

Alcor A-3637

Internal Case



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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-3637 was an 81-year-old member with whole-body cryopreservation arrangements who had been a member for less than a month at the time of cryopreservation. The cause of death shown on the death certificate was cancer.

Cardiac arrest was estimated to be at 20:31hrs on T-0 days and the member was pronounced legally deceased in Hawaii at 20:41 hrs on T-0 days in July of 2023. This was a cryopreservation without cryoprotection. The patient was air transported to Alcor for cryogenic cooldown. The patient arrived at Alcor at 16:57 hrs on T+5 days. The cryogenic cooldown was initiated on T+5 days at 17:33 hrs and terminated on T+9 days at 12:24 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+49 days at 14:34 hrs.

2. Patient Assessment

T-18 days

Member A-3637 had finalized cryopreservation contracts and funding less than a month from needing to be cryopreserved. Alcor's Medical Response Director (MRD) was contacted by the member's friend and Medical Power of Attorney (MPOA) to inform Alcor that the member's condition was deteriorating, no longer mobile, and the hospice nurse stated the member would not last a month.

Over the next two weeks, many conversations were had between the MRD and the member's MPOA about relocating the member to Arizona with emphasis on the difficulties experienced in the past, specifically regarding recovering patients from Hawaii. The member was agreeable to moving to Arizona.

T-4 days

Alcor's MRD spoke with the in-home hospice nurse and learned that the member's condition had continued to deteriorate. The member was barely arousable to verbal stimuli, had severe mottling in the lower extremities, respirations were gurgled, and oxygen was being administered. However, the member's vital signs were stable. At 16:50 hrs the Deployment Committee decided to wait one additional day for another medical update before calling a deployment.

T-3 days

At 09:50 hrs, Alcor's MRD contacted a coroner's clerk for information about the laws and regulations in Hawaii (this clerk was not in the county where the member was located, but had been referred to the MRD by Alcor's general counsel as being a person who would be helpful with providing information). The clerk informed the MRD that it would be a 3-day minimum to

receive a transit permit whether it was a weekday or the weekend and that Alcor should expect a 3-7 business day turnaround to be able to transport a patient to Arizona.

With this information it was discussed with the Alcor team that a neuro-on-whole-body field cryoprotection (FCP) procedure should be considered because the amount of time between cardiac arrest and the arrival of the patient at Alcor for whole-body cryoprotectant perfusion was likely to exceed the 24-hour rule.

Sidebar:

Ischemic damage of more than 24- hours can result in sufficient damage to the vasculature to compromise perfusability.

A source of dry ice was located, and funeral homes near the member were called. The funeral homes contacted were not interested in working with Alcor.

The MRD again urged the MPOA and the member at 11:09 hrs to consider moving to Arizona. The MPOA stated the member had previously planned to move to Arizona weeks ago, but had a change of mind and now did not want to leave Hawaii until within a week of needing to be cryopreserved. The MRD explained that this was not a safe plan because Alcor had experienced difficulties in the past when attempting to recover patients from Hawaii. The MPOA would not push the member to relocate.

The MRD called Alcor's Scientific Advisor (ASA) at 12:32 hrs to explore options for improving the outcome of this case. The ASA agreed that considering the totality of the information at that time, and weighing the pros and cons, the neuro-on-whole-body procedure and patient transport to Alcor on dry ice was the best, though obviously not ideal, option. It was also agreed that since this was a whole-body member, cephalic isolation should be avoided, and that all efforts needed to be made to expedite the transit permit process as much as possible.

The following update was given to the MRD from the hospice nurse at 15:40 hrs:

Neuro: No change from the day before. The member was lethargic but rousable to verbal stimuli and was not currently complaining of pain.

Cardio: The fingers were dark pink and cool to the touch. Mottling remained in the feet. Capillary refill in the fingers took 3 seconds.

Pulmonary: Sounds of breath were audible with gurgling while the member was resting. Breathing was labored, requiring 5L/min of oxygen. The nurse noted it took about 5 whole minutes for the oxygen saturation monitor to register a reading.

Gastrointestinal/Genitourinary (GI/GU): The member was incontinent to both urine and stool, needing to be changed only twice a day. Fluid intake was less than 500cc/day. There was no estimate of the amount of urine output. The member was eating 3 meals a day and consuming approximately 25% to 50% of those meals.

