Venous reservoir in corporation with compliance chamber facilities the management of cardiopulmonary bypass with closed circuit.

Tsutomu Mitsuie 光家　努
Department of Clinical engineering, Takamatsu Red Cross Hospital
Kazunobu Nishimura
Department of Cadiovascular surgery, Takamatsu Red Cross Hospital

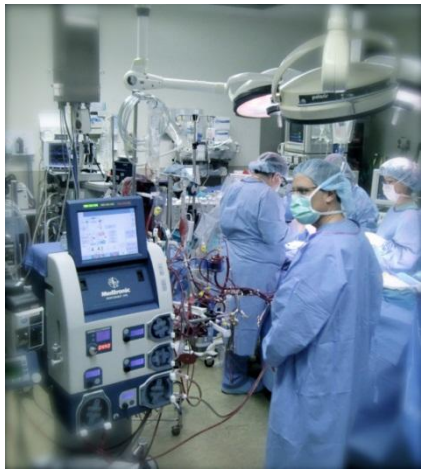
Background

- Minimized Extracorporeal Circulation (MECC) has been used as a closed circuit without blood reservoir, which enables to reduce priming volume, and to decrease damage for blood components owing to no contact to air.
- However, closed circuit has a drawback that perfusion flow rate tend to be unstable as blood volume decrease, which causes change in pressure inside circuit.

