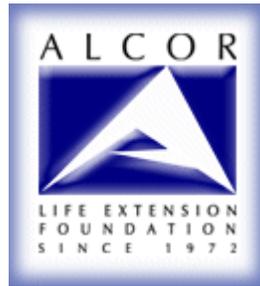


# **Alcor A-2435**

## **Case Report**



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## 1. Overview

### *Member Information*

Member A-2435, age 46, was born on October 22<sup>nd</sup> of 1962, in Baltimore, Maryland. She was a fashion designer, living in New York, NY, who became a member in 2009. Her husband is also an Alcor member.

### *Circumstances surrounding clinical death*

A-2435 was diagnosed with metastatic breast cancer that had invaded the brain and various other organs throughout her body. Clinical death occurred at 6:58 pm on August 9<sup>th</sup>, 2009 at a Phoenix-based hospice care unit located within a local hospital. In addition to hospice staff, witnesses included the member's husband as well as standby team personnel.

Just after the patient was pronounced, TeleMed was contacted by the hospice nurses to report the patient's legal death. This action sent an emergency text to everyone at Alcor Central, so they could begin to prepare for surgery.

## 2. Personnel

Personnel from both Alcor and Critical Care Research (CCR) participated jointly to support the cryopreservation wishes of Member A-2435.

### *Response Team*

Aaron Drake and Regina Pancake represented Alcor as Transport Coordinator and Readiness Coordinator, respectively, at the patient's care facility. They were supported by Jennifer Chapman, Executive Director; and Steve Harris, M.D., Chief Medical Advisor. Sandra Russell represented Critical Care Research.

### *Surgical Team*

Personnel at Alcor's surgery suite included Nancy McEachern, DVM, Surgeon; Aaron Drake, Surgical Assistant; Hugh Hixon, Cryoprotectant Perfusionist; Sandra Russell, Assistant Cryoprotectant Perfusionist; Steve Graber, Scribe; Regina Pancake, Support; Bruce Cohen; Support; and Richard Cremeens, Support.

## 3. Pre-Deployment

### *Communication*

During the approval process for membership in Alcor, A-2435's husband called Aaron Drake a few times to discuss

her medical issues. She had been diagnosed with breast cancer in 1998. Since she was unable to tolerate chemo- and radiation therapy, she elected to try various alternative, natural methods. This continued for approximately 10 years. Eventually, her personal physician convinced her to have a radical mastectomy. While PET/CT imaging appeared to show a successful procedure, she again refused any postoperative chemotherapy or radiation treatments.

In mid-2009, she began to show symptoms of vision changes. A visit with an ophthalmic oncologist and subsequent MRI revealed metastasis to the brain. A PET/CT further showed extension into the pelvis, liver, lungs, stomach, colon and cervix. As time progressed, her physical condition continued to deteriorate. She suffered from malnutrition as she became intolerant of food and liquids; her muscles atrophied from inactivity due to excessive sleep; and, she was in constant pain.

#### *Treatment in Mexico*

With only palliative care remaining for this advanced stage of cancer, coupled with her level of discomfort, she and her husband decided to seek non-FDA-approved alternative treatments outside the United States. On Saturday, August 1<sup>st</sup>, they flew to a cancer clinic in Tijuana, Mexico by way of air ambulance. The facility, Oasis of Hope Hospital, followed the Issels cancer treatment system from Europe. This system is promoted as a comprehensive immunotherapy program that is designed to stimulate the body's own regulatory, repair and immune mechanisms, to recognize and eliminate cancer cells. While this option gave hope, they realized that crossing an international boundary created logistical challenges for a quality cryopreservation. If needed, they were willing to cut her treatment short and fly back to the United States prior to death. Their personal physician in New York was very supportive of their cryonics-related decision and was willing to monitor the situation on a daily basis, by phone. Through the collective advice from her physicians, they would decide when to cut their treatment efforts short and fly back to the U.S. and ultimately Scottsdale, AZ, to be near Alcor.

Aaron continued to communicate with the husband over the course of the next week and relayed the progress to the Deployment Committee. Initially, the treatment consisted of attempting to rehydrate and renourish the patient with intravenous solutions packed with liquid vitamins, antitoxins and an amino acid diet. There appeared to be progress as the patient's liver began to function again. Her appetite returned and she started to feel better. The excitement surrounding her progress, however, was short lived. In the middle of the night, at 2:00 am, August 8<sup>th</sup>, Aaron received a frantic call from the husband. He was very concerned about his wife's condition. Apparently, over the evening she had become extremely lethargic, disoriented and semi-comatose. Her oxygen saturation had dropped to 80% on ambient air. The nurses were now giving her O<sub>2</sub> via a cannula and she still had only improved to 92%. Her blood lab results showed excessive levels of ammonia and a greatly elevated white blood count. As there were no physicians around at 2 am, the husband wanted someone to call and talk to about the situation. It became apparent that he was now leaning toward discontinuing the treatment course and starting to head towards Alcor. They discussed Alcor's relation with Hospice of the Valley and the probable logistics of having his wife flown from Tijuana to Scottsdale, via air ambulance. The husband closed out the conversation by saying that he planned on waiting until the morning to speak with the cancer clinic's physician before making his final decision.

