2017 ANNUAL CE REVIEW

MCHENRY WESTERN LAKE COUNTY EMS
SUMMER 2017
TOPICS FOR REVIEW:

• EKG
  • Basics
  • Interpretation

• Respiratory
  • Capnography
  • Asthma vs. COPD
  • CPAP use

• Changing Philosophies with CPR
  • Pit Crew CPR
  • Dual Monitor Sequential Defibrillation
  • Changes to CPR for FF in gear
EKG
ECG LEAD PLACEMENT

• “Limb Leads”
  • If 3 Leads (RA, LA, LL)
  • If 4 Leads (RA, LA, LL, RL)

• RA is ground for all leads (Including the 12 leads)

• If there is excess artifact or difficulty with the display
  • Replace the RA Lead with a fresh sticker

• Place Leads on muscle, not over bone
THE ECG PAPER

- **Horizontally (Time)**
  - One small box - 0.04 sec
  - One large box - 0.20 sec

- **Vertically (Voltage)**
  - One large box - 0.5 mV
PACEMAKERS OF THE HEART

- **SA Node** - Dominant pacemaker with an intrinsic rate of 60 - 100 beats/minute.

- **AV Node** - Back-up pacemaker with an intrinsic rate of 40 - 60 beats/minute.

- **Ventricular cells** - Back-up pacemaker with an intrinsic rate of 20 - 45 bpm.

Remember: - An accelerated interpretation is usually faster than the intrinsic rate
  - Tachycardia is usually faster than 100 bpm
IMPULSE CONDUCTION & THE ECG

- Sinoatrial node
- AV node
- Bundle of His
- Bundle Branches
- Purkinje fibers
THE “PQRST”

- **P wave** - Atrial depolarization
- **QRS** - Ventricular depolarization
- **T wave** - Ventricular repolarization

The Atria repolarizes at the same time that the Ventracles depolarize.
RHYTHM ANALYSIS

Step 1: Calculate rate.
Step 2: Determine regularity.
Step 3: Assess the P waves.
Step 4: Determine PR interval.
Step 5: Determine QRS duration.
### NORMAL SINUS RHYTHM (NSR)

- **Rate**: 60 - 100 bpm
- **Regularity**: Regular
- **P waves**: Before each QRS Complex
- **PR interval**: 0.12 - 0.20 sec
- **QRS duration**: 0.04 - 0.12 sec

(These are the normal that all interpretation variations are based on)
SINUS RHYTHMS:
RATE IS BIGGEST CHANGE

- **Sinus Tachycardia**: rate over 100 bpm

- **Sinus Bradycardia**: rate under 60 bpm

- **Sinus Arrhythmia**: common in Peds – changes w/respirations
ATRIAL RHYTHMS

- **Wandering Atrial Pacemaker**: irregular rate, below 60 bpm, P wave can change from beat to beat or may disappear completely.

- **Atrial Tachycardia**: rate over 100 bpm, no P wave.
• **Atrial Flutter**: Ventricular Rate-normal, Atrial Rate-250-320 bpm, multiple P (flutter) waves per each QRS Complex

• **Atrial Fibrillation**: Atrial Rate – can’t be counted, Ventricular Rate – varies, “irregularly irregular”
JUNCTIONAL RHYTHMS

- **Junctional Escape**: rate 40-60 bpm, p-wave inverted or flat, PR interval <0.12 - if before the QRS Complex

- **Junctional Bradycardia**: rate <40/bpm, p-wave inverted or flat, PR interval <0.12 - if before the QRS Complex
JUNCTIONAL RHYTHMS

- **Accelerated Junctional**: rate 60-100 bpm, p-wave inverted or flat, PR interval <0.12 - if before the QRS Complex

- **Junctional Tachycardia**: rate <100 bpm, p-wave inverted or flat, PR interval <0.12 - if before the QRS Complex
SUPRAVENTRICULAR TACHYCARDIA (SVT)

- **SVT**: rate > 150 bpm, unable to read p-wave, normal QRS Complex
• **10 HB + Underlying Rhythm:** Prolonged conduction delay in the AV node or Bundle of HIS, PRI will be greater than 0.20. There will be one P wave in front of every QRS Complex.

