283. The first medication given to all ACLS patients should be:
   a. Nitroglycerine
   b. Morphine
   c. Aspirin
   d. Oxygen

   ANSWER d. Oxygen. Note that the ABCD's should always be done first. The B includes
   providing ventilation and oxygen to all ACLS patients where it is available. Aspirin is
   important too, but it may be given at any time but only to suspected ischemic chest pain
   patients. The secondary ABCD's include IV and administration of medications. The ACLS 2000
   Manual says: "Oxygen is always appropriate for patients with acute cardiac disease or
   pulmonary distress...During cardiopulmonary emergencies use supplemental oxygen as soon
   as it is available....In patients with acute MI, supplemental oxygen reduces both magnitude and
   extent of ST-segment changes on the ECG." See: AHA, ACLS Provider Manual, chapter on
   "VF/Pulseless VT"

284. During ACLS certain drugs may be given down the ET tube. When most
   drugs are given by the endotracheal route you should __________ followed by several
   rapid bag inflations to aerosolize the medication.
   a. Half the dose and flush in with 20 mL D5W
   b. Half the dose and dilute in 10 mL of normal saline
   c. Double the dose and flush in with 20 mL D5W
   d. Double the dose and dilute in 10 mL of normal saline

   ANSWER d. Double the dose and dilute in 10 mL of normal saline or sterile saline.
   "If a tracheal tube has been placed before venous access is achieved, epinephrine, lidocaine, and
   atropine can be administered via the tracheal tube. Administer all tracheal medications at 2 to
   2.5 times the recommended IV dose, diluted in 10 mL of normal saline or distilled water.
   Tracheal absorption is greater with distilled water as diluent than with normal saline, but
   distilled water has a greater adverse effect on PaO2. Pass a catheter beyond the tip of the
   tracheal tube, stop chest compressions, spray the drug solution quickly down the tracheal tube,
   follow immediately with several quick insufflations to create a rapidly absorbed aerosol, then
   resume chest compressions." D5W is not recommended during resuscitation unless the patient
   is hypoglycemic.

286. This is the Vaughan Williams classification of antiarrhythmic drugs - Ia, Ib, Ic,
   II, III, and IV. Match the class with its action:
   I. Class I _______  a. Calcium channel blockers
   II. Class II. _______  b. Potassium channel blockers
   III. Class III. _______  c. Beta-1 channel blockers
   IV. Class IV. _______  d. Sodium channel blockers

   ANSWER
I. Class I. = d. Block fast Sodium channel (slow Na from entering cell during phase 0)
II. Class II. = c. Beta-1 channel blockers (block adrenergic sites) - most end in "-olol."
III. Class III. = b. Potassium channel blockers (prolong repolarization)
IV. Class IV. = a. Block slow Calcium channel.
Braunwald says: "the Vaughan Williams classification is widely known and provides a useful communication shorthand. It is listed here, but the reader is cautioned that the drug actions are more complex than those depicted by the classification."
See: Braunwald, chapter on "Management of Patients with Cardiac Arrhythmias"

289. Many drugs have antagonists that can counteract their action. Match the drug to its antagonist.
I. Heparin antagonist___________ a. Narcan
II. Demerol/morphine antagonist___________ b. Protamine
III. Midazolam (Versed) antagonist___________ c. Romazicon
IV. tPA antagonist___________ d. Amicar
V. Warfarin (Coumadin) antagonist___________ e. Vitamin K

ANSWER
I. Heparin antagonist = b. Protamine
II. Demerol/morphine antagonist = a. Narcan (Naloxone)
III. Midazolam (Versed) antagonist = c. Romazicon (Mazicon, flumazenil)
IV. Thrombolytic (tPA) antagonist = d. Aminocaproic Acid (Amicar)
V. Warfarin (Coumadin) antagonist = e. Vitamin K

Flumazenil (Romazicon) rapidly reverses the effects of Versed. It binds to benzodiazepine receptors in the CNS and block them. It may cause rapid withdrawal, which is shorter acting than the Versed itself - leading to delayed re-sedation. Side effects are panic attacks, seizures, cardiac ischemia and pulmonary edema. Narcan (naloxone) is an antagonist to opiate medications such as demerol, fentanyl, and morphine. However, it is shorter acting than the drug itself and may need to be redosed.

The thrombolytic (tPA) can be reversed with aminocaproic Acid (Amicar). Warfarin can be reversed with vitamin K or infusion of fresh frozen plasma. However, these two drugs do not completely reverse the primary drug effect.
Loebl, The Nurses Drug Handbook, Chapter on "Thrombolytic drugs"
Stimulation of different autonomic receptor sites causes specific hemodynamic effects. Match each receptor site to the hemodynamic effect it causes.

