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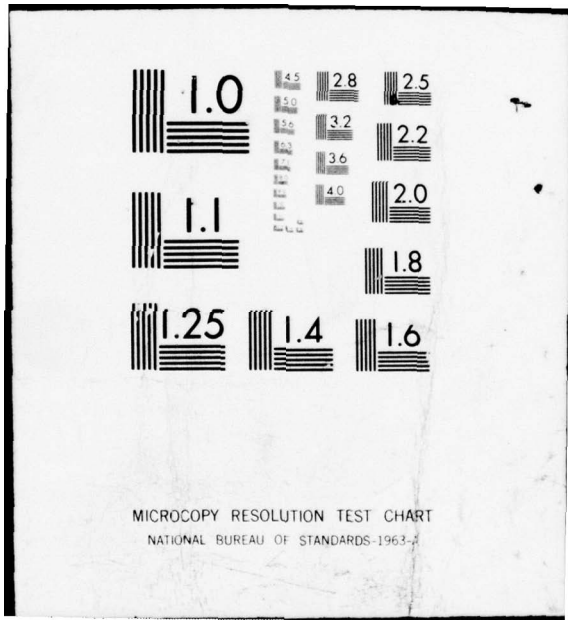
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REPORT NO. T 42/76

RESUSCITATION OF ACCIDENTAL HYPOTHERMIA VICTIMS

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

JUNE 1976

UNITED STATES ARMY
MEDICAL RESEARCH & DEVELOPMENT COMMAND

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Accidental hypothermia or whole body cooling is a serious medical emergency. The physician is often faced with a critically ill patient and is often uncertain of how to approach the clinical management and resuscitation of these patients. This paper outlines the physiology of hypothermia and describes the major decision making points in the resuscitation procedure and attempts to define the approach to returning these patients to a normal physiologic state and temperature. Special reference is given to utilization of internal methods of rewarming, in particular, warm

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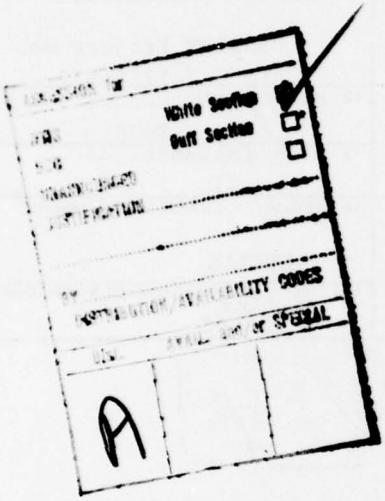
peritoneal dialysis and its effect on hypothermic patients.



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NO. T42/76

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RESUSCITATION OF ACCIDENTAL HYPOTHERMIA VICTIMS

by

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Acknowledgements: Dr. William Doolittle, Dr. Robert Boswell,
Dr. James Chandler, Dr. Mark Cunningham, Dr. James Rabb,
Dr. Richard Weiskopf, and COL George Smith

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US Army Research Institute of Environmental Medicine
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ABSTRACT

Accidental hypothermia or whole body cooling is a serious medical emergency. The physician is often faced with a critically ill patient and is often uncertain of how to approach the clinical management and resuscitation of these patients. This paper outlines the physiology of hypothermia and describes the major decision making points in the resuscitation procedure and attempts to define the approach to returning these patients to a normal physiologic state and temperature.

Special reference is given to utilization of internal methods of rewarming, in particular, warm peritoneal dialysis and its effect on hypothermic patients.

INTRODUCTION

This is a composite of the available clinical and experimental literature on clinical and experimental resuscitation of hypothermia victims. It is meant to be a basis for decision making by the physician when hypothermia is suspected. A number of individuals within and outside this Institute have contributed to this document and are cited in the literature review section, this author is merely the current point-of-contact at USARIEM. Discussion, questions, and further contributions are encouraged. The overall aim is to improve medical care and survival statistics for accidental hypothermia victims.

RESUSCITATION OF ACCIDENTAL HYPOTHERMIA VICTIMS

The recognition of hypothermia as a serious medical emergency is the first step to successful resuscitation. Patients often present cold, cyanotic and pale, stiff as if in rigor with no palpable pulse, no audible heart sounds, no visible respiratory excursions and fixed pupils. They may be in various states of undress and if cooled in a crouched or huddled position impossible to straighten out on an examination table. Their EKG may be extremely bizzarre ranging from flat to ventricular fibrillation. Because patients have been successfully resuscitated at core temperatures of 64°F with flat EKGs, the axiom here is "no one is dead until he is warm and dead; attempt rewarming and resuscitation of all cold patients."

There are essentially three types of hypothermia: acute, subacute and chronic, and each has specific requirements for resuscitation and clinical management. Acute hypothermia results from rapid cooling, such as seen in cold water immersion. This acute drop in core temperature is accompanied by few metabolic, electrolyte, and pH abnormalities other than those caused by the direct effect of temperature. The slow cooling rate of chronic hypothermia is usually produced by alcoholic stupor, barbiturate overdose, endocrinopathies, stroke, etc., that subject a person to long-term cold exposure. Slow cooling produces severe alterations in pH, electrolyte balance, and serious alterations in fluid volume. This occurs as the normal physiologic defense mechanisms against cold attempt to counteract the cooling process. The subacute hypothermic patient falls somewhere inbetween, that is, as alcohol

inhibition, rain, heavy winds, poor clothing, etc., subject him to varying cooling rates.

Careful analysis of the immediate prior history can lead to determination of both how and at what rate the patient became hypothermic. Both will impact on how they are handled in the emergency room and in the hospital. Keep in mind that freezing temperatures are not necessary for the production of hypothermic patients.

Resuscitation Tips:

1. Low reading clinical thermometers should be readily available in the emergency room.
2. Core temperature should be taken rectally and is a reliable indication of the progress of rewarming.
3. Careful handling of the patient is essential. Any changes in body position or rough handling can initiate ventricular fibrillation.
4. The blood glucose levels of hypothermic individuals may give a clue to the type of cooling that occurred. Acute hypothermia produces hyperglycemia, while chronic and subacute cooling produces hypoglycemia. The long term shivering of the chronic hypothermic utilizes vast amounts of blood glucose, and, conversion of glycogen to glucose decreases as temperature decreases.
5. Atrial fibrillation is more common in acute than in subacute or chronic hypothermia.

