Poisoning
Carbon Monoxide
- Carbon Monoxide poisoning occurs mostly in context poorly functioning heating systems, improperly vented fuel-burning devices (eg, kerosene heaters, charcoal grills, camping stoves, gasoline-powered electrical generators), and motor vehicles operating in poorly ventilated areas.
- Commonest method of suicide in Europe.
- Clinical Feature: headache (most common), dizziness $\rightarrow$ confusion $\rightarrow$ coma.
- Cardiac ischemia can also occur.
- Lab: elevated carboxyhemoglobin level and normal PO2.
- Treatment: 100% oxygen by tight fitting facemask.
- Hyperbaric oxygen if available.
- Most patients with milder intoxication can be discharge from ER.

Mercury
- People at risk: worker of thermometer factory and dental amalgam factory, heavy consumer of tuna or shark fish, worker of mercury mines.
- CLINICAL FEATURE: intention tremor, swollen and tender gum, excess salivation, psychiatric symptoms- anxious, irritable, insomnia.
- Investigation: Blood and urine mercury level (significant if level is >100 ug/L).
- Treatment: Elimination of exposure and Chelating agents.

Chelating agents
1: (BAL or (dimercaprol- I.M.).
2: Dimercaptosuccinic acid (DMSA) also called succimer $\rightarrow$ oral)
3: Pencillamine- oral, for few days.
4: 2,3 Dimercaptopropane sluphonate (DMPS)- IM or IV.
- Complication of Mercury Poisoning: Nephrotic Syndrome which is reversible.

House Cleaning Agents Poisoning
- Drain cleaner, oven cleaner, toilet bowl cleaner, household bleach, dishwasher detergent.
- Mostly acidic, although some are alkali.
- DO NOT INDUCE VOMITTING.
- DO NOT GIVE BICARBONATE OR OTHER NEUTRALIZING AGENTS.
- Immediately give milk or water (First Aid).
- In Emergency room Promptly do flexible upper GI endoscopy.
- If chest x-ray has air in the mediastinum $\rightarrow$ suggest esophageal perforation, or abdominal x-ray has air under diaphragm $\rightarrow$ suggest gastric perforation.
- CALL FOR SURGICAL EVALUATION.
- If someone drops these agents on skin $\rightarrow$ flood with water.
- If someone gets in eye $\rightarrow$ use local topical anesthetic agent and flood with water.
Methanol
-Usually after drinking bootleg whiskey, comes with visual disturbance.
-PE: mydriasis, hyperemia of optic disc.
-Lab: Anion gap metabolic acidosis, ↑ osmolal gap, ↑ serum methanol level.
-Treatment: Fomepizole (antidote of choice) - IV.
-Alternative: ethanol. hemodialysis for severe toxicity >50 mg/dL.

Ethylene Glycol
-Secondary to ingestion of antifreeze solution.
-Clinical Feature: confusion, tachypnea.
-Lab: Anion gap metabolic acidosis, urine test has oxalate crystal, ↑ osmolal gap.
-Treatment: same as methanol poisoning.

Organophosphate insecticide
-History of insecticide spray or a farmer coming from work.
-Complaints: Abdominal pain, diarrhea, vomiting, Shortness of breath.
-Physical Exam: Miosis (constricted pupil), sweating, wheezing.
-Treatment: Wash the skin with soap and water
          Atropine I.V. decreases sweating and wheezing
          Pralidoxime (2-PAM) I.V – specific antidote

Salicylate Poisoning
-Nausea, vomiting, tinnitus, tachypnea
-Lab: metabolic acidosis and respiratory alkalosis
-Treatment: Alkalinize urine by sodium bicarbonate I.V.
-Hemodialysis for severe acidosis or altered mental status

Black Widow Spider Bite
-Clinical Feature: generalized muscular pain, muscle spasm, rigidity.
-Treatment: parenteral narcotic – for pain.
-Muscle relaxant- methocarbomol I.M. or I.V. for spasm.
-Calcium gluconate I.V. for rigidity
-Rarely antivenin I.V.

Brown Recluse Spider Bite
-Clinical Feature: extensive local necrosis and hemolytic reaction, may not be felt at all or only as a pinprick.
-Lesion is small <2 cm
  -supportive measures: dress the wound, tetanus toxoid, rest, analgesics and close follow up
-Large massive necrotic lesion >2 cm
  -Treat with systemic corticosteroids 5-7 days.

Opioid Intoxication
Morphine, Codeine, Heroin, Meperidine, Methadone, Oxycontin.
Clinical Feature: Euphoria, drowsiness, constricted pupil, hypotension, bradycardia, hypothermia and respiratory arrest.

Seizure, likely secondary to Meperidine especially in patients with renal failure due to accumulation of metabolite: nor-meperidine.
Duration of effect of Heroin: 3-5 hr.
Methadone intoxication may last 48-72 hrs.
Most opioids are detectable on routine urine toxicology except Methadone, newer Fentanyl derivative.
Treatment: Naloxone 0.4 mg to 2 mg IV.
Duration of effect of Naloxone is 2-3 hr.
Repeated dosage required for patients intoxicated with Methadone.
Patient should be observed at least 3 hours after the last dose of Naloxone.

<table>
<thead>
<tr>
<th>Poisoning</th>
<th>Specific Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Blocker</td>
<td>Glucagon</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>Acetylcysteine</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>100% Oxygen</td>
</tr>
<tr>
<td>Benzodiazepine</td>
<td>Flumazenil</td>
</tr>
<tr>
<td>Cyanide</td>
<td>Nitrite (Amyl nitrite, Sodium nitrite)</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Fab antibody fragment (digibind)</td>
</tr>
<tr>
<td>Opiates</td>
<td>Naloxone</td>
</tr>
<tr>
<td>Iron</td>
<td>Defuroxamine</td>
</tr>
<tr>
<td>Methanol, ethylene glycol</td>
<td>Fomepizole</td>
</tr>
<tr>
<td>Methemoglobinemia</td>
<td>Methylene blue</td>
</tr>
</tbody>
</table>

Snake Bite
Venom could be cytolytic (Rattle snake, other Pit Vipers) most common in USA.
Or Neurotoxic (Coral Snake).
Cytolytic venom causes tissue destruction by digestion and hemorrhage due to hemolysis and destruction of endothelial lining of blood vessels.
Manifestation: local pain, redness, swelling, extravasation of blood, nausea, vomiting, hypotension, coagulopathy may also occur.
Neurotoxic venom causes ptosis, diplopia, dysphagia, respiratory paralysis.