The vital signs were: blood pressure (BP) 119/77, heart rate (HR) 87/min, temperature (T) 36.6 °C, respiration rate (RR) 18/min and labored, and capillary oxygen saturation (SpO₂) 96% on 5L/min.

T-2 days

The caregiver provided an update to the MRD. The member was about the same as the previous day, being more alert in the morning, and more lethargic at night. The MRD could hear the member moaning and coughing in the background of the phone call. The member was still eating at this time.

The Deployment Committee discussed the findings of the hospice nurse and agreed to continue to monitor the member closely, but deployment was not yet necessary.

The vital signs at 11:19 hrs were: BP 133/74, HR 87/min, RR 20 and labored, and SpO₂ 98% on 5 L/min.

The vital signs at 22:18 hrs were: BP 126/79, HR 89/min, and SpO₂ 98% on 5 L/min.

T-1 days

It was noted by the caregiver to the MRD at 11:18 hrs that the member was becoming confused, and mottling had started in the fingertips. The vital signs were: BP 122/83, HR 87/min, RR 18 labored, and SpO₂ 95%.

At 14:03 hrs the vitals were: BP 106/72, HR 89/min, and SpO₂ 78%. However, the caregiver sent the MRD a picture of the SpO₂ and the waveform was not uniform. The MRD called the hospice nurse to see if she would be willing to check on the member. At 16:19 hrs the vitals were taken by the weekend on-call hospice nurse: BP 106/60, HR 103/min, RR 20, and SpO₂ 95% on 4.5 L/min.

The MRD spoke with the weekend hospice nurse and learned that breathing was moderately labored with audible wheezing, but there was no gurgling or garbled speech. Mottling remained on the hands and feet. The nail beds were pale. The member was lethargic, rousable to verbal stimuli, and only able to answer yes or no. The member nodded “no” when asked if having pain. There had been no significant change in the member’s condition. The deployment committee agreed, and the MRD would continue to monitor once or twice a day with the updates from the hospice nurse.

3. Deployment

T-0 days

The MRD spoke with the hospice nurse at 13:06 hrs to obtain an update on the member’s condition, to confirm the need for the nurse to be with the member to pronounce legal death without delay, and to then inform the coroner through their normal process. The nurse was asked if the frequency of nursing visits could be increased, but that was not possible. However, she was willing to visit the member as needed, even on a non-scheduled visit day.

The vital signs at 13:33 hrs were: BP 80/54, SpO₂ 88%. The member was more confused than the day before, no longer on oxygen, was nonverbal, and was weaker. The Deployment

Committee agreed that it was time to call a Level-1 deployment. Because this was to be a neuro-on-whole-body field cryoprotection, the Deployment and Recovery Team (DART) at Alcor, consisting of the MRD and three other team members, would be deployed for this case. The earliest flights out of Arizona were for the next morning.

Sidebar:

The medical personnel on the Alcor Deployment Committee have established a list of medical indicators to assist in determining whether to call either a Level-1 standby, a high probability of death within seven days, or a Level-2 standby, a medium probability of death within seven days. The Deployment Committee voting members use these criteria when considering if a deployment is necessary.

4. Patient Recovery

T-0 days

The equipment, medications, and perfusate were shipped as cargo at 18:59 hrs. The Ziegler case and air tray were shipped the next day via FedEx. The local ice vendor again confirmed that they could supply 800 lbs. of dry ice in the form of pellets. The coroner's clerk stated he would be able to obtain a death certificate and transit permit, stating that the funeral director would not be needed for this. The hospice nurse verified that she was willing to come to the member's home to be at the bedside early to be present to pronounce at time of cardiac arrest. She also identified the physician who would immediately verify pronouncement. The member would remain a Full Code status until Alcor's team was onsite.

The hospice nurse reported to the MRD at 20:13 hrs that the member's heart had stopped. Since the member had full code status, the caregiver started manual chest compressions and 9-1-1 was called. The member was revived at 20:19 hrs and was transported to the nearest medical facility.

