

# 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: AIR GAS EMBOLISM

By Steven Haemmerle, RRT, EMT-P

On June 8, 2003, the Stonington Fire Department was dispatched to Stonington Harbor to aid 53 year old Stephen Grady, who was found unresponsive and in severe respiratory distress after an early morning scuba dive. Stephen, an experienced commercial diver, was performing a routine salt-water dive at a depth of no greater than ten feet. Immediately following ascent, fellow divers found him apneic, cyanotic and unconscious. Rescue breathing was initiated. Stephen soon became conscious and resumed spontaneous but labored respirations. An air gas embolism (AGE) was suspected and LIFE STAR was requested to transport this patient to Norwalk Hospital for hyperbaric treatment.

LIFE STAR physical exam revealed an alert male in moderate respiratory distress. Wheezing was noted in all lung fields and an albuterol nebulizer treatment was started. He denied any chest pain or aches in his joints, ears or back. No subcutaneous emphysema was noted. He moved all extremities equally and had no evidence of facial asymmetry.

During preparations for flight, Stephen suddenly became anxious, combative, air hungry, cyanotic and dyspneic. He was promptly medicated and intubated, with improved aeration to all lung fields resulting. A 12-lead EKG completed during transport showed no acute ischemic changes.

Stephen was ultimately transported to Norwalk Hospital for hyperbaric therapy. His treatment included three "dives" in the hyperbaric chamber, in addition to comprehensive care. He was discharged home several days later and has completely recovered from this injury.

### Discussion:

Breathing compressed gas above ambient pressure potentially exposes all divers to an array of life-threatening injuries including air gas embolism (AGE), pneumomediastinum, pneumothorax, and decompression sickness. The genesis for each of these types of dive injuries is directly related to the physics described by Boyle's and Henry's gas laws. A thorough under-

standing of each of these gas laws is needed to dive safely and to treat injuries should they occur.

Boyle's law states that at constant temperature, the relationship between pressure and volume are inversely related. In other words, air within the lungs and sinuses will shrink when a diver descends underwater and expand upon

needed to allow nitrogen to be reabsorbed. If the diver ascends to the surface too rapidly, nitrogen can bubble out of the blood stream and become lodged in tissues and in the vasculature, resulting in decompression sickness Type I, also known as "the bends." Divers experiencing DCS Type I may complain of a slowly progressing pain or numbness in the limbs. Joint pain or pain



☒ Hyperbaric Chamber at Hartford Hospital

ascent. While breathing compressed gas at depth, a diver should never hold his breath while ascending to the surface because the volume of air trapped in the lungs will expand, resulting in a pneumothorax, pneumomediastinum or air gas embolism (AGE). AGE formation will quickly evolve into unresponsiveness or cardiovascular collapse immediately upon ascent. These complications can be avoided simply by exhaling while slowly ascending to the surface.

Henry's Law describes the ability of a gas to dissolve into a solution when increased atmospheric pressure is exerted on the gas and liquid. An example of this is an unopened bottle of soda. Few, if any, bubbles are visible before the bottle is opened because the carbonation has been added to the liquid under pressure. Once the cap is opened, pressure is released and the gas bubbles quickly come out of the solution.

As a diver breathes compressed gas at depth, nitrogen becomes dissolved in the blood (Henry's Law). A slow ascent to the surface is

in the muscles or back that worsens with movement can also be present. Mild symptoms such as these are not life threatening but may require treatment. DCS Type I may be potentiated by air travel soon after a dive, or by multiple dives per day.

A more severe form of decompression sickness (DCS Type II) occurs when nitrogen bubbles out of the blood stream and affects the nervous or cardiopulmonary systems. The bubbles can travel to the heart causing cardiac arrest, to the pulmonary vasculature causing respiratory distress or arrest, or to the brain to cause a stroke. Dyspnea, chest pain, severe headache, altered mental status and shock may occur. Since the formation of these gas bubbles is related to the time spent underwater and the depth of the dive, strict adherence to dive table depth and time ratios is crucial.

A thorough history regarding the dive and the relationship to the onset of symptoms is key in diagnosing a potential dive injury. Important information to obtain includes: the depth of the dive; bottom time; decompression stops; past

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diving accidents and past medical history. Physical findings such as hemodynamic instability, subcutaneous emphysema, decreased function of extremities, difficulty breathing, or altered mental status strongly suggest a life-threatening dive injury and should be addressed during the primary survey. Abdominal pain, joint pain and paralysis are also common signs of this type of injury. Although physical exam and history can be highly suggestive of dive injury, differential diagnoses such as hypoglycemia and head injury must be considered.

