Case study
− ACS with cardiogenic shock −

Topic
- Partial Impella support
- Recovering LV function
- Stressed volume reduction

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Case

- **82 y.o Male with CKD**

- **Presented with dyspnea and fatigue**

Vital signs on admission:

BT 36.4 $^{\circ}$C, BP 118/79 mmHg, HR 96/min reg, SPO$_2$ 95% (O$_2$ mask 3L)

Data

ECG: ST elevation (+)

Echocardiogram: Severe LV dysfunction

Chest-Xp: Pulmonary edema

Laboratory: CK 1600 U/L, CK-MB 190 ng/ml, BNP 1000 pg/ml, TnT (+)

Emergent angiography:
LAD/LCX occlusion
BP decreased progressively; 81/58, HR 100

Hemodynamic consideration

| Hours	0	4	8	12	16	20	24	28	32
CHDF	Ultrafiltration								
Dobutamine	3γ		4γ	5γ					
HR (bpm)	111	108	112	118	111	107	97	98	101
BP (mmHg)	103/74	105/78	123/93	108/74	90/62	86/57	93/61	106/66	103/63
MAP (mmHg)	82	87	102	84	70	64	70	77	75
PA (mmHg)	52/35	52/36	66/38	53/29	44/27	38/20	33/19	39/23	32/19
CVP (mmHg)	14	15	8	7	5	8	8	7	7
IMPELLA level	P8(2.5)	P8(2.5)	P8(2.4)	P8(2.5)	P8(2.5)	P8(2.4)	P8(2.4)	P8(2.4)	P8(2.4)
Cardiac index	1.5	1.4	1.7	1.9	2.1	2.3	2.4	2.3	2.2
Cardiac output	2.7	2.6	3.7	3.5	3.9	4.2	4.4	4.2	4.0
Urine (ml/2h)	50	30	20	50	60	80	120	140	230
Lactate (mmol/l)	1.9	1.9	3.4	1.9	2.8	2.2	1.0	1.7	0.8

Impella initiation

1day after PCI

Hemodynamics

Circulatory equilibrium
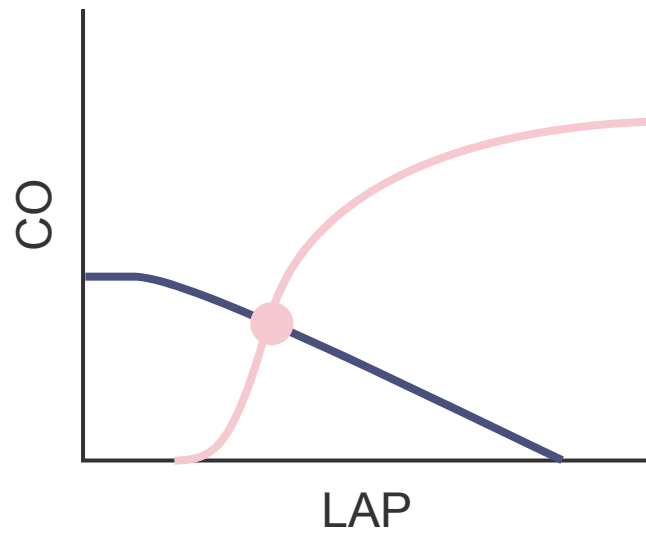
PV loop
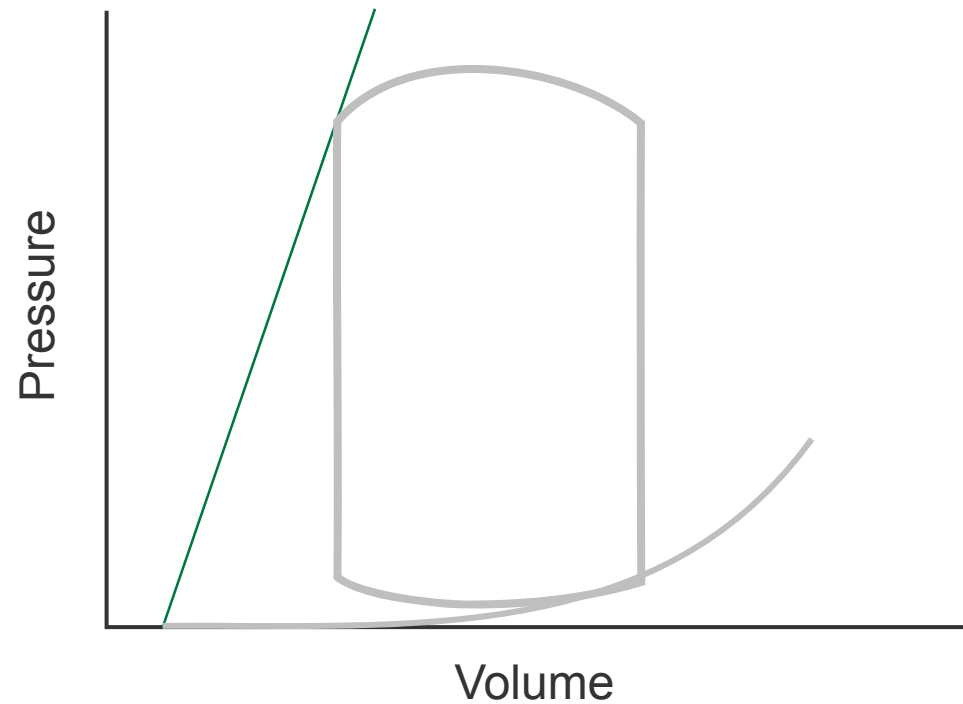
Estimate the cardiovascular properties

