Hypoxemia in sequential one lung ventilation: oxygen saturation tends to decrease in the second half rather than in the first half of ventilation

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Background and Goal of this study

- Sequential one lung ventilation(OLV) is uncommon, and there are few reports of it to date.
- At our institution, we perform atrial fibrillation treatment surgery (i.e. port-access thoroscopic radio frequency ablation for pulmonary vein isolation and left atrial appendix amputation)
- This surgery requires sequential OLV(shown below.)
- We have experienced hundreds of cases of sequential OLV and hypothesized that maintaining oxygenation is more difficult in the second half of the procedure than in the first half.

The goal of this study was to examine hypoxemia in sequential OLV retrospectively.

Materials and Methods

- Retrospective study**
- Date:From March 1, 2012 to March 31, 2017
- Inclusion:Patients who underwent atrial fibrillation surgery with sequential OLV
- Exclusion: Usage of Cardiopulmonary bypass. Lack of records.
- How to evaluate hypoxia:
hypoxia time
- defined as the period with an SpO₂ ≤95%, 92% and 89%.

This study was approved by the Tokyo Metropolitan Tama Medical Center's Institutional Review Board 29-65.

Atrial fibrillation treatment surgery in our hospital

Sequential OLV in our Atrial fibrillation surgery

All sequential OLV was done as below. Patient position was supine.

	First half	interval(about 5min)	Second half
Right lung	Ventilated	Expanded	Collapsed
Left lung	Collapsed	Expanded	Ventilated

Anterior view of lung

Fig.2 Sequential OLV procedure in atrial fibrillation surgery

Results and Discussion

- Patients: 199 patients were included(Table 1)
- The duration of OLV in first half is longer than in second half.(56min vs 39min)
- Hypoxemia time (SpO₂ ≤ 95%,92%,89%) is shown Fig. 3.
- Although the duration of the OLV in the first half was longer than in the second half, hypoxemia time in the second half was longer than in the first half.
- Hypoxemia may have occurred more frequently in the second half than in the first half.

Table 1 Characteristics of patients

	mean	s.d.	max.	min.
age[y.o.]	66.1	8.8	83	26
sex	male n=156/ female n=43			
BMI[kg/m ²]	23.7	3.4	35.6	16.2
ASA PS	PS2 n=175/ PS3 n=24			
duration of operation[min]	114	34	242	50
First OLV				
duration[min]	56	26	191	24
minimam SpO ₂ [%]	92.7	5.9	100	53
Second OLV				
duration[min]	39	14	104	9
minimam SpO ₂ [%]	89.2	6.1	100	67

Three possible reasons for these results.

- Right lung capacity is usually larger than left.
- The left lung may not have been expanded fully in the interval.
- Hypoxic pulmonary vasoconstriction (HPV) of the left lung occurred in the first half. And this HPV of left lung may have remained in the second half, making the shunt flow larger in the second half.

Conclusion

In sequential OLV, hypoxemia tends to occur in the second half rather than in the first half.