LIFE STAR LINES

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

Vol. XVI No. 2, Fall 2006

HARTFORD HOSPITAL

Case Study: NON-TRAUMATIC CARDIAC TAMPONADE

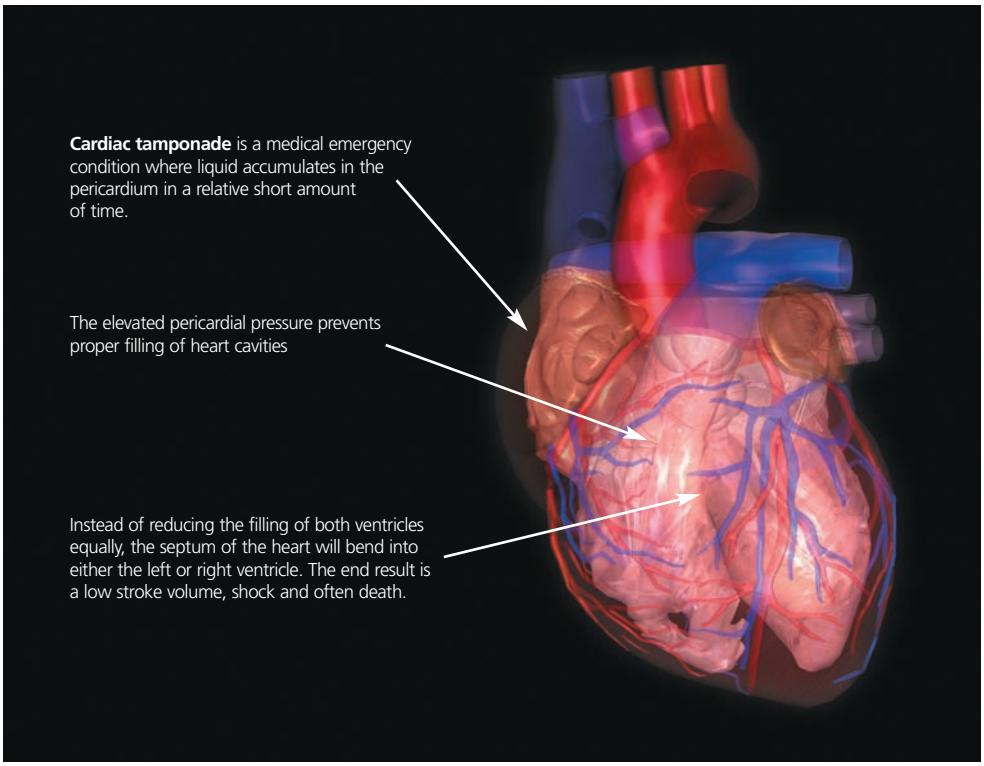
By Michael Sahjian, RN, CFRN, CCRN, NREMT-P

Cardiac tamponade may occur from many factors, however it is infrequently seen outside of the cardiothoracic intensive care setting. Definitive treatment often involves entering the chest surgically to relieve the pressure and allow the heart to fill normally. Because it is not frequently encountered, cardiac tamponade is sometimes overlooked in the formation of a differential diagnosis. Even when the diagnosis is made, the thought process is to transfer the patient to a center with cardiothoracic surgical ability for definitive treatment. Air medical transport teams frequently do this as we offer not only speed, but also an advanced skill set and training.

The LIFE STAR flight team was dispatched to transport a 55-year-old male who presented to a freestanding emergency clinic with hypothermia and hypotension. On arrival the crew was informed that the patient's medical history included an aortic valve replacement two weeks ago. He had become progressively weaker over the last day and had been anuric for 12 hours.

On exam, this 150 kg male was awake and able to follow commands. Vital signs were a HR 72, BP 64 by Doppler, RR 22, SpO2 98% on a non-rebreathing mask, and T 34C. The patient had periods of agitation and confusion that could be corrected with verbal redirection. His skin was cool and dry with mottling of his extremities, abdomen, and back. He was in a sinus rhythm without ectopy at a rate of 70 and a 12-lead EKG had no acute findings. Only weak central pulses were present, neck veins were masked by body habitus. Heart tones were a faint S1S2. Cardiac tamponade was suspected.