Management
In field:
Immobilize the patient and bitten part in neutral position.
Avoid manipulation of bitten area.
Avoid any stimulant.
Do not apply ice.
Do not apply tourniquet.
Incision and suction by unskilled people is not justified (in view of small amount of venom that can be recovered).
Transport pt to nearest facility.

In hospital:
- Labs: CBC, Chem 7, CPK, PT, PTT, Urine for myoglobin.
- If no local or systemic signs and symptoms and coagulation profile normal → discharge home in 12 hours.

Specific Antidote:
- Pit Vipers (Rattle Snake): Crotalid antivenin (CroFab). Slow IV in normal saline, antihistamine, keep epinephrine ready in case of anaphylactic reaction.
- Oxygen, IV fluid, Asses need for Tetanus toxoid, antibiotic (Augmentin).
- Coral Snake: For specific antivenin- call the regional poison center they help you to locate antisera. Horse serum based antivenom is available in USA.

Follow up:
- Adequacy of treatment is indicated by clinical signs and symptoms and rate of swelling slows down, also follow up the coagulation profile.

COMA:
DO NOT FORGET ABC:
- Control airway, oxygen, pulse oximeter, intubation.
- If trauma- first immobilize cervical spine with hard collar (until you r/o fracture or instability.
- IV line, cardiac monitor, check cardiac monitor.
- Vitals: stabilize it, if hypotensive start Intravenous normal saline, vasopressors (dopamine, norepinephrine)
- IV thiamine → 50% dextrose 50 cc IV →Naloxone IV
- Flumazenil IV- if the suspicion of Benzodiazepine is high. (Routine use is not advisable since it can cause Seizure)
- Exam: look for signs of head trauma, cirrhosis, sepsis, rash of meningococcemia.
- Look at the pupils:
  - o Small but reactive → narcotic overdose or metabolic encephalopathy.
  - o Dilated fixed unilateral → r/o uncal herniation → hyperventilation, mannitol IV, dexamethasone IV, urgent neurosurgery consult --> CT head.
  - o Dilated, fixed bilateral → drug intoxication with methyl alcohol or severe anoxic encephalopathy.
- If patient is febrile → vancomycin and gentamycin IV.
Follow up labs: If serum osmolality high and anion gap metabolic acidosis, hyperemia of optic disc → Fomepizole.
- If vitals stable → CT head non diagnostic → Lumbar puncture.
- Send CSF for cell count, cx, glucose, protein.
- Still undiagnosed → EEG (to diagnose non convulsive status epilepticus, encephalitis, encephalopathy)

CCS Case: Coma

Location: Emergency Room

CC: Unresponsive

Vitals: B.P is 120/60mm of Hg. Pulse is 100 /minute. Temperature is 99\^0F, RR is10-12/minute.

History of Present Illness:
30-year-old male brought by his girlfriend as was found unresponsive in his apartment. A bottle of liquor 75% empty and couple of bottles of medicines of anxiety were empty near him.

Past Medical History: Alcohol Abuse, Anxiety, Depression.


Allergy- Unknown

Family History- Unknown.

**DO NOT FORGET ABC**

Order:
- Airway oral (To maintain the patency of airway)
- Oxygen- continuous
- Pulse oximeter
- Cardiac monitor
- Intravenous access
- Intravenous fluid- Normal saline
- Finger stick- glucose

Results:
Pulse oximeter should have oxygen saturation more than 90%, if it is less than 90% → Intubation.

Note: If history is suggestive of some poisoning, and you are planning to do gastric Lavage, in a comatose patient, always intubate prior to gastric Lavage. Gastric Lavage is
not being used routinely, except if you have clear history of ingestion of toxic substance, if patient presents within 60 minutes of ingestion of the substance, if they want you to do gastric Lavage, history will be “patient took this medication, this many pill, while arguing with a family member or friend who brought the patient to the hospital.” If patient is conscious, you can perform gastric Lavage, without intubation. But if patient is unconscious, first intubate before gastric Lavage.

Again order battery of test and procedure:
CBC, Chem8, Liver Function Test (LFT), Ammonia, Arterial Blood Gas (ABG), PT, PTT, Type and cross match, blood c/s, Cardiac enzyme, Blood toxicology screen, Blood Alcohol level, Serum osmolality, X-ray chest AP, EKG, Foley’s catheter U/A, Urine toxicology, Urine Osmolality

*After above orders, Order the following in the same sequence.*

- Thiamine therapy- I.V one time bolus → Dextrose 50% in water- I.V. stat.
- Naloxone I.V one time bolus
- Flumazenil I.V. one time bolus

Note: Thiamine is give before the administration of Dextrose, because, if dextrose is administered in a Thiamine deficient patient it can precipitate, Wernicke’s Encephalopathy. Usually thiamine deficiency occurs in Alcoholics. If patient becomes conscious after the administration of I.V. Naloxone, suggest opiate intoxication. If this patient again becomes unconscious, suggest long acting opiate intoxication eg: Methadone, which will need multiple dosages of Naloxone I.V.

If patient becomes conscious after the administration of Flumazenil, suggests Benzodiazepine intoxication.

Patient did not respond to above treatment. If Urine toxicology result becomes available and is positive for benzodiazepine → this does not mean patient has benzodiazepine toxicity, since patient did not respond to Flumazenil. Although benzodiazepine was positive in urine because patient has history of anxiety and was on benzodiazepine.

Scenario 1:

If patient has hypotension and EKG shows Arrhythmia (Prolonged PR, QRS and QT interval) likely diagnosis is Tricyclic Antidepressant poisoning. (since patient has history of depression and anxiety) → Order Sodium bicarbonate I.V. continuous.

