Surgical Technique on Cardiac Surgery

Concomitant procedures using minimally access

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Abstract: Alongside the mitral repair or replacement, a considerable number of concomitant procedures can be performed with the minimally invasive mitral valve surgical approach. Some of these concomitant procedures comprise the tricuspid valve repair or replacement, left atrial appendage (LAA) exclusion, Interatrial septum defects correction and atrial fibrillation (AF) ablation.

Keywords: Minimally access mitral surgery; concomitant procedures

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Introduction

With the minimally invasive mitral valve surgical access, a considerable number of concomitant procedures can be performed in the same operation. We can divide the concomitant procedures by the anatomical location (left atrium, right atrium and interatrial septum) or by the type of procedure (structural and rhythm intervention). For current practice the anatomical classification is better because it will influence the cannulation setup for the entire surgery. Judicious echocardiographic information must be previously gathered to plan the best surgical approach. The concomitant procedures and cannulation setup are listed in *Table 1*.

Left atrium concomitant procedures

When only the left atrium approach is needed the for the surgery, standard femoral artery and vein cannulation will suffice for adequate exposure of the entire left atrium (*Figure 1*). After aortic cross clamping, cardiac arrest and left atriotomy, if the patient has a patent foramen ovale (PFO) or a small ostium secundum atrial septal defect (ASD), these interatrial communications should be corrected first (*Figure 2A*). Surgical approach and correction of these interatrial defects can easily be performed through the left atrium using a stay stitch for traction in the Waterston's groove before placing the left atrium retractor (*Figure 2B*).

With the left atrium retractor in position, the mitral valve and the surrounding anatomical structures can be identified and accessed (*Figure 3A*). Concomitant left atrial appendage (LAA) management should always be addressed to reduce thromboembolic events (1). Usually the LAA opening is 1 to 2 cm lateral to the P1–A1 section of the mitral annulus and has a trabecular inner interior wall distinctive from the contiguous smooth left atrial wall. Special care must be observed to avoid mistaking the LAA opening with one of the left pulmonary veins because the accidental oversewing of one of the left pulmonary veins is a serious error.

After clear identification of the LAA opening, direct oversewing can be performed, usually with double running suture to ensure proper closure (*Figure 3B*). Complete LAA closure from inside the heart is very important because an incompletely ligated LAA may lead to increased thromboembolic events (2). Some surgeons chose to close the LAA from the outside using a thoracoscopic LAA clip device through the transverse sinus (3).

With the left atrium access, atrial fibrillation (AF) ablation can and should be addressed as a concomitant procedure according to the current guidelines (4,5). Most surgeons limit this ablation procedure to the left lesion set instead of the bi-atrial Cox Maze lesion set because of a higher post-maze permanent pacemaker described after the right lesion set, although this complication is poorly demonstrated in the literature.

Left atrium AF lesion set is easily performed within the left atrium without opening the right atrium (6). The most popular lesion energy for this approach is the cryothermy energy. With cryoablation, all the left lesions lines can be performed and must include a line to the mitral valve

Table 1 List of concomitant procedures and suggested cannulation setup

Anatomical location	Concomitant procedure	Cannulation setup
Left atrium	LAA closure	Standard venous cannulation
	AF ablation (LA lesion set)	Standard venous cannulation
Right atrium	Tricuspid repair/replacement	Bi-caval cannulation
	AF ablation (RA lesion set)	Bi-caval cannulation
Interatrial septum	Small ASD or PFO closure	Standard venous cannulation (LA access)
	Large ASD closure	Bi-caval cannulation (RA access)

LAA, left atrial appendage; AF, atrial fibrillation; LA, left atrium; RA, right atrium; ASD, atrial septal defect; PFO, patent foramen ovale.

