Alcor A-3328

Case Report

Prepared by:

Linda Chamberlain, Co-Founder and Director of Special Projects, Alcor Life Extension Foundation

May– 2024

Table of Contents

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-3328 was a 71-year-old member with neuro cryopreservation arrangement. The member had been diagnosed with Parkinson's Dementia. Cardiac arrest took place on T-0 days at 19:52 hrs and the member was pronounced legally deceased in Nevada at 19:54 hrs on T-0 days in June of 2023.

After field cryoprotection (FCP), the patient was driven to Alcor for cryogenic cooldown. The patient arrived at Alcor on T+1 days. The cryogenic cooldown was initiated on T+1 days at 13:18 hrs and terminated on T+5 days at 08:58 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+78 days at 14:43 hrs.

2. Patient Assessment

T-10 days

Alcor's Medical Response Director (MRD) had not been informed of any medial issues prior to receiving a call at 11:59 hrs from the member's hospice organization and a family member that the Alcor member might only have hours to live. The MRD spoke to a hospice social worker at 12:57 hrs but was not able to obtain any medical information.

At 13:25 hrs the MRD spoke with the hospice nurse. The member had been diagnosed with Parkinson's Dementia and was severely malnourished, dehydrated, had a PEG (peripheral epigastric tube) placed for feeding, and a PICC (peripherally inserted central catheter) which inferred the member had been in a long-term care facility prior to hospice.

The member's vital signs were: blood pressure (BP) 145/68 (chronic HTN, or having high blood pressure and increased risk of heart attack, stroke, heart failure, or kidney disease), heart rate (HR) 108 bpm, respiratory rate (RR) 16/min., temperature (T) 37°C. The member had been prescribed 4 mg of morphine every 4 hours for pain management, and 10 mg of Ativan every 4 hours for anxiety. The member was very pale, unresponsive, had no oral intake for 48 hours, and 50 cc of urine output in the last 12 hours.

3. Deployment

The MRD discussed the case with Alcor's Deployment Committee at 13:35 hrs the decision was made to deploy the DART team immediately for a Level-1 deployment.

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.

Two DART team members departed Alcor in the mobile operating vehicle (MOV) at 17:00 hrs with an estimated time of arrival at the member's location of approximately 21:00 hrs. A cooperating funeral home near the member was contacted at 17:06 hrs. At 18:14 hrs the MRD and two additional DART team members departed the Phoenix airport for the member's location with an estimated time of arrival at the member's location of approximately 19:30 hrs.

4. Standby

The MRD assessed the member at 21:08 hrs.

Neurological: The member was unresponsive, pupils fixed and dilated. Cardiopulmonary: pulse weak and thready, breathing labored and shallow. Mottling in the lower extremities. The member had a left upper extremity midline catheter still in place.

Gastrointestinal/Genitourinary (GI/GU): The member had a PEG (percutaneous endoscopic gastrostomy) tube, clamped, no intake. There had been no urinary output for the last 12 hours.

Vital signs: BP 85/palp (blood pressure was too low to obtain a diastolic pressure), HR 132 bpm, SpO2 79%, T 37°C, RR 12/min.

The DART team members were stationed at a hotel 7 minutes away from the hospice facility. The member had been placed on 24/7 vitals machine monitoring with a certified nursing assistant (CNA) at the nurse's station 24/7, and a RN on shift 24/7.

T-9 days

The member's vital signs at 08:20 hrs were: BP 113/76, HR 101 bpm, SpO2 89%, T 37°C, RR 8/min. Vital signs were taken 3 additional times that day with only slight fluctuations.

The DART team moved to a hotel closer to the member, one driveway away, a 4-minute walk, a 1-minute drive. At 19:37 hrs, member A-3328 was being monitored on a vitals machine at the facility with 24/7 nursing care, and appeared to be in no immediate danger, so the Alcor Team members left the bedside to obtain dry ice for another case that was also in the same city. The team returned to the member A-3328 standby at 22:30 hrs.

The member's vital signs at 22:54 hrs were: BP 85/54, HR 105 bpm, SpO2 88%, and RR 12/min.

T-8 days

The member's vital signs at 09:40 hrs were: BP 89/58, HR100 bpm, SpO2 91%, T 36°C, RR 8/min. The vitals were taken three more times that day. At 17:53 hrs the member's vitals were: BP 101/68, HR 81 bpm, SpO2 92%, and RR 8/min.

T-7 days

The member's vital signs at 07:31 hrs were: BP 100/71, HR 80 bpm, SpO2 94%, and RR 8/min. The MRD updated Alcor at 08:21 hrs that the member's vitals were still relatively unchanged, but pointed out that this was day 6 with no food or fluids (other than flushes for medications). The

member was still unresponsive and was now receiving Dilaudid for pain management and Ativan for anxiety. At 16:56 hrs the vitals were BP 112/77, HR77 bpm, SpO2 92%, and RR 8/min.

T-6 days

The member's vital signs at 09:45 hrs were: BP 83/52, HR 92 bpm, SpO2 93%, and RR 8/min. The vitals remained nearly the same throughout the day.

