Alcor A-1095

Case Report

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November – 2024

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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-1095 was an 83-year-old member with neuro cryopreservation arrangements. The member was on the Alcor Watchlist for declining dementia and had been placed in hospice care. Cardiac arrest was estimated to be at 03:55 hrs on T-0 days and the member was pronounced legally deceased in Arizona at 04:27 hrs on T-0 days in August of 2024.

After stabilization, the patient was driven to Alcor for cryoprotectant perfusion and cryogenic cooldown. The patient arrived at Alcor on T-0 days at 05:26 hrs. The cryogenic cooldown was initiated on T-0 days at 11:45 hrs and terminated on T+4 days at 21:16 hrs. The patient was transferred to long-term care at liquid nitrogen temperature on T+18 days at 15:35 hrs.

2. Member Assessment

T-24 days

This member was placed on the Alcor Watchlist several weeks prior to legal death. The member was admitted to the hospital for a finger infection that was not healing and placed on I.V. antibiotics. Due to the member's declining dementia, the family requested the member be placed in a group care home because the family was unable to care for them alone.

T-5 days

Alcor's Medical Response Director (MRD) called the member's family for an update on the member's health status. The member had been discharged from the hospital and placed in a group care home under the care of hospice. The member was not eating or drinking, and the family reported that they mostly slept. The MRD called the group care home and obtained permission for Alcor to visit the member without restrictions. The MRD then called the hospice nurse caring for the member and received the following assessment:

The member had not eaten or drunk anything for the last two days. They did not open their eyes to verbal cues, but did open their eyes when the nurse took the vital signs, looked confused, and just stared at the nurse. The nurse listed the member as A+Ox1 (alert and oriented to self) but the MRD disagreed, calling the member A+Ox0, meaning the member was alert but not oriented to self. The member was bed bound and did not shift self in the bed. When attempting to speak, the member's speech was muffled and garbled. The member was not following commands. They made facial grimaces when trying to drink and did not swallow.

The vital signs were stable: blood pressure (BP): 129/85, temperature (T) 37°C, respiration rate (RR) 18, heart rate (HR) 94, capillary oxygen saturation (SPO2) 94% on room air. There were no signs of pitting edema. The lung sounds were clear. There were no apparent signs of pain. The member was incontinent with concentrated urine output.

The nurse stated that the member was officially admitted to hospice care, and hospice would not treat the member with aggressive care (interventions that are considered aggressive are fluids,

tube feeding, life sustaining medications, CPR/intubation). They would treat the member for comfort only.

T-4 days

The MRD dispatched a member of the Alcor Deployment and Recovery Team (DART) to obtain an eyes-on assessment of the member to confirm the information given by the group care home and to gather more information in order to make a well-informed deployment decision. The assessment was as follows: The member's vital signs were BP 160/100, HR 100, and SPO2 94% on room air.

The member opened their eyes when the DART team member spoke, but there was no attempt at communication from the member. During the assessment, the member was in and out (meaning the member would close their eyes and become intermittently unresponsive during assessment). The member was receiving no food, hydration, or any pain medication.

The member was placed on the Owlet monitoring device for monitoring of vitals and motion (see the Discussion section).

T-3 days

The member's family called Alcor via the emergency phone line at 11:04 hrs to inform the team that the hospice nurse had visited the member and reported that the member was actively transitioning (a term used by hospice to mean that the member is transitioning to the process of actively dying). This usually gives a window of 24-72 hours.

The MRD spoke with the hospice nurse at 11:55 hrs and obtained the following report: The member was unresponsive and not following commands. The vital signs were: HR 109, BP 148/107, the SPO2 was fluctuating between 86-94% without intervention, RR 20 and not labored. The nurse had given morphine due to the elevated vitals, and the member responded with a grimace to the medications.

The MRD reported to the Alcor Deployment Committee that the member was probably within 72 hours of cardiac arrest, which is less than the seven day, ideal window for deployment, and recommended that Alcor call a Level-1 deployment immediately. The Deployment committee discussed the details of the case and agreed to the Level-1 deployment at 12:00 hrs.

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.

3. Deployment

T-3 days

Four members of the DART team were deployed for this case (see Discussion section). One regional (not located in the Phoenix area) DART member arrived at Alcor at 20:00 hrs, and prepared the Alcor mobile response vehicle (MRV) for deployment. Two additional regional DART members arrived at 22:00 hrs, and joined the other regional member stationed at a rental property three minutes from the member's group care home.

Because the group care home visiting hours ended at 17:00 hrs, the DART team monitored the member by using the Owlet monitoring device until the morning.

4. Standby

T-2 days

The DART team assessed the member at 07:43 hrs, and gave the following report: The vitals were: BP 212/140, HR 105, SP02 87%, T 36°C, RR 10 and non-labored. The member had not been eating or drinking for five days. The last bowel movement (LBM) had been made seven days before, and bowel sounds were absent. When the member attempted to speak and to open their eyes, the sounds were muffled and garbled.

The member was A&Ox0 (not alert and oriented) and moaned when being moved. They were bed bound and moving the upper and lower extremities slightly. They were not following commands. No edema was noted, but there was mottling of the bilateral extremities (BLE). There was a fungal infection reported by a caregiver on the sacrum with a stage-2 (untreated) wound.

The member's breathing was clear, but shallow, not using the accessory muscles. The last morphine was given at noon the day prior, by a hospice nurse. No other PRN (as needed) medications had been given. The member groaned when given a bed bath. The member was incontinent with concentrated urine.

The caregiver reminded the team that they could not visit the member after 17:00 hrs to check on the member unless he went into cardiac arrest, at which point the team would be given immediate access. The team was also not allowed to stage the portable ice bath (PIB) in the group care home. The hospice nurse would visit the member later that morning to evaluate the pain medication regimen.

