Alcor A-3590

Case Report

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1. Summary

Information was derived from multiple sources and was all converted to Mountain Standard Time (MST). For de-identification, dates are not shown. T-0 represents the date of cardiac arrest, T-X represents occurrences before T-0, and T+X represents occurrences following T-0.

A-3590 was an 85-year-old member with neuro cryopreservation arrangements. The death certificate stated the cause of death as coronary artery disease. The estimated time of cardiac arrest was 11:30 hrs on T-0 days and the member was pronounced legally deceased in Arizona at 11:55 hrs on T-0 days in August of 2024.

After stabilization, the patient was driven to Alcor where field cryoprotectant perfusion (FCP) and cryogenic cooldown would be performed. The cryogenic cooldown was initiated on T-0 days at 17:47 hrs and terminated on T+4 days at 10:32 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+16 days at 15:27 hrs.

2. Member Assessment

T-0 days

This was an unexpected cardiac arrest of a member not on the Alcor Watchlist. The member's family contacted Alcor at 12:10 hrs and stated that the member had suffered a heart attack, had been transferred to the ER, and then taken to the Cath lab where the member went into cardiac arrest. The time of cardiac arrest was estimated to be 11:30 hrs, and the patient was pronounced legally deceased at 11:55 hrs.

3. Deployment

T-0 days

At 12:15 hours, Alcor's Medical Response Director (MRD) obtained contact information for the hospital and initiated 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.

On Level-2 deployments, it is standard practice to ship kits with equipment and medications required for the initial stabilization procedure, ensuring the DART team is fully prepared for an unexpected cardiac arrest. Once initial stabilization is started, the Alcor Medical Response Director (MRD) has time to ship the necessary perfusate to complete a Field Cryoprotection (FCP).

At 12:36 hrs, the MRD departed Alcor in the mobile response vehicle (MRV) to recover the patient. One local DART member was on call and available to meet at the hospital. On the drive, the MRD contacted the hospital and obtained pick-up information. It was discussed and agreed that transporting the member to the hospital morgue would shorten the time for pick-up, as it has a loading dock with direct access to the morgue, and the Cath Lab was far inside the hospital. The hospital security team met the MRD at the loading dock at 12:53 hrs with transfer papers ready to be signed. The digital audio recorder to record the stabilization procedures was turned on at 12:54 hrs.

4. Patient Recovery, Stabilization, and Transport to Alcor

T-0 days

At 13:06 hrs, the MRD obtained custody of the patient, and with the help of the hospital security personnel, transferred the patient into the portable ice bath (PIB) inside the MRV. 200 lbs. of water ice was added to the PIB. Due to back-to-back cases, some equipment had not been replenished in the MRV (see the Discussion section). Patient weight was 79.4 kg (175 lbs.).

Manual chest compressions were started at 13:10 hrs to circulate the stabilization medications. No intraosseous (IO) device was placed as the patient still had an I.V. in the left hand that had been earlier placed by hospital personnel. The I.V. was used to administer the stabilization medications which were started at 13:10 hrs (see the below Table of Medications Administration for the names of the medications, the dosages given, and the times of administration). Mechanical chest compression was not used on this case. Ventilation was provided by use of a manual AMBU bag. An endotracheal tube had been placed earlier by hospital personnel and was still in the patient.

Thermocouples were placed in the patient's nares at 13:31 hrs. The initial temperature readings were P-2/RNPT = 14.2°C, P-1/LNPT = 31.0°C. The MRV with the patient departed for Alcor at 13:34 hrs. Swimmer wax was placed in the nares to prevent water from entering, and the thermocouples were secured (stapled) to the patient's face to prevent slippage.

5. Cryoprotectant Surgery and Perfusion

T-0 days

The patient arrived at the back door to Alcor at 13:58 hrs and was brought into the OR at 14:00 hrs. The surface conduction cooling device (SCCD), which was not in the MRV (see the Discussion section) was not used until it was placed on the patient in the portable ice bath (PIB) upon arrival at Alcor. The nasopharyngeal temperatures (NPT) shown on the data logger at 14:01 hrs were P-2/ RNPT = 8.0°C, P-1/ LNPT = 28.2°C (see the Discussion section). The OR team waited for the patient's temperature to reach 20°C.

25,000 IU of streptokinase was added to bladder #1 at 14:21 hrs. A large bag of water ice was placed under patient's shoulders at 14:29 hrs to lift the patient's head out of ice. The burr hole was started on the patient's left forehead at 14:31 hrs using a Codman perforator. Cooled saline was poured over the perforator tip to cool the skull. The burr hole was complete at 14:33 hrs. A

Thermocouple was placed in the burr hole at 14:35 hrs and sutured to the scalp to secure. The initial burr hole temperature (BT) was 13.3°C.

The endotracheal tube was removed at 14:38 hrs to prepare for carotid artery cannulation and cephalic isolation. The first bilateral surgical cuts (one surgeon on each side of patient) were made at 14:40 hrs for the cephalic isolation. The right carotid artery was isolated 14:44 hrs and the left carotid artery was isolated 14:47 hrs.

The cephalic isolation procedure was started at 14:50 hrs. Using a mallet and osteotome, the spinal cord was severed at 14:51 hrs. The procedure was completed at 14:52 hrs. The cephalon was weighed at 14:53 hrs. The pre-cryoprotection weight of the cephalon was 5.085 kg. The cephalon was placed into halo in cephalic enclosure at 14:54 hrs.

The NPT and BH thermocouples were connected to the computer at 14:55 hrs. The initial temperature readings were: 19.3°C NPT, 17.9°C BH. The right carotid artery was cannulated with a 16-gauge, right angle cannula at 14:58 hrs. The left carotid artery was also cannulated with a 16-gauge, right angle cannula at 15:00 hrs.

