



## Pathology Biology Section – 2009

### G116 Autopulse® Associated Injuries

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By attending this presentation, attendees will become familiar with the Autopulse® resuscitation device and the variety of internal injuries that can be associated with its use.

This presentation will impact the forensic community by educating forensic pathologists about the visceral and skeletal injuries associated with the use of automated chest compression devices so that they are not misinterpreted as perimortem trauma.

Automated devices have been utilized to assist with cardiopulmonary resuscitation (CPR) for many years. The most commonly encountered device is an Automated External Defibrillator (AED) which provides rapid defibrillation for those patients with shockable rhythms. The newest device is a portable automatic external chest compression device. The Autopulse® Non-Invasive Cardiac Support Pump is one of these devices. Originally developed by the Revivant Corporation and subsequently purchased by Zoll Medical Corporation, the Autopulse® provides consistent, uninterrupted chest compressions through a load distributing band which squeezes the entire chest. Utilizing the device frees the emergency medical technician normally assigned to do chest compressions to perform other life saving activities while transporting the patient.

This FDA-approved device consists of a short backboard and a load distributing disposable compression band, called a LifeBand®. The patient is placed on the board and the band is secured around his or her chest. The band automatically sizes the patient, calculating the size, shape and compliance needed without requiring any patient information to be entered. Once started, the Autopulse® rhythmically constricts the entire rib cage, compressing at a rate of approximately 80 beats per minute. The LifeBand® can be placed over AED pads, but must be removed for standard paddle defibrillators. Compressions continue for as long as necessary or until the device is stopped. Standard protocol is for patients to receive manual chest compressions before the device is started.

Houston, Texas became a test center for the use of the Autopulse® with devices installed in all Houston Fire Department first responder vehicles. During a two month period, the Autopulse® was utilized on 264 patients, 156 (59%) of whom died and met criteria for medical examiner jurisdiction. Of these cases, 54 (35%) were autopsied. Nearly all patients had the external stigmata associated with Autopulse® use, a finding previously reported in the literature. More importantly, though, a significant number had internal injuries. The most common finding, after the external abrasions, is posterior rib fractures associated with posterior intercostal muscle hemorrhage, an injury previously not associated with manual chest compressions. Other injuries include liver and spleen lacerations, hemoperitoneum, vertebral body fractures, and mesenteric lacerations.

A subsequent study at the Harris County Medical Examiner's Office of patients who were resuscitated utilizing the Autopulse® was undertaken to determine if body habitus or bone strength played a role in occurrence of injuries. A total of 58 cases were reviewed and 36 (62%) were found to have posterior rib fractures. Rib fractures occurred fairly equally amongst younger individuals with robust bone as well as older individuals with osteoporosis. Furthermore, the overall size of the chest did not appear to be associated with an increase or decrease in rib fractures or visceral injuries. However, band placement, evidenced by the characteristic skin abrasions, and body habitus were associated with bone and visceral injuries.

Data is still being analyzed in the utility of the Autopulse® in mainstream resuscitation. Some studies have shown improvement in survival over manual compressions, while others did not. Over 4300 units have been installed and approximately 24000 LifeBands™ have been used clinically, and these numbers are likely to increase. A comprehensive understanding of biomechanics and resultant bone and visceral injuries is crucial for forensic pathologists charged with the responsibility to differentiate between Autopulse® and traumatic injuries. It would be prudent to have a policy in place with the EMS responders in your area such that they are not used on patients with traumatic injuries and they should never be utilized on children.

#### **Autopulse®, Autopsy, Posterior Rib Fractures**