

The impact of era and technical improvements in a high volume program of minimally invasive mitral valve surgery

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Background

Minimally invasive mitral valve surgery (MIMVS) has evolved over the last 2 decades

Improved clinical results overtime due to
- Increased experience
- Technical developments

Key factors of development
- Remote access perfusion
- Cardioplegic solutions
- 3D-Endoscopy
- Chordal replacement techniques

Aim

The aim of the study was to identify the impact of era and technical improvements on perioperative outcome after minimally invasive mitral valve surgery (MIMVS).

Methods

We retrospectively investigated 1000 patients (mean age: 60.8±12.7y, 60.3% male) who underwent minimally invasive or endoscopic mitral valve surgery between 2001-2020 in a single institution. The patients were allocated to 4 groups according to the case number quartiles. Periprocedural success, safety and operative times were identified as outcome parameters. Operative success was defined as: Successful primary mitral repair without conversion to replacement, or larger thoracic incisions, no residual MR>mild at intraoperative TEE, and no need for reoperation within 30d. The definition of safety included: freedom from perioperative (30d) death, myocardial infarction, stroke, use of ECMO or reoperation for bleeding. Three technical interventions were introduced during the observed period of 19 years: (1) the introduction of a fully endoscopic technique through 3D visualization, (2) the adoption of pre-measured loops of neochordae for prolapse correction and (3) the implementation of a preoperative CT scan to exclude unsuitable candidates for MIMVS. Comparisons were made between the 4 quartiles and before and after the introduction of technical improvements by chi-square test and one-way ANOVA.

MIMVS cases	1000
Isolated first mitral valve procedure	741
Concomitant procedures	259
Tricuspid valve repair	208
LA-Ablation	145
PFO/ASD-closure	172

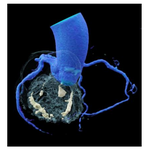
Etiology of Mitral regurgitation	Total	Repair	Replacement
Degenerative	738 (73,8%)	701 (95%)	37 (5%)
Functional of them atrial type	101 (10,1%) 68	98 (97%) 67	3 (3%) 1
Other (mainly rheumatic)	161	97 (60,2%)	64 (39,8%)
Total	1000	896 (89,6%)	104 (10,4%)

Methods (continued)

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(1) fully endoscopic technique through 3D visualization,
(2) the adoption of pre-measured loops of neochordae for prolapse correction
(3) the implementation of a preoperative CT scan to exclude unsuitable candidates for MIMVS

Comparisons were made between the 4 quartiles and before and after the introduction of technical improvements by chi-square test and one-way ANOVA.





Results

Perioperative survival, periprocedural success and safety were 99.1%, 93.5% and 96.3% respectively.

There was a significant improvement in the combined periprocedural safety endpoint within the different eras mainly attributed to the lower need for ECMO support (p=0.036) and less reoperations for bleeding (p=0.007). On the other hand, the influence of era according to the different quartiles on periprocedural success was not statistically significant (p=0.590).

	Conversion to sternotomy	Conversion to mitral replacement	Rethoracotomy for bleeding	Reoperation <30d	Myocardial infarction	Stroke	ECMO	Mortality
Q1	8 (3.2%)	2 (0.8%)	6 (2.4%)	2 (0.8%)	1 (0,4%)	0 (0%)	0 (0%)	2 (0.8%)
Q2	6 (2.4%)	6 (2.4%)	15 (6%)	4 (1.6%)	2 (0.8%)	2 (0.8%)	4 (1.6%)	4 (1.6%)
Q3	9 (3.6%)	4 (1.6%)	15 (6%)	2 (0.8%)	1 (0.4%)	1 (0.4%)	9 (3.6%)	3 (1.2%)
Q4	5 (2%)	2 (0.8%)	3 (1.2%)	1 (0.4%)	1 (0.4%)	0 (0%)	5 (2%)	0 (0%)
Total	28 (2.8%)	14 (1.4%)	39 (3.9%)	9 (0.9%)	5 (0.5%)	3 (0.3%)	18 (1.8%)	9 (0.9%)

Results (continued)

3D visualization
- improved periprocedural success but not on safety
- improved X-clamp- but not CPB-times

Use of loops
- No impact on periprocedural success or safety
- Improved CPB and X-clamp-times

Preop CT scan
- No impact on periprocedural success or safety
- Improved CPB and X-clamp times

	Before	After	p
3D Success	493/530 (92.5%)	353/367 (96.2%)	**0.044**
Safety	495/530 (93.4%)	346/367 (94.3%)	0.592
Loops Success	212/224 (94.6%)	293/303 (96.7%)	0.243
Safety	209/224 (93.3%)	286/303 (94.4%)	0.606
CT scan Success	657/701 (93.7%)	190/198 (96.0%)	0.234
Safety	653/701 (93.2%)	190/198 (96.0%)	0.149
3D CBP	202.3±64.8	198.0±55.5	0.284
X-Clamp	114.5±36.9	107.0±29.6	**0.001**
Loops CBP	210.5±58.7	198.3±55.7	**0.016**
X-Clamp	118.5±33.1	109.1±30.2	**0.001**
CT scan CBP	204.7±62.3	186.2±55.0	**<0.001**
X-Clamp	114.6±34.9	100.1±29.7	**<0.001**

Conclusions

Increased surgical experience improves safety in MIMVS
Technical additions which can improve outcome
- Use of 3D endoscopy
- Use of loops for chordae repair
- Use of preoperative CT scan

Technical improvements are related to increased operative success and decreased operative times in patients undergoing MIMVS