Author: Aric Kupper, M.D. Reviewer: Sarah Farris, M.D.

Case Title: Hypothermia

Target Audience: Nurses, Paramedics, Residents and Attendings.

Primary Learning Objectives: key learning objectives of the scenario

1. Recognition of hypothermia and its multi-system sequelae.
2. Resuscitation of the hypothermic patient.
3. Warming techniques (invasive & non-invasive).
4. Airway protection.

Secondary Learning Objectives: detailed technical goals, behavioral goals, didactic points

1. Understand the methods of rewarming (Passive, Active external, & Active core).
2. Gain proficiency in the methods of active core rewarming.
3. Gain proficiency in endotracheal intubation.
4. Utilization of alternate resources to obtain the patient's history.
5. Understand the multi-system effects of severe hypothermia (e.g., cardiac, renal, etc.).

Critical actions checklist – a list to ensure the educational/assessment goals are met.

1. Endotracheal intubation for definitive airway protection.
2. Continuous monitoring, including pulse oximetry.
3. Obtain rectal temperature.
4. Obtaining IV access (2 wide-bore IV's).
5. Confirmation of endotracheal tube placement by portable chest x-ray.
6. Utilization of alternative sources of information to obtain patient's history.
7. Initiation of active external and core warming techniques (e.g., Bair-Hugger, Inhalational (via warmed, humidified O2), Intravenous (warmed NS), Gastrointestinal (gastric &/or colonic w), Bladder, and
8. Aggressive IV hydration (at least 3L, Goal: UOP=1-2 mg/kg/hr).

Environment (if using as a simulation case)

1. Room – **Nurses, Residents & Attendings**: Emergency Department, Trauma room.

**Paramedics**: Patient's living room.

1. Manikin Set-up:

a. Type of manikin: Adult male.

b. Moulage: Perioral cyanosis.

c. Equipment:

i. IV set-ups,

ii. Normal Saline (10cc flushes & 1L bags),

iii. Sedation and paralytic agents (for endotracheal intubation),

iv. Basic airway equipment,

v. Cardiac monitor,

vi. Pulse oximetry,

vii. Electrocardiogram - Atrial fibrillation with bradycardic ventricular response and with Osborn (J) waves,

viii. Chest X-rays (3) - One pre-intubation x-ray (WNL) & 2 different post- intubation x-rays (1 with a well-positioned ETT & NGT, the other showing well-positioned NGT and a right mainstem endotracheal intubation).

ix. Code cart,

x. Foley catheter,

xi. Nasogastric tube (NGT),

xii. Tumi syringes (60cc),

xiii. Yankauer suction,

xv. Warmed normal saline (1 L bags),

xvi. Bair-Hugger,

xvi. Warmed, humidified O2,

xvii. Scalpel,

xviii. Peritoneal lavage equipment with warmed Potassium-free dialysis solution,

xix. Rectal thermometer.

1. Distractors: – list here any environmental or background distractors

a. None

## Actors (optional)

1. Roles:

a. Paramedic,

b. Nurse,

e. Respiratory therapist,

g. On-Line Medical Control Physician

(only if scenario is performed for a paramedic).

1. Who may play them – other residents, other students, actors

**For Examiner Only**

Author: Aric Kupper, M.D. Reviewer: Sarah Farris, M.D.

Case Title: Hypothermia

**CASE SUMMARY**

**CORE CONTENT AREA**

1. Airway management.

2. Recognizing and managing the hypothermic patient.

3. Emergent rewarming techniques and procedures.

**SYNOPSIS OF HISTORY/ Scenario Background**

67 y.o. African-American male is brought to the Emergency Department (ED) by EMS after being found by a neighbor in his bath tub confused. As per EMS, there was an empty bottle of whiskey and several empty beer bottles on the bathroom floor. Upon arrival, the patient has an 18-guage peripheral IV in the left antecubital fossa. He is hooked up to the EMS monitor and is using a non-rebreather at a flow of 15L/min.

**Chief Complaint** (from triage note)**:** Drunk.

**History of Present Illness:**

67y.o. African-American male is found by his neighbor taking a bath while he appears intoxicated. There are several empty beer cans and an empty whiskey bottle on the bathroom floor. The neighbor got worried when he had not seen the patient all morning and he did not answer his door. Neighbor had the super let him into the apartment where they found the patient in the bath tub. When he had difficulty waking up the patient, he called 911. The bath water is room temperature and the patient has been in the bath since yesterday afternoon. The neighbor told the EMT that he heard the patient running his bath yesterday afternoon. Unable to obtain any information from patient due to altered mental status.