I. Alpha 1 _____
II. Beta 1 _____
III. Beta 2 _____
IV. Parasympathetic _____
   a. Dilate lung bronchioles
   b. Stimulate heart muscle & AV node
   c. Vasoconstrict vascular smooth muscle
      (peripheral arteriolar arterioles...)
   d. Slow heart rate and AV node conduction

ANSWER
I. Alpha 1 = c  Vasoconstrict vascular smooth muscle (peripheral arteriolar vasoconstriction...)
II. Beta 1 = b. Stimulate heart muscle & AV node (catecholamine effect))
III. Beta 2 = a. Dilate lung bronchioles (reverse bronchoconstriction in asthma)
IV. Parasympathetic = d. Slow heart rate and AV node conduction

Remember alpha (α) adrenergic as follows: the Greek letter (α) looks like a knot in a suture tied around a vessel - constricting it.

To remember the 2 types of Beta receptors say the acronym "We have one heart, two lungs". To remind us that Beta 1 (one heart) causes cardiac stimulation, and beta 2 (2 lungs) causes bronchial dilation and some vascular dilation of skeletal muscle. Stimulation of these receptors can come either from a sympathetic neural discharge or from circulating norepinephrine stimulating the heart. Thus, a total sympathetic discharge would prepare you for "fight or flight" by stimulating these receptors. These are important because the actions of many of the cardiac drugs effect these receptor site.

Over a wide range of arterial blood pressure (70 - 160 mmHg) the sympathetic and parasympathetic systems have opposite effects; sympathetic - speeds, parasympathetic - slows. Like your cars gas pedal (speeds) and brake (slows). When your reflexes tell you to stop, you remove your foot from the gas and hit the brake. In the same way, the sympathetic and parasympathetic systems provide a push/pull control.

See: Todd, CV Review Book Vol. I, Chapter on "Autonomic CNS"
298. Vasopressin has several advantages over Epinephrine in VF/pulseless VT. Circle the 3 advantages of vasopressin.

a. Increased alpha and beta stimulation
b. Reduced cardiac ischemia and irritability
c. More effective in Asystole and PEA
d. One-time dose simplifies administration
e. Reduced propensity for VF
f. Shorter half-life

ANSWER b, d, & e.

b. Reduced cardiac ischemia and irritability (Epi. should be given cautiously in MI because its beta effects makes the heart beat faster and harder, whipping the heart, which may lead to ischemia and irritability)
d. One-time dose simplifies administration (Yes, You can only give it once, whereas epi. must be given every 3-5 minutes)
e. Reduced propensity for VF (High catecholamine state may make the heart return to VF)

The 2000 ACLS manual says: "Vasopressin produces the same positive effects as epinephrine in terms of vasoconstriction and increasing the blood flow to the brain and heart during CPR. Moreover, vasopressin does not have the negative, adverse effects of epinephrine on the heart, such as increased ischemia and irritability and paradoxically, the propensity for VF....

Vasopressin is not recommended for asystole and PEA at this time simply because its value in the treatment of these cardiac arrest rhythms has not yet been documented in human trials. Give vasopressin as a single, 1-time dose (40 u IV) a regimen based on the much longer half-life of vasopressin (10 to 20 minutes) compared with epinephrine (3 to 5 minutes). Higher epinephrine doses may contribute to return of spontaneous circulation, but they have also been associated with greater postresuscitation myocardial dysfunction, and they may create a "toxic hyperadrenergic state." Many hospitals give the vasopressin 1st and then start epi. and antiarrhythmics after 10 minutes when the vasopressin wears off.

See: AHA, ACLS Provider Manual, chapter on "VF/Pulseless VT"

303. Match the maximum dose of these antiarrhythmic medications.

I. Amiodarone _____________ a. 17 mg/Kg
II. Lidocaine ______________ b. 3 mg/Kg
III. Procainamide ____________ c. 2.2 g/24 hrs
IV. Atropine ________________ d. 0.03 mg/Kg (~2 mg)

ANSWER
I. Amiodarone = c. 2.2 g/24 hrs
II. Lidocaine = b. 3 mg/Kg
III. Procainamide = a. 17 mg/Kg
IV. Atropine = d. 0.03 mg/Kg (~2 mg) Note: the International consensus recommends a higher max. dose of 0.04 mg/k (~3 mg)

See: AHA, ACLS Provider Manual, chapter on "VF/Pulseless VT"
304. Antiarrhythmic meds have many side effects and special considerations. Match each major side effect/consideration with its medication.
I. Amiodarone _____________
II. Lidocaine _______________
III. Procainamide _____________
IV. MgSO4 _________________
V. Sodium Bicarbonate ______________
   a. CNS effects (numbness, tingling...)
   b. Don't shake ampule, Pulmonary Fibrosis
   c. Muscle paralysis, flush, sweating
   d. Do not mix with other meds
   e. Bradycardia, widens QRS, vasodilation, Lupus-like effects

ANSWER
I. Amiodarone = b. Don't shake ampule, Pulmonary Fibrosis
II. Lidocaine = a. CNS effects (numbness, tingling...)
III. Procainamide = e. Bradycardia, widens QRS, vasodilation, Lupus-like effects
IV. MgSO4 = c. Muscle paralysis, flush, sweating
V. Sodium Bicarbonate = d. Do not mix with other meds
See: AHA, ACLS Provider Manual, chapter on "VF/Pulseless VT"

308. In SVT if the initial dose of adenosine is ineffective after 2 minutes administer:
   a. DC cardioversion
   b. Transcutaneous pacing
   c. 6 mg adenosine rapid IV push x2
   d. 12 mg adenosine rapid IV push x2

ANSWER d. 12 mg adenosine rapid IV push x2. Opie says about adenosine: "The drug is given as an initial rapid intravenous bolus ... followed by a saline flush to obtain high concentrations in the heart. If it does not work within 1 to 2 minutes, a 12 mg bolus is given that may be repeated..." twice for a maximum of 30 mg.
See: Opie, Drugs for the Heart, Chapter on Antiarrhythmic Agents.

