Alcor A-1875

Case Report

Prepared by:

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

December – 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-1875 was a 77-year-old member with neuro cryopreservation arrangements. Cardiac arrest took place on T-0 days at 17:46 hrs and the member was pronounced legally deceased in Arizona at 17:48 hrs on T-0 days in September of 2024.

After stabilization, the patient was driven to Alcor where cryoprotectant perfusion and cryogenic cooldown would be performed. The cryogenic cooldown was initiated on T+1 days at 00:08 hrs and terminated on T+4 days at 22:19 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+13 at 12:43 hrs.

2. Member Assessment

T-100 days

The member was placed on the Alcor Watchlist after Alcor was told they were taken to the hospital for a seizure sustained during outpatient dialysis. The member had a diagnosis of end stage renal failure and was being treated for this with scheduled outpatient dialysis. The member had not been feeling well that day. During dialysis, the member suffered a seizure that lasted several minutes. The dialysis team immediately called EMS, and the member was transferred to the hospital and held for observation. The member was diagnosed with COVID-19.

The MRD gained permission to speak with the member's medical team and obtained the following report: The member was stable with the following vital signs: blood pressure (BP) 177/80, heart rate (HR) 87 bpm, respiration rate (RR) 22, SPO2 99% with 2 L/min of oxygen. The member was being admitted to ensure stability, and to undergo further testing.

T-99 days

The member had been started on a Keppra drip to prevent seizures and was awaiting further testing such as an MRI of the brain.

T-98/T-85 days

The MRD remained in communication with the member's family (husband). Nothing of note was relayed to the MRD during this period.

T-84 days

The member was transferred to an assisted living facility.

T-83/T-1 days

The member remained on the watchlist, with biweekly check-ins. Nothing of note happened on these days

T-0 days

At approximately 09:00 hrs, Alcor was notified by the family (husband) that the member had been transferred emergently to a hospital two days prior. No notification of this had been given to the MRD at the time of the event. The member had suffered a non-ST elevation myocardial infarction (NSTEMI) and was diagnosed with pulmonary edema. The member's last dialysis had been completed the day prior.

At 09:45 hrs, the MRD reached out to the distraught family. The family could not relay an accurate medical update, but stated the member only had days to live according to the medical team. The MRD asked the family to reach out to the hospital and give permission to the nurse to release medical information regarding the member so that the MRD could obtain an accurate update. The family gave the hospital information regarding the member's arrangements with Alcor. The family told the MRD that they requested that all life sustaining interventions be stopped only when Alcor was in place at the hospital.

At 12:47 hrs the hospital nurse had received permission to release information and gave the MRD the following report: The member was not receiving any fluids or nutrition and was not producing urine. They were non-responsive, and being given as needed, the end-of-life medications morphine for pain management and Ativan for anxiety (2 mg morphine,0.5mg Ativan). The member's vital signs were: BP 80/40, HR 82, SPO2 68% on 4L/min by nasal cannula, non-labored breathing, and RR 10. The nurse conveyed the family's wishes to continue care only until Alcor was in place, confirming that they would be cooperative to Alcor's needs. The nurse relayed that she believed the member would not live past that evening.

3. Deployment

T-0 days

The member's life insurance policy was no longer in force. It took about three hours for the Alcor Board of Directors to approve funding and allow DART to deploy. At 13:24 hrs, the Alcor Deployment Committee agreed to initiate a Level-1 deployment of the Alcor Deployment and Recovery Team (DART).

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, Stabilization, and Transport to Alcor

T-0 days

One DART member (see the Discussion Section) arrived at Alcor at 14:00 hrs to prepare for departure to the hospital. The MRD arrived at Alcor at 15:15 hrs (see the Discussion Section). They departed Alcor at 16:00 hrs and arrived at the hospital at 17:15 hrs. There was a slight delay in arrival time due to rush-hour traffic. The member's nurse stated she would remove the oxygen and provide the end-of-life medications at that time. The MRD asked the nurse, who agreed, to wait to remove care until their equipment was staged. The team planned the ingress and egress of equipment with the charge nurse.

Upon the ingress of the equipment at 17:46 hrs, the member's nurse called the charge nurse, who was escorting DART up the staff elevator, and stated that the member had gone into cardiac arrest at approximately 17:46 hrs. The member was pronounced legally deceased at 17:48 hrs. The member weighed 58.9 kg (130 lbs.).

The hospital had left in place a peripheral I.V. in the patient's left wrist. This was used to administer the stabilization medications. The digital audio recorder was turned on at 17:55 hrs and the first stabilization medication was administered (see the below Table of Medications Administered for the names of the medications, the dosages, and the times of administration).

At 17:59 hrs a King airway, with CO2 colorimeter detector, was placed, and ventilations were initiated with a SAVe ventilator. An 18-gauge nasogastric tube was placed at 18:00 hrs to administer antacid to the patient's stomach.

The patient was moved into the portable ice bath (PIB) at 18:01 hrs where 100 lbs. of water ice was already staged. The surface conduction cooling device (SCCD) with face mask was placed at 18:02 hrs. At 18:03 hrs, a thermocouple was placed into the left nasopharyngeal space, and the initial temperature reading was LNPT 38.8°C (port-1 on the datalogger #7). Swimmer wax was placed in the nare to prevent water from entering and interfering with temperature measurements, and the probe was secured (stapled).

Manual chest compressions were started at 18:08 hrs because the mechanical device was missing the proper size straps to fit the patient (see the Discussion section).

The PIB was leaking water onto the floor, resulting in the SCCD not having enough water to operate. While the DART member attempted to fix the leak, the MRD continued administering the stabilization medications between manual compressions. Once the leaks were fixed, the team started transporting the patient to the mobile recovery vehicle (MRV).

The charge nurse, who was in the hallway awaiting the release form, informed the team that the house supervisor was required to sign the form, and would go get the form signed. The team continued manual compressions and stabilization procedures as much as possible during this time, though measures to maintain the privacy of the patient did not allow some steps to be performed in their normal timely manner. The charge nurse returned to the floor with the signed form, and the team left the floor at 18:20 hrs.

After loading the patient into the MRV, the DART team departed the hospital with the patient at 18:27 hrs to transport the patient to Alcor. While enroute to Alcor, stabilization procedures continued. A second thermocouple was placed in the patient's right nasopharyngeal space at 18:33 hrs. The initial nasopharyngeal temperature (NPT) was: RNPT = 35.4°C (port-2 on the datalogger #7). Manual chest compressions were stopped at 18:43 hrs (see the Discussion Section).

