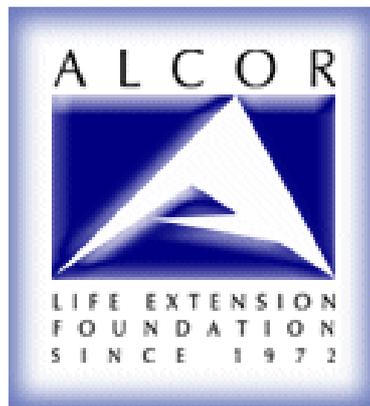


# **Alcor A-1556**

## **Case Report**



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**December 2011**

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## 1. Member's Background

Peter Toma, PhD, became a member of Alcor in 1991. Born in Doboz, Hungary, a village in the Southern Great Plain region of south-east Hungary, on July 10<sup>th</sup>, 1924. His family became refugees when Soviet forces invaded Hungary in 1944 and they fled to Bavaria and then to Switzerland. Peter eventually immigrated to the United States in 1952.

Peter's first professional job was in 1954 at the California Institute of Technology's physics lab in Pasadena. It was there he first heard about computers and the field attracted him right away. The school had just purchased their first computer, a Datatron 205, where Peter took the associated computer course that was offered. Since Peter spoke several languages, the inspiration came to him to use this new technology for translation. He believed his Hungarian background helped him to look objectively at how language systems worked, because Hungarian is so different from other European languages.

The circumstances in which he was employed at Cal Tech also allowed him the opportunity to explore his interests and passion. There, he had free access and free computer time and he spent many nights experimenting with the possibilities of the computer. He was able to combine linguistic approaches and computer programming. In 1957, the year he became a U.S. citizen, he was also named "one of California's five outstanding young men", due to his work on his language translation project. The government became interested in his work, including the U.S. Senate, the CIA, and the Pentagon, which led to numerous contracts for continued development.

Eventually, Peter's machine language translation programs developed into a suite of software called Systran. The advantage that Peter's programs had over other competitors was that Systran developed a special computer language that allowed linguists to communicate directly with the computer, rather than from language to language. This allowed for faster, more accurate translations, and could be used between any two languages.

Systran has performed extensive work for the U.S. Department of Defense, NASA, the Apollo-Soyuz Mission, U.S. Air Force, European Commission, and countless Universities and Fortune 500 companies. The advent of the Internet led Alta Vista, and eventually Yahoo, to use his software to run the web based application known as BabelFish. It allowed for instant cross-platform language translation, available to the world, free of charge.

Peter's mother, a microbiologist with the Salk Institute, was cryopreserved by Alcor in 1990 just prior to him completing his own membership application. Peter's health declined in his 80's and his clinical death occurred at 4:19 PM on June 24<sup>th</sup> of 2010.

## **2. Personnel**

Aaron Drake, Transport Coordinator, led response team members Eric Vogt, Sandra Russell, Andrei Sobolev and Richard Cremeens for the immediate stabilization and cool down. They were supported by Jennifer Chapman, Executive Director; and Steve Harris, M.D., Chief Medical Advisor.

Personnel at Alcor's surgery suite included Nancy McEachern, DVM, Surgeon; Aaron Drake, Surgical Assistant; Hugh Hixon, Cryoprotection Perfusionist; and Andrei Sobolev, Scribe. Surgical support staff: Eric Vogt, Sandra Russell, Bruce Cohen, and Bonnie Magee.

## **3. Pre-Deployment**

In May, 2006, Peter went into a hospital in Germany for back pain. While there, he tripped and broke the neck of his femur. Following surgery to repair the broken bone, Peter developed post-operative atypical dementia. This never resolved and produced a progressive decline in his daily living activities. In November of 2007, Hugh Hixon and Tanya Jones visited Peter at a care facility in San Diego to check on his condition. Sometime in early 2009, he was placed in the care of an Iranian family who lived in the San Diego area and cared for individuals with special long term needs. Alcor maintained communication with Peter through his daughter. As time progressed, the daughter felt her father's health was declining and she preferred that he be relocated to the Phoenix area, to be closer to Alcor.