Systolic function
- Low LVEF
- Low CI
- High PCWP

➡ $E_{es} \downarrow\downarrow$

Diastolic function
- Acute MI
- High PCWP

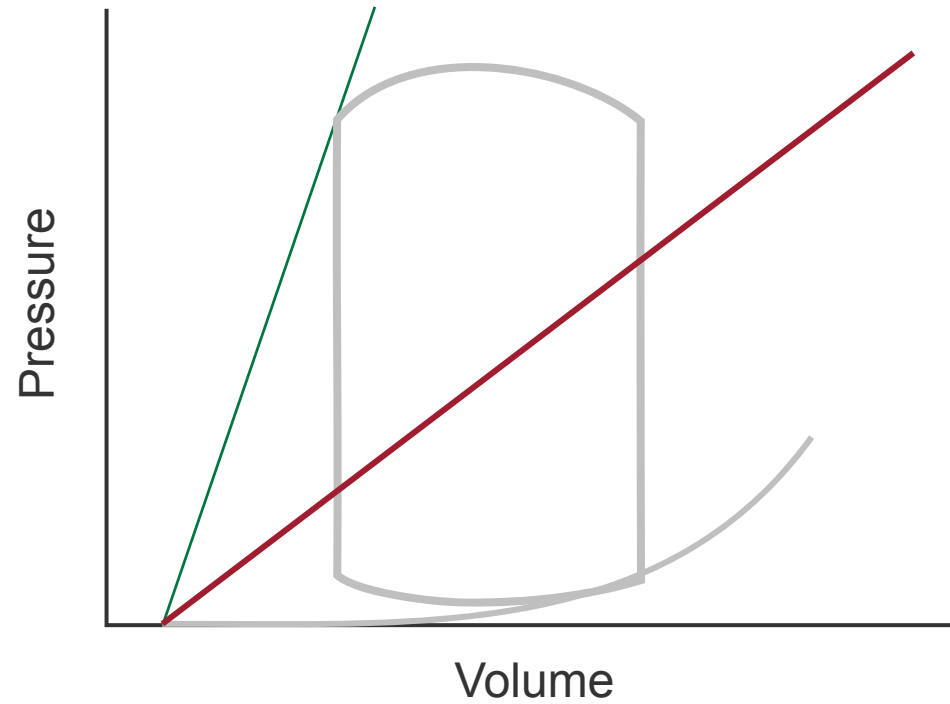➡ $EDPVR \rightarrow$

Preload
