

CASE STUDIES IN MONITORING THE ICU PATIENT

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OBJECTIVES

- EKG'S
- HEMODYNAMICS
- OPIOID OVERDOSE
- ETHICAL CHALLENGES
- SEDATION





CASE STUDY #1

- A 76-YEAR-OLD MAN WITH A HISTORY OF SMOKING WAS REFERRED TO OUR HOSPITAL WITH WORSENING DYSPNEA.
- HE HAD BEEN TAKING MEDICATION FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASE FOR 3 MONTHS, INCLUDING THEOPHYLLINE (200 MG TWICE A DAY), LONG-ACTING MUSCARINIC ANTAGONISTS, AND A LONG-ACTING BETA-AGONIST INHALER. ON ARRIVAL AT HOSPITAL.
- HIS BLOOD PRESSURE WAS 121/63 MMHG, PULSE WAS 192 BPM, BREATHING RATE WAS 30/MIN, AND BODY TEMPERATURE WAS 36.3 °C.
- THE EKG WAS PERFORMED WITH RESULTS ON NEXT SLIDE





WHAT IS THIS RHYTHM?



TREATMENT FOR SVT

- **HOW WOULD YOU TREAT SVT'S?**
- **CAROTID SINUS MASSAGE**
- **VAGAL MANEUVERS**
- **CARDIOVERSION**
- **MEDICATIONS**
- **AMIODARONE, PROCAINAMIDE, CALCIUM CHANNEL BLOCKERS (EG, DILTIAZEM AND VERAPAMIL), AND BETA-BLOCKERS (EG, METOPROLOL OR ATENOLOL)**
- **ABLATION**



CASE STUDY #2

- **A 67-YEAR-OLD MAN PRESENTS TO THE EMERGENCY DEPARTMENT WITH PALPITATIONS AND DYSPNEA WHICH BEGAN APPROXIMATELY 4 HOURS AGO.**
- **HE HAS A HISTORY OF HYPERTENSION, DIABETES, AND GASTROESOPHAGEAL REFLUX DISEASE. HIS CURRENT MEDICATIONS ARE LISINAPRIL, METFORMIN, AND OMEPRAZOLE.**
- **HE HAS NO HISTORY OF CONGESTIVE HEART FAILURE, STROKE, OR TRANSIENT ISCHEMIC ATTACK (TIA).**
- **HE APPEARS TO BE IN MILD RESPIRATORY DISTRESS. BLOOD PRESSURE IS 88/60 MMHG, PULSE RATE IS 140 BPM, RESPIRATORY RATE IS 24/MIN, AND TEMPERATURE IS NORMAL.**
- **OXYGEN SATURATION IS 90% ON 40% OXYGEN BY FACE MASK. CARDIAC EXAM REVEALS TACHYCARDIA WITH AN IRREGULARLY IRREGULAR TACHYCARDIC RHYTHM.**
- **THERE ARE CRACKLES IN THE LOWER LUNG FIELDS.**
- **ELECTROCARDIOGRAM DEMONSTRATES.....**





WHAT IS THIS RHYTHM?



TREATMENT FOR ATRIAL FLUTTER

- **ACUTE MANAGEMENT OF AF WITH HEMODYNAMIC INSTABILITY**
- GIVEN HIS PRESENTATION OF AF WITH HYPOTENSION AND PULMONARY EDEMA, HE UNDERGOES IMMEDIATE DIRECT-CURRENT CARDIOVERSION WITHOUT ANTICOAGULATION.
- HIS RHYTHM CONVERTS TO NORMAL SINUS RHYTHM.
- HIS VITAL SIGNS RETURN TO NORMAL AND HIS SYMPTOMS DISSIPATE.
- **ANTICOAGULATION**
- EVEN THOUGH HE IS NOW IN NORMAL SINUS RHYTHM AFTER CARDIOVERSION, HE IS STILL AT RISK FOR THROMBOEMBOLISM.
- ANTICOAGULATION IS INITIATED AND SHOULD BE CONTINUED FOR AT LEAST 4 WEEKS.
- THE DECISION TO CONTINUE ANTICOAGULATION BEYOND THE INITIAL 4 WEEKS IS BASED ON THE LONG-TERM RISK FOR THROMBOEMBOLISM ASSOCIATED WITH NONVALVULAR AF
- **RATE CONTROL IS MANAGED WITH BETA BLOCKER**