After some searching, she was able to find a Hungarian family that lived in the Scottsdale area who also cared for other elderly individuals in their home. When a vacancy opened up in June 2010, she brought her father out to Arizona. One of the first stops was to bring him by Alcor to meet the current staff and to see old friends. Although not able to verbally communicate, Peter looked very happy to see familiar faces. Peter suffered from atypical dementia and had not been able to speak for more than a year. He was also non-ambulatory and had to be moved around by wheelchair.

The daughter took the weekend to get him established into his new environment before leaving him and returning to California. Over the course of the week, it was reported that Peter ate almost no food. Concerned that the physical move and change of environment may have contributed to this, the daughter decided to return to check on him, hoping a familiar face would perk him up. Upon arrival, she did not like the way he looked and decided to take him immediately to the hospital via ambulance to determine his problems.

Peter was severely dehydrated, malnourished and slightly febrile. Blood lab tests showed he also was hypernatremic and hypokalemic. An IV was established in the Emergency Department and he was admitted to one of the medical floors. Levaquin, an antibiotic, was administered to treat a possible infection. After a day, the arm in which the IV was established was grossly swollen from shoulder to wrist (the IV catheter was initiated at his wrist.) The attending physician said that it appeared that Peter had venous collapse and if they were not able to rehydrate him, he would "die pretty soon." The physician said he could surgically insert a gastric feeding tube but that would lead to a very low quality of life. Given his advanced dementia, the physician recommended that Peter be referred to hospice. The daughter said that she did not believe that her father would want to continue living with a feeding tube so she called Aaron Drake, with whom she had communicated frequently, looking for direction about how best to handle her father's care and to ensure the plans aligned with Alcor's needs. Aaron suggested the hospital establish a Peripherally Inserted Central Catheter (PICC) line; that the daughter sign a DNR; and that she call a local hospice provider that Alcor frequently uses for an evaluation to admit. Aaron also traveled up to the hospital to meet with her and obtain additional medical information on Peter.

When Aaron arrived, the hospice nurse had completed her evaluation and had accepted Peter for a transfer from the hospital to a local hospice facility when they were ready. The medical staff was attempting to establish a PICC line. It took the PICC nurse more than 90 minutes to establish the line and she commented that she thought that the original IV line was not patent and had infiltrated, causing the excessive inflammation.

Alcor suggested for the daughter to request that Peter receive Total Parenteral Nutrition (TPN) through the PICC to bolster his stamina and for the hospital to continue to look for an infection through various tests. She seemed relieved that she did not have to accept the hospice decision just yet until she had exhausted other options.

On Sunday, after 24 hours of receiving TPN, Peter failed to show any significant improvement in his blood lab values. He had not opened his eyes in over two days and he still would not eat or drink anything. A different attending physician again suggested hospice to the daughter as the most reasonable option. Unless they insert a feeding tube, they did not expect him to last more than a couple of days as the TPN was only holding Peter in check. The daughter made her decision and contacted the hospice organization and scheduled the transfer for Monday, June 14<sup>th</sup>, 2010.

By mid-afternoon on the following day, Peter was discharged from the hospital and transferred by a local ambulance company to the hospice. The daughter, who was exhausted from the physical and emotion events that had transpired over the course of the week, returned to California shortly after the move was complete. Aaron requested the hospice nurses tape his

Alcor business card and contact information to the front of Peter's chart with the understanding to contact Alcor if there were any significant changes in his condition.

Over the next four days, Peter did not eat or drink anything. The hospice nurses said he refused despite their efforts. He was responsive to sounds, however he slept most of the time. His vital signs were stable and he was afebrile – which might otherwise indicate septicemia.

Although Aaron called daily for updates on vital signs, he visited Peter on Tuesday and Thursday for about 40 minutes each day. Peter would awaken and was visually curious the entire time of the visit. His room was large and spacious with relaxing music, colorful balloons and plenty of sunlight. On Thursday, the hospice staff flushed Peter's PICC line to maintain its patency.

