

# Conversion rate and contraindications for minimally invasive mitral valve surgery

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## Introduction

Over the past 15 years, minimally invasive mitral valve surgery via right lateral minithoracotomy has become the preferred method for mitral valve repair and mitral valve replacement in specialized centers worldwide. This technique refers to specific operation and visualization technologies and new perfusion methods. The minimally invasive approach affords faster patient recovery, less pain, shorter hospital stay and improved cosmesis. Moreover, minimally invasive mitral valve surgery may be an alternative to conventional mitral valve surgery, given that there is comparable short- and long-term mortality and comparable in-hospital morbidity. However, several studies have shown an increased risk of stroke, aortic dissection, groin infections, prolonged cross-clamp time and cardiopulmonary bypass time (1). Owing to severe intraoperative difficulties, conversion to full sternotomy is also a serious complication.

At our institution, we have a very extensive experience with minimally-invasive mitral valve surgery, dating back to the late 1990s (2). We therefore aim to review the reasons and the early postoperative outcomes for those patients who underwent conversion to full sternotomy. Furthermore, we outline the contraindications for minimally-invasive mitral valve surgery.

## Safeguards and pitfalls

Amongst the 3,125 patients who received minimally invasive mitral valve surgery at our center, 34 patients (1%) underwent conversion to full sternotomy. Previous cardiac operations had been performed in three patients (8.8%). The primary indication in the majority of patients was mitral regurgitation. In all 34 patients, surgery was performed using a transthoracic aortic cross-clamp (Chitwood clamp). Concomitant procedures consisted of tricuspid valve repair, atrial fibrillation ablation and patent foramen ovale defect closure.

The main reason for conversion was major bleeding in 18 patients (52.9%). After conversion, bleeding could be identified on the left atrial appendage in five patients (14.7%), the left ventricular apex in four patients (11.7%) and the ascending aorta in four patients (11.7%). The remaining five patients (14.7%) showed a distinct coagulopathy. Other reasons for conversion were severe pulmonary adhesions in six patients (17.6%) and aortic dissection type A in five patients (14.7%).

In all converted cases, the operative course was significantly prolonged. The average operating time was  $366.6 \pm 152.7$  min. The mean duration of cardiopulmonary bypass was  $251.3 \pm 136.1$  min. The postoperative course included low cardiac output syndrome in nine patients (26.5%), with the need for intra-aortic balloon pump (IABP) and extracorporeal membrane oxygenation (ECMO) support in three patients (8.8%). Postoperative renal failure was observed in 13 patients (38.2%). Respiratory failure occurred in ten patients (29.4%). Stroke occurred in four patients (11.8%). Overall, four patients (11.8%) sustained multi-organ failure. In seven patients (20.6%), septicemia prolonged the postoperative course. The 30-day mortality was 23.5%.

Occasionally, conversion to a full sternotomy is required during minimally-invasive mitral valve surgery for reasons that have not yet been well investigated or reported. In our series, the incidence of converting to full sternotomy was 1%, in contrast to previously reported studies where the conversion rate was between 2.4% and 2.6% (3).

## Bleeding

Fatal bleeding was the most common indication for conversion. Based on the dissimilar localizations and reasons for bleeding, we would herein recommend some technical safeguards to avoid such severe surgical complications.

In most patients, the aortic cross-clamp (Chitwood clamp)

injured the left atrial appendage and the ascending aorta. We therefore recommend that the Chitwood clamp should be placed very safely and under visual examination of the ascending aorta and the left atrial appendage. If there is any difficulty in placing the clamp, the placement should be aborted or deferred until an elective and safe conversion to full sternotomy is performed. An alternative strategy is opting for hypothermic fibrillation as a means of myocardial protection. Several studies have shown the safety of hypothermic fibrillation in redo cases. Therefore it seems reasonable to extend its use to other clinical situations in minimally invasive mitral valve surgery where aortic clamping is judged unsafe.

We do not advise the use of an endoaortic balloon occlusion technique. This technique significantly increases the cross-clamp and bypass time and is associated with a higher incidence of peri-operative cerebrovascular events.

In five patients, the cannula of the water probe injured the left apex after mitral valve repair. This disastrous complication is absolutely avoidable. As a consequence, we would recommend that the water probe should be performed very carefully with a flexible silicone catheter and should not be repeated many times. To avoid distinct coagulopathy, the surgery should be performed very safely and under permanent visualization of the surgical field.

### Pulmonary adhesions

The presence of severe pulmonary adhesions was another common indication for conversion to full sternotomy. If the right lung adheres to the thorax, early sternotomy is the safest way for these patients. Attempting to detach the lung and the pleura from the thoracic wall is very dangerous and often ruins the lung. In patients with any thoracic cancer and a history of radiotherapy, a preoperative computed tomography scan is very helpful for detecting severe intrathoracic and pulmonary adhesions.

### Vascular problems

Acute aortic dissection is a rare but often lethal complication during cardiac surgery, with an incidence between 0.16% and 0.35%. A predisposition is reported to arise from severe atherosclerotic change, cystic medial necrosis, collagen vascular disease and a thin or dilated ascending aorta. In our patients, dissection was identified most frequently after removal of the aortic clamp, but also occurred through the needle vent. In all these cases, graft interposition in deep hypothermia was the treatment of choice after immediate sternotomy. Particular intraoperative care should be taken in older patients with a dilated atherosclerotic aorta and in patients with collagen vascular disease. The routine and continuous application of transesophageal echocardiogram might be helpful in identifying iatrogenic aortic dissection and better results might be expected if there can be early recognition and proper

treatment. In general, a diameter of the ascending aorta greater than 4 cm is a contraindication for minimally invasive mitral valve surgery with transthoracic clamping.

All our patients underwent cannulation of the femoral vessels for institution of cardiopulmonary bypass. Nevertheless, several studies suggested that retrograde flow has a higher incidence of stroke and should be avoided in patients with distinct atherosclerosis. In these patients and in patients with very tortuous iliac arteries and peripheral vascular disease, central arterial cannulation via the axillary artery is also safe and feasible.

### Conclusions

Our analysis revealed that conversion to full sternotomy leads to severe peri-operative morbidities and causes very high 30-day mortality, above 23% (4). In conclusion, conversion from right lateral thoracotomy to full sternotomy occurs infrequently during minimally invasive mitral valve surgery. It is a rare but fatal complication and should be avoided by all means. Identification of potential risk factors and contraindications for the minimally-invasive approach is essential to achieve excellent post-operative results.

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### References

1. Falk V, Cheng DC, Martin J, et al. Minimally invasive versus open mitral valve surgery: a consensus statement of the international society of minimally invasive coronary surgery (ISMICS) 2010. *Innovations (Phila)* 2011;6:66-76.
2. Seeburger J, Borger MA, Falk V, et al. Minimal invasive mitral valve repair for mitral regurgitation: results of 1339 consecutive patients. *Eur J Cardiothorac Surg* 2008;34:760-5.
3. Tabata M, Umakanthan R, Khalpey Z, et al. Conversion to full sternotomy during minimal-access cardiac surgery: reasons and results during a 9.5-year experience. *J Thorac Cardiovasc Surg* 2007;134:165-9.
4. Vollroth M, Seeburger J, Garbade J, et al. Minimally invasive mitral valve surgery is a very safe procedure with very low rates of conversion to full sternotomy. *Eur J Cardiothorac Surg* 2012;42:e13-5; discussion e16.

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