

Alcor A-1107

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 (if more than a few moments before pronouncement) or pronouncement of legal death, T-X represents occurrences on dates before T-0, and T+X represents occurrences on dates following T-0.

A-1107 was a 93-year-old member with whole-body cryopreservation arrangements. The cause of death on the death certificate was atherosclerotic cardiovascular disease. The member was pronounced legally deceased at home in California at 07:20 hrs on T-0 days in January of 2022. This case was a cryopreservation without cryoprotection (i.e., straight freeze).

The patient was driven to Alcor for cryopreservation. The dry ice cooldown was initiated on T-0 days at 11:36 hrs and dry ice temperature (-79°C) was reached at 17:50 hrs. The patient arrived at Alcor on T+4 days at 11:34 hrs. The patient was transferred to long-term maintenance at liquid nitrogen temperature at 13:18 hrs on T+4 days.

2. Notification and Deployment

Information was derived from multiple sources and was all converted to Mountain Standard Time (MST), military notation.

T-0 days

Alcor's medical answering service relayed the message at 08:17 hrs that the member was deceased. The family called police and paramedics to come to the house to pronounce legal death (see the Discussion section for more details).

Alcor's Medical Response Director (MRD) spoke to the paramedic at the patient's home at 08:20 hrs to confirm that the member had been pronounced legally deceased. The patient was in rigor mortis. A local funeral home was contracted at 09:25 hrs to pick up the patient; they were expected to arrive at the patient's home at approximately 11:30 hrs. At 09:28 hrs local police arrived at the home to allow the paramedics to leave.

The estimated time of cardiac arrest for this report is 01:00 hrs as estimated by the Sheriff and emergency medical personnel on the scene. The MRD consulted Alcor's Scientific Advisors at 09:31 hrs to determine if a cryoprotectant perfusion would be done under the circumstances of unknown length of time between cardiac arrest and pronouncement of legal death with concern that this would lead to a low quality cryoprotectant perfusion. It was decided that this would be a cryopreservation without cryoprotection (i.e., a straight freeze).

Suspended Animation (SA) one of Alcor's strategic partners for stabilization, and transport was deployed to the patient's home at 08:36 hrs. As requested, they had stopped enroute to pick up dry ice to be used in the event the medical and scientific advisors decided that this would be a

straight freeze operation (see the Discussion section for more details). SA arrived at the home in their mobile operating vehicle (MOV) and a minivan at 11:22 hrs.

The patient was carried out of the home and placed into the portable ice bath (PIB) with a privacy drape cover. The patient was then loaded into the MOV at 11:29 hrs. Nasopharyngeal thermocouples were placed, and the patient was packed in 200 lbs. of dry ice at 11:36 hrs. The funeral director arrived and advised SA to transport the patient to the local funeral home 30 minutes away while he prepared the paperwork with the next of kin. An additional 300 lbs. of dry ice were ordered and would be delivered to the funeral home.

Enroute to the funeral home SA stopped at a hardware store to obtain supplies to build the dry ice shipper. At 12:52 hrs all supplies had been purchased and SA was again enroute to the funeral home.

The patient arrived at the funeral home at 13:15 hrs but had to await the arrival of the funeral director for access to the building. The additional 300 lbs. of dry ice arrived at approximately 14:00 hrs, but SA added only 50 lbs. and decided to wait until the patient was transferred to the Ziegler before adding more. Upon the arrival of the funeral director at 14:30 hrs, SA worked with him to build the dry ice shipper, transfer the patient, and package the patient into the Ziegler case. Dry ice was applied to the patient on top of the dry ice already applied at the patient's home. A total of about 450 lbs. of dry ice was used to cover the patient.

Due to the member having not been seen by a primary care physician in several months the physician was not comfortable stating a cause of death and refused to sign the death certificate. Therefore, no transit permit could be obtained that evening. SA loaded the patient into their auxiliary minivan and drove back to their southern California office. The patient was then monitored and kept in SA's indoor warehouse to be driven to Alcor once the paperwork was received.

When there is no signoff by an attending physician the case is automatically submitted to the coroner's office for review. Once submitted, the funeral director can obtain additional paperwork (Form 5) from the next of kin to allow a coroner's office to provide a transit permit. In this case, the next of kin was unreachable for a period of time.

Once the next of kin was reached and signed Form 5, the funeral director was able to schedule a meeting at the coroner's office to take photos for the case file. After the photos were taken and reviewed by the coroner's office, the request for a transit permit was filed. If this scenario happens in the future, the coroner must inspect/photograph the remains prior to performing any specimen removal.