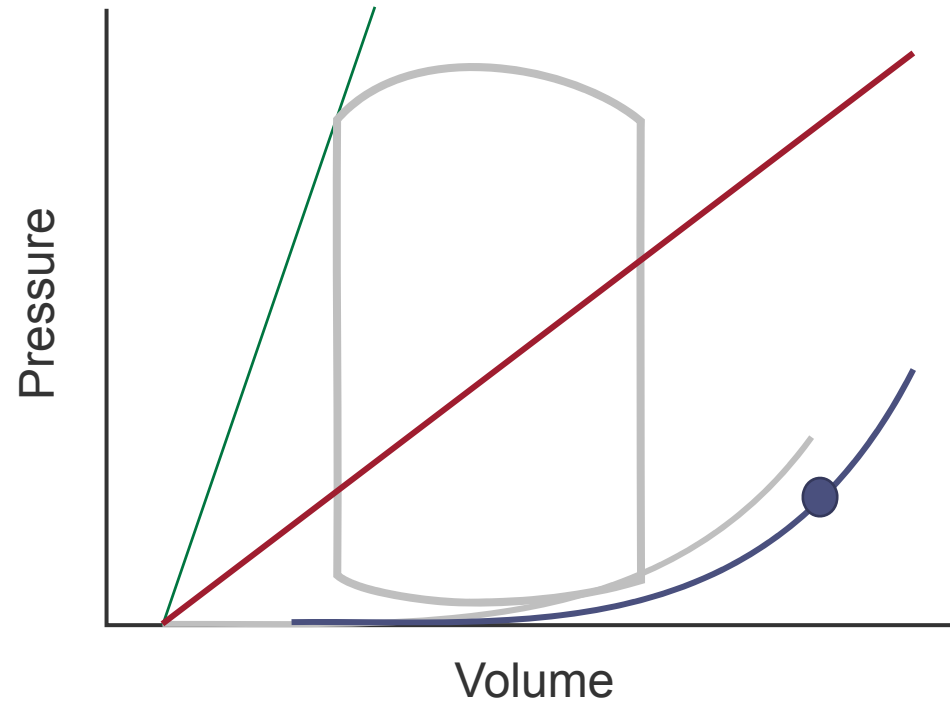- High PCWP
- High CVP

➡ $LVEDP \uparrow$

Afterload
- Tachycardia
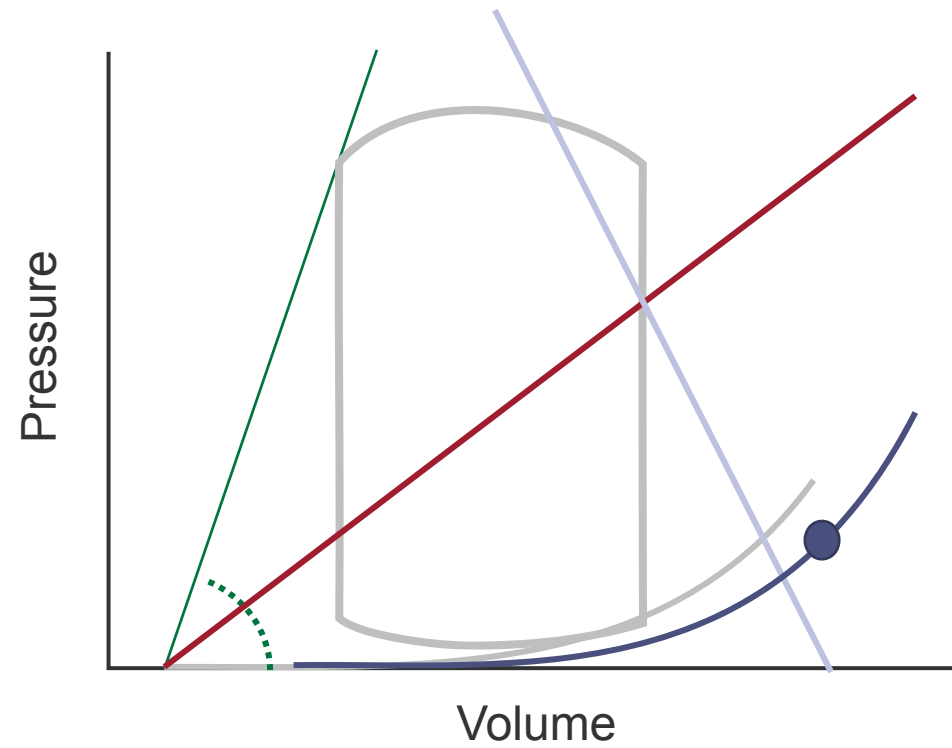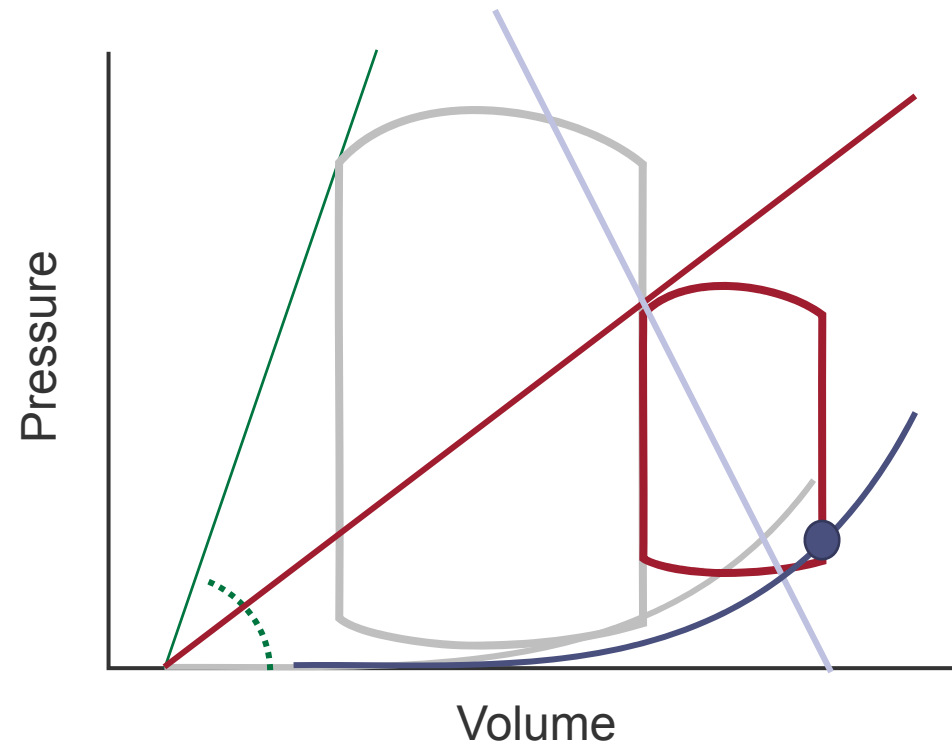- Low BP