Past Mini-CPB

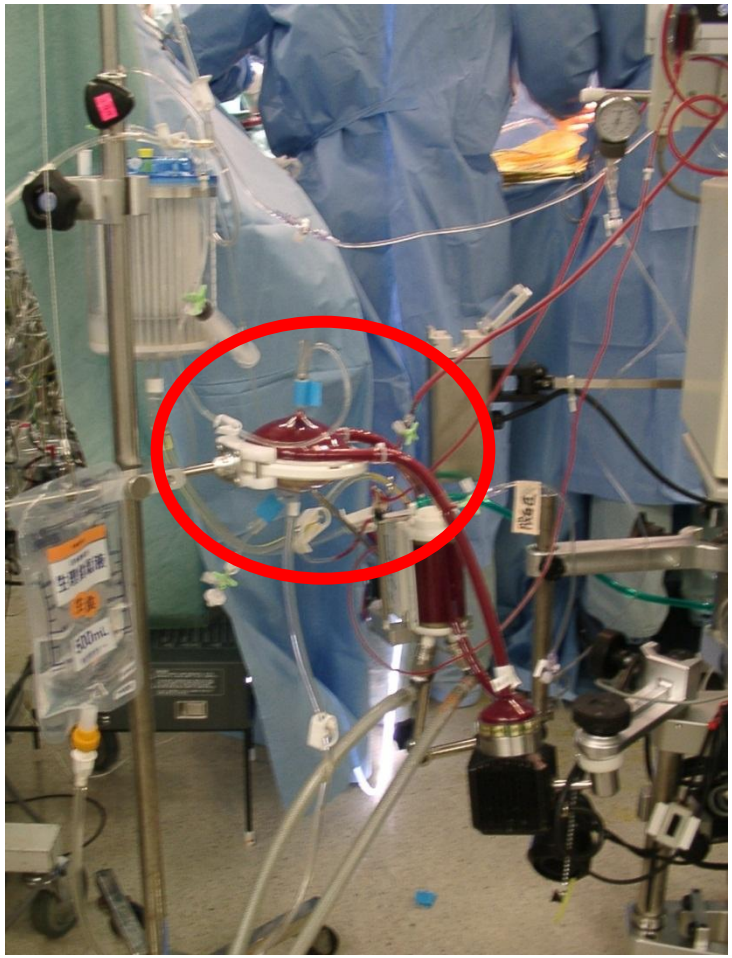
MAQUET
MECC SYSTEM

Medtronic
Resting Heart® System



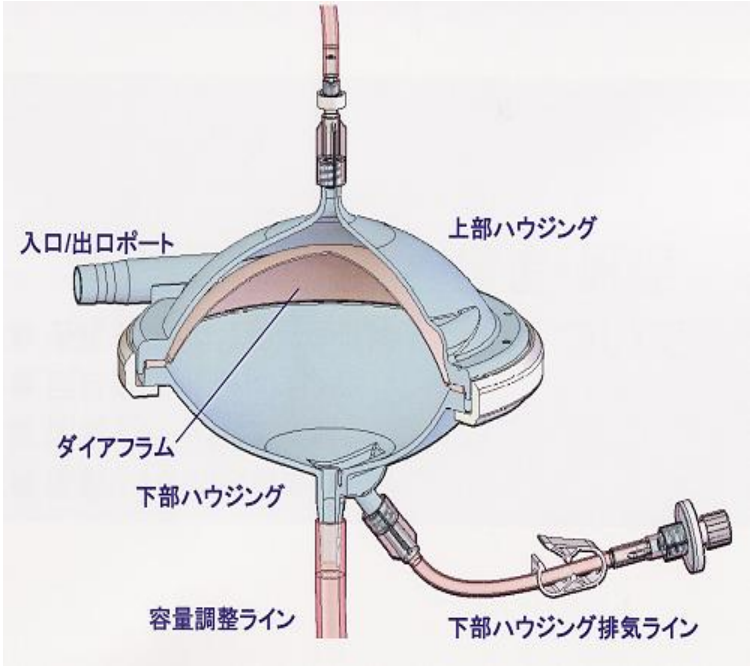
TERUMO
Emergency Bypass System

venous reservoir with compliance chamber (VRCC)



- The venous reservoir in corporation with compliance chamber (JMS Co. Japan) is one of solution for unstable perfusion flow rate.
- This system consists of compliance chamber and venous reservoir of 400 ml.
- We examined performance of this system to mimic clinical settings using mock circulation.

