Alcor A-1130

Case Report

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1. Summary

Information was derived from multiple sources and was all converted to Mountain Standard Time (MST). For de-identification, dates are not shown. T-0 represents the date of cardiac arrest, T-X represents occurrences before T-0, and T+X represents occurrences following T-0.

A-1130 was a 66-year-old member with neuro cryopreservation arrangements. The member had not been on the Alcor Watch List but did have a history of cardiac problems. The member was pronounced legally deceased in California on T-0 days in November of 2023. Neither the estimated time of cardiac arrest nor the time of pronouncement of legal death were on the death certificate.

This was a cryopreservation without cryoprotection (a straight-freeze procedure). After recovery, the patient was driven to Alcor for cryogenic cooldown. The patient arrived at Alcor on T+2 days at 00:25 hrs. The cryogenic cooldown was initiated on T+2 days at 11:07 hrs and terminated on T+7 days at 15:50 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+15 at 11:18 hrs.

2. Patient Assessment

T-0 days

One of the patient's family members returned home at 14:30 hrs to find the member deceased. The patient had last been seen alive approximately 10 hours earlier. As neither the coroner nor the death certificate provided an estimated time of cardiac arrest, for this report the estimated time of cardiac arrest is when the patient was last seen alive, or approximately 04:30 hrs. Alcor received notification on the medical emergency line while the police were at the home.

Alcor called the standby, stabilization and transport (SST) contractor, California-based Suspended Animation (SA), to respond to this case. An SA team member arrived at the patient's home at 16:30 hrs and attempted to do initial cooling with water ice, however, the coroner would not allow ice to be applied because an autopsy was required. Alcor attorneys were notified of the situation. Two members of the Alcor team arrived later that night to wait for the coroner to release the patient.

Alcor's Scientific Advisor was consulted to ensure that cryopreservation without cryoprotectant perfusion (the straight freeze procedure) was the best option for this patient, under the circumstances of this case. The Scientific Advisor confirmed that it was.

Sidebar:
Ischemic damage of more than 24 hours can result in sufficient damage to the vasculature to potentially compromise perfusability. Alcor's preference is to attempt cryoprotectant perfusion up to 24 hours, or even longer, depending on the circumstances and at the discretion of the team.

T+1 days

At 10:00 hrs Alcor was informed by the coroner's office that they had only performed an external exam and the patient would be released at 12:00 hrs, once the family completed the

required paperwork. A local Alcor member went to the home after both the coroner's office and Alcor were unable to reach the family about the required paperwork.

The SA team waited in the parking lot at the coroner's office to be notified that the patient would be released. The paperwork was completed at 13:14 hrs and the patient was released to the team immediately.

3. Patient Recovery

The patient was moved into the Alcor van, and 200 pounds of dry ice were placed around the patient at 13:35 hrs. A thermocouple was placed in the patient's right nare. The initial temperature was 15°C. After allowing time for the patient to cool and stiffen, to make neuro separation surgery easier, the cephalic isolation was initiated at 15:00 hrs and completed at 15:25 hrs.

4. Patient Transport to Alcor

The cephalon was placed in the dry ice shipper at 15:25 hrs and covered with 30 lbs. of dry ice. The patient's nasopharyngeal temperature (NPT) was 4°C. The Alcor team left California at 17:06 hrs to drive the patient to Alcor. Patient transport was uneventful.

5. Cooling to Liquid Nitrogen Temperature

T+2 days

The patient arrived at Alcor at 00:25 hrs. The NPT was -41°C. The patient arrived just after midnight with sufficient dry ice to last until the following morning. There is no risk of further ice formation in a straight-freeze case, so the team elected to perform the transfer to LN2 cooldown later that morning.

Computer-controlled cryogenic cooldown was initiated at 11:07 hrs on T+1 days, plunging to -80°C and descending thereafter at -1°C/hour to liquid nitrogen temperature.

At the beginning of the cooldown, the LN2 valve-set failed and excess LN2 bled into the patient chamber until it was disconnected. The valve set was replaced immediately, and temperatures slowly returned to the control range (see the Discussion section). The cooldown then proceeded uneventfully until completion.

On T+7 days at 15:50 hrs, the cooldown was terminated. On T+15 days at 11:18 hrs, the patient was transferred to long-term care at liquid nitrogen temperature.

6. Timeline and Time Summaries

Timeline

T-0	04:30	Estimated time of cardiac arrest
T+1	15:25	Start dry ice cooling
T+1	17:06	Start transport of patient to Alcor
T+2	00:25	Arrival of patient at Alcor
T+2	11:07	Start of cryogenic cooldown
T+7	15:50	End cryogenic cooldown
T+15	11:18	Transfer patient to long-term care at LN2

Time Summaries

34:55	From: Till:	T-0 T+1	04:30 15:25	Estimated time of cardiac arrest Start dry ice cooling
54:37	From: Till:	T-0 T+2	04:30 11:07	Estimated time of cardiac arrest Start of cryogenic cooldown
43:55	From: Till:	T-0 T+2	04:30 00:25	Estimated time of cardiac arrest Arrival of patient at Alcor
10:42	From: Till:	T+2 T+2	00:25 11:07	Arrival of patient at Alcor Start of cryogenic cooldown
54:37	From: Till:	T-0 T+2	04:30 11:07	Estimated time of cardiac arrest Start of cryogenic cooldown

7. Discussion

This patient had not officially seen a physician for more than two years. This contributed to the initial requirement of an autopsy. The patient was released from the coroner prior to the submission of documents from the Alcor attorney.

