



P-21

# Case & Quality Reports 2025

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## Introduction

The SST team consisted of six members with the following roles: lead surgeon, surgical assistant, perfusionist, support, and two remote supports. Initially, three team members arrived at the location and waited on standby prior to patient's legal pronouncement of death.

The patient went into cardiopulmonary arrest in the palliative care facility, and the legal pronouncement process was initiated after 96 minutes by the attending doctor. Legal pronouncement was completed approximately 110 minutes after cardiopulmonary arrest and the patient was transferred to the ambulance by the standby team.

The following stabilization procedures were performed by three team members and two remote supports; several procedures were performed in parallel:

- Thermocouple insertion into each ear.
- Rectal temperature probe insertion (with occlusion device).
- Chest compressions with LUCAS 2 device.
- Approximately 60 kg of ice and 80 L of water placed into ice bath.
- i-Gel placed and ventilation started.

The following medication was administered via two bone marrow needles:

Medication	Dosage
Urokinase	300,000 IE
Heparin	50,000 IE
Sodium Citrate	100 g
Lidocaine + MgCl	160 mg + 4 mg
TRIS	250 ml
Minocycline	200 mg
Vasopressin	0.4 mg
Insulin	900 IE

SCCD water flow around the body and nasopharyngeal cooling were initiated.

After cooldown to core temperature of 20°C, the fourth on-site team member arrived, and the team began preparing for surgery and perfusion:

- Perfusion system primed.
- Median sternotomy for cardiac surgical access.
- Aorta cannulated and perfusion initiated.
- Atrial incision performed and cardiotomy suction established.
- 21L of MHP-2 washout solution was initially perfused.
- Cryoprotectant perfusion with gradual increasing concentrations as shown in the table below:

<b>Concentration</b>	<b>Volume</b>
MHP-2	21 L
5% w/v	21 L
10% w/v	21 L
30% w/v	21 L
70% w/v	70 L
80% w/v	21 L

Perfusion was conducted in an open-circuit configuration. At the end of perfusion, the circuit was closed for 48 minutes with 80% w/v because of long-term transport at dry-ice temperature.

The patient was put into a slurry of salt water with no direct skin contact and ice for 9.5 hours for initial cooling as dry ice was not available on-site. The patient was then further cooled with dry ice until transport. Patient was transported on dry ice to a third party in the United States to a long-term storage facility. CT scans could not be performed as the patient was transported to the United States for long-term storage and shipment to Switzerland for CT scanning was not feasible.

# Cryoprotection Data

## Temperature

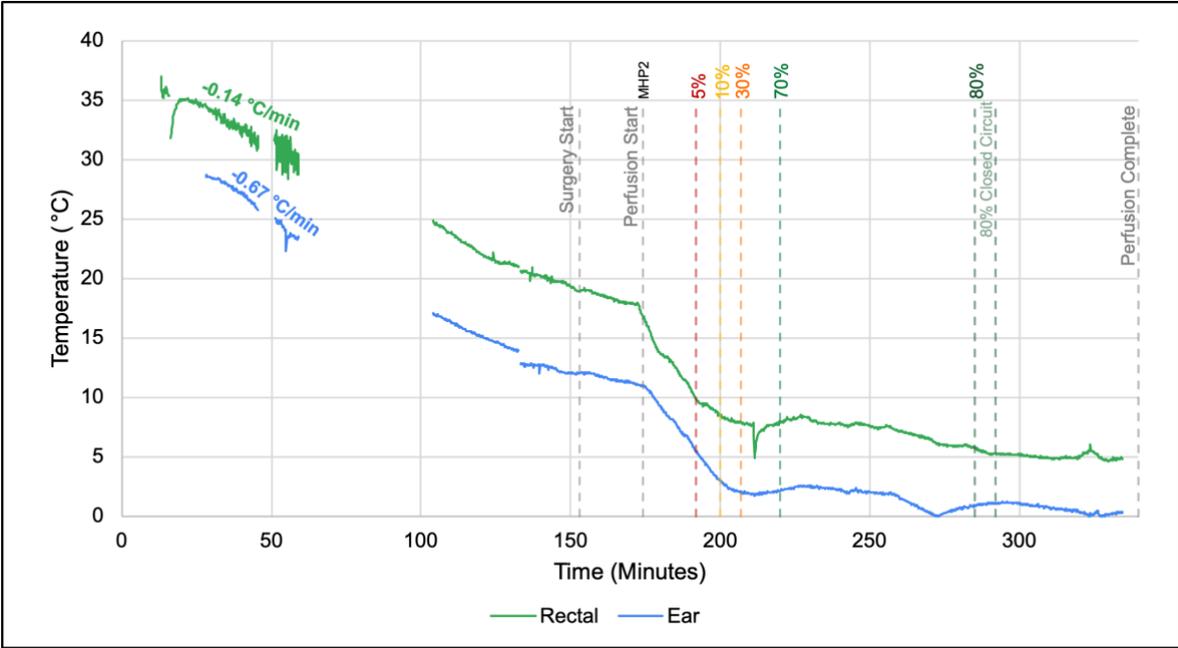


Figure 1. Patient temperature during stabilization, surgery, and perfusion, with a timeline highlighting the perfusates used. Initial cooling rates recorded by each probe are shown.