The open circuit, gravity-induced cryoprotectant perfusion was initiated at 15:01 hrs using Bladder #1, which had a molarity of 0.0 and a calculated concentration needed to vitrify (CNV) of 0.0 Brix. The arterial pressure was 60 mmHg. See the below Table of Concentrations (Brix) of nM22 Solution, for the times the bladders were started, the precalculated concentrations of each bladder, and the refractive index of effluent samples were taken.

Back flow from vertebral arteries was noted at 15:02 hrs. This is an indication that the Circle of Willis in the brain is intact and the whole brain will be perfused. Arterial pressure was raised to 70 mmHg at 15:03 hrs. The right vertebral artery was cannulated with a 16-gauge vertebral cannula at 15:05 hrs. The left vertebral artery cannulated with a 16-gauge vertebral cannula at 15:06 hrs. Both jugular veins were cannulated with standard jugular cannulae at 15:16 hrs and effluent was flowing from both vessels.

Bladder #5 was hung and opened at 15:40 hrs. Bladder #6 was hung and opened at 15:48 hrs and expended at 16:05 hrs. Concurrently, the temperature of the cephalic enclosure was reduced from 3°C to -3°C.

Sidebar:
Per the cryoprotection protocol, the ramp is to be paused at 30 Brix (50% of the desired terminal concentration) to allow the patient to come to osmotic equilibrium. When the bladder system is used, bladders 5 & 6 represent the pause. 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 (52.5 Brix) and held between 102% and 105% concentration until the terminal concentration is obtained.

Tanning of the patient's face was dramatic at 16:21 hrs, but only mottled on the forehead. The right cornea did not appear to be collapsing, but the left cornea was starting to collapse from exposure to the cryoprotectant perfusate. The refractive index (RI) of the samples taken from the jugular veins at 17:00 hrs were L RI 50.3 Brix, R RI 50.09 Brix. The perfusion flow was

slowing due to the viscosity of the perfusate. The arterial pressure was increased to 85.41 mmHg at 17:13 hrs.

At 17:30 hrs the RI readings from the jugular veins were L RI 51.72 Brix, R RI 51.97 Brix. Cryoprotectant perfusion was terminated at 17:31 hrs because Bladder #11 was expended and the terminal concentration of cryoprotectant had been reached.

Sidebar:
The normal endpoint perfusate concentration for whole body patients is over 100% of the concentration needed to vitrify (CNV) for over 30 minutes from the venous return. For neuro patients, the endpoint perfusate concentration is over 100% for over 30 minutes from both jugular veins. The main pump is turned on and off repeatedly to compensate for latency.

Lines and equipment were removed from the patient at 17:37 hrs to weigh the cephalon. At 17:44 hrs the post-perfusion cephalon weighed 4.45 kg (5.085 – 4.45 = 0.635 kg loss, or a 12.5% loss due to dehydration from the effects of the cryoprotectant). The patient was moved into the patient care bay.

6. Cooling to Liquid Nitrogen Temperature

Computer-controlled cryogenic cooldown was initiated at 17:47 hrs on T-0 days, plunging to -110°C and descending thereafter at -1°C/hour to liquid nitrogen temperature. On T+4 days at 10:32 hrs, an uneventful cooldown was terminated. On T+16 days at 15:27 hrs, the patient was transferred to long-term care at liquid nitrogen temperature.

7. Timeline and Time Summaries

Timeline

T-0	11:30	Time of cardiac arrest
T-0	11:55	Time of legal pronouncement
T-0	13:06	Start of ice bath cooling
T-0	13:10	Start of manual chest compressions
T-0	13:10	Administered first medication (sodium citrate)
T-0	13:30	Administered last medication (antacid)
T-0	13:34	Start transport of patient to Alcor
T-0	13:59	Termination of cardiopulmonary support (time estimated)
T-0	14:00	Arrival of patient at Alcor OR (RNPT 8.0°C, LNPT 28.2°C)
T-0	14:40	Start surgery (cannulation and cephalic isolation)
T-0	14:52	Surgery completed
T-0	15:01	Start of cryoprotectant perfusion ramp (FCP)
T-0	15:40	Start 30-min pause for equilibration (Bladder #5)
T-0	16:05	End 30-min pause (Bladder #6)
T-0	17:31	Termination of FCP (L 51.72 Brix, R 51.97 Brix)
T-0	17:47	Start cryogenic cooldown
T+4	10:32	Terminate cryogenic cooldown
T+16	15:27	Transfer patient to long-term care at LN2

Time Summaries

01:36	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	13:06	Start of ice bath cooling
01:40	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	13:10	Start of manual chest compressions
01:40	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	13:10	Administered first medication (sodium citrate)
00:20	From:	T-0	13:10	Administered first medication (sodium citrate)
	Till:	T-0	13:30	Administered last medication (antacid)
03:10	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	14:40	Start surgery (cannulation and cephalic isolation)
00:12	From:	T-0	14:40	Start surgery (cannulation and cephalic isolation)
	Till:	T-0	14:52	Surgery completed
03:31	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	15:01	Start of cryoprotectant perfusion ramp (FCP)
02:30	From:	T-0	15:01	Start of cryoprotectant perfusion ramp (FCP)
	Till:	T-0	17:31	Termination of FCP (L 51.72 Brix, R 51.97 Brix)
06:01	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	17:31	Termination of FCP (L 51.72 Brix, R 51.97 Brix)
00:12	From:	T-0	14:40	Start surgery (cannulation and cephalic isolation)
	Till:	T-0	14:52	Surgery completed
00:21	From:	T-0	14:40	Start surgery (cannulation and cephalic isolation)
	Till:	T-0	15:01	Start of cryoprotectant perfusion ramp (FCP)
02:51	From:	T-0	14:40	Start surgery (cannulation and cephalic isolation)
	Till:	T-0	17:31	Termination of FCP (L 51.72 Brix, R 51.97 Brix)
02:30	From:	T-0	11:30	Time of cardiac arrest
	Till:	T-0	14:00	Arrival of patient at Alcor OR (RNPT 8.0°C, LNPT 28.2°C)
03:47	From:	T-0	14:00	Arrival of patient at Alcor OR (RNPT 8.0°C, LNPT 28.2°C)
	Till:	T-0	17:47	Start cryogenic cooldown

