Cryotransport Case Report, A-1755, Part I

Third Party Anatomical Donor
Year of Birth: 1920
Date initiated cryotransport:
August 28, 1999

Report by: Fred Chamberlain
CryoTransport Manager
Alcor Life Extension Foundation
Scottsdale, AZ
November 30, 1999

Part I - Standby and Transport to Scottsdale, Arizona

(Condensed for publication in *Cryonics*)

Background History and Synopsis

Cryotransport can be broken down into four areas: (1) patient acquisition and initial biological stabilization, with transport to Alcor Central, (2) cryoperfusion, (3) cooldown and (4) long term care. This report, Part I of II, covers the first of these. Part II, in the next issue of Cryonics, will cover (2) and (3). Long term care (4) is just beginning.

The Patient was not a member of Alcor. The Next of Kin (of the Patient) was in the sign-up process for Alcor Membership and made arrangements to have the Patient placed into cryostasis as a "third party anatomical donation".

This is acceptable to Alcor if there are no indications that the Patient has rejected cryostasis. Alcor also was confident that there were no other problems (such as serious conflicts among family members) which might prevent the third party anatomical donation from taking place.

In August 1999, the Patient was hospitalized with apparent pneumonia. (To obtain hospital cooperation, Alcor agreed to confidentiality, not to name the hospital or the town in which it was located.)

By 8/26/99 the Patient's oxygen saturation level had fallen as low as 46. At the time Alcor was contacted, O_2 saturation level had been restored to nearly 80, by oxygen administration. This was still a very low value. Lymphoma was suspected, but not confirmed. The attending physician predicted mortality within 24 hours.

Administrative and Logistics Factors

Less than two hours after the initial contact, Alcor Directors had been contacted and consented to a third party anatomical donation. Funding and paperwork were to be accomplished incrementally.

Most of the administrative and logistics arrangements had to be completed in a period of about five hours, prior to departure of the last flight to Chicago for the day.

[Although there were special factors which gave the Alcor Board' confidence that in this case, rapidity of response was appropriate, the Board has now formally resolved that this cannot be a routine response of Alcor to requests for acceptance of third party anatomical donations.

As provided in Alcor's mission statement, its priorities are (1) safety of patients already in cryostasis, followed by (2) the capability to respond to members who already have arrangements. Rapid response to a request for rescue of a non-member could be in conflict with these priorities.

In a future case of this kind, it is likely that at least an additional twelve hours delay would be required prior to Alcor's initiating a standby. From our knowledge of this case, such a delay might have prevented a team from being on-site, ready to initiate cryotransport, before the Patient's cardiac arrest.

Those who have not competed their arrangements in advance are at far higher risk that Alcor will decline to become involved or that its response will be delayed, in a non-member, third party anatomical donation case.

Even with "direct public service" through BioTransport, Inc., there will be no way to respond as quickly as if the Patient were a fully signed up Alcor Member.]

Due to the failure of pagers and cell phones to work in all areas, Dr. Robert Newport could not be contacted to deploy with the remote rescue team. Linda Chamberlain called many funeral homes in the Patient's area without success, trying to secure local support. Only minutes before leaving for the airport did she find one which turned out to be extremely cooperative and helpful.

[The mortuary provided use of their surgical facility far in advance, not knowing how long the standby might take; they provided a mortician and vehicle standby at the hospital, assisted with surgery for blood washout, helped with packaging and shipment support, and solved problems from hundred miles away, when an air-cargo office initially refused to load the Patient.]

ACTs Louise Murray and Russ Cheney were asked to deploy as part of the standby team.

They reached the airport (Los Angeles International) in time, Russ missed the flight due to an airline foulup, but found an alternate flight and arrived in Chicago an hour ahead of the rest of us.

Alcor Central Activities; Standby Team Travel/Logistics

At Alcor Central, Hugh Hixon and Bruce Cohen set up the operating room and prepared for filtering of perfusate. Two local surgeons, Jose Kanshepolski M.D. and Nancy McEachern D.V., were on-call. Other ACT team members were contacted to participate in the cryoprotective perfusion.

The standby team (total of four) regrouped at O'Hare International Airport, at about 2:00 a.m. Central Daylight Time and departed. Equipment taken with us included the PIB/SCD (Portable Ice Bath & Spray Cooling Device) Kit, Medications Kit, ATP (Air Transportable Perfusion) System, MHP (organ preservation fluid; 20 liters), and a Thumper (automatic chest compression device dependent on hospital wall oxygen or local acquisition of high pressure oxygen cylinders).

Travel time by highway was about five hours (the distance was slightly over 200 miles; light fog slowed us down; team members were sleepy). Our two cell phones proved valuable in coordinating the drive and later were indispensable in organizing the standby.

Near the Patient's hospital, a motel was located as a base of operations; 24 hours had passed since Alcor was first contacted.

Communications and Coordination

The Patient's Next of Kin (PNK) was contacted by cell phone and found to still be en route. Instead of arriving in Chicago, the PNK's plane was diverted and landed even farther from the Patient than the Alcor team. The PNK was expected to reach the Patient's location about noon. Team Members slept if they could, 1-4 hours. Since we were not yet in contact with the Patient's physician or relatives (except the PNK), we were at a standstill pending the PNK's arrival.