T-5 days

The member's vital signs at 08:33 hrs were: BP 77/45, HR 103 bpm, SpO2 88%, RR 8/min. The vitals remained nearly the same throughout the day.

T-4 days

The member's vital signs at 08:32 hrs were: BP 64/34, mean arterial pressure (MAP) 44, HR 100 bpm, SpO_2 85%, and RR 8/min.

At 10:50 hrs the MRD noted that the member's breathing was irregular and shallow. The MRD was unable to obtain a temperature because the only method available was axillary which was not always reading due to the member's low weight. There was mottling in the lower extremities. The member was still completely unresponsive, and the pupils were fixed and pinpoint. The pulse was +1 (weak). Urine output had gone up to 400 ml per day 2 days ago but was again back down to 50 ml in the last 24 hours. The member's mean arterial pressure (MAP) was trending below 50 mmHg. The vital signs remained the same with no significant change throughout the day.

T-3 days

There was nothing significant to note. Vitals checks continued throughout the day with no significant change.

T-2 days

The member's vital signs were checked throughout the day. At 11:27 hrs the vitals were: BP 87/56, HR 59 bpm, SpO2 93%, RR 8/min, and T 30°C. This temperature drop was questionable but was verified after multiple readings.

At 11:46 hrs the member's pulse was weak, thready, and hard to find. The hands and feet were mottled. Breathing was still shallow and uneven. The MRD noted that the SpO2 reading of 93% was questionable with comparison to the other vital signs, especially the RR of 8, but the reading had been consistent throughout the day, so it was taken as an accurate value. The member was switched from Ativan to 10mg of Versed every 4hrs but was still prescribed 10 mg of Dilaudid every 4 hrs. According to the nurses, the member did not require any additional medications.

T-1 days

A hospice nurse called the Alcor team at 00:49 hrs to report that the member's heart rate had dropped to 48 and the SpO2 reading could not be found. The member's blood pressure was 91/48, and the breathing was unchanged.

At 06:48 hrs the member's vitals were: BP 94/63, HR 55 bpm, no SpO2 reading could be found, and was RR 8/min. At 11:41 hrs the SpO2 was reading 96%. At 20:28 hrs the RR was up to 20 /min.

T-0 days

A hospice nurse called the Alcor team at 02:32 hrs to report that the SpO2 was again not reading. The last readings they had recorded were still 80-90%., HR 55 bpm, and BP 61/40. The vital signs at 08:38 hrs were: BP 64/39, HR 53 bpm, SpO2 unreadable, and RR 20/min.

At 09:04 the Alcor team moved the standby to the member's bedside. At 13:23 hrs the BP was 47/26. Cardiac arrest took place at 19:52 hrs. The member was pronounced legally deceased at 19:54 hrs.

5. Stabilization

The hospice facility was very supportive and allowed the stabilization to proceed in the patient's room. The rectal occlusion device was inserted at 19:57 hrs and the patient was placed in the portable ice bath (PIB) at 19:58 hrs. The first stabilization medication was also administered at 19:58 hrs (see the below Table of Medications Administered for the complete list of medications, the dosages, and the times of administration).

The ROS-Q mechanical chest compression device was placed on the patient to circulate the medications. The King airway was placed at 20:01 hrs and manual chest compression were started. At 20:05 hrs, the ROS-Q was started. The surface conduction cooling device (SCCD) was started to improve external cooling.

The bone injection gun (BIG), an intraosseous device, was placed in the patient's greater tubercle of the humerus of the shoulder at 20:08 hrs, but the needles did not advance into the bone. At 20:09 hrs nasopharyngeal thermocouples were placed in the patient's nares.

A second BIG intraosseous device was placed in the tibial tuberosity patient's leg at 20:11 hrs. This device also failed; the needle did not advance. The IO in the patient's shoulder was manually advanced and worked properly. The shoulder was chosen because the patient had extreme mottling on the legs, and a humeral placement has higher possible flow rates.

6. Field Surgery and Cryoprotection (FCP)

Streptokinase was added to Bladder #1 at 21:15 to dissolve blood clots during perfusion. The right carotid artery was isolated at 21:30 hrs and cannulated at 21:32 hrs with a 16 French (Fr) right angle metal cannula. The gravity-induced perfusion flow was initiated at 21:32 hrs at the right carotid artery with Bladder #1 containing nM22 cryoprotectant with a concentration of 0.05 CNV, and a molarity of 0.47). See the below Table of Concentrations (Brix) of nM22 Solution for the precalculated refractive index of the individual bladders, times when the bladders were started, and the refractive index of the effluent samples.

The left carotid artery was isolated at 21:40 hrs and cannulated at 21:44 hrs with a 16 French (Fr) right angle metal cannula and perfusion flow was initiated. Using a Codman perforator, the single burr hole was started at 21:47 hrs and finished at 21:48 hrs. The cephalic isolation was started at 21:51 hrs and finished at 21:57 hrs.

The height of the cryoprotectant bladders on the teeter totter was 39 inches which produced (39" x 2.054 mmHg per inch of height) a maximum arterial pressure of 80 mmHg at the infusion site.

