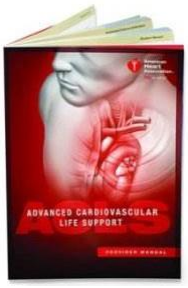
Prior to the class please:

- Check out and review the Course Manual.
- **Complete your BLS Heart Code Online Portion**.
    - **Internal Employees** in Sanford Success Center on your Active Transcript you will find course pa-4703 BLS Certification. Click on **Manage**, select HeartCode, Launch cc-6308. Bring the AHA certificate to class. If you have issues finding pa-4703, please contact your manager.
    - External participants can purchase the Heart Code BLS Online at https://shopcpr.heart.org/courses/bls, bring the certificate to class.
    - External participants, if you do not plan to renew your BLS certification, please provide a copy of your current BLS card.
    - Complete the online course and course evaluations
    - **Print and bring the online course completion certificate to class**.

- Adult and Pediatric BSL skills will be practiced during the course to verify and renew your BLS Certification. (Only if BLS online course completed)
- Review the EKG rhythm strips, ACLS core medications, and Benefits of Waveform Capnography information attached.
- Complete the **ACLS Pre-course self-assessment**, which can be accessed at https://elearning.heart.org/course/423. The pre-test can be completed as many times as necessary until a score of at least 70% is achieved.
- Print the self-assessment **Certificate of Completion** and bring it to class. Cards will not be issued if the self-assessment Certificate is not provided to the instructor.
- Participants attending the **Initial or Renewal** course should check out the 2020 ACLS Student Manual. This can be obtained by filling out a course book request form and picking it up at **EMS Education at 3451 N 14th Street**, Monday-Friday 0900-1200 and 1300-1600.
- **Print the Course Information as it contains the EKG Review and medication overview that can be used during the written examination.**

Course Manual for ACLS



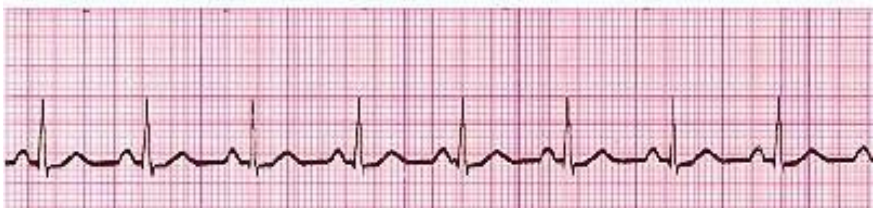
Public participants and Sanford employees can check out the course manual from Sanford Health EMS Education at 3451 N 145H ST, Suite D, Bismarck, ND 58503. Entrance is on North Side of building, Door D.

EMS Education is staffed 0900-1200 and 1300-1600 Monday-Friday.

Your class is located at Sanford EMS Education at 3451 N 14th Street Suite D, Bismarck, ND 58503. Enter through EMS Education Enterence on north side of building.

If you have any questions, please contact the EMS Education department at (701) 323-6075.

EKG REVIEW



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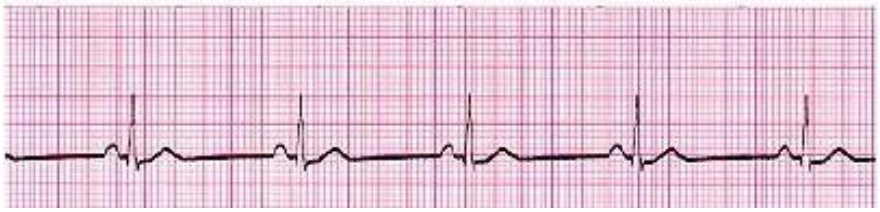

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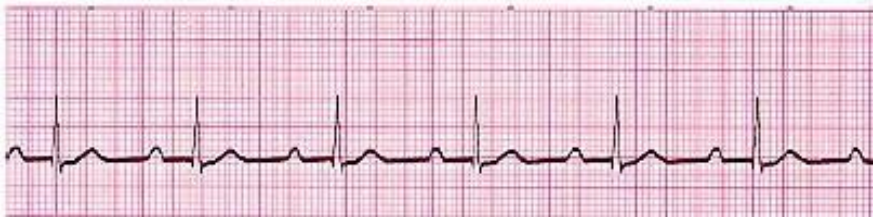