On Friday, June 18<sup>th</sup>, the nurses said that Peter was grimacing when he was being turned so they suspected he was in pain. They started IV morphine PRN to help control any discomfort. When Aaron visited Peter on Friday, it was recently after a dose of morphine so Peter was fairly unresponsive. Peter looked more dehydrated and he had only produced 100 cc's of fluid output since that morning.

Concerned about the effects of morphine on Peter, Aaron again visited Friday night at 9 pm after the local cryonics meet-up. His local caregivers were there - Anna and Nick. Anna was speaking Hungarian to Peter and he would respond to her questions with "yes and no" nods of his head. It's possible that because her questions were in his native tongue that he was more able to understand. His eyes were open for a while, however he kept them closed most of the time.

#### **4. Deployment**

Although Peter's vital signs had remained stable, the fact that he had gone without food and water for close to a week and his level of fluid output had greatly decreased, caused Alcor to start the standby on Saturday morning, June 19<sup>th</sup>.

Aaron drove Alcor's rescue vehicle to the hospice facility and parked about a block away in a church parking lot. The hospice administration had requested this due to the large size of the truck and the additional space that it occupied when parked in the somewhat narrow drive. They agreed to allow the vehicle to be parked closer when clinical death appeared to be imminent.

All of the equipment was pre-positioned in his private room and prepared. Four coolers of ice were maintained in his room as well. Aaron requested that the nurses attach Alcor's CO2SMO unit to Peter's finger so team members could actively monitor changes in his heart rate and oxygen saturation. A hand held two-way radio on voice-activated setting was positioned underneath the speaker of the CO2SMO. This allowed any alarm sounds to be transmitted to any

team member's radio throughout the facility as well as in Alcor's Rescue Vehicle. Because the radio was underneath the device, it was not able to pick up any room conversations which helped ensure privacy from anyone within earshot.

Alcor team member Eric Vogt was contacted and asked if he could travel from his home in San Diego to Arizona to assist on the standby. He arrived around 7 pm that evening and Hugh Hixon transported him from the airport to the hospice facility. The standby team consisted of Aaron Drake and Eric Vogt as team leads with Steve Graber and Andrei Sobolev for support. Sandra Russell from Critical Care Research in Rancho Cucamonga, CA, also flew out on Monday afternoon to join the team as Steve was only available for a day. A nearby motel room was acquired and this allowed team members to rest while others stayed at the hospice.

Over the next couple of days, Peter's vitals remained quite steady. The only change was a fluctuation in his O<sub>2</sub> saturation which ranged from 86 - 96 %. He developed some respiratory congestion and maintained a more open-mouth position for breathing. Peter slept most of the time. He could be aroused by the nurses when they would moisturize and massage his feet and legs with lotion but his eyes would not open far and he appeared to be very tired.

On Tuesday, the daughter called and asked about her father's condition. She indicated that she had said her "goodbyes" and did not plan on coming back to visit again. It was too hard emotionally for her and she just asked that we call her after it was all over.

One of the nurses commented that she almost slipped from some water on the floor of the patient's room. This was quickly cleaned up and the ice coolers were inspected. Although the ice in the coolers was replenished daily, it was identified that some of the coolers were leaking at their spigots. The coolers were swapped out more frequently and towels were placed along the edge to prevent any water from seeping into the traffic way again and creating a slip hazard.

By Wednesday, the staff was unable to auscultate a blood pressure, indicating that his pressure was now below 80 systolic. Peter's breathing turned into Cheynes-Stokes respirations with 30 seconds of hyperpnea followed by 30 seconds of apnea. This started after, and probably as a result of, the morphine administration. Peter's erratic breathing pattern persisted most of the day and his heart rate continued to rise steadily and then became erratic as well, ranging from 75 to 125 beats per minute. In the late evening, as the morphine wore off, his vitals would stabilize and his breathing would return to a more regular pattern again.

On day six of the standby, Thursday, the alarms on Alcor's CO<sub>2</sub>SMO began to sound due to Peter's oxygen saturation index falling into the mid 60's. We lowered the alarm settings to account for this but then the alarms would go off again due to his heart rate rising above 165. Eventually, his peripheral perfusion became poor enough that the monitor could not detect any readings at all and alarm continuously. The CO<sub>2</sub>SMO was disconnected and thus required that a standby member be assigned to Peter's room continuously to monitor his breathing.