6. Renal failure after rewarming is more common in chronic hypothermia.

7. Current British literature suggests that in acute hypothermia, rapid external rewarming is usually indicated. In chronic hypothermia, they prefer slow rewarming to allow for reversion of metabolic aberrations. This author feels, however, that rapid internal rewarming of chronic hypothermia is a more physiologic procedure.

PHYSIOLOGY OF HYPOTHERMIA

Hypothermia, the lowering of core body temperature to 94°F or below is a potentially lethal disorder requiring aggressive therapy. As body temperature decreases below 94°F, central nervous system functions are depressed. Initially, patients exhibit behavioral changes, then depression of consciousness, culminating in coma. The respiratory center is progressively inhibited until apnea supervenes. Cardiac ouput falls to such extent that despite maximum peripheral resistence the blood pressure falls. The pulse rate decreases. Conduction and heart rhythm abnormalities occur. The "J" wave, various degrees of heart block, atrial premature contractions (APC's), atrial flutter and fibrillation, ventricular premature contractions (VPC's), ventricular tachycardia and fibrillation (VF), and if the patient is cold enough, ventricular standstill can take place. The shift of water out of cells and the intravascular space into the extracellular space as well as decreased renal tubular fluid resorption can render the patient hypovolemic. Some profoundly hypothermic patients exhibit a syndrome similar to

disseminated intravascular coagulation (D.I.C.). Since insulin release and glucose utilization decline with temperature, blood glucose tends to be normal or elevated. Acid-base and electrolyte parameters are little affected by temperature alone but are often deranged by the disorder underlying the hypothermic episode.

The physician must bear in mind that patients who present with hypothermia often have underlying disorders which prevent appropriate physiological responses to the cold environment. Such illnesses include stroke, central nervous system trauma, shock, sedation, use of tranquilizer, or ethanol overdose, endocrinopathies like myxedema and hypoadrenocorticism, hypoglycemia, and old age.

Over medication while cold is a common problem. Subsequent rewarming brings patient into toxic areas for the drugs used. Most drugs are contraindicated in early hypothermia resuscitation.

Much controversy exists over which method of resuscitation, that is, active or passive, external or internal, yields the lowest mortality. The most frequent mechanism of death from hypothermia itself is ventricular fibrillation or standstill. These events can occur at temperatures in the mid 80°'sF (27°C) and below. Apnea can occur somewhat higher but usually occurs at lower levels. External warming techniques, active or passive, can actually increase the likelihood of fibrillation during the early phase of resuscitation. The application of heat to the body surface causes peripheral vasodilation, leading to the draining of heat away from core organs, the return of large volumes of cold blood to

the core and thus the lowering of core temperature to increasingly dangerous levels, and a drop in the already low blood pressure. Although this reasoning militates for methods of rewarming the core before the periphery, as through peritoneal dialysis and extracorporeal blood rewarming, the literature suggests that with close monitoring and rapid correction of life-threatening aberrations, external rewarming, both active (with a heated bath or hypothermia blanket), or passive (by wrapping the patient in blankets to prohibit the escape of body heat) yield high survival rates. The author feels that it is physiologically more reasonable to use active than passive methods.

Because of the potential for cardiopulmonary death, the hypothermic patient must be admitted to the intensive care unit. Skull and chest x-ray, blood gases electrocardiogram, blood count, BUN, creatinine, electrolytes, amylase, calcium, blood sugar, fibrinogen, prothrombin time, and platelet count will help in immediate management. If possible the attending physician should be cognizant of the mechanism of the patient's loss of proper thermoregulation. Continuous electrocardiographic monitoring should be instituted. Bizarre EKG tracings are to be expected. Respiratory support including intubation and mechanical ventilation is almost mandatory to keep the supply of oxygen ahead of the rewarming organ demand. Care should be taken during intubation as any rough manipulation can lead to ventricular fibrillation. Ventricular premature contractions are abolished by lidocaine infusion and correction of hypoxia and acidosis. APC's, atrial flutter, and fibrillation will spontaneously revert to normal without medication as cardiac temperature approaches normal. Atropine and electrical pacing have

little beneficial affect on conduction in the hypothermic heart. On the contrary the irritation of the myocardium by the pacemaker electrode itself or by its discharge can lead to VF. If ventricular tachycardia fails to respond to lidocaine or if VF takes place, rapid extracorporeal blood rewarming must be instituted immediately. Because the hypothermic heart is unresponsive to countershock, cardiac temperature must be raised before cardioversion can be successfully accomplished. In such emergencies, the cardiopulmonary bypass machine, equipped with heat exchanger, connected to the femoral artery and vein has been successfully employed. Like any cardiac arrest this situation calls for continuous closed cardiac compression and forced ventilation until the appropriate machines can be placed in operation.

Hypoxia and acidosis are major factors predisposing to ventricular arrhythmias. pH, P_{CO_2} and P_{O_2} may appear to be low but may in fact be correct for the organ and brain demand at the depressed temperatures seen in hypothermia. Blood gases and pH, corrected for temperature, should be determined, and abnormalities corrected by adjustment of respiratory parameters or bicarbonate infusion, whichever is necessary but do not overmedicate. Intubation and suction may be necessary to manage bronchorrhea, the physiologal response of the airway to exposure to cold air. The rate of spontaneous respiration will increase as the temperature rises.

Maintenance of the central venous pressure at 5-10cm water, with suitable volume expanders, will insure that intravascular fluid volume keeps pace with the capacity of the intravascular space, enlarging in

response to peripheral vasodilation which in turn is caused by external rewarming. Thus, when cardiac temperatures and correspondingly cardiac output and heart rate begin to rise, blood pressure will follow suit. Avoid the use of pressor agents which have no effect on the maximally constricted vessels but which increase the likelihood of ventricular arrhythmias. Similarly, in order to avoid myocardial irritation leading to VF the CVP catheter tip should not be advanced into the heart until some degree of rewarming has occurred and the myocardium is not exceptionally sensitive to physical irritation by the catheter tip. As with respiration, the heart rate will rise spontaneously with temperature. Begin intravenous heparin therapy if clotting tests indicate the occurrence of a DIC-like syndrome.

Other fluid, electrolyte and metabolic abnormalities should be treated as the clinical situation dictates. Therapeutic doses of steroids may be given if hypoadrenocorticism is suspected. Because of the high failure rate of resuscitation of hypothermic myxodematous patients, the latter state must be recognized and treated immediately. After the patient's condition has stabilized, perform whatever additional studies are called for to determine the disease process underlying the hypothermic episode.

HYPOTHERMIA CHECKLIST

1. Recognize that the patient is hypothermic - use low temperature thermometer.
2. For patients with compromised mental status or cardiovascular irregularities intensive care is necessary.