When morning arrived, Aaron provided an update to Jennifer Chapman. She recommended they contact the local hospice facility regarding the situation. Alcor had not worked with this hospice in quite some time, and it was a good opportunity to introduce the respective parties, discuss admittance requirements and review logistical details. The hospice representative was very receptive and agreed to speak with the hospice medical director, who had previously enjoyed a positive relationship with Alcor.

Jennifer and Aaron then contacted the husband to explain the hospice admittance requirements. He again expressed concern that his wife was increasingly unresponsive and encouraged us to speak with her doctor, as some diagnostic tests were being done that day. We placed a conference call to the clinic's physician, who was about to meet with

the husband regarding the results of the diagnostic tests and requested a return call in about 45 minutes.

In the meantime, we proceeded with some logistical planning. The Alcor Rescue Vehicle was in the middle of a remodeling and refitting project and was not suitable for use. Alcor had developed multiple contingency plans in the event a vehicle was needed in the interim. Jennifer called Catherine Baldwin, the General Manager of Suspended Animation, and received permission to utilize their Southern California-based rescue vehicle. A-2435 had prepaid her membership only days earlier, so Jennifer also called the bank to confirm her prepayment check had cleared.

Aaron Drake and Dr. Harris held a conference call with the clinic's physician, who indicated that, while he would like for the patient to continue her treatment regimen, he acknowledged that her condition was indeed terminal and the outcome was inevitable. He understood and respected the individual's directives at the time of clinical death and advised that her time would be better spent traveling to the US before she deteriorated to the point where she would be unable to travel, thus compromising the opportunity for a quality cryopreservation.

### *Relocating to Scottsdale*

We had received word from the hospice that, although there were no beds initially available, the organization's medical director made arrangements to accommodate the patient by ordering an extra room and bed. With that settled, the husband began to make plans with a local ambulance company to transfer his wife to the airport in Tijuana, MX for an awaiting medical air ambulance to fly her to the Scottsdale airport. He arranged for her to be transported by ambulance to the hospice upon landing in Arizona, and Aaron provided the local hospice contact information, so the husband could start the hospice's admittance process remotely.

At this point, Jennifer, Aaron, and Hugh held a consultation. The plan was for Aaron to meet the patient when she arrived to observe her admittance to the hospice program. This would allow him to speak with the hospice nurses, evaluate her condition and assess whether a team should be assembled to initiate a standby. We discussed whether to load the Alcor Suburban with

Alcor's emergency response kits and other equipment. Based on comments from the clinic's physician that the patient was not in immediate danger of death, we decided to await the results of her initial physical assessment by the hospice. The Deployment Committee would then decide whether to initiate a full standby.

### *Arrival in Scottsdale*

The patient was not scheduled to arrive until around 6:00 pm, August 8th, which allowed some time for logistical planning. Knowing that the patient was unconscious, Jennifer advised Hugh to begin preparing the operating room, which was several hours away from being ready. Jennifer confirmed with Dr. Harris that SA's vehicle, which is maintained by CCR, was ready to deploy and arranged for Sandra Russell to drive the vehicle to Arizona later that evening.

Aaron maintained contact with the airline ambulance's dispatch so he could be at the Scottsdale airfield when the plane arrived. The plane landed at 6:40 pm. As Aaron was going through security to drive out to the plane, the air ambulance's paramedic in charge of the patient called Aaron's phone to let him know of his emergency medical concerns. He reported that while they were in the air, the patient began to desaturate and exhibit signs of labored breathing. They considered attempting rapid sequence intubation (RSI) in order to maintain a patent airway, however high flow oxygen was sufficient to maintain adequate levels of oxygenation. He continued that since the patient was unstable, their protocols dictated that they transfer the patient "code three" by ground ambulance to the Emergency Department of the hospital.

Aaron recognized that this action could create some potential problems if the member suffered cardiac arrest while in the ambulance or in an emergency room as the medical examiner may feel the need to perform an autopsy due to the patient's age, regardless of her medical history. Aaron quickly called the inpatient coordinator of the hospice organization to relay the situation. If the patient needed immediate stabilization, it could still be provided through the hospice unit, without bureaucratic impedance. Aaron told the paramedic not to wait for him to come to the ambulance and that he would instead meet them at the hospital entrance. Aaron, being very familiar with the streets and traffic patterns, actually arrived prior to the

ambulance. When the ambulance arrived, the paramedics were instructed by hospital personnel to take the patient directly to the hospice unit as a “direct admit” and bypass the emergency department.

### *Hospice Unit*

Aaron accompanied the patient and paramedics to the hospice unit and received a medical report on the way. As a paramedic, Aaron understood why the air ambulance medics were so concerned with the patient’s condition. From an emergency medical perspective, it appeared as though she could clinically die at any moment. However from a hospice perspective, while the patient was very critical and needed constant monitoring, she probably had more time before she would arrest. The patient was delivered to the hospice unit and transferred to her bed. The husband provided copies of her medical documents and the administration completed her admittance.