## Refractive Index

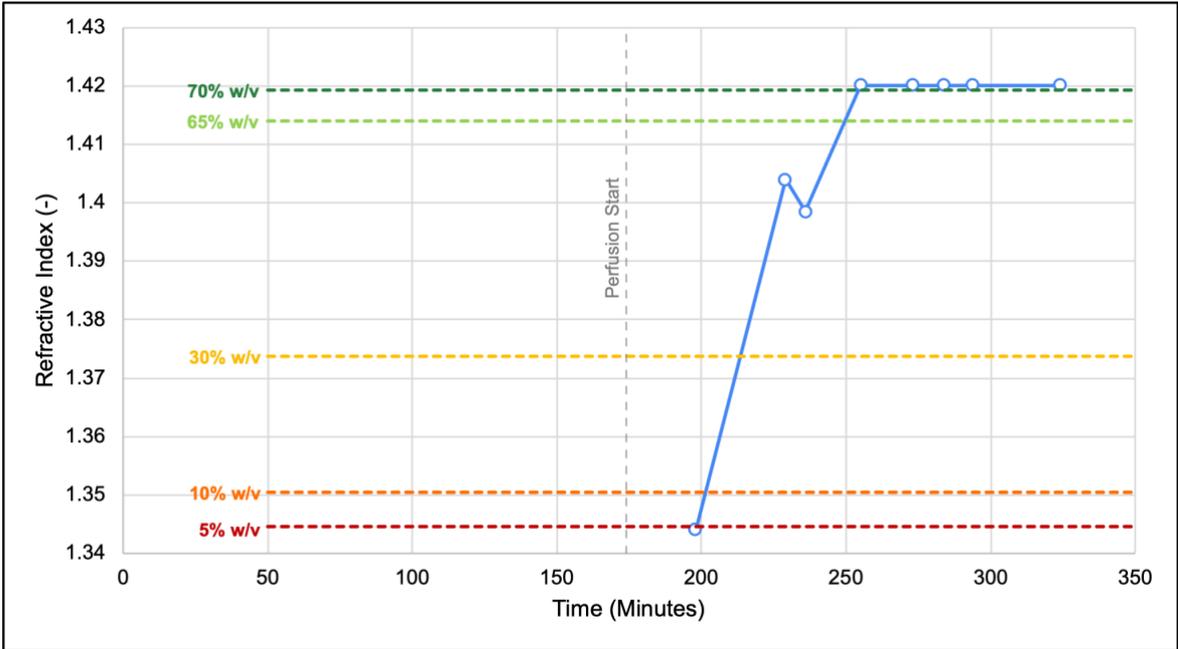


Figure 2. Patient's refractive index during surgery and perfusion.

# Pressure

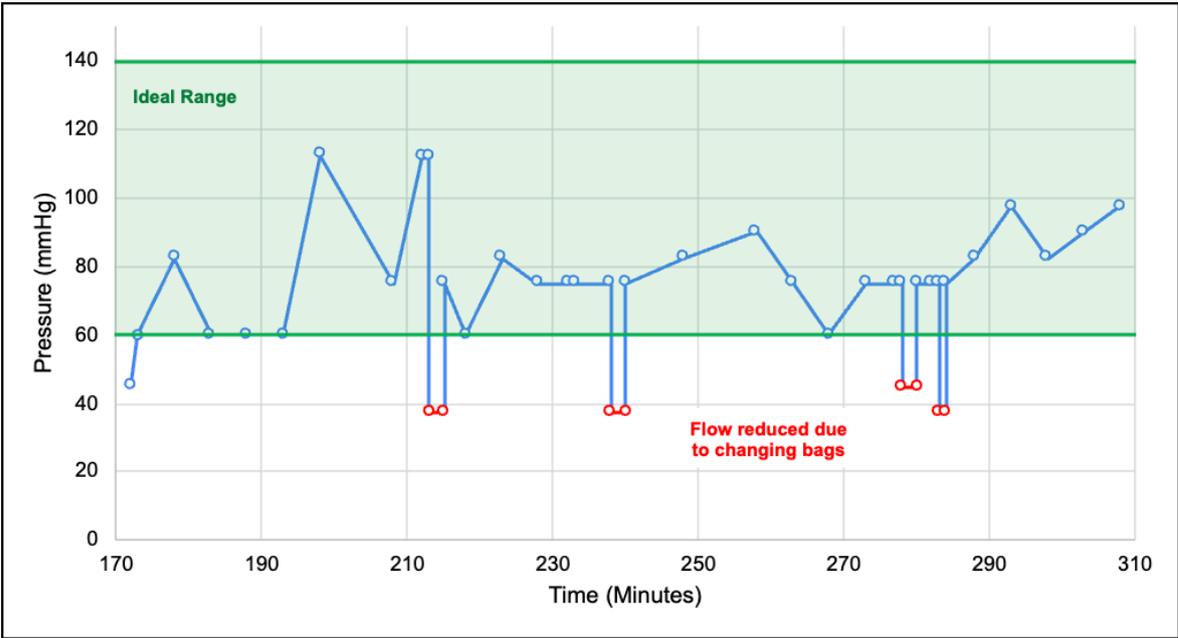


Figure 3. Perfusion pressure over time, with the ideal pressure range highlighted.