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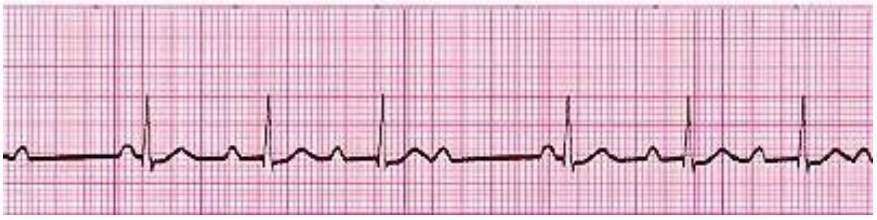

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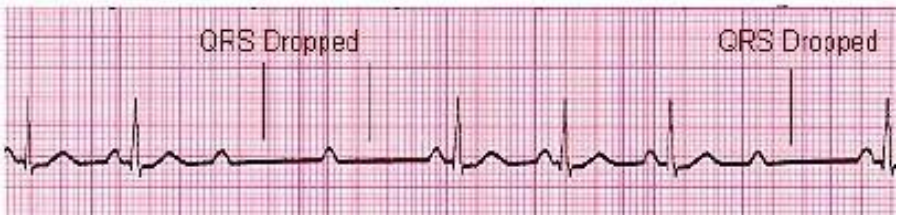

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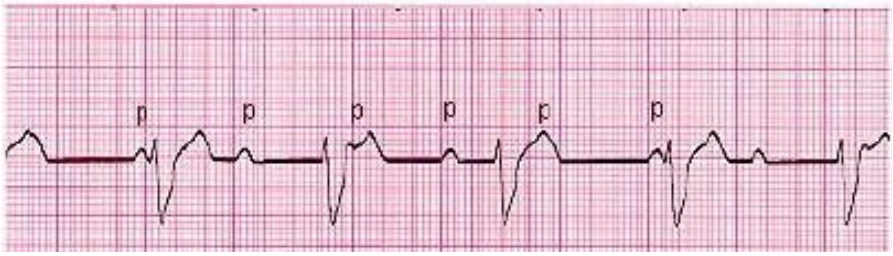

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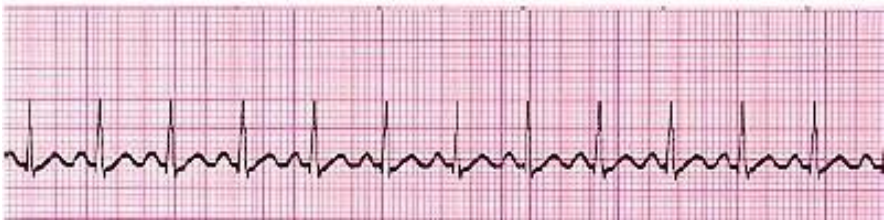

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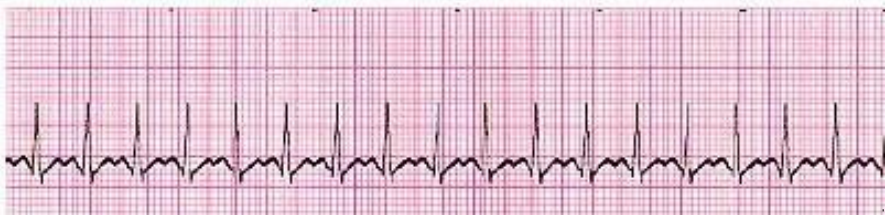

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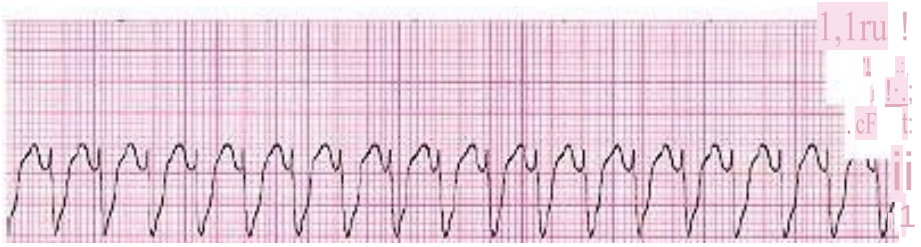

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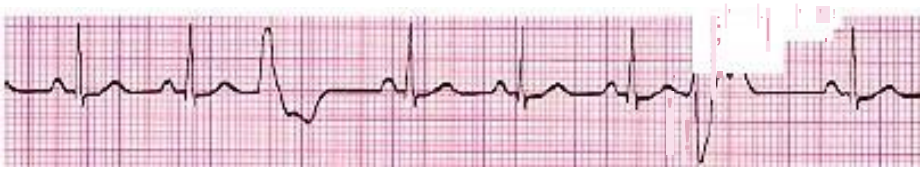