Sidebar: The gravity feed system for FCP uses a tripod that can be adjusted for height to control the arterial pressure. The pre-mixed cryoprotectant was in a series of bladders with graduated concentrations [measured by the refractive index (RI) in Brix units].

By hanging two bladders with different refractive index (RI) concentrations on a teeter-totter atop the tripod, the bladder with the lower RI runs out and becomes lighter. At the mid-way point, the teeter-totter will allow both bladders to flow, mixing the two concentrations and creating a smoother transition from one concentration to the next. When the bladder with the lower RI runs out, the full concentration of the bladder with higher RI is then flowing exclusively.

The optimum height of the bladders on the teeter totter is 39 inches which produces (39" x 2.054 mmHg per inch of height) a maximum arterial pressure of 80 mmHg at the infusion site. The goal is to have the pressure between 70 and 80 mmHg and the bladders can be raised or lowered as needed to optimize flow and protection of the vasculature.

The 30-minute pause for equilibration started at 22:47 hrs when bladder #5 was opened to flow, and anti-freeze was added to the heat exchanger (the amount and type was not recorded).

Sidebar:
Per the cryoprotection protocol, the ramp is to be paused at 30 Brix (approximately 50% of the desired terminal concentration of 52.5 Brix) to allow the patient to come to osmotic equilibrium.. <u>When the bladder system is used, bladders 5 & 6 represent the pause.</u> At the end of the 30-minute pause, the ramp is resumed at the maximum addition rate (maximum without losing total volume in the circuit) to go to 105% of the desired end concentration (49.9 Brix x 105% = 52.5 Brix) and held between 102% and 105% concentration until the terminal concentration is obtained.

T+1 days

At 01:22 hrs the refractive index (RI) of the effluent was 49.9 Brix. Cryoprotectant perfusion was terminated at 01:52 hrs when bladder 10 was expended. The final RI concentration was 50.9 Brix, which is a concentration of 1.06 CNV and a molarity of 9.91.

7. Patient Transport

The patient was placed in the neuro shipper at 01:53 hrs and approximately 30 lbs. of dry ice was added around the patient. The patient was driven to Alcor for cryogenic cooldown (time of departure not recorded).

8. Cooling to Liquid Nitrogen Temperature

The patient arrived at Alcor at 11:47 hrs on T+1 days. The patient's NPT was -73°C, the burr hole (BH) temperature was -71°C.

Computer controlled cryogenic cooldown was initiated at 13:18 hrs on T+1 days plunging to -110°C and descending thereafter at -1°C /hour to liquid nitrogen temperature. On T+5 days, an uneventful cooldown was terminated. On T+78 days at 14:43 hrs, the patient was transferred to long-term maintenance at liquid nitrogen temperature.

9. Timeline and Time Summaries

Timeline

T-0	19:52	Estimated time of cardiac arrest
T-0	19:54	Pronouncement of legal death
T-0	19:58	Start of ice bath cooling
T-0	19:58	Administration of first medication (propofol)
T-0	20:01	Placement of airway
T-0	20:05	Start mechanical chest compressions
T-0	20:07	Placement of first intraosseous (IO) device
T-0	20:11	Placement of second intraosseous device
T-0	20:18	Administration of final medication (decaglycerol/THAM)
T-0	20:25	Start transport of patient to FH (for surgery and FCP)
T-0	21:03	Arrive at funeral home
T-0	21:12	Termination of cardiopulmonary support
T-0	21:12	Start of field surgery
T-0	21:32	Start cannulation
T-0	21:32	Start of open circuit cryoprotection (FCP) on right carotid
T-0	21:44	Finish cannulation
T-0	21:48	Established single burr hole
T-0	21:50	Estimated start of cephalic isolation
T-0	21:57	End of field surgery, completed cephalic isolation
T-0	22:15	Start 30-minute pause for equilibration (bags #5 and #6)
T+1	01:52	End of FCP cryoprotection (final BRIX 50.9)
T+1	01:53	Start of dry ice cooling
T+1	11:47	Arrival of patient at Alcor (NPT -73°C, BH -71°C)
T+1	13:18	Start of patient cryogenic cooldown
T+5	08:58	End of cooldown
T+78	14:43	Transfer of patient to long-term care at LN2 temperature