T+1 days

Alcor's MRD checked with the physician's office at 10:44 hrs about the death certificate and was told that it had yet to be signed. The funeral director attempted multiple times throughout the day to contact both the patient's family and the physician's office with no success.

At 17:50 hrs both the left and right nasopharyngeal temperatures (NPT) were -81°C , indicating that dry ice temperature had been reached.

T+2 days

An additional 80 lbs. of dry ice were added to the shipper. Mid-day the funeral director was able to speak with the attending physician, who still would not sign the death certificate. Therefore, the funeral director and SA arranged for the coroner's office to take pictures of the patient and then provide the death certificate (see the Discussion section for more details). The funeral director met with the family to have the appropriate paperwork signed.

3. Patient Transport

T+3 days

The coroner signed off on the cause of death at 15:31 hrs and the paperwork was filed at 19:03 hrs but could not be processed until the next day. The SA team and the patient waited at a location near the Arizona border for the final paperwork.

T+4 days

SA received the paperwork at 09:13 and began the vehicle transport of the patient to Alcor. The patient arrived at Alcor at 11:34 hrs. The left nasopharyngeal temperature (NPT) was -86°C and the right NPT was -84°C .

4. Cooling to Liquid Nitrogen Temperature

Dry ice cooling had been initiated in the field at 11:36 hrs on T-0 days and dry ice temperature (-79°C) was reached at 17:50 hrs.

A computer program was used to initiate cryogenic cooldown at 01:18 hrs on T+4 days, starting at dry ice temperature (-80°C) since the patient was already at that temperature and descending $1^{\circ}\text{C}/\text{hour}$ thereafter. This program is used to minimize thermal stresses to the straight-frozen patient. The patient was transferred to long-term maintenance at liquid nitrogen temperature on T+4 days.

5. Timeline and Time Summaries

Timeline

T-0 days

01:00 Estimated time of cardiac arrest
07:20 Pronouncement of legal death by paramedics
08:17 Notification of legal death
11:36 Start of dry ice cooling
17:50 Dry ice temperature reached (-79°C)

T+4 days

09:13 Patient transport to Alcor initiated
11:34 Arrival of patient at Alcor
13:18 Start of patient cryogenic cooldown to -196°C
----- Transfer of patient to long-term maintenance at LN₂ temperature

Time Summaries

Event Duration
hrs: mins

06:20 From estimated time of cardiac arrest to pronouncement: 01:00 hrs to 07:20 hrs

10:36 From estimated time of cardiac arrest to start of field dry ice cooling:
01:00 hrs to 11:36 hrs

06:14 From start of dry ice cooling until dry ice temperature reached: 11:36 hrs to 17:50 hrs

106:34 From the estimated time of cardiac arrest to patient arrival at Alcor:
01:00 hrs on T-0 days to 11:34 hrs on T+4 days

01:44 From arrival at Alcor to start of cryogenic cooldown: 11:34 hrs to 13:18 hrs

108:18 From estimated time of cardiac arrest to start of cryogenic cooldown:
01:00 hrs on T-0 days to 13:18 hrs on T+4 days

6. Discussion

Deployment

This patient was found by a family member in the morning after having experienced an unattended death while asleep. The time of clinical death was uncertain, being estimated by the Sheriff and emergency medical personnel on the scene as being at approximately 01:00 hrs. The patient's family was not cooperative with Alcor, which caused further delays. These issues lead to the decision that too much time had probably lapsed for cryoprotectant perfusion to be successful and therefore a straight freeze was in the patient's best interests.

Alcor deployed Suspended Animation (SA) to the patient's location and they were instructed to obtain dry ice while on the way. The location of the dry ice vendor was selected because it was on the route to the patient. There were transit permits issues with the last California case and due to the circumstances of this case, efforts were made to prevent similar difficulties.

The patient had no critical health issues at her last appointment with a primary care physician, which caused further delays because the physician would not confirm a specific cause of death for the death certificate. When there is no sign off on the death certificate by an attending physician the case is automatically submitted to the coroner's office for review. Once submitted, the funeral director can obtain additional paperwork (Form 5) from the next of kin to allow a coroner's office to provide a transit permit. In this case, the next of kin was unreachable for a period of time.

Once the next of kin was reached and signed the Form 5, the funeral director was able to schedule a meeting at the coroner's office to take photos for the coroner's case file. After the photos were taken and reviewed by the coroner's office, the Form 5 request for a transit permit was approved. If a scenario happens in the future where a member arrests unwitnessed and the physician overseeing their care will not sign the death certificate then the coroner must inspect/photograph the remains prior to performing any specimen removal, which includes biological samples.