5. Cryoprotectant Surgery and Perfusion

T-0 days

The patient arrived at the back door to Alcor at 18:58 hrs and was moved into the operating room at 18:59 hrs. At 19:00 hrs the initial nasopharyngeal temperatures (NPT) from the data logger were: LNPT = 28.6°C and RNPT = 30.1°C. At 19:14 hrs, 25,000 IU of streptokinase was added to the mixing reservoir. The OR staff waited until the patient's temperature reached 20°C before starting surgery.

A 20 lb. bag of water ice was placed under the patient's head at 19:15 hrs to raise it out of the ice for surgery. In order to lower the patient's temperature faster to allow surgery to start more quickly, manual chest compressions were again started at 19:24 hrs. At 19:27 hrs, manual chest compressions were stopped. The temperature readings at 19:30 hrs were: LNPT = 21.0°C and RNPT = 20.4°C. Surgery could proceed. The airway was removed at 19:38 hrs.

The first surgical incision was made on the patient's neck at 19:40 hrs for cannulation and the surgical cephalic isolation. The left carotid artery was isolated at 19:44 hrs and the right carotid artery was isolated at 19:50 hrs. At 19:57 hrs the patient's scalp on the right forehead was cut in preparation for the burr hole. The burr hole was drilled at 19:57 hrs, and a thermocouple was placed in the burr hole at 19:59 hrs. The initial burr hole temperature was 11.7°C. The thermocouple was sutured to the patient's scalp at 20:01 hrs to prevent it from being dislodged. The spinal cord was cut, and at 20:02 hrs the cephalic isolation was completed.

The cephalon was weighed at 20:03 hrs. The pre-perfusion cephalic weight was 3.52 kg. The cephalon was placed in the cephalic enclosure at 20:04 hrs. All thermocouples were connected to the data acquisition system at 20:05 hrs.

The right carotid artery was cannulated with a red Robinson cannula at 20:09 hrs. The left carotid artery was cannulated with a red Robinson cannula at 20:11 hrs. Computer-controlled open-circuit blood substitution was started at 20:13 hrs with B1 solution. Perfusion flow was noted from both arteries. The arterial pressure was 30 mmHg.

The right vertebral artery was cannulated at approximately 20:20 hrs with a standard vertebral cannula. The left vertebral artery was cannulated at approximately 20:21 hrs with a standard vertebral cannula. The left jugular vein was cannulated with a standard jugular cannula at 20:23 hrs. The LNPT at 20:23 hrs was 15.1°C. 1 liter of B1 solution had been used.

Closed-circuit perfusion was initiated with B1 solution at 20:26 hrs. The flow rate was 71 ml/min. The cryoprotectant ramp was started at 20:27 hrs with nM22 cryoprotectant perfusate. The right jugular vein was cannulated at 20:28 hrs with a standard jugular cannula. At 20:32 hrs LN2 gas was connected to the cephalic enclosure and the target enclosure temperature was set to 3°C. The flow rate increased significantly to 151 ml/min.

Tanning of the facial skin from exposure to the nM22 was already noticeable at 20:36 hrs. The flow rate slowed to 120 ml/min at 20:55 hrs due to a leaky arterial cannula. The leak was stopped with an occlusion clamp and the flow rate began to rise again. At 21:25 hrs, the irises of both eyes were concave, and the patient's skin was exhibiting extreme tanning. Both of these are the result of dehydration from contact with the nM22 cryoprotectant.

The 30-minute pause for equilibration at the 50% concentration necessary for vitrification (CNV) was initiated at 21:46 hrs. The refractive index (RI) readings were: left venous 30.01 Brix, and right venous 30.75 Brix. The target temperature in the cephalic enclosure was switched to -3°C at 22:05 hrs. The pause was ended at 22:17 hrs and the cryoprotectant ramp was resumed at full speed.

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. The cephalic/patient enclosure and the chiller are switched from +3°C to -3°C operation. 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.

At 22:43 hrs it was noted that the refractometers were not giving consistent readings. The OR team stopped taking RI readings from the data acquisition system and switched to using the alternate Atago refractometers. It was later found that the arterial refractometer was malfunctioning and affecting the other two (see the Discussion section). An eyebolt was placed in the patient's vertebra at 23:23 hrs for ease of handling.

The 30-minute countdown to the termination of the cryoprotectant ramp was started at 23:29 hrs. The RI readings at 23:59 hrs were: left venous 50.0 Brix and right venous 51.5 Brix. The ramp was terminated. All lines and equipment were disconnected from the cephalon in preparation to weigh it.

Sidebar:
Per the cryoprotection protocol, a 30-minute countdown to the termination of cryoprotection is initiated, after which the final sub-zero terminal concentration ramp is resumed. The normal endpoint criterion for whole body patients is over 100% for over 30 minutes from the venous return and for neuro patients, it is over 100% target cryoprotectant concentration for over 30 minutes from both jugular veins. The speed of the addition pump is minimized, with frequent corrections, to compensate for latency.

T+1 days

The cephalon was weighed at 00:04 hrs. The post-perfusion cephalic weight was 3.02 kg (3.52 kg – 3.02 kg = 0.50 kg loss, a 14.2% weight loss). The patient was moved to the Patient Care Bay at 00:04 hrs.

6. Cooling to Liquid Nitrogen Temperature

T+1 days

Computer-controlled cryogenic cooldown was initiated at 00:08 hrs, plunging to -110°C and descending thereafter at -1°C/hour to liquid nitrogen temperature.

A supercooled phase transition was observed by the burr hole probe at -25.7°C, indicating a first-order phase transition (ice formation). The average cooling rate observed in the burr hole probe from 0°C to -110°C was -0.26°C /min.

On T+4 days at 22:19 hrs, an uneventful cooldown was terminated. On T+13 days at 12:43 hrs, the patient was transferred to long-term care at liquid nitrogen temperature.