The hospice nurse visited the member at 12:00 hrs, and educated the caregiver on when to administer morphine PRN. A dose had been given to the member at 10:00 hrs. The nurse stated that she believed the member was transitioning, but was not yet imminent.

The DART team assessed the member at 17:00 hrs, and provided the following report: The vitals were: BP 236/152, HR 109, SP02 89 %, T 36°C, RR 8, A+Ox0. The member was moving their arms and legs slightly but was not following commands or responding when spoken to.

The member had been given Ativan by the caregiver for anxiety and morphine for pain management at that time. The Owlet monitor was set up for the evening.

T-1 days

At 06:32 hrs, the DART team reported the following assessment from the overnight monitoring via the Owlet device: The member's SPO2 ranged from 86-90% over night, HR 109-150. The member appeared to be comfortable on the monitor and less restless.

The DART team visited the member at 08:16 hrs and reported the following: The vitals were: BP 220/150, HR 115, SPO2 89%, T 37°C, RR 8, with 2-3 seconds of apnea with snoring. A pedal pulse was present. 10 mg of morphine was given at 07:30 hrs. There were no changes in the skin or the appetite. The member appeared comfortable, displayed decreased restlessness, and was not moving the extremities. The caregiver reported that another dose of Ativan had been given (but the time and dosage had not been recorded).

The DART team visited the member again at 16:30 hrs and reported the following: BP 120/60, HR 110, SPO2 84%, RR 8 with increased apnea and by using the accessory muscles. No medications had been administered since 09:00 hrs. The member appeared to be imminent. The Owlet monitor was set up for overnight monitoring.

At 19:11 hrs, the DART team reported the following from the Owlet Monitor: The member's pulse was 110 and SPO2 was 85%. An alarm was set to notify the team if SPO2 dropped below 70%.

At 21:50 hrs, the MRD reported the following from the Owlet monitor: HR 123, SPO2 83%. Between the hours of 22:00 and 00:00, the MRD and DART team closely watched the Owlet monitor. The monitor occasionally alarmed that there was difficulty with obtaining a reading. This is a sign that either the monitor was taken off the member or the member was moving too much to obtain a proper reading. When the monitor alarmed, the team would check the app, and it eventually (within seconds) would recapture vital signs.

T-0 days

The Owlet Monitor alarmed at 00:00 hrs that it was having difficulty obtaining readings (see the Discussion section). The DART team took shifts watching the member via the video monitor. At 03:30 hrs: The MRD called the team member who was checking the monitor. Both the MRD and the DART member observed the member breathing (chest rise and fall with breath sounds) on the video monitor and counted in agreement that the respiration rate (RR) was 5 and irregular, with long pauses of apnea, a sign of imminent cardiac arrest.

They agreed to call the caregiver to request a check on the member and inform him that DART would be stationed outside the group care home. The caregiver did not answer the phone. They discussed how to proceed and agreed that the DART team would take the MRV to be at the member's location and then call the hospice nurse for standby and possible assessment.

At 03:55 hrs, the MRD was monitoring the Owlet device and observed the member take a breath, after which there were no further breaths. The MRD called the DART team, which was outside the member's location, and reported the final breath. The team immediately began

knocking on the door. The hospice nurse had been called by the MRD and was enroute to the member's location. No one answered the door. The caregiver was again called, but again there was no answer.

The hospice nurse arrived at 04:23 hrs. At 04:25 hrs, the hospice nurse called the caregiver with success, and the DART team and hospice nurse were granted entry. At 04:27 hrs, the member was pronounced legally deceased by the hospice nurse. The member weighed 99.8 kg (220 lbs.).

5. Patient Recovery, Stabilization, and Transport to Alcor

T-0 days

The patient was moved from the bed to the PIB at 04:29 hrs (see the Discussion section). The PIB had previously been filled with 210 lbs. of ice. Manual chest compressions were started at 04:30 to restart ventilation of the patient and to circulate the stabilization medications. At 04:35 hrs the mobile response vehicle (MRV) departed with the patient and started the drive to Alcor. One team member was driving, and three team members continued with the stabilization procedures.

At 04:35 hrs the first of two intraosseous (EZ-IO) devices was placed in the tibial plateau of the patient's right leg. A second EZ-IO was placed in the tibial plateau of the patient's left leg at 04:37 hrs, to make it possible for two team members, one on each side of the patient, to deliver stabilization medications at the same time. Mechanical chest compression with the Rosc-U device was started at 04:37 hrs. The first stabilization medication was administered at 04:38 hrs (see the below Table of Stabilization Medications for the names of all the medications, the times of administration, and the dosages).

A King LT-D airway was placed at 04:40 hrs, and mechanical ventilation of the patient was started at 04:42 hrs. The CO2 colorimeter detector was used to ensure the airway was properly placed. The surface conduction cooling device (SCCD) with face mask was started at 04:50 hrs to enhance external cooling by flushing ice water over the patient. Thermocouples were placed in the patient's nares at 04:45 (right, port-1) and 04:46 (left, port-2). Initial temperature readings were 35.9°C in the right nare and 32.9°C in the left nare.

6. Cryoprotectant Surgery and Perfusion at Alcor

T-0 days

The MRV with patient arrived at the back door at Alcor at 05:24 hrs. The patient, still in the PIB with the Rosc-U providing chest compression, was rolled into the operating room (OR) at 05:26 hrs. The initial nasopharyngeal temperatures (NPT) were 20.0°C on the right (RNPT) and 26.8°C on the left (LNPT).

The ice bags on and around the patient were repositioned at 05:32 hrs, and the face mask of the SCCD was removed to allow surgical access. The Rosc-U chest compression device was kept operating to continue external cooling. At 05:39 hrs the burr hole in the patient's left forehead was drilled using a Codman perforator. Sterile water was poured over the perforator to cool the

perforator and the skull. A thermocouple probe (port-3) was placed in the burr hole at 05:39 hrs. The initial burr hole temperature (BT) was 34.8°C.