CASE STUDY #3

- THE PATIENT IS A 60-YEAR-OLD WHITE FEMALE PRESENTING TO THE EMERGENCY DEPARTMENT WITH ACUTE ONSET SHORTNESS OF BREATH. SYMPTOMS BEGAN APPROXIMATELY 2 DAYS BEFORE AND HAD PROGRESSIVELY WORSENERD WITH NO ASSOCIATED, AGGRAVATING, OR RELIEVING FACTORS NOTED.
- SHE HAD SIMILAR SYMPTOMS APPROXIMATELY 1 YEAR AGO WITH AN ACUTE, CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) EXACERBATION REQUIRING HOSPITALIZATION.
- SHE USES BIPAP VENTILATORY SUPPORT AT NIGHT WHEN SLEEPING AND HAS REQUESTED TO USE THIS IN THE EMERGENCY DEPARTMENT DUE TO SHORTNESS OF BREATH AND WANTING TO SLEEP.
- SHE DENIES FEVER, CHILLS, COUGH, WHEEZING, SPUTUM PRODUCTION, CHEST PAIN, PALPITATIONS, PRESSURE, ABDOMINAL PAIN, ABDOMINAL DISTENSION, NAUSEA, VOMITING, AND DIARRHEA.
- EKG IS PERFORMED





WHAT IS THIS RHYTHM?



TREATMENT FOR NORMAL SINUS RHYTHM

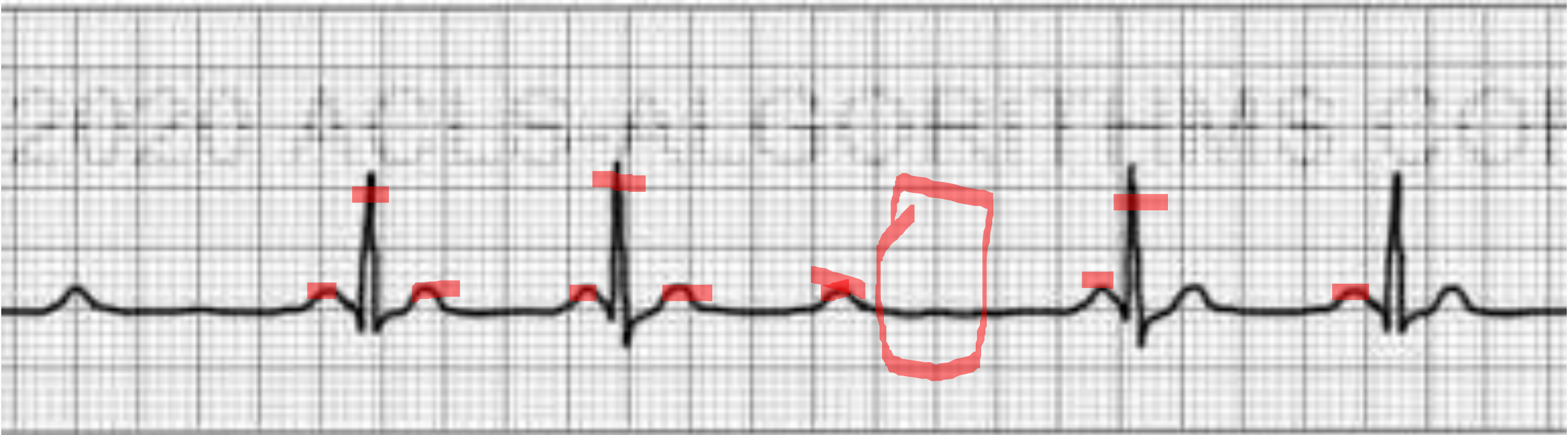
- NO TREATMENT NEEDED FOR SINUS RHYTHM
- TREAT HER COPD



CASE STUDY # 4

- AN 87-YEAR-OLD WOMAN REPORTS FEELING WEAK AND SHORT OF BREATH FOR 2 HOURS WHILE WALKING SHORT DISTANCES. SHE FEELS EXHAUSTED MOVING FROM THE CAR TO THE ED STRETCHER.
- ON PHYSICAL EXAM SHE IS PALE AND SWEATY; HR = 35 BPM; BP = 90/60 MM HG; RR = 18 RPM
- SHE EXPERIENCED NO CHEST PAIN OR ISCHEMIC SYMPTOMS PRIOR TO THE ONSET OF HER WEAKNESS AND SHORTNESS OF BREATH





WHAT IS THIS RHYTHM?