7. Timeline and Time Summaries

Timeline

T-0	17:46	Time of cardiac arrest
T-0	17:48	Time of legal pronouncement
T-0	17:55	Administered first medication (propofol)
T-0	17:59	Place airway and start ventilation
T-0	18:01	Start of ice bath cooling
T-0	18:08	Start of manual chest compressions
T-0	18:27	Start transport of patient to Alcor
T-0	18:28	Administered last medication (antacid)
T-0	18:43	Termination of cardiopulmonary support
T-0	18:59	Arrival of patient at Alcor OR (RNPT30.1°C, LNPT28.6°C)
T-0	19:40	Start surgery (cannulation and cephalic isolation)
T-0	20:13	Start open-circuit washout
T-0	20:25	Surgery completed
T-0	20:26	Start closed-circuit perfusion
T-0	20:27	Start of cryoprotectant perfusion ramp
T-0	21:46	Start 30-min pause for equilibration
T-0	22:17	End 30-min pause
T-0	23:29	Start 30-min countdown to terminate ramp
T-0	23:59	Termination of cryoprotectant ramp
T+1	00:08	Start cryogenic cooldown
T+4	22:19	Termination of cryogenic cooldown
T+13	12:43	Transfer patient to long-term care at LN2

Time Summaries

Event Duration hr:min		days	time	
00:02	From: Till:	T-0 T-0	17:46 17:48	Time of cardiac arrest Time of legal pronouncement
00:15	From: Till:	T-0 T-0	17:46 18:01	Time of cardiac arrest Start of ice bath cooling
00:22	From: Till:	T-0 T-0	17:46 18:08	Time of cardiac arrest Start of manual chest compressions
00:09	From: Till:	T-0 T-0	17:46 17:55	Time of cardiac arrest Administered first medication (propofol)
00:33	From: Till:	T-0 T-0	17:55 18:28	Administered first medication (propofol) Administered last medication (antacid)
01:13	From: Till:	T-0 T-0	17:46 18:59	Time of cardiac arrest Arrival of patient at Alcor OR (RNPT30.1°C, LNPT28.6°C)
01:54	From: Till:	T-0 T-0	17:46 19:40	Time of cardiac arrest Start surgery (cannulation and cephalic isolation)
00:45	From: Till:	T-0 T-0	19:40 20:25	Start surgery (cannulation and cephalic isolation) Surgery completed
00:47	From: Till:	T-0 T-0	19:40 20:27	Start surgery (cannulation and cephalic isolation) Start of cryoprotectant perfusion ramp
04:19	From: Till:	T-0 T-0	19:40 23:59	Start surgery (cannulation and cephalic isolation) Termination of cryoprotectant ramp
02:41	From: Till:	T-0 T-0	17:46 20:27	Time of cardiac arrest Start of cryoprotectant perfusion ramp
03:32	From: Till:	T-0 T-0	20:27 23:59	Start of cryoprotectant perfusion ramp Termination of cryoprotectant ramp
06:13	From: Till:	T-0 T-0	17:46 23:59	Time of cardiac arrest Termination of cryoprotectant ramp
05:09	From: Till:	T-0 T+1	18:59 00:08	Arrival of patient at Alcor OR (RNPT30.1°C, LNPT28.6°C) Start cryogenic cooldown
00:09	From: Till:	T-0 T+1	23:59 00:08	Termination of cryoprotectant ramp Start cryogenic cooldown
06:22	From: Till:	T-0 T+1	17:46 00:08	Time of cardiac arrest Start cryogenic cooldown

8. Table of Medications Administered

T-0 days

TIME	MEDICATION	DOSE	PURPOSE
17:55 hrs	Propofol	200 mg	Anesthetic; reduces cerebral metabolic demand; reduces the theoretical possibility of increased awareness during aggressive CPS.
17:56 hrs	Sodium citrate	20 g Note 1	Anticoagulant; prevents blood clot formation.
17:57 hrs	Heparin	50,000 IU	Anticoagulant; prevents blood clot formation.
17:58 hrs	Vasopressin (1st dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
18:14 hrs	Minocycline	200 mg	Antibiotic and neuroprotectant
18:15 hrs	SMT (S-methyl-isothiourea)	400 mg Note 3	Neuroprotectant (iNOS inhibitor); protects the brain from ischemic injury; raises blood pressure.
18:16 hrs	Decaglycerol/THAM (1st dose)	200 ml Note 4	Decaglycerol inhibits cerebral edema.
18:16 hrs	Vasopressin (2nd dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
18:17 hrs	Vital-Oxy (w/ saline)	40 mL Note 5	Antioxidants: melatonin, vitamin E (D-alpha tocopherol), PBN (alpha Phenyl t-Butyl Nitrone) and anti-inflammatory carprofen.
18:20 hrs	Decaglycerol/THAM (2nd dose)	200 ml Note 4	Decaglycerol inhibits cerebral edema.
18:28 hrs	Antacid	250 ml Note 6	A buffer used to neutralize stomach acid.
19:14 hrs	Streptokinase	250,000 IU Note 7	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 58.9 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. 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.

9. Discussion

Standby, Stabilization, and Transport

When preparing for deployment, the team was delayed in departing Alcor due to equipment being in different places for charging and testing. In the future, all equipment will be kept in the same place every time. Another cause for the delay was that the MRD had to pick up her kids from school, drop them off, and then drive to Alcor.

Only one DART member was on-call locally to respond. This required the MRD's involvement in the standby and stabilization of this case. The MRD has other responsibilities, such as preparing for surgery at Alcor (setting up surgical tray table, etc., in anticipation of the surgeon's arrival). This also left only two responders available to perform standby and stabilization, which is not enough. Alcor has hired another local DART member to be on call during this shift. This should help mitigate this problem in the future. With more advanced notice, the MRD would have considered bringing in a regional DART member for this case, but time did not permit this option.

Manual compressions were required due to the thumper straps not fitting the patient. The small size straps were affixed to the backboard, with no other sizes available in the mobile recovery vehicle (MRV) or kits. The MRD has added to the kit list different size options in all kits and in the van to prevent this from happening again in the future. Also, due to the lack of personnel, manual compressions were not consistently administered. The team ensured delays did not last over 10 to 20 seconds between repetitions of 30 compressions. This is another reason that 3 or more team members are needed for each full protocol case.

The body bag leaked, resulting in the loss of water that was needed to run the surface conduction cooling device (SCCD). The team has been instructed to always double bag to avoid leaking.

The team was not familiar with all the functions of the gurney. This can cause delays in transport or safety issues. An in-service on the gurney and SOP training will be given to all

the team members. This is a repeated issue, so training of the gurney functions has been given a priority.

The hospital staff was very cooperative. Although there were hospital policies that caused some delays, the entire hospital staff recognized the urgency of the situation and responded quickly. Good communication from Alcor's MRD to hospital staff before DART's arrival resulted in smooth processes.