The PNK informed the team (by cellular phone) of an arrangement for a staff physician in the PNK's company to be present and (possibly) participate. In view of the difficulty we had experienced in contacting Alcor's primary team M.D., this was welcome backup.

During this phone call, the possibility was discussed that the washout procedure take place on the hospital's premises. With this idea in mind, the PNK called the hospital (again, from a cell phone en route) to propose this approach.

The hospital was *resistant* to the proposal. They made an urgent request for detailed information concerning our protocol, credentials of team members, and the extent to which hospital facilities and their personnel would be needed.

In the end, communications with the hospital by the PNK's staff physician led to partial cooperation. Without this, we could have been far more restricted in our procedures. Although the hospital finally allowed medications to be given without delay after cardiac arrest, they refused to allow use of the Thumper (chest compression device), based on the fact that this could disturb other patients.

Preparations for Transport

By mid-afternoon (Friday, August 27, 1999, at about 4:00 p.m.) the PNK told us that the Patient was slipping rapidly and that we should prepare for a cryotransport as quickly as possible. Logistics work accelerated. Drawing medications began at about 4:15 p.m. At the mortuary, setup and checkout of the ATP took place. Readiness for a suspension was complete by 7:00 p.m. By this time, about 35 hours had passed since the first call came in to Alcor.

By 10:30 p.m., following brief meals in shifts, the team regrouped outside the hospital. The principal concern was the timeline. Based on the afternoon's outlook that cardiac arrest was hours away, all medications were drawn (except Streptokinase, because of its expense). Within 24 hours, our protocol would require discarding the old medications and redrawing them when a suspension appeared to be near at hand. At that point, we would already be arranging for more medications to be flown in, as a backup.

Nearing 40 hours with very little sleep, we began planning how to obtain as much sleep as we could, while maintaining enough on-site presence to start a transport if a sudden turn for the worse occurred.

Outside the ICU, the team reviewed the ""First Ten Minute" protocol, assigning actions to team members and rehearsing procedures to make them go as smoothly and quickly as possible.

Changes in Support; Criteria for Decision-making

The PNK requested that any optional life-support measures for the Patient be stopped, so long as they did not cause discomfort, yet the hospital staff would not cooperate with this request until certain criteria were met. The criteria kept changing, ranging from "pupils fixed and dilated" to "pain unresponsiveness."

At about midnight, a nurse from ICU informed the team that the Patient was unresponsive and they were about to remove physiological support, but they could not find the PNK. While a search began for the PNK, the last of the medications were made ready.

CPR, Medication, and Initial, External Cooling

The Alcor Team was finally allowed to move to a location close to the Patient at 2:10 a.m., when pronouncement was imminent. At 2:35 a.m. the PNK told the Team that the Patient had been pronounced, and we were permitted to begin our procedures. The PNK provided the times of arrest and pronouncement. Major events logged are as shown in Figure 1.

Remote Whole Body Washout

The Patient was transported from the hospital to the mortuary's field washout facility. There was no delay in removing the patient from the hospital inasmuch as the mortician was on standby throughout the critical waiting period from about 10:00 p.m. the previous evening until transport began at 2:35 a.m.

Transport Timeline; Major Items - at Hospital

0235 Team notified in waiting room (down hall from ICU).
0239 Tympanic temperature probes placed in patient's ears.
0241 Data logger turned on (to record temperatures).
0242 Ice bags placed around patient's head.
0245 Manual CPS begun.
0249 THAM I.V. (500 ml) started into Schwan catheter.
0250 Mannitol IV started (500 ml).
0254 Dextran 40 IV started (500 ml).
0255 Diprivan (10.9 cc).
0259 Potassium chloride (27.2 cc).
0300 Sodium Heparin (2.3 cc).
0301 Streptokinase (250,000 IU).
0301 Metubine Iodide (1.9 cc).
0303 Epinephrine (10.9 cc).
0303 Nimodipine (0.5 cc).
0304 Deferoxamine (2000 ml).
0304 Chlorpromazine (6.5 cc).
0304 Methylprednisolone (8 cc).
0305 Gentamicin sulfate (2.7 cc).
0306 Bactrim 10 cc) given (End of IV).
0309 Maalox 60 cc given by gastric tube.
0310 Prepared to leave hospital room.
0318 Permission from hospital to remove patient.
0325 Removal of patient from ICU.

Figure 1.

Times logged during the washout are as shown in Figure 2. The mortician assisting with cannulation was unfamiliar with medical cannula and the surgical instruments in Alcor's kit. For fear of friability of vessels, the cannula used were smaller than optimal. Thankfully, the washout went smoothly; brain cooling was effective.

The flow rates noted reflect less actual arterial pressure than measured, since pressures were measured upstream of the small cannula. While the flow rates were thus less than usually employed, they nonetheless produced a rapid bilateral reduction in brain temperature.

Alcor had been advised by a scientist at 21st Century Medicine, Inc., that lower perfusion pressures than in the past be used, at least in the cryoprotection phase, even at the expense of lower flow rates. In that light, the lower pressures may have not detracted, and could have been beneficial. As medications were able to be given immediately after pronouncement, coagulation was minimal and posed no significant obstacle. Except for initial problems with cannulation, the washout was uneventful.