Check vitals, if vitals remain stable, order CT scan of the head. If the scan report is normal, transfer the patient to the Intensive care unit.
Follow up serum and urine toxicology to confirm, the diagnosis of TCA poisoning.

Scenario 2:
If patient has not responded to above cocktail, look into the examination HEENT finding:
- Dilated pupils, hyperemia of optic disc → check labs → serum osmolality
- Serum osmolality high → check anion gap → (Anion gap > 14) Anion gap metabolic acidosis → check U/A - normal. No crystals → most likely diagnosis → Methanol poisoning → Start IV Fomepizole (or Ethanol).

Check vitals, if vitals remain stable, order CT scan of the head. If the scan report is normal, transfer the patient to the Intensive care unit.

Scenario 3:
If patient has not responded to above cocktail, look into the examination HEENT finding:
- Pupils are normal → check labs → serum osmolality → Serum osmolality high → check anion gap → (Anion gap > 14) Anion gap metabolic acidosis → check U/A - calcium oxalate crystals → most likely diagnosis → Ethylene Glycol (anti-freeze) poisoning → Start IV Fomepizole (or Ethanol).

Check vitals, if vitals remain stable, order CT scan of the head. If the scan report is normal, transfer the patient to the Intensive care unit.

Scenario 4:
If patient has not responded to above cocktail, look into the examination HEENT finding:
- pupils are normal → check labs → serum osmolality → Serum osmolality high → check anion gap → Anion gap - normal (12±2) → check U/A → increased ketones in the urine, no crystals → Order serum ketone. Follow up the serum toxicology result, which tells you about isopropyl alcohol level → most likely diagnosis → Isopropyl Alcohol poisoning → Treatment is supportive, continue above management.

Check vitals, if vitals remain stable, order CT scan of the head. If the scan report is normal, transfer the patient to the Intensive care unit.

Primary Immune Deficiency
Common Variable Immune deficiency disease (CVID)
- Abnormality in B-cell function.
- Presents between one year to adulthood.
- When onset is in adulthood, they may have underlying lymphoid malignancy.
- Presents with recurrent bacterial infection involving sinuses, middle ear, lung with systemic spread.
- Treatment: IVIG lifelong.

Hyper IgE syndrome (Job’s syndrome)
- Recurrent skin and visceral (hepatic, renal, pulmonary perianal) abscess.
- Mostly secondary to staphylococcal infection.
- Elevated IgE level.

DiGeorge Syndrome
- Secondary to deletion of chromosome 22q11, development of 3rd and 4th pharyngeal pouch gets affected, causing anomaly of face, thymus, parathyroid and cardiac structures.

- Triad of:
  1) Absent T cells, secondary to absence of thymus
  2) Congenital heart disease
  3) Hypocalcemia secondary to hypoparathyroidism

Diagnosis:
- Characteristic facial appearance (cleft palate, small mouth, low set ears, short palpebral fissure, widened distance between the inner canthi (telecanthous))
- Congenital heart disease (Tetralogy of fallot, Truncus arteriosus, atrial and ventricular septal defect)
- Hypocalcemia (presents with tetany, seizure)
- Treatment: Bone marrow transplant

**Wiscott-Aldrich syndrome**
- Mix of immunoglobulin defect and T cell deficiency.
- Clinical Features: Eczema- develops during first year of life, resembles atopic dermatitis.
- Thrombocytopenia- presenting with bleeding.
- Characteristic immunoglobulin pattern IgG normal IgM very low, IgA and IgE elevated.
- Prone to have infection with encapsulated organisms due to immunoglobulin defect.
- Increased incidence of non Hodgkin’s lymphoma.
- Treatment: Bone marrow transplant.
- If bone marrow transplant not feasible due to absence of HLA matched donor, splenectomy is the treatment of choice for patients with platelet count less than 50,000.
- IVIG- every 3 to 4 weeks.
- Antibiotic prophylaxis- Amoxicillin or Trimethoprim- sulfamethoxazole daily.

**Severe combined immunodeficiency disease (SCID)**
- Absence of both cellular and humoral immunity.
- Usually symptoms starts in newborn period.
- Classical symptoms are recurrent severe infection, chronic diarrhea and failure to thrive.
- Chronic mucocutaneous candidiasis is a common early finding.
- Attenuated vaccine such as OPV can cause severe infection.
• Blood transfusion can cause graft-versus-host disease (GVHD).
• Lab: lymphopenia (absolute lymphocyte count less than 2000/mm³ in a newborn is an absolute indication for evaluation of SCID).
• Hypoglobulinemia.
• Impaired specific antibody response.
• Cutaneous anergy.
• Treatment: Bone marrow transplant.

Adenosine deaminase deficient SCID:
• Profound lymphopenia (absolute lymphocyte count less than 500/mm³)
• Chondro-osseous dysplasia of costochondral junction.
• Vertebral bodies reveal “Rachitic Rosary” rib cage.

Chediack Higashi Syndrome:
• Phagocytic disorder- Neutrophils contain abnormal “Giant” granules due to inappropriate fusion of lysosomes and endosomes.
• Recurrent pyogenic infection.
• Partial oculocutaneous albinism.
• Neurologic abnormality (Photophobia, Nystagmus, Peripheral neuropathy, seizure, dysfunction of spinal tract and cerebellum).

IgA deficiency:
• Most common primary immunodeficiency.
• Predominent immunoglobulin of nasal secretion is IgA.
• Most patients are asymptomatic but may develop recurrent sino-pulmonary infection, recurrent gastrointestinal infection, particularly giardia lamblia (secretory IgA usually binds with pathogens and toxins).
• Anaphylactic blood transfusion reaction.

Ataxia Telangiectasia:
• Progressive cerebellar ataxia since the beginning of walking (appear healthy for the first year of life) which slowly gets worst and by 10-12 years of age, become wheelchair bound.
• Ocular or facial Telangiectasia (mostly appear when child is 3-5 year of age).
• Elevated alpha-feto protein is found in more than 95% patients over the age of 8 months.
• Immunodeficiency, Absent or low IgA and IgE level, mostly develop sino-pulmonary infections.
• No effective treatment.

