

A diagnosis that's yours to make

Accidental hypothermia in the elderly

W. Victor R. Vieweg, MD

Department of Psychiatry, Medical College of Virginia,
Virginia Commonwealth University, Richmond

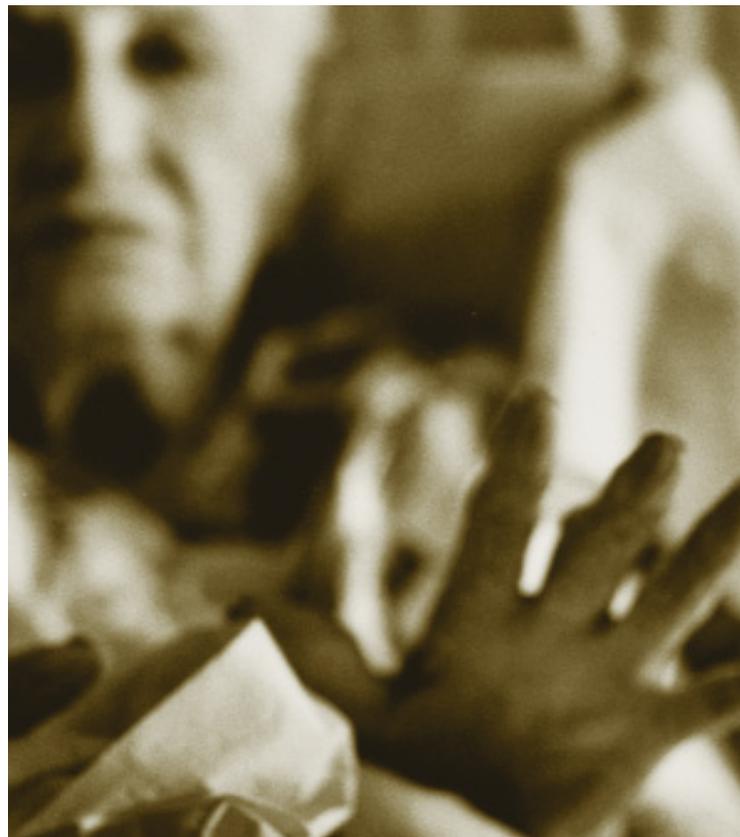
Although a metabolic illness, patients with hypothermia usually present with cognitive impairment and bizarre behavior that mimic psychiatric illness. Patients with schizophrenia or on phenothiazines are at increased risk. Psychiatrists can play a role in detecting hypothermia early.

You may well be the first specialist to evaluate an elderly patient with accidental hypothermia, a severe medical illness, because patients with this condition may present initially with cognitive impairment and disruptive behavior. This problem is particularly evident when evaluating elderly patients. Accidental hypothermia commonly mimics major mental illness, may be induced or exacerbated by psychotropic medications, is commonly fatal, and may remain unrecognized without a high index of suspicion.

Hypothermia is defined as a fall in body temperature below 95°F or 35°C (*Box 1*). Clinical mercury thermometers commonly range between 96°F and 106°F. Thus, the family member or clinician may not suspect hypothermia after the initial temperature measurement.

The diagnosis of accidental hypothermia is straightforward if there is a history of environmental exposure, but such evidence is often lacking in urban settings and among the elderly. Also, particularly in the elderly, hypothermia may occur at room temperature, secondary to diseases that strike the hypothalamic thermoregulatory center.

Subjects with core body temperatures dropping from 95°F to 90°F develop amnesia, dysarthria, confusion, and disruptive behavior.¹ Further cooling as the body temperature falls to 82.4°F yields stupor, paradoxical undressing, and hal-



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Box 1

WHEN THERMOREGULATION FAILS

The body's thermoregulatory center located in the hypothalamus normally maintains core body temperature between 97.5°F (36.5°C) and 99.5°F (37.5°C). When body temperature declines, heat production increases by shivering, and heat loss is reduced by decreasing cutaneous blood flow.

Accidental hypothermia is defined as an *unintentional* fall in body temperature below 95°F (35°C). The coordinated systems responsible for thermoregulation start to fail. Heat loss through radiation, conduction, convection, respiration, and evaporation occurs because compensatory physiologic mechanisms are both limited and impaired.

lucinations. These characteristics are illustrated in the accompanying vignette of Ms. B. (see page 31).