One important observation: During recirculation, which was maintained for more than one half hour with rapid drop of temperatures in the brain, there was no evidence of tissue accumulation of fluids or loss of them, based on a static level in the venous return reservoir. Thus, although the cannula were maintained in position manually, leakage as might have occurred was undetectable.

When brain temperature on both probes dipped below 10°C and the remaining reserve organ preser-

Transport Timeline - Major Items
Field Washout and Shipping Preparations

0335	Arrival at mortuary with patient.
0349	Prep patient with Betadine scrub.
0353	Patient's left Femoral artery raised.
0357	Patient's left Femoral vein raised.
0437	Vein cannulated with 18 french Sairns venous cannula.
0439	Artery cannulated with 16 french Baird arterial cannula.
0410	Primed cannulas; problems with insertion.
0410	Observations of sclerotic vessels.
0437	Cannulation complete.
0445	Perfusion commenced.
	(Paused to resolve cannulation difficulties. Washout .commenced.)
0510	Ten liters of perfusate expended.
0512	Clamps switched on supply/venous return lines
	(Recirculation commenced)
0513	Second blood sample taken
(See * at right.)	Flow vs. Pressure Determination; 85 mm Hg ~ 0.70 l/min.
	Flow vs. Pressure Determination; 95 mm Hg ~ 0.80 l/min.
	Flow vs. Pressure Determination; 105 mm Hg ~ 0.90 l/min.
	Flow vs. Pressure Determination; 115 mm Hg ~ 1.00 l/min.
0523	Brain temperature 15.1°C, 15.1°C
0544	Final blood sample taken
0546	Recirculatory perfusion terminated.
	(Venous outflow 8.6°C, 10.2°C)
0605	Cannula secured for airshipment of Patient.
	(Preparations for Shipment)
0515	Placed dropcloth in shipping tray
0708	Surround Patient with ice bags
0709	Close body pouch
0710	Place lid on Ziegler case.
0712	Wrap fiberglass insulation around Ziegler case
0730	Place insulation on top of Ziegler case.
0731	Place cardboard outer cover in place

* (Times not noted. These were rapidly sequenced measurements of flow vs. perfusion pressure to characterize vascular resistance.)

Figure 2.

vation fluid was permitted to flow open circuit, it was apparent that none of it had been used to replace fluids lost by surgical leakage or edematous buildup of body fluids. This was a very positive aspect of the washout.

At your right in Figure 3 is the primary temperature profile of the washout. Other supporting plots are included and discussed.

Temperature Descent Data; Tympanic Membrane Probes

In Figure 3, temperature descent data is timed in terms of hours and minutes after start of data loging. "0:00" on the data logger corresponds to 02:41 a.m. 2:24 on the logger would be 5:05 a.m. Comparing this with the timeline log, 05:12 a.m. is commencement of recirculation, and the first phase (open circuit washout) would have been started at almost exactly 5:00 a.m. This matches the change in trend of the graph exactly. T1 and T2 represent the two channels of the data logger (unfortunately, the relationships of left and right tympanic probes to channel numbers were not recorded).

Figure 4 on the next page shows, at higher resolution, shifts of tympanic temperature during recirculatory washout of the brain. Clock times vs. relative times to the start of data logging are shown, to help relate data to the chronology of events.

As mentioned above, open circuit perfusion started at about 5:00 a.m., and continued for about thirty minutes after recirculation began (at 5:12 a.m.). In that time, typanic temperatures as recorded by the data logger (DuaLogR)

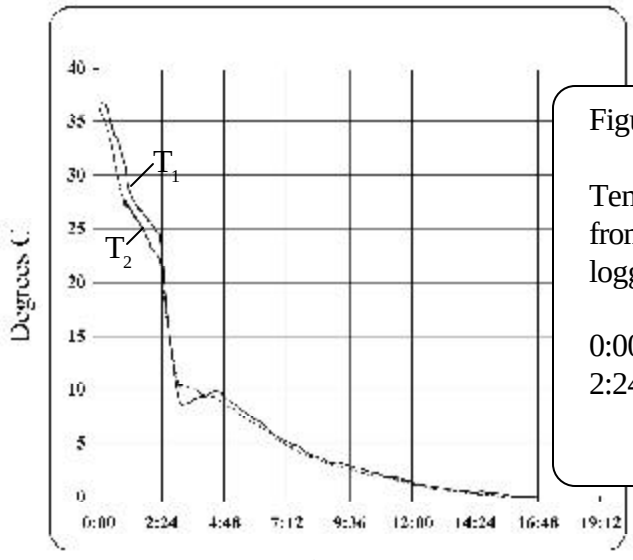


Figure 3.

Temperature Descent from initiation of data logger operation.

0:00 = 02:41 a.m.
2:24 = 05:05 a.m.

(See text.)

showed a drop of 17°C for T2, and 13°C for T1.

Figure 3 shows T2 rising sharply immediately after insertion, and then staying at a higher temperature until the crossover shown in Figure 4. Channel T1 was the "cooler" channel initially, and then became warmer during blood washout. Both channels converged during air shipment, and other comparisons lead us to believe that instrumentation error or lack of calibration do not explain the differences. What might have happened?