This change was the determining factor to begin preparing the medications. Aaron, Andrei and Richard Cremeens spent the next hour drawing up and pre-filtering the medications. The meds

were then stored in one of the coolers until they were needed. Alcor's Rescue Vehicle was moved into position outside of the hospice facility's exit.

Peter's most fragile moments would come in the hours after each morphine administration when his breathing would become heavily labored. His respiratory rate increased to 44 and he developed tracheal deviation. His fluid output decreased to 100 cc's in a 24 hour period. Some mottling began to appear around his knees, legs and feet.

In the afternoon, after another dose of morphine was administered by the staff, Aaron was convinced that Peter's breathing had reached a critical level. He called Sandra, who was at the motel resting, and asked her to come early for her shift. When she arrived, she joined Aaron, Eric, Andrei and Richard for a full complement of five team members on site. They reviewed their prospective tasks and watched as Peter's breathing became increasingly more erratic.

The nurse was summoned to watch Peter's breathing as it began to fail. Within five minutes, the pause between breaths lengthened until they stopped altogether. The nurse checked for a pulse and listened for lung sounds. After one minute had passed without a breath or a pulse, she said that the Alcor team could begin. The time was 16:14, June 24<sup>th</sup>, 2010.

## **5. Field Stabilization, Cooling & Transportation**

Aaron directed Eric to administer the first five medications through the previously established PICC line. While Andrei and Sandra placed a base layer of ice into the portable ice bath, Aaron called Alcor's emergency answering service to announce that the patient had been pronounced. Once the initial low volume medications were flushed with 60 cc's of normal saline to enhance circulation, the patient was rolled onto a MegaMover, the Foley catheter was removed, and the rectal occlusion device was inserted. The patient was then transferred from the bed to the ice bath and covered with additional ice.

The Lucas 2 automatic chest compression device was placed over the patient's chest and initiated to circulate the medications through the vascular system. A King airway was placed and secured in the patient's esophagus while a thermocouple was inserted in the nasopharynx to begin recording cooling progress on a DuaLogR. A second medication administration site was established with a Bone Injection Gun and a Baxa infusion pump was connected to the port to begin auto infusion of the epinephrine.

The patient was now ready to be moved from the hospice room to Alcor's rescue vehicle which was parked just outside the facility. The nurses were notified the team was ready and they closed the other patient's rooms along the route and opened the locked exit door for Alcor to use. The portable ice bath was covered with a privacy drape and moved into the hallway, through the exit and rolled across the parking lot until it could be loaded into the back of the rescue vehicle. A total of 15 minutes had elapsed at this point in the stabilization.

Aaron, Eric and Sandra entered the back of the rescue vehicle with the patient to begin administering the large volume medications. The team elected to stay in place rather than depart for Alcor as this allowed for more providers to push meds instead of breaking someone away to drive the vehicle. The patient's temperature needed to drop to 20° C before chest compressions could stop and surgery could begin. Since the total drive time is approximately 15 minutes, there was plenty of time before needing to depart. Andrei was sent back to the patient's room to gather up any remaining stabilization supplies and ensure that the room was left in an acceptable condition.

Additional ice that was stored in the rescue vehicle was added to completely cover the patient to maximize the rate of cooling. As the last of the medium and large volume medications were administered, the back of the vehicle was prepped for departure. Hugh Hixon was notified by phone that we were ready to leave for Alcor while Eric backed the vehicle out of the stall and departed.

## **6. Surgery and Perfusion**

Fifteen minutes later, the rescue vehicle arrived at Alcor and was greeted by Hugh Hixon and Bruce Cohen at the rear of the facility. The core body temperature had dropped to 26° C, so Hugh decided to continue cooling before proceeding to surgery. The ice bath was lowered from the rescue vehicle to the ground and rolled into the operating theater. Additional ice was added to the PIB to assist in the cooling process. After 25 minutes of cooling, the temperature had decreased by another 2° C, so the decision was made to start the surgical procedure. During this time, Dr. McEachern and Aaron Drake had scrubbed and prepped for surgery.