Timely recompression in a hyperbaric chamber is the only definitive treatment for a serious dive injury. Pre-chamber treatment goals are aimed at rapid patient transport to a hyperbaric medicine center and supportive care. LIFE STAR is often used to meet these goals for critical patients. The altitude changes occurring during typical LIFE STAR transport are not significant enough to negatively impact a patient with a dive injury.

The Diver's Alert Network (DAN), is a tremendous resource for anyone who suspects they may have a dive injury, or for health care providers with acute questions regarding the treatment of dive injured patients. The 24-hour DAN Hotline number is 1-919-684-4326, and emergency collect calls are accepted. More information about the Diver's Alert Network can be found at [www.diversalertnetwork.org](http://www.diversalertnetwork.org).

Today, hyperbaric medicine is used to treat many different diseases including AGE, DCS, carbon monoxide poisoning, gas gangrene, crush injuries, wounds resistant healing, blood loss anemia, intracranial abscess, necrotizing soft tissue infections, osteomyelitis, delayed radiation injury, compromised skin grafts and thermal burns. In Connecticut, only Norwalk Hospital and Hartford Hospital offer hyperbaric therapy. Norwalk Hospital has offered hyperbaric care in its mono-place chamber for years. Offering a multi-place chamber that can accommodate up to ten patients at a time, Hartford Hospital's recently opened Center for Wound Healing and Hyperbaric Medicine is now one of the largest hyperbaric facilities in New England.

#### References:

1. Campbell, Ernest S. Decompression Illness in Sports Divers: Part I. Medscape Orthopaedics & Sports Medicine eJournal. 1997. [www.scuba-doc.com/DCSPartI.html](http://www.scuba-doc.com/DCSPartI.html)

2. Kaplan, Joseph. Emedicine. July 23, 2003. About. Sept. 20, 2003. [www.emedicine.com/emerg/topic53.htm](http://www.emedicine.com/emerg/topic53.htm).

3. Walker, Stuart. Hyperbaric Medicine Unit. Sept. 2, 2003. About. Dec. 26, 2003. [www.hyperchamber.com/decompression\\_illness/](http://www.hyperchamber.com/decompression_illness/).

Indications for Hyperbaric Oxygen Therapy. Undersea and Hyperbaric Medical Society. [www.uhms.org/Indications/indications.htm](http://www.uhms.org/Indications/indications.htm)

## Another Airway Adjunct: THE BOUGIE

By Steven Neher, RN, CEN, EMT-P

Poor vocal cord visualization due to debris, soft tissue swelling or anatomic variants can make intubation difficult. Further complicating matters, patients may be in compromising positions on scene, neck movement may be contraindicated or lighting may be inadequate.



The LIFE STAR team has added use of a gum elastic bougie (pronounced 'boo-jee') to facilitate intubation when laryngoscopy provides a less than optimal view of the glottic opening.

The bougie is a disposable, low cost device made of latex-free polyethylene. Measuring 5 mm in diameter and 60 cm in length, it is a semi-rigid plastic rod that has a 36 degree angled tip and a rounded end to prevent airway trauma. The small diameter, shape and elasticity of this device may allow it to pass through the vocal cords more easily than an endotracheal tube.

The bougie, first described by Macintosh in 1949, is widely accepted by anesthetists as an alternate method to achieve intubation of the dif-

icult airway. To use the bougie, laryngoscopy must reveal at least a view of the epiglottis. Once the epiglottis is identified, a well-lubricated bougie is advanced past this structure with the angled tip pointing anteriorly and midline, allowing the device to pass through the glottic opening even when the vocal cords are not visible.

Bougie placement into the trachea is suggested when a washboard or clicking sensation is felt as the bougie tip moves over the tracheal rings, or resistance is met as the device encounters the carina. The bougie should be advanced until the lips fall between the two black parallel lines found proximally on the device. At this depth, the distal tip is beyond the cords and there is enough length proximally to use the bougie as an introducer. Once in proper position, an endotracheal tube is threaded over the bougie and advanced to an appropriate depth. The bougie is then removed and endotracheal tube placement must be confirmed and secured.

Although not commonly used in the pre-hospital environment, the bougie has easily transitioned into LIFE STAR practice. Our team has used this lightweight, inexpensive tool on several occasions to secure a difficult airway. A continued improvement in difficult intubation success rates is anticipated.

## The LIFE STAR Communications Center

By John Grenier, Communications Specialist

Located in the Emergency Department at Hartford Hospital, the dimly lit LIFE STAR Communications Center buzzes 24 hours a day. As the coordination point for two full-time rotor wing aircraft, 125 Security and Fire Safety Department personnel, and the Connecticut Children's Medical Center critical care ground transport team, continuous radio chatter and ringing phones are baseline quiet for the center. Full throttle multitasking and seamless transitions are the norm.

