**Resuscitation of Avalanche Victims**

Avalanches kill roughly 150 people annually in North America and Europe. The overall survival of avalanche victims is 77% (1453/1886). Survival is dependent on grade of burial, asphyxia, trauma and hypothermia.

Those who were completely buried survived at a rate of 47.6% while those who were partially buried survived at a rate of 95.8%. In victims who are completely buried survival is 80% before 18 minutes and drops to 32% after this point.

Asphyxia is the MCC of death in avalanche and survival decreases markedly one the asphyxia phase sets in. A patent airway is absolutely necessary for survival past 35 minutes, no survivors reported who were buried for longer than this without a patient airway. Compression only CPR should not be performed when resuscitating these patients. Those found in cardiac arrest with a known burial time of less than 35 minutes should be resuscitated with CPR + ventilations regardless of whether or not the airway is patent. If > 35 minutes assess for patency then begin resuscitation. Definitive airway placement improved mortality but only when done by a skilled practitioner. When done by a less skilled provider the rate of complications is unacceptably high. In these instances a better alternative is an LMA, BVM or mouth to mask resuscitation. If ROSC is achieved or if resuscitation has not been terminated, patients should be transported to the nearest emergency department. The use of mechanical chest compression devices can improve outcomes during transport.

Trauma was shown to be the leading cause of death in Western Canada and a secondary cause of death in Austria and in Utah. However the Western Canadian studies showed ISS scores of > 15 in 12% of the patients who were classified as having died due to asphyxia.

On scene management should be centered around c-spine immobilization, splinting, analgesia and insulations. The treatment team should be able to perform endotracheal intubation, thoracotomy, IV/IO access and medication/antibiotic administration. Delay of transport should be kept to a minimum.

Hypothermia: see the NEJM paper and our previous discussions for an overview.

If the core temperature is < 32 and the airway is obstructed this is an indication to withhold/discontinue resuscitation. See Table 2 and Figure 2.

Rescue collapse is most often due to lethal arrhythmias as myocardium is far more irritable in a hypothermic state. Continuous EKG monitoring is recommended and mechanical irritation should be avoided during transport and re-warming. Core temperatures should be obtained via an esophageal probe in intubated patients and via an epitympanic probed in non-intubated patients. In the presence of trauma and/or asphyxiation clinical staging systems are unreliable. Rectal temps can lag behind esophageal temperatures during re-warming.

Hypothemic patients should be insulated with wind and water resistant outer shells. Do not remove wet clothing in the absence of adequate insulation. There is little downside to passive rewarming with hot packs and active with the administration of warm fluids however these measures will not significantly affect core temperature.

Pulse oximetry measurements are notoriously unreliable in hypothermic patients, generously administer supplemental O2 as it may improve myocardial stability.

Defibrillation may be ineffective under 28oC however 3 attempts should be made as indicated by ACLS protocols. Subsequent attempts can be delayed until the core temp is 30oC or greater. There is a discrepancy in the European and AHA guidelines on the administration of vasopressors. ERC guidelines recommend against it, AHA guidelines are for it. There may be a theoretical risk of increased arrhythmias and increased risk of frostbite. Vasopressors may be tried in conjunction with re-warming strategies.

Victims who have a core temperature of less than 32oC but no evidence of hemodynamic instability or arrhythmias can be rewarmed via active external measures. Those with a core temp of less than 28oC, cardiac instability, cardiac arrest should be transported to ECMO/CBP centers.

Potassium: less than 8, continue. More than 12. STOP. Between 8-12, use your clinical judgement and consider other factors (ie presence of trauma, core temp etc).

In terms of triage/resource allocation give priority to those with stable cardiac, rhythms and higher core temps.

My biggest take home points from these guidelines: K > 12, mouth packed with snow, chest wall frozen are all indications to STOP resuscitation and move on.