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Case Series

Feasibility of on-table extubation after minimally invasive cardiac surgeries: A case series

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ABSTRACT

Background: Minimally Invasive Cardiac Surgery (MICS), which involves less invasive approaches using smaller incisions, has various advantages. MICS had an even better outcome with on-table extubation, including early postoperative recovery and reduced postoperative complications.

Materials and Methods: The objective of our case series was to demonstrate early postoperative recovery and reduced postoperative complications after on-table extubation of MICS cases. In our case series, we have analyzed 5 MICS cases, where the anaesthesia technique was tailored to extubate the patient on the table and followed up till discharge. All 5 patients were extubated on the table safely.

Result: One patient had transient hypercapnia for 30 minutes post-extubation. There were no other postoperative complications. The inotropic support, length of stay in the Intensive Care Unit (ICU) and the hospital were reduced.

Conclusion: It is feasible and safe to extubate MICS cases on the table with a multidisciplinary approach that helps to reduce post-operative complications and duration of stay in the hospital.

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1. Introduction

Significant advances continued in cardiac surgery after the introduction of cardiopulmonary bypass (CPB). As a result, refinements in surgical and anaesthetic techniques combined with improved technology and the use of intraoperative Trans-Esophageal Echocardiography (TEE) have enabled less invasive approaches using smaller surgical incisions. Minimally Invasive Cardiac Surgery (MICS) refers to a broad group of operations designed to reduce the level of surgical trauma and facilitate early postoperative recovery.¹ Cosgrove and colleagues described the first minimally invasive valve procedure in 1996.^{2,3}

Advantages of MICS over a conventional midline sternotomy include reduced postoperative pain, early mobilization, reduced blood loss, rapid wound healing,

minimization of sternal wound complications, a shorter postoperative ICU stay, shorter hospital stay and cosmetically a better result.^{4,5}

MICS is done for coronary revascularization, valve repair and replacement, removal of the atrial mass, repair of Atrial Septal Defect and Atrial Fibrillation ablation procedures.

Prolonged intubation for >24 hours after cardiac surgery is associated with poor outcomes, post-operative respiratory complications, increased vasopressor support, ICU delirium and increased mortality.⁶ On-table extubation is a technique that is used in minimally invasive cardiac surgery to reduce the duration of postoperative mechanical ventilation and thereby, costs and complications.⁷

In our case series, we have studied 5 minimally invasive cardiac surgeries done for Atrial Septal Defect repair, Mitral Valve Replacement and Aortic Valve Replacement, which were extubated on the table.

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2. Aims and Objectives

The objective of this case series was to demonstrate the early postoperative recovery and reduced post-operative complications following on-table extubation after MICS.

3. Materials and Methods

We conducted a retrospective observational case series with a duration from August 2023 to December 2023.

3.1. Inclusion criteria

All the patients who were posted for elective MICS between the ages of 20 to 65, with normal biventricular function were included in the case series.

3.2. Exclusion criteria

Hemodynamically unstable patients, posted for emergency surgery, re-do surgery, with pulmonary adhesions, coagulopathy, abnormal ejection fraction and difficult airway were excluded.

3.3. Procedure

Similar to conventional surgery, the preoperative evaluation involves standard history, physical examination, laboratory investigations and imaging.

The monitors used were Electrocardiogram, capnograph, invasive blood pressure, central venous pressure, oxygen saturation, core temperature, urine output, Bispectral index (BIS) and TEE. External defibrillator paddles were attached for all the patients. An invasive radial arterial line was inserted before induction. An initial dose of fentanyl 100mcg was given. After induction of general anaesthesia with propofol or etomidate, a volatile agent, usually sevoflurane, was used for maintenance of anaesthesia before the institution of Cardio-Pulmonary Bypass (CPB). The first two cases were intubated with Double Lumen Tube and the rest 3 cases were intubated with Single Lumen Tube. The total dose of fentanyl was limited to 250 to 400mcg. The anaesthetic depth was monitored to a BIS target of 40-60 throughout the surgery. After induction, the left internal jugular vein was accessed with a central venous catheter. The patient was carefully positioned and ensured that all the pressure points were properly padded and the neck, arms and legs were not hyperextended or hyperflexed. Injection of Epsilon-aminocaproic acid 100mg/kg was given before CPB, during CPB and after CPB to reduce post-op bleeding.