3. History of predisposing disease - (Myxedema, hypoadrenocorticism, etc.).
4. Begin, continuous or frequent temperature recording with low temperature recording thermistor or thermometer.
5. Install I.V., (possibly an arterial line), C.V.P., foley catheter (may be extremely difficult).
6. Begin continuous cardiac monitoring.
7. Frequently monitor vital signs and urinary ouput (at least every hour or more frequently as necessary during rewarming).
8. Wrap patient in rewarming blanket and set to as high a temperature as can be tolerated without burning the patient (104-110^{o}F).
9. Give respiratory support - oxygen by mask or by endotracheal tube (may produce VF) with mechanical ventilation - Aim for high PO_2 normal pH and PCO_2, and clearance of secretions. Monitor arterial gases and pH as frequently as necessary.
10. Tests: CBC, BUN, creatinine, electrolytes, glucose, amylase, calcium, fibrinogen, prothrombin time, platelet count, chest and skull x-rays, 12 lead E.K.G., arterial blood gases and pH (corrected to core temperature).
11. Maintain C.V.P. between 5 and 10cm with appropriate expanders or fluids calculated to correct electrolyte imbalance gradually.
12. Give bicarbonate to correct acidosis.
13. Treat VPC's with standard boluses 15mg/kg of lidocaine and the correction of hypoxia and acidosis. If ventricular tachycardia, fibrillation, or standstill occur begin closed-chest cardiac compression and assisted

ventilation until extracorporal blood rewarming can be instituted with cardiopulmonary bypass with heat exchanger. Electrical cardioversion will succeed when the heart warms sufficiently. Atrial premature contractions, flutter and fibrillation will revert to normal with rewarming.

14. Give therapeutic doses of corticosteroids or thyroid hormone if called for.

15. Give heparin for a D.I.C. like syndrome.

THERAPEUTIC OUTLINE FOR THE HYPOTHERMIC PATIENT

WITH CONSIDERATION OF PERITONEAL DIALYSIS

I. Immediate cardiorespiratory support will, of course, be the first concern, but in the severely hypothermic patient, vigor and rates of resuscitation and dosages of medications should be reduced until patient has begun to reach a more normal temperature.

II. Respiratory considerations:

A. Initially respiration is depressed - decreased rate, volume.

B. Must secure a patent airway which probably means intubation.

C. Oxygen frequently should be given by mask or endothracheal tube. (tube may produce VF).

D. Bronchorrhea is common response to cold injury.

E. Chest x-ray will be required later.

III. EKG and continuous rectal temperature monitoring needed initially to determine if patient is in fact dead.

A. Criteria to proceed:

1. Any electrical activity on EKG (may look artifactual).

2. Any respiratory effort.

3. Absence of pulse, blood pressure, or heart sounds <u>are not</u> adequate for pronouncing death. Neither pupillary dilation nor non-response to light is enough. DTR's may also be absent.

B. Pronouncing dead:

1. May be very difficult decision - probably only guide line is that resuscitation and rewarming of all patients must be attempted.

2. History of long term exposure if A-1,2,3 absent.

3. Rectal temperature less than $50^{\circ}F$.

IV. Rewarming should follow closely with resuscitative efforts.

A. Establish IV line CVP line (cut down may be necessary as venous filling is poor and vessels will be difficult to raise. CVP tip must be kept out of heart early to prevent arrhythmia. Maintain CVP between 5-10 cm water with appropriate fluids, volume expanders. Warm IV fluids to $42^{\circ}C$ before use.

B. Concentrate on core rewarming (i.e., peritoneal dialysis) and specifically avoid the application of shell heat initially.

C. Gray zone of when to dialyze.

1. At 90 degrees or greater, one can probably use conservative modalities (i.e., active external rewarming).

2. At 87 degrees or less, dialysis should definitely be utilized.

3. Some recommend dialysis if less than $94^{\circ}F$.

D. Monitor urinary system. Record output, measure specific gravity, Na, and K.

E. Baseline blood studies - probably should <u>not</u> use as indicator for immediate treatment - CBC, Na, <u>K</u>, Cl, CO_2, BUN, amylase, glucose, pH, PO_2, PCO_2, Ca, fibrinogen, platelets, pro time.

F. Dialysis protocol should proceed as per routine in cases of dialysis for renal failure except that exchanges are far more rapid. Bottles should be heated to 45°C and fluid will be about 40-42°C after passage through tubing and arrival at abdomen. Each exchange should take approximately 20 minutes.

Two liters should be run in as fast as bottle elevation and tubing length will allow.

1. Add NO K to dialysate due to possibility of acute renal failure and sensitization of myocardium to VF.
2. Add 1000 units heparin per bottle to prevent clotting of dialysis system.
3. Culture first, fifth, and every tenth exchange.

V. Complications of hypothermia.

A. Cardiac - arrhythmias are biggest concern.

1. At low temperatures may have intractable response in cardioversion and may wind up:
   a. Trying repeated ineffective shocking causing chest burns.
   b. Using entirely too much drug for effect at the hypothermic level which then winds up at toxic levels upon rewarming.
2. Xylocaine is probably drug of choice for most arrhythmias given at 15 mg/kg in a bolus or 100 mg total.
3. Defibrillate prn.

4. Atrial premature contractions, flutter, and fibrillation should revert to normal with warming.

5. With only slow normal EKG/ cardiac response, one probably need not apply active CPR

B. Psychiatric problems may result.

1. Patient must be restrained on rewarming due to possible hyperactivity, disorientation, etc.

2. After rewarming, patient may look extremely well but should not be released without adequate observation period. (24 hrs. plus).

C. Pneumonia may ensue. Prophylactic antibiotics should be considered.

1. Poor respiratory effort.

2. Bronchorrhea due to cold injury.

D. Renal failure - be forewarned by hypertension post rewarm.

E. Pancreatitis is a common post rewarming sequella in all types of rewarming.

F. Diabetic ketoacidosis.

G. Disseminated intravascular coagulation - Rx with heparin.

H. Myocardial infarction.

I. Gastrointestinal bleed.

J. Hypotensive episodes.

K. Peritoneal infections secondary to dialysis.

L. Ileus.

Patients should be kept absolutely NPO. Continuous monitoring of rectal temperature, EKG, and blood pressure is absolutely essential.

SUMMARY

Once diagnosed, start rapidly on rewarming then continuously monitor with minimal interference as the patient recovers.