Time Summaries

Event Duration hr:min		days	time	
00:02	From: Till:	T-0 T-0	19:52 19:54	Estimated time of cardiac arrest Pronouncement of legal death
00:06	From: Till:	T-0 T-0	19:52 19:58	Estimated time of cardiac arrest Start of ice bath cooling
00:13	From: Till:	T-0 T-0	19:52 20:05	Estimated time of cardiac arrest Start mechanical chest compressions
00:06	From: Till:	T-0 T-0	19:52 19:58	Estimated time of cardiac arrest Administration of first medication (propofol)
00:20	From: Till:	T-0 T-0	19:58 20:18	Administration of first medication (propofol) Administration of final medication (decaglycerol/THAM)
01:20	From: Till:	T-0 T-0	19:52 21:12	Estimated time of cardiac arrest Start of field surgery
00:45	From: Till:	T-0 T-0	21:12 21:57	Start of field surgery End of field surgery, completed cephalic isolation
01:40	From: Till:	T-0 T-0	19:52 21:32	Estimated time of cardiac arrest Start of open circuit cryoprotection (FCP) on right carotid
04:20	From: Till:	T-0 T+1	21:32 01:52	Start of open circuit cryoprotection (FCP) on right carotid End of FCP cryoprotection (final BRIX 50.9)
06:00	From: Till:	T-0 T+1	19:52 01:52	Estimated time of cardiac arrest End of FCP cryoprotection (final BRIX 50.9)
00:45	From: Till:	T-0 T-0	21:12 21:57	Start of field surgery End of field surgery, completed cephalic isolation
00:20	From: Till:	T-0 T-0	21:12 21:32	Start of field surgery Start of open circuit cryoprotection (FCP) on right carotid
04:40	From: Till:	T-0 T+1	21:12 01:52	Start of field surgery End of FCP cryoprotection (final BRIX 50.9)
00:01	From: Till:	T+1 T+1	01:52 01:53	End of FCP cryoprotection (final BRIX 50.9) Start of dry ice cooling
06:01	From: Till:	T-0 T+1	19:52 01:53	Estimated time of cardiac arrest Start of dry ice cooling
15:55	From: Till:	T-0 T+1	19:52 11:47	Estimated time of cardiac arrest Arrival of patient at Alcor (NPT -73°C, BH -71°C)
01:31	From: Till:	T+1 T+1	11:47 13:18	Arrival of patient at Alcor (NPT -73°C, BH -71°C) Start of patient cryogenic cooldown

10. Table of Medications Administered

T-0 days

TIME	MEDICATION	DOSE	PURPOSE
19:58 hrs	Propofol	200 mg	Anesthetic; reduces cerebral metabolic demand; reduces the theoretic possibility of increased awareness during aggressive CPS.
19:59 hrs	Sodium citrate	20 g Note 1	Anticoagulant; prevents blood clot formation.
20:07 hrs	Heparin	50,000 IU	Anticoagulant; prevents blood clot formation.
20:09 hrs	Minocycline	200 mg	Antibiotic and neuroprotectant
20:07 hrs	Vasopressin (1st dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
20:09 hrs	Minocycline	200 mg	Antibiotic and neuroprotectant
20:10 hrs	SMT (S-methyl-isothiourea)	400 mg Note 3	Neuroprotectant (iNOS inhibitor); protects the brain from ischemic injury; raises blood pressure.
20:12 hrs	Decaglycerol/THAM	200 ml Note 4	Decaglycerol inhibits cerebral edema.
20:13 hrs	Vasopressin (2nd dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
20:14 hrs	Vital Oxy (w/ saline)	70 mL Note 5	Antioxidants: melatonin, vitamin E (D-alpha tocopherol), PBN (alpha Phenyl t-Butyl Nitrone) and anti-inflammatory carprofen.
20:14 hrs	Antacid	250 ml Note 6	A buffer used to neutralize stomach acid.
20:15 hrs	Decaglycerol/THAM	200 ml Note 4	Decaglycerol inhibits cerebral edema.
20:18 hrs	Hetastarch	250 ml Note 7	Restore volume in dehydrated patients and increase cerebral perfusion during CPS.
21:15 hrs	Streptokinase	25,000 IU Note 8	A thrombolytic used to break up existing blood clots.

Notes:

1. The standard formulation for sodium citrate is 20% w/v, in sterile packaging provided by the manufacturer. 10 grams of sodium citrate are given to patients who weigh less than 40 kg, and 20 grams are given to patients who weigh over 40 kg. This patient weighed 63 kg and therefore received 20 grams of sodium citrate.

2. Vasopressin is a fixed dosage of 40 IU, per dose for two doses. The second 40 IU dose is to be administered concurrently with Vital-Oxy, I.V. Vasopressin is to be administered only if the patient's temperature is above 20°C as it is ineffective at cold temperatures.

3. SMT (S-methyl isothiourea) is a powder, (1 vial = 400 mg) dissolved in 10 mL of saline and injected through a 0.2 µ filter. SMT is unstable in solution with a use life of approximately six hours.

4. Decaglycerol/THAM is administered as a custom formulation of 20% w/v decaglycerol and 4.5% w/v THAM (tromethamine) in water (pH = 10.4 and pKa = 8.3). It is a fixed dose of 400 ml to be given in two separate doses.

5. The medications protocol dilutes 70 mL or less, based on body weight, of Vital-Oxy into 150 mL of saline for a total of 220 cc of diluted Vital-Oxy saline. Each mL of Vital-Oxy contains 194 mg Sigma Cremophor EL (or Sigma Kolliphor EL), 155 mg ethanol, 19.4 mg PBN, 3.24 mg carprofen, 1.55 mg melatonin, and 198 IU vitamin E.

6. An antacid can be given in several doses, totaling 250 mL, and inserted through the nasogastric tube in an airway.

7. Hetastarch is a volume expander used to restore volume in dehydrated patients and increase cerebral perfusion during CPS. It is administered 250 mL as a fixed dosage by I.V.