At 05:49 hrs the temperatures were: RNPT 20.5°C, T-2 LNPT 23.8°C, BH 33.8°C. The chest compressions were discontinued to start surgery. The first surgical cut for cannulation was made at 06:02 hrs. The left carotid artery was isolated 06:06 hrs and the right carotid artery was isolated 06:11 hrs. The patient's neck was being cleared of tissue for the cephalic isolation at 06:15 hrs. The spinal cord was severed at 06:18 hrs and the cephalic isolation was complete at 06:20 hrs.

The right carotid artery was cannulated with a red Robinson cannula while the patient was still in the ice bath (with the top of the head resting on the ice) at 06:22 hrs. The left carotid artery was cannulated with a red Robinson cannula at 06:23 hrs. The pre-perfusion cephalon weighed 5.23 kg at 06:24 hrs. The patient was placed in the halo in the cephalic enclosure at 06:25 hrs. The cephalon was adjusted lower in the cephalic halo at 06:29 hrs so the enclosure lid would fit.

The right vertebral artery was cannulated with a right-angle cannula at 06:31 hrs and the left vertebral artery was cannulated at 06:39 hrs (the gauges of the cannulae were not recorded.)

Open circuit washout with B1 carrier solution was initiated at 06:46 hrs. Both vertebral arteries were flowing, indicating that the Circle of Willis was complete. The B1 concentration was started too high; the flow rate was immediately lowered to compensate.

Nitrogen gas connected to the cephalic enclosure at 06:52 hrs. The lid was placed on the enclosure at 06:53 hrs. The target arterial pressure was set to 80 mmHg. The cryoprotectant ramp was started at 06:54 hrs with nM22 cryoprotectant perfusate.

The right eye had started to collapse at 07:12 hrs from dehydration from exposure to the cryoprotectant, a normal response, and mottling of the skin was also present, another indication of uptake of the cryoprotectant solution. At 07:19 hrs, both corneas had completely collapsed. At 07:42 hrs, the skin tanning was noted to be uniform and significant.

At 07:58 hrs, the venous refractive index (RI), a measure of the uptake of cryoprotectant, was 30 Brix. The 30-min pause for equilibration started, and the target enclosure temperature was lowered to -3°C

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.

The 30-minute pause for equilibration was ended at 08:28 hrs, and the pump was set to full speed. Visual inspection of the burr hole at 09:37 hrs showed that the brain may have retracted from the burr hole, but not measurably.

The venous RI at 11:01 hrs was 49.9 Brix. The cryoprotectant ramp was halted for the 30-minute countdown to termination of cryoprotection.

Sidebar:
Per the cryoprotection protocol, a 30-minute countdown to the termination of cryoprotection is initiated, and 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.

At 11:29 hrs, the venous RI was 50.69 Brix. The cryoprotectant ramp was terminated. The lid of the cephalic enclosure was removed and removal of lines and equipment on the cephalon was started. At 11:31 hrs, the post perfusion cephalon weighed 4.8 kg (5.23 - 4.8 = 0.43 kg loss, or an 8.22 % weight loss from dehydration). The cephalon was moved to the Patient Care Bay at 11:28 hrs.

7. Cooling to Liquid Nitrogen Temperature

Computer-controlled cryogenic cooldown was initiated at 11:45 hrs on T-0 days, plunging to -110°C and descending thereafter at -1°C/hour to liquid nitrogen temperature.

The cooldown proceeded normally; however, the nasopharyngeal probe spontaneously disconnected after a few hours. The cause of the probe issue is unknown.

On T+4 days at 21:16 hrs, an uneventful cooldown was terminated. On T+18 days at 15:35 hrs the patient was transferred to long-term care at liquid nitrogen temperature.

8. Timeline and Time Summaries

Timeline

T-0	03:55	Time of cardiac arrest
T-0	04:27	Pronouncement of legal death
T-0	04:29	Start of ice bath cooling
T-0	04:30	Start cardiopulmonary support
T-0	04:38	Administration of first medication (propofol)
T-0	04:42	Administration of final medication (Decaglycerol-THAM)
T-0	05:26	Arrival of patient in OR at Alcor (RNPT=20°C, LNPT=26.8°C)
T-0	06:02	Start of surgery (cannulation and cephalic isolation)
T-0	06:24	End of surgery
T-0	06:54	Start of cryoprotectant ramp
T-0	07:58	Start 30-minute pause for equilibration
T-0	08:28	End of pause for equilibration
T-0	11:01	Start 30-minute countdown to end of ramp
T-0	11:29	End of cryoprotectant ramp
T-0	11:45	Start cryogenic cooldown
T+4	21:26	End cryogenic cooldown
T+18	15:35	Transfer patient to long-term care in LN2