➡ E_a Relatively $\uparrow$
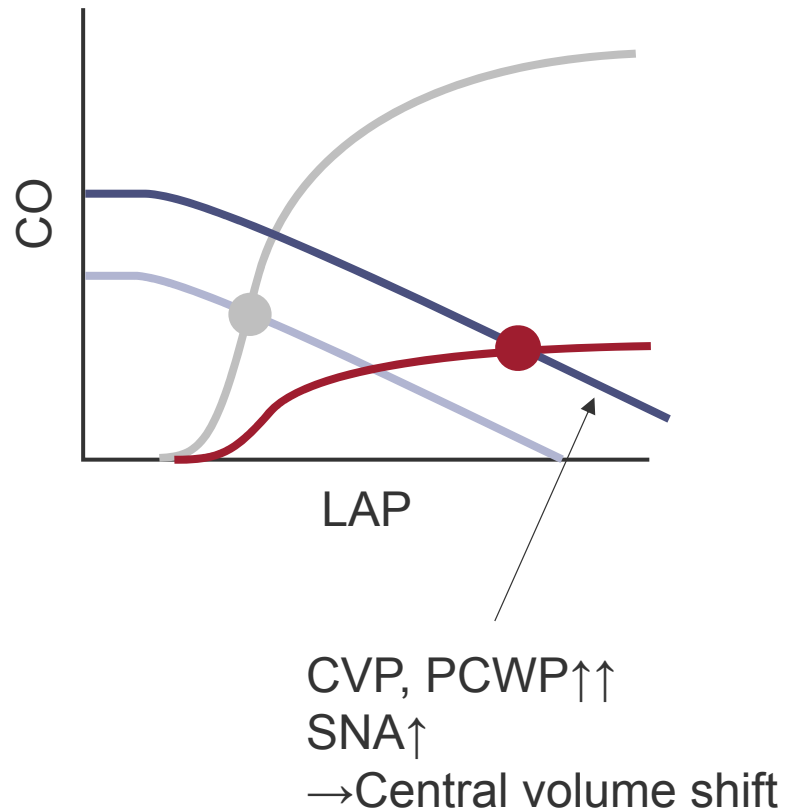
Step1: ESPVR

