



European Cave Rescue Meeting

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Medical rescue conference



14. – 17. November 2019

Consensus paper

Aim

This paper seeks to summarize the common sense about medical treatment in European Cave Rescue Organizations. Therefore, all old papers up to this edition have been reviewed, and if still valid, integrated.

General aspects

The group seeks to provide consensus and establish an expert body in cave rescue medicine. When practical, it is proposed to apply/adapt recognized international medical recommendations to the special conditions.

Any medical rescuer (doctors, paramedic etc.) needs to be a competent caver (technical/ speleological skills).

Surgical interventions underground (e.g. appendectomy) should be the last possibility, wide spectrum antibiotic should be considered first.

Medical check-up can be considered for all cave rescuers according to national regulations and protocols.

Every patient has a right to a best treatment possible (in first line pain killers and immobilization and prevention/treatment of hypothermia).

With development of new technologies, the whole spectrum of new possibilities opens. There are benefits in using patient monitoring during cave rescue missions as well as using visual communication device and further development and testing of these devices in caving conditions should be encouraged. All the data collected in this way shall stay a private property of the patient and shall be treated confidential.

Education of cave rescuers (non-medical)

Mandatory cycles of repetition of official courses provided by each nation may be too long, e.g. for BLS. Higher frequency may be desirable (e.g. annual).

Every caver should have a basic first aid training, every rescuer an advanced first aid training with regular refreshers. Since cave rescuers represent the organisation to the outside BLS/AED should be included.

A written protocol on the patient (monitoring sheet) should be started as soon as possible.

Education of medical professionals for cave rescue

International collaboration and exchange of information. By recruiting new medical personnel for cave rescue some minimal standard should be achieved, e.g. International Diploma in Mountain Medicine.

Material

No international consensus so far because of legal regulations.

Medical material should generally be contained in white bags. Vice versa white bags only for medical equipment, no personal white bags.

Drugs

Analgesia

- Try to use drugs that keeps the casualty mobile
- Every person has the right of sufficient pain relief
- It is suggested that all cavers carry their own pain killers
- A basic combination of analgesia (e.g. Paracetamol/NSAD/weak oral opiate) should be administered rapidly, potentially by non-medical personnel.
- Do not use ASA as a pain killer
- Ketamine is a useful adjunct in the treatment of severe pain.
- Psychological first aid & care is very important in the treatment of pain apart of painkillers
- Regional anaesthesia can be considered in special cases

Antibiotics

- If antibiotics are indicated start as soon as possible
- Check for allergies
- Keep the route of administration as simple as possible
- Choose accurate antibiotic substance according to national guidelines

i.v. fluids

- Provide fluids orally if possible
- The use of i.v. fluid in cave rescue may be appropriate. Rescue complexity (duration, patient status, injuries) will influence the decision.
- In principle types of fluids or replacement regimes to use should be kept simple.

- All patients have the basic right of adequate hydration. The most appropriate method for monitoring hydration status is measuring or estimating the urine output (≥ 0.5 ml/kg bw/h)
- Preferably the i.v. line should be kept functional during transport

Thromboprophylaxis

- Consider thromboprophylaxis if patient immobilised for more than 12 hours

Tranexamic acid

- Probably not useful due to late arrival of professional medical care in cave rescue (> 4h after onset of bleeding)

Immobilisation

- Splinting and other types of immobilisation are the base for pain relief.
- Consider instructing first aiders to immobilise with whatever they have (e.g. commercial (e.g. vacuum) or improvisation material) as soon as they can. Health care professionals can always replace as needed.
- Monitor carefully after splinting e.g. circulation, neurological deficits etc.

Hypothermia

- All patients should be considered hypothermic unless proven otherwise; normal temperature should be the goal.
- Apply common sense measures to avoid temperature loss (insulation etc.)
- Apply all available means
- Consider temperature assessment by clinical symptoms, e.g. walking capability. Any patient that can walk, keep mobile. After-drop exists, but is not a reason to stop mobilizing.
- In case of mild to moderate hypothermia temperature measurement is used rather to indicate trends than reliable exact values. In case of severe hypothermia try to measure as accurately as possible, allowing the distinction between trauma and hypothermia as a cause of unconsciousness.
- Caution in administering medication to hypothermic patients
- Consider warm up severe hypothermic patients to at least 28 °C prior to starting transportation

Suspension Trauma

- Unconscious patient has to be rescued from the rope as quick as possible
- If feasible without delay, keep feet up already during rescue or try at least to achieve horizontal position
- Victims of suspension trauma should be placed horizontally once safely off the rope

