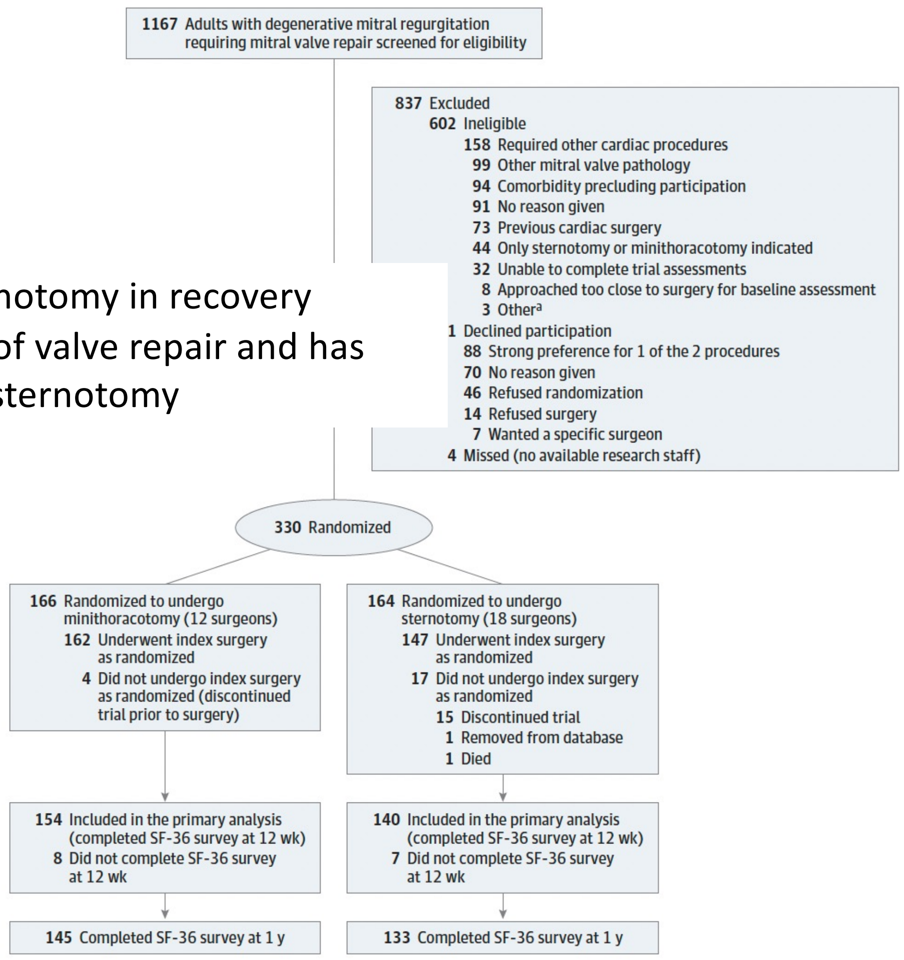


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Table 2. The potential of minimally invasive approaches to provide advantages for the conduct of classic cardiac surgery.

Surgical Scenarios in Which Minimally Invasive Approaches Have Provided Advantages for the Conduct of Classic Cardiac Surgery through Sternotomy (Modified from Doenst and Lamelas [21])
Tricuspid valve: surgery without sternotomy, as a redo without pericardial dissection, with or without cross-clamping
Mitral valve: surgery without sternotomy, as a redo (specifically with patent mammary) with or without pericardial dissection, with or without cross-clamping, beating heart/fibrillating heart.
Redo cases with previous sternal wound infection (specifically those with loss of sternal bone)
Cases with morbid obesity
Frail patients with or without significant osteoporosis
Patients with large breast implants

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Review Article

Outcomes of minimally invasive versus conventional sternotomy for redo mitral valve surgery according to Mitral Valve Academic Research Consortium: A systematic review and meta-analysis

Dudy Arman Hanafy*, Stefanie Melisa, Galih Asa Andrianto, Widya Trianita Suwatri, Sugisman

Division of Thoracic, Cardiac, and Vascular Surgery, University of Indonesia, Harapan Kita National Heart Center, Jakarta, Indonesia

Study or Subgroup	MINI Events	MINI Total	STER Events	STER Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Burfeind 2002	1	60	8	155	6.9%	0.31 [0.04, 2.55]	2002
Hiraoka 2013	0	10	2	27	3.1%	0.49 [0.02, 11.00]	2013
Vallabhajosyula 2015	0	67	3	220	3.4%	0.46 [0.02, 9.02]	2015
Ghoneim 2016	1	12	1	6	3.5%	0.45 [0.02, 8.83]	2016
Losenno 2016	1	40	6	92	6.6%	0.37 [0.04, 3.16]	2016
Patel 2019	2	90	2	90	7.8%	1.00 [0.14, 7.26]	2019
Zhang 2020	1	30	4	50	6.1%	0.40 [0.04, 3.73]	2020
Kwon 2022	12	168	22	218	56.6%	0.69 [0.33, 1.43]	2022
Monsefi 2022	1	27	4	26	6.0%	0.21 [0.02, 2.03]	2022
Total (95% CI)		**504**		**884**	**100.0%**	**0.56 [0.32, 0.97]**	
Total events	19		52				