8. The standard administration of streptokinase is 250,000 IU fixed dose, dissolved in 5 mL of 9% sodium chloride, to be added to the blood washout solution prior to remote blood washout, or to the first cryoprotection flush in the OR. The dosage is reduced to 25,000 IU in field neuro (FCP) cases and added to the first bladder). This medication previously needed to be infused through a 0.2 µ filter. The medication now in use is already sterile-filtered and can be reconstituted in the vial.

11. Table of Concentrations (Brix) of nM22 Solution

A-3328 step-ramp, nM22								
Preferred endpoint is over 49.9 Brix from both jugulars for 1/2hr								
2L Bag label number	**[nM22], CNV**	**Molarity of penetrating CPAs***	**Brix (calc)**	**Bag start hh:mm, MST**	**hrs post pronounc-ement**	**Bag avg. flow rate, mL/min**	**Sample time hh:mm, MST**	**Effluent Conc., Brix**
1	0.05	0.47	11.81	21:32	1.63	87.0	1:21	49.9
2	0.08	0.78	13.14	21:55	2.02	142.9	1:52	49.9
3	0.14	1.29	15.35	22:09	2.25	90.9		
4	0.23	2.15	19.03	22:31	2.62	125.0		
5	0.50	4.67	29.85	22:47	2.88	90.9		
6	0.50	4.67	29.85	23:09	3.25	166.7		
7	1.06	9.91	52.31	23:21	3.45	71.4		
8	1.06	9.91	52.31	23:49	3.92	57.1		
9	1.06	9.91	52.31	0:24	4.50	66.7		
10	1.06	9.91	52.31	0:54	5.00	34.5		
END				1:52	5.97			
* does not account for concentration of non-penetrating CPAs								

12. Discussion

Standby, Recovery, and Stabilization

There was difficulty with the tube of the King airway. When the SAVe ventilator was turned on, it was not functional. The equipment will have to be periodically charged when on long standbys.

The ROS-Q chest compression device would not start initially. Troubleshooting should be included in training as well as more hands-on training.

The peripheral I.V. was used at first, but the flow was extremely slow. An IO should be placed immediately. The BIG IOs have been replaced as the primary tool with EZ-IO, reducing the risk of failed insertions and the need to add more IO needles to the kits.

The standby for this patient lasted longer than anticipated. The member had very low blood pressure but still held on to life longer than anyone could foresee. The team member were rotated so that the stabilization and transport personnel would be fresh.

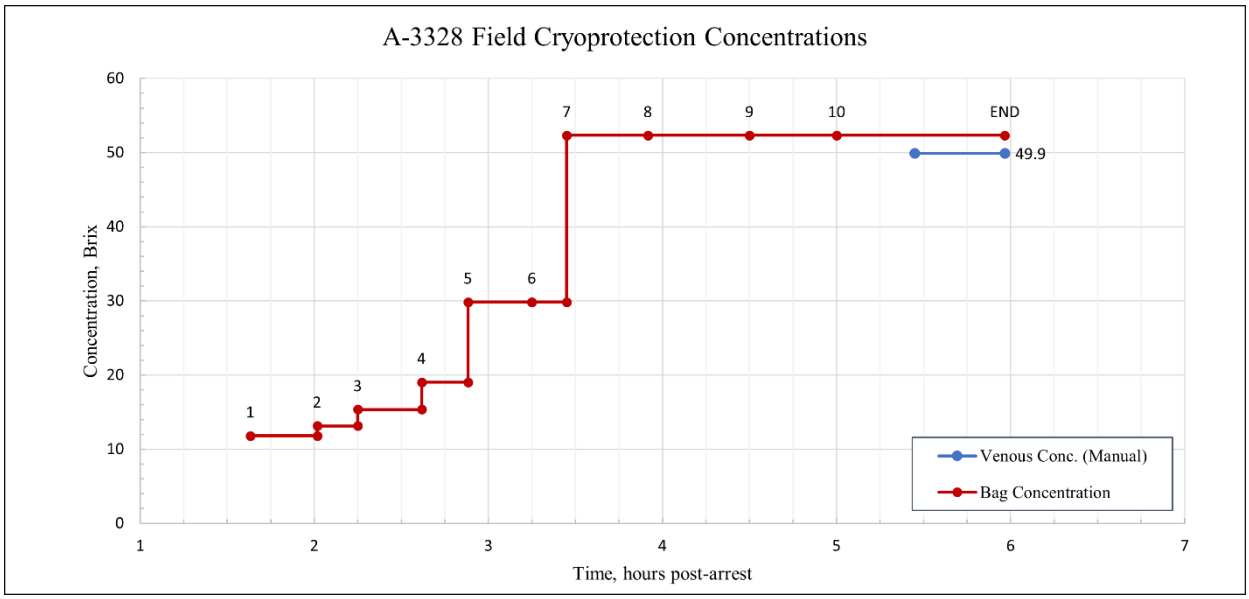
Field Surgery and Cryoprotectant Perfusion (FCP)

The surgical cannulation of the patient's carotid arteries took longer than is ideal. Additional cadaver training will be planned to enhance knowledge and skills.