Without complete information about the patient’s condition, Jennifer contacted our hospice representative who explained that the patient was actively dying but was expected to live awhile longer. Jennifer confirmed the hospice would pronounce her quickly and that Alcor’s team would be given immediate access to the patient thereafter. They also discussed placement of Alcor’s equipment in the room.

### *Transportation*

Knowing that Sandra was planning to drive the vehicle later that evening, Jennifer contacted Steve Rude to arrange a temporary transportation van that could be stationed at the hospice until Sandra’s arrival. If necessary, the van could transfer the patient in Alcor’s portable ice bath, along with the team, back to Alcor.

Jennifer directed Hugh to load Alcor’s Suburban with the response equipment based on a previously determined inventory list and requested that Bruce Cohen, an Alcor member volunteer, deliver it to Aaron at the hospice. When the Suburban arrived, Aaron discovered that not all components of the medication kit were gathered upon departure. Jennifer drove the remaining supplies over to the hospice herself. With the complete response kit at the hospice, all of the supplies were positioned in the patient’s room. The nursing staff provided an update of the patient’s condition now that she was stabilized. After learning that

Aaron and/or other Alcor team members would be there for the duration of the individual's stay, they offered the adjacent break room to use as a work area or to rest.

#### **4. Deployment**

Jennifer and Aaron called Dr. Harris to provide him with a summary of the events along with the most recent vital signs of the patient. There were still a number of puzzling questions as to why the patient was exhibiting certain signs and symptoms, making it difficult to determine how long she may have before clinical death. Many of these questions could be answered with some specific lab work and a few diagnostic tests. Dr. Harris provided Aaron with a "wish list" of tests to request. It was evident that a standby needed to be initiated immediately and the Deployment Committee made it official.

Typically, once a patient enters into hospice, diagnostic tests are not performed, as the main objective is to only provide comfort until death arrives. As these were extenuating circumstances, and Alcor has maintained a strong relationship with this facility, a request of this type might be granted. The requests were given to the head nurse of the unit and she said she would ask the medical director for permission. He graciously approved the entire list.

After communicating with Jennifer and establishing the plan for the following morning when Sandra Russell would arrive with the Suspended Animation rescue vehicle, Aaron returned to the patient's room and spent some time getting to know the husband, learning about his wife and their life together. As the husband had not yet eaten that day and had been awake for more than two days straight, the staff provided him with a tray of food; he then fell asleep in the chair next to his wife's bed. Aaron requested that the nurses provide him with updates on the patient's vital signs every hour through the night and he then retired to the adjacent room.

### *Additional team members*

There had been no major change in the patient's condition overnight. The next morning, Sunday, August 9<sup>th</sup>, Sandra called to say she was still driving, though now within the city limits. Prior to arriving at the hospice, she intended to stop and purchase fresh ice for the additional ice chests she had brought with her. Jennifer spoke with Aaron about a rotation schedule of staff to provide relief, as the length of the standby was unknown. Jennifer again spoke with Catherine Baldwin and inquired about sending one or possibly two SA team members out to Phoenix to assist on the standby as independent contractors. Catherine was agreeable, however they would not be able to catch a flight out until late in the day, and arrive sometime much later that evening, or catch a flight the following morning. We discussed the terms of the contract and what would be expected of the team members. They tentatively agreed on a plan to send Kelly Kingston, an experienced member of Suspended Animation's team, however she would check with Alcor before departing, as the conditions of the standby could change over the course of the day. They elected to have her travel to Phoenix on Sunday morning. Since her role was to provide relief for team members as they become exhausted, the team in place would be able to cover until that time.

When Sandra arrived at the hospice, Aaron provided her with an orientation of the facility and introduced her to the patient's husband. The rescue vehicle was positioned closest to the building exit that would be used and the driver with the Rude Family Mortuary van was thanked for his services and released to return home. It was decided that since the Suspended Animation portable ice bath was secured to the inside of the rescue vehicle, it would be safer for the team to use it over the Alcor ice bath. These were switched out and taken, along with the ice chests, to the patient's room.

### *Active Monitoring*

Aaron had earlier requested that a cardiac and pulse oximetry monitor be brought to the patient's room. Most hospice patients have no monitoring devices attached to notify nursing staff when a patient's heart is failing, or more importantly, when they have arrested. While this may be acceptable for the typical patient, those precious minutes between clinical death and when a patient is discovered are critical.

By setting alarms to sound at minimum levels of both cardiac activity and oxygen saturation, the standby team would have early notification that their work is about to begin. This unit had arrived and it was connected to the patient and the alarms were set.

Jennifer requested an update from Aaron. By now, the lab and test results that had been requested by Dr. Harris were starting to come in and indicated the patient's health was rapidly declining. The Deployment Committee spoke over the phone to discuss the findings. In consulting with Dr. Harris, he felt that the patient would likely experience clinical death the same day. It was decided that Alcor should plan to use local staffing resources and begin to prepare the medications. Aaron called Regina Pancake, Alcor's Readiness Coordinator, and asked for her to come to the hospice to provide additional standby support.