Bags of ice, from a cooler inside the OR, were placed on the operating table to create an ice bed for the patient to lie upon. Using a MegaMover fabric sling, the remainder of the team transferred the patient from the portable ice bath to the table. Sandra and Eric took additional bags of ice and packed them around the patient.

Dr. McEachern and Aaron reentered the room and began to drape the patient. Aaron prepped the patient's chest with Betadine and alcohol. Dr. McEachern opened the surgical trays and noticed the Sarns sternal saw was not readily available. While Hugh left to retrieve the saw, Nancy moved to the head to establish burr holes while she waited. The patient's head was shaved, prepped with alcohol and two vertical incisions were made with a scalpel to expose the skull. The scalp was parted with retractors and burr holes were made using a Codman perforator. Dr. McEachern cleaned each of the burr holes with a Kerrison rongeur. Establishing burr holes took approximately eight minutes.

Upon completion, Dr. McEachern returned to the chest to perform the median sternotomy. Aaron made a vertical inline incision along the patient's sternum from the suprasternal notch to below the xiphoid process. The guide of the Sarns sternal saw was placed below the sternum at the suprasternal notch. Steve Graber operated the foot pedal on the floor as Aaron lifted and guided the saw to divide the sternum. After the sternum was separated, the chest was opened with Finochietto rib spreaders, exposing the pericardial sac. Dr. McEachern accessed the heart by making an incision through the pericardium.

Dr. McEachern performed an arterial cannulation of the heart by sewing a purse-string suture in the wall of the aortic arch, puncturing the vessel within the purse-string, and advancing and securing the catheter. She then repeated this process for the venous cannulation of the heart, going into the right atrium and advancing the cannula into the inferior vena cava. The purse-strings were tightened around the cannulae and secured. Thirty-six minutes had passed from initiating the median sternotomy to starting the bypass. At 2 hours, 32 minutes post arrest, the patient was on bypass.

An hour and half into the perfusion, it was noticed that there was a loss of effluent coming from around the venous cannula. As Dr. McEachern had previously left, she was called to come back in to re-secure the cannula however Hugh only reached her voice mail. Dr. Kanshepolsky was also contacted and said he could come in directly. Dr. Kanshepolsky arrived 18 minutes later and Dr. McEachern arrived 30 minutes later. Together they worked to fix the problem however in the end, they decided to just manually hold the cannulae in place. Within 35 minutes, the ramp was turned off as the brain was determined to be well cryoprotected with the endpoint criterion of the effluent having a refractive index of 50.35 Brix for over 30 minutes, without concentrate addition. Dr. Kanshepolsky closed the sternum and the patient was moved to cooldown at 6 hours, 52 minutes post arrest.

## **7. Timelines:**

### Stabilization

24 June, 2010

Time / Post arrest

1619 (0:00) Patient pronounced  
 Permission to begin procedures given  
 Ice placed in PIB  
 120 mg Propofol administered

1620 (0:01) 250,000 U Streptokinase administered  
 100,000 U Heparin administered  
 30 U Vasopressin administered  
 60 mg Gentamicin administered

- 60 cc saline bolus given to flush medications
- 1620 (0:02) Patient's Foley catheter removed  
Rectal Occlusion Device inserted  
TeleMed contacted
- 1622 (0:04) Patient moved to PIB and covered with ice
- 1625 (0:06) Lucas2 sized over patient and started
- 1626 (0:07) King airway placed and secured  
355 cc Maalox administered through King airway
- 1628 (0:09) Nasopharyngeal probe placed  
DuaLogR recording started
- 1629 (0:10) Temp = 35.1° C
- 1631 (0:12) Second access site established with Bone Injection Gun  
Epi pump started
- 1632 (0:13) Patient moved from room to RV
- 1634 (0:15) Patient loaded into RV and PIB secured
- 1638 (0:19) 400 mg SMT in 50 cc Citrate-Dextrose administered
- 1640 (0:21) 1.5 g Ni-Ky in 100 cc Citrate-Dextrose administered
- 1642 (0:23) 4-Hydroxy-TEMPO in 50 cc Citrate-Dextrose administered
- 1643 (0:24) 32 mg Acetylsalicylic Acid in 10 cc THAM administered
- 1644 (0:25) 190 cc THAM administered
- 1647 (0:28) Temp = 34.2° C
- 1649 (0:30) 500 cc Hetastarch administered
- 1651 (0:32) Temp = 33.4° C
- 1656 (0:37) 400 cc Vital Oxy administered
- 1657 (0:38) Temp = 31.9° C
- 1707 (0:48) 500 cc Mannitol administered
- 1708 (0:49) Changed battery on Lucas2
- 1720 (1:01) Departed for Alcor
- 1735 (1:16) Arrived at Alcor  
Temp = 26.0° C