Vitamin Deficiency
Vitamin deficiency syndromes develop gradually, symptoms are non-specific and physical exam is rarely helpful in early diagnosis.

- Some vitamins can be used efficaciously as drugs.
  - Vitamin A derivatives: Treat cystic acne and skin wrinkles.
  - Niacin: Treats hyperlipidemia.

Vitamin A Deficiency
- Important for normal retinal function, wound healing and cell growth and differentiation.

- Causes: Fat malabsorption syndromes and mineral oil laxative abuse, it occurs commonly in the elderly and urban poor in the US.
- CLINICAL FEATURE: Night blindness, xerosis (dryness of the conjunctiva), Bitot’s spots, Keratomalacia, perforation, endophthalmitis and blindness.
- Treatment: Vitamin A 30,000 IU/day x 1 week for early deficiency.
- Toxicity: staining of the skin orange-yellow, and with hypervitaminosis- dry scaly skin, hair loss, mouth sores, painful hyperostosis, anorexia and vomiting early on. Late findings- hypercalcemia, increased ICP, cirrhosis.
- Vitamin A derivatives also used to treat Cystic Acne and Skin wrinkles, remember however it is teratogenic, therefore always do a pregnancy test in females of child bearing age. Topical use can increase the risk of skin cancer.

Vitamin B1 (Thiamine) Deficiency
- Causes: alcoholic, chronic dialysis
- CLINICAL FEATURE:
  - Wet beriberi: Symptoms are cardiovascular: heart failure, ascites, edema.
  - Dry beriberi: Symptoms are neurological-both peripheral and central:
  - Wernicke’s encephalopathy (nystagmus, ophthalmoplegia, ataxia, change in mental status).
  - Korsakoff’s psychosis (confabulation, and retrograde amnesia).
- Treatment: large parenteral doses 50-100 mg/day for first few days, followed by daily doses 5-10 mg/day.

Vitamin B2 (Riboflavin) Deficiency
- Causes: drugs (phenothiazine, tricyclic antidepressants)
- CLINICAL FEATURE: Glossitis, cheilosis, angular stomatitis, seborrheic dermatitis, weakness, corneal vascularization and anemia.
- Treatment: meat, fish, dairy or oral preparation of vitamin 5-15 mg/day.

Vitamin B6 (Pyridoxine) Deficiency
- Causes: patient on INH, Penicillamine, OCPs, or alcoholism.
- CLINICAL FEATURE: mouth soreness, glossitis, cheilosis, if severe: peripheral neuropathy, seizure.
- Treatment: oral supplements 10-20 mg/day, typically given with INH.
Toxicity: irreversible sensory neuropathy on high doses.

**Niacin Deficiency**
- **Causes:** Historically it occurred when corn, which is relatively deficient in niacin was the major source of calories. Today: Alcoholism, INH, Carcinoid syndrome.
- **CLINICAL FEATURE:** Pellagra- 3D (diarrhea, dementia, dermatitis) and if advanced even death.
- **Treatment:** oral doses 10-150 mg/day.
- It is also used to treat hyperlipidemia.
- **Toxicity:** can be seen when treating hyperlipidemia, Cutaneous flushing (to avoid pre-treat with Aspirin 325 mg/day).

**Vitamin C Deficiency**
- Potent antioxidant, also required for the synthesis of collagen.
- Increases absorption of Iron.
- Decreases effect of Warfarin.
- Causes hyperoxaluria.
- **CLINICAL FEATURE:** Scurvy (Due to impaired collagen synthesis). Symptoms are bleeding gum, ecchymoses, petechiae, hyperkeratosis, impaired wound healing, weakness, joint pain and swelling, neuropathy.
- **Treatment:** Ascorbic acid 300-1000 mg/day.
- **Toxicity:** gastric irritation, flatulence, and diarrhea at high doses. Fecal occult blood could be false negatives and urine glucose could be false positives.

**Vitamin D Deficiency**
- **Causes:** insufficient sun exposure, malnutrition, malabsorption, rickets, anticonvulsants, often seen in institutionalized elderly.
- **CLINICAL FEATURE:** osteomalacia, osteopenia
- **Treatment:** Sunlight, Vitamin D supplements.

**Vitamin E Deficiency**
- Functions as an antioxidant, protecting cell membranes and other structures from the attack of free radicals.
- Investigational use to prevent Alzheimer's.
- **CLINICAL FEATURE:** Hemolysis, Ataxia, Myopathy.
  - Increases effect of Warfarin (Causes Vitamin K deficiency).
- **Treatment:** oral doses of 100-400 units/day.
- **Toxicity:** nausea, diarrhea, and may cause bleeding in those taking coumadin.

**Vitamin K:**
- Factor II, VII, IX ,X , protein C and S are vitamin K dependent clotting factors
- **Causes:** poor diet, malabsorption, broad spectrum antibiotics.
- **CLINICAL FEATURE:** bleeding from venipuncture site
- **Treatment:** Subcutaneous vitamin K supplement

Selenium: Deficiency of Selenium can cause Congestive Heart Failure
Chromium: Deficiency of chromium can cause Insulin Resistance
Zinc: Deficiency of Zinc can cause delayed wound healing.

Complications of modern day hobbies:
Tanning beds: Addictive, can cause basal cell carcinoma especially in women who are taking OCP or Antihistamine.
Hair Removal: Eflornithine (ornithine decarboxylase inhibitor) is FDA approved for the use of abnormal facial hair.
Complication: Reversible Anemia, Leucopenia.
Laser Hair removal: Side effect could be hypo-pigmentation, flare up of Acne, and Purpura.