After completing an assessment, the flight crew was able to place a 14g peripheral IV and crystalloid volume resuscitation was initiated. There was brief consideration of intubating the patient based on his hemodynamic status, but the concern for preload impairment with RSI and positive pressure ventilation, even with use of etomidate, the absence of a primary airway or breathing problem, and a predicted difficult airway supported a decision to defer the procedure[1]. Although the patient had hemodynamic impairment, an immediate pericardiocentesis was recognized as being of little or no value due to the likely presence of a large volume of blood and, presumably, a large volume of clot. The decision was made to proceed with the 7 minute air transport to Hartford Hospital.



Once in the emergency department, a bedside ultrasound confirmed a mediastinal effusion. Volume resuscitation continued with crystalloids and uncrossmatched PRBC's. The patient had a respiratory arrest, was intubated, and then had a cardiac arrest. Standard ACLS guidelines where followed and a pericardiocentesis was performed with 50 ml of bloody output. There was no change in the patients' condition and a subxiphoid window was performed without any blood or clot evacuation. Echocardiography confirmed a persistent effusion and the subxiphoid incision was extended to the level of the clavicles, the sternal wires were cut, and an estimated 750-1000 ml of blood and clot was evacuated.

Spontaneous circulation returned shortly thereafter, however the patient remained bradycardic. Epicardial pacing wires were attached and the patients' color and vital signs improved dramatically. He was taken to the operating room for further exploration but a definitive source of bleeding was not found.

Post-operatively, the patient remained hemodynamically stable without medications, intra-aortic balloon pump, or ventricular assist device. His pupils were fixed and dilated but slowly became reactive. In the next few days an EEG was performed which showed little activity. He was made comfort measures only, was extubated, and transferred out of the intensive care unit where he later died.

continued on page 2

Discussion:

continued from cover

Pericardial effusion can occur from many causes, including aortic disruption, cardiac surgery, cancer, myocardial rupture or perforation. Tamponade occurs when there is equalization of intrapericardial pressure and right ventricular (RV) diastolic pressure by the accumulation of fluid or blood. This accumulation of fluid causes compression of the heart and obstructs blood flow from the venous system through the heart and into the arterial system as the heart can no longer fill.

Cardiac tamponade in patients who have undergone recent cardiac surgery varies slightly from pericardial tamponde in the traditional sense. During cardiac surgery, the pericardial sac is cut open and not sutured back together prior to closing the chest. This leaves open communication between the heart and medistinum. What frequently happens is the formation of adhesions causing loculated areas that can accumulate blood or fluid causing a tamponade; however, it is possible for the whole mediastinum to fill. Another difference is that the post-operative blood will frequently clot if the accumulation is not rapid. Late effusions and tamponade after cardiac surgery occur almost exclusively with valve replacement surgery and the incidence is only increased when combined with anticoagulant use.

Signs and symptoms of tamponade are the signs and symptoms of shock, including agitation, confusion, anxiety, cool, diaphoresis, pale, or mottled skin, hypotension, tachycardia, and tachypnea. There may also be a marked metabolic acidosis with a base deficit, lactic acidosis, and signs of end organ compromise or failure as a result of hypo-perfusion. Other signs include muffled or absent heart tones, JVD, narrowing of pulse pressure, equalization of invasive pressures (CVP, pulmonary and arterial diastolic pressures), and pulsus paradoxus.

EKG findings may include signs of pericarditis such as diffuse ST segment elevation and PR depression or electrical alternans. Electrical alternans is a broad term that describes alternate-beat variation in the direction, amplitude, and duration of any component of the ECG waveform. Alternans involving all aspects (P, QRS, T) of the EKG is almost pathognomic of the condition however it is infrequently seen. More frequently there is alternans of the QRS only as the heart beats in a large volume of fluid. The patient may also complain of RUQ abdominal pain caused by liver congestion.

Definitive diagnosis is made with echocardiography or portable ultrasound. Stabilization can be achieved with large amounts of volume expansion, increasing preload, to force blood through the heart according to Starling's Law. Inotropes or vasopressors might have limited use, however the problem is obstructive. Inotropes are meant to improve cardiac contractility but when the heart is compressed no matter how much one pushes it to beat more forcefully it cannot "open" to fill. A similar situation holds true with vasopressors. Vasopressors improve arterial vascular tone thus improving blood pressure and hopefully end organ perfusion. But, if the heart does not fill, there is minimal cardiac output.

Treatment for tamponade includes pericardiocentesis if the volume is small and there is no clot. Definitive treatment often involves a subxiphoid window, an incision made below the xiphoid through which the mediastinum or pericardial sac, if intact and present, is accessed. Should this approach fail, the incision can be extended to the top of the sternum, the sternal wires cut in patients with a recent sternotomy, and the mediastinum accessed directly. Should the tamponade be the result of trauma; as opposed to post cardiac surgery, the pericardial sac is accessed through a left side thoracotomy as this facilitates rapid access to the heart and mediastinal structures.