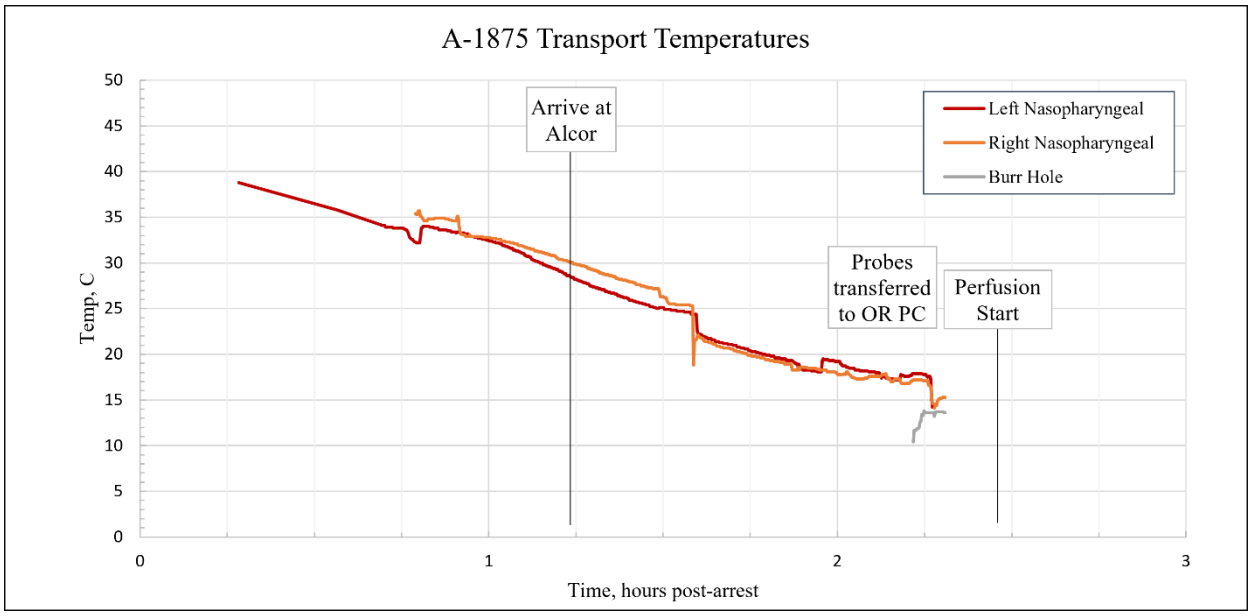
The transportation of the patient was uneventful. The cooling rate measured by the nasopharyngeal probe over the duration of the transport, from first placement of the probe until the cephalic isolation was complete, was -0.19C/minute.

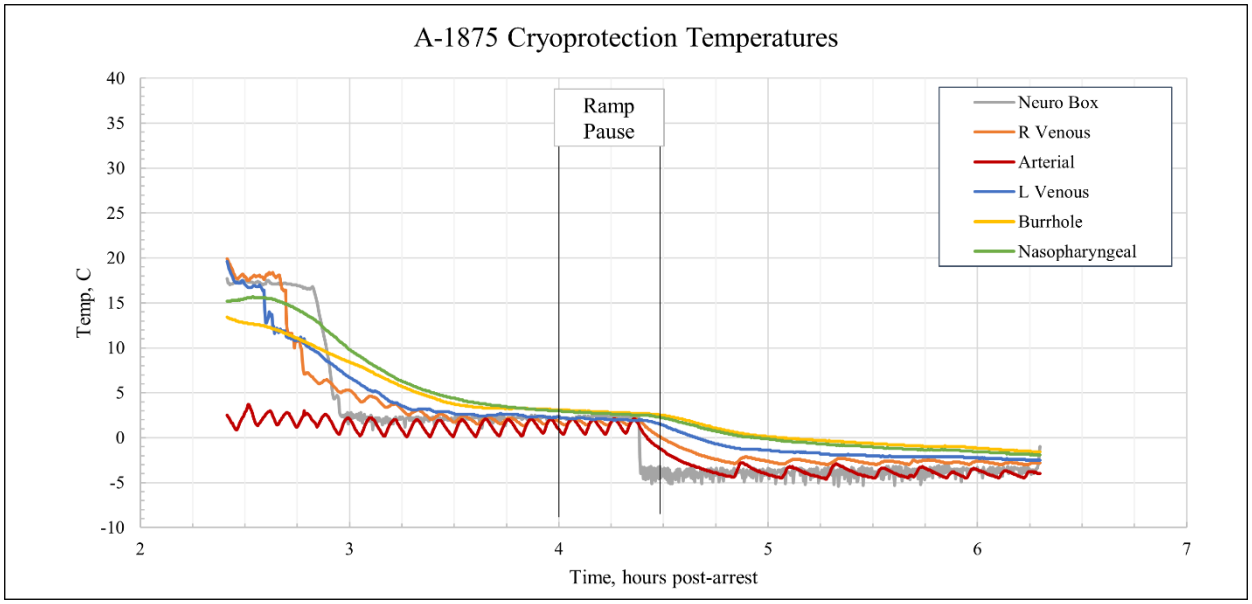
Cryoprotectant Surgery and Perfusion at Alcor

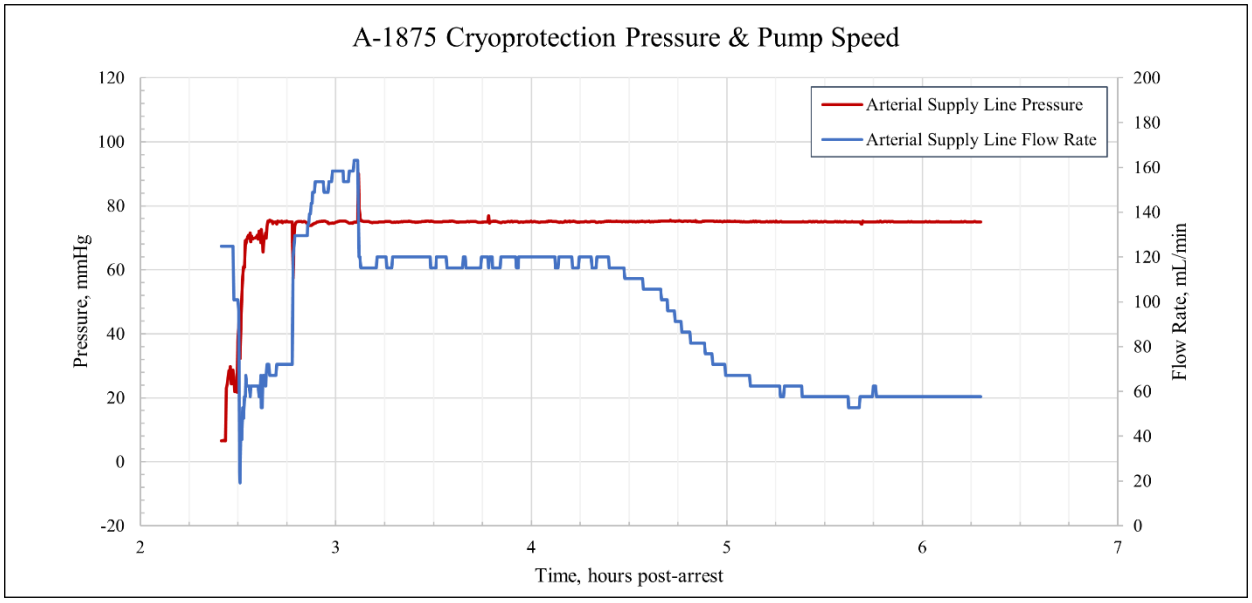
The signs observed during the cryoprotectant perfusion were consistent with good perfusion.