After heparinization, the arterial cannula was placed via the femoral artery using TEE guidance. The IVC cannula was placed in the femoral vein and advanced until it was just distal to the cavoatrial junction. The SVC cannula was placed in the right IJV via the Seldinger technique and advanced proximal. The position of both cannulas was verified with TEE. Aortic cross-clamp was

done with a special device, chitwood clamp. Cardioplegia was delivered into the proximal ascending aorta through a separate cannula. All the cases were done under mild hypothermia.

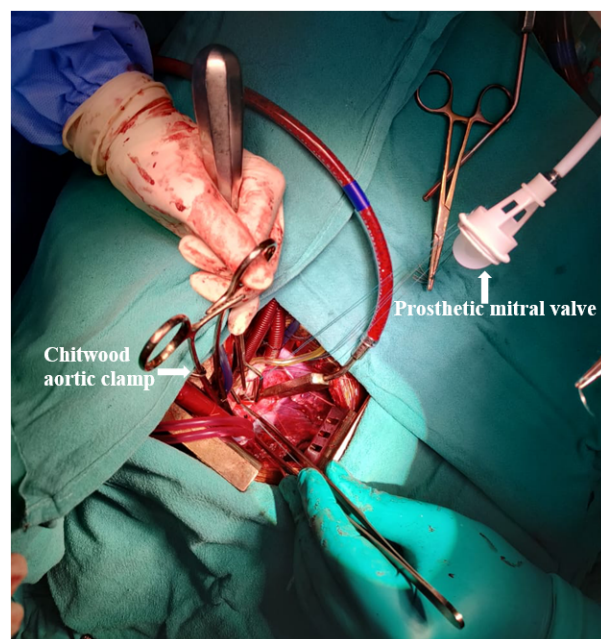


Figure 1: Procedure of Mitral valve replacement done through right sided mini thoracotomy

4. Results

The patient's demographic and intra-operative characteristics are shown in Table 1. All the patients were safely extubated on the table. There was transient hypercapnia in one patient which settled in 30 minutes and did not have any impact on the surgical outcome. There were no other complications during the period of ICU and ward stay. It was noticed that no new inotropes were started in the ICU in all 5 patients. The details about the post-operative complications, inotropes used, duration of hospital and ward stay are given in Table 2.

5. Discussion

This case series demonstrates that MICS patients can be extubated on the table safely with minimal post-operative complications. Case 4 and case 5 had prolonged cardiopulmonary bypass time and Aortic clamp time because of technical difficulty compared to Case 1, 2 & 3. Case 4 & 5 were found to have longer duration of inotrope use and stay in the ICU compared to the latter. Case 5 had a surgical wound gap of 1cm. For the purpose of cleaning and dressing, the patient was in the ward for an extra day, with 8 days of total duration of stay in the hospital. Rest of the 4 cases were discharged on their 7th day.