The MRD was notified at 22:00 hrs by a nurse at the hospital that the member's heart had stopped again at 20:31 hrs. CPR was again administered with no success. The patient was pronounced legally deceased at 20:41 hrs. The MRD requested the nurse to pack the patient with water ice in sealed bags, focusing on the head and neck. The nurse stated she would only be able to pack the head and neck and the MRD confirmed understanding.

T+1 days

The MRD was notified at 07:11 hrs that the patient had been transferred in the night to the nearest funeral home. The nurse stated she packed the patient's head and neck with water ice prior to being picked up by funeral home personnel.

The MRD tried to contact the funeral home before leaving Arizona, but it did not take calls overnight, and the answering service was for transport pick/up only.

On the layover for the flight to Hawaii, the MRD was able to contact the funeral home patient coordinator. She told the MRD that no decision would be made for patient arrangements over the phone. She stated the funeral director/CEO was in a meeting and the patient care team was

also in this meeting. She said she would pass on the request to replenish the water ice placed on the patient's head and neck, but she did not have access to the patient care area.

Upon landing in Hawaii, the MRD called the funeral home coordinator at 18:24 hrs to arrange for access to their preparation room but was again told that this could not be arranged by phone and that the MRD would have to speak with the funeral director in person.

The MRD and the DART members arrived at the funeral home at 18:45 hrs and were informed that the funeral home would not allow Alcor to access the patient or to perform any procedures on their property. It was negotiated that the funeral home would sign over the patient to Alcor custody, and Alcor would then secure a private location to perform the procedure safely.

The MRD sent the DART team to retrieve the dry ice. They called the ice vendor at 19:00 hrs to confirm the dry ice order and were informed that the vendor had just closed, and would not stay open for Alcor to pick up the order. The team called every grocery store on the island. There was no dry ice for sale at any other location available at that time of night, not even a small amount to cover just the patient's head. Alcor's Scientific Advisor and the technical staff at Alcor were consulted in the following hours, for advice on how to proceed (see the Discussion section). The decision was made to keep the patient on water ice overnight and dry ice would be purchased as early as possible the next morning to begin dry ice cooldown via straight freeze.

At 19:30 hours the patient was released into DART custody, and placed in the portable ice bath (PIB). The DART team placed 250 lbs. of water ice around the patient in the PIB, where the patient would be held overnight.

At 23:45 hours, an additional 100 lbs. of the water ice was added to the PIB. The temperature of the patient was not taken because the data logger was missing from the kit (see the Discussion section).

T+2 days

A data logger was purchased that could function for Alcor's needs as well as withstand the temperature of dry ice during transport. Only one temperature probe was available for purchase. The temperature probe was placed into the right nasopharyngeal passageway and the initial temperature for the patient was estimated to be 20°C (see the Discussion Section).

800 lbs. of dry ice was purchased at 03:00 hrs (06:00 hrs Hawaiian time), as soon as the supplier opened. With the patient in the insulated dry ice shipper and covered with dry ice, the cooldown was initiated at 12:00 hrs. This delay was due to picking up the insulated dry ice shipper and the need to find a private space because the funeral home would not allow it done on their property (see the Discussion section).

5. Patient Transport

While a safe private location was being secured for the transfer of the patient into dry ice, the MRD was also working to secure commercial air transport for the patient. The coroner's clerk the team had worked earlier had been mistaken about advising the team that a funeral home was not required to be involved in obtaining transit permits. The funeral home from which the patient had been picked up agreed to help with this. The funeral home coordinator secured transit permits and booked a flight for the following day. To avoid dry ice limitations and delays in transport, the flight reservation was made for the patient to be taken to the airline cargo department at 23:00 hours (MST) with an estimated arrival in Phoenix the next day at 09:15 hrs (MST).

T+3 days

At 17:37 hrs the transit permits had been obtained and the patient was ready to transport. The patient and shipper were ready to be accepted at the cargo department at 20:57 hrs. Unfortunately, other overweight shipments had previously been accepted, resulting in our patient being rejected. The flight had to be rescheduled. There were no direct flights. The only other flight with a semi-direct connection was the next evening with a connection in Detroit. The patient's nasopharyngeal temperature (NPT) was -76°C . The kits were accepted at cargo and shipped at that time.