**Past medical history:** Chronic alcohol abuse.

**Medications:** None.

**Allergies:** NKDA

**Family history:** Unknown.

**Social history:** + Smokes cigarettes (~1 ppd). Denies illicit drug use.

+ Alcohol abuse.

Divorced. Unemployed. Lives alone.

**SYNOPSIS OF PHYSICAL**

**Vital signs:** Pulse: 48 beats/min

Blood pressure: 110/54 mm Hg

Resp: 9 breaths/min

Temp (oral): 95o F (35o C)

SaO2: 100% (on NRB).

**Initial physical exam:**

General: Somnolent, Confused, GCS= 11 (M:5, V:4, E:2).

Head: NC/AT.

Eyes: EOMI/PERRL.

Ears: WNL.

Nose: WNL.

Throat: Perioral cyanosis, Minimal gag response, Pooling secretions.

Neck: Supple.

CV: Irregularly irregular, bradycardic.

Lungs: CTA b/l, breath sounds equal bilaterally with symmetric chest rise.

Abdomen: Soft, Non-tender, Non-distended, No palpable masses, No bruits or thrills, +Mild hepatomegaly, .

Extremities: WNL.

Skin: WNL.

**For Examiner Only**

**CRITICAL ACTIONS**

**Scenario branch points/ PLAY OF CASE GUIDELINES**

Key teaching points or branch points that result in changes in patient’s condition

1. **Endotracheal intubation**

If the need to intubate the patient is recognized and acted upon early, then no complications ensue. If the intubation is delayed greater than 10 minutes from arrival of patient, then his pulse oximetry reading will slowly go down and his breathing will become louder as he pools secretions in his oropharynx.

Cueing Guideline: Nurse: "Doctor, his breathing sounds more difficult."

Nurse: "Doctor, he's making gurgling sounds when he breathes."

1. **Provide continuous monitoring of vital signs and pulse oximetry.**

If the patient is not hooked up to the appropriate continuous monitoring within 2-3 minutes, he will gradually become more obtunded/lethargic.

Cueing Guideline: Nurse: "Doctor, his radial pulse feels weird."

1. **Obtain rectal temperature**

Without a rectal temperature, the severity of hypothermia is unknown. If untreated, the patient's mental status will decline and he will eventually go into V-fib arrest. If warming measures, other than passive measures, are attempted prior to the rectal temperature, the nurse will state that she cannot get the necessary equipment without an actual diagnosis.

1. **Obtain IV access**

Patient requires 2 wide-bore peripheral IV's as part of her medical resuscitation.

Cueing Guideline: Nurse: "Doctor, he doesn't seem stable. What should I do?"

Nurse: "Doctor, I don't think he can swallow any medicines."

1. **Confirmation of endotracheal tube placement by portable chest x-ray**

If not requested within 1-2 minutes of intubating patient, his SaO2 will start to decline. The x-ray will show a right mainstem intubation. Once corrected, the SaO2 will improve. If the x-ray is ordered without prompting or delay, the ETT will be well-positioned.

Cueing Guideline: Respiratory therapist: "Doctor, the patient's pulse ox is falling."

**6. Utilization of alternative sources of information to obtain patient's history**

Patient is minimally communicative and does not volunteer information. Therefore, some of the information needed for informing consultants and getting the patient admitted or transferred must come from sources other than the patient.

Cueing guidelines: Paramedic: "This was my last run of the night. Do you need anything else from me?"

Neighbor: "Is there anything I can do to help? I just want him to be OK."

**7. Initiation of active external and core warming techniques**

Without active warming techniques, the patient's mental status and hemodynamic stability will gradually worsen until he goes into V-fib arrest. Without active core rewarming techniques, the patient will not improve no matter what else is done for him. If rewarming techniques are properly initiated in a timely manner, the patient will improve.

Cueing Guidelines: Nurse: "Doctor, is there anything else we should do for him?"

Nurse: "Are you sure, I feel like I'm forgetting something."

**8. Aggressive IV hydration (at least 3L, Goal: UOP=1-2 mg/kg/hr).**

Without aggressive hydration, the patient will have only minimal UOP when Foley catheter is first inserted. The urine is tea-colored (myoglobinuria).