Schizophrenia and the hypothalamus

Over the course of 6 months before her death, Ms. B. showed evidence of both thermoregulatory dysfunction and autonomic nervous system instability. We do not know if these hypothalamic problems were separate from, or intrinsic parts of, her schizophrenia.

The hypothalamus regulates autonomic, endocrine, and visceral function. Hypothalamic dysfunction may be an intrinsic part of schizophrenia. Such dysfunction occurs most commonly in the periventricular and supraoptic nuclei of the hypothalamus.² These areas are adjacent to hypothalamic areas regulating body temperature.³

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Cognitive impairment is a core feature of schizophrenia, and dementia is common among elderly patients suffering with the disorder

Lesions in anterior parts of the hypothalamus (temperature-sensitive neurons in the preoptic nuclei—located close to nuclei controlling thirst and osmotic regulation) may induce *hyperthermia*, impairing heat-dissipating mechanisms including vasodilatation and sweating. Lesions in posterior parts of the hypothalamus may impair heat conservation and heat production mechanisms and induce *hypothermia*.⁴

Associated medical problems

Independent of drug treatment, metabolic and cardiovascular problems occur more frequently in patients suffering from schizophrenia than they do in the general population.⁵ Ms. B. developed hypertension, diabetes mellitus, dyslipidemia, and coronary artery disease.

Diabetes mellitus in particular is a risk factor for hypothermia and may be found in more than 10 percent of elderly patients who suffered thermoregulatory failure before dying.⁶ Diabetes may impair autonomic system vasomotor stability and the body's ability to vasoconstrict to preserve body heat.

Dementia and hypothermia

Cognitive impairment is a core feature of schizophrenia,⁷ and dementia is a common outcome among elderly patients suffering with the disorder.⁸ We don't know whether Ms. B.'s progressive cognitive deterioration derived from dementia associated with schizophrenia or from a separate process such as Alzheimer's disease.

Alzheimer's disease may limit behavioral responses to cooling or even recognition that the body temperature is dropping.⁹ This disease is associated with weight loss (and attendant loss of body fat that acts, in part, as insulation), hypothalamic pathologic changes, and decreased serotonin activity in the hypothalamus. The processes leading to Ms. B.'s progressive cognitive impairment most likely contributed to hypothalamic dysregulation and subsequent accidental hypothermia.

Ms. B.'s repeated disrobing during her stay at the adult care facility was ascribed to dementia. Serial body temperature measurements were not available, so we do not know the extent to which the

disrobing may have been paradoxical—that is, undressing when cold rather than dressing more warmly. Paradoxical

undressing is found during moderate (82.4°F to 90°F) hypothermia.¹

Medications and hypothermia

Normally, mild hypothermia induces vasoconstriction and initial increases in heart rate and cardiac output. (The latter increase is principally driven by the accelerated heart

Ms. B.: Schizophrenia, dementia, and eventually accidental hypothermia

Over the course of several months, Ms. B., a woman in her mid-70s, manifested features of accidental hypothermia, which went undiagnosed amid a backdrop of a long history of schizophrenia and a more recent history of dementia.

In 1996, almost 5 years before developing accidental hypothermia, Ms. B. sought care for paranoia, nervousness, and dysphoria. The records showed a history of cigarette abuse, diet-controlled type 2 diabetes mellitus of more than 20 years duration, and kidney surgery. She was cognitively intact and had received doses of up to 3 mg/bid of risperidone and desipramine. A few months later, temazepam was added for insomnia. Still later, following the death of her husband, lorazepam was added.

Until late 1999, Ms. B. remained psychiatrically stable. Then she became more anxious and her lorazepam dosage was increased. But in June 2000, she was admitted to a local hospital following a month of confusion, weakness, and slurred speech. The precipitating event was a fall. A head CT scan showed brain atrophy and white-matter disease. Extensive condylomata led to a partial vulvectomy. Her lowest recorded oral temperature was 95.6°F.

Ms. B. returned to a residential home briefly but was readmitted when she was found unresponsive; hypotension and bradycardia were detected. Cardiac catheterization showed normal left ventricular function and severe 3-vessel coronary artery disease with a 50% obstruction of the left main coronary artery. This procedure was complicated by severe agitation, confusion, and a large post-catheterization hematoma requiring blood transfusions.