End of 1st Hour
<table>
<thead>
<tr>
<th>Medicine</th>
<th>Use</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. John’s Wort</td>
<td>Depression</td>
<td>Avoid with SSRI Activates Cytochrome P450 system and so decreases the plasma concentration of Theophylline, Cyclosporine, Indinavir, Warfarin, Digoxin, Simvastatin, Oral contraceptive</td>
</tr>
<tr>
<td>Saw Palmetto</td>
<td>Benign Prostatic Hypertrophy</td>
<td>Improves urinary symptoms Does not decrease Prostate size or PSA level May cause Hypertension</td>
</tr>
<tr>
<td>Ginseng</td>
<td>Fatigue, Diabetes</td>
<td>Hypertension, Hypoglycemia</td>
</tr>
<tr>
<td>Witch Hazel</td>
<td>Hemorrhoids and Acne</td>
<td>External use has no side effect.</td>
</tr>
<tr>
<td>Ginkgo</td>
<td>Dementia</td>
<td>Avoid with NSAID, Warfarin, Heparin increased risk of bleeding</td>
</tr>
<tr>
<td>Glucosamine</td>
<td>Osteoarthritis</td>
<td></td>
</tr>
<tr>
<td>Creatine</td>
<td>Athletes to increase performance</td>
<td>Avoid in renal failure</td>
</tr>
<tr>
<td>DHEA</td>
<td>Anti-aging agent, sexual enhancer, depression</td>
<td>Hypertension, arrhythmia, stroke.</td>
</tr>
<tr>
<td>Ephedra</td>
<td>Sympathomimetic used for weight loss, stimulant</td>
<td></td>
</tr>
<tr>
<td>Licorice</td>
<td>Used in chewing gum and chewing tobacco.</td>
<td>Inhibits 11β hydroxy steroid dehydrogenase which converts Cortisol to Cortisone, if Cortisol level is high, it will stimulate Aldosterone receptors. Patient will have symptoms of primary hyperaldosteronism like hypertension, hypokalemia, and metabolic alkalosis.</td>
</tr>
</tbody>
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## Geriatrics

Changes in physiologic function with age

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<th>Organ System</th>
<th>Age-Related Decline in Function</th>
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<td>Presbyopia</td>
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<tr>
<td>Lens opacification</td>
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<tr>
<td>Decreased hearing</td>
<td></td>
</tr>
<tr>
<td>Decreased taste and smell</td>
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<tr>
<td><strong>Cardiovascular</strong></td>
<td></td>
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<tr>
<td>Impaired intrinsic contractile function</td>
<td></td>
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<tr>
<td>Decreased conductivity</td>
<td></td>
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<tr>
<td>Decreased ventricular filling</td>
<td></td>
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<tr>
<td>Increased systolic blood pressure</td>
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<tr>
<td>Impaired baroreceptor function</td>
<td></td>
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<tr>
<td><strong>Respiratory</strong></td>
<td></td>
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<tr>
<td>Decreased lung elasticity</td>
<td></td>
</tr>
<tr>
<td>Decreased maximal breathing capacity</td>
<td></td>
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<tr>
<td>Decreased mucous clearance</td>
<td></td>
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<tr>
<td>Decreased arterial PO\textsubscript{2}</td>
<td></td>
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<tr>
<td><strong>Gastrointestinal</strong></td>
<td>Decreased esophageal/colonic motility</td>
</tr>
<tr>
<td><strong>Renal</strong></td>
<td>Decreased Glomerular filtration rate</td>
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<tr>
<td><strong>Immune</strong></td>
<td>Decreased cell mediated immunity</td>
</tr>
<tr>
<td>Decreased T-cell number</td>
<td></td>
</tr>
<tr>
<td>Increased T-suppressor cells</td>
<td></td>
</tr>
<tr>
<td>Decreased T-helper cells</td>
<td></td>
</tr>
<tr>
<td>Loss of memory cells</td>
<td></td>
</tr>
<tr>
<td>Decline in Ab titers to known Ag</td>
<td></td>
</tr>
<tr>
<td>Increased autoimmunity</td>
<td></td>
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<tr>
<td><strong>Endocrine</strong></td>
<td>Decreased hormonal responses to stimulation</td>
</tr>
<tr>
<td>Impaired glucose tolerance</td>
<td></td>
</tr>
<tr>
<td>Decreased Androgens and Estrogens</td>
<td></td>
</tr>
<tr>
<td>Impaired norepinephrine response</td>
<td></td>
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<tr>
<td><strong>Autonomic Nervous</strong></td>
<td>Impaired response to fluid deprivation</td>
</tr>
<tr>
<td>Decline in baroreceptor reflex</td>
<td></td>
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<tr>
<td>Increased susceptibility to hypothermia</td>
<td></td>
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<tr>
<td><strong>Neurologic</strong></td>
<td>Decreased vibratory sense</td>
</tr>
<tr>
<td>Decreased proprioception</td>
<td></td>
</tr>
<tr>
<td><strong>Musculoskeletal</strong></td>
<td>Decreased muscle mass</td>
</tr>
</tbody>
</table>

### Sensory Impairment

- **Hearing:**
  - The most common cause of hearing loss is sensorineural: Presbycusis.
  - Screening test: Hearing Handicap Inventory for the Elderly- Screening Version (HHIE-S), whispered voice test, audioscopy.
  - Hearing loss leads to social isolation and depression.
Vision:
- The most common causes of age related visual impairment: Age related macular degeneration (AMD), cataracts, glaucoma.
- AMD- leading cause of blindness in those >65.
- Screening test: Snellen or Jaeger eye chart.

Q: 87 yo M, living in an assisted living home, recently became socially isolated, no longer visiting with friends, eating in the common dining room or watching television. Vitals are all stable. All labs WNL. Geriatric depression score 1/5. (low risk for depression) What to do?
A: _________________________________________________________________

Q: An 81-year-old man is evaluated for a 6-month history of a constant buzzing sound in both ears. The noise interferes with reading, watching television, and sleep. He denies headache, vertigo, or sinus pain. Depression screening results are negative. Vitals are stable, PE normal. What to do?
A: __________________________________________________________________

Cognition
- The prevalence of dementia doubles every 5 years after age 60, by the age of 85 about 30-50% of individuals have some degree of impairment.
- Short term memory is important to inquire about, finding out whether patients have difficulty forgetting to take medications, forgetting appointments or getting lost while driving.
- Screening test: Folstein Mini-Mental State Examination- <24/30 is significant. Level of education can affect performance.
- Identification of dementia early can identify potentially reversible causes like folate, B12 deficiency, syphilis, hypothyroidism, depression.
- Treatment for dementia:
  - Donepezil, a centrally acting cholinesterase inhibitor modestly improves cognition, global function, and psychiatric symptoms.
  - Memantine, is recommended for patients for moderate to severe Alzheimer’s.
  - Vitamin E, may help slow progression.