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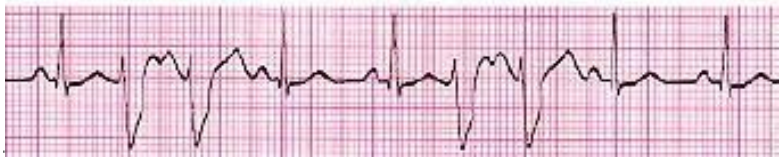

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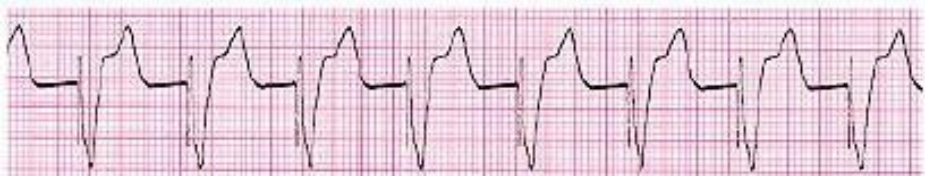

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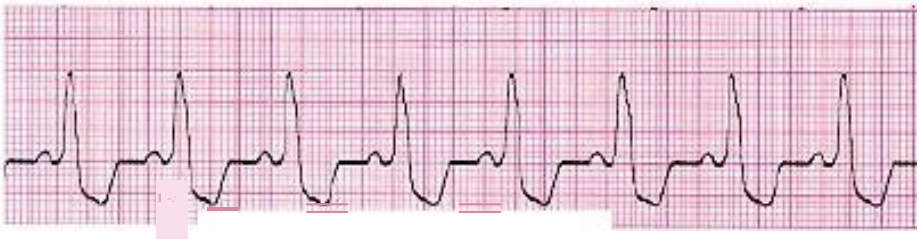

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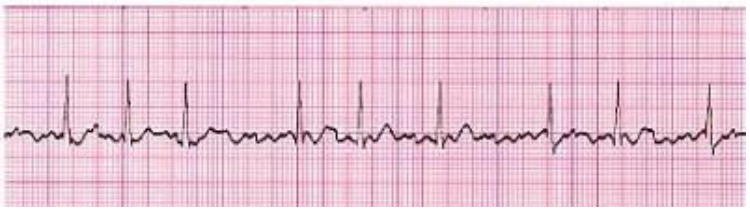

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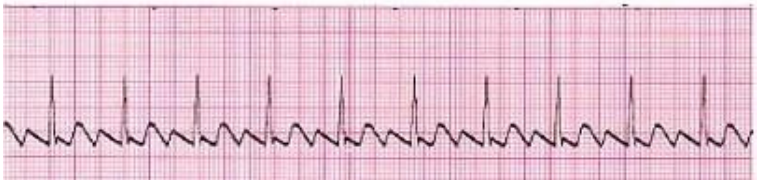

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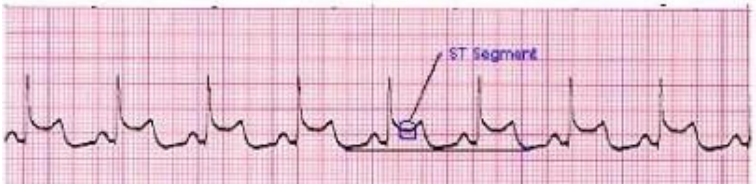

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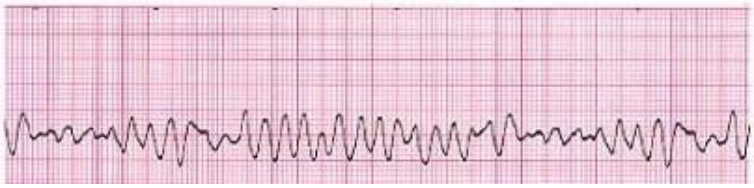

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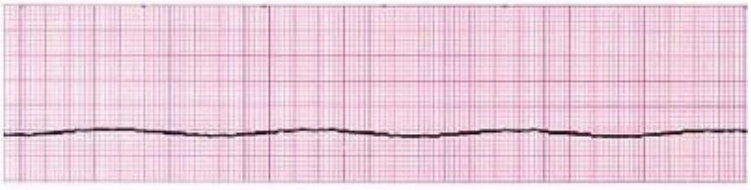

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EKG Review Answer Key

1. Normal sinus Rhythm
2. Sinus Bradycardia
3. 1" Degree AV Block
4. 2nd Degree Block Type 1 (Wenchebach)
5. 2nd Degree Block Type 2
6. 3'" Degree AV Block
7. Sinus Tachycardia
8. Supra Ventricular Tachycardia
9. Ventricular Tachycardia
10. Multi-Focal PVC's
11. Coupled Uni-Focal PVC's
12. Paced Rhythm
13. Bundle Branch Block
14. Atrial Fibrillation
15. Atrial Flutter
16. STEMI
17. Ventricular Fibrillation (VF)
18. Asystole