Most emergency department staff or flight crews do not often see cardiac tamponade. Knowing the signs and symptoms, along with recognizing mechanisms by which it can occur, will raise suspicion enough to warrant further evaluation. Rapid transport, often by air medical crews, can significantly reduce the time to definitive care and possibly be a life saving intervention.

[1]References available on request at Msahjia@harthosp.org

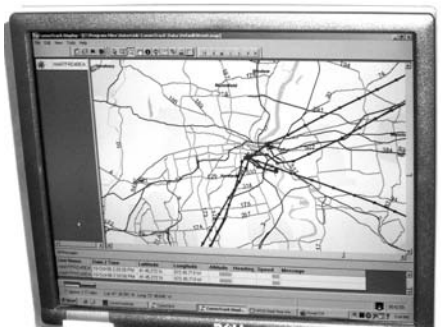
LIFE STAR begins use of OuterLink

By Ric Shotwell, Pilot

In early 2006 LIFE STAR installed and began to use OuterLink systems to enhance the flight locating of its two BK117A4 helicopters. Each system consists of a sending antenna, a receiving antenna, a CP-2 unit, which is a bi-directional satellite transceiver with built in GPS, and CommTrack software for the communications center's computers at Hartford Hospital.

The CP-2 unit is located in the nose of each aircraft, and the two 3 1/2 inch long by 2 1/2 inch wide by 1/2 inch tall antennae are mounted on the roof of the aircraft, one in front and one in back to reduce possible interference from close proximity to the other. The unit receives power as soon as the radio master switch is turned on. The CP-2 automatically transmits an "ID, location, and status" report upon application of power to the unit and periodically thereafter. The unit requires no manual intervention or control.

The CP-2 unit uses the GPS to determine its position, speed and heading, and sends that information to a ground base at predetermined time intervals through geostationary satellites. The



information is then passed from the ground base to LIFE STAR Center through a high-speed internet connection and is displayed as a map on a computer screen. Each aircraft is shown as an individually colored icon on the map and each aircrafts' flight path is displayed as an individually colored line from its origination point. The software allows the communication specialist to determine the latitude/longitude of the aircraft by clicking on the icon or the last known position of the aircraft. The Communication Center can also determine the ground speed of the aircraft, and is notified when the aircraft stops moving.

The use of the OuterLink has not meant the discontinuation of traditional flight following methods. Each aircraft is still required to make periodic position reports using the navigation GPS and give a latitude/longitude, altitude and groundspeed. The communication specialist will then relay to the aircraft where the OuterLink shows the aircraft to be, for verification purposes. This dual method effectively eliminates the possibility that the communications specialist will not know where the aircraft is at all times.

LIFE STAR will also be able to use OuterLink in conjunction with new charting software now in service, and the Communications Center will be able to determine headings and distances to locations from the aircraft's present position if there is a need to divert an aircraft to a new location while the aircraft is flying.

Can Ya Hear Me Now?

By John Spencer, EMT-B/CISD-F, Communications Coordinator

LIFE STAR's Communication Center recently underwent a major upgrade and this improvement is one that is part of a three-phase project being completed by Hartford Hospital in their commitment to continue with enhancing the LIFE STAR Program and several additional departments including the hospital's Incident Command Center with delivering the quality of services that our customers have come to appreciate and recognize over the years.

Orchestrated by the Communications Team Leader John Spencer, the redesign included the complete reconfiguration of the consoles that are now ergonomically designed and allows for electronic height adjustments of the individual work stations to meet the needs of on-duty Communications Specialist's. With that, is the addition of two state-of-the-art Motorola MCC-5500 dispatch consoles that have the ability to communicate not only with our two LIFE STAR helicopters, but are also equipped with the ability to operate on the STOCS (Connecticut State Tactical On-Scene Channel System), the State-Wide ITAC/ ICALL Emergency Communications Network, the Hartford County Intercity Operational System along with all of our previous abilities to communicate directly with Hartford C-MED and with all of the State-Wide County Dispatch Centers with the use of the MED-NET Operational System. With all of these improvements, the radio transmitters and all relative features were also replaced and upgraded and these operational systems were essentially duplicated in order to create a redundant system that is powered by two completely separate electrical grids with emergency power back-up that essentially allows for the Communications Center to remain totally operational if one of these two separate systems fails to perform at any given time for whatever reason.