Q: A 78-year-old F concerned that she is losing her memory visits her primary care physician accompanied by her daughter. The daughter confirms that the patient is forgetful and does not recall conversations that have occurred in recent days. The patient appears cheerful, physical exam: well-groomed and friendly. Which of the following is the most appropriate next step in the assessment of this patient’s cognitive impairment?
A: __________________________________________________________________

Depression
- A simple 2 question screen has shown 96% sensitivity for detecting major depression in the general population, and even higher in those > 65.
  - In the last month have you often been bothered by feeling sad, depressed or hopeless?
In the last month have you often been bothered by little interest or pleasure in doing things.

Q: A 66-year-old man is having difficulty concentrating and performing work as manager for 6 months, H/o depression, treated with antidepressants for 6 mo. On examination, he replies slowly to questions and has Mini–Mental State Examination score of 26/30. On neuropsychological examination, he has impairments of attention and speed of processing, but normal recent memory and visuospatial function. Which of the following is the most appropriate next step in evaluating this patient?

A: __________________________

Falls and Gait Instability
- 30-40% of community dwelling and 50% of long term care elderly residents fall/year.
- Causes: Mostly due to the interaction between the patient and an environmental risk factor.
  - Medications and alcohol use are the most common reversible cause in the elderly.
  - Benzos, sedative-hypnotics, antidepressants, neuroleptics and the use of 4 or more meds simultaneously are associated with increase fall risk.
- Screening for functional status and gait instability
- Get up and go test
  - Patient rises from the chair, walks 10 feet, turns, walks back to chair and sits.
  - Those who take longer than 10 seconds are at increased risks for falls.
- Prevention: Treat all contributory medical conditions, minimize environmental hazards and reduce number of medications.
  - Focus on strength, balance and gait training and improve bone density with calcium and vitamin D supplementation.

Preventative Measures
Exercise
- Sedentary elders should be urged to increase their level of physical activity.

Hypertension
- Treatment may be more beneficial in older than in younger people.
- Widened pulse pressure is a marker of risk for heart failure and stroke.
- Thiazides are the drug of choice unless comorbid conditions make another choice preferable.

Stroke Prevention
- Incidence of stroke doubles every 10 years in older adults.
- Risk factors: Hypertension, DM, Congestive Heart Failure, Atrial Fibrillation (Age >75 use of warfarin decreases risk 2/3).

Cancer Screening
- Screening for prostate cancer is not recommended.
- Breast cancer screening should be stopped at 74.
Colon cancer screening is stopped at 75.
Cervical cancer screening is stopped at 65 if there is a history of regular screening with normal pap smears.

Osteoporosis
- Identify risk factors: older age, female, white or Asian, low calcium intake, smoking, excessive alcohol use, chronic glucocorticoids.
- Screen those with multiple risk factors with bone mineral density test (DEXA).
- In men screening strategies are controversial but should be offered to those receiving hormonal treatment for prostate cancer.

Immunizations
- Influenza: age > 50 and health care workers in contact with them annually.
- Pneumococcal: one vaccine after the age 65.
- Tetanus and diphtheria: booster dose after age 65.

Abdominal Aortic Aneurysm
- AAA: Men who have ever smoked between 65-75 years, screen for AAA → Ultrasound
- Men who has a family history of AAA also need screening 65-75 → Ultrasound

PPD for Congregate Living
- Over 20% of the elderly who develop TB live in nursing homes.
- Long term care facilities should routinely perform PPD on all patients annually.

Geriatric Syndromes
Dementia and Delirium
- Most common dementia: Alzheimer’s and multi-infarct.
- Acute confusion should focus on nonpharmacologic intervention, and avoid physical restraints because they increase morbidity.

Polypharmacy
- Although elderly patients make up 12.4% of population, they account for over 1/3 of all prescription drugs in the US.
- Polypharmacy is inappropriate use of multiple medications.
- The best way to reduce Polypharmacy: review of all medications at every visit
- Pharmacokinetics and pharmacodynamics change with age.
  - Volume of distribution is increased- increase in fat:muscle ratio.
  - Renal elimination is decreased; Creatinine may be misleading given this decrease in muscle mass.
- Drug side effects can occur with low doses of drugs.
  - A mild anticholinergic (diphenhydramine) may cause confusion.
  - Diuretics may precipitate urinary incontinence.
  - Digoxin may induce anorexia.
  - Over the counter sympathomimetics may result in urinary retention in older men with mild prostatic obstruction.
- Nonpharmacologic interventions
  - Asymptomatic bacteriuria- don’t treat with antibiotics.
  - Ankle edema: leg elevation or pressure gradient stockings.
Specific drug classes:
- Anticoagulants: determine if worth anticoagulating afib.
- Glaucoma meds:
  - Topical Beta blockers- bradycardia,
  - Carbonic Anhydrase inhibitors- malaise, anorexia, weight loss.
- Analgesics:
  - Meperidine- delirium and seizures,
  - NSAIDs (Indomethacin)- confusion, worsen hypertension
- Thiazides- Increase gout flares
- Cold remedies (anticholinergic) - confusion, impair bladder emptying.
- Antiemetics (Prochlorperazine, Metoclopramide)- drug induced Parkinsonism.