# S-MIX

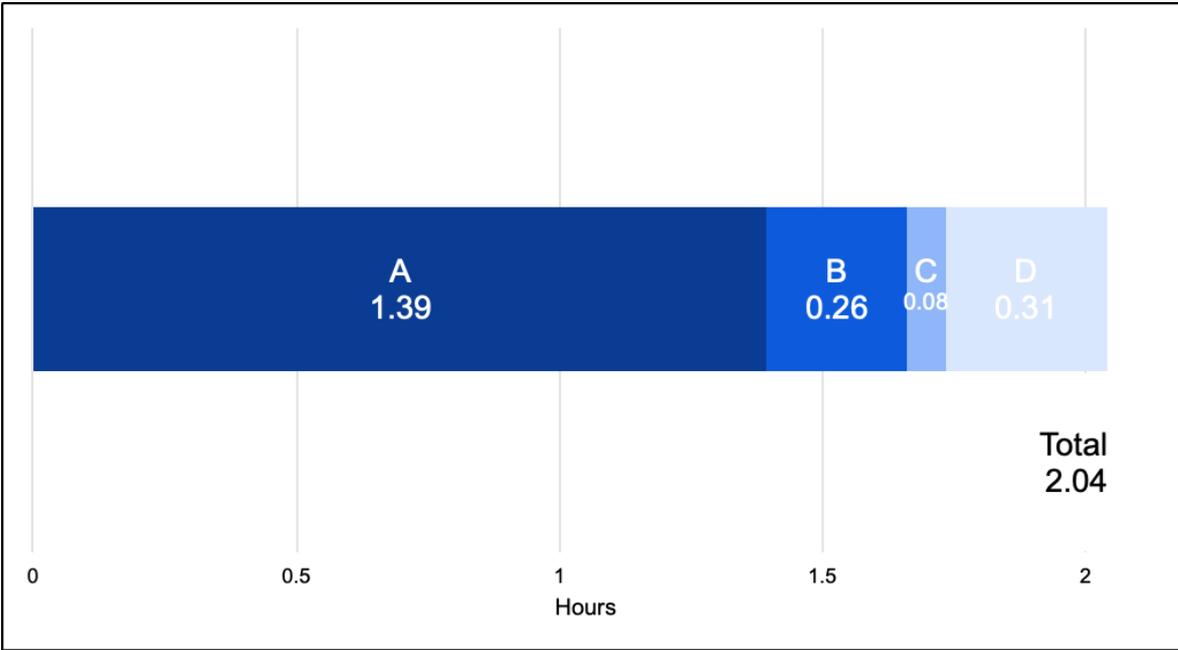


Figure 4. S-MIX calculation.

Segment A: Time of death until start of chest compressions – 1.39

Segment B: Start of chest compressions until start of surgery – 0.26

Segment C: Start of surgery until start of perfusion – 0.08

Segment D: Start of perfusion until the end of perfusion – 0.31

## Issues and Mitigation

Issue	Severity	Mitigation	Status
Issues with ice bath loading (took multiple attempts)	Medium	Replacing ambulance stretchers with Stryker Power Pro stretchers.	In Progress
Communication difficulties to off-site team members	Low	Every ambulance gets a conference speaker installed.	Completed
Fluid level was low and therefore perfusion needed to be stopped	Medium	Integrated level sensors into the perfusion kits to better notify the perfusionist.	Completed
Less experienced initial team	Low	Remote support was given to the team for guidance.	Completed

## Discussion of Results

CT scans could not be performed as the patient was transported to the United States for long-term storage and shipment to Switzerland for CT scanning was not feasible. Therefore, the quality of preservation cannot be definitively evaluated. Based on the observed dehydration and terminal venous CPA concentration at the end of perfusion, it is likely that perfusion was complete and in line with prior well-perfused CT scan results. The patient was transported on dry ice to a third-party long-term storage facility in the U.S.

## Timeline

<b>Activity</b>	<b>Timestamp from cardiopulmonary arrest (minutes)</b>	<b>Timestamp from patient pick-up (minutes)</b>
Patient transfer to ambulance	118	0
Chest compressions (LUCAS-2)	139	21
Water and ice into bath and i-Gel inserted	140	22
First medication administered	156	38
Squid pumps activated	170	52
Final medication administered	179	61
Stabilization complete	184	66
Fourth on-site team member arrived	252	134
LUCAS deactivated	270	152
First cut	271	153
Chest opened	277	159
Perfusion started	298	180
Perfusion completed	458	340