T+4 days

The patient and shipper were accepted at cargo at 16:24 hrs. After waiting for nearly two hours in the Arizona cargo office to retrieve the kits from cargo, the Alcor staff member was informed that cargo personnel in Salt Lake City had failed to load the kits onto the plane, so the kits were delayed one more day.

T+5 days

Upon picking up the patient and insulated shipper at the Phoenix airport, it was found that the entire shipper had been badly damaged significantly reducing the insulating ability (see the Discussion section). The shipper had been ripped apart when the lid was shoved down into the container, rupturing the corners, and significantly reducing the insulating ability. Because the shipping container was intact when left at cargo, the damage must have resulted when the airline cargo personnel placed something large and heavy on top of the patient shipper, causing this damage.

6. Cooling to Liquid Nitrogen Temperature

The patient arrived at Alcor at 16:57 hrs. Notwithstanding the damage to the shipper, the NPT upon arrival was -71.4°C .

Computer-controlled cryogenic cooldown was initiated at 17:33 hrs on T+5 days at 17:33 hrs, plunging to -110°C and descending thereafter at $-1^{\circ}\text{C}/\text{hour}$ to liquid nitrogen temperature.

On T+9 days at approximately 00:30 hrs, the system began the final phase of its cooldown program. Due to what is believed to be stalling of the mixing motor on the lid from an unidentified cause, the gas temperature probe at the top of the tank was exposed to warming stagnant air in proximity to the lid. The elevation of the measured temperature caused the system to inject increasingly larger and larger quantities of nitrogen as the target temperature slowly descended below the measured temperature. It is typical at this phase of the cooldown to halt the computer program and manually fill the tank. Due to the late hour, however, the system was allowed to run in this high-liquid-consumption state. On T+9 days at 05:09 hrs the system then depleted its supply of LN2 and began to alarm as the gas probe near the top of the tank read elevated temperatures. The team believes with a high level of confidence that the patient was partially submerged in LN2 by this time, due to the volume of LN2 that had been injected into the tank. The fan was not repaired at this point, but the team refilled the supply tank.

On T+9 days at 12:24 hrs, the cooldown was terminated and the dewar containing the patient was topped off. On T+49 days at 14:34 hrs, the patient was transferred to long-term care at liquid nitrogen temperature.

7. Timeline and Time Summaries

Timeline

T-0	20:31	Time of cardiac arrest
T-0	20:41	Time legal death pronounced
T+2	12:00	Start dry ice cooling
T+3	17:37	Near dry ice temperature measured (-76°C)
T+4	16:24	Patient shipped from remote location
T+5	16:57	Arrival of patient at Alcor
T+5	17:33	Start of cryogenic cooldown (to -196°C)
T+9	12:24	Termination of cryogenic cooldown
T+49	14:34	Transfer of patient into long-term care

Time Summaries

00:10	From:	T-0	20:31	Time of cardiac arrest
	Till:	T-0	20:41	Time legal death pronounced
39:29	From:	T-0	20:31	Time of cardiac arrest
	Till:	T+2	12:00	Start dry ice cooling
69:06	From:	T-0	20:31	Time of cardiac arrest
	Till:	T+3	17:37	Near dry ice temperature measured (-76°C)
116:26	From:	T-0	20:31	Time of cardiac arrest
	Till:	T+5	16:57	Arrival of patient at Alcor
00:36	From:	T+5	16:57	Arrival of patient at Alcor
	Till:	T+5	17:33	Start of cryogenic cooldown (to -196°C)
117:02	From:	T-0	20:31	Time of cardiac arrest
	Till:	T+5	17:33	Start of cryogenic cooldown (to -196°C)

8. Discussion

Deployment

The logistics of this case were severely compromised by the laws, regulations, and customs of the state of Hawaii (HI). It has been discussed that a separate SOP (Standard Operating Procedure) for the state of Hawaii be written and implemented in the future. The SOP will include, but will not be limited to the following:

1. Deploying earlier than within the continental US in order to secure logistics in person/on the ground.
2. Deploying earlier than within the continental US due to the travel time/delays that may occur when traveling to this state.
3. Reaching out to funeral homes of each island to form contracts with them as soon as possible or at least 8 weeks in advance of an expected deployment.
4. Establishing transport and local residence options for HI members to the island of HI, where the local County Clerk is better able to assist with logistics, funeral home cooperation, use of facilities for procedures, etc.
5. Establishing understanding with the members that HI poses many logistical obstacles, and that moving to AZ is the best way to ensure a smooth standby and recovery.
6. Source and pick up dry ice immediately upon arrival to HI.