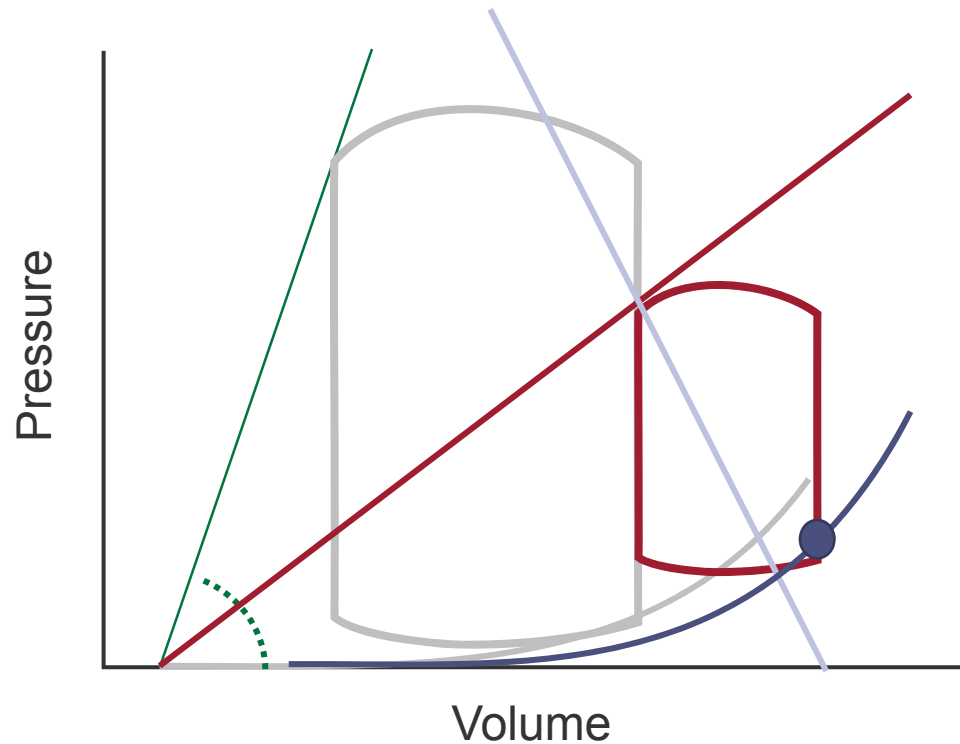# Step2: EDPVR and LVEDP

Step3: E_a

Step4: Illustrate PV loop

CV framework in this case

Circulatory equilibrium

CO

LAP

CVP, PCWP↑↑
SNA↑
→Central volume shift

PV loop

Pressure

Volume

Hemodynamics after Impella 2.5

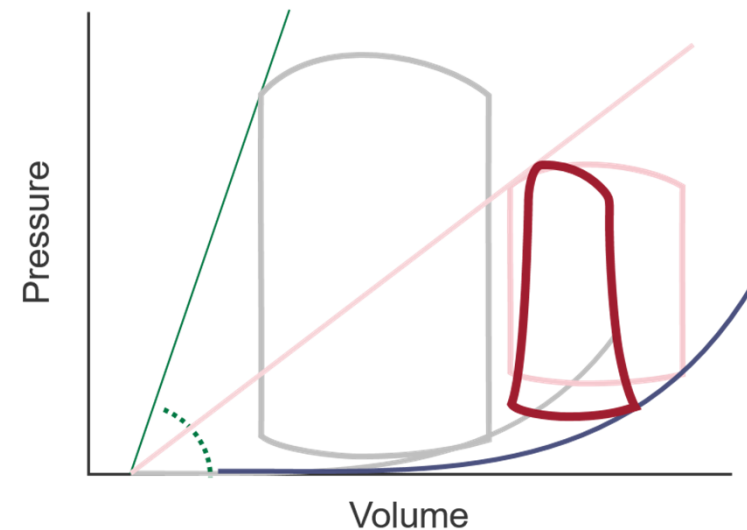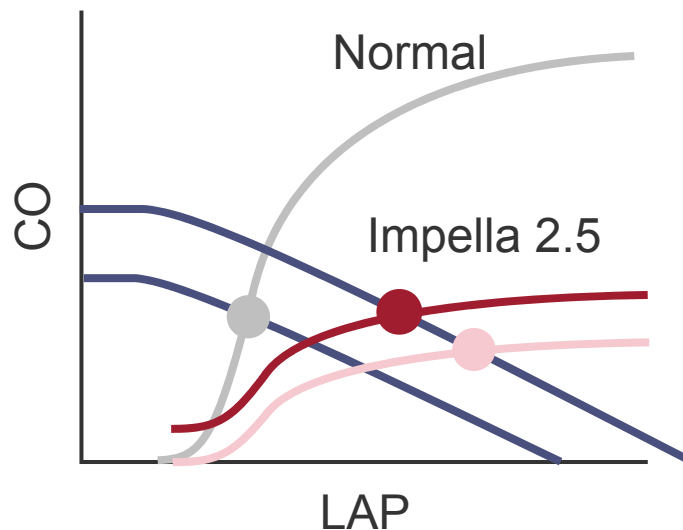## Circulatory equilibrium

CO

LAP

PV loop

Pressure

Volume
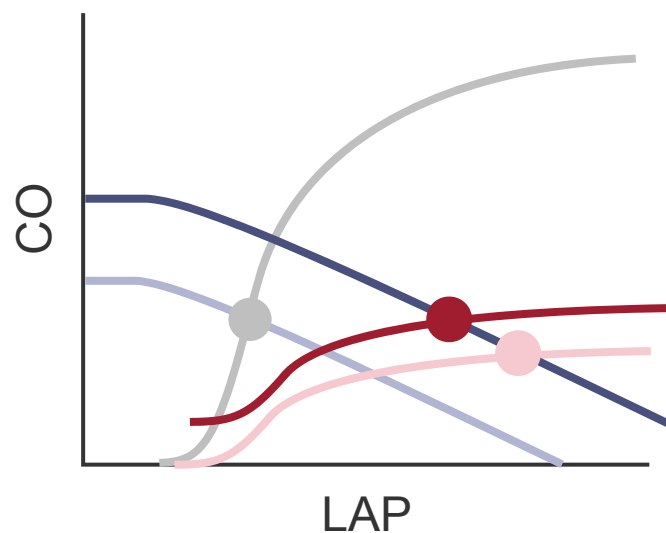
Supported by Impella 2.5

- Impella increased CO and decreased PCWP.
  →However, Impella did not normalize hemodynamics.
  →PCWP and CVP remained high after Impella

- Impella support helped the stable PCI.

- Since the Impella 2.5 cannot achieve total support, PVA did not decrease much in this case.

Recovery of LV function

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Impella initiation   1day after PCI

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Est Native CO	0.2	0.1	1.3	1.0	1.4	1.8	2.0	1.8	1.6

- Native CO apparently increased after 8hr.
- In 24 hr after PCI, Native CO was almost equivalent to Impella flow.
- As a result of increased native CO, pulse pressure increased in 24 hr.