Epinephrine-vasopressor-use for: VF/Pulseless VT; Asystole/PEA; Symptomatic Bradycardia

- Increases heart rate
- Increases force of contraction
- Increases conduction velocity
- Peripheral vasoconstriction
- Bronchial dilation

1 mg (10ml) 1:10,000 IV/IO push; may repeat every 3 to 5 minutes

Vasopressin – vasopressor – may be used to replace first or second dose of Epinephrine for VF/Pulseless VT, Asystole/PEA

- Vasoconstrictor
- Improves perfusion of heart, lungs, brain

One dose of 40 units IV/IO push.

Amiodarone – antiarrhythmic - use for: VF/Pulseless VT (unresponsive to shock, CPR and vasopressor); recurrent, hemodynamically unstable VT

- Powerful antiarrhythmic (substantial toxicity potential)
- Affects sodium and potassium

300 mg IV/IO push; second dose 150 mg IV/IO push

For stable VT with a pulse use: 150 mg IV/IO push

Lidocaine – antiarrhythmic – alternative to Amiodarone for: VF/Pulseless VT

- Depresses automaticity
- Depresses excitability
- Raises ventricular fibrillation threshold
- Decreases ventricular irritability

1-1.5 mg/kg IV/IO; repeat if indicated at 0.5 to 0.75 mg/kg IV/IO over 5-10 minute intervals to a maximum of 3 mg/kg.

Magnesium Sulfate – use to terminate or prevent recurrent VT associated with Torsade de Pointes; Refractory VF; VF with history of alcoholism

- Correct hypomagnesemia state
- Correct ventricular arrhythmias due to digitalis toxicity, tricyclic-anti depressant overdose

1 to 2g (2 to 4 ml of a 50% solution) diluted to 10 ml D5W IV push

Adenosine – use when vagal maneuvers fail to terminate: stable narrow complex SVT; regular monomorphic wide complex tachycardia

- Interrupts reentry (SVT causing) pathways through the AV node to restore sinus rhythm in patients with SVT

6 mg RAPID IV push. If no conversion after 1-2 minutes administer **second dose 12 mg RAPID IV push**

Consider β blocker or calcium channel blocker

Atropine – use for: **Bradycardia**

- Increases heart rate

1.0 mg IV bolus; repeat every 3-5 minutes; maximum 3 mg. (note: May not be effective for Patient's with transplanted hearts or AV Blocks.)

ACLS Core Medication Overview

Epinephrine is a naturally occurring catecholamine that works on four major receptors found on cells in certain organ systems i.e. heart, lungs and arteries. The four major receptors are alpha-1, alpha-2, beta-1 and beta-2. These receptors cause the body to prepare for "fight or flight" (Imagine a mugger jumping out of the bushes). When alpha- 1 is stimulated, arteries constrict, veins dilate, eyes dilate, hairs erect, nose dries up, and sweat is released. When alpha-2 is stimulated veins constrict, gut relaxes, insulin decreases, and other alpha-1 functions reverse. Beta-1 activation causing an increased heart rate, automaticity, force of heart contraction, salt and water reuptake in the kidneys, and fat lipolysis. Beta-2 activation causes more blood supply to the muscles, bronchodilation in the lungs, and stops bladder contraction. The benefits of epinephrine during a cardiac arrest are the beta-1 and alpha-1 stimulation. Epinephrine is the first line medication in all pulseless arrest algorithms.

Atropine

Atropine is used in the treatment of symptomatic bradycardia. Atropine works to block the uptake of acetylcholine at the end organ on the parasympathetic side of the autonomic nervous system. The standard dose is 1.0 mg IV push, with a maximum dose of 3mg.

Amiodarone

Amiodarone is categorized as a class III antiarrhythmic, and prolongs phase 3 of the cardiac action potential. It has numerous other effects however, including actions similar to those of antiarrhythmic classes 1a, II, and IV.
Amiodarone shows beta blocker like and potassium channel blocker-like actions on the AV node, increasing the refractory period via sodium- and potassium-channel effects, and slows intra-cardiac conduction of the cardiac action potential, via sodium-channel effects. Amiodarone is the first line medication for stable Ventricular Tachycardia as well as being the first line antiarrhythmic agent in the pulseless V-Fib V-Tach algorithm. The stable V-Tach dosage is 150mg, given over a 10 minute period of time. The pulseless dosage is 300mg initially, repeated at 150mg if necessary. 450mg is the maximum IV dosage.