Time Summaries

Event Duration hr:min		days	time	
00:32	From: Till:	T-0 T-0	03:55 04:27	Time of cardiac arrest Pronouncement of legal death
00:34	From: Till:	T-0 T-0	03:55 04:29	Time of cardiac arrest Start of ice bath cooling
00:35	From: Till:	T-0 T-0	03:55 04:30	Time of cardiac arrest Start cardiopulmonary support
00:43	From: Till:	T-0 T-0	03:55 04:38	Time of cardiac arrest Administration of first medication (propofol)
00:04	From: Till:	T-0 T-0	04:38 04:42	Administration of first medication (propofol) Administration of final medication (Decaglycerol-THAM)
01:31	From: Till:	T-0 T-0	03:55 05:26	Time of cardiac arrest Arrival of patient in OR at Alcor (RNPT=20°C, LNPT=26.8°C)
02:07	From: Till:	T-0 T-0	03:55 06:02	Time of cardiac arrest Start of surgery (cannulation and cephalic isolation)
00:36	From: Till:	T-0 T-0	05:26 06:02	Arrival of patient in OR at Alcor (RNPT=20°C, LNPT=26.8°C) Start of surgery (cannulation and cephalic isolation)
00:22	From: Till:	T-0 T-0	06:02 06:24	Start of surgery (cannulation and cephalic isolation) End of surgery
02:59	From: Till:	T-0 T-0	03:55 06:54	Time of cardiac arrest Start of cryoprotectant ramp
01:28	From: Till:	T-0 T-0	05:26 06:54	Arrival of patient in OR at Alcor (RNPT=20°C, LNPT=26.8°C) Start of cryoprotectant ramp
00:52	From: Till:	T-0 T-0	06:02 06:54	Start of surgery (cannulation and cephalic isolation) Start of cryoprotectant ramp
05:27	From: Till:	T-0 T-0	06:02 11:29	Start of surgery (cannulation and cephalic isolation) End of cryoprotectant ramp
04:35	From: Till:	T-0 T-0	06:54 11:29	Start of cryoprotectant ramp End of cryoprotectant ramp
00:08	From: Till:	T-0 T-0	11:29 11:37	End of cryoprotectant ramp Start cryogenic cooldown
07:42	From: Till:	T-0 T-0	03:55 11:37	Time of cardiac arrest Start cryogenic cooldown
06:11	From: Till:	T-0 T-0	05:26 11:37	Arrival of patient in OR at Alcor (RNPT=20°C, LNPT=26.8°C) Start cryogenic cooldown

9. Table of Medications Administered

T-0 days

TIME	MEDICATION	DOSE	PURPOSE
04:38 hrs	Propofol	200 mg	Anesthetic; reduces cerebral metabolic demand; reduces the theoretic possibility of increased awareness during aggressive CPS.
04:39 hrs	Sodium citrate	20 g Note 1	Anticoagulant; prevents blood clot formation.
04:41 hrs	Heparin	50,000 IU	Anticoagulant; prevents blood clot formation.
04:42 hrs	Vasopressin (1st dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
04:42 hrs	Antacid	250 ml Note 6	A buffer used to neutralize stomach acid.
04:44 hrs	Minocycline	200 mg	Antibiotic and neuroprotectant
04:47 hrs	SMT (S-methyl-isothiourea)	400 mg Note 3	Neuroprotectant (iNOS inhibitor); protects the brain from ischemic injury; raises blood pressure.
04:49 hrs	Decaglycerol/THAM	200 ml Note 4	Decaglycerol inhibits cerebral edema.
04:50 hrs	Vasopressin (2nd dose)	40 IU Note 2	Vasopressor; increases blood pressure during CPS.
04:53 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.
04:55 hrs	Decaglycerol/THAM	200 ml Note 4	Decaglycerol inhibits cerebral edema.
05:26 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 99.8 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.

10. Discussion

Standby and Recovery

The Medical Response Vehicle (MRV) at Alcor was not prepared and ready to deploy at the start of this case. This hinders the immediate response capability of the DART team. A pre-deployment checklist is implemented and instructions to strictly follow this protocol have been discussed with each DART team member to periodically do vehicle readiness checks so that this does happen in the future.

The team was not able to be at the member's location outside the visitation hours. Due to this, the team relied on the use of the Owlet video monitor to observe the member's vitals and movement.

The patient was placed in the ice bath at 04:29 hrs, and the data logger thermocouples were placed at 04:49 hrs and 04:50 hrs, which was 0.8 hours post pronouncement. The MRD thinks that a decline in temperature was not seen earlier because the temperatures were not being recorded earlier.

The DART team has begun using the Owlet monitor to virtually observe members for which a standby is being held, when it is not possible to physically be with the member. The Owlet obtains constant vitals of heart rate and capillary oxygen saturation (SPO2), while also providing constant video monitoring that detects and tracks member movement. This device also alerts the team based on parameters that can be set in advance, such as when the heart rate falls below 60 or SPO2 falls below 88%, to fit the team's needs.

The Owlet monitor was not operational at the start of the case because the monitor was not placed on the patient correctly. Verification of all monitoring equipment will be part of the pre-deployment checklist mentioned above. Training will be provided to all DART team members on how to effectively use the Owlet monitor.

Cryoprotectant Surgery and Perfusion at Alcor

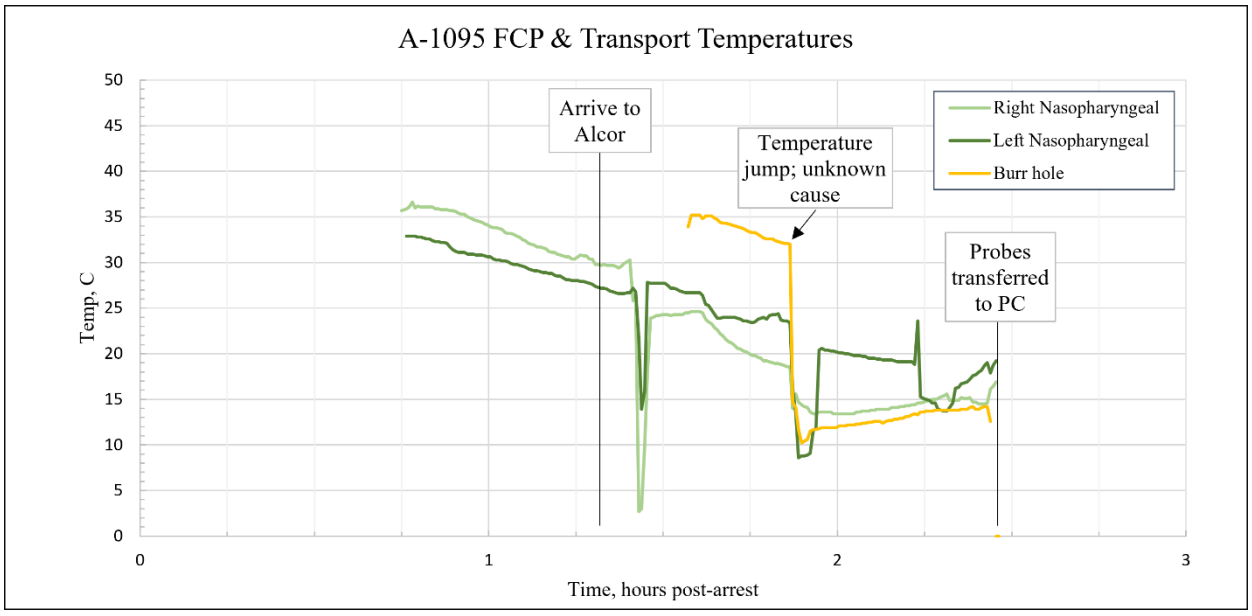
Shortly after the burr hole probe was placed, two temperature channels exhibited a sudden decrease in measured temperature. The cause of this jump is unknown; however, the recorded temperatures at the end of transport align with the temperatures measured once the probes were switched to the OR PC. Otherwise, transport was uneventful.