There was approximately 11 hours between the arrival of the patient at Alcor at 00:25 hrs and the start of the cryogenic cooldown at 11:07 hrs the next day. Since the patient was at dry ice temperature (-80°C) and not in danger from 11 hours at dry ice temperature, the cryogenic cooldown was scheduled for the next morning.

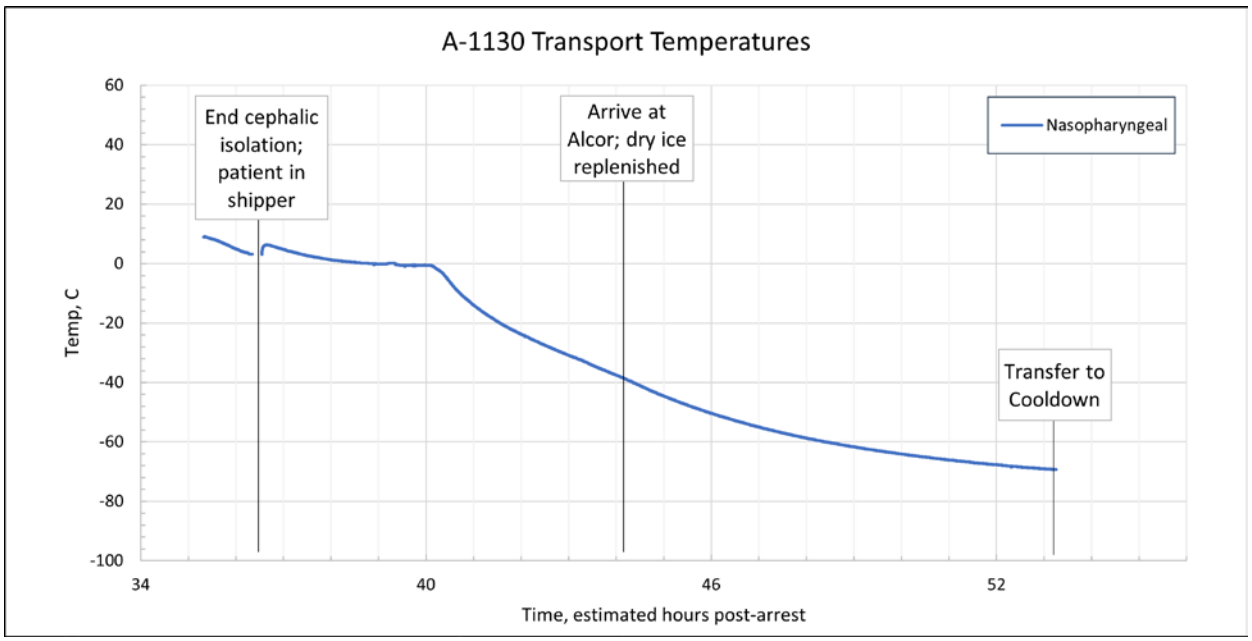
At the beginning of the cooldown, the LN2 valve-set failed at 55.65 hours post arrest (see the graph titled “A-1130 Cooldown – Valve Failure Detail”). Typically, when a valve fails it is for one of two reasons. Debris or water entering the valve prevents it from properly closing, or the valve becomes mechanically stuck in the open or closed position due to wear. Due to the rate at