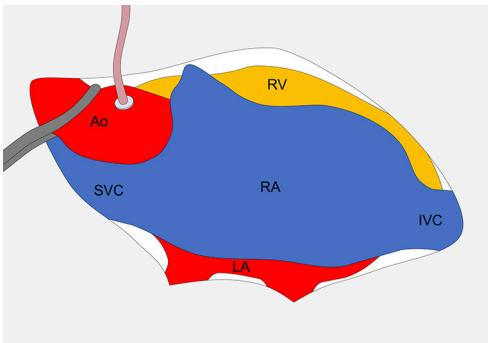

Figure 1 Minimally invasive right thoracotomy mitral valve surgical access. Ao, aorta; RV, right ventricle; RA, right atrium; LA, left atrium; SVC, superior vena cava; IVC, inferior vena cava.

annulus across the mitral isthmus (*Figure 4A*), a line to the base of the LAA (*Figure 4B*) and a line to complete the isolating box of the pulmonary veins (*Figure 4C*). Depending on the size and anatomy of the left atrium, with 3 to 5 cryoablation lesion lines all the left Cox Maze lesion set can be accomplished (*Figure 4D*). Bloodless field near the cryoablation probe during freeze phase is very important to achieve good transmural lesions and improved results. Special care should be observed when applying the freezing lesions to avoid proximity and injury to the phrenic nerve.

After correcting existing PFO or ASD, LAA closing and eventual AF ablation, the mitral valve can finally be inspected and treated whenever possible with a mitral repair.

Right atrium concomitant procedures

When right atrium approach is also needed the for the surgery, additionally to the standard femoral artery cannulation, the venous cannulation must accomplish isolated bi-caval drainage for bloodless surgical field within the right atrium as described previously in the topic "Cannulation techniques and the Vienna way".

Usually the right atrium is opened after completing the left atrium procedures and closing the left atrium. A parallel to the septum right atriotomy is the most common incision although some surgeons prefer the oblique incision from the right atrial appendage to the inferior vena cava.

To expose the right atrium, the same left atrium retractor can be used, preferably with a wider and shorter blade for optimal exposure. The tricuspid valve and the coronary sinus opening can easily be identified (*Figure 5*).

If a large ASD is present (*Figure 6A*) and couldn't be closed from the left atrium, this defect can be corrected with direct oversewing or with a patch (*Figure 6B*).

Right atrium AF ablation can also be performed as a concomitant procedure and the lesions set can easily be achieved within the right atrium with cryoablation (4,5). The right atrium lesions lines must include a tricuspid line between the right atriotomy and the tricuspid annulus (*Figure 7A*), a line to the superior and inferior vena cava (*Figure 7B,C*) and a line to the right atrial appendage (*Figure 7D*) (6). With 4 to 5 cryoablation lesion lines all the right Cox Maze lesion set can be accomplished (*Figure 7E*). Again, a bloodless field is very important for better results and special care should be observed when applying the freezing lesions to avoid injury to the sinus node and the phrenic nerve.

After correcting any ASD and eventual AF ablation, the tricuspid valve can finally be inspected and treated according to indication whenever possible with a tricuspid ring repair (*Figure 8*).

Conclusions

When considering the minimally invasive mitral valve surgery, careful planning is paramount to decide what

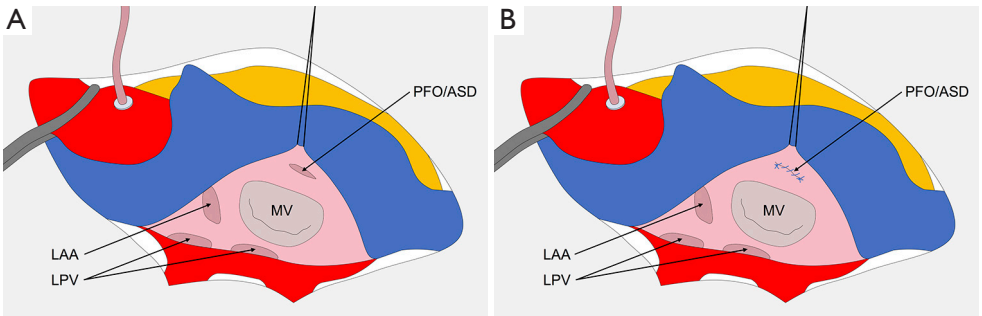

Figure 2 Left atrium exposure with a stay stitch in the Waterston's groove. (A) Left atriotomy Interatrial septum exposure with a stay stitch for traction in the Waterston's groove; (B) direct oversewing of a patent foramen ovale or a small atrial septal defect. MV, mitral valve; PFO, patent foramen ovale; ASD, atrial septal defect; LAA, left atrial appendage; LPV, left pulmonary veins.