317. What concentration of Lidocaine would result from 1 gram being mixed with 250 ml saline?
   a. 2.5 mg/ml
   b. 4.0 mg/ml
   c. 25. mg/ml
   d. 40.0 mg/ml
ANSWER b. 4.0 mg/ml. Here you simply plug in the numbers and change grams into mg.
= 1 gm/250 ml = 1000 mg/250 ml = 4 mg/ml.

Concentration by unit cancellation:

<table>
<thead>
<tr>
<th>1 gm</th>
<th>1000 mg</th>
<th>==1000</th>
<th>== 4 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 ml</td>
<td></td>
<td>250</td>
<td>ml</td>
</tr>
</tbody>
</table>

See: Craig, Clinical Calculations Made Easy, Chapter on "Solving Problems Using Dimensional Analysis"

320. Side effects of procainamide indicating that it should be discontinued or the dosage reduced include: (Circle 3 answers below)
a. Hypotension
b. Tachycardia
c. QRS widens by > 50%
d. Decreases contractility
e. PVCs

ANSWER a. hypotension , c. QRS widens by > 50% , d. Decreases contractility.
ACLS 2000 guidelines say: "Procainamide hydrochloride suppresses both atrial and ventricular arrhythmias... Procainamide hydrochloride may be given in an infusion of 20 mg/min until the arrhythmia is suppressed, hypotension ensues, the QRS complex is prolonged by 50% from its original duration, or a total of 17 mg/kg (1.2 g for a 70-kg patient) of the drug has been given."
See: AHA Guidelines 2000...Consensus on Science. Supplement to Circulation Vol. 102, #8 Aug 22, 2000 chapter on "Pharmacology I"

327. Which vitamin is necessary for the formation of clotting factors?
a. Vitamin A
b. Vitamin C
c. Vitamin D
d. Vitamin K

ANSWER d. Vitamin K. Guyton says, "Vitamin K is required . . . for normal formation of prothrombin as well as four other clotting factors . . . Therefore, the lack of vitamin K can decrease the prothrombin level so low that a bleeding tendency results." An important long term anticoagulant coumadin functions by inhibiting vitamin K. Administration of vitamin K reverses this anticoagulant effect.
See: Guyton, chapter on "Hemostasis and Blood Coagulation"
Keywords: vitamin K, coumadin
336. At the beginning of a diagnostic coronary arteriogram procedure a patient was given 5000 units of IV heparin. Before you pull the sheath the physician wants you to neutralize 4000 units of heparin. What medication and dosage should be given to reverse 4000 units of heparin?

a. 2 cc of Protamine (100 micrograms/cc) IV push
b. 4 cc of Protamine (10 mg/cc) slowly over 5 minutes
c. 2 cc of Amicar (100 micrograms/cc) IV push
d. 4 cc of Amicar (10 mg/cc) slowly over 5 minutes

ANSWER b. 4 cc of Protamine 10 mg/cc slowly over 5 minutes. Grossman recommends 10 mg (1.0 cc) of Protamine to counteract every 1000 units of heparin. It's easy to remember because they react 1:1 by volume, or 1000µ:10 mg, by dosage. If the concentrations are standard (1000 units heparin = 1 cc and 10 mg Protamine = 1 cc), then each 1 cc of protamine counteracts each 1 cc of heparin.

Grossman says: "If systemic heparinization is used, its effects must be reversed at the termination of the left heart catheterization and associated angiography. This is usually accomplished by the administration of protamine (1 mL = 10 mg of protamine for every 1,000 IU of heparin) . . . . When giving protamine, administer it slowly (over 5 minutes), since more rapid administration can provoke severe back pain of unknown etiology."

See: Grossman, Chapter on "Percutaneous Approach."

294. To mix an epinephrine drip at a concentration of 4 micrograms/ml put ____ mg. of epinephrine into 250 ml. (Use Concentration = amount/volume)

a. 1
b. 2
c. 4
d. 8

ANSWER a. 1 mg. \(X/250 \text{ ml} = 4 \text{ micro gm/ml} \)
\[X = (250 \text{ ml})(4 \text{ micro gm/ml}) = 1000 \text{ microgram} = 1 \text{ mg}\]

In the unit drug dosing system 1 mg of epi comes in the "unit" vial (E.g.: 1 mg/10 ml syringe). When the entire vial is added to 250 ml a standard concentration results.
See: ACLS Manual
Keywords: epinephrine concentration