

8. Health Issues and Communicable Diseases

While cryonics has aimed for the acceptance and participation of medical professionals in its procedures, to some degree the field has always depended on volunteers who lack such credentials and who have acquired most of their knowledge and skills through self-education and practice. As a consequence, many of these volunteers may not have formal training to identify potential health hazards during cryonics cases, nor possess the knowledge to prevent and treat them. This short section identifies the areas in cryonics operations where precautions should be taken to deal with health hazards such as infection risk or blood-borne diseases.

Perfusate preparation

The history of cryonics can be characterized as sustained progress towards lower toxicity cryoprotectants, from the early days of DMSO and glycerol to today's peer-reviewed vitrification solutions. It would be a mistake, however, to assume that this progress implies correspondingly decreased health hazards in perfusate preparation. For example, the combination of DMSO and formamide is a core principle of reducing overall toxicity in today's vitrification solutions. However, a chemical such as formamide on its own presents more serious health issues to staff members than a chemical such as glycerol. Consequently, perfusate preparation should be performed under conditions that protect staff members from health hazards such as respiratory problems and teratogenic effects. In practice, this means that perfusates (cryoprotectants in particular) should be prepared using personal protective equipment and in conjunction with a fume hood or other ventilation to prevent exposure to fumes.



Figure 8-1. Fume Hood for protection against toxic chemicals and gases.

Emotional Stress

Like pre-hospital emergency medicine or military medicine, cryonics procedures can be emotionally stressful. In addition to the elements that

contribute to emotional stress in pre-hospital care, cryonics has a number of distinct characteristics that can exacerbate stress:

Hostility from family, third parties, and medical professionals.

Unlike conventional emergency medicine, cryonics team members should be prepared for skeptical, hostile, and even uncooperative responses. These can range from attempts by family members to interfere with deployment and procedures, to legal threats from hospital administrators. As a general rule, the best response is to remain polite and to emphasize that you are there to *honor the wishes of the patient*, who has voluntarily chosen to make cryonics arrangements. In case of doubt or legal threats, the best course of action is to contact your organization for further instructions. If you think you are not able to deal with this kind of stress, remove yourself from the team if you can do so without compromising response capabilities.

Fatigue.

Unlike conventional pre-hospital care, in which EMS teams rotate to prevent long hours and fatigue, standby deployments are often characterized by prolonged periods of wakefulness and anxiety. If such fatigue combines with additional stress associated with hostile family members or third parties, the result can be volatile. It is of great importance that a cryonics organization deploys enough people to allow adequate resting time without risking that the patient will go into cardiac arrest without enough team members present.

Unexpected technical and logistical problems.

A typical cryonics case is more akin to an experimental form of military medicine than an in-hospital procedure. Despite the fact that more than 200 cryonics cases have been performed to date, each case is prone to throw some unexpected technical and logistical problems at team members. These problems can further attribute to stress levels. It is not realistic to anticipate all potential problems, but the number of such problems can be substantially reduced if those participating in a case have studied case reports in detail and are well versed and trained in the equipment that they are using.

- Common warning signs of stress include:
- Difficulty sleeping.

- Irritability.
- Sadness.
- Guilt.
- Indecisiveness.
- Loss of appetite.
- Loss of interest in work.
- Physical symptoms.
- Lack of focus or concentration

It cannot be emphasized enough that ensuring the presence of sufficient team members and allowing a person to balance personal life and cryonics case work can prevent a lot of stress related problems.

Scene Safety

This concept is emphasized in conventional emergency medicine because pre-hospital professionals typically operate in an environment where a serious accident has occurred and substantial risk remains a possibility. Many of these scenarios are not relevant to cryonics (for example, it is not likely that a cryonics team will be stabilizing a patient immediately after a homicide or car accident) but that does not mean that this topic can be ignored altogether.

Cryonics team members do often need to perform labor-intensive and equipment-intensive standby procedures in environments such as hospitals, single-family homes, and apartments. From the moment of pronouncement of legal death to arrival at the cryonics facility, there are numerous opportunities for personnel to be injured. In particular, the lifting and moving of a patient, especially in a fully loaded ice bath, can be hazardous for volunteers who have not been appropriately trained.

Cryonics procedures are often performed during transport to the vehicle and while driving. A cryonics organization can get a good understanding of the kinds of health risks that are typically encountered in these situations by

conducting a dry run and documenting the risks. Such documents in turn should be used to conduct relevant training sessions under the leadership of certified medical professionals such as paramedics, to teach team members the proper skills and treatment options.

Communicable Diseases

Various modes of transmission exist for infectious and contagious diseases.

