MEDICINE

Freezing To Live

Because chilling the body lowers its demand for oxygen, surgeons are using refrigeration to save life and limb in bloodless operations.

By JANE STAFFORD

➤ MORE AND more patients these days are getting cold treatment from doctors. Theirs is not a case of getting the cold shoulder. The treatment is really cold in the temperature sense. They are being almost frozen—to live.

Some of them are small children born with defective hearts that need "blue baby" and other kinds of operations to mend them. Others are grown-ups with tumors, called aneurysms, of blood vessels. Servicemen with leg and arm wounds will benefit from the new developments in cold treatment. For the future, there is hope that the experience of some patients in freezing to live will show how to save fliers forced down in icy seas or men on Arctic duty marooned in blizzards away from base.

The patients do not feel chilled. They are put gently to sleep before the cold is turned on. They do not awaken until they are warm again. While they are having their frosty nap, surgeons have time to perform intricate operations that are practically bloodless, even when the operations are done on veins and arteries and the heart itself.

More Time

The time factor is the big gain from this cold treatment. When a surgeon cuts into a large blood vessel or the heart he must stop the blood flow temporarily. But blood carries oxygen. And body tissues cannot live long without oxygen. Some can take oxygen lack for longer periods than others. But for vital organs such as the brain, liver and kidneys, the crucial period is measured in minutes. The human brain dies if deprived of oxygen for more than four or five minutes. The liver is hopelessly damaged by about 20 minutes of oxygen lack. Kidneys will not return to functioning if blood is kept from them for 45 minutes.

One way of sparing tissues from suffocation is to reduce their demand for oxygen. Years ago anesthetists recognized, in a backhanded way, that reducing body temperature would reduce oxygen demand. What they recognized first was really the reverse of this. A patient brought to the operating room for an emergency appendix operation did poorly under the anesthetic if he was feverish. This was because the need for oxygen is increased seven percent for every degree Fahrenheit rise in body temperature. A patient with a temperature of 101.6 degrees Fahrenheit would need a 20% increase in oxygen. Such patients could not get by on the oxygen in the air of the room. So anesthetists faced with such patients would turn on the oxygen tank to give extra oxygen to the patient. Air-conditioning for operating rooms helped when it came along. So did ice packs and putting ether on the skin.

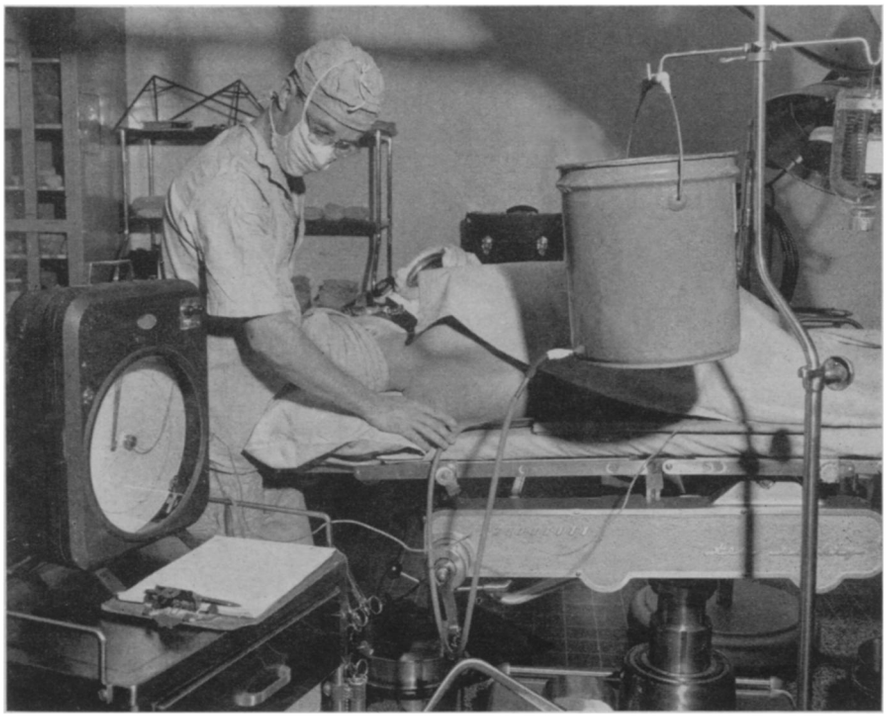
These measures helped feverish patients by reducing the body's demands for oxygen. Next step, though it was not taken immediately, was to reduce oxygen demand in patients with normal temperatures by dropping their temperatures below normal.

The idea was to make the patient something like the hibernating ground squirrel and ground hog settled for the long winter's nap. In true hibernators, the breathing and pulse almost stop and the temperature drops to a point very little above that of the animal's environment. The animal's body apparently has its oxygen needs reduced to a very low level and yet it can survive. Some Canadian scientists have been studying hibernating ground hogs in the hope of finding the secret of their survival with such low amounts of oxygen. Meanwhile they and doctors elsewhere have been deliberately chilling patients many degrees below normal body temperature of 98.6 degrees Fahrenheit.