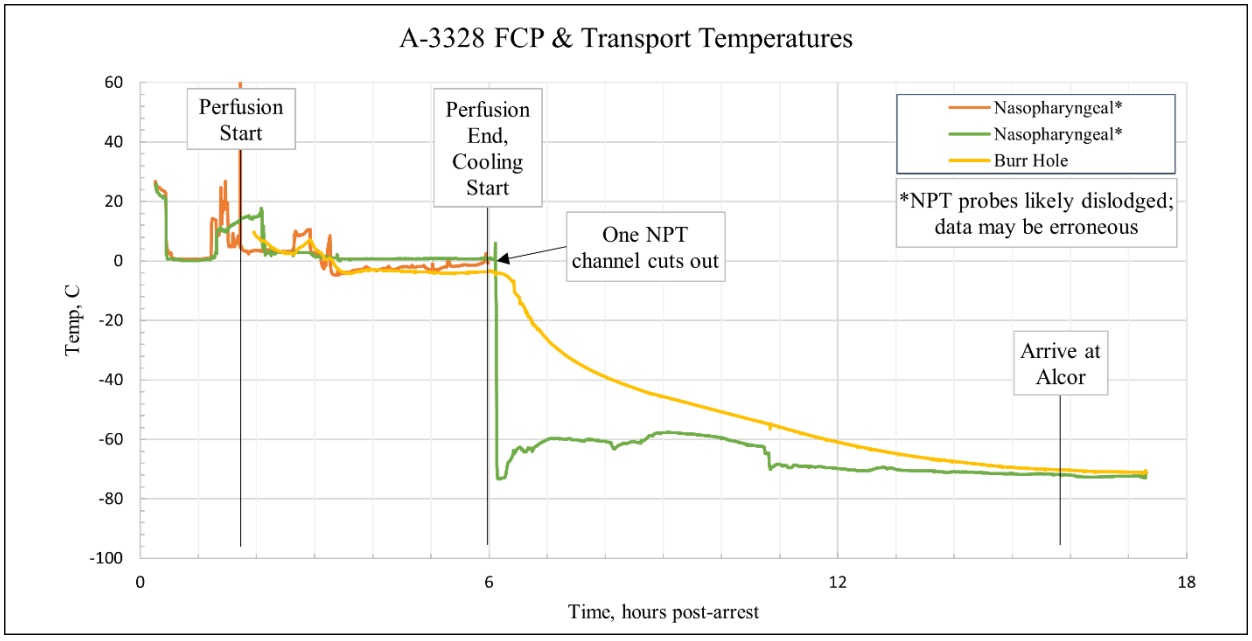
Cryogenic Cooldown

Upon arrival at Alcor, the nasopharyngeal probe was found to have become dislodged from the patient at some point during the procedure. It could not be reinserted, so it was not connected to the cooldown PC. The cooldown was uneventful.

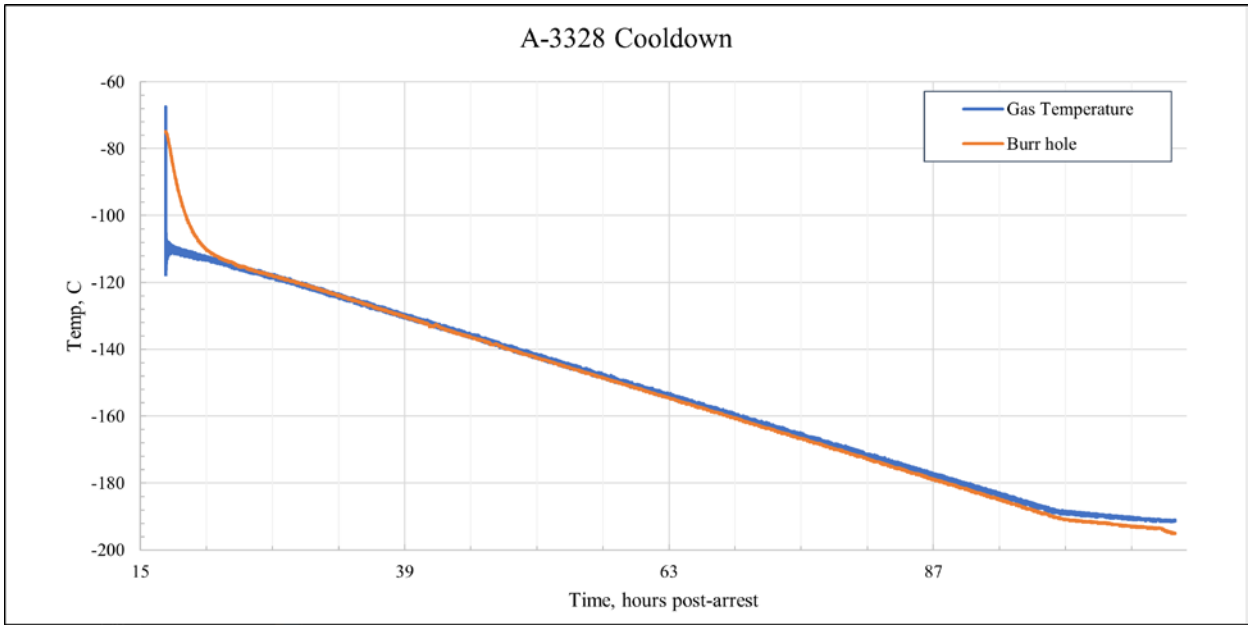
13. Cryoprotection and Temperature Graphs