Cueing Guidelines: Nurse: "Doctor, the patient has very little urine in the Foley."

Nurse: "Doctor, I've never seen urine this dark."

**SCORING GUIDELINES**

1. **Endotracheal intubation**

Score decreased if endotracheal intubation is not initiated early in case.

1. **Provide continuous monitoring of vital signs and pulse oximetry.**

Score decreased if continuous monitoring of vital signs and pulse oximetry is not initiated.

1. **Obtain rectal temperature**

Score decreased if rectal temperature is not obtained early in case.

1. **Obtain IV access**

Score decreased if not obtained early in case.

Score increased if need for 2 wide bore IVs is recognized early in case.

1. **Confirmation of endotracheal tube placement by portable chest x-ray**

Score decreased if not done right after endotracheal intubation.

1. **Utilization of alternative sources of information to obtain patient's history**

Score decreased if attempts are not made to obtain patient information from alternative sources.

1. **Initiation of active external and core warming techniques**

Score decreased if rewarming techniques are not initiated.

Score increased if multiple methods of rewarming are used.

1. **Aggressive IV hydration (at least 3L, Goal: UOP=1-2 mg/kg/hr).**

Score decreased if IV hydration is not adequate.

**For Examiner Only**

**HISTORY**

**Onset of Symptoms:** Unknown.

**Background Info:** 67y.o. African-American male is brought to the Emergency Department by EMS after his neighbor found him confused and sleepy. He was found in his bath tub confused and somnolent with an empty whiskey bottle and several empty beer bottles on the floor. The patient was last seen yesterday morning and the neighbor heard the bath running yesterday afternoon. At arrival he has an 18-gauge peripheral IV in the left antecubital fossa. He is hooked up to the EMS monitor and is using a non-rebreather at a flow of 15L/min.

**Chief Complaint:** Altered mental status

**Past Medical Hx:** Chronic alcohol abuse

**Past Surgical Hx:** None

**Habits:** Smoking: 1 ppd.

EtOH: Daily.

Drugs: Denies.

**Family Medical Hx:** Unknown.

**Social Hx:** Marital Status: Divorced.

Children: None.

Education: Unknown.

Employment: Unemployed.

**ROS:** Unable to obtain due to altered mental status.

**For Examiner Only**

**PHYSICAL EXAM**

**Patient Name:** Leroy Greene **Age & Sex:** 67 y.o. Male

**General Appearance:** Wet, somnolent male in no acute distress.

**Vital Signs:** T(oral)=95o F P=48 BP=110/54 R=9 SaO2=100% (on NRB)

**Head:** NC/AT, +Temporal wasting.

**Eyes:** EOMI, PERRL (at 4mm).

**Ears:** WNL.

**Mouth:** Perioral cyanosis, Minimal gag response, Pooling secretions.

**Neck:** Supple.

**Skin:** Cold, Wet.

**Chest:** WNL.

**Lungs:** CTA b/l, +Symmetric chest wall rise.

**Heart:** Irregularly irregular, +Bradycardia, No murmurs, rubs, or gallops.

**Back:** WNL.

**Abdomen:** Soft, Non-tender, Non-distended, +Hepatomegaly.

**Extremities:** Cold, 1+ pulses in all extremities.

**Rectal:** WNL.

**Pelvic:** WNL.

**Neurological:** WNL

**Mental Status:** Somnolent, Confused, GCS= 11 (M:5, V:4, E:2).

**For Examiner Only**

**STIMULUS INVENTORY**

**Suggested items as relevant to the case**

#1 Emergency Admitting Form

#2 CBC

#3 BMP

#4 LFTs

#5 Ammonia (NH3)

#6 TSH

#7 Cardiac enzymes

#8 UA

#9 Myoglobin (urine & serum)

#10 ABG

#11 Toxicology (Aspirin, Acetaminophen, alcohol and urine toxicology screen)

#12 Rectal temperature

#13 EKG

#14 CXR (x2)

#15 Pulse oximetry (SaO2) (x2)