The Communications Center has also replaced all of the existing computers and subsequent equipment that has now improved and enhanced both the aircraft and the hospital's video surveillance monitors, operational monitoring systems, CAD Systems and several additional features that assist the Communications Specialist's in their daily activity. All of this was done in our efforts to continue providing our customers with exceptional customer service as we continue to move forward in the upcoming years and throughout the 21st century.

First Annual Poker Run

photos by Greg Noble

The Hartford Hawks Motorcycle Club held their First Annual Poker Run on August 26, 2006. Motorcyclists toured from East Hartford, on to Hebron, then made stops in East Hampton and Berlin, ending the ride on the Hartford Hospital campus. Proceeds from the Poker Run were donated to the LIFE STAR Program.

LIFE STAR Lines Staff:

Editor: Lisa Duquette, RN
Nicole Wilson, Communications Specialist
Medical Director: Kenneth Robinson, MD, FACEP

Advisory Board: Jim Marcelynas, RN, Chief Flight Nurse
Lee Monroe, Director of Public Relations
Printing Advisors: Reginald Leonard, Director of Printing Services
Sal DiNino, Graphic Designer

New Crew Members

Flight Nurse
Susan Verrengia, APRN, CCRN, EMT-P
Sue joined the program in June. She graduated from UMASS Amherst in 1998 with a BSN and completed CRNA school in October 2004. She has extensive critical care experience and has worked as an EMT/firefighter in Amherst.

Pilot
Bill Clark
Bill brings 34years of pilot experience to LIFE STAR, 13 years flying EMS helicopters. He is retired from the army and is a champion fisherman.

Flight Respiratory Therapist
Colleen Scanlon, RRT, EMT
Collen has 9 years experience as a respiratory therapist at Bridgeport and Hartford Hospital, and has worked as an EMT for Campion Ambulance and Naugutuck Ambulance for many years. She joined the LIFE STAR team in August.

Visit the new LIFE STAR Website

Check out the new LIFE STAR website at www.harthosp.org/lifestar. This exciting resource now contains up-to-date general LIFE STAR information, a listing of job opportunities within the program, and several easy links to scheduling an event or ride-along time.

- LIFE STAR Observer Sign-Up Capability: Police/Fire/EMS and medical providers are able to sign up to observe with LIFE STAR via the website. Click on the link, fill out the observer form, and submit it through the website.
- LZ and Safety Information: Police/Fire/EMS personnel can now get specific LZ and Safety information from the website.
- Request LIFE STAR Safety Presentations: Police/Fire/EMS personnel can request a LIFE STAR Safety Presentation via the website by filling out the form and submitting it through the website.
- LIFE STAR Safety/Promotional Events: Schools, EMS Departments, etc. can request LIFE STAR via the website to come to their safety events such as a drill, safety day, DUI programs, etc. Simply go the website and click on the link.

There is a simple form to fill out and submit through the website.

Other features, including recent pictures and contact information, are available through the website, so please visit us at: www.harthosp.org/lifestar

Research and education are important in all LIFE STAR roles.

The following crew members were selected to present their work at the industry-wide Air Medical Transport Conference in Phoenix, AZ in September 2006:

Frakes M and Kelly JG et al, "Actual worked hours for critical care transport professionals".

Marcelynas J and Duquette L, "Flight volume and revenue effects of a 'Flying Standby' auto-launch policy".

Robinson K, Marcelynas J and Phillips E, " Line oriented flight training".

Frakes M, "Saving lives with aggressive sepsis therapy", "High-fidelity human patient simulation" and "Fatigue in critical care transport medicine".

Grenier J and VanVoorhis S, "Planning a realistic PAIP drill".

James S, "Characteristics of the dysfunctional team" and "Marketing organizational excellence".

O'Donnell S, Sahjian M and Frakes M, "Resuscitation from cardiac arrest in patients managed by rotor wing critical care transport teams" and "Need for defibrillation during cardiac arrest management by rotor wing critical care transport teams".

Lord W, Frakes M et al, "Factors associated with trauma oligoanalgesia by critical care transport teams".

VanVoorhis S and Frakes M, "Effectiveness of a checklist in verifying operational safety behaviors at a rotor wing air medical program".

LIFE STAR
HARTFORD HOSPITAL
80 Seymour Street
PO Box 5037
Hartford, CT 06102-5037

NON-PROFIT ORG
U.S. POSTAGE
PAID
PERMIT #4361
HARTFORD, CT