The most logical explanation is that the probe placement, in which wax was used to secure the probes, resulted in a shallower placement for T1 than T2, and that T1 cooled more rapidly than T2 in the beginning due to closer proximity to surface cooling. Based on this scenario, T2 (cooling more slowly) would more accurately reflect blood temperature at the tympanic membrane and would be the best measure of initial brain cooling.

Once blood washout commenced, the conditions would reverse. T1, coupled to the inertia of surface temperatures, would have been overtaken by T2, which would more closely be coupled to the cold perfusate circulating in the vascular system. While this explanation is hypothetical, it is consistent with all of the data.

Until Figure 4 was generated, with the foregoing analysis, Figure 3 had been used as the primary interpretation tool. Comments had been obtained from team members as to the possibilities for the data's divergence prior to washout, and the apparent excellent convergence once perfusion began. Figure 4, however, clearly indicates that the washout produced a systematic

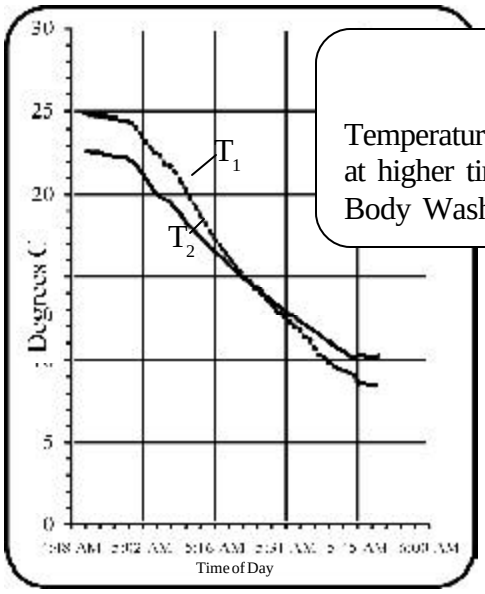


Figure 4.

Temperature Data from tympanic membranes at higher time resolution during TBW (Total Body Washout).

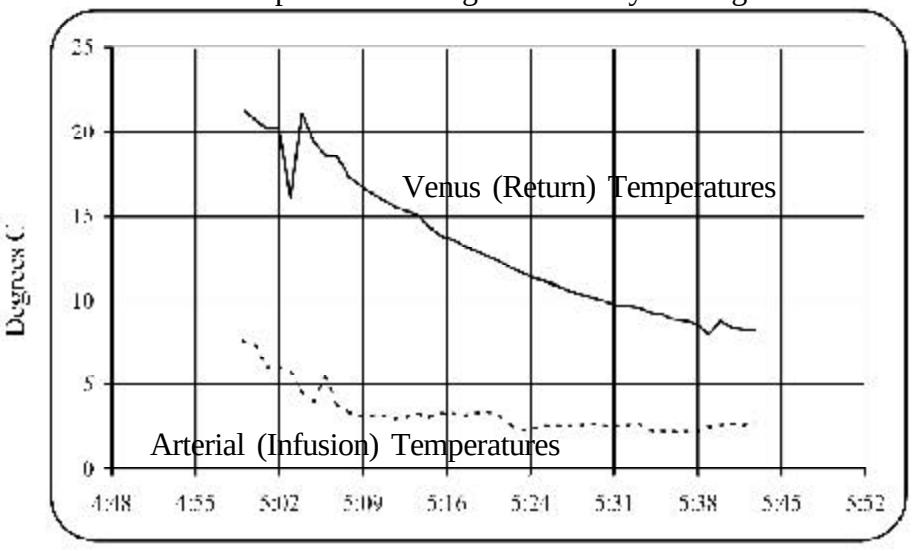
crossover of temperatures, rather than a convergence, and helped to better explain what might have happened.

[In an earlier article in *Cryonics* (see Appendix A), referring only to Figure 3, the observation was stated as follows: "In particular, data showed smooth, balanced cooldown of the brain during initial blood washout and recirculatory perfusion for cooling. This not only showed that perfusate was reaching the brain, but (as the diagram shows) it was bilaterally effective (both sides of the brain were equally protected). The two plots tracked closely during perfusion, as compared with the earlier stage of transport. We are still sorting out reasons for this difference in the data."]

Temperature Descent Data; Field Washout Perfusion Circuit

In addition to temperatures at tympanic membranes (Figures 3 and 4), temperatures in the arterial and venous lines were measured

Figure 5. Extracorporeal circulation system line temperatures during recirculatory cooling.



during recirculatory cooling. The temperature differential between arterial and venous lines is a clear measure of the degree to which each liter perfused removed heat, so this data could be correlated with reduction of brain temperature, if desired.

In Figure 5, it is apparent that the chilled perfusate (once recirculation began at 5:12 a.m.) stayed at approximately 3°C throughout the recirculation, while the relatively warm venous return dropped systematically with the exception of a few fluctuations between 5:02 and 5:09 (a period during which we were struggling to obtain secure cannula placement - finally one of the surgical team members was instructed to "hold the cannula in place manually," as discussed earlier.)