#16 Debriefing materials

**For Examiner Only**

**LAB DATA & IMAGING RESULTS**

**Stimulus #2**

**Complete Blood Count (CBC)**

WBC 15.6 /mm3

Hgb 15 g/dL

Hct 43.1 mL/dL

Platelets 386 /mm3

Differential

Segs 59 %

Bands 1 %

Lymphs 35 %

Monos 3 %

Eos 2 %

**Stimulus #3**

**Basic Metabolic Profile (BMP)**

Na+ 145 mEq/L

K+ 4.4 mEq/L

CO2 19 mEq/L

Cl- 112 mEq/L

Glucose 82 mg/dL

BUN 33 mg/dL

Creatinine 1.5 mg/dL

**Stimulus #4**

**Liver Function Tests (LFTs)**

T. Bili 0.6 mg/dL

AST 84 U/L

ALT 175 U/L

Alk. Phos. 115 IU/L

**Stimulus #5**

**Miscellaneous Lab**

NH346 mcg/dL

**Stimulus #6**

**Miscellaneous Lab**

TSH 5.40 uIU/dL

**Stimulus #7**

**Cardiac Enzymes**

CK 1940 U/mL

CK-mb 37 U/mL

Troponin <0.05 U/mL

**Stimulus #8**

**Urinalysis (U/A)**

Color Turbid

Sp gravity >1.030

Glucose neg

Protein ++

Ketone neg

Blood +++

Leuk. Est. neg

Nitrite neg

Micro

WBC 0-1

RBC 0-1

**Stimulus #9**

**Miscellaneous Lab**

Urine

Myoglobin +

Serum

Myoglobin +

**Stimulus #10**

**Arterial Blood Gas**

pH 7.42

pCO2 34 mm Hg

pO2 103 mm Hg

O2 Sat99 %

**Stimulus #11**

**Toxicology**

Serum

Salicylate Neg

APAP Neg

ETOH 52 mg/dl

Urine

Cocaine Neg

Cannabinoids Neg

PCP Neg

Amphetamines Neg

Opiates Neg

Barbiturates Neg

Benzodiazepines Neg

**Stimulus #12**

**Rectal Temp**. 82oF

(28o C)

**Stimulus #13**

**EKG**: Atrial fibrillation at 50bpm, intervals WNL, and no ischemic changes, +Osborn (J) waves.

**Stimulus #14**

**CXR** (#1): NAD

**CXR** (#2): ETT & NGT w/ good placement

**CXR** (#3): NGT- Proper placement; ETT- Right mainstem intubation

**Stimulus #15**

**SaO2** 100% (on NRB)

**SaO2** 100% (on Vent)

**Learner Stimulus #1**

**ABEM General Hospital**

**Emergency Admitting Form**

Name: Leroy Greene

Age: 67 years

Sex: Male

Method of Transportation: ALS Ambulance

Person giving information: Neighbor and EMT

Presenting complaint: Hypothermia

**Background:**

67y.o. African-American male is brought to the Emergency Department (ED) by EMS after being found by a neighbor in his bath tub confused. As per EMS, there was an empty bottle of whiskey and several empty beer bottles on the bathroom floor. Upon arrival, the patient has an 18-guage peripheral IV in the left antecubital fossa. He is hooked up to the EMS monitor and is using a non-rebreather at a flow of 15L/min.