Contact transmission. This mode can be divided into direct personal contact with the carrier of a disease and indirect personal contact through an intermediate object, such as a doorknob or infected material.

Droplet transmission. This can occur as a result of an infected person expelling droplets as in coughing or sneezing.

Airborne transmission. This occurs when diseases are carried from one place to another by air currents.

Vehicle transmission. This involves the spread of disease through contaminated items such as hospital equipment.

Vector transmission. This occurs when a disease is spread by a vector such as insects or animals. A good example of vector transmission is the spread of malaria by mosquitoes.

The probability of infection is a function of the nature and duration of the exposure. For example, injection of an infectious agent directly into the blood presents a much more serious threat than a brief random encounter with a disease-carrying individual at a distance. In addition, some infections are more aggressive than others.

Control of Transmission and Infection

Cryonics team members are at risk for communicable diseases in three distinct situations: (1) during access of the terminal patient prior to pronouncement of legal death; (2) during cryonics procedures; and (3) during the handling of fluid or tissue samples after a case.

A commonsense approach for infection control during patient assessment is to wear the same kind of protection and follow the same

procedures as those used by medical professionals who are treating the patient. As a general rule, always consult a professional about the health risks associated with a specific patient.

During a cryonics case a distinction should be made between universal precautions and specific precautions. Universal precautions should always be followed for every cryonics case. In practice this means always wearing gloves and scrubs. In cases where there is a high risk of blood splatter and airborne transmission (e.g., surgery and endotracheal intubation), a mask and protective eyewear should be worn. Universal precautions operate from the conservative assumption that the patient is carrying an infectious disease.



Figure 8-2. Example of face mask and goggles combination.

In theory it's also possible to be exposed to an infectious disease by handling fluid or tissue samples after a case. Such samples should always be handled as if they could transmit infection.

The first line of defense in infection control is to ensure that people who participate in cryonics cases are vaccinated against the most common infectious diseases (see below). The next step is to ensure that staff members or volunteers with a compromised immune system or specific susceptibility to specific diseases (i.e. high-risk individuals) are excluded from case work. Since fatigue and stress can compromise the immune system, this is an additional argument to encourage good health practices and low levels of stress in cryonics team members.

Other important steps that must be taken to reduce risk of infection and transmission to other team members include hand washing and the use of aseptic technique. A good way to prevent transmission of communicable diseases is to aim for not introducing something to a patient and not receiving anything from a patient. A good 30-second scrub before donning your gloves and another 30-second scrub after doffing your gloves is recommended. If no (clean) station for hand washing is available, alcohol can be applied directly to hands, or disinfected towelettes can be used to clean hands. For major surgical and invasive procedures, double-gloving is recommended.

With prolonged use and handling of various types of equipment it is not unusual for gloves to sustain tears and punctures. Make sure to promptly replace a damaged glove.

Throughout its history, Alcor has always aimed to perform procedures using aseptic technique. Non-invasive equipment should be maintained in a clean state and sterile technique should be used in the case of invasive procedures. For example, a typical transport surgery for washout is performed in surgical gown with sterile gloves and autoclaved surgical instruments. Although a cryonics patient cannot incubate diseases while in biostasis, and even the worst known pathogens are an insignificant medical problem compared with the challenges of revival and rejuvenation, we should avoid introducing bacteria into the circulatory system that could grow during hypothermia and affect later cryoprotective perfusion. Clean and sterile instruments also protect the circulatory system from particulate contamination.

Sources of Disease Transmission in Cryonics

It is important to recognize that reducing the risk of disease transmission in cryonics does not just concern transmission of disease from or to the patient but also between team members.

- Transmission of disease during pre-patient assessment (see above).
- Transmission of disease by direct contact with fecal material during ice water recirculation in the ice bath. Prevention: use the right kind of SQUID device and place a rectal occlusion device in the patient prior to starting CPS and ice-water recirculation. An additional measure is to add a small amount of bleach to the ice bath.
- Transmission of disease by endotracheal intubation and aspiration of fluids. Prevention: wear an additional mask and protective eyewear.
- Transmission of disease by needles and sharps. Prevention: use safe and aseptic technique to prepare, draw, and administer medications and fluids. Take great care in using needles and sharps during transport and always use a sharps container to dispose of used sharps and needles.
- Transmission of disease during surgery for washout and cryoprotective perfusion. Prevention: Wear standard medical outfit for sterile surgical procedures and prevent bystanders from getting too close to the patient.
- Transmission of disease during conduct of washout and cryoprotective perfusion. A major risk factor is splashing of body fluids and perfusate as a consequence of direct contact with the effluent or splashing associated with broken connections in the circuit. Prevention: Wear an additional mask and protective eyewear if working in close proximity to the patient or the

perfusion circuit. Prevent extremely high pressures in the circuit, especially upstream of the circuit filter. Pause the perfusion and replace the circuit filter if pressures become excessive.