*Preparation of equipment  
and medications*

Sandra and Aaron then started the process of preparing all the medications. With only two people, this can take upwards of an hour to complete. Once a patient is pronounced, the medications are injected through an IV administration set. This can be very time consuming as many of the medications are reconstituted and therefore pushed through a filter during administration. Pushing through this filter is very slow and takes time away from other important chores. Since there was time available, Sandra suggested that they pre-filter the medications now to save time later. Aaron agreed; the process took about an hour. Aaron pointed out to Sandra another timesaving measure – he had noticed the patient had a central line catheter installed in her upper chest. It contained two ports that could both be used to administer medicines immediately when the patient was pronounced, rather than wait while an I.V. or I.O. was established. Aaron had also requested that the line be flushed by the hospice nurse to ensure that it was still patent.

By mid-afternoon, Regina had arrived and her presence provided Aaron with an opportunity to rest. He too had very little sleep since the husband had called in the middle of the night, two days prior. He tried to rest in the break room, but with nurses coming and going out of the room, sleep proved difficult. The patient's vital signs were still being reported on an hourly basis. If the

numbers continued on their current trend, clinical death should occur in a few hours. Aaron reported this information to Jennifer, and she made sure that Alcor's O.R. was prepared and all the individuals who would participate in the surgery were notified and ready to respond. Jennifer had spoken with the husband and arranged appropriate standby funding, because Alcor's Comprehensive Member Standby program does not provide coverage during the first six months of membership.

At 6:45 pm, the husband came rushing out of the room into the hallway and was very concerned with his wife's breathing. His wife's breathing had become very erratic and he thought she might have stopped breathing altogether. Since the monitoring alarms had not sounded this was not likely; however, this probably signaled that the end was near. The nurses and Alcor's standby team went into the room and saw that while the patient was breathing erratically, she was still alive. Her vital signs were hovering just above the alarm settings. Aaron requested that the head hospice nurse, as well as the standby team, now stay in the room through the duration. The standby team donned their personal protective equipment and moved the prepared medications tray next to the patient's bed. A layer of ice was placed in the bottom of the portable ice bath. A bag of saline with an IV administration set was prepared and hung on the IV pole and the air hose was connected between the O<sub>2</sub> tank and the Michigan Instruments Thumper.

Within a few minutes, the alarms begin to sound that the patient's heart was beginning to fail. The monitors were now turned off, disconnected and moved away from the bedside. Everyone began to watch the patient's breathing. If a full minute passed between breaths, the hospice nurse indicated she would check for a pulse. Over the next five minutes, her breathing became less frequent to the point where she displayed only an occasional agonal breath – the irregular gasping often seen during cardiac arrest.

As of 6:56 pm, one minute had passed with no breath and the nurse checked the patient for a pulse. The nurse was startled as the patient took one final agonal breath. The nurse let another minute pass; there was no movement and she again rechecked for a pulse. There was none. At 6:58 pm, the nurse softly pronounced that the patient was legally deceased and nodded for Alcor to begin their work.

## 5. Field Stabilization and Cooling

### *Initial procedures after pronouncement*

Aaron immediately turned on his voice recorder, and within 45 seconds had pushed the first five medications followed by a saline bolus through the central line port that was still in place. The team grabbed the four corners of the bed sheet, lifted the patient off the bed and moved her to the ice bath. Sandra and Regina worked quickly to completely cover the patient with ice. Aaron placed the thumper over the patient and turned it on. The device began to compress the patient's chest, circulating the medications that had just been administered throughout the blood stream. The prepared IV tubing that was hanging on the pole at the end of the ice bath was now attached to the patient's ports. As Aaron established and secured an airway with a Combitube, Sandra and Regina continued to push additional medications through the IV line, calling out the name of each medication as they finished. Aaron repeated everything that he heard to ensure that the voice recorder he was wearing around his neck kept track of every action.

### *Preparation for departure*

As the team worked through the medications, Regina was directed to move the rescue vehicle to the ambulance entrance and to wait so the patient could be moved directly into the waiting vehicle. She took with her some of the equipment that might be needed during the short ride from the hospice to Alcor. Two security guards, who had been requested earlier, were now present and waited to accompany the patient and the team through the hospital. As the last of the medications were pushed, the ice bath and the equipment that would accompany the team as they traveled to Alcor were gathered and prepared for transport.

The security guards provided an escort through the hospital. The patient and ice bath were taken down the service elevators to the main floor and directed through the

back offices to the Emergency Department entrance. Enroute, the O<sub>2</sub> began to run out. The ice bath was rolled up the ramp of the rescue vehicle and secured to the interior side wall. Aaron entered the back of the vehicle with the patient while Sandra prepared to drive. The patient's husband rode along in the passenger seat. Regina took her personal vehicle and had Sandra follow her back to Alcor Central. Just prior to departure, Aaron attempted to connect the thumper to SA's O<sub>2</sub> tank, finding however that the fittings were incompatible. He then pulled out the Ambu Cardiopump and began performing manual compressions.

## 6. Transportation

### *Continuation of CPS*

At 7:28 pm, the team departed for Alcor with the patient. Aaron continued to perform CPS and stopped every five minutes to administer 1 mg of Epinephrine, consistent with Alcor's stabilization protocol. The ride from the hospice to Alcor took 30 minutes. Sandra called Alcor while enroute to keep them updated as to their expected time of arrival and to ensure that the doors closest to the surgery bay were open and plenty of staff was available to assist in moving the patient. Suspended Animation's vehicle pulled up to the rear of Alcor at 7:58 pm and everyone helped roll the ice bath down the ramp and into the building. Aaron continued compressions until the patient was in the operating room and he was relieved by Bruce Cohen.