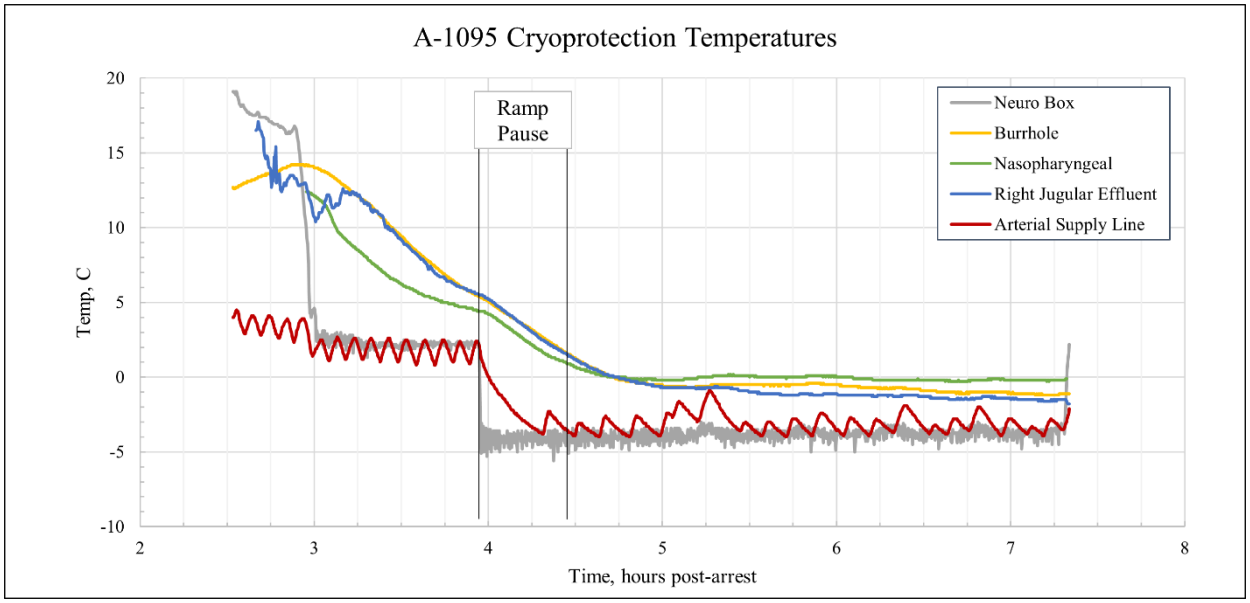
When the patient was brought into the OR, there was a short delay in starting surgery (from 05:39 hrs to 05:49 hrs) while the OR setup was finished after the cleanup from the prior day's patient.

