

LIFE STAR LINES

A Hartford Hospital publication addressing articles of interest to emergency and critical care personnel

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 HARTFORD HOSPITAL

Case Study: CARBON MONOXIDE POISONING

By Wendy Lord, RN, BSN, CCRN, EMT-P & Richard Kamin, MD

Karen Davenport immediately knew something was very wrong when she opened the door of the Dunn home in Niantic at 7 PM on January 11, 2004. She had visited the previous day and noticed that all of the Duns seemed out of sorts, possibly suffering from food poisoning or the flu. Karen called the family several times throughout the day of the 11th to check on the welfare of her relatives, but when no one answered the phone, she decided to stop by. Upon entering the home, she immediately spotted her niece, 7 year old Chelsea, and Chelsea's mom, 37 year old Kelly Cameron-Dunn, lying unresponsive in the living room. Just ahead, Kelly's mother and her friend lay lifeless in the kitchen. Karen quickly scooped up Chelsea and ran to the neighbors for help. With EMS and East Lyme Fire and Police Departments en route, Karen quickly ran back into the house and began opening windows and dragged Kelly outside.

With specialized meters, East Lyme Fire personnel began measuring high carbon monoxide levels even before entering the home. Kelly's mother and her friend were quickly evacuated from the home while other rescue workers discovered three-year-old Alyssa unconscious in an upstairs bedroom and her father in cardiac arrest in a bedroom nearby. EMS personnel provided ALS care and ventilatory support with 100% O₂ to all six victims during transport to Lawrence and Memorial Hospital Emergency Department. Sadly, only Kelly and her two daughters, Chelsea and Alyssa, could be successfully resuscitated.

Both LIFE STAR teams responded to Lawrence and Memorial Emergency Department and were triaged to transport Kelly and Chelsea to Hartford Hospital for emergent hyperbaric therapy. Care during flight focused on hyperoxygenation with 100% O₂, airway protection and ventilatory support due to severely depressed mental status, and supportive care. Also in need of hyperbaric therapy and pediatric intensive care, Alyssa was transported by ambulance to Hartford Hospital/ Connecticut Children's Medical Center.

Once at Hartford Hospital, Kelly, Alyssa and Chelsea each received five hyperbaric treatments and intensive care. Alyssa made the quickest recovery, transitioning from an obtunded, intubated



From left to right: Kelly Cameron-Dunn with daughters Chelsea and Alyssa

ed state in the pediatric ICU to a full recovery and discharge home in a few days. Chelsea also did well, making slow but steady progress over time. After nearly two months in the hospital, Chelsea was discharged home with only a small "hitch" in her gait and minimal deficits. By far, Kelly has had the longest road to recovery but continues to make phenomenal progress toward independent living as she recuperates at a local rehabilitation facility.

Discussion:

Carbon monoxide (CO) is a colorless, odorless, and non-irritating gas that is produced by the incomplete combustion of carbon-containing materials (fires, car exhaust, and improperly functioning or ventilated charcoal or gas stoves). As one of the most common causes of poisoning in the United States, approximately 40,000 people are seen in emergency departments for CO exposure each year. As the result of CO poisoning, thousands of people are killed yearly; with many more being left with long term disabilities.

The damaging effects of CO toxicity are multifaceted. CO binds to hemoglobin approximately 250 times more strongly than oxygen to form carboxyhemoglobin (COHb). Oxygen is displaced from hemoglobin and is consequently less available leading to tissue hypoxia and/or ischemia. It is also thought that CO can directly interfere with cellular metabolism by disturbing mitochondrial function, producing toxicity via the generation of oxygen free radicals.