Following discussions with the cardiac surgeons, the family considered Ms. B. too ill to undergo coronary artery bypass surgery. The lowest recorded oral temperature was 94°F.

Ms. B. returned to the residential home—but not for long. In August 2000, she was again taken to the hospital. She was confused, threatening to harm herself with a knife, and eating “hair grease.” Her medications now included temazepam, lorazepam, risperidone, paroxetine, and desipramine—plus aspirin, verapamil, lisinopril, metoprolol, amlodipine, and isosorbide dinitrate for coronary heart dis-

ease and hypertension. The admission database included a temperature of 96.2°F. She received a Global Assessment of Functioning score of 20 contrasted with a high score of 70 the preceding year.

Ms. B.’s hospital stay lasted 2 months. Confusion and disorientation persisted one month after admission while still undergoing psychiatric care. Midway during her hospitalization, she underwent a cholecystectomy.

When she was discharged to an assisted living facility, Ms. B. required assistance with self-care and restraint with a posey vest. Dementia was considered the major psychiatric problem. Medications now included amlodipine, aspirin, famotidine, isosorbide dinitrate, lisinopril, metoprolol, oxybutynin, metoclopramide, lorazepam 0.5 mg 3 times a day, and risperidone 1 mg twice daily.

Two weeks later, Ms. B. was still confused and disoriented. Risperidone was increased to 1 mg 3 times daily and lorazepam was increased to 0.5 mg 4 times daily. A week later, the nursing staff noted further deterioration. She would wander, on occasion even into the street. Subsequently, she began disrobing for no apparent reason, 3 to 4 times a week.

In early December 2000, nurses called an ambulance because Ms. B. was “lethargic, unresponsive to name call.” The ambulance crew noted she was “foaming at the mouth,” lying “naked” in bed, and very “cold” to the touch. At the hospital, hypothermia was documented with a body temperature of 84°F rectally. (Of note, the patient’s roommate manifested a normal body temperature, was cognitively intact, and did not complain that their room was cold.) Medications at the time of admission included lisinopril 10 mg/d, aspirin 325 mg/d, amlodipine 10 mg/d, oxybutynin 5 mg twice daily, lorazepam 0.5 mg 3 times daily, metoprolol 50 mg twice daily, famotidine 20 mg twice daily, isosorbide dinitrate 10 mg 3 times daily, metoclopramide 10 mg 4 times daily, and risperidone 1 mg twice daily.

Initially, Ms. B. manifested bradycardia requiring temporary pacing, and hemoconcentration without explanation for the low body temperature. Despite return to normal body temperature within 24 hours, vasomotor instability, body temperatures ranging between 95.9°F and 100.1°F, encephalopathy, and general organ failure persisted. Ms. B. was pronounced dead on the 18th hospital day. An autopsy was not performed.

Ms. B manifested features of accidental hypothermia, which were hidden by her history of mental illness

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rate rather than increased stroke volume.) These changes tend to protect the patient from further lowering of body temperature. But Ms. B.'s medications included the vasodilator, isosorbide dinitrate; the beta-blocker, metoprolol; and the angiotensin-converting enzyme (ACE) inhibitor, lisinopril. All these agents impaired her capacities to vasoconstrict and to increase cardiac output, thereby reducing her ability to conserve body heat.

Amlodipine, a calcium channel blocker, enhances vasodilatation and may also have limited Ms. B.'s capacity to vasoconstrict. Calcium channel blockers may have variable effects on intraoperative core body temperature in humans.¹⁰

Phenothiazines, particularly the low-potency agents in this class, are the antipsychotic drugs most commonly associated with drug-induced hypothermia.^{6,9,11} Phenothiazines seem to have a direct effect on hypothalamic thermoregulation. About a month before developing moderate hypothermia, Ms. B. received an increase in her risperidone dosage from 1 mg twice daily to 1 mg 3 times daily because of agita-

Up to one third of cases of accidental hypothermia occur during the warmer months

tion. The package insert for risperidone states:

"Disruption of body temperature regulation has been attributed to antipsychotic agents. Both hyperthermia and hypothermia have been reported in association with Risperdal use. Caution is advised when prescribing for patients who will be exposed to temperature extremes."¹²

Lorazepam very rarely may be associated with hypothermia. In animal studies, zolpidem, diazepam, and lorazepam produced comparable dose-dependent hypothermia.¹³ Ms. B. had her dosage of lorazepam increased from 0.5 mg 3 times daily to 0.5 mg 4 times daily because of increasing agitation and wandering. About 10 days before developing moderate hypothermia, she became more lethargic and the nursing staff was directed to withhold lorazepam if she appeared unduly sedated. At this point, Ms. B. may have had a drug-induced delirium superimposed upon dementia or a toxic-metabolic encephalopathy superimposed upon dementia. In her case, we do not know if drug-induced or metabolic-induced changes (or a combination of the two) best explained her change in mental status.