Further questions can be directed to:

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The opinions and assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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Dr. Robert Boswell
Dr. James Chandler
Dr. Mark Cunningham
Dr. James Rabb
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Dr. Richard Weiskopf

NOTE:

Unpublished Report on Hypothermia presented at UROMED Conference 5 March 1975, Gol Norway: Malm, Ole J. Accidental Hypothermia.

An excellent review article with 428 references: Little, D.M. Hypothermia. Anesthesiology. 842-877, Nov-Dec, 1959.

BIBLIOGRAPHY

1. Accidental hypothermia in the elderly. British Medical J. 2:1255-1258, 1964.

2. Adamsons, K., et al. Influence of temperature on blood pH of the human adult and newborn. J. Appl. Physiol. 19:897-900, 1964.

3. Alexander, L. The treatment of shock from prolonged exposure to cold especially in water. Combined Intelligence Objectives Sub Committee APO 413, No. 24, 1945.

4. Anderson, M. J. Accidental hypothermia complicated by bronchopneumonia. J. Am. Osteopathic Assoc. 59:379-380, 1960.

5. Anderson. S., B. G. Herbring, and B. Widman. Accidental profound hypothermia. Brit. J. Anaesth. 42:653, 1970.

6. Angel, J. H. and L. Sash. Hypothermic coma in myxoedema. Brit. Med. J. 5189:1855-1859, 1960.

7. Austin, W. H., H. L. Eleanor, and P. W. Rand. pH-temperature conversion factors and PCO_2 factors for hypothermia. J. Appl. Physiol. 19:893-896, 1964.

8. Bacon, A. P. C., and A. E. Gent. Recovery from hypothermic myxoedema coma. Practitioner. 193:325-327, 1964.

9. Barcroft, J., and W. O. R. King. The effect of temperature on the dissociation curve of blood. J. Physiol. 39:374-384, 1909.

10. Bass, D. E. Metabolic and energy balance of men in cold environment. Cold Injury. Steven M. Horvath, Editor, Trans. Sixth Conf., New York, Josiah Macy, Jr. Foundation, 1960 (p. 317).

11. Beckman, E. L. Thermal protection during immersion in cold water. Proceedings of the Second Symposium on Underwater Medicine. National Academy of Science (Wash) 1811:247-266, 1963.

12. Beckman, E. L., E. Reeves, and R. Goldman. A review of current concepts and practices applicable to the control of heat loss during water immersion. J. Aerospace Med. 36:136-137, 1965.

13. Behnke, A. R., and C. P. Yaglou. Responses of human subjects to immersion in ice water and the slow and fast rewarming. J. Appl. Physiol. 3:59, 1950.

14. Beran, A. V., K. G. Proctor, and D. R. Sperling. Hypothermia and rewarming induced by surface and He-O_2 inhalate temperature control. J. of Appl. Physiol. 39(2):337-340, 1975.

15. Berne, R. M. Myocardial function in severe hypothermia. Circulation Research. 2:90, 1954.

16. Berne, R. M. The effect of immersion hypothermia on cornonary blood flow. Circulation Research. 2(3):236-242, 1954.

17. Bigelow, W. G., W. K. Lindsay, and W. F. Greenwood. Hypothermia. Ann. of Surg. 132:849, 1950.

18. Blair, E. A physiologic classification of clinical hypothermia. Rec. Adv. Surg. 58:607-618, 1965.

19. Blair, E. Clinical Hypothermia. New York, 1964, McGraw-Hill, 183-187.

20. Blair, E. Generalized Hypothermia. Fed. Proc. 28:1456-1462, 1969.

21. Blair, E., A. V. Mongomery, and H. Swan. Posthypothermic circulatory failure. I. Physiologic observations on the circulation. Circulation. 13:909-915, 1956.

22. Blair, E., H. Swan, and R. Virtue. Clinical hypothermia: A study of the icewater surface immersion and short-wave diathermy rewarming techniques. Amer. Surgeon. 22(9): 859, 1956.

23. Brennan, J. L. Case of extensive necrosis of the oesophageal mucosa following hypothermia. J. Clin. Pathol. 20:581-584, 1967.

24. Brown, E. B. and Miller, F. Ventricular fibrillation following a rapid fall in aveolar CO_2 concentration. Am. J. Physiology. 169:56-60, 1952.

25. Buchanan, K. D., M. T. McKiddie, and J. M. Reid. Respiratory acidosis in hypothermic myxoedema coma. Postgrad. Med J. 43:114-116, 1967.

26. Buky, B. Effect of magnesium on ventricular fibrillation due to hypothermia. British J. of Anaesthesia. 42:886-888, 1970.

27. Burchett, G. D. Management of hypothermia: A case report. J. Am. Osteopathic Assoc. 66:735-737, 1967.

28. Burton, A. C., and O. G. Edholm. Man in a cold environment; physiological pathological effects of exposure to low temperatures. London: Edward Arnold, 1955.

29. Carlson, L. D. Man in cold environment. Arctic Aeromedical Laboratory, August 1954, (ASTIA-67874).

30. Carlson,L. D., et al. Immersion in cold water and body tissue insulation. J. Av. Med., 29:145-152, 1958.

31. Chatfield, W. R. Hypothyroidiam in pregnancy, complicated by hypothermia. J. Obstet & Gynaacol. Brit. Commonwealth. 73:311-315, 1966.

32. Clements, S. D., and J. W. Hurst. Diagnostic value of electrocardiographic abnormalities observed in subject accidentally exposed to cold. Am. J. Cardiology, 29:729-734, 1972.

33. Colin, J., et al. Physiological reactions and tolerance of the man immersed in cold water. Rev. Corps. Sante Armes. 8:591-612, 1967.

34. Cooper, K. E. The physiology of hypothermia. Brit. J. Anaes. 31:96-105, 1959.

35. Cooper, K. E., and D. N. Ross. Hypothermia in surgical practice. London: Cassell, 1960.

36. Coopwood, T. B., and J. H. Kennedy. Accidental hypothermia. Cryobiology. 7:243-248, 1971.

37. Critchley, M. Shipwreck survivors: A medical study. London: J. and A. Churchill, 1943.

38. Davies, D. M., E. J. Millar, and I. A. Miller. Accidental hypothermia treated by extracorporeal blood-warming. Lancet. 1:1036-1037, 1967.