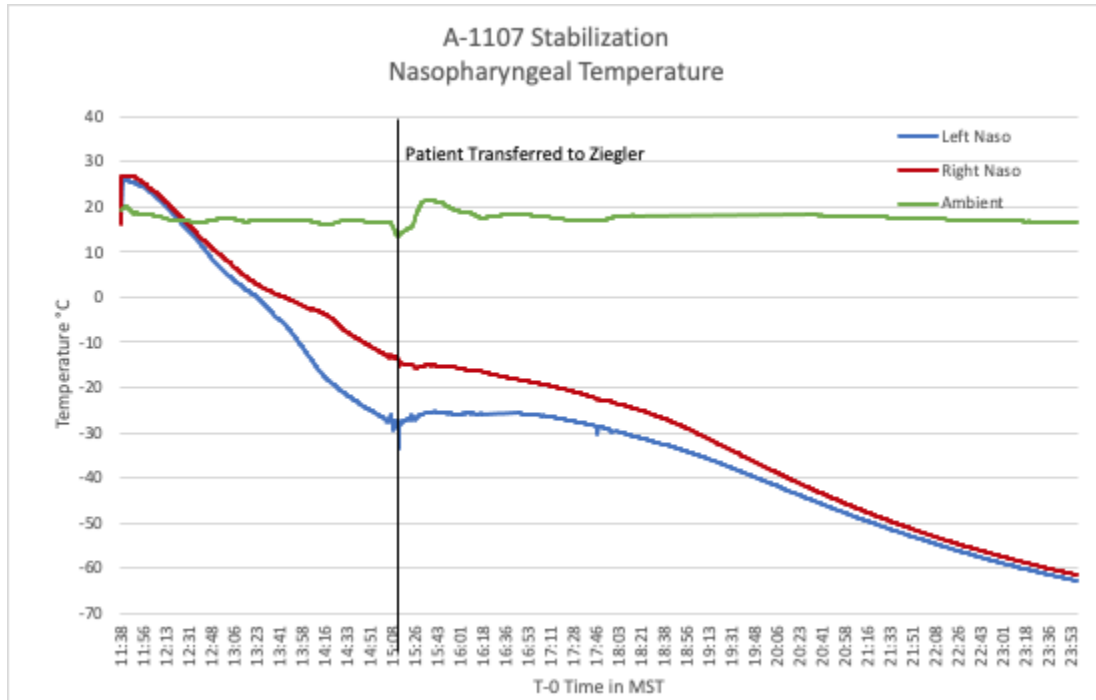
Cooldown

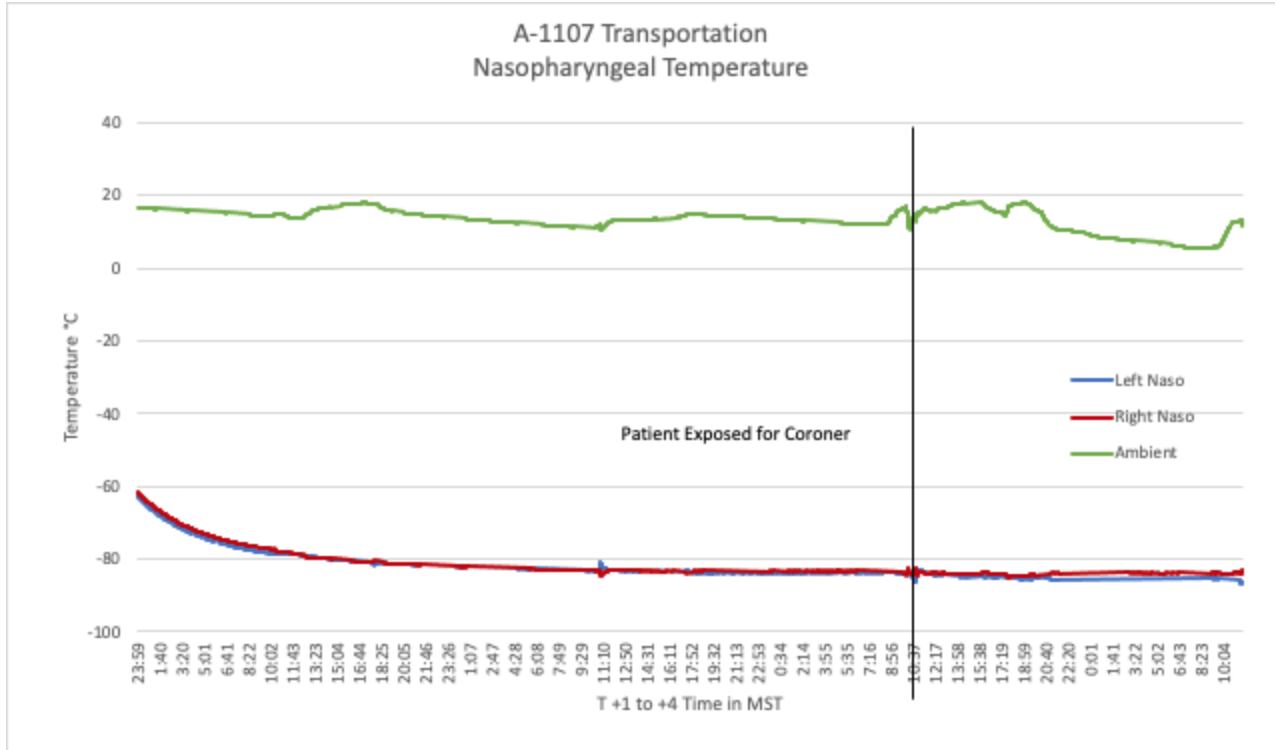
The patient's burr hole temperature is lower than the gas temperature for a significant portion of the cooldown, which suggests a problem with one of the probes or the cooldown setup itself. After terminating the cooldown, the gas temperature probe was found to have shifted from its mounting point due to repeated handling. A new probe was placed and securely screwed in the correct location.