8. Table of Medications Administered

TIME	MEDICATION	DOSE	PURPOSE
13:10 hrs	Sodium citrate	20 g Note 2	Anticoagulant; prevents blood clot formation.
13:12 hrs	Heparin	50,000 IU	Anticoagulant; prevents blood clot formation.
13:15 hrs	Tempol	5 g	Low molecular weight superoxide scavenger used to mitigate ischemia-induced free radical damage.
13:16 hrs	Minocycline	200 mg	Antibiotic and neuroprotectant
13:17 hrs	Decaglycerol/THAM (1st dose)	200 ml Note 3	Decaglycerol inhibits cerebral edema.
13:18 hrs	Vasopressin (1st dose)	40 IU Note 4	Vasopressor; increases blood pressure during CPS.
13:22 hrs	SMT (S-methyl-isothiourea)	400 mg Note 5	Neuroprotectant (iNOS inhibitor); protects the brain from ischemic injury; raises blood pressure.
13:25 hrs	Vasopressin (2nd dose)	40 IU Note 4	Vasopressor; increases blood pressure during CPS.
13:25 hrs	Vital-Oxy (w/ saline)	40 mL Note 6	Antioxidants: melatonin, vitamin E (D-alpha tocopherol), PBN (alpha Phenyl t-Butyl Nitrone) and anti-inflammatory carprofen.
13:27 hrs	Decaglycerol/THAM (2nd dose)	200 ml Note 3	Decaglycerol inhibits cerebral edema.
13:30 hrs	Antacid	250 ml Note 7	A buffer used to neutralize stomach acid.
15:01 hrs	Streptokinase	25,000 IU Note 8	A thrombolytic used to break up existing blood clots.

Notes:

1. Because this was a postmortem notification the abbreviated medications protocol should have been used (see the Discussion section). Instead, all medications except propofol were administered.

2. 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 79.4 kg and therefore received 20 grams of sodium citrate.

3. 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.

4. 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.

5. 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.

6. 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.

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

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.

9. Table of Concentrations (Brix) of nM22 Solution

A-3590 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**
1	0.00	0.00	9.80	15:01	3.10	285.7
2	0.05	0.47	11.81	15:08	3.22	250.0
3	0.08	0.78	13.14	15:16	3.35	133.3
4	0.14	1.29	15.35	15:31	3.60	222.2
5	0.50	4.67	29.85	15:40	3.75	250.0
6	0.50	4.67	29.85	15:48	3.88	117.6
7	1.06	9.91	52.31	16:05	4.17	400.0
8	1.06	9.91	52.31	16:10	4.25	71.4
9	1.06	9.91	52.31	16:38	4.72	250.0
10	1.06	9.91	52.31	16:46	4.85	181.8
11	1.06	9.91	52.31	16:57	5.03	58.8
END				17:31	5.60	
* does not account for concentration of non-penetrating CPAs						

10. Discussion

Standby and Stabilization

Though this should have been an abbreviated medication protocol case, all medications were administered with the exception of propofol, which was omitted because this was a postmortem notification. The medications that are not given in the abbreviated protocol are Propofol, Vital-Oxy, Vasopressin, and SMT. Three of these medications were given during this case (Vital-Oxy, Vasopressin, and SMT). In this case, the patient had been deceased for approximately one hour at the time of arrival on scene. Alcor's standard protocol states that the full medication protocol should be used when death occurs within an hour, as many of the body's systems are still responsive, allowing medications like Propofol, Vital-Oxy, Vasopressin, and SMT to be effective.

The team had initially hoped to reach the patient within that one-hour window and, considering the patient was right at the hour mark, the decision was made to proceed with the full protocol. Given that the team was operating in a gray area, where the time of death was very close to the one-hour cutoff, the team erred on the side of caution and used the full protocol, believing it might still provide benefit. Since the team was initially working under the assumption that the patient could be reached within the hour, the decision to administer medications from the full protocol was based on the possibility that certain systems may still be responsive enough to improve the outcome of the cryopreservation. While it is now recognized that the abbreviated protocol should have been used due to the slight delay, the decision was made with the patient's best interests in mind, and the team aimed to maximize the chances of successful stabilization.

The administration of these medications likely did not have a negative impact on the overall outcome of the case. However, the inclusion of unnecessary medications may have affected the timeline of stabilization, added complexity to the process, and potentially interfered with prioritizing other aspects of the case. While Propofol was correctly omitted, the other three medications from the full protocol were given in good faith, but they likely did not alter the overall case outcome. While the team's decision to administer the full protocol in this case was based on good intent and the hope of arriving within the one-hour window, it is recognized that switching to the abbreviated protocol would have been the more appropriate response. Moving forward, communication and training will be improved to ensure such errors are avoided in similar scenarios.