Safety and quality assurance are top priorities in our communications center. The environment is technology intensive, relying on two Motorola Centracom consoles, advanced camera systems, Aeromed software, and WSI weather monitors to keep operations flowing smoothly. A digital based recording system capable of long-term storage, quick playback, and enhanced sound quality has recently been added, and plans for improved rooftop weather monitoring, remote headset communications and automated flight following are underway.

From the console, communication specialists can access multiple tools to generate essential navigation information for the LIFE

STAR crew. Map books, aviation sectionals, and Delorme Street Atlas Software are all on hand. The Yeoman, an electronic marine navigation plotter that utilizes various area maps to immediately identify latitudes, longitudes, headings and distances, offers quick directional precision. A Connecticut grid map (a state DOT tourism map printed with a grid overlay) may also be used to pinpoint scene locations. Since these grid maps are located in all regional dispatch centers, in our communications center and in both aircraft, the continuity of information and accuracy on scene work is extraordinary, allowing us to respond to and locate scenes efficiently and safely.

In 2003, our eight communication specialists used their 61 years of combined experience to field 2,367 LIFE STAR requests and coordinate 176 critical care ground transports for Connecticut Children's Medical Center ground team. Impressive numbers, but contributions extend far beyond the console. Education, participation in community outreach programs, navigation, documentation, customer service, mission coordination and many other activities make the LIFE STAR Communications Center not only the primary link to our customers but also a major link in our team.

## Connecticut Children's Medical Center & Hartford Hospital: PURSUE JOINT PEDIATRIC TRAUMA CENTER STATUS

By Scott James, RN, Trauma Coordinator

The Connecticut Children's Medical Center (CCMC) continues its preparations in partnering with Hartford Hospital as a joint level I pediatric trauma center in Fall 2005. To further this endeavor, CCMC underwent a consultation visit by the American College of Surgeons Committee on Trauma in late April 2004. The purpose of the visit was to provide a comprehensive assessment of the pediatric trauma system to date, and to render guidance in furthering the hospital's goal.

Joint pediatric trauma center verification between CCMC and Hartford Hospital was identified as a best practice model for both institutions to provide expertise in caring for traumatically injured children in the region. Under the joint trauma center status, the most critically injured children continue to be transported to and resuscitated at Hartford Hospital's Emergency Department. A pediatric trauma team from CCMC responds and oversees care of the child. The child is then transported to an appropriate in-patient unit at CCMC. Children who are not critically injured are transported to and treated by the CCMC Emergency Department. Medical control at CCMC plays an



important role in assisting prehospital providers in triaging patients to the most appropriate emergency department.

The acceptance of injured children at Connecticut Children's Medical Center from other hospitals has also been enhanced. With the goal of streamlining acceptance from outside referrals, CCMC's "Transport Line" offers the referring physician an ability to have a pediatric trauma patient transported directly to CCMC when clinically appropriate or when an assessment at a Level I or II trauma center has already occurred. Referring physicians can call (860) 545-8989 and immediately speak to an Emergency Medicine Attending Physician at CCMC.

Preparations for joint trauma center verification have provided many enhancements to the care of patients at Connecticut Children's Medical Center. The hospital announced a formal Pediatric Trauma Program, which works collaboratively with the Hartford Hospital Trauma Program, LIFE STAR, the CCMC Injury Prevention Center, and the Department of Pediatric Surgery. The Emergency Department renovated its resuscitation room to include a trauma bay that caters to the potential needs of the trauma patient while department staff underwent specialized training for assessing and caring for the pediatric trauma patient. Most importantly, CCMC implemented a three tiered trauma response system, each with pre-determined resources that are dedicated to the pediatric trauma patient throughout their admission in the hospital. Numerous other changes have occurred to facilitate optimal trauma patient care.

Questions regarding the Pediatric Trauma Program at Connecticut Children's Medical Center can be directed to Scott James, Trauma Program Coordinator, at (860) 545-9810.

## New Crew



Flight Respiratory Therapist Michael Murphy, RRT, EMT-P: Mike joined the LIFE STAR team in August 2003. He has three years of respiratory care experience in the ICU at

Hartford Hospital and has worked as a paramedic in CT for the last 10 years. He holds an Associate's Degree in Respiratory Therapy from Naugatuck Valley Community College.



Flight Nurse Roberta Wood-Lantz, RN, CEN, NREMT-P: Roberta brings 10 years of critical care experience to her new flight nurse role. She worked in the Emergency

Department and Cardiothoracic ICU at St. Francis Hospital in Hartford for many years, and spent one year working in the Burn Unit at Straub Hospital in Honolulu, Hawaii. She is a graduate of Quinsigamond College and currently attends Sacred Heart University.