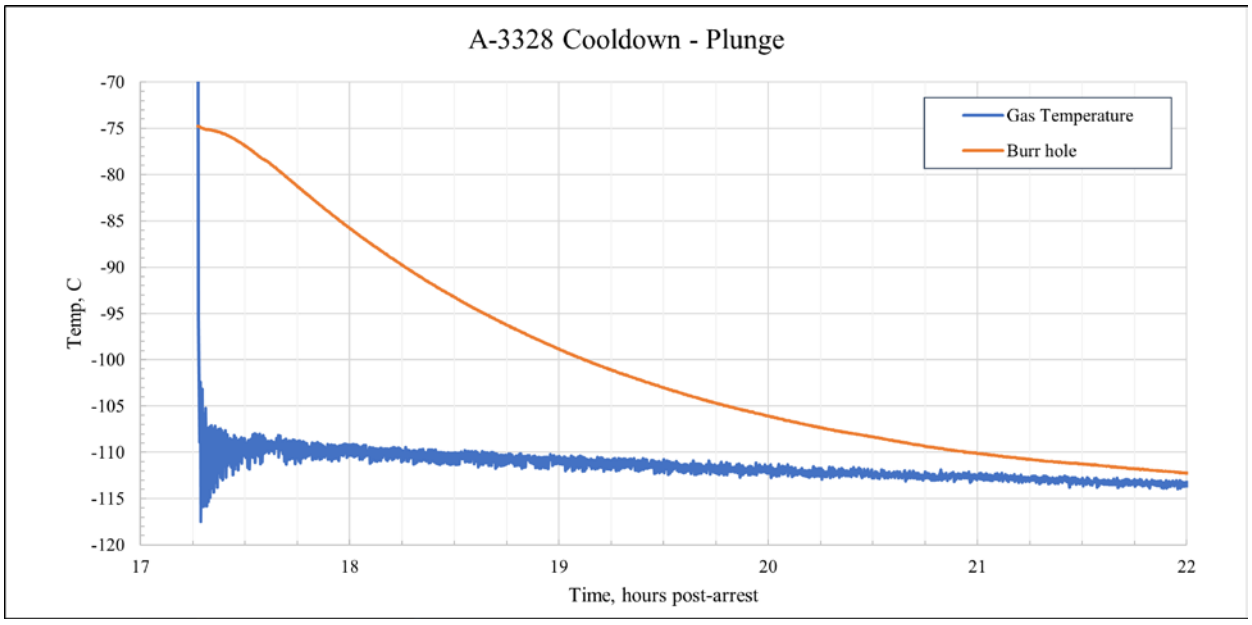


Because the field cryoprotection was done in the moving Medical Response Vehicle, it was only possible to manually record cryoprotectant concentrations.



There is strong evidence that the nasopharyngeal probe was dislodged from the patient, perhaps very early in the procedure. The temperature fluctuations are significant and rapid, and the temperature reading drops immediately upon transfer to the transport container with dry ice. Furthermore, during the perfusion there is an extended period over which the probe reads almost exactly zero degrees Celsius, which is very unlikely to happen unless the probe was exposed to the water/ice mixture in which the patient was immersed.