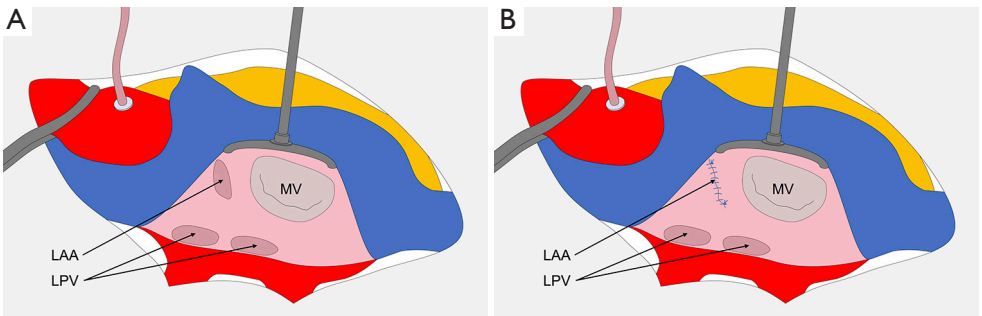

Figure 3 Left atrium exposure with the left atrium retractor. (A) Left atrium exposed with the atrium retractor in position; (B) left atrial appendage direct oversewing. MV, mitral valve; PFO, patent foramen ovale; ASD, atrial septal defect; LAA, left atrial appendage; LPV, left pulmonary veins.

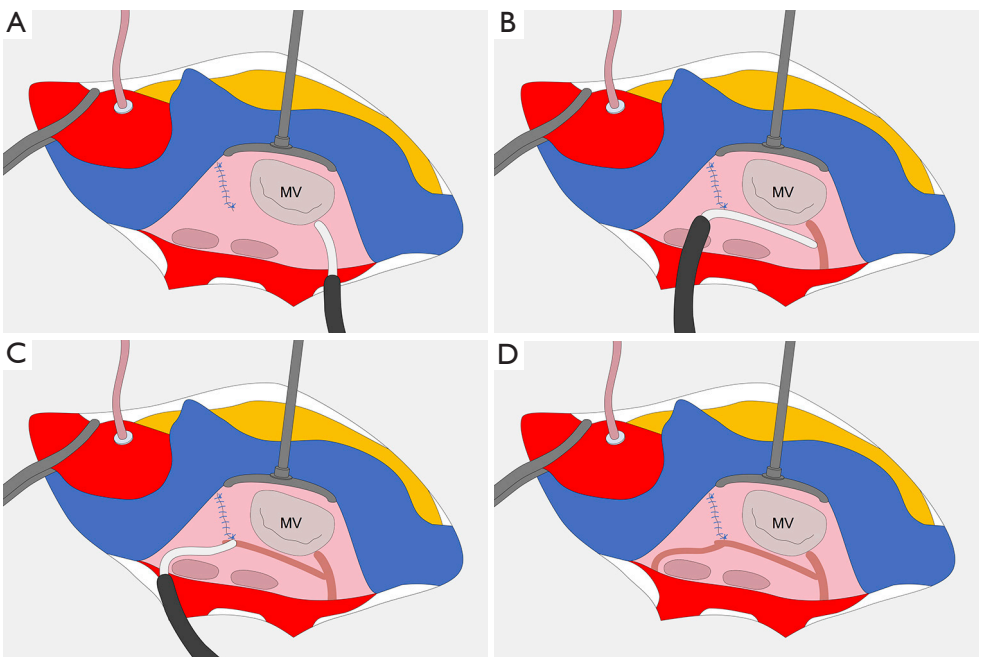

Figure 4 Exemplary atrial fibrillation left lesion set. (A) Cryoablation line to the mitral valve annulus across the mitral isthmus; (B) cryoablation pulmonary veins box line to the base of the left atrial appendage; (C) cryoablation last box line to complete the pulmonary veins box; (D) exemplary atrial fibrillation complete left lesion set. MV, mitral valve.