Patient Recovery

The temperature data logger was missing from the kit. DART and the MRD searched the island for a functional data logger that could withstand dry ice temperatures during transport. Unfortunately, the data logger purchased was not meant for long term storage of data so upon arrival, the cooldown team turned the logger off, which erased all data from the logger. This issue has been resolved by purchasing a total of 8 more data loggers and pre-packing them in each kit, rather than having to add them to the kits in real time when a deployment is called. It has been made standard practice to note initial temperatures in the team external communications in real time to avoid the loss of temperature data.

With no dry ice in which to pack the patient after field cryoprotection, the patient's temperature would rise, resulting in unacceptable damage. This suggested that the neuro-on-whole-body procedure should be replaced with a blood substitution procedure followed by storing the patient on water ice until dry ice could be sourced. At which point, full field cryoprotection could be completed. Unfortunately, the blood substitution solutions for the other procedure were not available. Alcor now takes kits for all possible situations, not just the one that appears likely early in the case.

When the MRD called the ice vendor to confirm the dry ice order she was told that the vendor had just closed and would not open until the next morning. Alcor's Scientific Advisor and technical staff at Alcor were contacted immediately for advice on how to proceed. Collaborative efforts were made to find some kind of compromise that would improve the situation for the patient. For example, the use of bladder #1, which contained only B1 solution and no cryoprotectant, to do a washout prior to the remaining bladders with increasing concentrations of cryoprotectant was discussed. But, because it had been more than 18 hours since cardiac arrest,

almost 24 hours, and the ischemic damage to the vasculature would result in poor perfusion, if any could be done at all, as well as the knowledge that by the time dry ice was available, it would be in excess of 36+ hours after cardiac arrest, the final decision was that to prevent further damage to the patient, there was no choice but to perform a whole-body cryopreservation with no cryoprotection, a straight freeze procedure. The patient was kept on water ice overnight and dry ice would be purchased as early as possible the next morning to begin dry ice cooldown.

The time between dry ice pick up and placing the patient in dry ice cooldown was delayed due to the lack of a private space to perform the process. The team did not want the patient exposed to any legal or ethical issues regarding transferring the patient from water ice to dry ice which required moving the patient from the PIB to the dry ice shipper. Several funeral homes were called, and all denied us access to do this process. The patient's home was considered, however, it was over an hour drive away, so it was decided to make attempts for a closer spot prior to resorting to that further delay. A safe private location nearby was secured, and the patient was transferred to dry ice.

Patient Transport to Alcor

Upon picking up the patient in the insulated shipper at the Phoenix airport, it was found that the entire shipper had been badly damaged. The shipper had been ripped apart when the lid was shoved down into the container, rupturing the corners and significantly reducing the insulating ability. Because the shipping container was intact when left at cargo, the damage must have resulted when the airline cargo personnel placed something large and heavy on top of the patient shipper, causing this damage.

Per mortuary regulations, human remains are shipped on a wooden airtray under the Ziegler case. This is then covered with a cardboard lid to disguise the Ziegler case, but is clearly labeled as human remains. This configuration is fragile, and no cargo department should place any items on top of it. As a result of this case, a whole-body shipper will be built and stocked at all times at Alcor HQ for shipment to a member's location, rather than building it onsite.

9. Cryogenic Cooldown Graphs

Transport data for A-3637 is unrecoverable. The HOBO logger was not taken on the case, so the team in the field purchased a combination multimeter with a temperature probe that could record a single temperature channel. However, upon arrival, the logger was turned off by the cooldown team. They did not know that this particular brand deletes all data when it is turned off – it's not designed to be a long-term storage device, just a measuring tool. So, when the logger was turned off, the data was lost. No cooldown graph could be produced. The team has received instructions regarding this.

10. CT Scans

Cryoprotectant Distribution (Post-cryopreservation CT scan)

As this was a whole-body cryopreservation, no post-cryopreservation CT scans were obtained. When the in-house scanner is functional and whole-body patients are being scanned, additional information will be added to this report.