39. Dent, C. E., J. F. Stokes, and M. E. Carpenter. Death from hypothermia in steatorrhoea. Lancet. 1:749, 1961.

40. Deterling, R. A., Jr., E. Nelson, S. Bhonslay, and W. Howland. Study of basic physiologic changes associated with hypothermia. A. M. A. Archives of Surgery. 70:87, 1955.

41. Dill, D. B., and W. H. Forbes. Respiratory and metabolic effects of hypothermia. Amer. J. Physiol. 132:685-697, 1941.

42. Drew, C. E., et al. Profound hypothermia. Lancet. 1:745-747, 1959.

43. Drugs and Therapeutic Bulletin. Emergency treatment of accidental hypothermia. 9(2): 5-7, 1971.

44. Duckworth, W. C., and B. C. Cooper. Accidental hypothermia in the Bantu. South African Mod. J. 38:295-298, 1964.

45. Duguid, H., R. G. Simpson, and J. M. Stowers. Accidental hypothermia. Lancet. 2:1213-1219, 1961.

46. Dyson, A., and M. W. W. Wood. Triiodothyronine in myxoedema coma. Lancet. 2:757-759, 1956.

47. Eason, D. W., and F. L. Macnaughton. Barbiturate coma with hypothermia. Lancet. 1:835-836, 1956.

48. Edholm, O. G., and A. L. Bacharach. The physiology of human survival. London, New York, Academic Press, 1965.

49. Edwards, H. A., et al. Apparent death with accidental hypothermia. Brit. F. Anaesth. 42:906, 1970.

50. Emslie-Smith, D. Accidental Hypothermia; A common condition with a pathognomonic electrocardiogram. Lancet. 2:492-495, 1958.

51. Exton-Smith, A. N. Accidental hypothermia in the elderly. Practitioner. 200:804-812, 1968.

52. Exton-Smith, A. N., J. Agate, G. S. Crockett, R. E. Irvine, and M. G. Wallis. (Special Committee of the Committee on Medical Science, Educaiton and Research of the BMA): Accidental hypothermia in the elderly. Brit. Med. J. 2:1225-1258, 1964.

53. Fairley, H. B., W. G. Waddell, and W. G. Bigalow. Hypothermia for cardiovascular surgery: Acidosis in the rewarming period. British J. of Anaesthesia. 29:310-318, 1957.

54. Fedor, E. J., B. Fisher, and S. H. Lee. Rewarming following hypothermia of two to twelve hours. Annals. of Surgery. 147(4):515-530, 1958.

55. Fell, R. H., A. J. Gunning, K. D. Bardhan, and D. R. Triger. Severe hypothermia as a result of barbiturate overdose complicated by cardiac arrest. Lancet. 1:393-394, 1968.

56. Fernandes, J. P., R. A. O'Rourke, and G. A. Ewy. Rapid active external rewarming in accidental hypothermia. J. A. M. A. 212:153-156, 1970.

57. Ferriman, D. Two cases of hypothermia. Proceedings, Royal Society Medicine. 55:998-999, 1962.

58. Fisher, B., C. Russ, and E. J. Fedor. Effect of hypothermia of 2 to 24 hours on oxygen consumption and cardiac output in the dog. Am. J. Physiol. 188(3):473-476, 1957.

59. Fisher, B., C. Russ, E. Fedor, and R. Wilde. Experimental evaluation of prolonged hypothermia. A. M. A. Arch. of Surg. 71:431, 1955.

60. Fisher, B., E. J. Fedor, and S. H. Lee. Rewarming following hypothermia of 2 to 12 hours. Annals. of Surgery. 148(1):32-43, 1958.

61. Fisher, B., M. Levine, E. Saffer, S. H. Lee, and E. J. Fedor. Rewarming following hypothermia. III. Blood Volume Changes. In Press.

62. Freeman, J., and L. G. C. Pugh. Hypothermia in mountain accidents. International Anesthesiology Clinic. 7(4):997-1007, 1969.

63. Friedman, M., and P. J. Hare. Gluten-sensitive enteropathy and eczema. Lancet. 1:521-524, 1965.

64. Fruehan, A. E. Accidental Hypothermia. Report of eight cases of subnormal body temperature due to exposure. Arch. Int. Med. 106:218-229, 1960.

65. Fuhrman, F. A., and J. M. Crismon. The influence of acute hypothermia on the rate of oxygen consumption and glycogen content of the liver and blood glucose. Amer. J. Physiol. 149:552-560, 1947.

66. Golden, F. St. C. Accidental hypothermia. J. Royal Naval Med. Service. 58:196-206, 1972.

67. Golden, F. St. C. Death after rescue from immersion in cold water. J. Rayal Naval Med. Service. 59:5-8, 1973.

68. Golden, F. St. C. Recognition and treatment of immersion hypothermia. Proc.Roy. Soc. Med. 66: 1058-1061, 1973.

69. Golden, F. St. C., and G. R. Hervey. A class experiment on immersion hypothermia. J. Physiol. 227:35-36, 1972.

70. Gregory, R. T. Accidental Hypothermia: Part I. An Alaskan problem. Alaska Medicine. 13:134-136, 1971.

71. Gregory, R. T., and J. F. Patton. Treatment after exposure to cold. Lancet. 1:377, 1972.

72. Gregory, R. T., and W. H. Doolittle. Accidental hypothermia Part II: Clinical implications of experimental studies. Alaska Med.

73. Gregory, R. T., J. F. Patton, and T. T. McFaddon. Cardiovascular effects of arteriovenous shunt rewarming following experimental hypothermia. Surgery (in press).

74. Grice, K., L. M. Blendis, M. L. Keir, and R. F. Harvey. Accidental hypothermia in erythroderma from generalized psoriasis. Arch. Dermatol. 98:263-267, 1968.

75. Grosse-Brockoff, F. German avaition medicine, World War II. U.S.A.F. Surgeon Generals Office. 2:828, 1946.

76. Gubbay, S. S., and D. D. Barwick. Two cases of accidental hypothermia in Parkinson's Disease with unusual EEG findings. J. Neurology, Neurosurgery, and Psychiatry. 28:459-466, 1966.

77. Hardwick, R. G. Two cases of accidental hypothermia. Brit. Med. J. 5272:147-149, 1962.

78. Hedley-Whyte, J., and M. B. Laver. O_2 Solubility in blood and temperature correction factors for PO_2. J. Appl. Physiol. 19:901-906, 1964.

