The Danish National Hypothermia Team

Use of portable ECMO-device in hypothermic patients and alternative applications

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INTRODUCTION

The Danish National Hypothermia Team is an perfect example of civil/military partnership utilizing 722 SQN capabilities (Merlin EH101) to transport advanced equipment and medical expertise to the hypothermic patient and evacuate to appropriate high level health care facility.

The Hypothermia Team consists of 1 thoracic surgeon and 1 nurse perfusionist.

Treatment of the hypothermic patient depends more on the clinical condition than on the core temperature. The Danish Hypothermia Team use a simplified clinical approach to on-site triage of hypothermia[1].

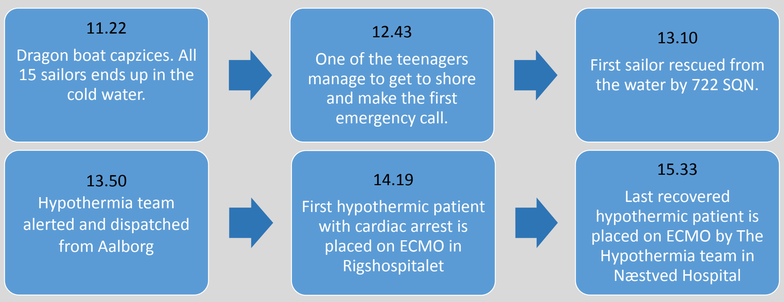
1. Mild hypothermic patient: Below 35°C. Awake (Glasgow Coma Scale > 8).
2. Moderate hypothermic patient: Below 32°C and unconscious.
3. Severe Hypothermic patient: Below 32°C, unconscious and abscent respiration/circulation.

Unconscious hypothermic patients need thorough investigation, and they can often be rewarmed with warm water in the pleural cavities. Cardiac arrest requires cardio pulmonary rescue until rewarming can be established by extra corporeal circulation - unless the patient is dead.
The diagnosis of death can be difficult in the hypothermic patient.
As a guideline the following criteria are used when deciding to terminate resuscitation:

- Asystole and P-potassium > 10 mmol/L
- Asystole and temperature > 32 °C
- Cadaverositas – (NOT rigor mortis/livor mortis)

THE PRÆSTØ ACCIDENT

In February 2011 a dragon boat carrying 15 people - 13 teenagers and 2 adults – capsized leaving all 15 sailors in the water. Water temperature was 2°C and air temperature was 4°C.



One adult was not recovered initially but drowned and was not found until 2 months later.
6 teenagers and one adult was treated for moderate hypothermia.
7 of the rescued teenagers suffered from cardiac arrest and had dilated unresponsive pupils. The core temperature varied between 15,5-20,2 °C and pH-level between 6.43–6.94[2].
6 of these patients was initially transferred to Copenhagen University Hospital Rigshospitalet and treated with ECMO. 1 patient was transferred to a smaller hospital in Næstved and treated locally with portable ECMO-device by the Hypothermia Team from Aalborg. The patient was subsequently transferred by 722 SQN to Aarhus University Hospital while on ECMO.
Once rewarmed to mild hypothermic state, all patients were weaned from ECMO and transferred to ICU.

Outcome: Although intensive neurorehabilitation was required for several months, only one patient suffered from severe neurological impairment after the accident. The other 6 was able to continue their education.

TRACTOR INCIDENT 2014

In September 2014 a farmer was run over by his own tractor and sustained multiple injuries. The accident took place on a very muddy field and therefore the SAR SQN 722 was scrambled. In cooperation with arriving anesthesiologist staffed ambulance, vital on scene resuscitation was performed. The patient had GCS 3. He was intubated and transferred to Aalborg University Hospital.

Patient suffered from a wide range of traumas including multiple rib fractures with flail chest, pneumothorax, hemothorax, lung contusion, crushed pelvis and intra abdominal injuries. This led to emergency surgery. Due to the chest-/lung injuries it was difficult to maintain sufficient oxygenation during emergency surgery and the situation became critical.
The in hospital ECMO team (The Hypothermia Team) was called, and the patient was placed on veno-venous ECMO. The cardiopulmonary assist continued for 4 days. After 4 months of further hospitalization patient was discharged with an ileostomy. Cerebral- and kidney function was intact and the patient had no major disabilities.
In this case use of ECMO bought the surgical team much needed time to complete interventions.

DISCUSSION

This is an example of the ECMO system used in a trauma setting. In other cases the portable ECMO-device has been used in patients with warm cardiac arrest until underlying pathology was investigated (e.g. CT-scan or CAG) sufficiently to either terminate further treatment or select appropriate intervention. The table below shows Aalborg cases with ECMO-treatment including patients with accidential hypothermia from 2004-2015 (february).

Categories	Number of patients	Survivors
Accidential Hypothermia (ECMO)	41	18 (plus 1 organ doner)
Accidential Hypothermia (Pleural lavage)	17	13 (1 converted to ECMO)
Warm Cardiac arrest (ECMO)	54	30

As with the hypothermic patient, huge benefits can be achieved when bringing portable ECMO-device and capable personnel to other types of critical illness/traumas.

Portable ECMO-device may be used in initial treatment of life threatening asthma attacks, heart attacks, pulmonary embolism and severe pneumonias. May also be used for long distance evacuation of critical injured patients who are circulatory/ respiratory unstable (e.g. blast lungs)[3].

Due to legislation regarding research animals, expertise and experience with porcine models and tradition for civil-/military cooperation, Denmark offers excellent conditions for further research in MEDEVAC using cardio-pulmonary assist as well as other highly specialized interventions. International cooperation within this field of research is welcomed.

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