- Consider vagal syncope and venous blood pooling as a probable reason for unconsciousness in casualty without trauma and treat respectively

Monitoring

- Use appropriate patient monitoring according to situation
- Consider electronic monitoring devices if available and indicated
- Consider using heart rate training device for observation
- Due to limited or no access to facilities, use history, observation, fingers, eyes etc. for the assessment, clinical assessments remains of high values
- Assessment should be a continuous process and documented properly (monitoring sheet)
- Monitoring sheets are legal documents and may be subject to critical examination later

Pre-existing medical conditions

- Cavers should carry their own drugs and peers should be competent in the indication for the use of their medication

NOT revised 2019 from below

Diving medicine

Instead of list of hyperbaric chambers, every country should know where they exists in their country but it is normally responsibility of the ambulances.

There needs to be a clear distinction between decompression sickness (DS), divers with trauma and combinations of the two scenarios.

Generally

- Muscular activity produces more bubbles and so causes more problems
- Severe decompression sickness (DS) often cannot be treated in the cave, because only the pressure chamber is really effective
- Bends in the joints are not life threatening but painful
- DS can begin even hours after leaving the cave
- Divers often, but not always know the first symptoms
- It is not important to know with which type of decompression-accident we have to deal with, because the treatment on the spot in the cave is always the same
- Divers can collapse leaving the cave as consequence of a decompression-problem
- Divers often are dehydrated

Prevention:

- Technical rescue divers should undergo complete medical check-up regularly including full cardio-pulmonary assessments.
- If a diver had an non-expected DS problem, an Echo Cardiogram or intracranial Doppler should be made
- Ensure proper hydration before diving
- Consider training technical divers in recognizing and treating typical medical situations (e.g. splinting a leg for transport through siphon)
- Every diving team should know where the closest hyperbaric centres are.

Diagnosis:

- If decompression sickness is suspected, neurological monitoring should be applied continuously.
- Keep in mind that some divers might have taken self-administered drugs previous or during the dive that can mask early symptoms of decompression disease.
- Decompression sickness (DS) in the cave can be very critical, any unclear symptom should be considered as DS until proven otherwise.

First aid/pre-hospital treatment in decompression accidents (only)

- 100% Oxygen by regulator or re-breather or at least by mask with reservoir even if 100% cannot be achieved. Nitrox is still better than air if no pure oxygen is available.
- Position the victim straight horizontal
- Administration of drugs is very controversy and there is no evidence of drugs for treating decompression sickness. The use of drugs for pain relieve can be considered (Pre-medication!)
- Fluid replacement by any way, intravenous application must be considered
- Unless the victim can be assessed by a doctor experienced in hyperbaric medicine on site, careful and rapid transportation to a centre for hyperbaric medicine is recommended.
- Prevention of hypothermia is even more important than in other cave rescue situations
- To prevent further progression of hypothermia, the body temperature needs to be stabilized before exposing a victim to cold water again. Be aware that re-warming in the case of severe hypothermia can lead to further progression of decompression sickness.
- Wet decompression is not recommended.

Treatment of trauma behind siphon:

- Any treatment needs to consider the diving requirements
- Regional anaesthesia may be a considerable alternative for pain treatment
- There are different ways for transporting a victim through a siphon. The medical condition of the victim may influence the choice of equipment and that influences the victim's preparation for the transport (e.g. combination of KED and immobilisation of a broken leg).
- To prevent further progression of hypothermia, the body temperature needs to be stabilized before exposing a victim to cold water again.

Combination of trauma and deco:

Such a situation will be too complex to be able to give standard recommendations

Gaz:

Prevention:

- The doctor may be the only one with experience on gas intoxications.
- The safety of the rescue team is essential
- Monitoring of critical gaseous (e.g. CO₂, CO, NO_x) may be necessary
- CH₄ (e.g. mines or caves with lots of organic material degradation) in addition has an explosion risk
- Remember: acetylene (carbide lamps) does impact the measurement.
- Natural CO₂ may accumulate at the lowest points even without blasting or without organic material
- In case of CO contamination it may be wise not to re-employ rescuers during the event.
- Consider air contamination in caves also several days after blasting
- The season may impact natural ventilation in the cave; artificial ventilation may push CO₂ further into the cave.
- Oxygen is an explosive – ensure safe transport.

Treatment of gas intoxication:

- Evacuate from dangerous environment as soon as possible and in case of CO poisoning decide if hyperbaric treatment may be needed
- Administer oxygen with reservoir mask
- Half time value of CO in blood is 3.5 to 6 hours, in pure oxygen atmosphere 1.5 hours. Damages may persist even after elimination of CO from the blood