Heterogeneity: Tau² = 0.00; Chi² = 1.93, df = 8 (P = 0.98); I² = 0%
Test for overall effect: Z = 2.08 (P = 0.04)

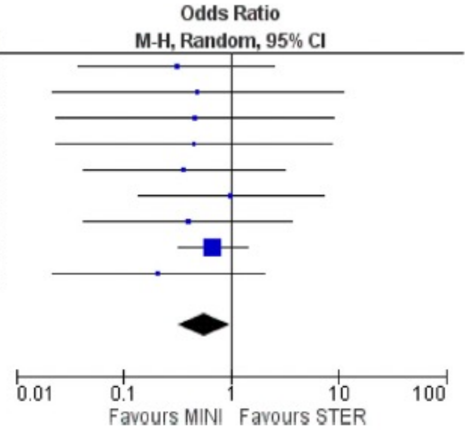

Fig. 3. Forest plot for reintervention for bleeding between MINI vs STER group.

Study or Subgroup	MINI Events	MINI Total	STER Events	STER Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Ghoneim 2016	4	12	1	6	5.0%	2.50 [0.21, 29.25]	2016
Losenno 2016	1	40	12	92	6.8%	0.17 [0.02, 1.36]	2016
Zhang 2020	12	30	22	50	23.1%	0.85 [0.34, 2.13]	2020
Hamandi 2021	22	88	21	88	31.2%	1.06 [0.53, 2.12]	2021
Monsefi 2022	0	27	1	26	3.0%	0.31 [0.01, 7.94]	2022
Olsthoorn 2022	17	80	33	80	30.9%	0.38 [0.19, 0.77]	2022
Total (95% CI)		**277**		**342**	**100.0%**	**0.65 [0.37, 1.17]**	
Total events	56		90				

Heterogeneity: Tau² = 0.15; Chi² = 7.44, df = 5 (P = 0.19); I² = 33%
Test for overall effect: Z = 1.44 (P = 0.15)

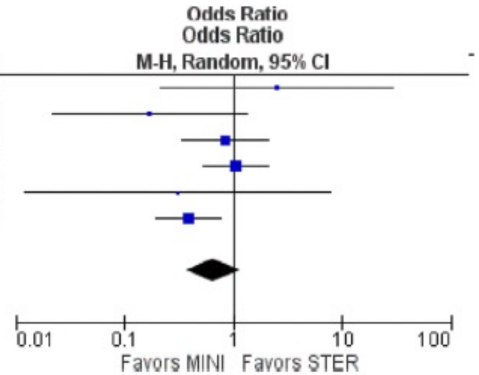

Fig. 4. Forest plot for acute renal failure between MINI vs STER group.

This systematic review and meta-analysis showed good and comparable outcomes of a minimally invasive approach compared to median sternotomy for redo mitral valve surgery. A minimally invasive approach through right mini-thoracotomy showed more favorable outcomes regarding in-hospital mortality, reintervention for bleeding, and acute r
mitral valve surgery, a ri
to median sternotomy.

- Comparable outcomes to sternotomy
- Minimally invasive approach is more favourable regarding in-hospital mortality, re-intervention for bleeding and acute renal failure

Summary

- Minimally invasive access is here to stay
- There are many levels of minimally invasiveness
- Patient selection and planning is crucial
- Limitations has to be respected
- Results in minimally invasive mitral surgery are as good as with sternotomy
- For redo mitral surgery minithoracotomy may be better than sternotomy
- Further development to endoscopic and robotic techniques are promising

CENTRAL ILLUSTRATION Assessing the Impact of Transcatheter Edge-to-Edge Mitral Valve Repair on Surgical Mitral Valve Repair Volume and Outcomes

Surgical Mitral Valve Repair (MVr):	Comparator:	Results: Surgery After First Transcatheter Edge to Edge Repair (TEER)
n = 13,959 for Degenerative Mitral Regurgitation (DMR) from the Society of Thoracic Surgeons (STS) registry with Centers for Medicare and Medicaid Services (CMS) linkage for long-term outcomes	Surgery performed before vs after date of institution's first transcatheter mitral valve repair	• No significant change in annual MVr volume • Downtrend in higher-risk MVr • Improved risk adjusted 30-day mortality • Improved risk adjusted 5-year mortality