The limit to which patients have been chilled has been about 75 degrees Fahrenheit. Below this, complex chemical changes occur which may become irreversible. Theoretically, if patients could safely be cooled to about 53 or 54 degrees Fahrenheit, their body tissues would make no demands for oxygen.

The 75-degree limit, however, has enabled many life-saving operations to be performed. One case was that of a young man with a blood vessel tumor of the aorta. This tumor, or aneurysm, was in the arch of the aorta and involved the main blood supply to the body. Each time the heart pumped, the balloon-like sac on the blood vessel wall was in danger of blowing out. Unless it could be removed and the blood vessel wall stitched together, the patient's life was in constant danger, since a blow-out of the sac would mean a swift and fatal hemorrhage.

To remove this patient's aneurysm required clamping the aorta shut between the heart and the aneurysm. This would



PREPARING FOR FROSTY SLEEP—Many methods of chilling body have been developed. At Walter Reed Army Hospital in the Nation's Capital, Capt. Thomas G. Barila shows the over-sized cold water bottle or mattress he has developed as a simple, effective apparatus.

stop all blood flow through the body except to the right arm and right half of the brain. The needed surgical repair could not be done in the four or five minutes that the aorta could be clamped shut at normal body temperatures. So the anesthetist chilled the patient, the surgeon performed the operation, the patient was warmed and 11 days later walked out of the hospital, a well man.

Equally dramatic was the case of a man past 70 years old with a bad heart who developed an aneurysm. He needed to have the aneurysm removed and a piece of blood vessel grafted to replace that cut out. The surgeons were not sure how long this would take. They feared that with ordinary methods interruption of blood supply to the lower part of the man's body might have so starved the tissues of oxygen that his kidneys might have gone bad or his legs might have become gangrenous and had to be removed. So they chilled him before operating. Today this 70-year-old with the bad heart is still alive and "running around."

Methods Outlined

Refrigerating patients, inducing hypothermia (low temperature) doctors call it, can be done by many methods. At the Army's Walter Reed General Hospital in Washington, D. C., it is done by an "overgrown water bottle." This is simply a rubber mattress through which ice water can be circulated. The sleeping patient lies on the mattress and is cooled to the desired degree.

At the University of Colorado School of Medicine, Denver, the patient is cooled by being put in a tub full of ice water, warmed to normal by immersion in a tub of warm water.

European scientists run blood from an artery through a plastic tube packed in ice and back to a vein.

George Washington University scientists in Washington, D. C., run sterile cold salt water into the patient's chest, warm him up by running sterile warm salt water into the chest cavity. This is for patients who will have operations on the heart and whose chests will be opened anyway.

Doctors at Guy's Hospital in London suggest putting a small balloon into the patient's stomach through his throat, running ice water into it to cool the patient and hot water to warm him. The method succeeded in reducing high fever in a very sick baby and should, the doctors believe, be equally useful for patients having heart and great blood vessel operations.

Refrigerating human patients got its modern start in 1937 when Philadelphia doctors tried it for hopelessly sick cancer patients. The theory was that the low temperatures would slow the growth of the cancer cells. Studies of chick embryos had showed that the growth of young, embryonic and fast-growing cells was checked as temperatures were reduced. Patients were kept in "frozen sleep" at 75 degrees Fahrenheit for from 24 hours to eight days, with relief of pain and suffering.

During World War II refrigeration anesthesia was used for arm and leg wounds. The arm or leg was packed in ice and a tourniquet applied for two hours or so. After that, needed operation could be performed without further anesthetic.

"Frozen sleep" is, however, only semi-hibernation. And while it is helping patients get vitally needed surgery, it is different from the chilling that is experienced in accidental exposures to very low temperatures. The patients are gently put to sleep before the chilling. This saves them from the stressful state of great cold which can be fatal. For explorers or servicemen who might be exposed to freezing, survival might be possible if the stress could be prevented. The Chicago woman who recovered after being frozen stiff in an alley was "well anesthetized," according to one authority, by alcohol consumed before she froze.

Various drugs are now being experimented with in the hope of finding one that could prevent the stress state in freezing. Then, perhaps, men likely to be lost in very cold regions could carry with their emergency rations a supply of hibernating pills. Swallowing a few of these might enable them to have a ground hog's nap until rescuers arrived to awaken them.

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NUTRITION

Seek Food Source In Scum on Ponds

➤ EFFORTS TO mass-produce algae, seen often as the blue-green scum on ponds, as a possible food source will be supported by a $30,000 grant to the University of Texas for a three-year period, Dean Rusk, president of the Rockefeller Foundation, announced in New York.

The algal research program is being directed by Dr. Jack Myers, head of the university's Laboratory of Algal Physiology. For the immediate future, Dr. Myers proposes to search for new algae with characteristics of possible experimental or economic importance, to study algal metabolism, and to attempt the complete carbon dioxide reduction of blue-green algae.

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