*Causes, associations with accidental hypothermia

Medical conditions	Psychiatric conditions
Hypoglycemia	Alzheimer's disease
Hypothyroidism	Schizophrenia
Adrenal insufficiency	
Hypopituitarism	Medications
Stroke	Ethanol
Malnutrition	Phenothiazines
Shock	Barbiturates
Sepsis	Anesthetics
Hepatic or renal failure	Neuromuscular blockers
Burns	
Exfoliative dermatitis	
Immobility or debilitation	
Hypothalamic disorders	
Parkinson's disease	
Spinal cord injury	
Diabetic ketoacidosis	

*Adapted from Danzl DF. Hypothermia. *Harrison's 15th Ed., Principles of Internal Medicine*, New York: McGraw-Hill, 2001, p. 107.

Once accidental hypothermia sets in

During the days before Ms. B. developed moderate hypothermia, the temperature outside the assisted living facility ranged from 25°F to 40°F. When she was found by the nursing staff to be unusually unresponsive, she was wearing her nightgown under bed sheets. Even if her room temperature had been at 70°F, an almost 30°F gradient would exist between that and normal body temperature (98.6°F). In complete thermodyregulation, her body temperature of 84°F could have been reached within 5 to 8 hours. The colder the room, the faster her body would cool in the presence of thermodyregulation.

Although sepsis and adverse environmental exposure are the most common conditions leading to hypothermia, up to one-third of cases of accidental hypothermia in the elderly occur during the warmer months, with one-half of these cases found in the hospital.⁶ In cases of accidental

hypothermia occurring during the winter, one-half occur in a normal room temperature setting.⁹

In a United Kingdom study, about 25% of elderly patients with hypothermia died.⁹ Still, the severity of underlying disease is more predictive of mortality than is the degree of hypothermia.¹⁴ Ms. B.'s fatal clinical course was that of multiple organ failure complicated by hypothermia. No mention was made in the hospital records of her vulnerability to hypothermia. This vulnerability placed significant burden on the assisted living facility staff.

Hypothermia should be considered in the differential diagnosis of confusion and disruptive behavior in the elderly patient. In Ms. B.'s case, an early diagnosis of accidental hypothermia by a psychiatrist could have made a difference.

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Related resources *Oriented to mental health issues*

- ▶ Kramer MR, Vandijk J, Rosin AJ. Mortality in elderly patients with thermoregulatory failure. *Arch Intern Med.* 1989;149:1521-1523.
- ▶ Murphy PJ. Hypothermia. In *Oxford Textbook of Geriatric Medicine.* Evans JG, Williams TF, Beattie BL, Michel J-P, Wilcock GK, eds. New York: Oxford University Press, 2000: 857-863.
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- ▶ Fischbeck KH, Simon RP. Neurological manifestations of accidental hypothermia. *Ann Neurol.* 1981; 10:384-387.

DRUG BRAND NAMES

Amlodipine • Norvasc
Famotidine • Pepcid
Isosorbide dinitrate • Isordil
Lisinopril • Prinivil
Metoclopramide • Reglan

Metoprolol • Lopressor
Oxybutynin • Ditropan
Paroxetine • Paxil
Risperidone • Risperdal
Zolpidem • Ambien

DISCLOSURE

The author reports that he is on the speakers' bureau of Janssen Pharmaceutica, Eli Lilly and Co., Pfizer Inc., Wyeth-Ayerst Pharmaceuticals, Forest Pharmaceuticals, and GlaxoSmithKline.

Accidental hypothermia in the elderly may first be clinically evident to the psychiatrist because it presents with cognitive impairment and disruptive behavior. Patients with psychoses—schizophrenia in particular—may be at increased risk. Psychotropic medications, particularly low-dose phenothiazines, may impair the body's capacity to thermoregulate, as may many nonpsychotropic drugs that the elderly take concomitantly.

BottomLine