On the last local case, the battery-operated devices had malfunctioned due to the heat of Arizona, having been left in the mobile response vehicle (MRV) during standby. The DART members had taken all battery-operated devices out of the MRV following the last case for testing and preparation for the next case. All devices tested were in good operating condition, but they were staged by the back door to be grabbed and put in the MRV when needed so they weren't sitting in the heat. These devices included the SCCD, the thumper, and the SAVe-I ventilator. When departing Alcor for this case, the MRD was unaware that the devices had not been placed back in the MRV for use.

Due to not having the equipment, manual compressions were administered for no less than 10 minutes following the administration of the last medication. Manual breaths were administered via AMBU bag ventilation for the entirety of stabilization, and the SCCD was not placed until the team arrived back at Alcor with the patient, when the SCCD was placed immediately on the patient for cooling, with a focus on the head and neck. The MRD has implemented a process for

local cases that requires the battery-operated devices to be staged on the shelf with the “ready to go” kits during intercessions between cases to protect the equipment from the heat. The equipment is clearly labeled as “MRV” so the team can easily identify them. The MRD has sent a communication to the entire DART team educating them on this new process and sent pictures of the location of the equipment, so the team is fully aware.

There were no ice chests in the MRV as it was still being replenished from the previous case. There should always be three ice chests in the MRV.

Transport of the Patient

The transportation of the patient was uneventful. The data file from the logger was successfully retrieved. When the patient first arrived in the OR, the initial nasopharyngeal temperatures showing on the data logger at 14:01 hrs were RNPT = 8.0°C and LNPT = 28.2°C. It was assumed that the right thermocouple was not placed deep enough into the nare, but it was reliably tracking the other thermocouple with the temperature descent.

Cryoprotectant Surgery and Perfusion at Alcor

The cryoprotection was a gravity-fed step ramp procedure in the Alcor OR with computer data acquisition. The details observed during the procedure are widely consistent with a successful cryopreservation. No notable issues emerged.

Sidebar:

The gravity feed system for field cryoprotection 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].

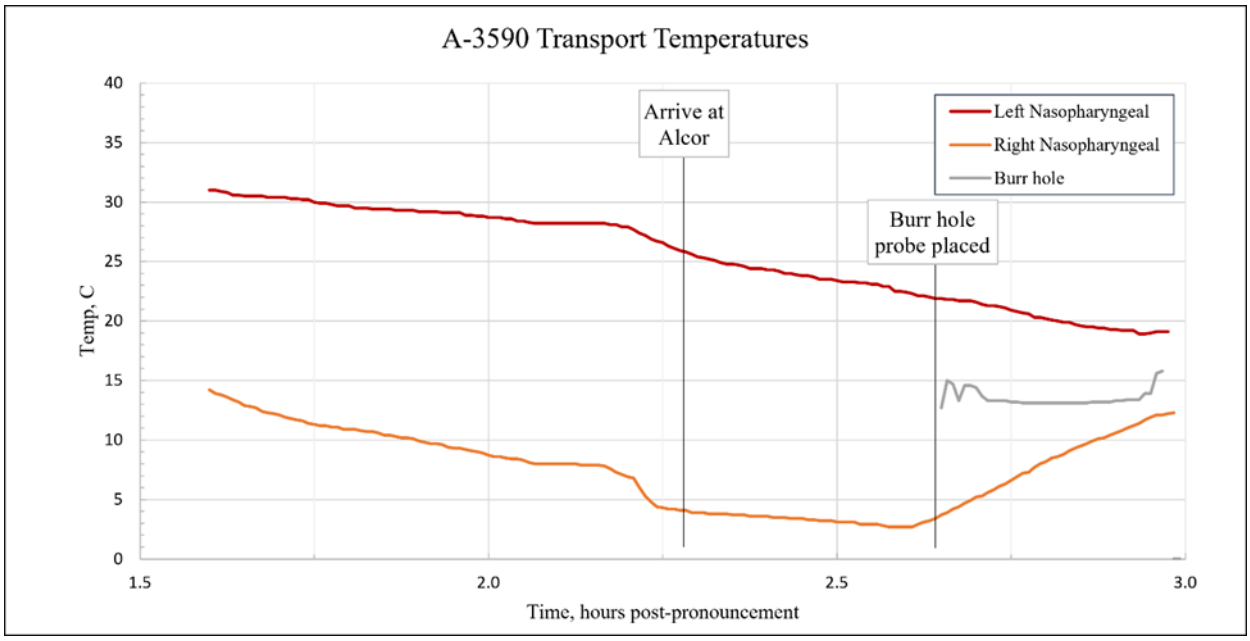
By hanging two bladders with different refractive index (RI) concentrations on a teeter-totter atop the tripod, the bladder with the lower RI runs out and becomes lighter. At the mid-way point, the teeter-totter will allow both bladders to flow, mixing the two concentrations and creating a smoother transition 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.