VRCC is characteristic and structure



☆**Upper part housing (the blood side)**

a blood retention part becomes the turning style, there is not stay of the blood.

→*Heparin decrease*

simple air bubbles separation function.

→ *air removal possibility*

☆**Lower part housing (the sodium solution side)**

Space to use it for the adjustment of the circulation blood volume.

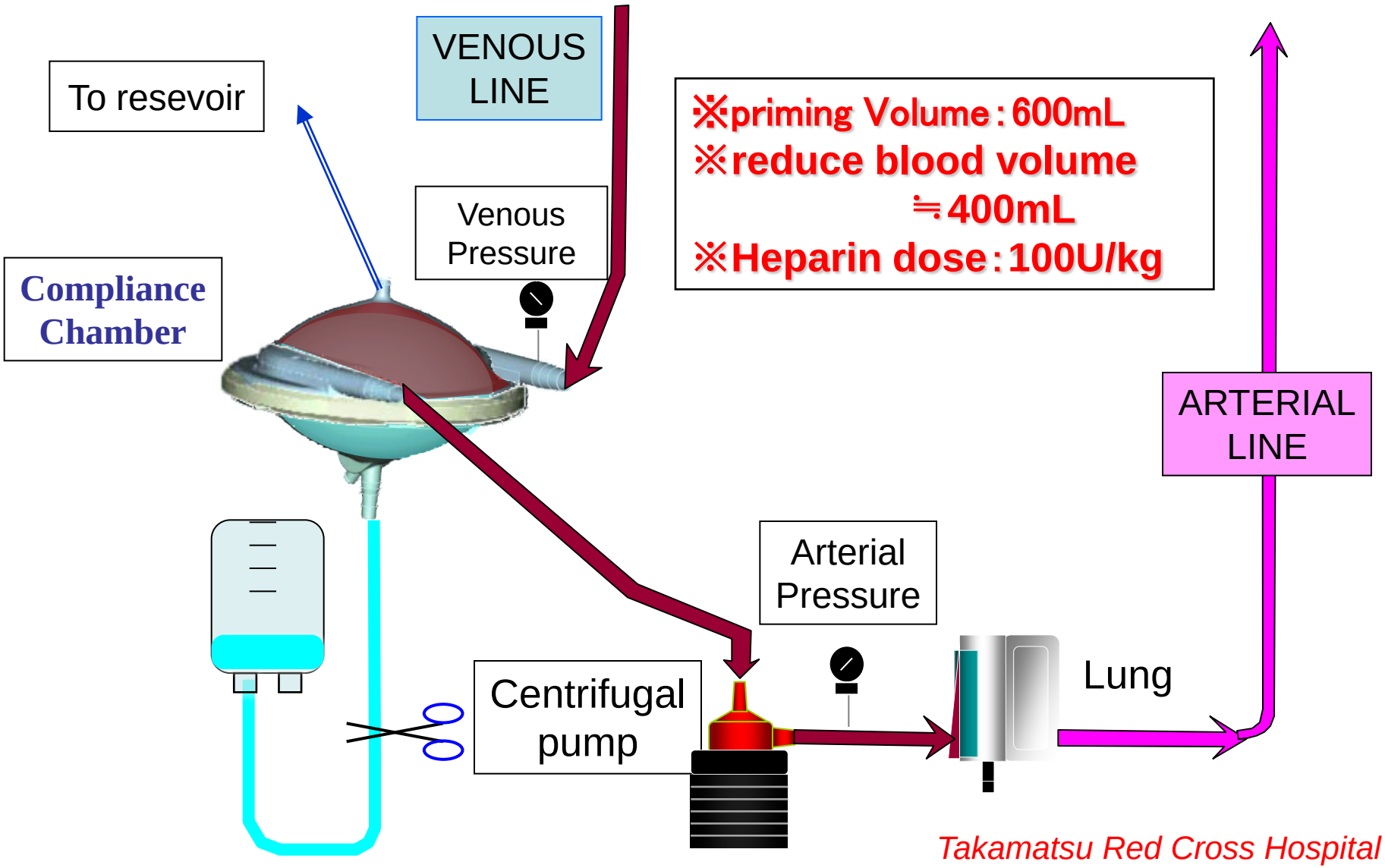
(approximately 400 ml of de-blood possibility)