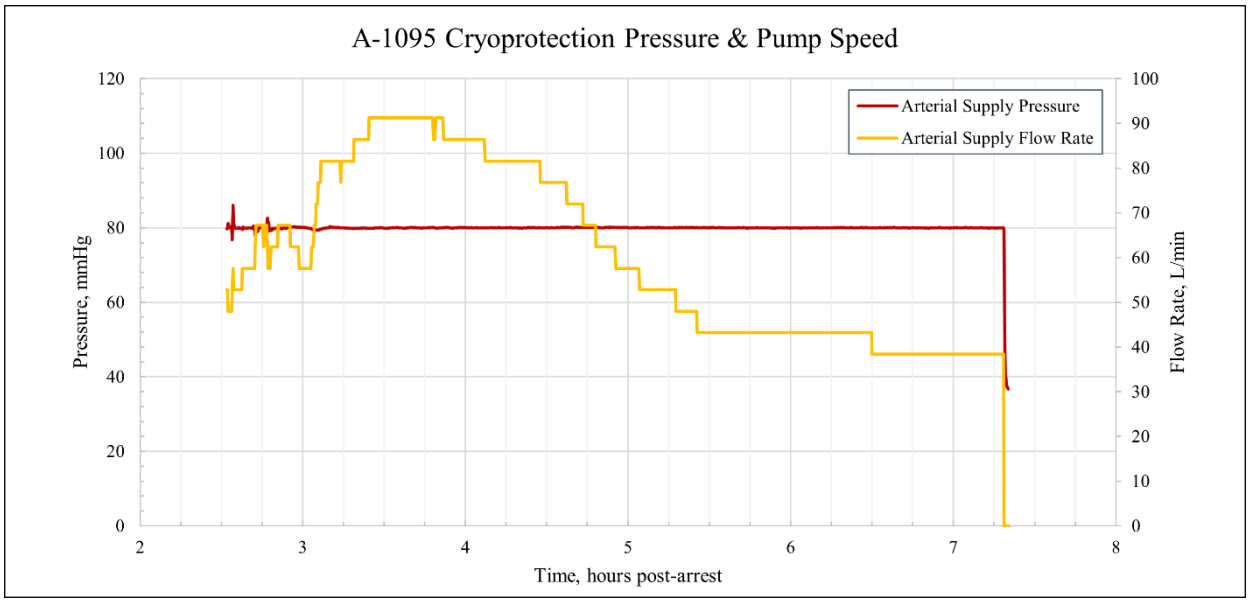
Cryogenic Cooldown

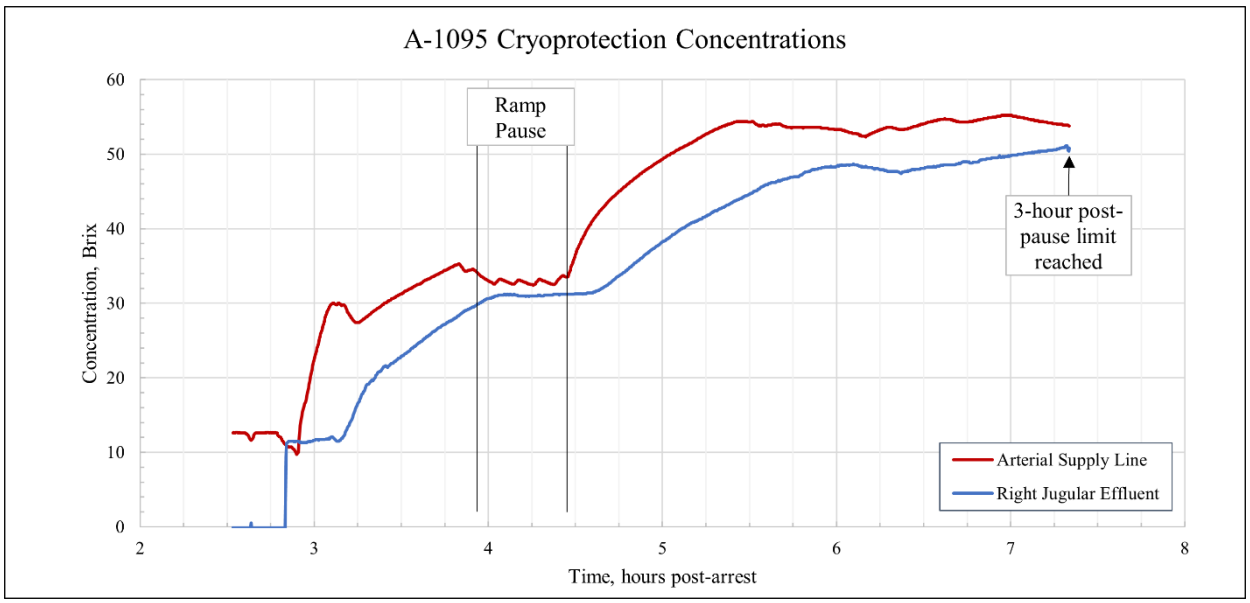
The cooldown proceeded normally; however, the nasopharyngeal probe spontaneously disconnected after a few hours. The cause of the probe issue is unknown.

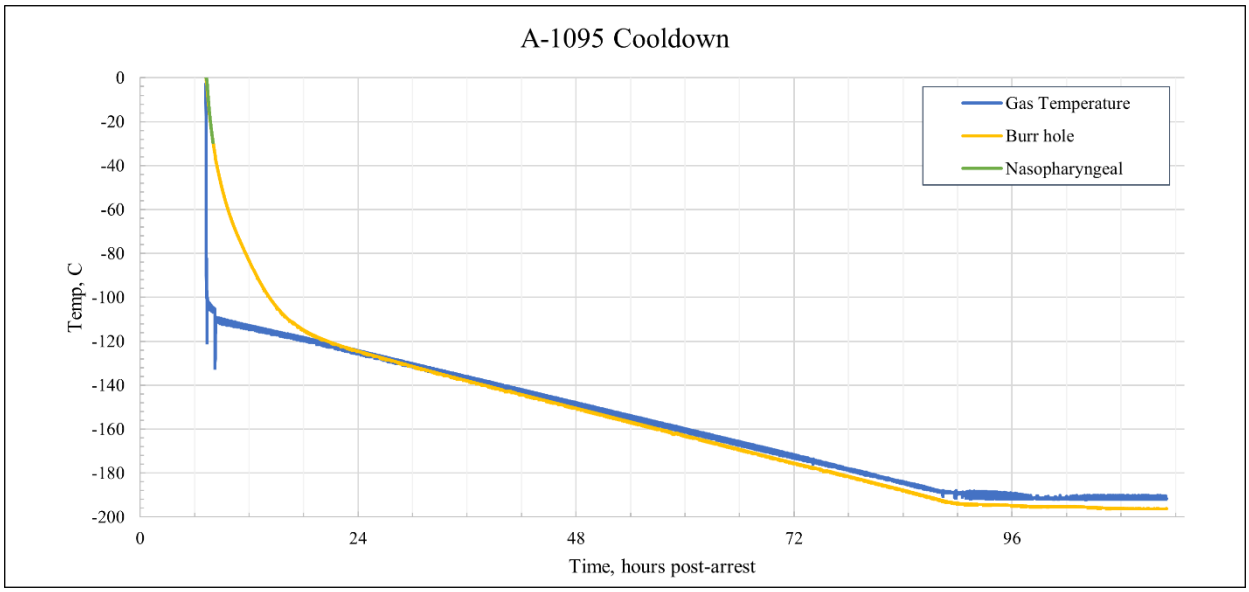
11. Cryoprotection and Temperature Graphs