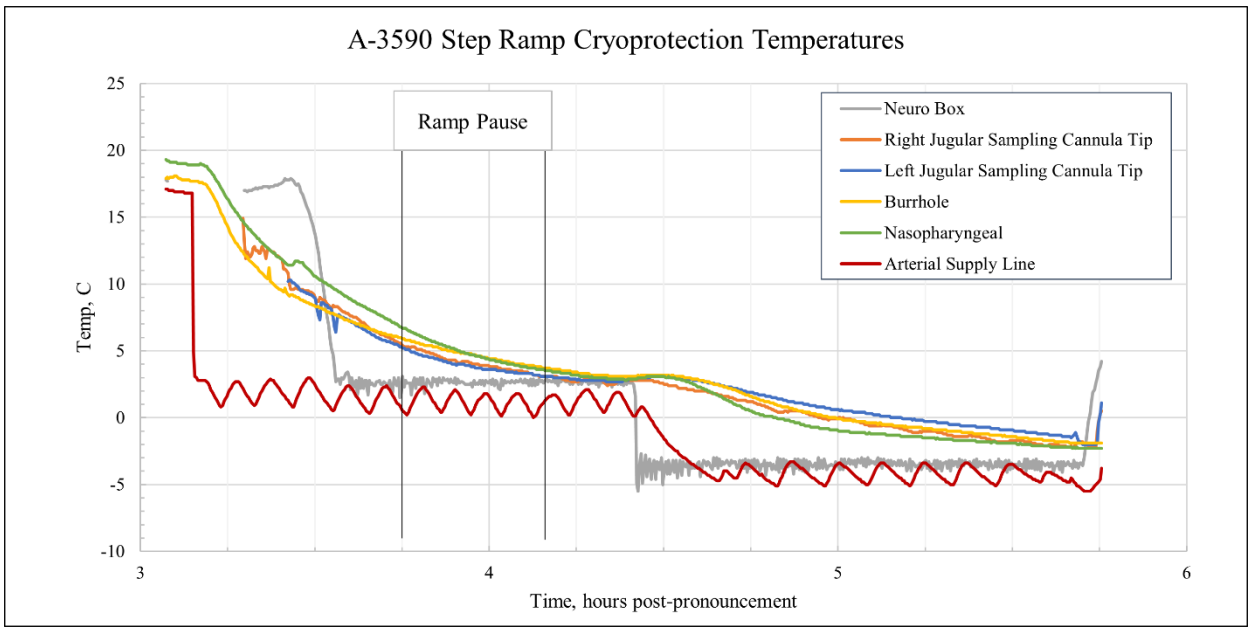
Alcor’s local surgeon was on hospital duty until 15:30 hrs when this last-minute case started at 11:55 hrs. The Medical Response Director (MRD) discussed this problem with the Chief Operating Officer (COO) and other Alcor staff, all of whom were in agreement that it was not beneficial to the patient to wait for the surgeon. It was decided that when the patient reached the optimal temperature of 20°C, surgery would commence with the MRD as the lead surgeon.