Table 1: Patient demographic characteristics

Name	Case 1	Case 2	Case 3	Case 4	Case 5
Age	37	34	18	27	63
Gender	F	F	M	F	M
Diagnosis	OS ASD Trivial TR Normal LV	OS ASD MILD TR Severe PAH Normal LV	SV ASD MILD TR Severe PAH Normal LV	RHD Severe MR MILD TR Moderate PAH Normal LV	Severe CALCIFIC AS Trivial AR Normal LV HTN / DM
Surgery	MICS ASD Closure	MICS ASD CLOSURE + TV Repair	MICS SV-ASD Closure	MICS MVR	MICS AVR BIO
Cpb time (mins)	153	150	159	239	189
Aorta clamp time (mins)	68	49	102	150	128
Inotropes used(mcg/kg/min)	NTG-1 DOBU- 2.5	NTG-0.25 DOBU- 10	NTG-0.5 DOBU- 5	NTG-0.5 DOBU- 5	NTG-0.4 DOBU- 5
Duration of Surgery (mins)	283	280	289	369	319

Table 2: Observation

	Case 1	Case 2	Case 3	Case 4	Case 5
Respiratory Complication	Nil	Transient hypercapnia present for 30mins post extubation	Nil	Nil	Nil
Re-intubation	Nil	Nil	Nil	Nil	Nil
Bleeding	Nil	Nil	Nil	Nil	Nil
Duration of inotrope use (days)	1	1	1	1	2
Infection	Nil	Nil	Nil	Nil	Nil
Dos ICU (hours)	18	24	17	38	57
Dos hospital (days)	7	7	7	7	8

OcéaneJaquet MD et al. did a retrospective observational case series, on 294 patients who underwent MICS, out of which 186 patients were extubated on the table and the rest did not meet the extubation criteria. The case series concluded that "On-table" extubation was associated with a lower risk of postoperative pneumonia and lower vasopressor requirements.⁸

Yunfen Ge et al. did a retrospective case series of 93 patients who were above 60years age and underwent MICS for valve replacement. Among them, 71 patients who were extubated on table had a reduced duration of stay in the ICU and hospital and reduced total cost and medication cost. 22 other patients had delayed extubation, and they had longer surgery time, longer clamp time and bypass time. In this case series, patient's total cost and medication cost were analyzed and compared, which was not done in our case series.⁹

Jens C Kubitz et al. did a retrospective case series of 50 patients who underwent MICS. Enhanced Recovery after Surgery (ERAS) was followed in all 50 patients, which included fastrack anesthesia, on table extubation and early mobilization. Postoperative atrial fibrillation developed in 6 patients, postoperative delirium emerged in two patients and reintubation was required in one patient. The average

duration of stay in the ICU is 14 hours and the total hospital stay is 7 days. This case series says that ERAS protocol is feasible and safe in the MICS setting and has a clear potential to improve a patient's outcome.¹⁰

The inclusion of SAP Block and PEC2 Block in our case series, along with intravenous analgesia has facilitated smooth extubation with adequate pain control.

The SAP block is the injection of local anaesthetic between the serratus anterior and latissimus dorsi muscles. It is performed in a much more lateral plane, and therefore does not cause a sympathectomy and may have a better safety profile in anticoagulated patients.¹¹

The PECS I block targets the medial and lateral pectoral nerves and may block the intercostobrachial nerve and the intercostal nerve branches anteriorly. The block involves the injection of local anaesthetic in the fascial plane between the pectoralis major and minor muscles. The PECS II blocks the long thoracic nerve and thoracodorsal nerve.¹² It is an extension of PEC1 that involves a second injection lateral to the PEC 1 injection point in the plane between the pectoralis minor and serratus anterior muscles.

The conduct of MICS is intrinsically more complicated for both surgeons and anesthesiologists. The best outcomes of MICS on table extubation are achieved by a thorough

preoperative evaluation, an anaesthetic team skilled in TEE, multimodal analgesia, and an experienced surgical team.

6. Limitations

Since it is a retrospective case series, having only 5 cases, we cannot generalize the results and cannot avoid the observer bias and recall bias. To overcome this limitation, we need to do a large-scale prospective case series.

7. Conclusion

Our case series demonstrated that on-table extubation of MICS cases helps to reduce post-operative complications, and duration of stay in the ICU and hospital, thereby reducing the cost burden and increasing patient turnover.

8. Source of Funding

None.

9. Conflict of Interest

None.

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