The insidious nature of CO poisoning is enhanced by the broad spectrum of signs and symptoms that toxic patients can present with. Symptoms at presentation can range from headache, nausea, vomiting, diarrhea, weakness, confusion, and memory problems to more dramatic mental status changes, focal neurologic deficits, seizures, syncope, hypotension, coma or death. Patients with coronary artery disease are at greater risk of suffering cardiac ischemia or infarction. Individuals who survive the acute episode are often left with chronic neurologic impairment. The more subtle symptoms listed above are often attributed to viral illness or food borne disease and as such may contribute to a

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high rate of misdiagnosis. This is further complicated because multiple members of the same domicile may experience similar symptoms secondary to CO exposure, as would also be the case with a viral or other communicable illness.

Measuring CO exposure is also challenging. Smokers can have a baseline CO level of 5-10%. Transcutaneous pulse oximetry uses light to measure the amount of oxygen saturated hemoglobin in the blood and as such is considered a surrogate indicator of arterial blood oxygen content. Unfortunately, pulse oximetry may underestimate the level of COHb since most devices cannot differentiate between hemoglobin saturated with CO and hemoglobin saturated with oxygen. This could produce "normal" oxygen saturations in the face of significant CO exposure. Accurate quantification of CO exposure can be achieved by blood analysis performed on venous or arterial blood (an arterial sample is not necessary as previously thought). It is paramount to remember that a patient's COHb level does not necessarily parallel the clinical severity of the poisoning. Treatment must often be initiated based on clinical suspicion as well as laboratory findings.

Treatment for CO toxicity has two goals: 1) elimination of CO from the affected individual in order to minimize the acute symptoms (with subsequent return of functional hemoglobin) and 2) prevention of chronic neuropsychiatric sequelae which can affect up to 40% of patients and are almost impossible to anticipate. The cornerstone of treatment is the provision of supplemental oxygen. Oxygen displaces CO from hemoglobin and promotes return of normal oxygen carrying capacity and cellular function.

The half-life of COHb on room air at sea level is 4-6 hours. Breathing 100% oxygen reduces this to 60-90 minutes. Breathing 100% oxygen in a hyperbaric chamber (at increased atmospheric pressure) further decreases the half-life of COHb to 20-30 minutes. Experts in the fields of toxicology and hyperbaric medicine are still debating the utility of hyperbaric oxygen (HBO) for the treatment of CO poisoning. Recently however a study by Weaver et al was heralded as proving that the incidence of delayed neuropsychiatric sequelae was decreased in individuals who received HBO therapy for CO poisoning. Unfortunately, the final answer to the debate regarding HBO is still pending as these findings were challenged by some reviewers. Regardless, although it has not been definitively proven that HBO does much to significantly improve patient outcome, most clinicians would agree that the sooner a toxin is cleared from the body, the less opportunity there is for damage by that toxin. Additionally, until the risk of HBO (of which there is some) is proven greater than the possible benefit an individual with CO poisoning might obtain, most consultants will continue to recommend HBO for the treatment of certain cases of CO poisoning. The generally accepted indications for hyperbaric treatment in the face of acute CO toxicity are suspected or proven CO exposure with any of the following: syncope, coma, GCS <15, seizures, focal neurologic deficit, myocardial ischemia or arrhythmias, COHb > 10% in pregnant or young people, and COHb > 25% regardless of symptoms.

References are available on request from rakamin@hart Hosp.org

Ventricular Assist Device Note

The discrepancy between the number of patients awaiting organ transplant and the actual number of organs available is vast and well documented, with many patients dying before a suitable organ match can be found. For patients suffering from severe cardiomyopathy, the window of opportunity to be saved by a heart transplant can be particularly short. Implanted cardiac ventricular assist devices, known as an LVAD (left ventricular assist device) or BiVAD (bilateral ventricular assist devices), can provide a temporary but useful bridge between critical ventricular failure and transplant by replacing either one or both ventricles with a mechanical pump. There are several types of these devices.

Recent technological advances now allow patients with these devices implanted to return home to await transplant. It is important to note that these devices can only be placed and serviced at select hospitals in New York and Boston at this time, and that these patients could require emergent air transport to these appropriate centers. If you are aware of a patient in your community who has a ventricular assist device, please notify John Fisher, Chief Flight Nurse, LIFE STAR at (860) 545-4302.