→*easy volume shift*

☆**Diaphragm** : The lower part housing filled with isotonic solution functions as the compliance chamber through the diaphragm, corresponding to changes in blood volume and internal pressure inside circuit.

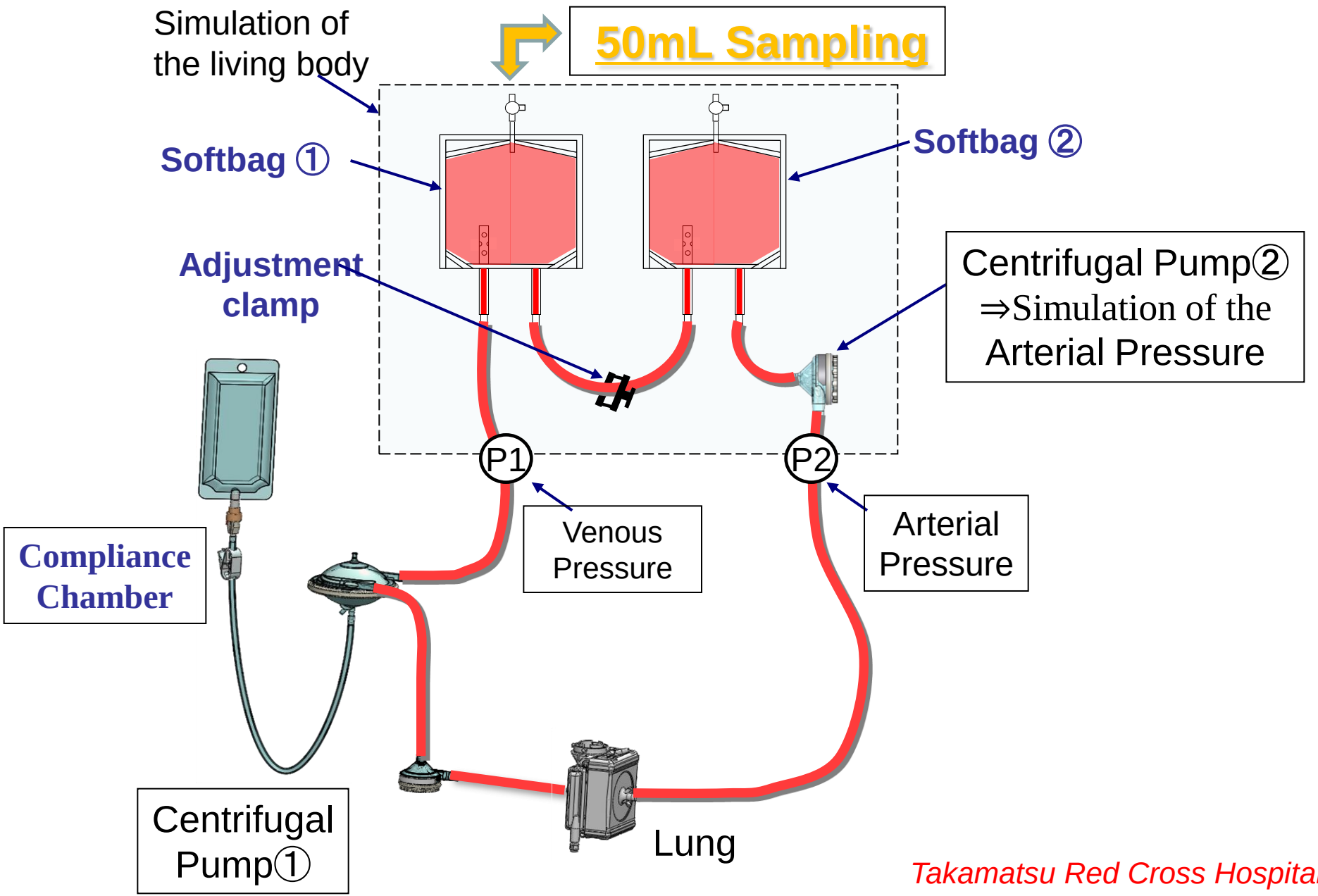
→*Stability of the circulation change*

Venous reservoir with compliance chamber (VRCC) and mini-closed circuit



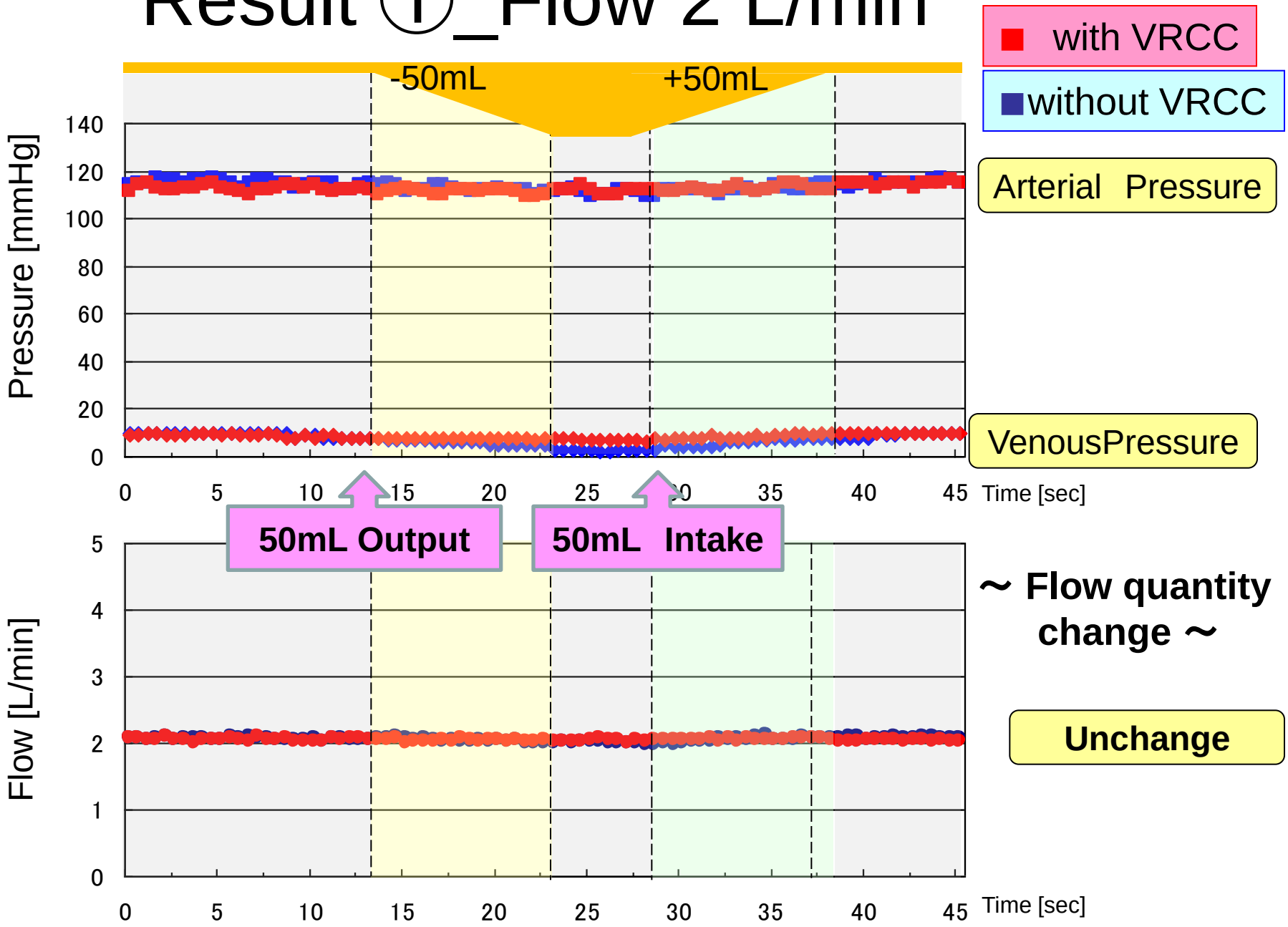
Takamatsu Red Cross Hospital