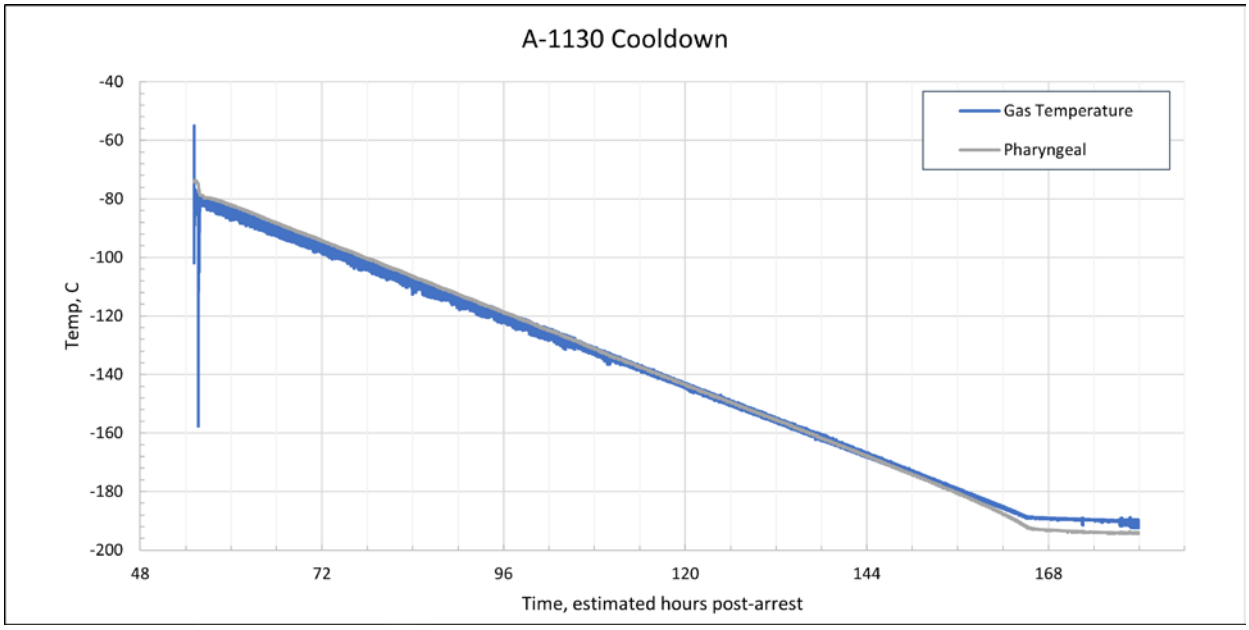
which the system cooled, the cause was most likely either water or mechanical failure causing it to lock in the fully open position. Debris usually causes a slow leak and a gradual temperature decline, not a precipitous drop. Therefore, the primary LN2 valve became stuck in the fully open position due to wear or water ingress. The secondary valve successfully halted the flow once the alarm tripped, but not before a significant quantity of LN2 was injected.

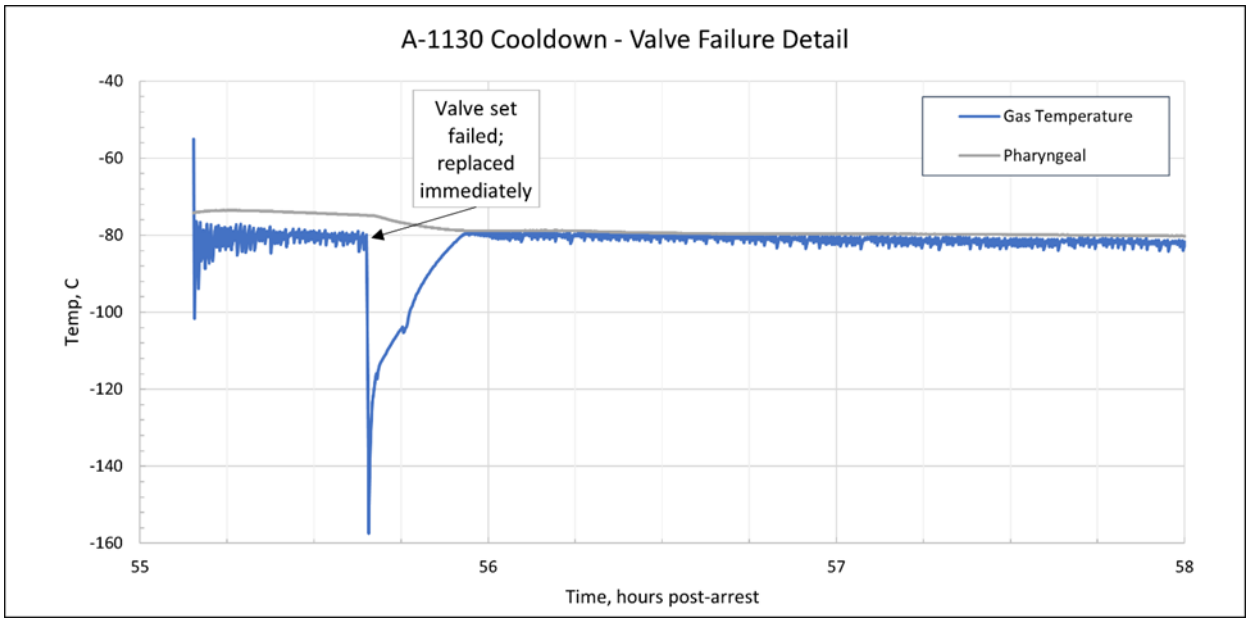
The valve set was replaced at 55.68 hours post arrest (in less than two minutes from the alarm). The patient's temperature readings went from -75.0°C to -78.8°C. As this was a straight-freeze procedure, that temperature rise was not sufficient to have any deleterious effect on the patient.

The valves are always rebuilt if they fail, checking for wear, cleaning debris, and drying them. It is felt water ingress is the most common failure mode, because worn valves are regularly removed from service. The engineering team will investigate a procedure for drying the valves after each case.

8. Cryoprotection and Temperature Graphs







9. CT Scans

Cryoprotectant Distribution (Post-cryopreservation CT scan)

Because this was a cryopreservation without cryoprotectant perfusion (straight freeze), no post-cryopreservation CT scans were obtained.