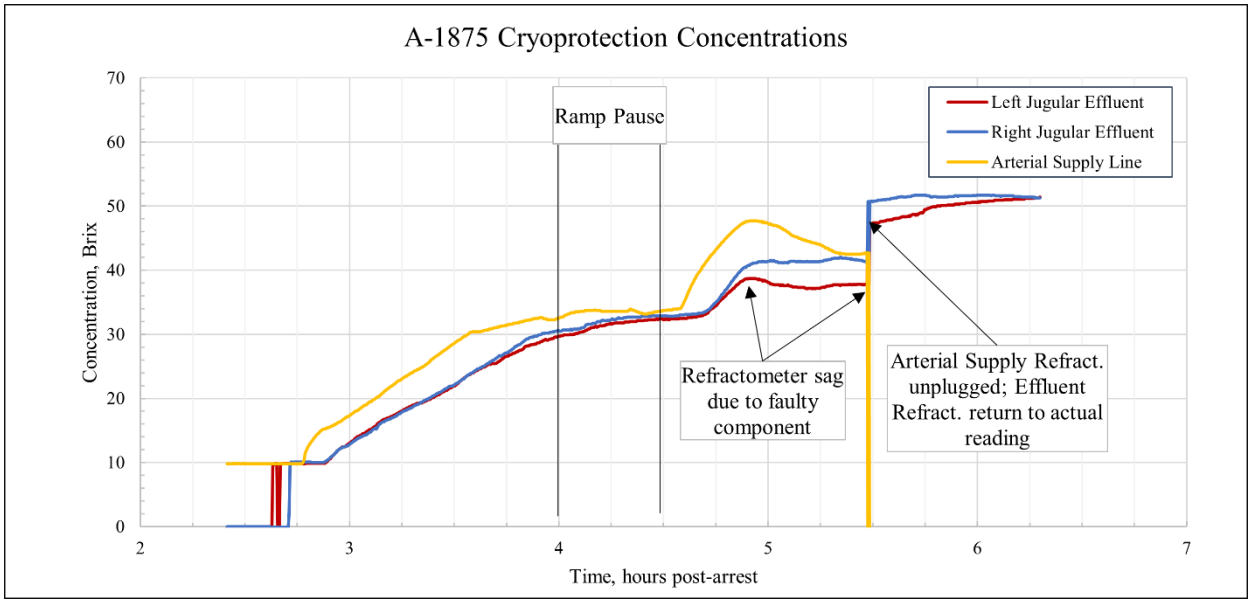
Due to a faulty component, the concentration reported by the refractometers began to sag during the ramp to terminal concentration. The team unplugged the arterial supply line refractometer, after which the jugular sampling refractometers returned to reading the actual concentration for the remainder of the procedure. Perfusion continued with a perfusate concentration of 54-54.5 Brix for the remainder of the procedure. This problem has occurred before, but this time the team was able to isolate the faulty component and replace it, which should prevent the problem from occurring again in the future.

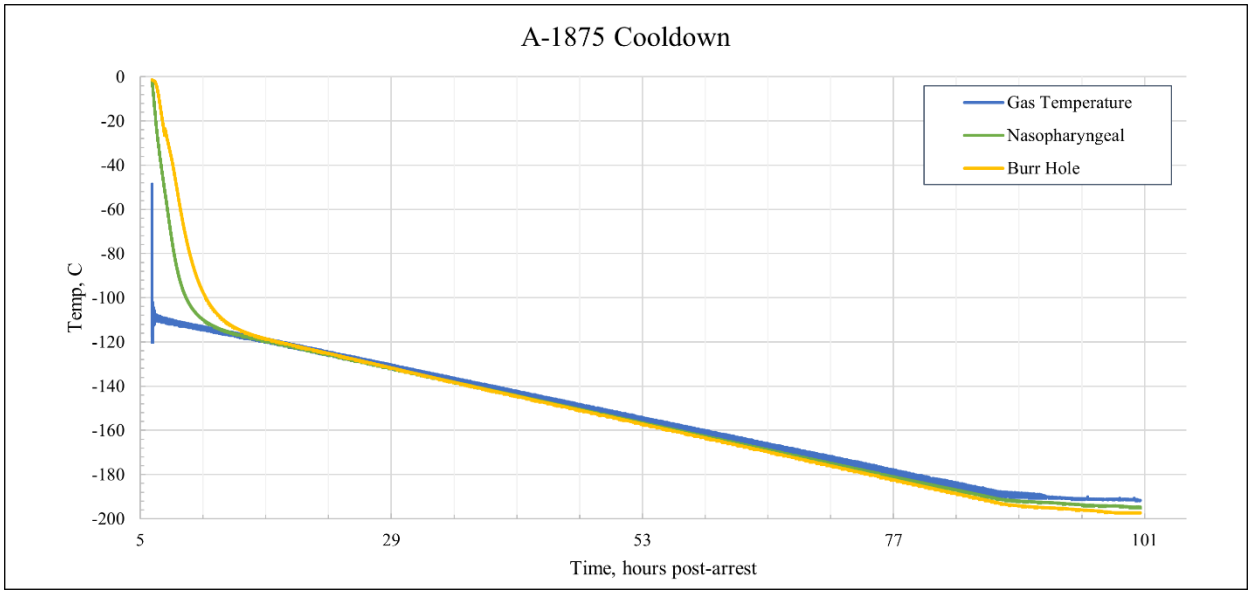
10. Cryoprotection and Temperature Graphs