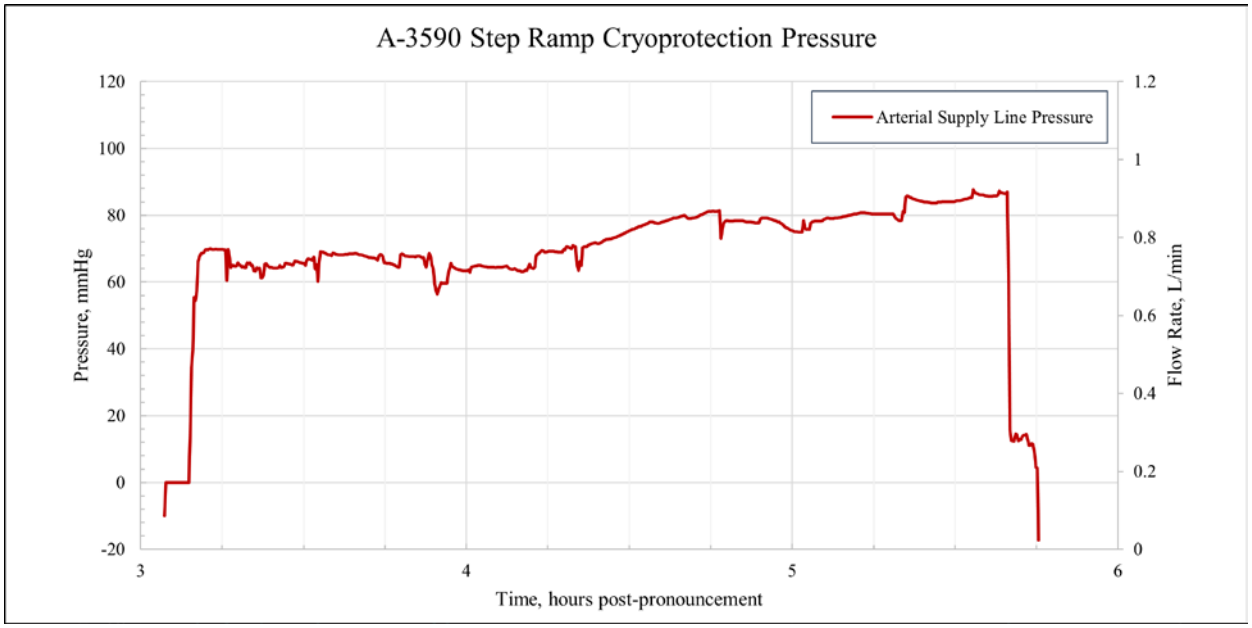
Cryogenic Cooldown

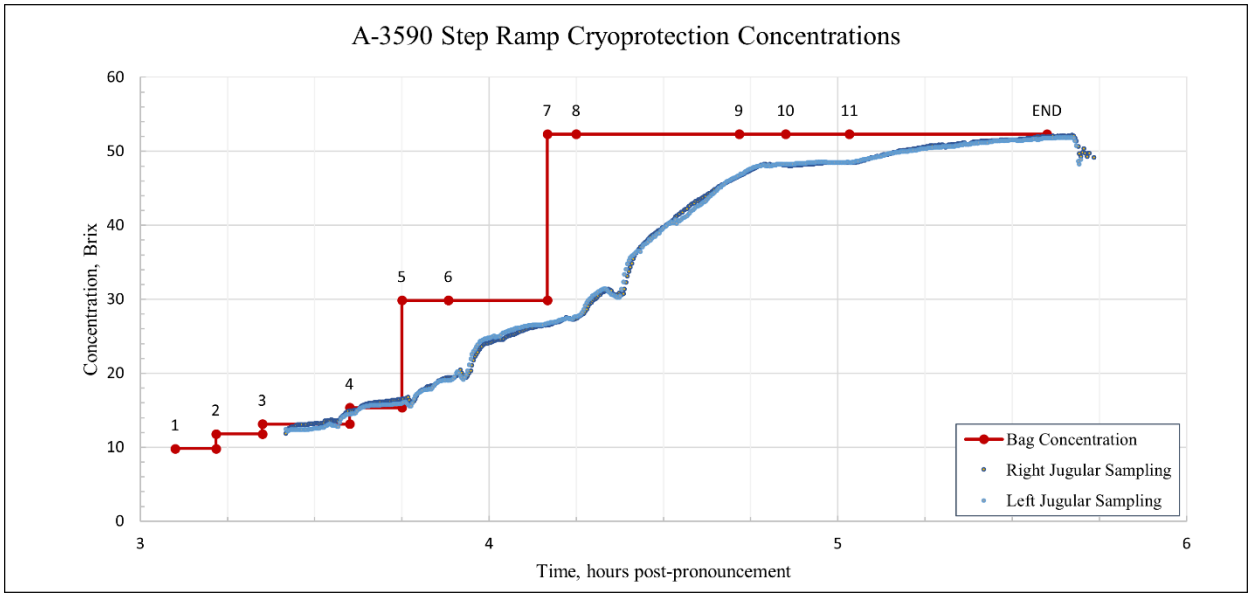
The cooldown proceeded uneventfully. No isotherm is observed in the patient temperature probes. From -3°C to -110°C, the burr hole probe recorded an average cooling rate of -0.26°C/min.

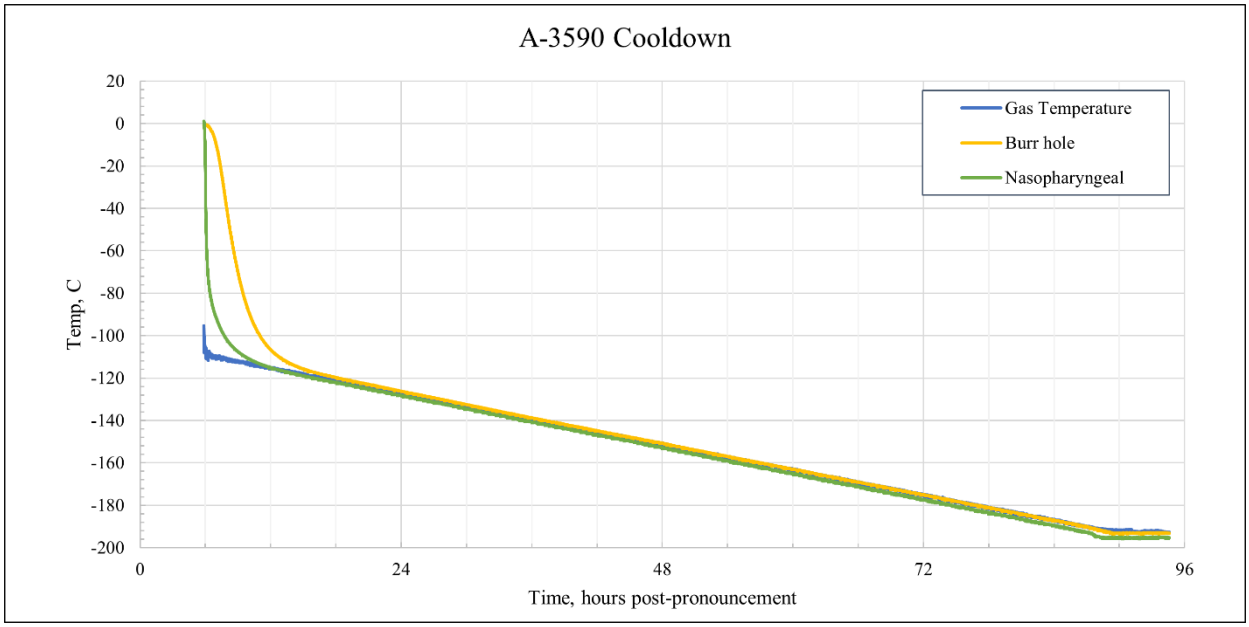
11. Cryoprotection and Temperature Graphs