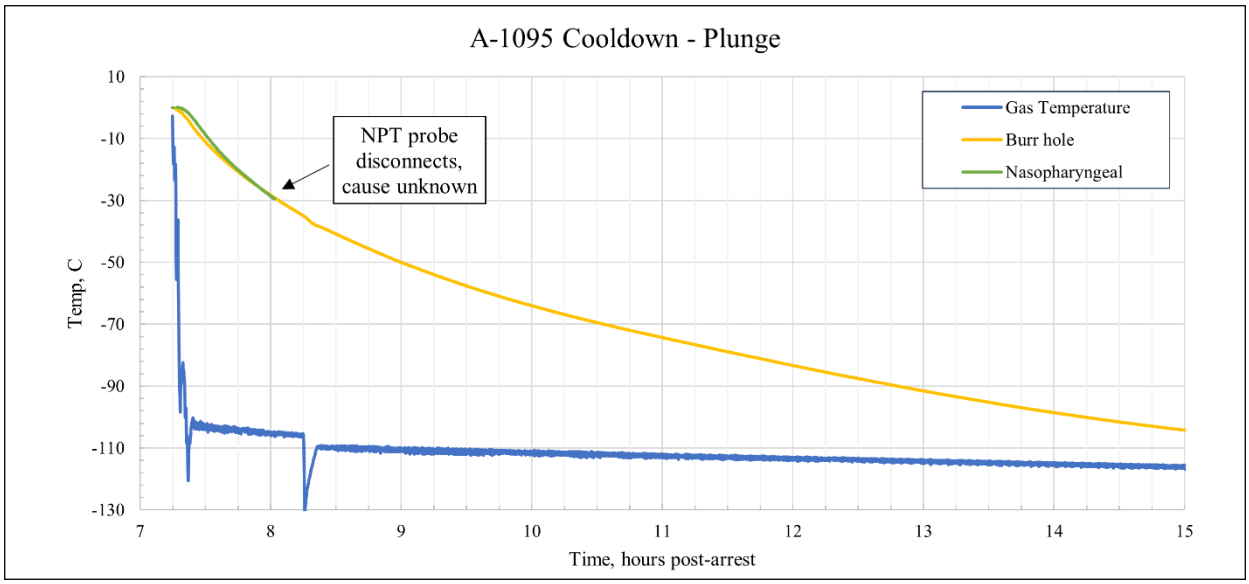





A-1095 Cryoprotection Pressure & Pump Speed
Arterial Supply Pressure
Arterial Supply Flow Rate
Pressure, mmHg
Flow Rate, L/min
Time, hours post-arrest
120
100
80
60
40
20
0
100
90
80
70
60
50
40
30
20
10
0
2
3
4
5
6
7
8


A-1095 Cryoprotection Concentrations
Ramp
Pause
3-hour post-pause limit reached
Arterial Supply Line
Right Jugular Effluent
Concentration, Brix
Time, hours post-arrest
60
50
40
30
20
10
0
2
3
4
5
6
7
8


A-1095 Cooldown
Temp, C
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
0
24
48
72
96
Time, hours post-arrest
Gas Temperature
Burr hole
Nasopharyngeal

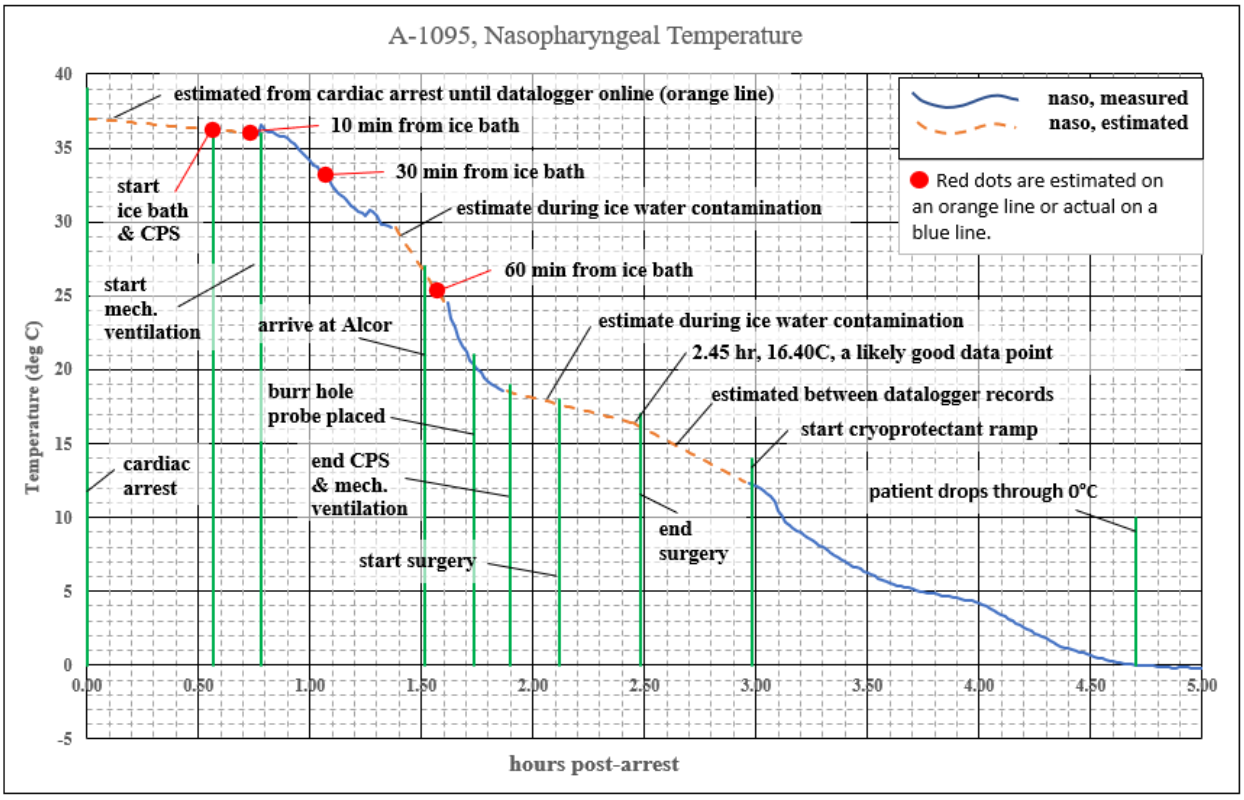

A-1095 Cooldown - Plunge
Temp, C
10
-10
-30
-50
-70
-90
-110
-130
7
8
9
10
11
12
13
14
15
Time, hours post-arrest
NPT probe disconnects, cause unknown
Gas Temperature
Burr hole
Nasopharyngeal