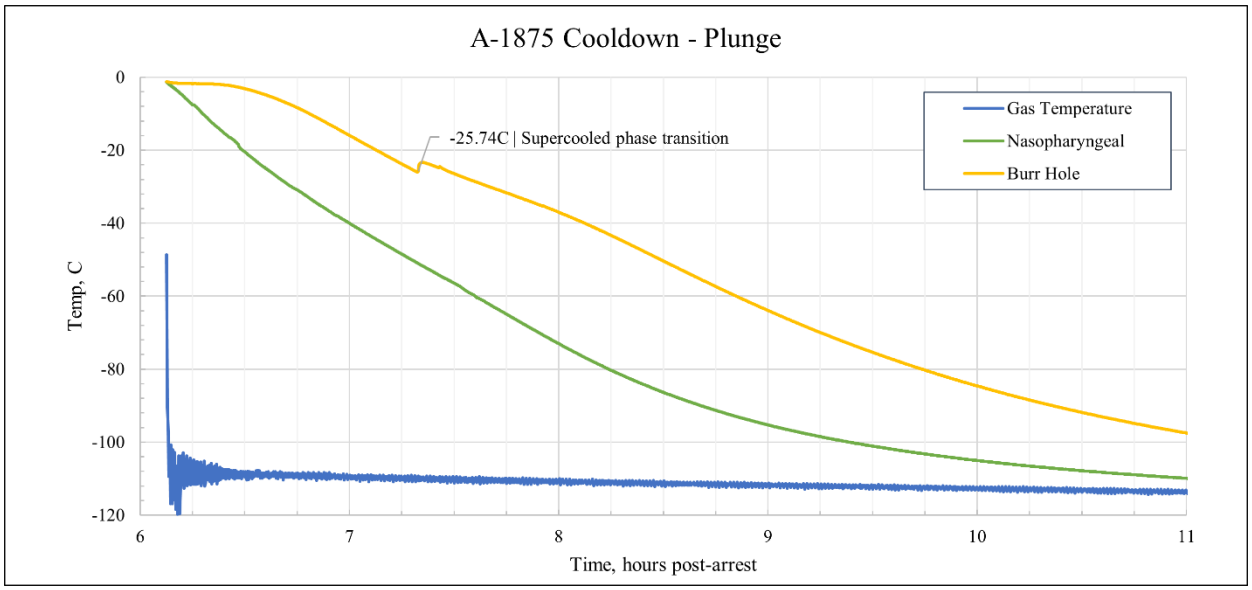





A-1875 Cryoprotection Pressure & Pump Speed
Arterial Supply Line Pressure
Arterial Supply Line Flow Rate
Pressure, mmHg
Flow Rate, mL/min
Time, hours post-arrest
120
100
80
60
40
20
0
-20
200
180
160
140
120
100
80
60
40
20
0
2
3
4
5
6
7


A-1875 Cryoprotection Concentrations
Ramp Pause
Left Jugular Effluent
Right Jugular Effluent
Arterial Supply Line
Refractometer sag due to faulty component
Arterial Supply Refract. unplugged; Effluent Refract. return to actual reading
Concentration, Brix
Time, hours post-arrest
70
60
50
40
30
20
10
0
2
3
4
5
6
7


A-1875 Cooldown
Temp, C
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
5
29
53
77
101
Time, hours post-arrest
Gas Temperature
Nasopharyngeal
Burr Hole


A-1875 Cooldown - Plunge
Temp, C
0
-20
-40
-60
-80
-100
-120
6
7
8
9
10
11
Time, hours post-arrest
-25.74C | Supercooled phase transition
Gas Temperature
Nasopharyngeal
Burr Hole