The temperature difference of the two lines varied from nearly 15°C at the outset to about 5°C near the end, and flow was slightly less than one liter per minute. A "straight line" analysis of this would thus project that (assuming one liter per minute, for convenience) that thirty minutes of such perfusion at an average temperature difference of 10°C would have cooled a mass of 120 pounds (approximately 55 Kg or 55 liters) by 30x10/55 = (only) 5.45°C. But the brain was cooled between 13°C and 15°C, according to the tympanic data!

The explanation is almost certainly a combination of (1) better perfusion of the brain than of the body core in general, and (2) circulation that did reach the body's surface area being further cooled by externally cooled tissues, augmenting the cooling that would have been expected by reference to the temperature change of the perfusate alone.

Each patient's physiology will be different, as to degree of obesity, patency of circulatory system, etc. In the case of this Patient, we may recall that there was no evidence of loss of fluids to tissues or dehydration during the period of recirculation. This is consistent with the idea that the circulatory system was in very good condition in general and contributed to the overall cooling effect of TBW (total body washout) with thirty minutes of recirculation.

Packaging and Air Transport to Scottsdale, Arizona

By the time field washout procedures were complete, it was nearly 6:00 a.m. The first available flight to Scottsdale from O'Hare International Airport in Chicago was at about 2:00 p.m. With a driving time of (conservatively) at least three hours, a necessity to deliver the Patient to the air cargo office two hours before takeoff and the patient yet to be packed, there was little margin for unforeseen delays. In Scottsdale, preparations for surgery and cryoperfusion were in progress, based on our making that particular flight. The cardboard outer box (per the time line above) was placed at 7:31 a.m., and the team's two vehicles left for Chicago between 8:00 and 9:00 a.m.

During transit to Chicago, it was possible to contact the driver of the mortuary vehicle that was transporting the Patient by cell phone and to monitor his progress. It was nearly noon at the time the teams reached the airport, and a decision was made to check the equipment in and proceed to the boarding area rather than attempting to use the rental cars to supervise loading at air cargo. A problem was encountered when the mortuary driver failed to communicate well with the personnel at air cargo, and there was a brief period during which it appeared the Patient would not be loaded. As mentioned earlier, the mortuary, several hundred miles away, was contacted by cell phone, and resolved the problem in short order.

In Phoenix, Joe Hovey picked up the team at the airport, and Bruce Cohen took Alcor's ambulance to air cargo to transport the Patient. By late afternoon, all team members and the Patient were en route to Alcor. At that point, about 5:00 p.m Scottsdale time, it had been approximately 57 hours since the first call had come in to Alcor.

End of Part I (Part II will be published in the next *Cryonics*).

Note: This report conveys a realistic picture of some of the the many challenges and uncertainties involved with cryotransport.

Alcor's rescue teams are presently its only means of responding, if your life is endangered. Someday, such rescue efforts might be launched by calling "911".

Until then, we ask that you encourage and support all of the Alcor CryoTransport Team (ACT) Members you know. Your life might depend on them, and they have pledged to be there for you, if you need them.

Cryotransport Case Report, A-1755, Part II

Third Party Anatomical Donor
Year of Birth: 1920
Date initiated cryotransport:
August 28, 1999

Report by: Fred Chamberlain
CryoTransport Manager
Alcor Life Extension Foundation
Scottsdale, AZ

Part II - Cryoperfusion and cooldown at Scottsdale, Arizona

(Condensed for publication in *Cryonics*)

Background History and Synopsis

Cryotransport can be broken down into four areas: (1) patient acquisition and initial biological stabilization, with transport to Alcor Central; (2) cryoperfusion; (3) cooldown; and (4) long-term care. This report, Part II of II, covers (2) and (3). As mentioned in Part I, long-term care (4) is just beginning.

Recalling the situation from Part I, the Patient was not a member of Alcor. The Next of Kin (of the Patient) was in the sign-up process for Alcor Membership and made arrangements to have the Patient placed into cryostasis as a "third party anatomical donation."

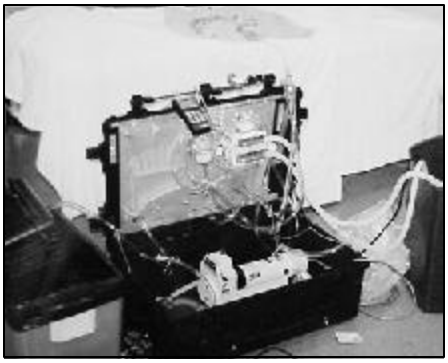
This was Alcor's most rapid response ever for a nonmember, other than one postmortem "straight freezing" in Scottsdale, Arizona. In no other case has an Alcor team been *on the scene* before the arrangements were finalized. Also, it was the first time Alcor's ATP (Air Transportable Perfusion) System had been taken on standby for a field washout.

Part I of this article ends with: "In Phoenix, Joe Hovey picked up the team at the airport, and Bruce Cohen took Alcor's ambulance to air cargo to transport the Patient. By late afternoon, all team members and the Patient were en route to Alcor. At that point, about 5:00 p.m. Scottsdale time on 8/28/1999, it had been about 57 hours since the first call had come in to Alcor."