Q: A 67-year-old man PVD and venous insufficiency, presents with a painful right lower-extremity ulcer. It is weeping, shallow, red-based, with a moderate serosanguinous exudate above the right medial malleolus, with no surrounding erythema or warmth. Bilateral symmetric 2-mm pitting pretibial edema and hyperpigmentation of the anterior shins are also noted. His lower legs and feet are hairless, and the pedal pulses are not palpable. The ankle-brachial index on the right is 0.7. What is the most appropriate treatment for this patient's condition?
A. occlusive hydrocolloid dressing  
B. start antibiotics  
C. give Lasix  
D. elastic compression stockings

Weight Loss & Malnutrition
- Unintended weight loss exceeding 5% in 1 month or 10% in 6 months deserves evaluation.
- Causes:
  - Medical: CHF, dementia, oral problems, dysphagia, mesenteric ischemia, cancer, diabetes, hyperthyroidism.
  - Psychosocial: Alcoholism, Depression, social isolation, limited funds, problems with shopping or food preparation, inadequate assistance with feeding.
  - Drug related: NSAIDs, Antiepileptics, Digoxin, SSRIs.
- Work-up: CBC, Lytes, UA, CXR to rule out occult metabolic or neoplastic cause.
- Megestrol Acetate has not been shown to help in the elderly.

Q: An 80-year-old woman is evaluated for a 8 lb weight loss over the past 5 months. Her mood is good and on depression screening she is 1/5 on Geriatric Depression scale. She shops by herself for groceries, but finds it difficult to do more often than once or twice per month. She denies anorexia, abdominal pain, and change in bowel habits, is negative. Recent screening for breast and cervical cancer has been normal. Vitals are normal. Labs are normal including fecal occult blood test. What is the most appropriate next step in the management of this patient?
A: ________________________________
Pressure Ulcers:

**Stage 1.** The skin is intact, but there is evidence of pressure changes, including changes in temperature, consistency, or sensation.

**Stage 2.** The wound is superficial, with partial-thickness skin loss involving the epidermis or dermis.

**Stage 3.** There is full-thickness skin loss extending to the subcutaneous tissue.

**Stage 4.** There is extensive destruction, including to the muscle, bone, or supporting structures.

- **Prevention:**
  - Good nursing care, maintenance of skin hygiene, and nutrition.
  - Water filled mattresses, rubber pillows, alternating-pressure mattresses, and thick papillated foam pads.

- **Treatment:**
  - Early lesions: topical antibiotic powders and adhesive absorbent bandages. Once clean hydrocolloid dressing- Duoderm, can be used.
  - Late lesions: surgery for debridement, cleansing and dressing.
  - In general topical antiseptics are not recommended, although systemic antibiotics are required for deep infections.

**Remember:** The best approach to geriatric pt population is a multidisciplinary approach utilizing multiple healthcare workers, in many different fields to give the pt the best possible treatment.

**Pain Management**

**Nonopioid Analgesics**

**Differ from Opioids:**

- There is a ceiling effect to analgesia.
- They do not produce tolerance or physical or psychological dependence.
- They are antipyretic.

**Aspirin**

- Side effects: Gastric disturbances and bleeding.
- **DO NOT GIVE TO CHILDREN UNDER 12 YO WHO HAVE A VIRAL ILLNESS SUCH AS VARICELLA -> REYE’S SYNDROME.**
- Hypersensitivity can present as a respiratory reaction with rhinitis, asthma or nasal polyps or urticaria, wheals, angioedema, hypotension, shock and syncope within minutes of ingestion.

**Acetaminophen**

- Similar to Aspirin in its analgesic and antipyretic potency without antiplatelet effects.
- Recommend dose: 4,000 mg/day, OD- hepatic necrosis.
Patients with chronic alcoholism and liver disease or patients who are fasting can develop severe hepatotoxicity even at usual therapeutic doses.

**NSAIDs**

- Analgesic, inhibits both COX1 and COX2.
- **Heme effects**: contrast to Aspirin has reversible inhibition, platelet aggregation lasts only as long as there is an effective drug serum concentration.
- **GI effects**: Patients on steroids or anticoagulation or SSRI (Selective serotonin reuptake inhibitor), with previous h/o ulcers and advanced age are at greatest risk for: ulcerations, bleeding and perforation.
- **Protection**: misoprostol, Proton pump inhibitor, H2 blocker.

Selective COX2 inhibitors have been developed to avoid GI effects, however they have been found to increase the risk for thrombosis, MI, CVA.

- **Renal effects**: decreased synthesis of renal vasodilator prostaglandins, interstitial nephritis, impaired renin secretion, and enhanced tubular water sodium reabsorption.
- **CNS effects**: decreased attention span, loss of short term memory, headache.

**Q:** Pt on selective COX-2 inhibitor, going for surgery, should they stop this medication prior to surgery?

**A:**

**Opioid Analgesics**

- There is no ceiling dose.
- Administer analgesics regularly (not only prn) if pain is present most of the day.
- First establish optimal dose by using short acting drugs such as Morphine Immediate Release (MSIR).
- Once you know how much total morphine is required in 24 hours. Patient can be started on long acting morphine {Morphine Sustained release (MS Contin, Oramorph-SR), Oxycodone (Oxycontin)} twice a day along with PRN short acting morphine.
- Methadone or Levorphanol can also be used for pain management, they have long half life.

**Q:** Pt with cancer on opioids, has well controlled pain, comes to you for follow up. He’s worried that pain may worsen in future and he’s already taking a high dose of opioids. What will he do if pain worsens?

