Independent Cryonics Educators Program

2.4: Cryonics vs. suspended animation vs. TTM (EPR and DHCA)

Suspended animation is the temporary (short- or long-term) slowing (hypometabolic) or stopping (ametabolic) of biological function so that physiological capabilities are preserved. It may be either hypometabolic (lowered metabolism) or ametabolic (no metabolism) in nature. It means putting the processes of life on pause. In true suspended animation, metabolic activity is stopped and restarted without any damage to the organism. Suspended animation may be induced endogenously or exogenously by biological, chemical, or physical means.

Reversible cryopreservation would constitute true suspended animation for humans. Fully reversible suspended animation is the goal of cryonics but not currently achievable. In cryonics as currently practiced, patients experience some damage from the procedure that cannot be perfectly undone with current methods. The value of aiming to achieve fully reversible cryopreservation or suspended animation is that it would counter the objection that our patients sustain too much damage in our procedures. The debate can then turn to the technical feasibility of rejuvenating the patient and restoring them to good health.

Related terms and concepts

Targeted temperature management (TTM), also referred to as **Therapeutic Hypothermia** or **Protective Hypothermia**, is the maintenance of a specific body temperature for a specific period of time after a period of stopped blood flow to the brain and after return of spontaneous circulation (ROSC) post-cardiac arrest in order to reduce or prevent brain injury. There are four stages to TTM:

1. Initiation: Cool to the target temperature (usually 33° to 36 °C) as soon as possible or within 4-6 hours after return of spontaneous circulation.
2. Maintenance: Maintain target temperature for 24 hours.
3. Rewarming: Gradually increase core temperature to normothermia (36° to 37.9 °C).
4. Fever prevention: Maintain normothermia for 72 hours.

TTM can be initiated using surface cooling (ice, cooling blankets, commercial cooling devices); intravascular cooling catheters; or other internal devices and devices with temperature feedback; and administration of cold IV fluids.

Emergency preservation and resuscitation (EPR) and **Deep hypothermic circulatory arrest (DHCA):** These are similar in how they work but differ in the application and situation. DHCA induces hypothermia to aid preplanned surgery. EPR is an emergency procedure in cases where an emergency department patient is rapidly dying from blood loss following a shooting or stabbing and will not otherwise survive long enough for resuscitative surgery.

EPR is still considered an experimental medical procedure (as of 2022). EPR uses hypothermia, medications, and fluids to extend the time available for surgery. At the temperatures being used, EPR may quadruple the time available to the surgeon to complete surgery as compared to without EPR. It is hoped that EPR may someday be deployed in the field so that paramedics can suspend and preserve patients for transport.

Human trials began in the last decade. The procedure is similar to canine research done by Alcor (with Cryovita Laboratories) in the 1980s. In EPR, blood is replaced by a saline solution, and the patient is cooled into a suspended state where metabolism is slowed and brain activity ceases. An aortic flush is used to rapidly induce profound hypothermia (10° C) in patients who have suffered cardiac arrest and failed standard resuscitative efforts. Following surgery, the trauma team rewarms and restarts circulation.

Other related term include "**human hibernation**" and "**torpor**". These are often used interchangeably in relation to human beings. Hibernation is more usually applied to animals that seasonally go into long periods of inactivity, with reduced body temperature and metabolism, made up of multiple bouts of torpor. (Strictly speaking, this is *hibernation* if it occurs during winter and *aestivation* if it occurs during the summer.)

Torpor is a state of decreased physiological activity in an animal, usually marked by a reduced body temperature and metabolic rate. Torpor enables animals to survive periods of reduced food availability. The term "torpor" can refer to the time a hibernator spends at low body temperature, lasting days to weeks, or it can refer to a period of low body temperature and metabolism lasting less than 24 hours, as in "daily torpor".

Accidental cases of therapeutic hypothermia or torpor have been observed in human cases. Two especially dramatic cases stand out. The first is Anna Bågenholm, a Swedish radiologist who allegedly survived 80 minutes under ice (including an estimated 40 minutes in cardiac arrest) in a frozen lake in a state of cardiac arrest with no brain damage in 1999. She was recovered from a core body temperature of 13.7 °C. The other case is an unnamed woman in 1955 who was cooled to 9 °C for 45 minutes in an attempt to treat her cancer. Although not cured of cancer, she was successfully recovered.

Other people have been returned from a state of (incomplete) suspended animation:

- John Smith, a 14-year-old boy who survived 15 minutes under ice in a frozen lake before paramedics arrived to pull him onto dry land and saved him. He wasn't breathing, and paramedics and doctors performed CPR on him for 43 minutes before regaining a pulse.
- Mitsutaka Uchikoshi, a Japanese man, was reported by media to have survived the cold for 24 days in 2006 without food or water when he purportedly fell into a state similar to hibernation. This was doubted by some medical experts, claiming that surviving such a prolonged period without fluids was physiologically impossible.
- Paulie Hynek, who, at age two, survived several hours of hypothermia-induced cardiac arrest and whose body temperature reached 64 °F (18 °C).

- Erika Nordby, a toddler who in 2001 was revived after two hours without apparent heartbeat with a body temperature of about 61 °F (16 °C).

References

Targeted Temperature Management – Core EM
Core Emergency Medicine.

Suad A. Niazi and F. John Lewis , "Profound Hypothermia in Man: Report of a Case." https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC1450560/pdf/annsurg01232-0140.pdf

Gilbert, Mads; Gilbert M; Busund R; Skagseth A; Nilsen P; Solbo J (2000). "Resuscitation from accidental hypothermia of 13.7°C with circulatory arrest". The Lancet. 355 (9201): 375–376. doi:10.1016/S0140-6736(00)01021-7. PMID 10665559. S2CID 54348869.

Next: 2.5: The various meanings of "death"

ICE Program

Part I: ICE: Why it is important

Part 2: Introduction to cryonics

Part 3: Procedural aspects

Part 4: Technical aspects

Part 5: Science

Part 6: Financial

Part 7: Legal aspects

Part 8: Membership

Part 9: Concerns about cryonics

Part 10: Philosophical and ethical issues

Part 11: Cultural, religious, and social issues