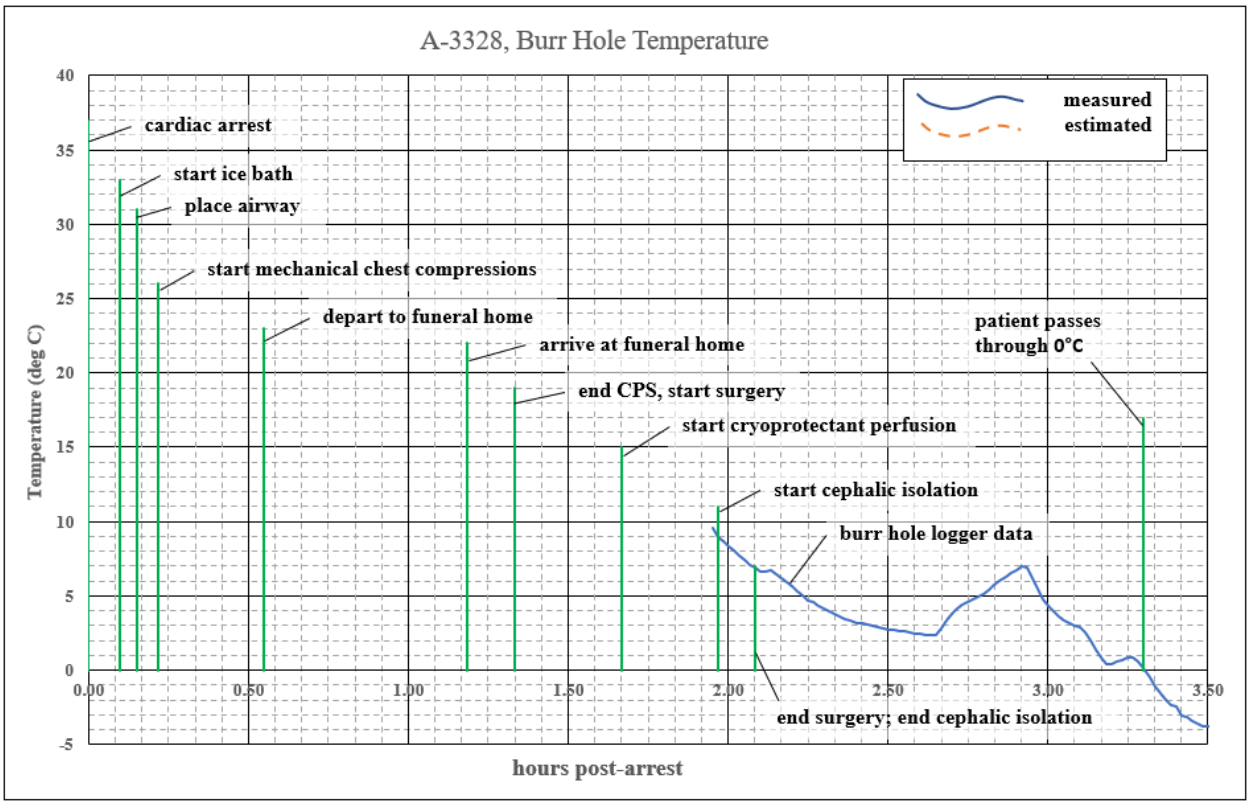

A-3328 Cooldown
Gas Temperature
Burr hole
Temp, C
-60
-80
-100
-120
-140
-160
-180
-200
15
39
63
87
Time, hours post-arrest


A-3328 Cooldown - Plunge
Gas Temperature
Burr hole
Temp, C
-70
-75
-80
-85
-90
-95
-100
-105
-110
-115
-120
17
18
19
20
21
22
Time, hours post-arrest

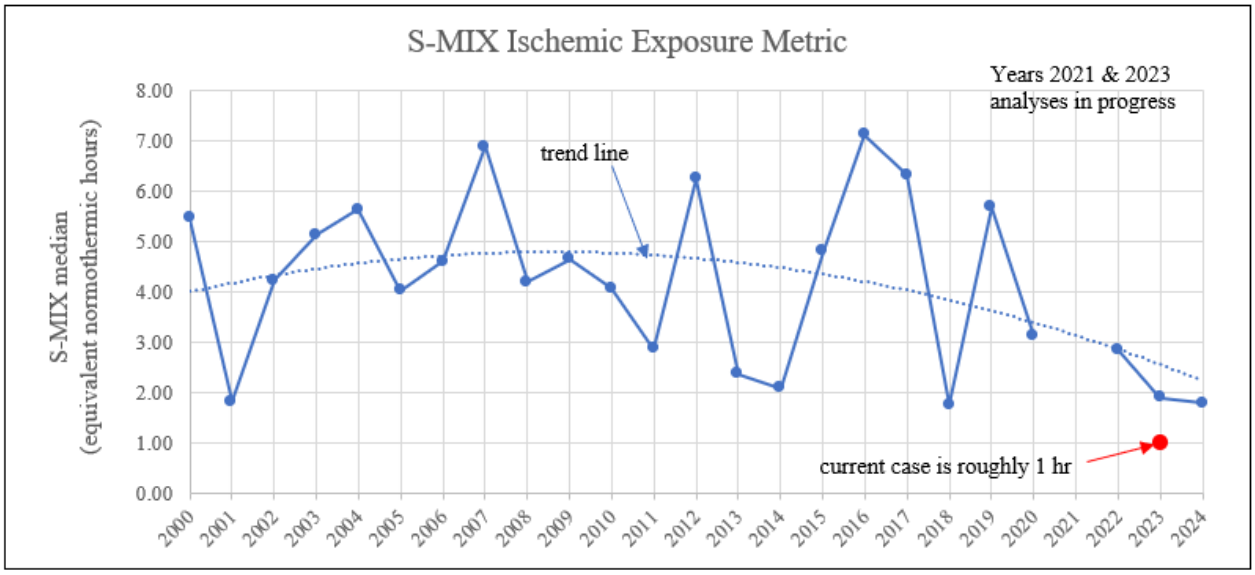
14. S-MIX

Considering that the patient was promptly stabilized with an ice-bath, cardiopulmonary support, cannulation, and perfusion with cold solution in only 100 minutes after cardiac arrest, this likely resulted in an S-MIX of less than 60 minutes. However, it wasn't possible to confirm this by direct calculation because of problems with nasopharyngeal temperature acquisition during initial stabilization.

Stabilization events and burr hole temperature are shown below.



The following plot shows the trend of S-MIX achieved since 2000.



15. CT Scans

Cryoprotectant Distribution (Post-cryopreservation CT scan)

This is on hold until the in-house scanner is functional, at which time CT scans and additional information will be added to this report.