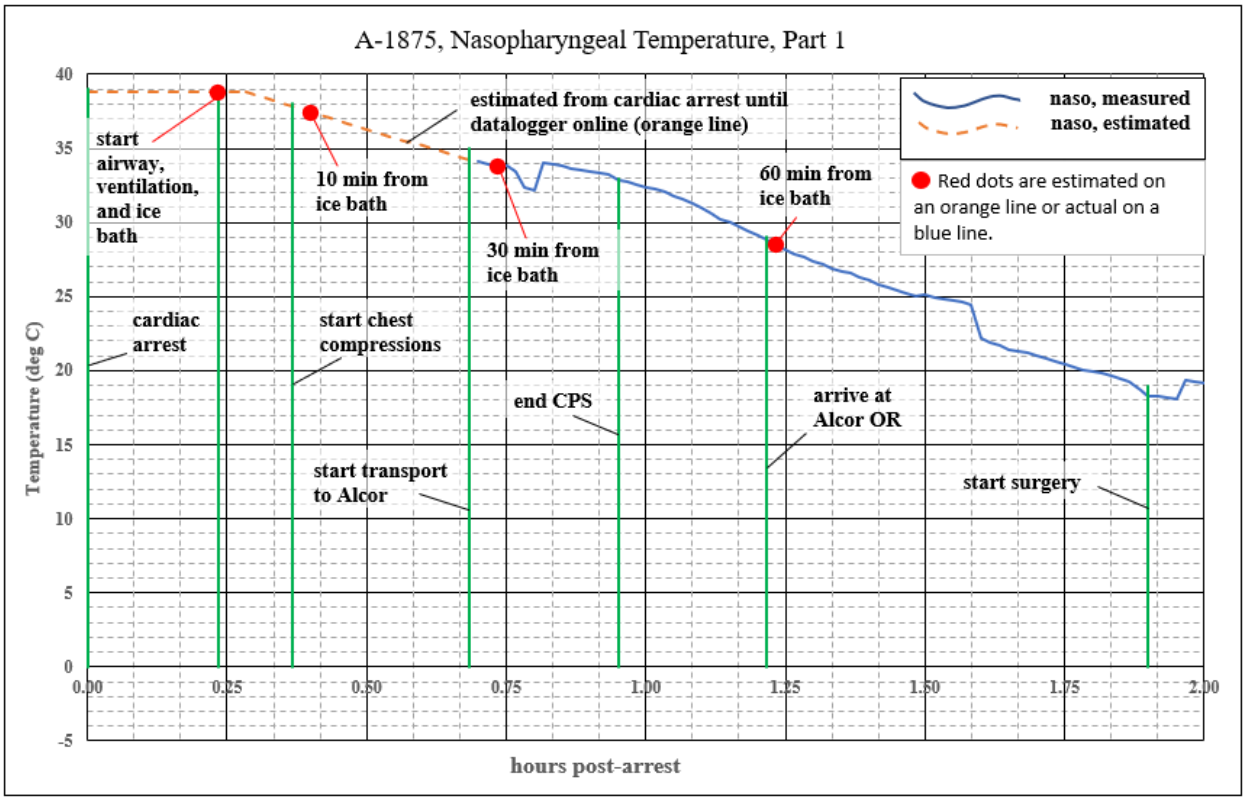
11. S-MIX

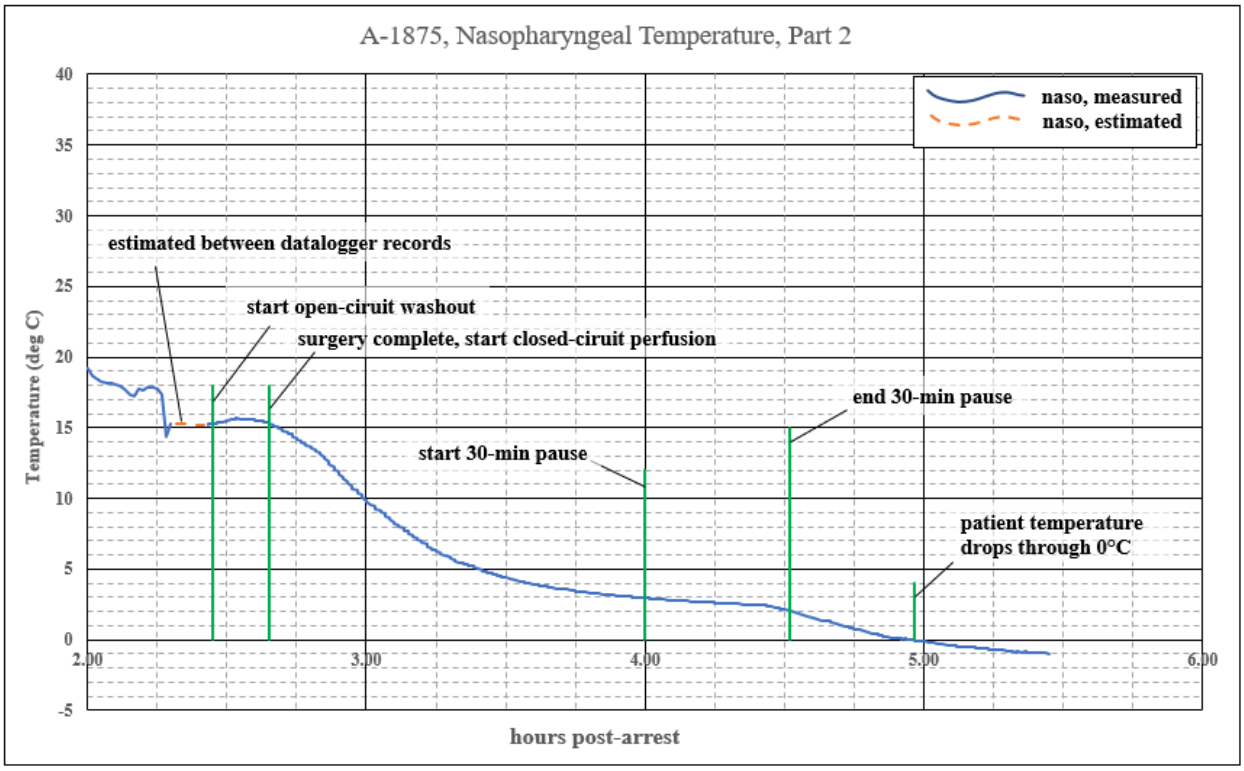
The Standardized Measure of Ischemic Exposure (S-MIX) expresses the total ischemic exposure prior to the start of cryogenic cooling as the equivalent duration of normothermic ischemia. An S-MIX of 00:00 (hh:mm) is the ideal case of no ischemic damage. The higher the S-MIX time, the more damage. Factors that improve the S-MIX, and that are quantitatively accounted for in the below table are: shorter times at higher temperatures, ventilation during cardiopulmonary support (CPS), and oxygenation during blood washout. The duration from cardiac arrest to 0°C is 04:58. As shown below, and due to lowering of the body temperature, S-MIX duration is shorter, at 01:34.

event	segment #	days (T+X)	time (MST) duration	post-arrest	Tnaso (deg C)	CPS w/ ventil.	washout oxygen.	S-MIX (hh:mm)
Time of cardiac arrest		T-0	17:46	00:00	38.8			
	seg 1		00:14	00:14	0.0	no	no	00:16
Place airway, start ventilation & ice bath		T-0	18:00	00:14	38.8			
	seg 2		00:08	00:08	-1.0	no	no	00:09
Start of manual chest compressions		T-0	18:08	00:22	37.8			
	seg 3		00:19	00:19	-3.6	yes	no	00:09
Start transport of patient to Alcor		T-0	18:27	00:41	34.2			
	seg 4		00:16	00:16	-1.3	yes	no	00:06
Termination of cardiopulmonary support		T-0	18:43	00:57	32.9			
	seg 5		00:16	00:16	-4.1	no	no	00:11
Arrival of patient at Alcor OR		T-0	18:59	01:13	28.8			
	seg 6		00:41	00:41	-10.5	no	no	00:17
Start surgery (cannulation and cephalic isolation)		T-0	19:40	01:54	18.3			
	seg 7		00:33	00:33	-3.0	no	no	00:08
Start open-circuit washout		T-0	20:13	02:27	15.3			
	seg 8		00:12	00:12	0.1	no	no	00:03
Surgery complete; start closed-circuit perfusion		T-0	20:25	02:39	15.4			
	seg 9		01:21	01:21	-12.4	no	no	00:11
Start 30-min pause for equilibration		T-0	21:46	04:00	3.0			
	seg 10		00:31	00:31	-0.9	no	no	00:03
End 30-min pause		T-0	22:17	04:31	2.1			
	seg 11		00:27	00:27	-2.1	no	no	00:02
Patient temperature thru 0°C		T-0	22:44	04:58	0.0			
totals:			04:58	04:58	-38.8			01:34*

* Each case has a different level of temperature estimation. Carefully review each case before using S-MIX in analyses.