79. Hegnauer, A. H. Lethal hypothermia temperatures for dog and man. Ann. N.Y. Acad. Sci. 80(2):315-319, 1959.

80. Hegnauer, A. H., and K. E. Penrod. The hypothermic dog. U.S.A.F. Tech. Rep. 5912, 1950.

81. Hinshaw, L. B., F. D. Masucci, C. M. Brake, L. E. Wittmers, and T. E. Emerson. Renal vascular response to hypothermia. Proc. Soc. Exptl. Biol. Med. 118:623-627, 1965.

82. Hockaday, T. D. R. Accidental hypothermia. Brit. J. of Hosp. Med. 2(60):1083-1093, 1969.

83. Hockaday, T. D. R., W. I. Cranston, K. E. Coopper, and R. F. Mottram. Temperature regulation in chronic hypothermia. Lancet. 2:482-432 1962.

84. Hoke, R., D. L. Jackson, J. Alexander, and E. Flynn. Respiratory heat loss from breathing cold gas at high pressures. 1971.

85. Houck, C. R. Statistical analysis of filtration rate and effective renal plasma flow related to weight and surface area in dogs. Am. J. Physiol. 153:169-175, 1948.

86. Hovarth, S. M., G. B. Spurr. Effects of hypothermia on general metabolism. Wash. Nat. Acad. Sci., 451:8-25, 1955.

87. Hudson, M. D., G. J. B. Robinson. Treatment of accidental hypothermia. Med. J. Anst. 1(8):410-411, 1973.

88. Hyams, D. E. Hypothermic myxodema coma. Brit. J. of Clin. Practice. 17:1-4, 1963.

89. Jessen, K., and J. O. Hagelsten. Search and rescue service in Denmark with special reference to accidental hypothermia. Aeorspace Med. 43(7):787-791, 1972.

90. Johansson, B. W. Electrocardiographic changes in depressed metabolism, IN: Depressed Metabolism, Ed. X. J. Musacchia and J. F. Saunders, New York, 1969, Amer. Elsevier Pub. Co., Inc. p. 349-354.

91. Johnson, R. H., et al. Oxygen consumption of paralyzed men exposed to cold. J. Physiol. 169:584-591, 1963.

92. Jones, H. J. Peritoneal dialysis. Brit. Med. Bull. 27:165-169, 1971.

93. Jones, I. H., and T. W. Meade. Hypothermia following chlorpromazine therapy in myxoedematous patients. Gerontologia. Clinica. 6:252-256, 1964.

94. Jones, R. F., D. O. Watson, and G. D. Tracy. "Cold Injury" in a temperature climate: Report of three recent cases with a review of the literature. Med. J. Australia. 57-1(17):323-327, 1970.

95. Jones, R. H. T., R. E. Bourdillon, R. Finn, and K. Martindale. Hypothermia associated with pneumonia and acidosis. Postgrad. Med. J. 42:273-275, 1966.

96. Kanter, G. S. Hypothermia hemoconcentration. Am. J. Physiol. 214:856-859, 1968.

97. Kanter, G. S. Renal clearance of Na^+ and K^+ in hypothermia. Canad. J. Biochem. 40:113-122, 1962.

98. Karim, F., and H. Reza. Effect of induced hypothermia and rewarming on renal hemodynamics in anesthetized dogs. Life Sci. 9:1153-1163, 1970.

99. Kearns, J. B., and M. F. Murnaghan. Ventricular fibrillation during hypothermia. J. Physiol. 203:51-53, 1969.

100. Keatinge, W. R. Death after shipwreck. Brit. Med. J. 2:1537-1541, 1965.

101. Keatinge, W. R. Survival in Cold Water. Oxford, Edinburgh. Blackwell Scientific Publications. 102:66-74, 1969.

102. Keatinge, W. R. The effects of subcutaneous fat and of previous exposure to cold on the body temperature, peripheral blood flow and metabolic rate of men in cold water. J. Physiol. 153:166-178, 1960.

103. Keatinge, W. R., and Evans. The respiratory and cardiovascular response to immersion in cold water. Q. Jl, Exp. Physiol. 46:83-94, 1961.

104. Kelman, G. R., and J. F. Nunn. Nomograms for correction of blood PO_2, PCO_2, pH and base excess for time and temperature. F. Appl. Physiol. 21:1484, 1966.

105. Kernohan, R. J. Electrocardiographic and serum-enzyme changes in hypothermia. Irish J. of Med. Sci. 321-325, 1969.

106. Kinnell, J. D., and H. M. Snow. Blood rheology in deep hypothermia. Brit. J. Anaesth. 34:849-856, 1972.

107. Klintevich, G. N. Prevention of the pathological effects of cold after shipwreck. Voennomed ZH. 10:69-70, 1968.

108. Knocher, P. Effects of experimental hypothermia on vital organs. Lancet. 2:837-840, 1955.

109. Koeppen, A. H., J. C. Daniels, and K. D. Barron. Subnormal body temperatures in Wernicke's Encephalopathy. Arch. of Neurol. 21:493-498, 1969.

110. Kreider, M. B. Death and survival during water immersion: Account of plane crashes near Cape Cod and Hamilton Bay. Aerospace Med. 38:1060, 1967.

111. Krook, G. Hypothermia in patients with exfollative dermatitis. Acta. Dermato-Venereologica. 40:142-160, 1960.

112. Kugelberg, J., et al. Treatment of accidental hypothermia. Scand. J. Thor. Cardiovasc. Surg. 1:142-146, 1967.

113. Lancet Editorial. Severe accidental hypothermia. Lancet. 1:237, 1972.

114. Lash, R. F., J. A. Burdett, and T. Oxdil. Accidental profound hypothermia and barbiturate intoxication. J.A.M.A. 201:123-124, 1967.

115. Lathrop, T. G. Hypothermia: Killer of the unprepared. Portland, Oregon, Mazamas. 1970.

116. Laufman, H. Profound accidental hypothermia. J.A.M.A. 147:1201-1212, 1951.

117. Ledingham, I. McA. and J. G. Mone. Treatment after exposure to cold. Lancet. 1:534-535, 1972.

118. Linton, A. L., and I. McA. Ledingham. Severe hypothermia with barbiturate intoxication. Lancet. 1:25-26, 1966.

119. Little, D. M. Hypothermia. Anesthesiology. 842-877, Nov-Dec, 1959.

120. Little, E. Generalized hypothermia. Fed. Proc. 28:1456-1462, 1969.

121. Lloyd, E. L. Accidental hypothermia treated by central rewarming through the airway. Brit. J. Anaesth. 45:41-48, 1973.

122. Lloyd, E. L., N. A. Conliffe, H. Orgel, and P. N. Walker. Accidental hypothermia: An apparatus for central rewarming as a first aid measure. Scottish Med. J. 17:83-91, 1972.