**A:**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Adults-start oral (mg)</th>
<th>ORAL – equiv (mg)</th>
<th>IV- equiv (mg)</th>
</tr>
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<tbody>
<tr>
<td>Codeine</td>
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</tr>
<tr>
<td>Oxycodone</td>
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<td></td>
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<tr>
<td>Meperidine</td>
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</tr>
<tr>
<td>Hydrocodone</td>
<td>5-10</td>
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<td></td>
</tr>
<tr>
<td>Tramadol</td>
<td>50-100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Morphine
- Dose: 15-30 mg
- Conversion: 30 mg
- Metabolism: 10 mg

### Hydroxydorphone
- Dose: 4-8 mg
- Conversion: 7.5 mg
- Metabolism: 1.5 mg

### Oxycodone
- Dose: 15-30 mg
- Conversion: 20 mg

### Methadone
- Acute: 5-10 mg
- Chronic: 20 mg
- Conversion: 20 acute, 10 chronic

### Fentanyl
- Dose: 0.1 mg

### Oxymorphone
- Dose: 1 mg

### Meperidine
- Dose: 300 mg
- Conversion: 75 mg

### Nalbuphine
- Dose: 10 mg

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**Side Effects**

- **Sedation:** Decrease the dose; if pain is not controlled add non-opioid. In some patients we do regional nerve block for pain (e.g., Pancreatic cancer patient can get celiac plexus blockage).
- **Nausea:** If constipated first treat that. Otherwise use Metoclopramide especially if having postprandial nausea. If feels nauseous during movement can use Meclizine. Switching from oral to subcutaneous route is also helpful.
- **Constipation:** Prophylactic drugs used are: Docusate or Senna. Adequate hydration is also important.
- **Respiratory Depression:** Use Naloxone.

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**Q:** Pt with pancreatic cancer, pain is well controlled but says he’s feeling foggy and sleepy. What to do?
**A:** ___________________________________________________________________

**Q:** Pt with intra-abdominal cancer on opioids, pain is well controlled, comes to you c/o diffuse abdominal pain, mild distention, nausea x 2 wks. PE: mild diffuse tenderness. What is the cause and what is the next step?
**A:** ___________________________________________________________________

**Q:** Pt with severe pain on high dose morphine develops respiratory depression, Naloxone is given and pt wakes up, 1 hour later pt is unresponsive. What to do?
**A:** ___________________________________________________________________

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**Analgesic Adjuvants (AA)**

**Tricyclic Antidepressants**
- Amitriptyline, doxepin, imipramine, nortriptyline, desipramine.
- Used for Diabetic neuropathy, Post herpetic neuralgia, atypical facial pain, migraines.
- Typically lower doses for treating chronic pain then when used for depression.
- Contraindicated in coronary artery disease. Pretreatment need EKG.
- Anticholinergic effects: dry mouth, urinary retention, constipation.
Anticonvulsants
- Carbamazepine, Valproic acid, Phenytoin, Gabapentin, Clonazepam.
- May relieve lancinating pain, peripheral nerve syndromes such as trigeminal neuralgia, postherpetic neuralgia, posttraumatic neuralgia, diabetic neuropathy also used in migraine prophylaxis.

Adjuvants Worth Mentioning:
- Antihistamines: Hydroxyzine has analgesic, antiemetic and mild sedative activity.
- Benzodiazepines: Coanalgesia, reduce anxiety.
- Bisphosphonates: Reduce pain from osteolytic bone metastases.
- Capsaicin: Oral mucositis, post-mastectomy, post-herpetic neuralgia.
- Clonidine: Can be used as epidural administration for neuropathic pain.
- Corticosteroids: Coanalgesics when inflammation or vasogenic edema causes pain.
- Local anesthetics: Mucocutaneous and neuropathic pain like Oral mucositis, postherpetic neuralgia.

PCA, Patient Controlled Analgesia
- Technique for the administration of small doses of drug at the patient’s demand by utilizing a microprocessor-controlled infusion pump.
- It used for acute pain over chronic or relatively stable cancer pain.

Hospice
A program that provides special care for people who are near the end of life and for their families, either at home, in free standing hospice facility, inpatient hospital or skilled nursing facility. The goal of hospice is to provide quality of life, peace, comfort and dignity via medical, psychological, social and spiritual care. The care is NOT intended to cure the problem.

The hospice care has to be certified by the physician only NOT nurse practitioner or nurses.
1. The patient's condition is life limiting, and the patient and/or family have been informed of this determination.
2. The patient and/or family have elected treatment goals directed toward relief of symptoms, rather than cure of the underlying disease.
3. The patient has clinical progression of the primary disease and recent impaired nutritional status related to the terminal process.
4. In best judgment of the physician, patient would live no more than six month.

Benefits of Hospice Care:
- Comprehensive interdisciplinary care.
- Twenty-four hours per day, seven days per week access.
- Reduction in out-of-pocket expenses for medications, durable medical equipment, etc.
- A broad range of nursing, psychosocial, and pastoral care services.
- Coverage for all age groups.
Disadvantage of Hospice Care
- Any labs or radiological services are not re-imbursed by Medicare or HMOs during the hospice care.
- Hospitalizations are usually discouraged.
- Specific anticancer treatments, including participation in phase I clinical trials, are not allowed as they are considered life-prolonging.

Insurance and Medicare coverage:
- Most HMOs cover for hospice care.
- Patient above 65 or disabled (eligible for Medicare), are covered by Medicare. Physician has to certify that the illness is terminal. The first certification is valid for 90 days and after that physician certifies the patient for 60 days at a time for unlimited period.

Death
We think, patient is dead when he or she stops breathing and heart stops. But due to scientific success of modern medicine, we can keep the lungs and heart working for a long time on machine. So, now we need to know the brain death as well.

Brain death is the complete and irreversible loss of cerebral and brain stem function → USA in the presence of Core temperature ≥36.5°C or 97°F, systolic blood pressure ≥90 mmHg, and euvoletic state.

Brain death is complete and irreversible brain stem function → UK

Brain death can be determined after doing the following test
- Coma
- Absent motor response, including response to pain stimulus above the neck
- Absent pupillary light reflex; pupils are midposition or dilated (4 to 9 mm)
- Absent corneal reflexes
- Absent oculovestibular reflexes (caloric responses)
- Absent jaw jerk
- Absent gag reflex
- Absent cough with tracheal suctioning
- Absent sucking or rooting reflexes
- Apnea as demonstrated by apnea test (absence of respiratory movement to a PaCO2 >60 mmHg or 20 mmHg greater than baseline values for about 10 minutes)

Most states (40) in USA need one physician to certify death. Two states allow nurse practitioners to declare death, 8 states require 2 physicians to certify death.