- Transmission of disease during transport and handling of fluid and tissue samples. Prevention: Avoid direct contact with the samples and handle with care if there is a specific reason to suspect an increased risk for disease transmission (e.g., in the case of blood samples).

Postexposure Protocol

If a team member suspects having been exposed to an infectious disease, the first step to inform the team leader and the Medical Advisor retained by your organization. If a team member suspects infection by a highly dangerous virus such as HIV, the team member should be immediately transported to a medical facility for rapid antiviral therapy.

Communicable Diseases

Before listing some infectious diseases, we must emphasize two important considerations. First, not all viruses and bacteria have a health-threatening effect, or even noticeable symptoms. It is common knowledge in microbiology that the human body is the home of many bacteria and viruses, some of which actually assist the body in doing its job. Of course, knowledge of whether a virus is innocent tends to change over the time as we learn more about its long-term effects. For example, the herpes simplex virus 1 (HVS-1), which is present in the body of more than 50% of the population, has recently been associated with the etiology of sporadic Alzheimer's disease.

Second, many infectious diseases that are among the top killers worldwide are relatively unusual in modern Western countries such as the United States. However, immigration and global travel can reintroduce these diseases to the United States. The rarity of many third-world diseases in the modern world should never lead to complacency regarding protection.

Also note that as a general rule, cryonics patients have usually undergone a prolonged period of physical decline, with associated immune depression and various infections, within a medical setting. Treatment facilities such as hospitals are particularly fertile grounds for spreading infections due to high concentrations of sick and elderly patients with compromised immune systems.

The World Health Organization (WHO) listed the following 10 leading infectious causes of death worldwide in 2001:

1. Respiratory infections
2. HIV/ AIDS
3. Diarrheal diseases
4. Tuberculosis (TB)
5. Malaria
6. Measles
7. Pertussis
8. Tetanus
9. Meningitis
10. Syphilis

HIV/AIDS

Human Immunodeficiency Virus (HIV) is a blood-borne disease that causes Acquired Immunodeficiency Syndrome (AIDS), which is potentially fatal. It is often sexually transmitted. There are no vaccines or cures for HIV/AIDS at this time, although the progression of HIV to AIDS has been mitigated by a combination of anti-retroviral therapies. Unlike many other dangerous contagious diseases, infection with HIV does not produce acute life-threatening symptoms. As a consequence, people can be infected with HIV without showing visible signs. Since HIV cannot be transmitted by air or

casual contact, the greatest risk for exposure to the HIV virus for cryonics team members is by exposure to blood or needle sticks.

Hepatitis

Hepatitis means inflammation of the liver and can be the consequence of a number of causes including viruses, alcoholism, toxic chemicals, and drugs. It can manifest itself as an acute or chronic condition. The most noticeable symptom is jaundice, or yellowing of the skin.

Distinctions are made between hepatitis A, B, C, D, and E. Hepatitis A and hepatitis E are transmitted by the fecal-oral route and do not produce a chronic condition. Hepatitis A can be prevented by vaccination, good hygiene and sanitation. Like HIV, hepatitis B can be transmitted through body fluids and can produce chronic hepatitis.

There are approximately 200,000 new hepatitis B infections a year, and EMS personnel have an elevated risk. They will benefit from vaccination.

In the United States, around 2% of the population is infected with hepatitis C, and it is the most common chronic blood-borne infection, spread through body fluids and blood. There are currently no vaccines against this virus. Prevention measures for emergency health care providers consist of universal precautions and the use of sterile needles.

Hepatitis D can only be transmitted and propagated in the presence of the hepatitis B virus, and can produce chronic liver conditions. The best way to protect oneself against hepatitis D is to get the hepatitis B vaccine and take all the precautions against transmission of hepatitis B.

Tuberculosis (TB)

Tuberculosis is a bacterial disease that can manifest itself in dangerous and lethal health problems. It can be acquired by airborne or droplet transmission. TB is more prevalent in non-Western countries, but the AIDS epidemic, and resistant strains, have made it a great concern for those practicing medicine. If TB is suspected or diagnosed, each team member should wear a HEPA mask.

Other Diseases

Other infectious diseases that can be transmitted through respiratory secretions and airborne exposure include meningitis, chickenpox, and (German) measles. If a cryonics stabilization case is conducted in a third-world country, extra precautions are advisable—for example, protection against malaria. Also, information gathering is required prior to deployment.