123. Lodingham, I. McA., and J. G. Mone. Treatment after exposure to cold. Lancet. 1:534-535, 1972.

124. Lombardo, T. A., et al. Myocardial failure in experimental hypothermia. Circ. Res. 5:22-26, 1957.

125. Lougheed, W. M. The central nervous system in hypothermia. Brit. Med. Bull. 17:61-65, 1961.

126. Love, A. H., and R. A. Womersley. Accidental hypothermia. Ulster Medical J. 28:193-196, 1959.

127. Lovel, T. W. L. Myxoedema coma. Lancet. 1:823-827, 1962.

128. Macdonald, W. W. Hypothermic myxoedema coma. Brit. Med. J. 5105:1144-1146, 1958.

129. Maclean, D., P. D. Griffiths, and D. Emslie-Smith. Serum-enzymes in relation to electrocardiographic changes in accidental hypothermia. Lancet. 2:1266-1270, 1968.

130. Magnusson, B. Exfoliative dermatitis with hypothermia. Acta. Dermatovener. 40:161-166, 1960.

131. Malden, M. Hypothermic coma in myxoedema. Brit. Med. J. 2:764-766, 1955.

132. Mant, A. K. Autopsy diagnosis of accidental hypothermia. J. of Forensic Medicine. 16:126-129, 1969.

133. Marshall, R. J., and W. T. E. McCaughey. Hypothermic myxoedema coma with muscle damage and acute renal tubular necrosis. Lancet. 2:754-757, 1956.

134. Mathews, J. A. Accidental hypothermia. Postgrad. Med. J. 43:662-667, 1967.

135. Mattocks, A. M., and E. A. El-Bassiouni. Peritoneal dialysis: A review. J. Pharm. Sci. 60:1767-1782, 1971.

136. Matz, R. Hypothermia in diabetic acidosis. Hormones 3:36-41, 1972.

137. McCance, R. A., C. C. Ungley, J. W. L. Crosfill, and E. M. Widdowson. The hazards to men in ships lost at sea. Med. Research Council, Special Report Series No. 291, 1956.

138. McGrath, M. D., and R. C. Paley. Hypothermia induced in a myxoedematous patient by imipramine hydrochloride. Brit. Med. J. 5209:1364, 1960.

139. McKean, W. I., S. R. Dixon, J. F. Gwynae, and R. O. H. Irvine. Renal failure after accidental hypothermia. Brit. Med. J. 2:463-464, 1970.

140. McNicol, M. W., and R. Smith. Accidental hypothermia. Brit. Med. J. 5374:19-21, 1964.

141. McQueen, J. D. Effect of cold on the nervous system. Wash. Nat. Sci. 451:243-250, 1956.

142. Meriwether, W. D., and R. M. Goodman. Severe accidental hypothermia with survival after rapid rewarming. Amer. J. Med. 53:505-509, 1972.

143. Miazi, S. A., and F. J. Lewis. Profound hypothermia in man. Ann. Surg. 147(2):264-266, 1958.

144. Miles, B. E., and H. C. Churchill-Davidson. The effect of hypothermia on renal circulation of the dog. Anesthesiology. 16:230-234, 1955.

145. Mitchell, J. R. A., D. H. C. Surridge, and R. G. Willison. Hypothermia after chlorpromaxine in myxoedematous psychosis. Brit. Med. J. 5157:932-933, 1959.

146. Molnar, G. W. Survival of hypothermia by men immersed in the ocean. J. Am. Med. Assoc. 131:1046-1050, 1946.

147. Morales, P., W. Carbery, A. Morello, and G. Morales. Alterations in renal function during hypothermia in man. Ann. Surg. 145:488-499, 1957.

148. Mouritzen, C. V., and M. N. Andersen. Myocardial temperature gradients and ventricular fibrillation during hypothermia. J. Thoracic and Cardiovas. Surg. 49(60):937-944, 1965.

149. Moyer, J. H., G. Morris and M. E. Debakey. Hypothermia: I. Effect on renal hemodynamics and on excretion of water and electrolytes in dog and man. Ann. Surg. 145:26-40, 1957.

150. Murphy, E., and P. J. Faul. Accidental hypothermia in the elderly. J. Irish Med. Assoc. 53:4-8, 1963.

151. Neil, E. Metabolic circulatory and respiratory changes in hypothermia. Proceedings of the 20th International Congress, Brussels, 90-97, 1956.

152. Nelms, J. D., and J. G. Soper. Cold vasocilation and cold acclimatization in the hands of British fish filleters. J. of Appl. Physiol. 17:444-448, 1962.

153. Niazi, S. A., and F. J. Lewis. Profound hypothermia in man. Annals of Surgery. 147(2)264-266, 1958.

154. Nicol, M. W., and R. Smith. Accidental hypothermia. Brit. Med. J. 1:19-21, 1964.

155. Nielsen, P. E., and P. Ranlov. Myxoedema coma. Acta. Endocrinol. 45:353-364, 1964.

156. Nisbet, H. I. A. Acid-base disturbances in hypothermia. Inter. Anes. Clinics. 2:829-855, 1964.

157. Osborne, J. J. Experimental hypothermia: Respiratory and blood pH changes in relation to cardiac function. Am. J. Physiol. 175:389-398, 1953.

158. Page, L. B. Effects of hypothermia on renal function. Am. J. Physiol. 181:171-178, 1955.

159. Patton, J. F., and W. H. Doolittle. Core rewarming by peritoneal dialysis following induced hypothermia in the dog. J. Appl. Physiol. 33:800-804, 1972.

160. Phillips, R. A., V. P. Dole, P. B. Hamilton, K. Emerson, R. M. Archibald, and D. D. Van Slyke. Effects of acute hemorrhagic and traumatic shock on renal function of dogs. Am. J. Physiol. 145:314-336, 1946.

161. Phillipson, E. A., and F. A. Herbert. Accidental exposure to freezing: Clinical & Laboratory observations during convalescence from near-fatal hypothermia. Can. Med. Assoc. J. 97:786-792, 1967.

162. Prec, O., R. Rosenman, K. Brown, S. Rodbard, and L. N. Katz. The cardiovascular effects of acutely induced hypothermia. J. Clin. Invest., 28:293,1949.

163. Prescott, L. F., M. C. Peard, and I. R. Wallace. Accidental hypothermia. A common condition. Brit. Med. J. 5316:1367-1370, 1962.