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 04:42. As shown below, and due to lowering of the body temperature, S-MIX duration is shorter, at 01:32.

event	seg-ment #	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	03:55	00:00	37.0			
	seg 1		00:34	00:34	-0.8	no	no	00:33
Start of ice bath cooling & CPS		T-0	04:29	00:34	36.2			
	seg 2		00:13	00:13	0.4	no	no	00:12
Mechanical ventilation started with King airway		T-0	04:42	00:47	36.6			
	seg 3		00:44	00:44	-10.1	yes	no	00:16
Arrival of patient in OR at Alcor		T-0	05:26	01:31	26.5			
	seg 4		00:13	00:13	-6.2	yes	no	00:03
Burr hole themocouple placed		T-0	05:39	01:44	20.3			
	seg 5		00:10	00:10	-1.8	yes	no	00:01
End CPS and mechanical ventilation		T-0	05:49	01:54	18.5			
	seg 6		00:13	00:13	-0.8	no	no	00:03
Start of surgery (cannulation and cephalic		T-0	06:02	02:07	17.7			
	seg 7		00:22	00:22	-1.5	no	no	00:05
End of surgery		T-0	06:24	02:29	16.1			
	seg 8		00:30	00:30	-3.9	no	no	00:06
Start of cryoprotectant ramp		T-0	06:54	02:59	12.2			
	seg 9		01:43	01:43	-12.2	no	no	00:11
Patient temperature thru 0°C		T-0	08:37	04:42	0.0			
totals:			04:42	04:42	-37.0			01:32

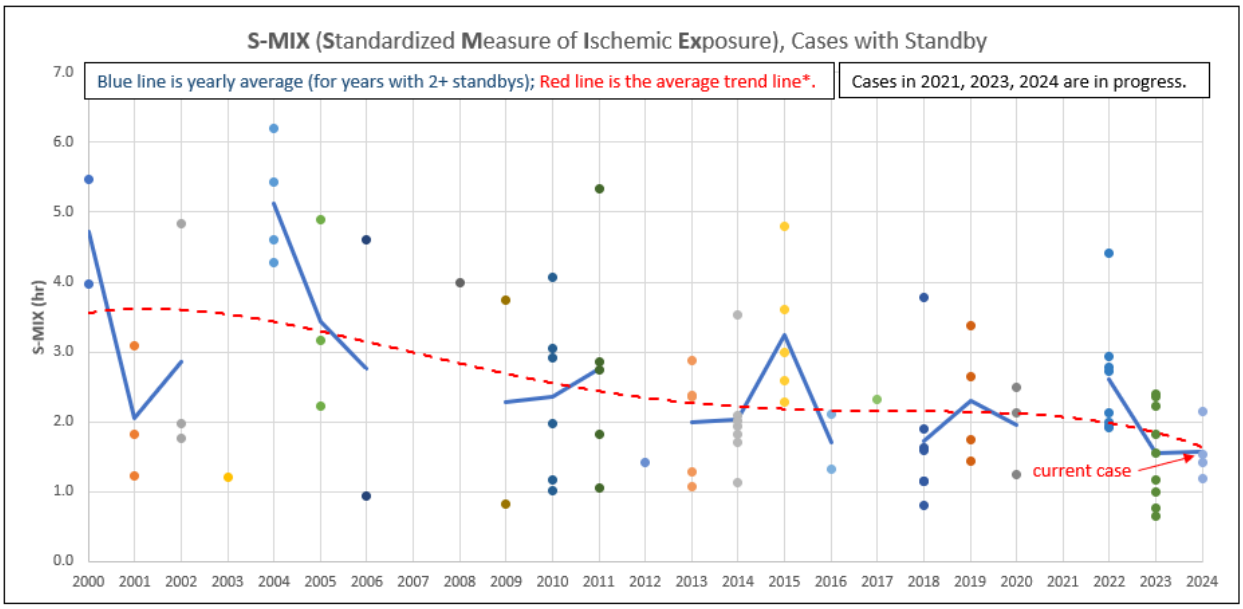
The below plot shows events related to the S-MIX calculation. The red dots can be used to construct a metric for how fast the patient is initially cooled (see the Patient Cooling Rate table below). This is a critical period since body temperature is highest and ischemic damage most rapid.



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

Patient Cooling Rate			(patient weight 99.8 kg; 220 lb)	
Note: time = 0 at start of ice bath	0 min elapsed	10 min elapsed	30 min elapsed	60 min elapsed
Naso temperature (°C)	36.2	36.0	33.2	25.4
Temperature drop (°C) from t = 0	0.0	-0.2	-3.0	-10.9
Cooling rate (°C/min) from t = 0	N/A	-0.02	-0.10	-0.18

The following plot shows the trend of S-MIX achieved since 2020 for just those cases that had standby and sufficient temperature data to calculate S-MIX. Standby means that Alcor had staff and/or contractors, and their equipment, nearby the patient when cardiac arrest occurred. Each standby 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 which indicates that ischemic damage is lessening with progressing years.



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

13. 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.