## Surgical

Estimated weight 140 lbs, M22 requirement 77 liters

Time / Post arrest

- 1735 (1:16) - Arrive at Alcor.  
Noted: blood coming out of mouth
- 1800 (1:41) - On table

- 1812 (1:53) - Bur holes completed
- 1815 (1:56) - Begin sternotomy
- 1826 (2:07) - Diaphragm pushed up into chest
- 1851 (2:32) - On bypass
- 1854 (2:35) - Perfusion pressure 100 mmHg, 1.24 liters/min
- 1900 (2:41) - Start ramp
- 1906 (2:47) - Brain: swelled to a retraction of L - 0 mm, R - 1-2 mm
- 1927 (3:08) - General skin color change
- 1936 (3:17) - Losing a lot of perfusate through bur holes
- 2000 (3:41) - Left eye retracted, right eye expanded
- 2006 (3:47) - Brain: swelled to a retraction of L - 15 mm, R - 10 mm
- 2011 (3:52) - Connect second bag of M22
- 2012 (3:53) - Pause ramp, got to -3° C due to temperature of enclosure and perfusate
- 2019 (4:00) - Foam in reservoir
- 2100 (4:41) - Loss of effluent around venous cannula
- 2148 (5:29) - Call back Nancy, call in Jose for leakage around venous cannula - stop pump to connect third bag of M22
- 2158 (5:39) - Making up lost volume with M22 addition
- 2206 (5:47) - Jose working on leak
- 2218 (5:59) - Nancy arrives
- 2221 (6:02) - Arms and legs shrinking, brain well cryoprotected by now
- 2225 (6:06) - Brain: swelled to a retraction of L - 25 mm, R - >25 mm
- 2230 (6:11) - Jose and Nancy holding cannulas in place
- 2254 (6:35) - Ramp off; venous over 50.35 Brix for over 30 min
- 2255 (6:36) - Brain: swelled to a retraction of L - 8 mm, R - 5 mm  
Note: unsure why perfusion pressure reached 200+ mmHg

#### 25 June

- 0011 (6:52) - Chest closed, moved to cooldown
- 0020 (7:01) - Cooldown initiated - plunge to -80° C
- 1636 (24:17) - Transfer to pod and dewar, and began cooldown to LN2 at -1° C/hr

#### 30 June

- 140 (141: 48) - Patient at LN2 temperature cold-soaking for dry transfer due to multiple cooldowns in progress

#### 1 July

- 1553 (167:34) - Transfer to BF11
- A-1556, Peter Toma, PhD, became Alcor's 97<sup>th</sup> patient

## 8. Discussions and Recommendations:

**Problem:** Coolers had a slow leak that created a slip hazard

**Solution:** Cooler spigots have been sealed inside and out.

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**Problem:** Make sure RV has comfort items for standby team.

**Solution:** Purchase pillows and comforters.

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**Problem:** RV needs additional air movement for comfort.

**Solution:** Purchase a small floor fan.

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**Problem:** Excessive patient movement in the Portable Ice Bath (PIB) when driving.

**Solution:** Develop a non-slip mat for the base of the PIB.

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**Problem:** Difficult to monitor patient after the pulse-oximeter is no longer able to detect peripheral heart rate and oxygen saturation.

**Solution:** It would be beneficial to have a cardiac monitor to view heart rhythms to assist in monitoring a patient's condition. We will consider purchasing an older used monitor.

## 9. Graphs