The patient's arrival temperatures are somewhat odd; -84°C and -86°C , which are unlikely, because dry ice sublimates at -78.5°C . Even at the altitude of 35,000 feet, dry ice's sublimation temperature would only be depressed by approximately 4°C . How the patient got to this temperature is unknown. One hypothesis is that the rubber coating on the thermistors was frozen and broken off.

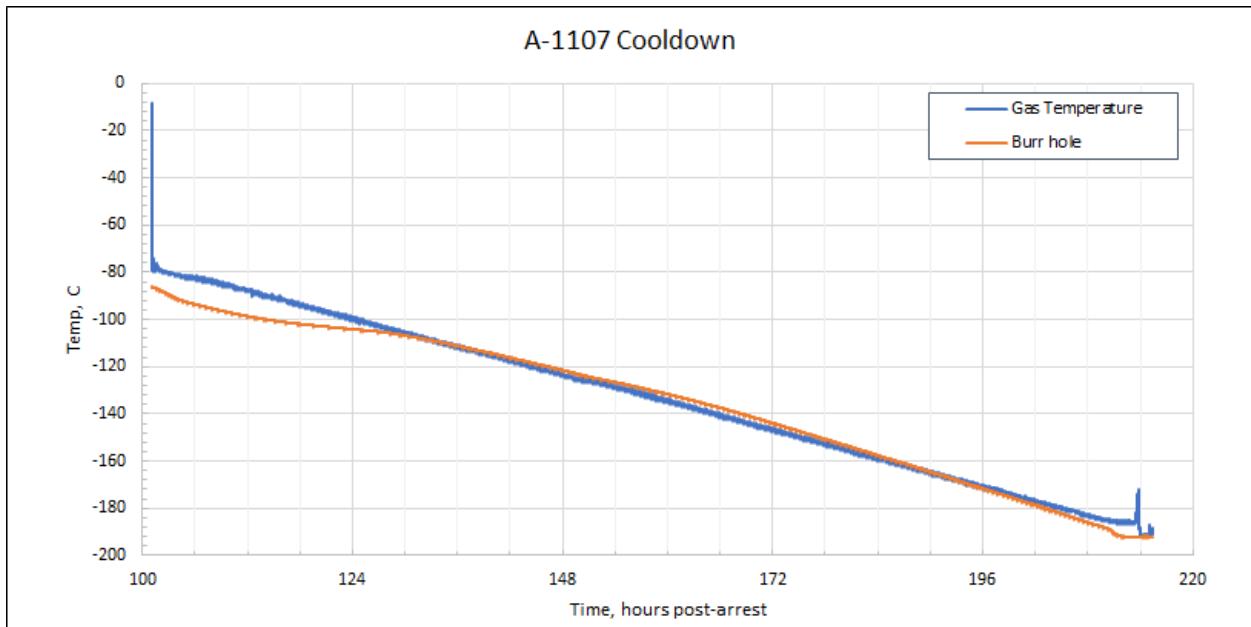
7. Graphs and CT Scans

Graphs provided by SA:





Graphs provided by Alcor:



The accuracy of the nasopharyngeal thermocouple is questionable (see the discussion section).

Cryoprotectant Distribution (Post-cryopreservation CT scan)

As this was a whole-body straight freeze procedure; no post-cryopreservation CT scans were obtained.