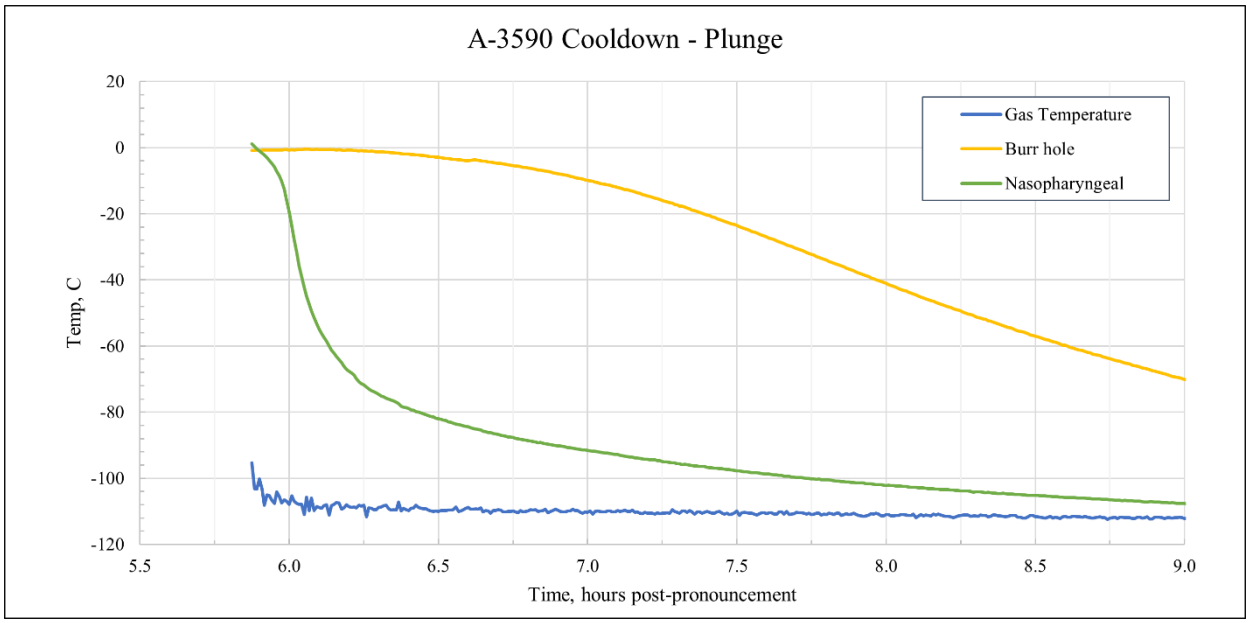





A-3590 Step Ramp Cryoprotection Pressure
Arterial Supply Line Pressure
Pressure, mmHg
Flow Rate, L/min
Time, hours post-pronouncement
120
100
80
60
40
20
0
-20
1.2
1
0.8
0.6
0.4
0.2
0
3
4
5
6


A-3590 Step Ramp Cryoprotection Concentrations
Concentration, Brix
Time, hours post-pronouncement
Bag Concentration
Right Jugular Sampling
Left Jugular Sampling
1
2
3
4
5
6
7
8
9
10
11
END
60
50
40
30
20
10
0
3
4
5
6


A-3590 Cooldown
Temp, C
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
24
48
72
96
Time, hours post-pronouncement
Gas Temperature
Burr hole
Nasopharyngeal


A-3590 Cooldown - Plunge
Temp, C
20
0
-20
-40
-60
-80
-100
-120
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
Time, hours post-pronouncement
Gas Temperature
Burr hole
Nasopharyngeal