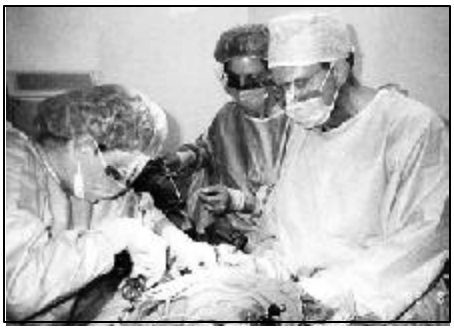
Team Composition

Linda Chamberlain was Alcor's CryoTransport Manager at the time of this suspension. The surgeons were Jose Kanshepolski, M.D., and Nancy McEachern, D.V.M., Hugh Hixon, who has participated in more of Alcor's suspensions than any other staff member, present or past, was the OR (Operating Room) Assistant, meaning that he was involved in practically all aspects of what took place.

Rhonda Iacuzzo filled the role of Surgical Nurse, which she has handled skillfully many times in the past. Mike Perry managed the data collection and analysis for our first



ATP - First Time in the Field



Jose Kanshepolski, M.D., Nancy McEachern, D.V., and Rhonda Iacuzzo, R.N., in surgery.

experience with in-line refractometers. The job of assistant perfusionist went to Bruce Cohen, drawing on skills he developed at BioTime, Inc.

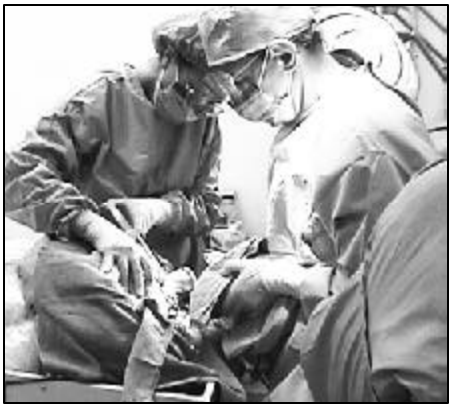
Peter Voss, a member of the So. California ACT Team, collected samples for analysis. Louise Murray and Russell Cheney, who had been part of the transport team in the Midwest, recorded what took place in the surgical and perfusion areas. My job was perfusionist.

Initial Observations

The patient's temperature on arrival at Alcor was close to 0°C. No edema or dehydration was observed. Ice was intact, surrounding the Patient. Apparently, very little had melted.

Preparations for Perfusion

Shortly after 6 p.m., the Patient was moved into the Operating Room, placed on a layer of ice bags, and preparations for surgery began. Surgical scrubbing and preparation of the surgical field took place, thermocouples were positioned,



Burrhole placement by Jose Kanshepolski, M.D., assisted by Rhonda Iacuzzo, R.N.

and burrholes were created. This was the first time burrhole surgery had been performed for Alcor by a neurosurgeon; Dr. Kanshepolski retired shortly before he started working with Alcor, after a long career with Barrows Neurological Institute in Phoenix.) From the burrholes (which expose small areas of the surface of the brain), we could see clear tissue with no indications of brain hemorrhage or edema.

Surgery (median sternotomy) was performed to expose the pericardium and ascending aorta, with the observation "Washout good; tissue devoid of blood!" (extracorporeal circulation in the field after remote standby was confirmed as successful).

Surgical table, with clear plastic hood connected to air sterilizing system for improved infection control.

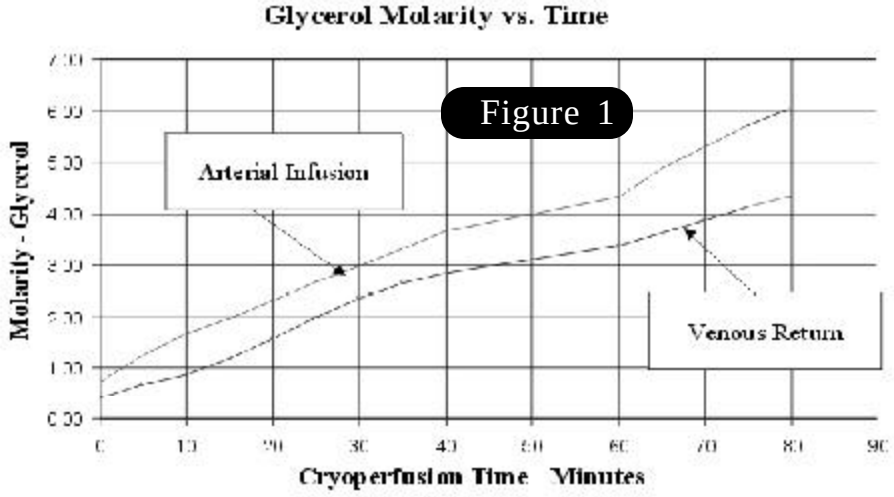
Connections to the system for cryoprotective perfusion took place in parallel with surgery to directly obtain samples of perfusate leaving the brain through the venous system (for better evaluation of cryoprotective levels). The intention was to establish a route for frequent sampling of this, but the complexity of doing so proved excessive, and this approach was not carried to completion.