CCMC & LIFE STAR: PARTNERS IN SAFETY

By Tricia Lohan, RRT, EMT

The LIFE STAR team is proud to be a part of the "STAR" program at Connecticut Children's Medical Center. The "STAR" Program promotes Safety, Training and Recreation for the many children who are treated in CCMC's emergency department. Jackie Grogan is CCMC's child/family liaison and is the director of the "STAR" program. Jackie coordinates many activities to educate and entertain young patients while they are at CCMC. She is dedicated to improving their trip to the emergency department.

When the LIFE STAR crew is not flying they frequently visit the children in the emergency department to promote helmet safety. Many state and local police officers also participate in the "STAR" program. The West Hartford Police promote bicycle safety and the East Hartford police teach about dog safety. The Hartford Fire Explorers instruct the children how to stop, drop, and roll if ever involved in a fire. Several ambulance



✉ Flight crew: from left to right: Roberta Wood-Lantz, Mike Vaclavik, Tricia Lohan. At Center: Jackie Grogan and patients

services such as AMR and ASM show the children their ambulances and equipment so that they will not be afraid if they have to be transported by ambulance. Twice a month Jackie organizes a magician to perform magic tricks for the children. Also, local college and high school students volunteer to entertain the children with activities such as coloring. The "STAR" program enriches these children's stay in the hospital and will hopefully improve their safety when they return home.

New Crew



Flight Respiratory Therapist Jarrett Assael, RRT, EMT-B joined the LIFE STAR team in May 2004. He has eleven years of respiratory care experience including seven at

New Britain General Hospital and is also a member of Wethersfield Volunteer Ambulance Association. He holds an Associates Degree in Science and obtained his respiratory registry from California College for Health Science.

Elections

Congratulations to Flight Nurse John Kelly and Communications Specialist John Grenier for their wins in the recent annual transport industry elections. John Kelly has been elected to serve on the Board of Directors for the Air and Surface Transport Nurses Association, and John Grenier will serve as a Board Member at Large for the National Association of Air Medical Communication Specialists. LIFE STAR members now serve in all of the air medical industry's national leadership organizations.

Hartford Hospital's annual Black & Red gala: TO BENEFIT LIFE STAR

Hartford Hospital will mark the 20th anniversary of its LIFE STAR service in 2005, so it is fitting that the hospital's annual fund-raiser, the Black & Red gala, will benefit this critical care helicopter service – the only such service in Connecticut.

Over the last 19 years LIFE STAR has flown over 18,000 patients, and has provided service to over 120 hospitals in 9 states, over 200 towns in and around Connecticut and over 750 EMS and fire agencies. The LIFE STAR Program provides service to the full spectrum of patients including: neonates, pediatric medical and trauma patients, adult medical and trauma patients, cardiac patients, patients requiring hyperbaric oxygen therapy, neurologic patients and high risk obstetric patients. LIFE STAR has an extremely active community education outreach program.

The proceeds from Black & Red will help LIFE STAR save lives in the following ways:

- The purchase of a state-of-the-art:
 1. Neonatal isolette to provide cutting-edge care to very young infants and neonates.
 2. Cardiac monitors.
 3. Transport ventilators to provide respiratory support to a wide range of patients, both adult and pediatric.
 4. Hare traction splints, which provide stabilization for fractured femurs.
 5. Communication equipment to more securely and more fully integrate our operations with state and local agencies, including disaster and bio-terrorism preparedness activities.
 6. Landing zone safety equipment to ensure optimally safe conditions for scene operations, thereby improving the service we provide.
- Continuing education for our crews, which care for the broadest spectrum of patients. The crews are also faced with high-risk, low frequency situations for which they must always be prepared. Continuing education to maintain the crews' widely diverse competencies enables us to provide cutting-edge care to all of our patient populations.