Adenosine

Adenosine slows conduction time through the A-V node, it can interrupt the re-entry pathways through the A-V node, and it can restore normal sinus rhythm in patients with supraventricular tachycardia, including PSVT associated with Wolff-Parkinson-White Syndrome. Adenosine usually has no systemic hemodynamic effects. Because of the rapid half-life of Adenosine, is given as a rapid IV bolus with a 20ml flush. The dose of 6mg initially can be repeated once if necessary at 12mg.

Dopamine

Dopamine, much like Epinephrine, is a naturally occurring catecholamine. Dopamine however, affects the central nervous system differently; depending on the dosage it is administered. At lower doses, Dopamine has increased inotropic effects. At higher doses, Dopamine will increase both inotropy and chronotropy. For patients that present with cardiogenic shock, the dose should be 2-5mcg/kg/min. For patients with symptomatic bradycardia (resistant to Atropine), Dopamine at 5-1O mcg/kg/min should be considered as an equally effective alternative to TCP. Based on the above information, the standard dose range for Dopamine is 2-10mcg/kg/min.

Benefits of Waveform Capnography and ETC02 Monitoring

Recently completed research has shown that there are many benefits from Waveform Capnography and End Tidal CO2 monitoring. The following is a very brief description of just a few of these benefits.

Confirmation and monitoring of correct ETT placement

Waveform Capnography should be used to confirm and monitor enctotracheal tube placement for the purpose of reducing the risk of unrecognized tube misplacement or displacement. Studies on waveform Capnography have shown *100% sensitivity* and *100% specificity* in identifying correct endotracheal tube placement.

Following Endotracheal Intubation, the presence of a waveform indicates correct tube placement. Conversely, a flat waveform indicates an esophageal intubation.

Colorimetric ETC0 2 devices (Easy-Cap) should only be used when waveform Capnography is not available. This device has several drawbacks when compared to waveform Capnography. It is not continuous, has no waveform, no number, no alarms, and is easily contaminated.

Capnography versus Pulse Oximetry

While Capnography and Pulse Oximetry may seem similar, they are quite different. Capnography is a measurement of ventilation and, indirectly, circulatory and metabolic status. Pulse oximetry measures the color of the hemoglobin molecule and then uses mathematic algorithms to estimate the percentage of hemoglobin saturation. One of the primary issues with pulse oximetry is that there can be significant delays when measuring 02 saturation at the finger, compared to W1lat is happening centrally, at the core. When a patient becomes apneic, it can take up to several minutes for the pulse oximetry value to reflect this. Capnography on the other hand, instantly detects that a patient has stopped breathing.

Circulation and Metabolism

While Capnography is a direct measurement of a patient's ventilatory status, it also indirectly measures metabolism and circulation. For example, an increase in metabolism will increase production of lactic acid, which converts to CO2 in the lungs, thereby increasing the ETC02. A decrease in cardiac output will lower the delivery of lactic acid to the lungs, decreasing the ETC02.

Measuring Cardiac Output during CPR

With the new American Heart Association Guidelines calling for high quality compressions (push hard and fast), rescuers should switch places every 2 minutes. Set the monitor up so that the compressor can view the ETCO2 readings as well as the waveform generated by their Compressions. Encourage them to keep the ETCO2 number as high as possible. Effective compressions should produce an ETCO2 value of at least 10. *If the value is less than 10, you should first confirm that the compressions are "hard and fast*

Note: Patients with extended down times may have ETCO2 readings so low that even with quality compressions, there is little to no change in the reading

Return of Spontaneous Circulation (ROSC)

ETCO2 values can be the first sign of a return of spontaneous circulation (ROSC) during a cardiac arrest, if you see the CO2 number suddenly spike upward, you should stop CPR and check for pulses. ETCO2 values will often elevate well beyond normal levels following ROSC, this is due to CO2 "washout". With ROSC the CO2 that has developed in the peripheries suddenly returns to the lungs, increasing the ETCO2. Following a few minutes of effective ventilations, the ETCO2 should settle into the normal range of 35-45 mm/Hg. *A target range of 35-40 mm/Hg is desirable.*

Terminating the Resuscitation

End tidal CO2 monitoring can also confirm the futility of resuscitation as well as forecast the likelihood of resuscitation.

Multiple studies have shown that of the patients who maintained an ETCO2value of 10 mm/Hg or less while receiving 20 minutes of quality CPR and ACLS care, none of those patients survived.

Conversely, in one study, all 35 patients in whom spontaneous circulation was restored the ETCO2 had risen to at least 18 mm/Hg prior to the ROSC.