Recovery of LV function

動画はこちら　https://youtube.be/H7skQsySzT4
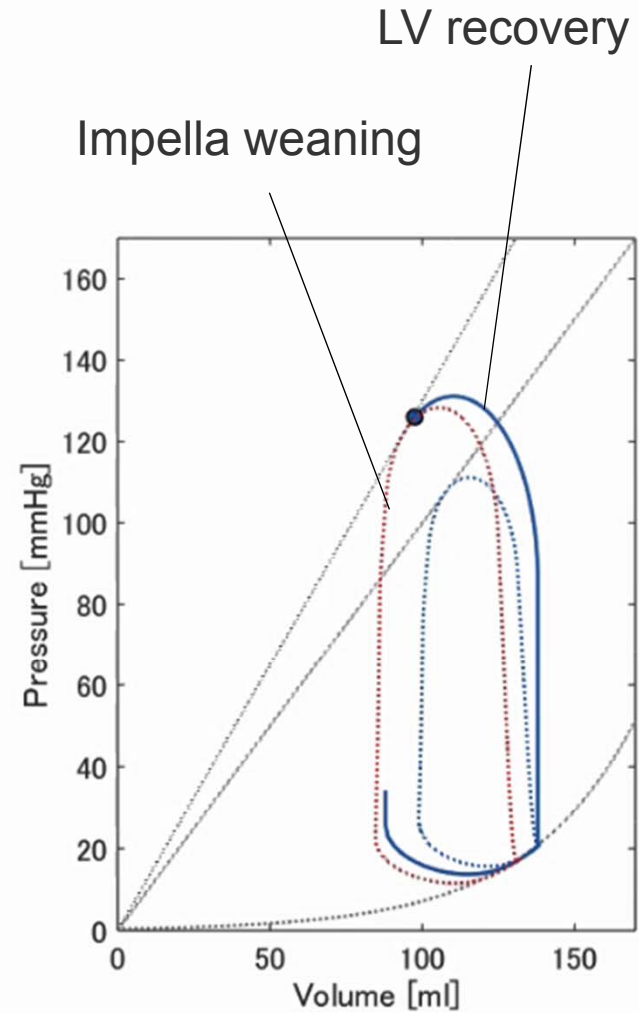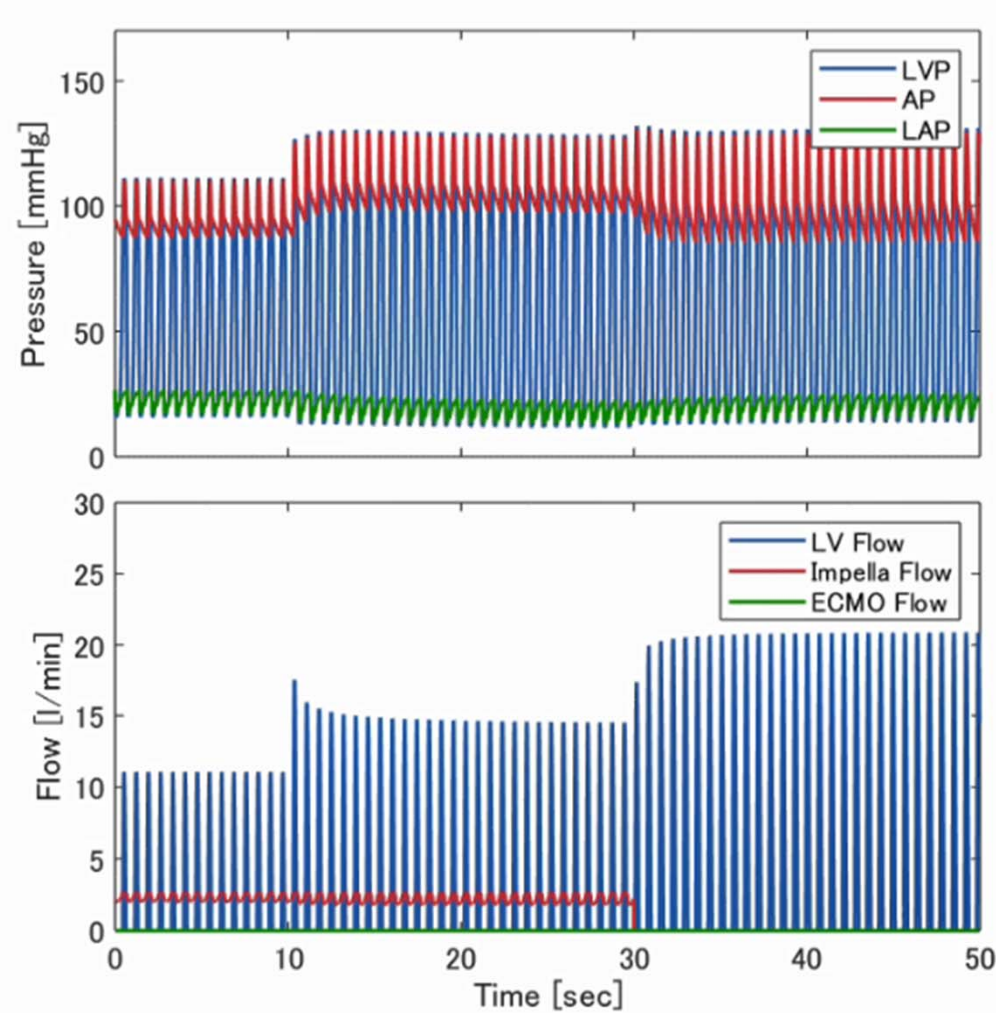
Volume reduction

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- CVP, PA and PCWP decreased in 8 hr after PCI.
- Urine gradually increased after PCI.