B L A C K R E D



The Black & Red gala will be held on Saturday, January 8, 2005 from 6:00 p.m. to midnight at The Bushnell and will include a performance by the Emmy, Oscar, Tony and Grammy Award Winning Legend, Rita Moreno.

Contact Heather Sullivan, (860) 545-2969 or hsulliv@harthosp.org for more information on how you can make a gift, purchase tickets to the event or become a sponsor to support Hartford Hospital and LIFE STAR.



Rita Moreno ☒

Pilots' Corner:

WEATHER OR NOT

By Rich Magner, Pilot

At various LIFE STAR presentations, a frequent question often asked of pilots is: "What kind of weather can you fly in?"

A variety of weather conditions affect our ability to fly. Thunderstorms and icing are obvious threats to safety but the not so obvious are:

- Ceilings: Cloud levels above the ground. Look up, how far can you see?
- Visibility: restrictions to horizontal visibility- fog, haze, smoke, etc.
- Precipitation: rain or snow which cause reduced ceilings & visibility
- Wind: velocities 30 kts & above, severe gusts
- Thunderstorms: severe turbulence, intense rain, possibly hail & lightning
- Icing: conditions with visible liquid precipitation less than +4 degrees C.

We are often asked, "Can you fly in rain?" Yes, we certainly can. It is not the precipitation that poses a problem but the low ceiling and reduced visibility that often accompanies rain and snow. Our ceiling is defined as the lowest layer cloud above the highest terrain on our enroute flight path. Our local weather minimums are 800 feet and 2 miles for day and 1000 feet and 3 miles for

night. Ceiling and visibility are the factors that most often curtail our flying.

Flights beyond the greater Hartford area and the central Connecticut River valley necessitate cross-country weather minimums. For daytime cross-country flight, ceilings of 1000 feet and/or three miles visibility are required. A nighttime cross-country flight destination west of Route 8 or north to Massachusetts and beyond requires a ceiling of 2000 feet and five miles visibility. For the remainder of Connecticut and Rhode Island our night cross-county minimums are 1500 feet and five miles visibility.

For example, prior to accepting a night flight to Sharon Hospital in Western Connecticut, we need to glean a degree of assurance from forecast and station reports that the ceiling and visibility will exceed our minimums. Since there are no reporting stations between Hartford and Northwestern Connecticut, this launch decision is based upon an interpolation of weather data from the surrounding stations at Bradley, Hartford, Oxford, Danbury, Poughkeepsie, Albany,



and Pittsfield, along with what we may see out of our twelfth floor office window at Hartford Hospital. The ability to visually verify the weather from the rooftop heliport at Hartford Hospital allows decisions for local flights within the Connecticut River valley to be made with greater certainty. Occasionally, weather encountered is different than what is reported and we will cancel en route.

LIFE STAR weather decisions are almost always complex. The best policy is to make the request for the aircraft when needed, even if the weather seems questionable.

News Briefs: FYI

Safety Patch Programs

LIFE STAR recently hosted two in-house Safety Patch Programs. The first program was offered at Hartford Hospital and was widely attended by EMS, police and fire personnel. A second Safety Patch was held at Backus Hospital and was also well attended. Dates for future in-house Safety Patch programs will be announced soon.

LIFE STAR Lines Staff:

Editor: Lisa Duquette, RN
Nicole Wilson, Communications Specialist
Medical Director: Kenneth Robinson, MD, FACEP
Advisory Board: Steve Haemmerle, RRT, Chief Resp. Therapist
John Fisher, RN, Chief Flight Nurse
Lee Monroe, Director of Public Relations
Printing Advisor: Reginald Leonard, Director of Printing Services

LIFE STAR at the Big E

Crewmembers pose with University of Hartford Women's Basketball Coach Jennifer Rizzotti (center) at the LIFE STAR booth during this year's Eastern States Exposition on Connecticut Day.



LIFE STAR

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80 Seymour Street
PO Box 5037
Hartford, CT 06102-5037

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