The underlying rhythm is part of the interpretation.
BLOCKS

- **2° Type I – Wenkebach**: Atrial Rate – normal, Ventricular Rate – Bradycardic, P waves normal, PR interval progressively longer until the QRS is blocked – then recaptures

![EKG Image]

- **2° Type II – Classical**: Atrial Rate – normal, Ventricular Rate – Bradycardic, P waves in a ratio to QRS), PRI normal or prolonged when followed by a QRS Complex (PRI will be the same when present)

![EKG Image]

(P wave conduction is blocked in a consistent repeating pattern)
BLOCKS

- **30° degree HB**: Atrial Rate – normal, Ventricular Rate – Bradycardic, regular from P to P or QRS to QRS, P waves are unrelated to QRS Complex, QRS duration is slower than 0.12 seconds

(The P waves are completely blocked in the AV junction; QRS complexes originate independently from below the AV junction.)
ECTOPIC BEATS

- **Premature Atrial Contraction (PAC):** Excitation of an atrial cell forms an impulse that is then conducted normally through the AV node and ventricles.

- **Premature Junctional Contraction (PJC):** Excitation of cells in the AV Node. A pause is dependent on if the SA Node is depolarized when the impulse occurs.
ECTOPIC BEATS

• *Premature Ventricular Contraction (PVC)*: Ectopic beats originate in the ventricles resulting in wide and bizarre QRS complexes

  • **Uni-focal**: single area of origin

  • **Multi-focal**: multiple area of origin
VENTRICULAR RHYTHMS

- **Wolf Parkinson White (WPW):** Congenital defect in conduction system, presence of an abnormal electrical pathway that can cause tachycardia. Episodes often begin occurring in teens and early 20’s
VENTRICULAR RHYTHMS

- **Run of V-Tach**: If 3 or more PVCs occur in a row then it is Ventricular Tachycardia

- **Ventricular Tachycardia (V-Tach)**: Verify Pulse or No Pulse, Rate between 100 - 250 bpm, QRS complexes can be bizarre, >0.12 seconds
VENTRICULAR RHYTHMS

- **Torsade de pointes**: Escape rhythm to prevent ventricular standstill, Bundle of HIS/Purkinje Fiber pacemaker takes over, Technically - V-Tach, but have to Defibrillate to convert.

  - Can be caused by mixture of antiarhythmic drugs, non-sedating antihistamines, anti fungal meds and certain antibiotics, Can be seen in alcoholic, anorexia and/or bulimic patients.
VENTRICULAR RHYTHMS

- **Ventricular Fibrillation (V-Fib):** No organized electrical activity, No cardiac output, Fires continuously from multiple foci, can be course or fine

- **Asystole:** Ventricular standstill, no electrical activity, no cardiac output
OTHER RHYTHMS

• **Idioventricular**: Escape rhythm to prevent ventricular standstill, HIS/Purkinje system takes over as the heart’s pacemaker, Regular, Rate 20-40 bpm, QRS: > 0.12 seconds (wide and bizarre)

• **Accelerated Idioventricular**: Escape rhythm to prevent ventricular standstill, HIS/Purkinje system takes over as the heart’s pacemaker, Regular, Rate 60-100 bpm, QRS: > 0.12 seconds (wide and bizarre)
OTHER RHYTHMS

- **Paced**: Man made mechanical pacing device, Rhythm: regular if continuous firing and irregular if pacing on demand, Rate: Based on what is programmed, P wave: dependent on where pacer is originating from, The only thing to identify is that it is a “Paced Rhythm”

- **PEA (Pulseless Electrical Activity)**: This is only electrical activity with no mechanical function
RESPIRATORY
BASIC DEFINITIONS

Apnea - absence of breathing
Dyspnea - abnormality of breathing rate, pattern or effort
Orthopnea - difficulty breathing while lying supine
Tachypnea - rapid respirations
Bradypnea - slow respirations
Hypercarbia - excessive levels of carbon dioxide in the blood
BASIC DEFINITIONS

- **Perfusion** - supply of oxygen and nutrients to the body’s tissue as a result of constant passage of blood through the capillaries.

- **Respiration** - exchange of gases between a living organism and its environment.

- **Ventilation** - rate that gases enter and leave the lungs.
  - **Minute Ventilation** - Total volume of gas entering lungs per minute.
  - **Alveolar Ventilation** - Volume of gas that reaches the alveoli.
**Autonomic Function (Why Do We Breathe)**

**Primary drive:** increase in arterial CO$_2$

(Hypercarbia) – need to get rid of excess CO$_2$

**Secondary drive:** decrease in arterial O$_2$

(Hypoxia) – need to get more O$_2$

**Hering – Breuer reflex:** a reflex triggered to prevent over-inflation of the lungs

- Pulmonary stretch receptors present in the smooth muscle of the airways response to excessive stretching of the lungs during large inspirations/expirations
CAPNOGRAPHY

END TIDAL CARBON DIOXIDE ($E_TCO_2$)
Blood must be moving in order to move CO₂ from the tissues to the alveoli.