**Triage or Initial Vital Signs**

BP: 110/54 mm Hg

P: 48 beats/min

R: 9 breaths/min

T(oral): 95oF

**Learner Stimulus #2**

**Complete Blood Count (CBC)**

WBC 15.6 /mm3

Hgb 15 g/dL

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Segs 59 %

Bands 1 %

Lymphs 35 %

Monos 3 %

Eos 2 %

**Learner Stimulus #3**

**Basic Metabolic Profile (BMP)**

Na+ 145 mEq/L

K+ 4.4 mEq/L

CO2 19 mEq/L

Cl- 112 mEq/L

Glucose 82 mg/dL

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Creatinine 1.5 mg/dL

**Learner Stimulus #4**

**Liver Functions Tests (LFTs)**

T. Bili 0.6 mg/dL

AST 84 U/L

ALT 175 U/L

Alk. Phos. 115 IU/L

**Learner Stimulus #5**

**Miscellaneous Lab**

NH346 mcg/dL

**Learner Stimulus #6**

**Miscellaneous Lab**

TSH 5.40 uIU/dL

**Learner Stimulus #7**

**Cardiac Enzymes**

CK 1940 U/mL

CK-mb 37 U/mL

Troponin <0.05 U/mL

**Learner Stimulus #8**

**Urinalysis (U/A)**

Color Turbid

Sp gravity >1.030

Glucose neg

Protein ++

Ketone neg

Blood +++

Leuk. Est. neg

Nitrite neg

Micro

WBC 0-1

RBC 0-1

**Learner Stimulus #9**

**Miscellaneous Lab**

Urine

Myoglobin +

Serum

Myoglobin +

**Learner Stimulus #10**

**Arterial Blood Gas**

pH 7.38

pCO2 42 mm Hg

pO2 103 mm Hg

O2 Sat99 %

**Learner Stimulus #11**

**Toxicology**

Serum

Salicylate Neg

Acetaminophen Neg

ETOH 52 mg/dl

Urine

Cocaine Neg

Cannabinoids Neg

PCP Neg

Amphetamines Neg

Opiates Neg

Barbiturates Neg

Benzodiazepines Neg

**Stimulus #12**

**Rectal Temperature** 82oF (28o C)

**Feedback / Assessment Forms**

**Hypothermia**

**Candidate: Examiner: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Critical Actions:**

* Endotracheal intubation.
* Continuous monitoring and pulse oximetry.
* Rectal temperature
* IV Access (2 wide bore IV's).
* CXR (to confirm endotracheal tube placement).
* Utilization of alternative sources of information to obtain history.
* Active external and core warming techniques.
* Aggressive IV hydration (at least 3L, Goal: UOP=1-2 mg/kg/hr).

**Dangerous Actions:**

(Performance of one dangerous action results in failure of the case)

* Insertion of nasogastric tube prior to protecting patient's airway via endotracheal intubation.
* Pronouncing patient dead prior to warming his core temperature to > 86oF (30o C).

**Overall Score:**

* Pass
* Fail

**Optional Addendum 2:**

**Core Competency Assessment**

**Hypothermia**

**Candidate: Examiner: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Does Not Meet Expectations** | **Meets Expectations** | **Exceeds Expectations** |
| **Patient Care** |  |  |  |
| **Medical Knowledge** |  |  |  |
| **Interpersonal Skills and Communication** |  |  |  |
| **Professionalism** |  |  |  |
| **Practice-based Learning and Improvement** |  |  |  |
| **Systems-based**  **Practice** |  |  |  |

**For Examiner**

Date: Examiner: Examinee(s):

Scoring: In accordance with the Standardized Direct Observational Tool (SDOT)

The learner should be scored (based on level of training) for each item above with one of the following:

NI = Needs Improvement

ME = Meets Expectations

AE = Above Expectations

NA= Not Assessed

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Critical Actions** | **NI** | **ME** | **AE** | **NA** | **Category** |
| Perform endotracheal intubation competently with appropriate technique and pharmacologic therapy |  |  |  |  | PC, MK, ICS, SBP |
| Place patient on cardiac monitor with pulse oximetry |  |  |  |  | PC, MK, PBL, ICS |
| Rectal temperature |  |  |  |  | PC, MK, PBL, ICS |
| IV Access (2 wide pore IV's) |  |  |  |  | PC, MK, PBL, ICS |
| Confirm endotracheal tube placement with chest x-ray |  |  |  |  | PC, MK, PBL |
| Utilize alternative sources of information to obtain history |  |  |  |  | PC, MK, ICS, P |
| Perform active external and core rewarming techniques |  |  |  |  | PC, MK, PBL, ICS, SBP |
| Aggressive IV hydration (at least 3L, Goal: UOP=1-2 mg/kg/hr) |  |  |  |  | PC, MK, PBL |

Category: One or more of the ACGME Core Competencies as defined in the SDOT

PC = Patient Care

Compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.

MK = Medical Knowledge

Residents are expected to formulate an appropriate differential diagnosis with special attention to life-threatening The score sheet may be used for a variety of learners. For example, in using the case conditions, demonstrate the ability to utilize available medical resources effectively, and apply this knowledge to clinical decision making.

PBL = Practice Based Learning & Improvement

Involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care.

ICS = Interpersonal Communication Skills

Results in effective information exchange and teaming with patients, their families, and other health professionals.

P = Professionalism

Manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.

SBP = Systems Based Practice

Manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

**Debriefing Materials:** See attached powerpoint

**Add 4-6 keywords for future searching functions**

1. Hypothermia

2. Rewarming

3. Peritoneal lavage

**References**

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**Has this work been previously published?**

**No.**