164. Pugh, L. G. C. Accidental hypothermia in walkers, climbers and campers. Report to the Medical Commission on Accident Prevention. Brit. Med. J. 1:123-129, 1966.

165. Pugh, L. G. C. Clothing insulation and accidental hypothermia in youth. Nature. 209:1281-1285, 1966.

166. Puch, L. G. C., and O. G. Edholm. The physiology of channel swimmers. Lancet. 2:761-768, 1955.

167. Raymond, L. W. Physiologic mechanisms of maintaining thermal balance in high pressure environments. J. of Hydronautics. 1(2):102-107, 1967.

168. Read, A. E., D. Emslie-Smith, K. R. Gough, and R. Holmes. Pancreatitis and accidental hypothermia. Lancet. 2:1219-1221, 1961.

169. Ree, M. J. Electrocardiographic changes in accidental hypothermia. Brit. Heart J. 26:566-571, 1964.

170. Rees, J. R. Accidental hypothermia. Lancet. 1:556-559, 1958.

171. Report of the Committee on Accidental Hypothermia. Royal College of Physicians of London Report - 1966.

172. Richardson, D. K. Cold is a killer. Nursing times. 66:1234-1236, 1970.

173. Riordan, F. The use of DMSO in a case of severe clinical frostbite. Proceedings Western Pharmacology Society. 13:138-143, 1970.

174. Roe, P. F. Accidental hypothermia. Irish J. Med. Sci. 454:459-463, 1963.

175. Rosin, A. J., and A. N. Exton-Smith. Clinical features of accidental hypothermia, with some observations on thyroid function. Brit. Med. J. 1:16-19, 1964.

176. Rubelberg, J., Schuller, H., B. Berg, and B. Kallum. Treatment of accidental hypothermia. Scand. J. Thoracic Cardiovas. Surg. 1:142-146, 1967.

177. Sabiston, D. C., Jr., E. O. Theilen, and D. E. Gregg. The relationship of coronary blood flow and cardiac output and other parameters in hypothermia. Surgery. 38:498, 1955.

178. Severinghaus, J. W. Respiration and hypothermia. Ann. N.Y. Acad. Sci. 80:384-394, 1959.

179. Severinghaus, J. W., et al. Alveolar dead space and arterial to end tidal carbon dioxide differences during hypothermia in dog and man. J. Appl. Physiol. 10(3):349-355, 1957.

180. Sheehan, H. L., and V. K. Summers. Treatment of hypopituitary coma. Brit. Med. J. 1:1214-1215, 1952.

181. Shirriffs, G. G., and P. D. Bewsher. Hypothermia abdominal pain, and lacitic acidosis in phenformin-treated diabetic. Brit. Med. J. 3:506, 1970.

182. Sly, R. M. Perforation of a gastric ulcer in a premature infant exposed to cold. Am. J. Dis. 9:525-530, 1964.

183. Smith, H. W. Principals of renal physiology. Oxford University Press, New York. 202-214, 1956.

184. Sprunt, J. G., D. Maclean, and M. C. K. Browning. Plasmacorticosteroid levels in accidental hypothermia. Lancet. 1:324-326, 1970.

185. Summers, V. K. Myxoedema coma. Brit. Med. J. 2:366-368, 1953.

186. Surtees, S. J. A case of myxoedema coma successfully treated with Tri-iodo-thyronine. Postgrad. Med. J. 34:443-445, 1958.

187. Swan, H. Clinical hypothermia: A lady with a past and some promise for the future. 73(5):736-758, 1973.

188. Tauber, J. F., J. S. P. Rawlins, K. R. Bondi, and C. R. Lindberg. Theoretical and experimental thermal requirements of divers. Naval Medical Research Institute, Internal Report No. 1, 1969A.

189. Thomas, J. E. P., S. Gerber. Accidental hypothermia. Central African J. Med. 11:151-152, 1965.

190. Thorapson, M. R. A case of traumatic rupture of the thoracic aorta associated with hypothermia. Brit. J. Surg. 59:243-245, 1972.

191. Toleman, K. G., and A. Cohen. Accidental hypothermia. Can. Med. Assoc. J. 103:1357-1361, 1970.

192. Towne, W. D., W. P. Geiss, H. O. Yanes, and S. H. Rahimtoola. Intractable ventricular fibrillation associated with profound accidental hypothermia -- successful treatment with partial cardiopulmonary bypass. N.E.J.M. 287:1135-1136, 1972.

193. Trafford, J. A. P., and A. Hopkins. Letter to Editor. Brit. Med. J. 1:400, 1963.

194. Treinno, A., et al. The characteristic electrocardiogram of accidental hypothermia. Arch. Intern. Med. 127:470-473, 1971.

195. Trevino, A., B. Razi, and B. M. Beller. The characteristic electrocardiogram of accidental hypothermia. Arch. Intern. Med. 127:470-473, 1971.

196. Vandam, L. D., and T. K. Burnap. Medical Progress: Hypothermia. New England J. of Med. 261(11):546-553, 1959.

197. Vandam, L. D., and T. K. Burnap. Medical Progress: Hypothermia (Concluded). New England J. of Med. 261(12):595-603, 1959.

198. Veghte, J. H. Cold sea survival. Aerospace Med. 43(5):506-511, 1972.

199. Verbov, J. L. Modern treatment of myxoedema coma associated with hypothermia. Lancet. 1:194-196, 1964.

200. Ward, D. J. Accidental hypothermia as a phychiatric emergency. Practitioner. 196:120-124, 1966.

201. Wayburn, E. Immersion hypothermia. Arch. Intern. Med. 79:77-91, 1947.

202. Wilson, O., et al. Effect of acute cold exposure on blood lipids in man. Fred. Pasc. 28:1209-1215, 1969.

203. Wollner, L. Accidental hypothermia and temperature regulation in the elderly. Gerontolgia Clinica. 9:347-361, 1967.

204. Woolf, P. D., C. S. Hollander, T. Mitsuma, L. A. Lee, and D. S. Schalch. Accidental hypothermia: endocrine function during recover. J. Clin. Endocr. 34:460-466, 1972.

205. Wynn, V. Electrolyte disturbances associated with failure to metabolism glucose during hypothermia. Lancet. 2:575-578, 1954.

206. Zingg, W. Accidental hypothermia. Medical Services. J. Canada. 22:399-410, 1966.

207. Zingg, W. Hemodynamic changes before and after short and prolonged periods of hypothermia in dogs. Cryobiology. 11:278-284, 1974.

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