## 7. Surgical Procedures

### *Move to surgical table*

Manual CPS was continued on the patient while fresh ice was brought in from Alcor's ice machine. The existing ice was removed from on top of the patient and she was pulled out of the ice bath and placed on the OR surgical table at 8:11 pm.

Testing of the sternal saw prior to the surgery revealed that the flexible shaft had frozen up. The problem was handed to Richard to deal with, and he had it unfrozen in a few minutes. The shaft was subsequently disassembled and lubricated.

### *Burr Holes*

The patient's head was shaved to prep for the burr holes to be drilled. These are used to monitor the temperature of the patient's brain as well as a way to visually watch for swelling. While the burr holes were being drilled using a craniotome perforator, Aaron prepped the patient's sternum with Betadine, an antiseptic agent used topically to destroy microbes. Dr. McEachern cleaned each of the burr holes as they were completed. At 8:42 PM, she stood on a step stool to gain a higher position above the patient in order to perform a median sternotomy. This is a procedure in which a vertical inline incision is made along the sternum, after which the sternum itself is divided to provide access to the heart for cannulation. Dr. McEachern cut through the skin of the chest with a scalpel. The guide of the saw blade was placed below the sternum. Richard operated the foot pedal on the floor as she guided the saw up the sternum. She talked through the procedure, step by step, to Aaron so he could gain additional training in its operation and application. After the sternum separation was completed, the chest was opened with Finochietto spreaders and the pericardial sac was exposed. Access to the heart was accomplished by cutting through the pericardium.

### *Vascular Access*

Dr. McEachern performed an arterial cannulation of the heart by sewing a purse-string suture into the wall of the aortic arch, puncturing the vessel within the purse-string, and advancing and securing the catheter. She then repeated this process for venous cannulation of the heart, going into the right atrium and advancing the cannula into the inferior vena cava. This process took approximately one hour and was completed at 9:48 PM. A thermocouple was placed under the dura through the burr hole at 3.0 hours post-arrest. Brain temperatures were taken under the dura and beneath the brain (nasopharyngeal).

### *Perfusion*

Now the washout could begin. This process is used to replace the patient's blood with cryoprotectant. The extracorporeal perfusion circuit had been primed with B1 base perfusate solution prior to the surgery and was being circulated through the bypass loop. When cannulation was complete, the circulation was transferred from the bypass loop into the cannulas. The circuit was switched from closed to open circulation and the blood was washed out of the patient's vascular system, the visual blood concentration going from opaque to light pink.

At the end of the washout, the extracorporeal circuit was switched back to closed circulation and the cryoprotective ramp was started at about three hours post-arrest. Pressure at the arterial cannula inlet was held at about 100 mmHg throughout the cryoprotection, the pump speed being reduced as the circulating cryoprotectant became more viscous due to the temperature decreasing and the cryoprotectant concentration increasing.

M22 cryoprotectant concentrate was added over the next hour and a half and the temperature of the patient lowered to 3C. At that point (4.65 hours post-arrest) The cryoprotectant concentration was approximately one-half of the desired endpoint concentration and the cryoprotective ramp was stopped for the patient to equilibrate with the circulating cryoprotectant solution and the temperature of the circulating perfusate was dropped to -3C, as was the rest of the system.

At 4.85 hours post-arrest, the second phase of the cryoprotective ramp was started, and cryoprotectant concentrate was added as rapidly as possible to over 100% of the desired terminal concentration and then held there. The cryoprotectant concentration of both the entering perfusate and the venous effluent were monitored both with the inline refractometers of the data collection system and with a bench refractometer.

At 5.6 hours post-arrest, the ramp was paused to lower the level of the circulating perfusate in the mixing reservoir, draining the system in to the waste tank, and resumed at about 5.8 hours post-arrest.

At 7.43 hours post-arrest, the pump shoe was changed from 3/8" ID to 1/4" ID to use a higher pump speed with better control as viscosity had increased and the speed had been reduced to maintain the perfusion pressure.

#### *Completion of procedure*

Just after 4:00 am (9.5 hours post-arrest), Hugh determined that the proper terminal cryoprotective concentration had been achieved (venous return above desired terminal concentration for over 30 minutes) and the pumps were turned off and the process was shut down. Seventy liters of cryoprotectant concentrate had been used.

During the cryoprotection, the patient's skin became mottled and the eyes partially collapsed, as is normal as water is replaced in the patient. No notes were made of the brain volume. As is normal, most of the effluent was lost through the mouth, probably from the lungs, rather than being withdrawn from the extracorporeal circuit.

The patient was disconnected from the extracorporeal perfusion circuit, and the chest and burr holes closed. The patient was moved from the surgical table to the fast cooldown box, where the temperature was dropped to -110 Celsius immediately. The patient's interior brain temperature reached -110C about 19 hours post-arrest, and she was held at that temperature for the next 190 hours (8 days). This hold was imposed because another patient was being cooled down in the cooldown dewar.