Changes of operating point
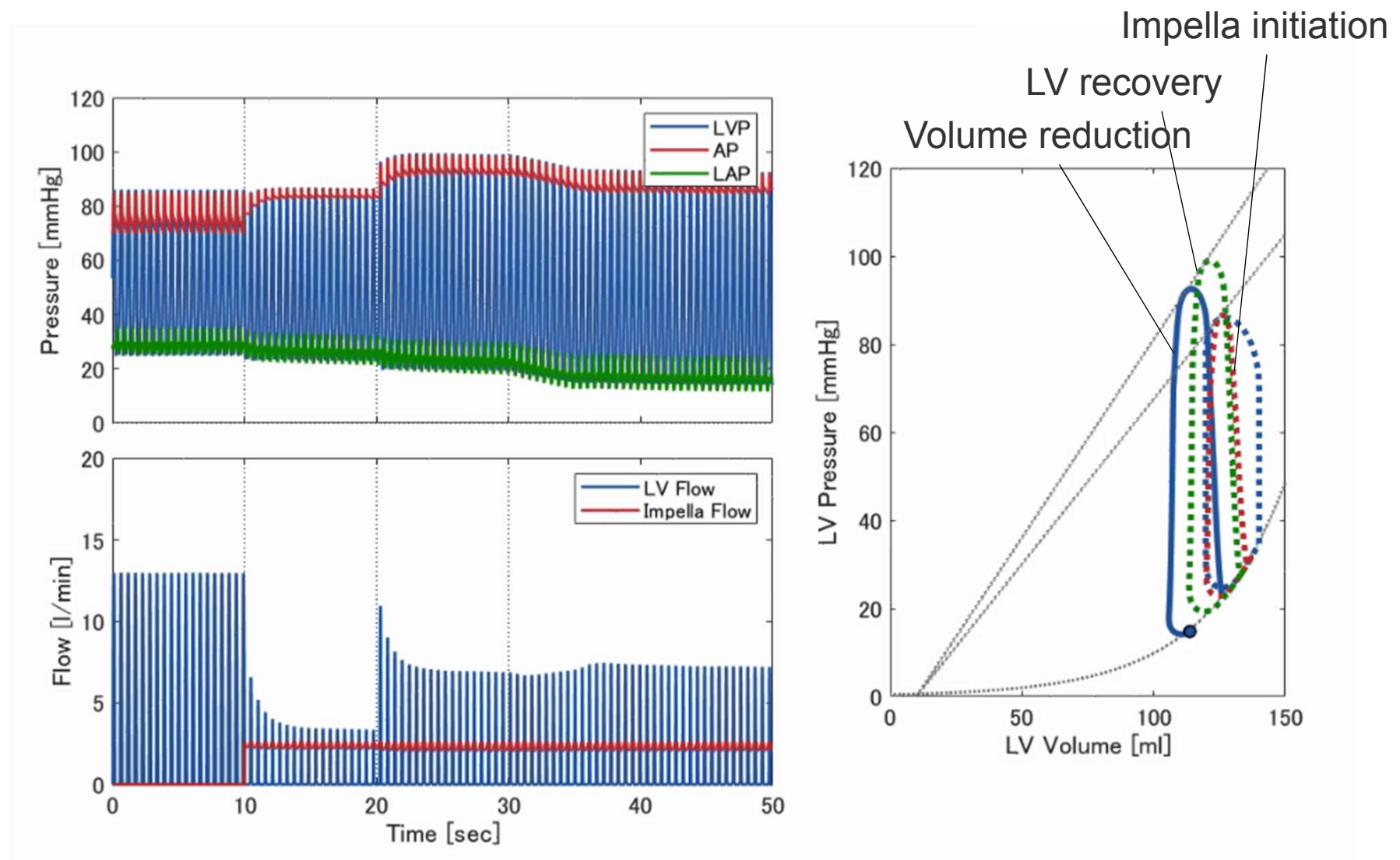
CV framework

Volume reduction

LV recover

Impella insertion

CO

LAP
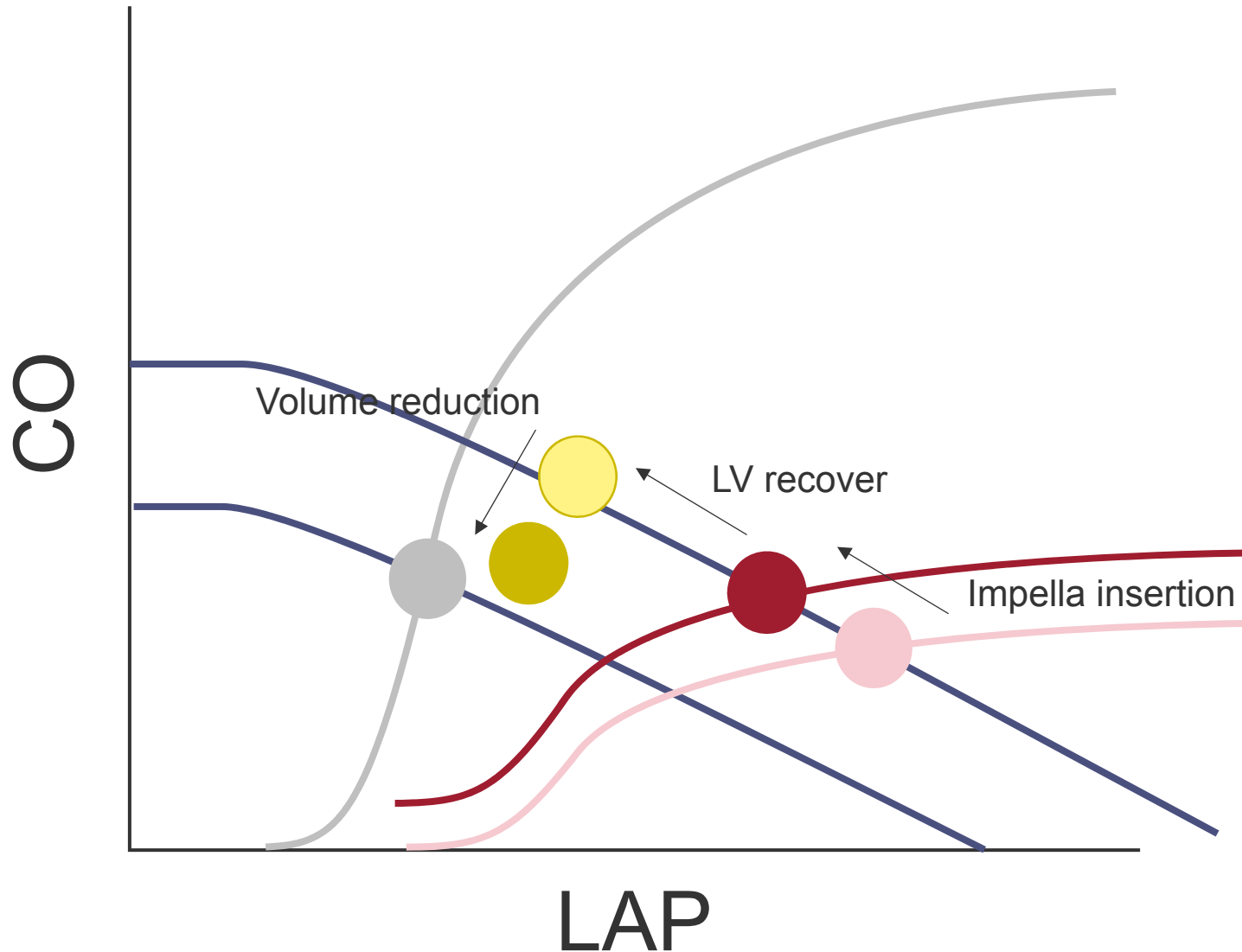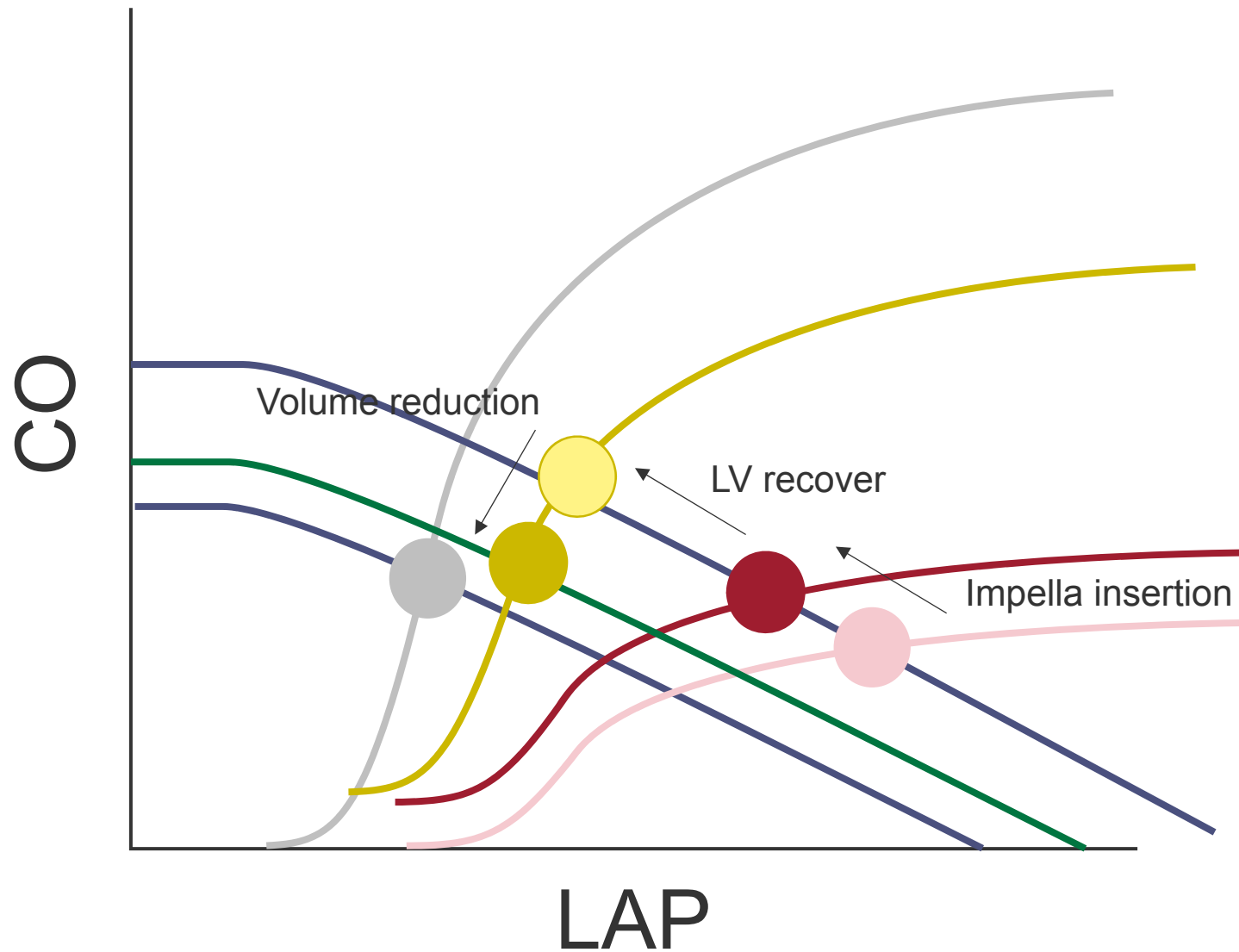
General trend in this case

動画はこちら　https://youtube.be/pZBCF1I_Co4

Conclusions

- Impella 2.5 supported total CO, but it did not fully normalize hemodynamics.
- In this case, the augmented AP by Impella may help stable PCI and induce early LV recovery and diuresis.
- Higher flow Impella might increase AP and decrease LVEDP further. Thus, it could avoid the adding of inotropes.
- In terms of acute LV unloading, higher flow Impella could limit PVA and the infarct size.

Impella CP

Impella 5.0