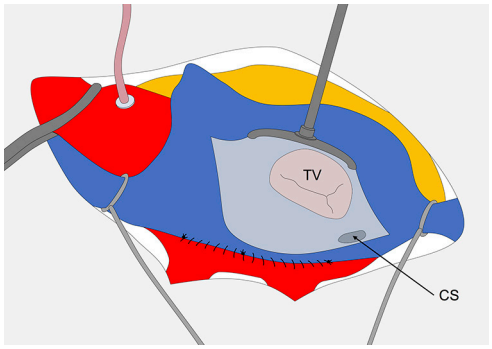

Figure 5 Right atrium exposed with of the atrium retractor in position. TV, tricuspid valve; CS, coronary sinus.

concomitant procedures should be added. Rule of thumb is that any interatrial septal defect and the LAA should be closed in every mitral valve surgery. AF ablation should be often considered and discussed with the patient and the cardiologist given the expanding indications for concomitant AF ablation. The tricuspid valve must also be carefully evaluated and addressed according to the current guidelines. Some surgeons consider securing the tricuspid annulus with a ring in patients with long standing mitral disease to lower the risk of later significant tricuspid regurgitation even in the setting of slightly enlarged tricuspid annulus or low pulmonary hypertension.

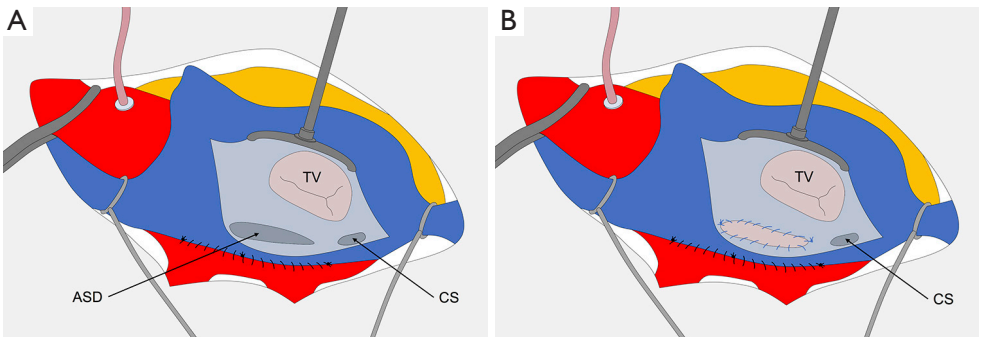

Figure 6 Right atrium exposure with an ostium secundum atrial septal defect. (A) Large ostium secundum atrial septal defect; (B) atrial septal defect correction with a patch. TV, tricuspid valve; CS, coronary sinus; ASD, atrial septal defect.