Cryoprotection

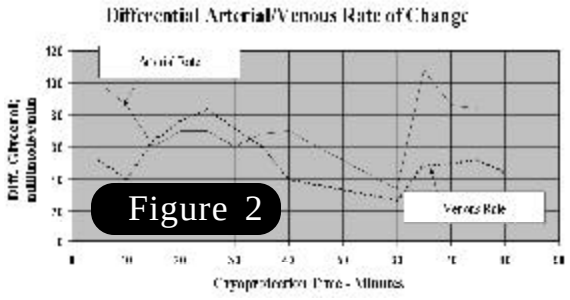
Surgical problems developed due to implanted catheters and other artifacts of earlier hospital treatments. This reduced the time for cryoprotection, since we were combatting leakage from earlier surgical sites and edema (swelling) that went with this.

Linda Chamberlain sets lines for monitoring of cryoprotective agent levels leaving the brain.

Notwithstanding, the level of cryoprotection at the end of the ramp reached 4.36 molar glycerol, as shown in Figure 1. A level of 6.00 molar glycerol was the goal, but many past successful suspensions were lower. For example, in



Data from inline refractometers was not yet automated and was plotted at five minute intervals. Notwithstanding this, clear trends of concentrations of arterial and venous CPAs (cryoprotective agents) are evident. The rates of change of the two concentrations were more sensitive, but both rates declined after initial upswings until a decision was made at sixty minutes to accelerate the ramp. This produced the rapid rise in arterial rate, then both rates again fell back to within the rates preferred in the protocol.



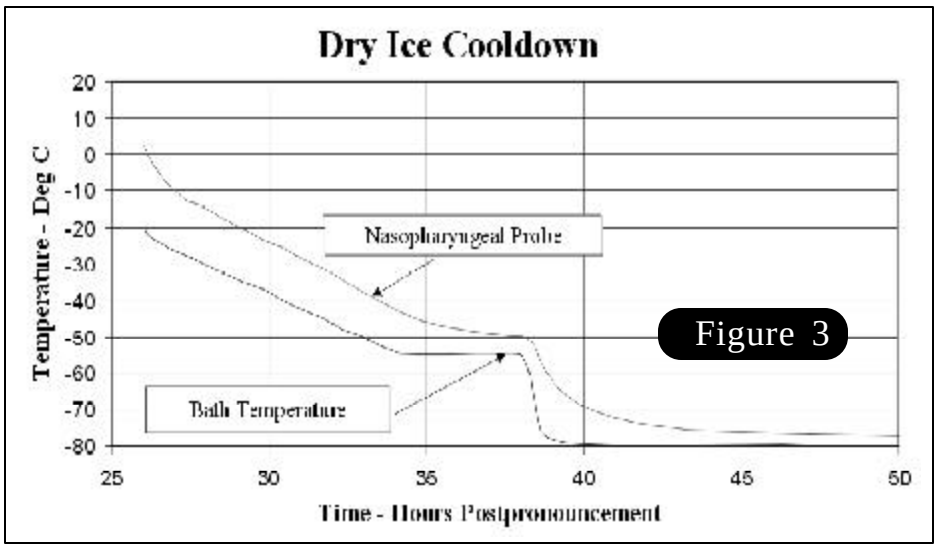


Figure 3

the highly successful suspension of Arlene Fried in 1991 (this was Linda Chamberlain's mother), the final glycerol concentration at the end of the ramp was 4.30 molar.) Figure 2 shows variations of the ramp rate with time. Rates were within acceptable limits.

Cooldown

Cooldown to the temperature of dry ice took place immediately after cryoprotection. The patient was submerged in a Silcool bath, precooled to -20ºC. Readings immediately after submersion in the Silcool were: pharyngeal, 3ºC and Silcool bath, - 20.3ºC.

The patient's cooldown to dry ice temperature, as charted in Figure 3, was controlled by a temperature ramp of the external media at -4ºC /hour down to a temperature of -55ºC. At -55ºC, controlled rate cooling was terminated, and the bath was filled with dry ice. This temperature descent to -79ºC took place over a period of about twenty (20) hours. This data is based on the pharyngeal probe. Readings on the burrhole probe were erratic during cooldown to dry ice temperature. By the time cooldown to liquid nitrogen began, the burrhole probe was operating normally.

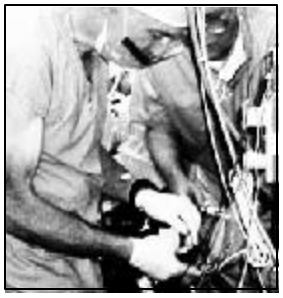
Figure 4 indicates the profile of cooling to liquid nitrogen. The Bath Probe was calibrated at liquid nitrogen temperature, and the other probes were adjusted to this one at dry ice temperature. Computer controlled temperature descent began at -1ºC /hour and continued at this rate down to liquid nitrogen temperatures.

Cooling from dry ice temperatures to the temperature of liquid nitrogen took approximately 120 hours.

Crackphone Analysis

Three cracking events were recorded during the descent to LN2 temperatures. The first two (the only two of major amplitude) occured at approximately -100 ºC and -126 ºC.

A third and final cracking event, of such low magnitude that



Above: Fred Chamberlain and Hugh Hixon check the perfusion system. Inline refractometers *(right)* provide continuous monitoring of levels of CPA in both the arterial and venous lines.