Because of the long holding time in the fast cooldown box, there was water condensation and ice buildup around the motor of the circulating fan of the cooldown box, and various expedient methods were used to remove the water and ice and insure the continued operation of the fan. Subsequently, insulation was applied to the interior of the circulating plenum below the motor to correct this problem.

At 211.7 to 212.25 hours post-arrest, the patient was transferred to slow cooldown, being placed in a precooled mummy bag in a patient storage pod and moved into the cooldown dewar. Slow cooling was done at 1C/hr from -110C to -196C, and the cooldown dewar filled with LN2.

*Placement into long term storage*

On September 9th 326 hours post-arrest, the patient was transferred at LN2 temperature from the cooldown dewar to long term storage in a bigfoot dewar.

A-2435 is now Alcor's 89<sup>th</sup> patient.

## 8. Timelines

### Pre-Stabilization Timeline

Saturday, 8/8/09

- 8:55 AM J. Chapman, A. Drake consult; Concerned patient may die in Mexico; Called HOV to discuss admittance requirements and locations; Explained admittance requirements to spouse; Attempted to speak with Dr. Jiminez regarding patient's condition
- 10:00 AM J. Chapman requesting rental of SA vehicle
- 10:41 AM J. Chapman, A. Drake consult; Spouse is trying to decide whether to continue treatment or transfer to hospice care in Arizona; Continued coordination with HOV regarding an available bed
- 11:12 AM J. Chapman, A. Drake consult; HOV created a bed for the patient; Following conference call with S. Harris, Dr. Jiminez recommends transferring patient to Arizona; Spouse making air ambulance arrangements
- 11:47 AM J. Chapman, A. Drake consult; Direct admit approved; Arrival time is 6:00 pm; Ambulance transport arranged
- 11:52 AM J. Chapman, A. Drake, H. Hixon consult; Discuss hospice location; A. Drake will meet patient upon landing
- 12:17 PM J. Chapman coordinating SA vehicle
- 12:23 PM J. Chapman, H. Hixon consult; OR to be prepared in advance of landing
- 1:02 PM J. Chapman, H. Hixon consult; N. McEachern to be on alert
- 1:24 PM J. Chapman, A. Drake consult; A. Drake to await initial assessment of patient's condition upon landing; J. Chapman advised not to touch patient until post-pronouncement
- 3:53 PM J. Chapman arranged for S. Russell to drive SA vehicle and assist with standby
- 7:01 PM J. Chapman, A. Drake consult; Patient's vitals were concerning upon landing; Ambulance taking her to hospice
- 7:26 PM J. Chapman consult with HOV regarding patient's arrival
- 7:48 PM J. Chapman arranges temporary transportation until SA vehicle arrives
- 8:05 PM J. Chapman consult with HOV regarding patient's condition; She is actively dying, but will not die within the hour; Obtained approval for stationing equipment in her room; Confirmed pronouncement procedure
- 8:14 PM J. Chapman consult with S. Rude regarding dispatch of temporary van
- 9:10 PM J. Chapman dispatches B. Cohen to drive Alcor's kits to HOV
- 9:19 PM J. Chapman assigns H. Hixon to load Alcor's vehicle
- 9:45 PM J. Chapman delivers meds to HOV
- 10:16 PM Deployment Committee officially launches standby
- 10:30 PM J. Chapman delivers additional supplies to HOV

Sunday, 8/9/09

8:39 AM J. Chapman, A. Drake consult; No major changes in patient overnight; S. Russell's ETA is 30 minutes  
 9:37 AM J. Chapman consult with K. Kingston regarding standby relief  
 11:05 AM J. Chapman, A. Drake consult with C. Baldwin regarding standby relief; Discussed standby procedure; A. Drake plans to use SA's ice bath and thumper; Discussed possible standby schedules and rates  
 11:08 AM J. Chapman, A. Drake consult; Discussed readiness and frequency of vitals; Pulse-ox monitor placed; Discussed alternative sources of standby relief  
 11:28 AM J. Chapman, A. Drake consult; Lab test results are in; Pronouncement looks imminent  
 12:19 PM J. Chapman coordinates with spouse regarding standby payment  
 12:54 PM J. Chapman, H. Hixon consult; R. Pancake to join standby  
 1:26 PM J. Chapman coordinates with spouse regarding standby payment  
 1:31 PM J. Chapman, A. Drake consult; Patient's pressure is dropping  
 1:44 PM J. Chapman, H. Hixon consult; OR should be ready within 30 minutes  
 5:24 PM J. Chapman, R. Pancake consult; Meds are drawn  
 7:01 PM TeleMed sends text indicating patient pronounced