Circulation requires:
- Blood
- An effective pump
- Adequate blood pressure

Preload plus afterload equals circulation/perfusion
MEASUREMENT OF CO$_2$ IN EACH EXHALATION REFLECTS:

• CO$_2$ is produced by metabolism

• CO$_2$ is transported by the circulatory system

• CO$_2$ is exhaled by the respiratory system
  • Better indicator for Pt. status
  • No CO$_2$ exhalation means patient is not breathing
  • Pulse Ox shows normal O$_2$ saturation up to 15 minutes after pt stops breathing
HOW IS $E_T CO_2$ MEASURED?

- **Capnometry** - Analysis only of the presence of Carbon Dioxide
  - Color change only

- **Capnography** - Continuous analysis and recording of Carbon Dioxide concentrations in respiratory gases
  - Waveforms and numeric values

- Normal Ventilation 35 – 45 mmHg

- Hypoventilation >45 mmHg
  - $\downarrow RR = \uparrow CO_2$

- Hyperventilation <35 mmHg
  - $\uparrow RR = \downarrow CO_2$
CAPNOGRAPHY WAVEFORMS

- Hypoventilation
  - $CO_2$ is retained so numeric values increase

- Hyperventilation
  - $CO_2$ is eliminated quicker so numeric values decrease
Asthma/COPD/Airway Obstruction

Difficulty exhaling evidenced by slow, gradual upslope – “Shark Fin”
CAPNOGRAPHY WAVEFORMS

- Apnea or loss of airway
  - Wave form to flat line

- Good CPR should be 15 – 20mm/hg
  - ROSC is indicated by a sudden/dramatic increase in EtCO₂

Sudden increase in EtCO₂

- Return of spontaneous circulation (ROSC)
ASTHMA VS COPD

ALL THAT WHEEZES IS NOT ASTHMA.....
COMPARISON OF ASTHMA AND COPD

- **Chronic obstructive pulmonary disease (COPD)**
  - General term that describes progressive respiratory diseases like *emphysema* and *chronic bronchitis*
  - Progressively worsening condition

- **Asthma**
  - Chronic condition that only affects the patient when a trigger activates it
SYMPTOMS OF ASTHMA/COPD:

- Bilateral Wheezing
  - Both lungs are affected
- Chest Tightness
- Shortness of Breath
- Cough

Both can be exacerbated by:
- viral infections
- exposure to tobacco/smoke
- pollutants (indoor and outdoor)
- occupational exposures
Asthma is a disease in which the airways become inflamed and irritable in response to an allergen. The body limits the exposure by:

- inflammation of the lower airways
- release of a sticky mucous

Usually diagnosed in childhood/adolescence
- Adult onset is rare
ASTHMA......
WHAT IS CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)?

• In COPD, the lungs become damaged following exposure to certain irritants
  • most common irritant - chronic smoking
  • chronic exposure causes damage
  • leads to airway obstruction & hyperinflation
  • commonly due to bacteria growth

• Usually diagnosed in Adulthood
  • Symptoms get progressively worse
COPD

Change to Alveoli structure
TREATMENT PHILOSOPHY:

• Asthma
  • attempt to lower or suppress inflammation

• COPD
  • reduce symptoms
    • Nothing can be done to reverse the damage
CPAP
CPAP: JUST A REMINDER ON HOW IT WORKS

- Maintains constant pressure within the airway and throughout the respiratory cycle
  - Keeps alveoli open and expanded
- Also decreases venous return to the heart thereby lessening the heart's work load
- In CHF, forces excess fluid out of alveoli & interstitial space back into the vasculature
- Can avert the need for advanced airway and mechanical ventilation if applied early enough
THIS IS HOW CPAP FEELS TO THE PATIENT!!
Indications

- Heart Failure - acute
- Asthma/COPD - severe
- Near Drowning - conscious
- Flail chest (w/o pneumothorax)

As long as there are no contraindications
CONTRAINDICATIONS

Airway
- Unable to obtain adequate seal
- Facial anomalies/injury

Breathing
- Inadequate respiratory effort
- Pneumothorax
- Penetrating chest trauma

Disability - Consciousness
- Decreased LOC
- Unable to follow commands

Circulation
- SBP <90 mmHg / DBP <60

GI
- Aspiration risk
- Gastric distention
- Vomiting

Pregnant
CPAP TIDBITS

• Be prepared to coach the patient through first few minutes of CPAP use

• Explain to them what you are doing
  • Patient is already frightened
  • Patient may feel suffocated by the mask
  • Exhaling against the resistance is tough at first