The plots below show events related to the S-MIX calculation. The red dots can be used to construct a metric for how fast the patient is initially cooled (see the Patient Cooling Rate table below). This is a critical period since body temperature is highest and ischemic damage most rapid.

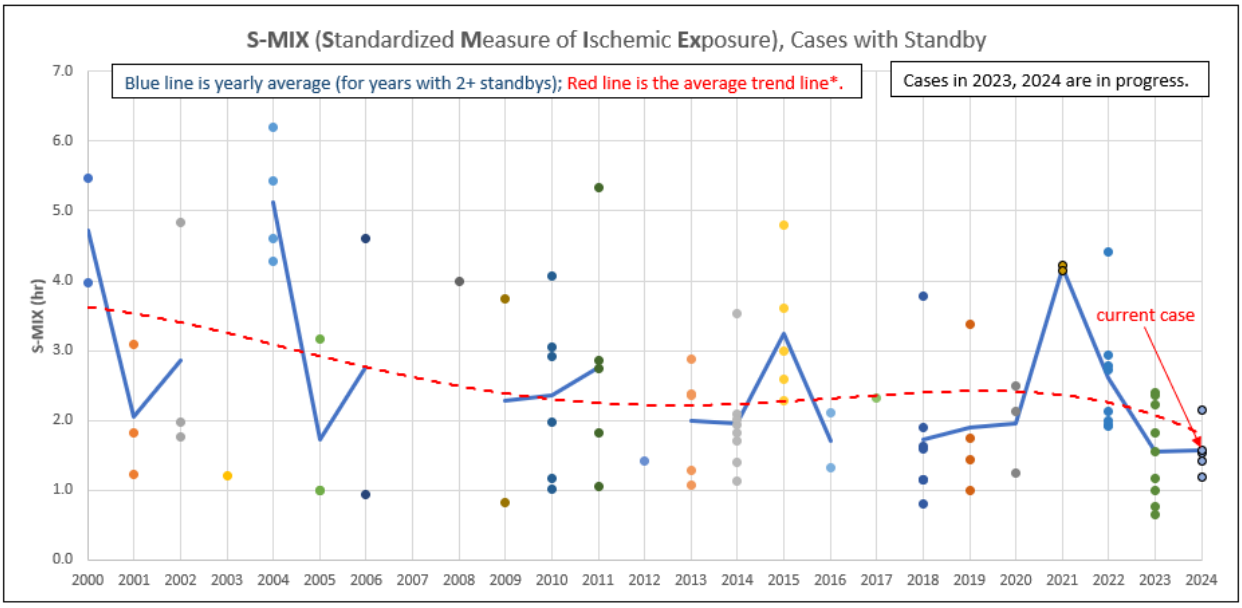




The table below provides cooling data for 10, 30, and 60 minutes after the team first applies water ice.

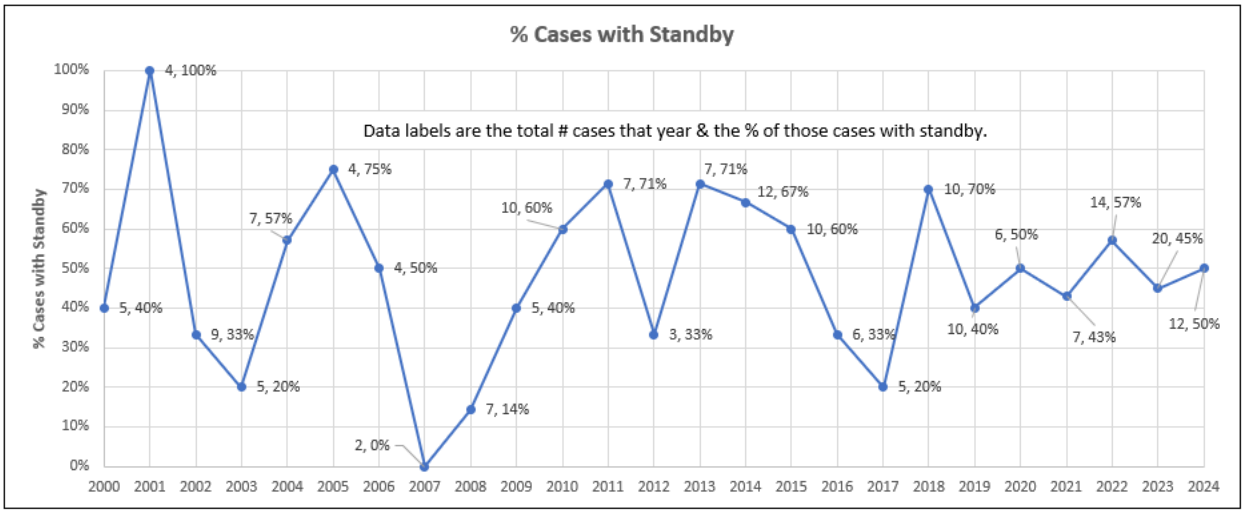
Patient Cooling Rate			(patient weight 58.9 kg; 130 lb)	
Note: time = 0 at start of ice bath	0 min elapsed	10 min elapsed	30 min elapsed	60 min elapsed
Naso temperature (°C)	38.8	37.4	33.8	28.5
Temperature drop (°C) from t = 0	0.0	-1.4	-5.0	-10.3
Cooling rate (°C/min) from t = 0	N/A	-0.14	-0.17	-0.17

The following plot shows the trend of S-MIX achieved since 2020 for just those cases that had standby and sufficient temperature records. Standby means that Alcor had staff and/or contractors, and their equipment, nearby the patient when cardiac arrest occurred. Each case is a dot. The blue line is the average SMIX each year. That line is broken for years that did not have at least 2 standby cases. The red line is the trend of the yearly averages. It shows a decline from 2000 to 2012, and again from 2021 to 2024, which indicates that ischemic damage is being reduced in those time frames.



* Trend line is a 4th-order polynomial fit of the blue average line.

The following plot shows how often cases receive standby. Cases may not receive standby for a number of reasons. The most common reason is that Alcor is notified post-mortem. This happens when a member dies unexpectedly, when a member dies alone, when a third party decides to cryopreserve a person after they die, and for various other reasons. Roughly speaking, half the cases receive standby.



Note: the total # cases from 2000 - 2024 is 191 and the % of those cases with standby is 50%

12. CT Scans

Cryoprotectant Distribution (Post-cryopreservation CT scan)

When the in-house scanner is functional and patients are being scanned, additional information will be added to this report.