**Stabilization Timeline:**

6:58 PM Patient pronounced  
 8 seconds – 120 mg Propofol administered  
 20 seconds – 250,000 IU Streptokinase administered  
 38 seconds – 100,000 IU Heparin administered  
 45 seconds – 1.0 mg Epinephrine administered  
 54 seconds - 30 U Vasopressin administered  
 6:59 PM 60 cc Saline bolus given and IV attached to port  
 Directed Nurses to call Alcor's Emergency 800 number to alert network  
 7:00 PM Patient moved to ice bath, cut away clothing to fully expose  
 Added additional I.V. line to second central line port  
 Ice placed on top of patient  
 7:02 PM Thumper positioned over patient  
 7:03 PM Thumper started and chest compressions begin  
 Thumper stopped to insert Combi-tube  
 7:04 PM Combi-tube placed, thumper restarted.  
 1 mg Epinephrine administered  
 400 cc Vital Oxy administered  
 1.5 g NiKy in 100 cc Citrate-Dextrose administered  
 7:05 PM Telemed notification received  
 7:08 PM Nasal-Gastric tube inserted  
 7:09 PM 400 mg SMT in 50cc Citrate-Dextrose administered  
 7:11 PM 1 mg Epinephrine administered  
 7:12 PM Hydroxy Tempo flakes in 50cc Citrate-Dextrose administered

7:13 PM 200 ml Tham started  
60 mg Gentamicin administered

7:14 PM 32 mg Acetylsalicylic Acid administered

7:15 PM 500cc Mannitol administered  
355cc Maalox administered

7:17 PM 1 mg Epinephrine administered  
Tham completed  
500cc Hetastarch started

7:18 PM Regina prepares kits to take to Rescue Vehicle  
Privacy drape added to patient  
Meds administration completed

7:19 PM Regina leaves for RV  
Tank begins to run out of O<sub>2</sub>  
Shut off thumper and O<sub>2</sub> tank

7:21 PM Started moving patient towards RV

7:24 PM Patient outside of hospital at emergency room entrance

7:25 PM Loaded patient into RV  
Aaron gets in back with patient  
1 mg epinephrine administered

7:28 PM Leave hospice for Alcor Central  
Attempt to hook up thumper to new O<sub>2</sub> tank

7:35 PM Unable to connect O<sub>2</sub> tank  
1 mg Epinephrine administered  
Begin manual compressions with Ambu CardioPump

7:40 PM 1 mg Epinephrine administered  
Continued compressions

7:45 PM 1 mg Epinephrine administered  
Continued compressions

7:50 PM 1 mg Epinephrine administered  
Continued compressions

7:55 PM 1 mg Epinephrine administered  
Continued compressions

7:58 PM Arrived at Alcor, manual compressions throughout

### Operating Room Timeline:

8:11 PM Patient placed on OR table

8:12 PM Placed new ice bags on patient.

8:19 PM Richard takes over chest compressions from Bruce

8:20 PM Bruce shaving head – compressions stop for chest prep

8:22 PM Regina completes floor cleanup

8:24 PM Head shaving complete, Hugh working on sternal saw

8:27 PM Hugh tells Nancy sternal saw may be broken  
First incisions for burr holes by Nancy

8:30 PM Richard fixes cable on sternal saw. Hugh completes repair.  
Ready to drill burr holes

8:32 PM Bruce starts left burr hole, Nancy assisting, Aaron attending

8:34 PM Nancy cleaning left burr hole

8:37 PM Bruce starts right burr hole

8:38 PM Nancy completes right burr hole  
Betadine out, alcohol out, sponges out, wrong controller on liq nitro  
shaft seized on sternum saw

8:42 PM Nancy on step stool preparing chest incision

8:45 PM Nancy instructs Aaron on saw procedure

8:46 PM Nancy starts operating saw. Richard controlling saw from floor  
Nancy on a step stool

8:47 PM Hugh note: sternal saw needs to be at head of table  
Nancy moves from right side to head  
Sawing begins

8:48 PM Nancy calls for sternum retractor  
Hugh note: small trays need to be laid out in sequence

8:50 PM Sternum spread by Nancy with Fianchetto Spreaders  
Hugh constantly monitoring equipment, perfusion circulating fluid,  
2.8L/min. perfusion program running

8:53 PM Nancy call for cannulas, Hugh goes looking  
Nancy unsure of positioning of aortic cannula. Hugh explains

8:57 PM Nancy stitching aorta with cannula

8:59 PM Cannula ready for priming

9:02 PM Cannula inserted, looking for snare ---found by Hugh

9:03 PM Regina clamps off arterial line, Nancy tying down cannula

9:06 PM Nancy switching to 2.0 silk for cannula

9:13 PM Nancy tying on another 2.0 silk

9:15 PM Nasal temp – 16C

9:18 PM Arterial cannulation complete. Venous cannulation starting

9:19 PM Venous cannula requires an adapter. Hugh provides

9:22 PM 32 French cannula prepared for right atrium by Sandra

9:23 PM Nancy making cut into atrium

9:24 PM Cannula inserted by Nancy

9:25 PM Nancy and Hugh working on perfusate lines

9:30 PM Tying off of arterial cannula continues

9:31 PM Hugh replaced fem/fem coupler in arterial line - pressure line leaking.  
Nasal temp 15.4C and 16.8C

9:35 PM Nancy placing a 2<sup>nd</sup> purse string on Aorta since first one did not hold

9:37 PM Sandra unclamps line to run fluid, air enters line and is bled out  
Cannula re-inserted into aorta by Nancy

9:41 PM Nancy requests suction  
Sandra and Hugh provide sucker setting at 4.0

9:48 PM Aortic cannulation re-secured  
Hugh and Sandra unclamped perfusate lines  
Nancy suctions chest cavity