## Pilots' Corner

By Bob Dziezynski, Pilot

Thanks to all of the Hospital Security, Fire, Police, and EMS personnel out there, I am happy to report that we had no incidents or accidents (or even close calls) while operating in and out of helipads or landing zones this past winter. Great job! Accurate and timely communication between ground personnel, the aircraft, and LIFE STAR dispatch helped to contribute to this success.

Michelle North, the former director of Safety at Rocky Mountain Helicopters, had a conviction: "In almost all cases, someone on the ground or in the aircraft had a piece of information, which if passed on, could have prevented an aircraft or ground accident." A tree branch sticking out of the snow may not seem important, but with the rear of the helicopter only eleven inches off the ground, it would cause major problems if it is not seen. If landed on it may puncture a fuel cell. Please pass on ANY information, no matter how trivial it may seem.

We are in the process of updating our radio frequency logs. We can now program digital PLs into our radios. If you have any frequency changes, additions, or deletions please pass

them on to our communications center at 860-545-4369. In addition, if you haven't had a safety patch done recently, please call us to set one up. A reminder that the minimum size for our landing zones has increased from 60 x 60 feet to 75 x 85 feet or twice the width and length of the aircraft.

Here's an interesting thought that I read in the February issue of *AOPA Pilot Magazine*: "A wise grandmother once suggested that you can tell a lot about a man by looking at his shoes. If he shines his shoes, he usually does so for himself, as an act of personal pride. He doesn't do it to impress others, because most folks don't seem to pay attention to a man's shoes."

Many pilots have specific behaviors that they perform in airplanes to please only themselves, not others. Taxiing on the centerline is something I do for just for me. Whether or not the nose wheel remains glued to the yellow line or wanders probably doesn't amount to much at all. Yet I find enormous satisfaction in trying to keep the nose tire planted there. A few weeks ago, I was taxiing behind a small U.S. Air Force Minijet and noticed that the nose wheel never left that line for nearly two-thirds of a mile. No doubt the pilot's shoes were shined, too.

## Crew Member Spotlight:

**ROCKY 1, RICH MAGNER**

By John Grenier, Communication Specialist

It was 1985 when Rich Magner answered LIFE STAR's original call for pilots. Nineteen years of service later, the fit continues to be just right.

Born and raised in St. Joseph, Missouri, Rich has always been interested in aviation.



After being drafted by the United States Army in July of 1967, Rich volunteered for flight school, completed the AH-1G Cobra transition course and was then shipped to Vietnam. In his fourth month of duty

on March 8, 1969, Rich was wounded while on a mission and spent the next three years of his Army career on patient status at Fitzsimmons Army Medical Center in Denver.

Rich resumed flying in 1976. He began his long air medical industry career at St. Anthony Hospitals in Denver, and eventually joined the Baptist Life Flight team in Pensacola, Florida. Five and a half years passed.

In 1985, Rich relocated to Connecticut to help establish the LIFE STAR program. He is the only original LIFE STAR crew member still with our team. Rich has flown countless miles, completed over 5,000 LIFE STAR missions and has logged more than 2,750 flight hours. An icon in the air medical industry and a well-known figure throughout our service area, LIFE STAR is privileged to have Rich on our team.

## News Briefs: FYI

### NEAA Summer Conference

LIFE STAR was proud to host the summer educational event for the North East Air Alliance (NEAA). The conference was held on June 3, 2004, at Foxwoods Resort and Casino in Ledyard, CT. Educational topics included hyperbaric medicine, nitric oxide use and a historical perspective on air medical transport.

The North East Air Alliance is comprised of seven air medical programs servicing CT, MA, NY, NH and ME. By fostering collaboration, NEAA's goal is to enhance safe operations in the air medical environment, address public health issues and promote quality patient care throughout the region.

Our new email address is up and running, [LIFESTAR@hartosp.org](mailto:LIFESTAR@hartosp.org). Feel free to use the site to ask general questions about the program or to provide feedback on our operation. We look forward to hearing from you!

For questions about merchandise or catalog, please contact the LIFE STAR Communications Center (860) 545-4369 or call Barker Specialty directly 1-800-BARKERS (227-5377)

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## Bowling for Dollars

LIFE STAR recently participated in the Country 92.5 "Super Bowl" for St. Jude's Children's Research Hospital. The event, which took place on January 30th at AMF Silver Lanes in East Hartford, had more than 100 teams participate and helped raise close to ten thousand dollars for St. Jude's Hospital.



LIFE STAR crew members: from left to right: John Grenier, Michael Frakes, Paul Mangini, and Jodie Russo. Also in the picture are morning radio personalities Dave Mester (standing) and Cory Myers (seated).

## Factoid: LIFE STAR FACTS

From December 1, 2003 to March 31, 2004, LIFE STAR has:

- Completed 375 patient missions
- Flown 25,759 miles
- Worked with 150 different fire, police and EMS agencies and more than 65 hospitals.