• Monitor B/P
  • B/P can drop with CPAP use
  • Reduce PEEP to bring B/P back up, don’t just remove
    • IF SBP < 90 with reduction in PEEP – then discontinue
FLOW SAFE II® CPAP

- CPAP Valve
- 02 Tubing
- PEEP Manometer
- Quick Release Clip
- Head adjustment straps
- Forehead adjustment
- Pop off Valve
QUICK GUIDE FOR LPM TO PEEP

- Yellow label displays $O_2$ flow with PEEP ranges
FLOW-SAFE II® CPAP DEVICE

PEEP depends on
- $O_2$ flow rate
- Face mask seal (no leaks)

Oxygen concentration depends on
- $O_2$ flow rate
- Respiratory rate
- Tidal volume
TITRATE PEEP TO PATIENT’S WORK OF BREATHING

• Start at 6 L which equals 2-3 cm H₂O PEEP

• Titrate up to positive patient response
  • decreased work of breathing

• Maximum PEEP 8 - 9 cm at 12 L O₂
**O₂ FLOW**

- Attach CPAP O₂ tubing to regulator/flow-meter
- Begin O₂ flow @ 6 L
- If needed, slowly increase O₂ to desired O₂ sat/PEEP (do not exceed 12 LPM)
UNDO 1 OR 2 OF THE QUICK RELEASE CLIP(S)
OPEN PACKAGE

• SECURELY CONNECT MASK TO VALVE/TUBING
HOLD, OR HAVE PT. HOLD, MASK SNUGGLY TO FACE...
GOOD FACE-MASK SEAL IS CRITICAL
TIGHTEN HEAD STRAPS USING VELCRO TABS
ADJUST FOREHEAD PAD FLAT ON FOREHEAD

Squeeze together and raise or lower to adjust

WRONG

RIGHT

Adjusted
Heart Failure SOP: If systolic B/P is 90 or above, give nitro every 3-5 minutes: unlimited

USE QUICK RELEASE TO ADMINISTER NITROGLYCERIN PER SOP
CAPNOGRAPHY CAN BE USED UNDER CPAP

CPAP with MWLC EMS Neb
USING IN-LINE NEBULIZER WITH CPAP……..

The patient needs a neb treatment……..

CONNECT NEBULIZER BETWEEN CPAP VALVE & MASK
ADAPTORS

• Some nebulizers may require an adaptor
  • same adapter used for in-line nebs
• You will need this for Good Shepherd nebulizers

22 ml adaptor
NO-ADAPTOR

• This will also work:

• Make sure the Nebulizer stays upright
• Document the oxygen flow rate

• Document the PEEP reading on the manometer
  • Remember to use the manometer reading when patient exhales
  • This can be documented in your narrative
PIT CREW CPR

CLEARLY DEFINED ROLES BASED ON POSITION AROUND THE PATIENT
GOAL OF CPR

Ultimate Goal:
To have patient discharged from the hospital, neurologically intact

• The main purpose of CPR is to keep oxygen rich blood flowing to the brain and other vital organs

• CPR gives the patient time for the ultimate goal to be achieved
AHA HAS IDENTIFIED.......

• Health Care providers (all aspects) are taking long breaks in CPR (for a lot of different reasons)
  
  • Effective/Continuous compressions are showing greatest change to patient outcomes
  
  • Interruptions should be no longer then 10 seconds
  
  • Start thinking of using pauses in CPR as the time to do things
    • Move the patient to the cot
    • Moving patient down stairs
The only time we pause CPR for a procedure is when the AED is analyzing and discharging.

- First Defibrillation in V-fib is still important.
  - Pause CPR when AED/Monitor is analyzing.
    - Start compressions right after “Shock Advised” or “No Shock Advised”
      - While monitor is charging
      - Can get a few compressions in
    - Stop for Defibrillation/Discharge
    - Re-start compressions right away

The First Defibrillation is the only time that we are not doing Defibrillations in our 2 minute cycles.
- As soon as the First Defibrillation is ready....Give it
TRIANGLE OF LIFE .......

Primary Roles:

PIT CREW
CPR

Rescuer #1
Chest compressions

Rescuer #2
AED

Rescuer #3
Airway
There are 3 Basic roles in Pit Crew Resuscitation

- **#1 (Compressor) at one shoulder**
  - Good place for non-crew to be put (PD, By-stander, etc.)
  - Bagging while resting

- **#2 (Compressor) at the other shoulder**
  - switch off doing chest compressions with #1
  - AED/Monitor
  - Bagging while resting

- **#3 Head (Airway)**
  - Hold proper seal of BVM over the patient’s mouth/nose
    - Res-Q-Pod only works if Mask seal is maintained
  - keeps track of time
BEYOND TRIANGLE OF LIFE
Additional Crews Show up