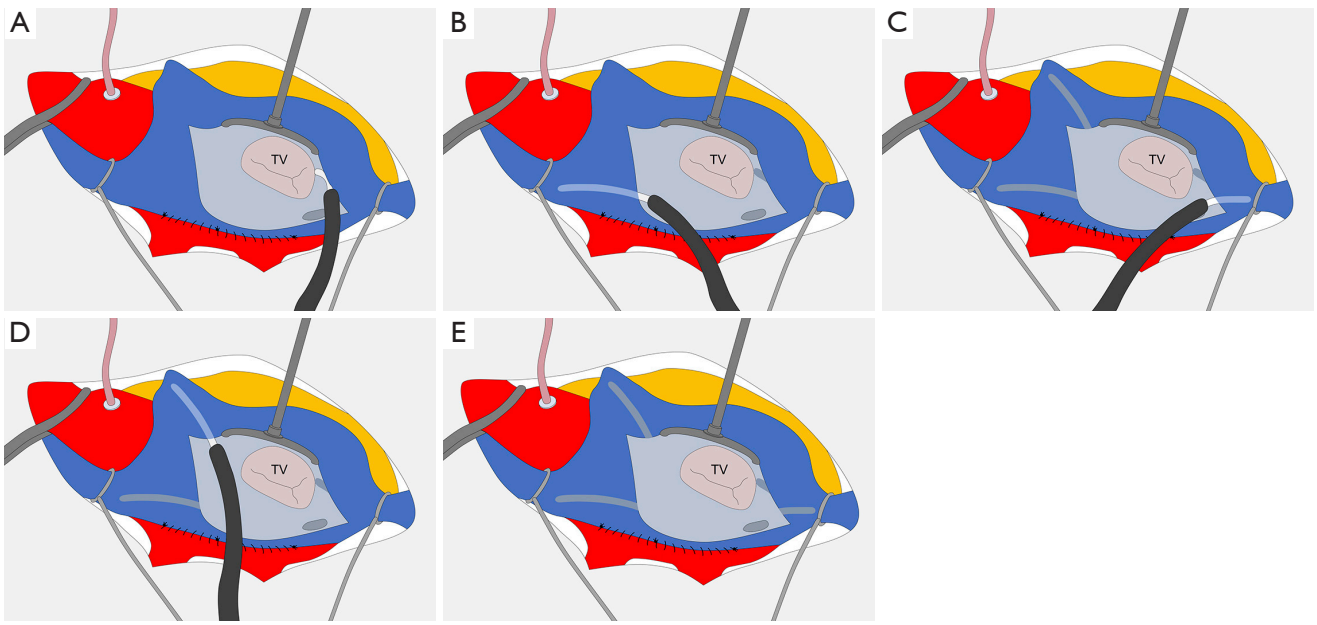

Figure 7 Exemplary atrial fibrillation right lesion set. (A) Cryoablation line to the tricuspid valve annulus; (B) cryoablation line to the superior vena cava; (C) cryoablation line to the inferior vena cava; (D) cryoablation line to the right atrial appendage; (E) exemplary atrial fibrillation complete right lesion set. TV, tricuspid valve.

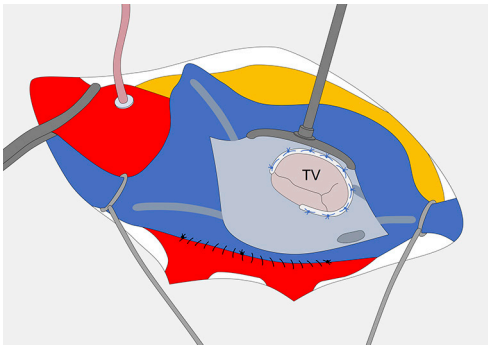

Figure 8 Tricuspid valve repair with a ring and atrial fibrillation cryoablation right atrium lesion set. TV, tricuspid valve.

Acknowledgements

None.

Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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References

1. Blackshear JL, Odell JA. Appendage obliteration to reduce stroke in cardiac surgical patients with atrial fibrillation. Ann Thorac Surg 1996;61:755-9.
2. Aryana A, Singh SK, Singh SM, et al. Association between incomplete surgical ligation of left atrial appendage and stroke and systemic embolization. Heart Rhythm 2015;12:1431-7.
3. Alqaqa A, Martin S, Hamdan A, et al. Concomitant left atrial appendage clipping during minimally invasive mitral valve surgery: technically feasible and safe. J Atr Fibrillation 2016;9:1407.
4. Kirchhof P, Benussi S, Kotecha D, et al. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. Eur J Cardiothorac Surg 2016;50:e1-e88.
5. Badhwar V, Rankin JS, Damiano RJ Jr, et al. The Society of Thoracic Surgeons 2017 Clinical Practice Guidelines for the Surgical Treatment of Atrial Fibrillation. Ann Thorac Surg 2017;103:329-41.
6. Lee AM. Maze permutations during minimally invasive mitral valve surgery. Ann Cardiothorac Surg 2015;4:463-8.