Methods （Mock circuit）

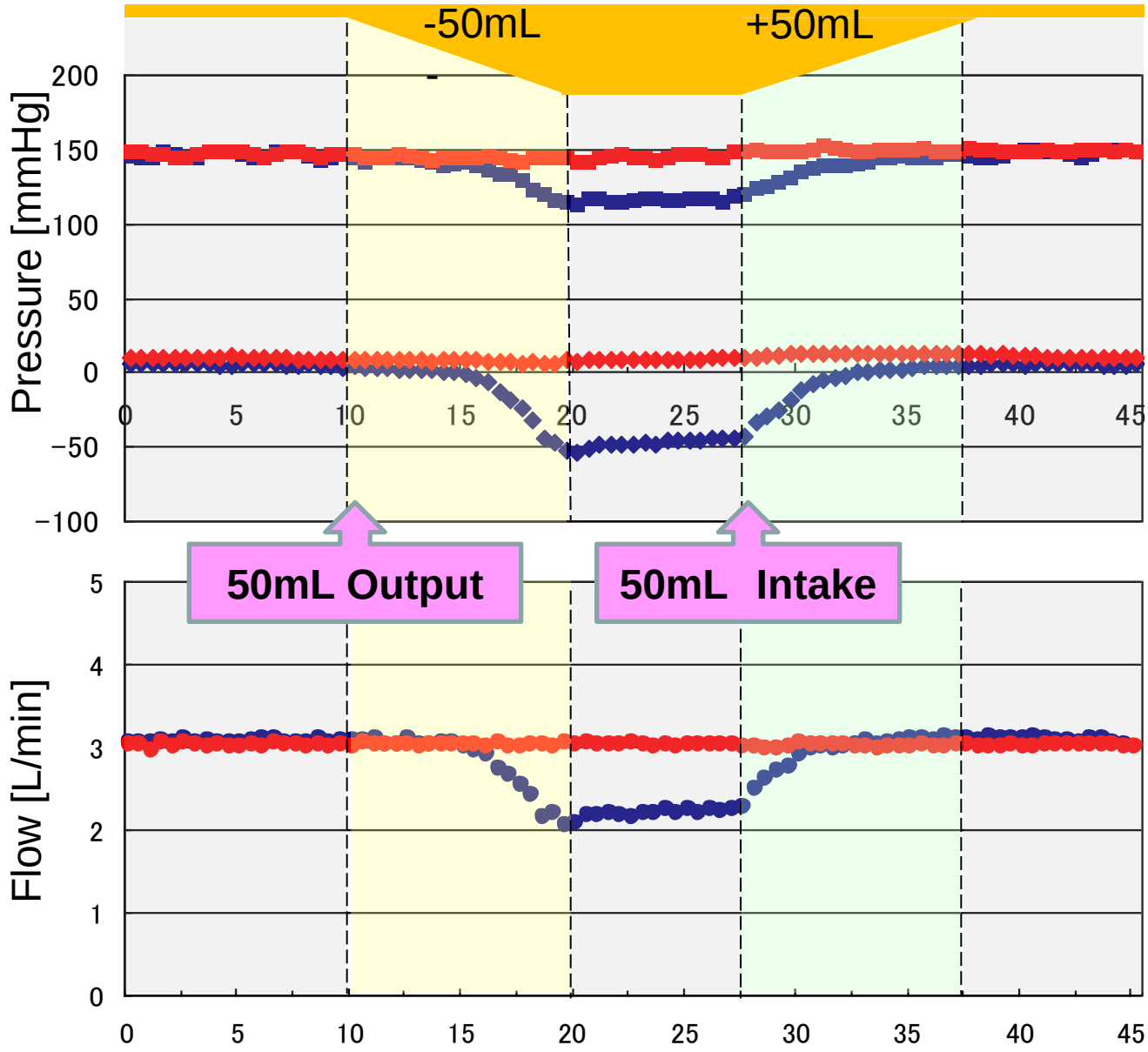


Takamatsu Red Cross Hospital

Result ①_Flow 2 L/min



Result ②_Flow 3 L/min



with VRCC

without VRCC

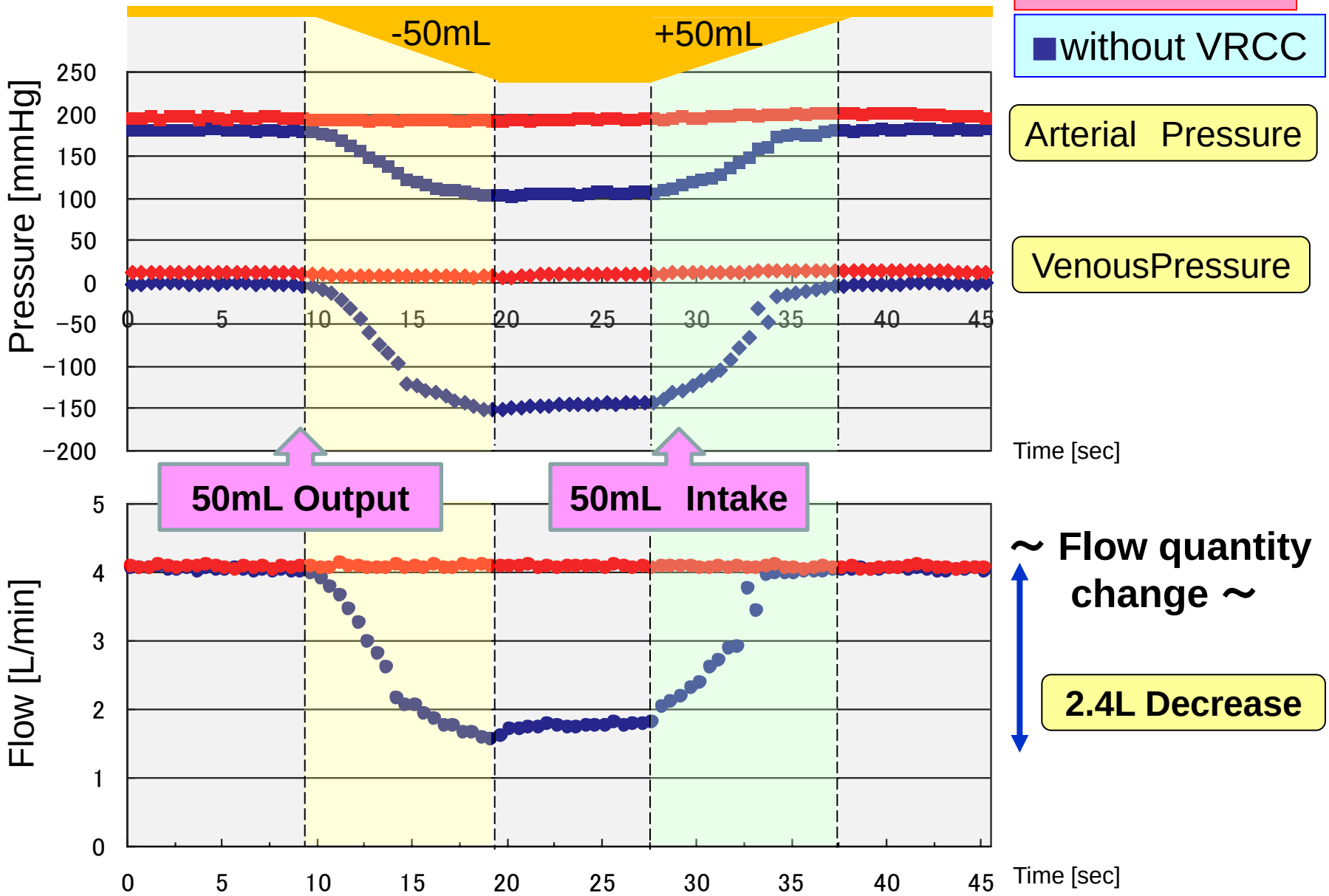
Arterial Pressure

VenousPressure

～ Flow quantity change ～

1 L Decrease

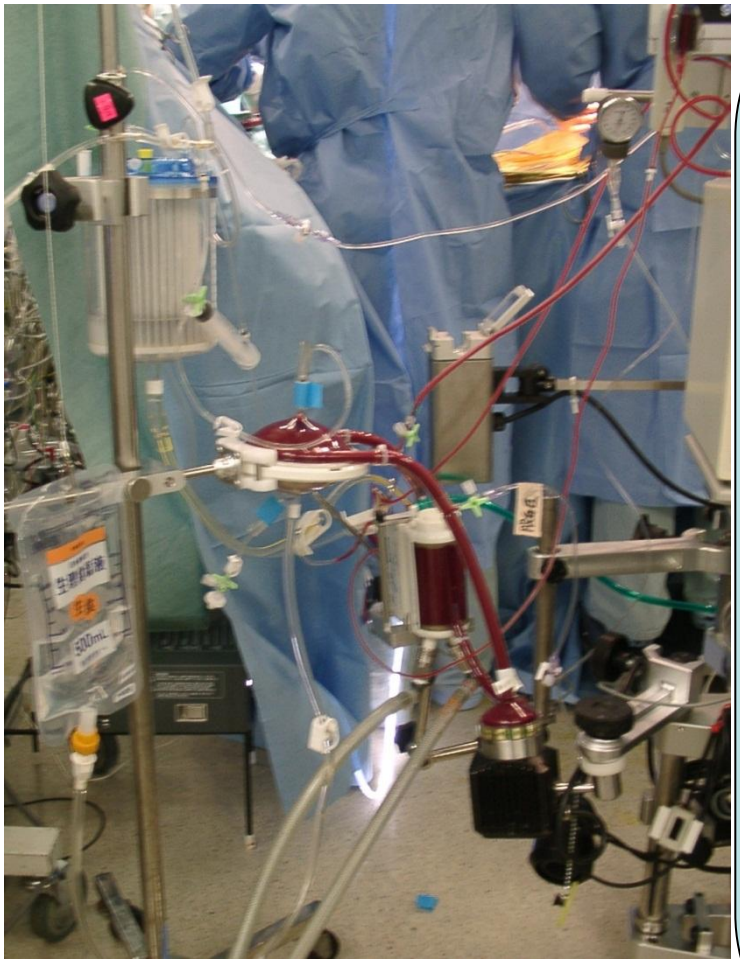
Result ③_Flow 4 L/min



Summary of the result

1. At the flow rate of 2 L / min, there were no changes of flow rate during the volume shift between with and without the VRCC system.
2. At the flow rate of 3 L / min, volume shift caused decrease in flow rate down to 2L/min without the VRCC, while no change of flow rate with the VRCC.
3. At the flow rate of 4L / min, volume shift induced further decrease in flow rate down to 1.6 L/min without the VRCC, again while little change with the VRCC.

Summary of the clinical experience



We experienced on-pump beating CABG 53 cases

A man: Woman = 39:14

The average age: 71±10

BSA: 1.64±0.15 ㎡

CPB time: 160 ± 60min

dialysis, CAPD patient: 14

IABP : 9

Bypass number: 3±0.73

There were no troubles in spite of emergency and severe cases .

Takamatsu Red Cross Hospital

Conclusion

- The VRCC system provides stable perfusion rate inside the closed circuit, even when the volume shift happens, because the compliance chamber follows the venous volume shift.
- This system contributed to perform cardiac operation using MECC system.