H143 Pericardial Rupture After Mechanical Resuscitation With the Lund University Cardiopulmonary Assist System, 2nd Generation (LUCAS™2)

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After attending this presentation, attendees will understand how to recognize pericardial rupture after mechanical Cardiopulmonary Resuscitation (CPR) using the LUCAS™2 device, an automatic device for active chest compression and decompression. Attendees will better understand the importance of discerning the complications of CPR and their significance in forensic settings, avoiding misinterpretation of injuries detected at autopsy.

This presentation will impact the forensic science community by highlighting pericardial rupture as a potential complication of mechanical CPR in cases of cardiac tamponade.

Traumatic injuries related to resuscitation maneuvers are well known. After mechanical resuscitation, traumatic injuries are frequent, especially rib fractures; however pericardial rupture has been previously reported as a direct consequence of chest fracture related to CPR, but it is not considered as a typical traumatic complication of CPR. Nevertheless, it has been recently hypothesized that CPR could cause left pericardial tear and hemothorax by the combining stress of pericardial effusion and chest compressions. A brief review of specific literature will be presented.

The Geneva emergency department began using the LUCAS™2 device in 2011. Observation of a new type of traumatic injuries associated with mechanical CPR in bodies that underwent unsuccessful CPR started in the same period in the medicolegal service. A previously published study reports rib fractures were more frequently observed after mechanical CPR. Neither immediate life-threatening injuries nor pericardial tear were observed.

More recently, four cases of pericardial rupture were observed at autopsy after LUCAS™2-CPR. In every case, cardiac tamponade from natural disease was identified as the cause of death (myocardial rupture after infarction or intrapericardial ascending aortic rupture due to dissection or aneurysm). Massive hemothorax was observed each time. Only a small amoount of blood was present in the perforated pericardium. Some cases exhibited concomitant signs of blood loss. All cases presented rib and sternal fractures. In three cases (out of four), rupture was located on the left side. Hemorrhagic infiltration was observed at histology (hematoxylin and eosin staining). Because of these interesting statements, a retrospective study (time period 2011 to 2015) was conducted to better investigate the phenomenon of pericardial rupture in cases of cardiac tamponade. No other pericardial rupture was reported in cases with similar pathology (n=12). Cardiac tamponade was present without any pericardial injury after CPR maneuvers in nine cases (after manual CPR in five cases and mechanical (LUCAS™2) in four cases). Rib fractures were described in both populations, with sternal fractures only present after mechanical CPR.

Cardiac tamponade is associated with high mortality. In such cases, CPR maneuvers are known to be ineffective due to a lack of myocardial load. Referring to previously reported observations, pericardial rupture in cases of pericardial tamponade is to be considered as a potential complication of CPR. During resuscitation, concomitant hemorrhagic shock could therefore occur due to pericardial tear and consecutive hemothorax. In forensic investigation, knowledge of resuscitation artifacts is very important to avoid misinterpretation of trauma injuries described during autopsy procedures. Forensic pathology plays a key role in the description of those lesions.

CPR Trauma Injuries (LUCAS™2), Pericardial Rupture, Cardiac Tamponade