- Advanced Care would be below the waist
  - I/O and Medications (Position #4)
  - Monitor/Defibrillation (Position #5)
    - Change to Monitor
    - Dual Monitor Sequential Defibrillation
- Team Leader/Documentation (Over View of Scene)
  - Can be doubled into Position #5
  - Protocol/Documenting
    - For advanced procedures
- Over View of the Crew
  - Are procedures being done right
  - Does someone need to be swapped out
POSITION #6

- **Resources**
  - Does anyone need to swap out (Position #1 or #2)

- Do we have patient Information
  - History
  - Medications

- Do we need other equipment
  - Cot
  - Mechanical Compressor device
    - If not already applied
    - Put on in steps to minimize pause in compressions
DUAL MONITOR SEQUENTIAL DEFIBRILLATION
CHANGE PAD PLACEMENT OR DUEL SEQUENTIAL MONITOR DEFIBRILLATION...........

- **This is not for every V-Fib patient**
  - For patients that have had multiple rounds of CPR and....
  
  - Multiple **Defibrillations** (at least 4-5) and...
  
  - Multiple rounds of **Medications**
    - Epinephrine and Amiodarone
  
  - And are still in **V-Fib**
PERSISTENT V-FIB

- With good CPR, patients are staying in V-Fib longer (not going into Asystole)

  - What can we do to convert if our current defibrillations are not working
    - Change pad placement
    - Dual Sequential Monitor Defibrillation
STANDARD PAD PLACEMENT

Anterior and Posterior

Anterior and Lateral
CHANGING PAD PLACEMENT

- Alternate to the placement that was not initiated:
  - Anterior and Posterior
  - Anterior and Lateral
DUEL SEQUENTIAL MONITOR
DEFIBRILLATION

Thinking outside the Box:

Early 1990’s – first used

1994 - David Hoch (Cardiologist) - Published

5 patients with refractory v-fib, converted after double sequential defibrillation when they had failed to convert with multiple shocks at 360J.
WHY GO TO 2 MONITORS

• Theory:
  • Longer duration of electrical Charge
    • Charge lasts longer because they are not being given at the same moment
  
  • More of the Myocardium is being covered
    • Multiple pads are covering more of the heart
  
  • A lot more current is being delivered
    • $360j \times 2 = 720j$ (or Biphasic equivalent)
PROCEDURE

• Only done with **Monitors** (can be different brands)
• Not done with AED or any combination of AED
• Place second set of pads – Monitor pads can’t touch each other
  • both placements are acceptable
PROCEDURE

- Charge both monitors to 360j (or Biphasic equivalent)

- Once charged:
  - Have everyone clear Patient
  - Press Defib button on both monitors at the same time.
    - shocks will be delivered between 0.5 and 4.5 seconds apart (Sequential)
      - simultaneously is only achieved by linking monitors a cable or Bluetooth
  - Start 2 minutes of CPR
CONCERNS

• Does this void the Monitor Warranty

• This is considered “Off Label” use of the monitor
  • Monitor Manufacturers don’t test for this in their production
    • Concern is electricity from 1 monitor going into the other monitor (potential is there for 150 milliseconds)

• **Follow Department Policy** – Remember:
  • Very Specific Patient – not every Pt in V-Fib
  • Can still change pad placement
FF DOWN CPR
TAKING CARE OF OUR OWN——

• CPR on a downed Firefighter
  • Delay in getting Firefighter out of building
  • Delay in getting firefighter out of gear
  • Delay in getting compressions started

• How do we minimize these delays
FD-CPR

- May be RIT, May be your Crew, Could be in Rehab
  - Anytime a FF is in gear
- Checking for Pulse is not the only way to establish need for compressions
  - Unconscious
  - Complaint before FF collapsed
  - Visualize Skin Parameters – through Face Piece
  - If heat/off gassing is not an issue – feel for Carotid pulse
- Need is Identified
  - Start Compressions
    - If we don’t start CPR and they need it – no change in outcome
    - If we start CPR and they don’t need it – we won’t stop their heart
      - They will be around months later to remind us – a much better option
      - If they are fighting you, they don’t need CPR
FF IN GEAR AND CPR

Presented by FD-CPR

https://www.youtube.com/watch?v=45qDPFj4lpI

Please cut and paste the above link to view in your web browser.
ANY QUESTIONS?

• If there are any questions on what was presented
  • Please contact us at the EMS Office (815) 759-8040
    • Cindy Amore  (815) 759-8044
    • Eric Podowski  (815) 759-8043
    • Scott Anderson  (815) 759-8042
GOOD LUCK ON YOUR TEST.