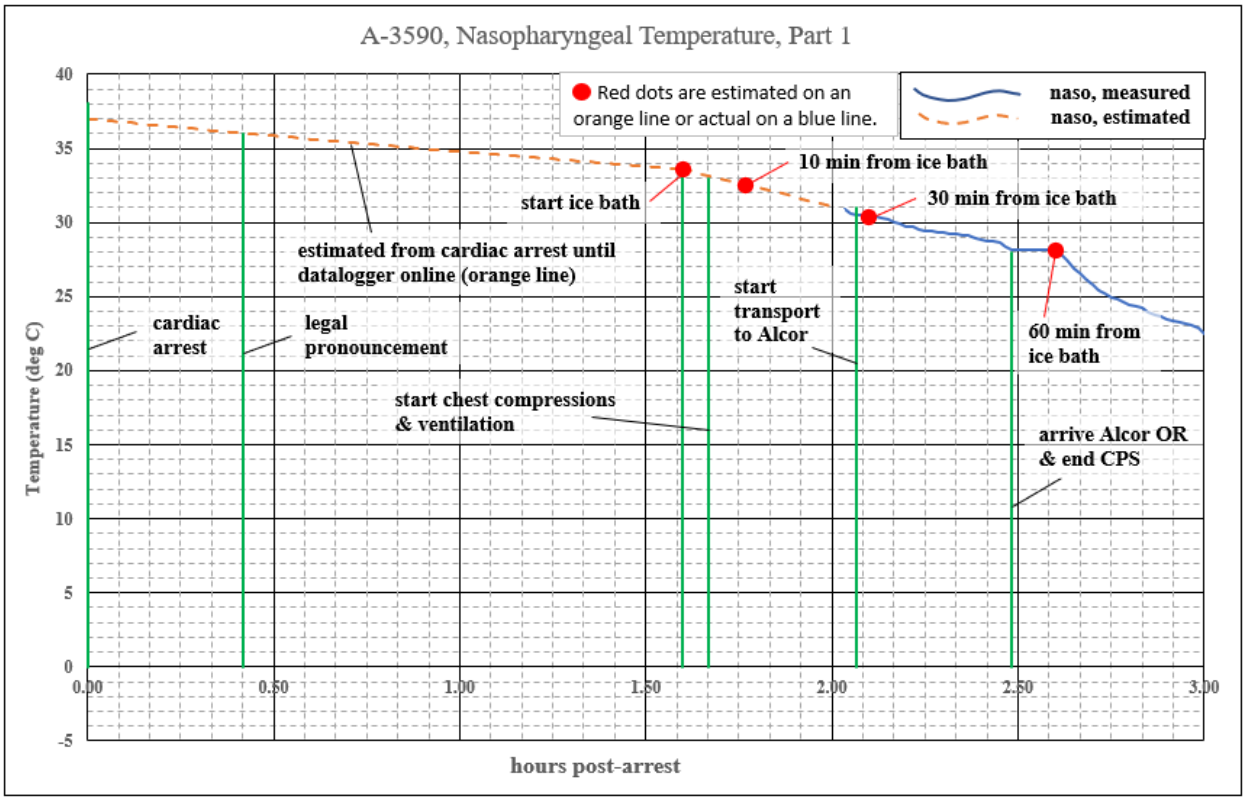
12. S-MIX

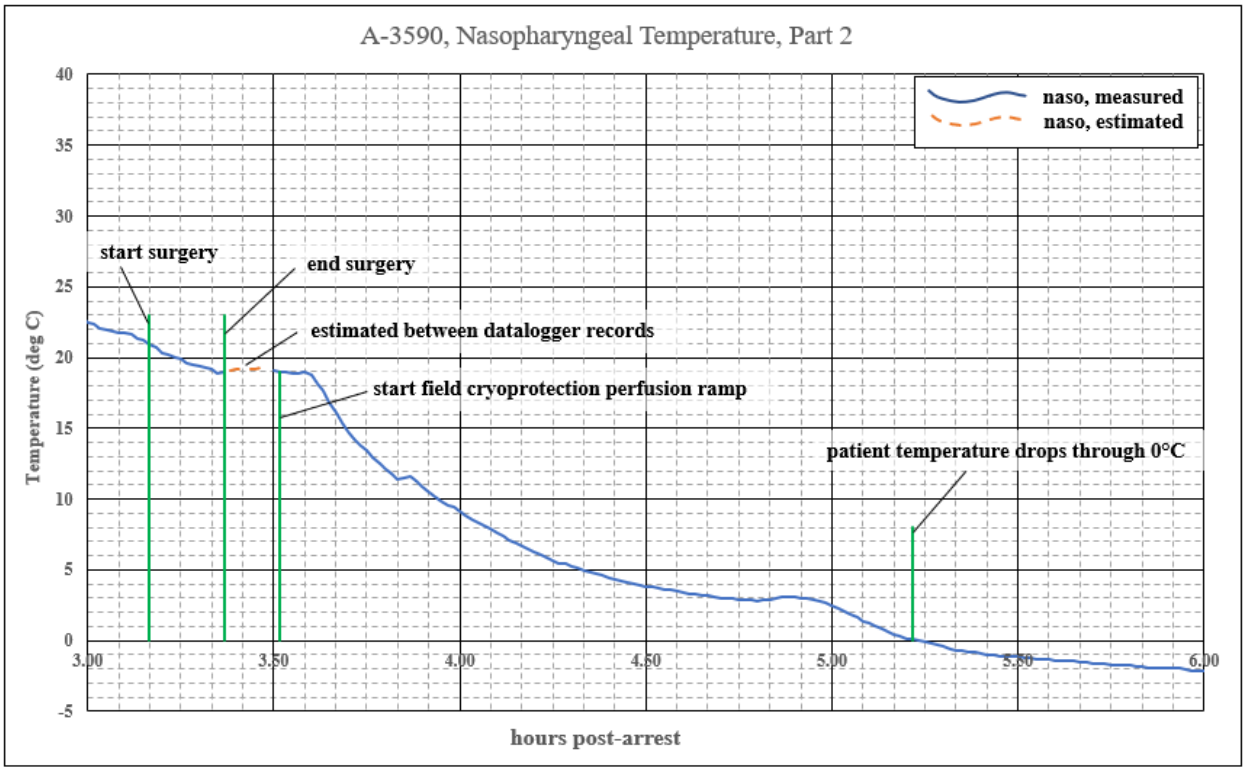
The Standardized Measure of Ischemic Exposure (S-MIX) expresses the total ischemic exposure prior to the start of cryogenic cooling as the equivalent duration of normothermic ischemia. An S-MIX of 00:00 (hh:mm) is the ideal case of no ischemic damage. The higher the S-MIX time, the more damage. Factors 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 05:13. As shown below, and due to lowering of the body temperature, S-MIX duration is shorter, at 02:21.

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	11:30	00:00	37.0			
	seg 1		00:25	00:25	-1.0	no	no	00:24
Time of legal pronouncement		T-0	11:55	00:25	36.0			
	seg 2		01:11	01:11	-2.4	no	no	01:01
Start of ice bath cooling		T-0	13:06	01:36	33.6			
	seg 3		00:04	00:04	-0.4	no	no	00:03
Start chest compressions & ventilation		T-0	13:10	01:40	33.2			
	seg 4		00:24	00:24	-2.7	yes	no	00:08
Start transport of patient to Alcor		T-0	13:34	02:04	30.5			
	seg 5		00:25	00:25	-2.3	yes	no	00:07
Arrival at Alcor OR & end CPS		T-0	13:59	02:29	28.2			
	seg 6		00:41	00:41	-7.3	no	no	00:18
Start surgery (incl cephalic isolation)		T-0	14:40	03:10	20.9			
	seg 7		00:12	00:12	-1.9	no	no	00:04
Surgery completed		T-0	14:52	03:22	19.0			
	seg 8		00:09	00:09	0.0	no	no	00:03
Start field cryoprotectant perfusion ramp		T-0	15:01	03:31	19.0			
	seg 9		01:42	01:42	-18.9	no	no	00:13
Patient temperature thru 0°C		T-0	16:43	05:13	0.1			
totals:			05:13	05:13	-36.9			02:21*

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

The below plots show events related to the S-MIX calculation. The unexpected cardiac arrest resulted in a delayed start of the ice bath. 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 below table provides cooling data for 10, 30, and 60 minutes after the team first applies water ice.

Patient Cooling Rate			(patient weight 79.4 kg; 175 lb)	
Note: time = 0 at start of ice bath	0 min elapsed	10 min elapsed	30 min elapsed	60 min elapsed
Naso temperature (°C)	33.6	32.6	30.4	28.1
Temperature drop (°C) from t = 0	0.0	-1.0	-3.2	-5.5
Cooling rate (°C/min) from t = 0	N/A	-0.10	-0.11	-0.09

13. CT Scans

Cryoprotectant Distribution (Post-cryopreservation CT scan)

When the in-house scanner is functional additional information will be added to this report.