9:50 PM Washout starts. Cryoprotectant is Modified M22 with B1 Carrier Solution  
 9:52 PM Waste container almost full – Richard replaces  
 Hugh note: No burr hole temp probe  
 Hugh found one asap  
 9:58 PM Hugh worked on perfusate system  
 9:59 PM Burr hole temp probe inserted and stapled  
 10:02 PM Nasal temp probe #2 removed by Sandra. Probe #1 remains and now data logging to PC  
 10:06 PM Nancy and Sandra cleaned suture trays  
 10:09 PM Hugh attaches Plexiglass covers to table  
 10:21 PM Hugh removes burr hole staples to observe brain  
 10:22 PM Hugh notes discoloration of skin around face  
 10:24 PM 2<sup>nd</sup> drain container 2/3 full  
 10:31 PM Nancy, Richard removed ice bags  
 Aaron held perfusate lines  
 10:32 PM Hugh clamped off line to bring up level on reservoir  
 10:37 PM Hugh and Aaron placed lid on box  
 10:40 PM Nancy checks out, Sandra, Bruce, Regina, Aaron also check out  
 10:55 PM Hugh checking perfusate levels, cooling system working properly  
 11:00 PM Hugh notices leakage out of mouth, retraction of eyes and coloration of skin  
 11:30 PM Hugh pausing ramp, changing temp to -3  
 11:45 PM Hugh takes refractometer reading from brain L-39/R-40.8  
 11:45 PM Hugh restarts ramp leaves cooling system off

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12:00 AM Restarted cooling system for box  
 12:08 AM Hugh stops ramp to add new bag of perfusate  
 12:09 AM Hugh restarts ramp  
 Note: Just passed 30 liter mark on cryoprotectant so far virtually all waste has come out via table  
 12:27 AM Hugh stops ramp, mix res at 18L  
 12:40 AM Drained mixing res to waste tank  
 1:21 AM Hugh drains mixing tank to allow more cryoprotectant to flow into the system  
 1:40 AM Hugh switches out new cryoprotectant bladder. 50 liters used  
 2:18 AM Hugh shifted from 3/8" to the 1/4" pump shoe  
 4:00 AM Hugh draining last bag of perfusate  
 Ramp turned off by Hugh  
 4:18 AM Terminal proper cyroprotectant concentration achieved; process shutdown  
 4:21 AM Hugh disassembles equipment while Richard removes table end and 3 top pieces  
 4:23 AM Hugh cuts tubing, turns pumps back on to drain cryoprotectant from lines  
 4:28 AM Pumps all off, tubing cut from table

4:57 AM Hugh, Richard and Steve clean up patient, re-attach temp probes and prepare for lifting  
 4:58 AM Richard lifts legs to place lifting strap  
 Hugh ties thigh strap in a knot  
 5:01 AM Hugh rotates the patient, Richard places strap under back  
 Hugh and Richard tie the knot  
 5:10 AM Patient placed in intermediate cool-down  
 5:15 AM OR scribe notes complete.

## 9. Discussion & Recommendations

**Problem:** Emergency vehicle was not deployed to hospice prior to arrival of air ambulance.

**Solution:** When a terminal member arrives for hospice care, deploy emergency vehicle to hospice as a precaution, until patient assessment complete.

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**Problem:** The medications were not initially delivered with the standby kit.

**Solution:** Develop a checklist to be placed with the kit to ensure that all components are gathered.

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**Problem:** O<sub>2</sub> operating thumper ran out prematurely

**Solution:** Test thumper on a fresh 80 cuft O<sub>2</sub> tank; Ensure all tanks have pressure gauges and are full before use.

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**Problem:** Compatibility problems with O<sub>2</sub> fittings, couplings between Alcor's O<sub>2</sub> tank and CCR's Michigan Instrument's thumper.

**Solution:** Determine the type of fittings used by CCR and add additional adapters.

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**Problem:** The medication kit needs to have additional IV supplies.

**Solution:** Add more saline bags and IV administration sets to the medication kits.

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**Problem:** The Suspended Animation portable ice bath requires more ice than Alcor's PIB.

**Solution:** When using this vehicle, it is important to have additional ice chests.

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**Problem:** There was no ice ready when the patient arrived at Alcor.

**Solution:** An OR checklist needs to be established.

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**Problem:** There was confusion in the OR initially as to who was assigned to each duty.

**Solution:** Establish one person who is the decision maker in the OR; either management or an OR Director.

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**Problem:** Surgeon felt that the surgical instrument tray was too crowded.

**Solution:** Prepare more or larger surgical instrument trays.

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**Problem:** OR notes are handwritten and need to be transcribed.

**Solution:** Make sure that a scribe uses the laptop for notes.

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**Problem:** Surgery to establish cannulation was delayed to make burr holes.

**Solution:** Burr holes should usually be established after vascular access is achieved.

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**Problem:** CPS was discontinued with insufficient consideration of brain temperature.

**Solution:** Do not discontinue CPS until the patient's brain temperature is no higher than +20 degC on local cases.

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### 10. Graphs

08/09/2009