As a general rule, cryonics standby team members should never participate in a case without prior consultation with medical caregivers, family members, and the patient about the presence of contagious diseases.

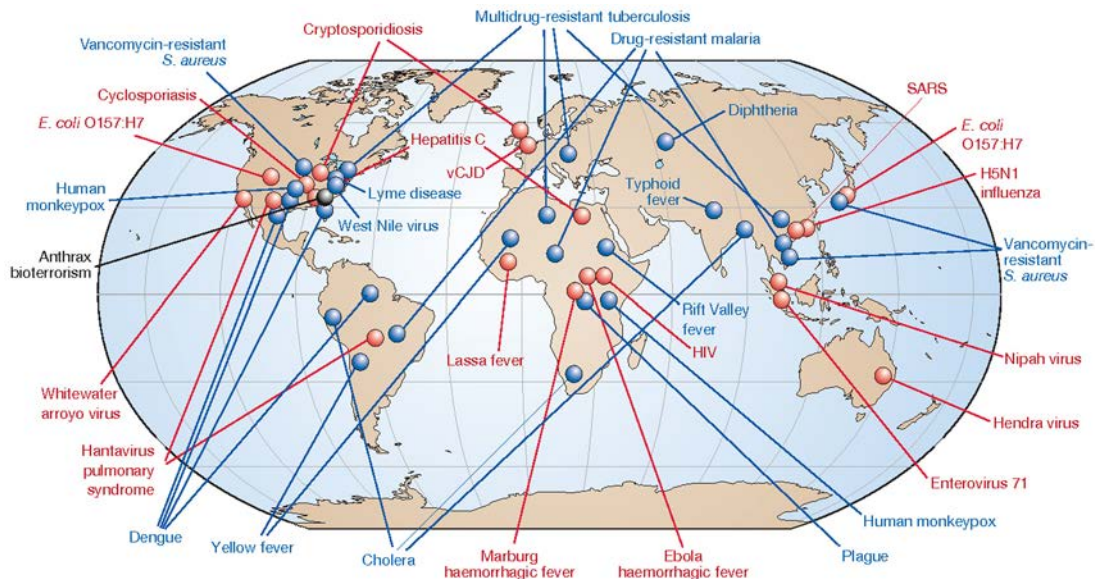


Figure 8-3. Emergent diseases (red) and re-emergent diseases (blue), worldwide.
Source: Nature volume 430, pages242–249(2004).

Vaccinations

Immunity against infectious diseases can be conferred by prior exposure and successful elimination of the pathogen, or by intentional vaccination.

Recommended vaccinations for cryonics staff members who participate in cases, and standby volunteers, include:

- Tetanus, Diphtheria and Cellular pertussis

- Hepatitis A
- Hepatitis B
- Influenza
- Pneumococcal vaccine
- Varicella (chickenpox)
- MMR (measles, mumps, rubella)
- PPDB
- Measles
- Rubella
- Chickenpox
- Meningitis
- Bacillus Calmette-Guérin (TB)

The importance and nature of these vaccines can change over time and a cryonics organization should always make efforts to remain informed about emerging epidemics and new vaccines.

AIDS Cases in Cryonics

We know of at least two cases at Alcor where the organization needed to stabilize a patient with advanced symptoms of AIDS (case A-1036 and case A-1399). In A-1036 the presence of AIDS was used as justification by hospital administrators to prevent Alcor from gaining access to the patient. In a brief submitted to the judge they wrote:

Mr. Roe's and Alcor's requests would violate hospital procedure for the handling of the remains of AIDS patients, whose body fluids are infectious. The customary procedure for handling such remains is to seal them in a nonpermeable shroud marked "communicable disease" and have a mortician

remove the body from the hospital in a sealed shroud, without performing any procedures on the body at the hospital.

Ultimately, Alcor prevailed in the legal fight and a report is available on the organization's website. This episode does highlight that the presence of a dangerous infectious disease can not only provide health challenges for team members, but can also present challenges in obtaining access to the patient. It is important that a cryonics organization anticipates and is equipped to deal with such circumstances.

Case A-1039 was cryopreserved on April 11, 1993. As can be seen in the photograph in Figure 8-4, Alcor team members took extra precautions to protect themselves against transmission of the HIV virus. In this case, bleach was also incorporated in Alcor's AIDS precautions because of its property to kill the HIV virus.



Figure 8-4. Stabilization procedures for an AIDS patient.

In the unlikely event that a patient with cryonics arrangements is a carrier of a very dangerous and highly communicable disease, a cryonics organization may omit procedures such as stabilization and cryoprotectant

perfusion before freezing. In extreme cases, especially if required by law, cryopreservation may not be possible.