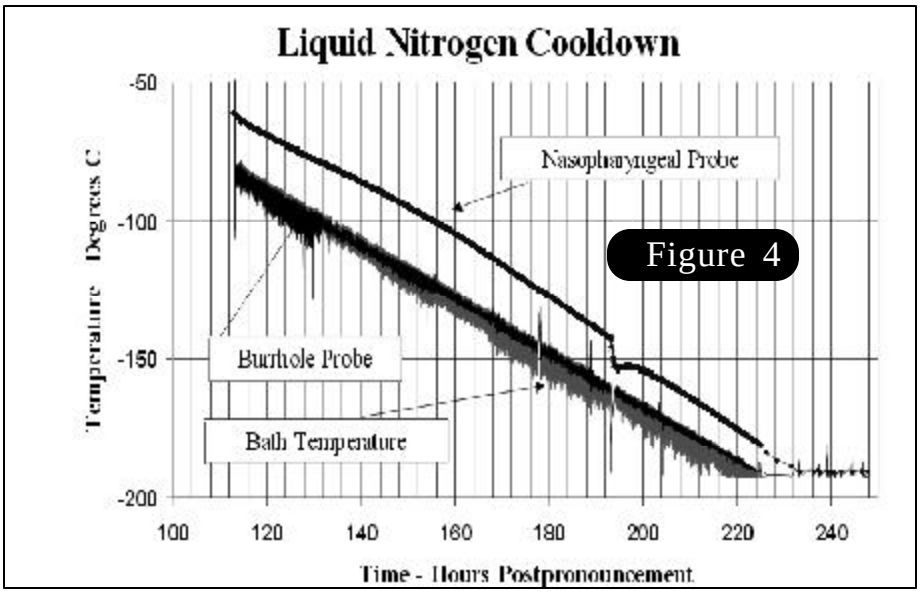


Figure 4

it only recorded on one of the two channels, was at about -186 ºC.

The small number of cracks observed is probably due to the lower level of glycerolization. Higher levels (6-7M is now considered best) usually result in (very roughly) 20 cracking events. l

Blood Sample Analysis

Although blood samples taken at the start of washout do not serve a purpose directly in the procedure used for cryostasis, they may help later in interpreting physiological roadblocks encountered. We are sometimes asked, "Why do you want to obtain medical records for people whose illnesses will surely be well understood by reanimation teams of the future?" The answer is that our purpose is to understand better how to carry out procedures here and now. Medical records, in conjunction with the data obtained during field stabiliziation, may be of great value in the improvement of what we can do in future cases to anticipate the problems we will have in suspensions, and to try to circumvent them.

Transport Blood Sample Data

Test	Normal Range	Units	Sample#A	Sample#B	Sample#C
GLUCOSE	82 to 115	MG/DL	138	81	141
BUN	8 to 25	MG/DL	45	32	39
CREAT	0.5 to 1.5	MG/DL	0.9	0.5	0.5
BUN/CRE	12.0 to 20.0	MG/DL	50	64	78
URIC ACID	2.2 to 7.0	MG/DL	7.2	3.8	5.4
SODIUM	135 to 145	MEQ/L	100	75	83
POTASSIUM	3.5 to 5.1	MEQ/L	21.5	24.6	23.1
CHLORIDE	96 to 110	MEQ/L	80	63	68
CO2	22 to 30	MEQ/L	7	11	9
GAP	4 to 16	MEQ/L	13	1	6
OSMO-CALC	275 to 295	MOSM/K	248	198	217
T PROT	5.9 to 8.4	G/DL	3.0	0.6	0.6
ALBUMIN	3.6 to 5.2	G/DL	0.9	0.2	0.2
GLOBULIN	1.9 to 3.4	G/DL	2.1	0.4	0.4
ALB/GLOB	1.1 to 2.2	MG/DL	0.4	0.5	0.5
CHOL	0 to 200	MG/DL	43	5	6
TRIG	30 to 175	MG/DL	86	69	90
CALCIUM	8.5 to 10.5	MG/DL	5.9	3.6	4.5
ION CA-CAL	3.5 to 5.2	MG/DL	3.8	3.2	4.1
PHOS	2.5 to 4.5	MG/DL	9.4	4.6	5.8
GGT	0 to 65	IU/L	14	3	3
ALK PHOS	30 to 130	IU/L	39	7	13
SGPT (ALT)	0 to 40	IU/L	53	100	170
SGOT (AST)	0 to 41	IU/L	204	73	210
LDH	95 to 250	IU/L	418	199	587
CPK	25 to 225	IU/L	290	51	86
T BILI	0.2 to 1.2	MG/DL	0.1	0.0	0
D BILI	0.0 to 0.3	MG/DL	0	0.0	0
I BILI	0.0 to 1.2	MG/DL	0.1	0.0	0
IRON	40 to 150	MCG/DL	0	0	0

Note: This report conveys a realistic picture of some of the the many challenges and uncertainties involved with cryotransport.

Alcor's rescue teams are presently its only means of responding, if your life is endangered. Someday, such rescue efforts might be launched by calling "911."

Until then, we ask that you encourage and support all of the Alcor CryoTransport Team (ACT) Members you know. Your life might depend on them, and they have pledged to be there for you, if you need them.