TREATMENT FOR SECOND DEGREE AV BLOCK TYPE 2

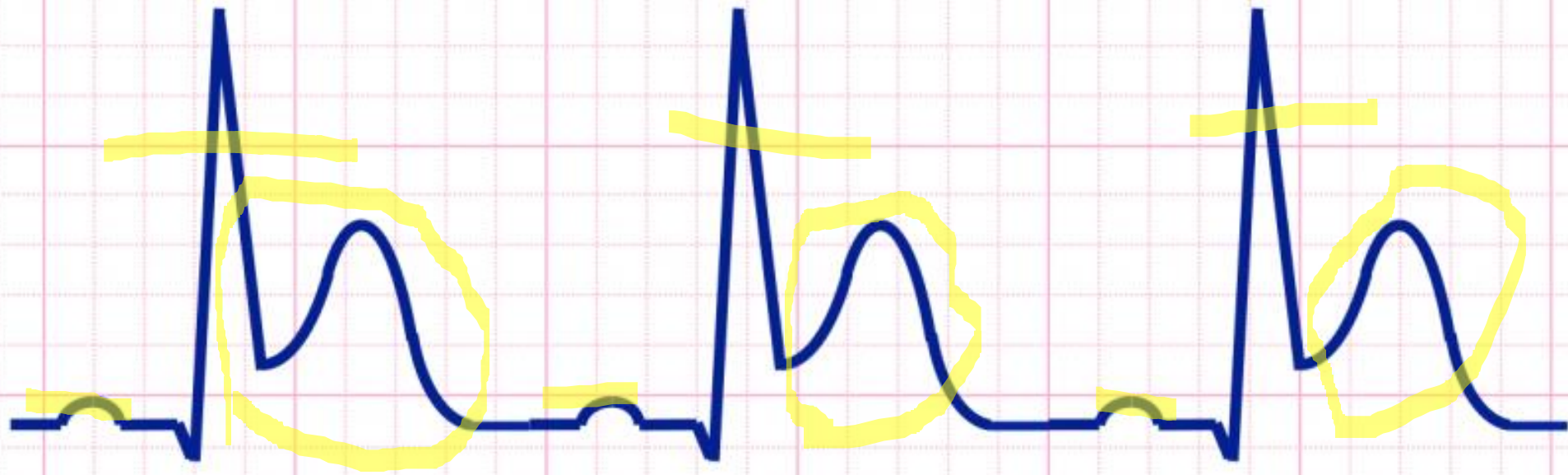
- **SINCE SHE IS ASYMPTOMATIC- HOW WOULD YOU TREAT HER?**
- **SECOND-DEGREE ATRIOVENTRICULAR (AV) BLOCK IN THE ASYMPTOMATIC PATIENT DOES NOT REQUIRE ANY SPECIFIC THERAPY IN THE PREHOSPITAL SETTING.**
- **IF SHE WAS SYMPTOMATIC- HOW WOULD YOU TREAT HER?**
- **TREATMENT FOR A MOBITZ TYPE II INVOLVES INITIATING PACING AS SOON AS THIS RHYTHM IS IDENTIFIED.**
- **TYPE II BLOCKS IMPLY STRUCTURAL DAMAGE TO THE AV CONDUCTION SYSTEM. THIS RHYTHM OFTEN DETERIORATES INTO COMPLETE HEART BLOCK.**
- **THESE PATIENTS REQUIRE TRANSVENOUS PACING UNTIL A PERMANENT PACEMAKER IS PLACED.**



CASE STUDY #5

- A 57-YEAR-OLD MALE TRUCK DRIVER, PRESENTED TO HIS LOCAL EMERGENCY DEPARTMENT WITH A 20-MINUTE EPISODE OF DIAPHORESIS AND CHEST PAIN. THE CHEST PAIN WAS CENTRAL, RADIATING TO THE LEFT ARM AND CRUSHING IN NATURE.
- THE PAIN SETTLED PROMPTLY FOLLOWING 300 MG ASPIRIN ORALLY AND 800 MCG GLYCERYL TRINITRATE (GTN) SPRAY SUBLINGUALLY ADMINISTERED BY PARAMEDICS IN THE COMMUNITY. HE SMOKED 20 CIGARETTES DAILY (38 PACK YEARS) BUT WAS NOT AWARE OF ANY OTHER CARDIOVASCULAR RISK FACTORS.
- ON EXAMINATION HE APPEARED COMFORTABLE AND WAS ABLE TO COMPLETE SENTENCES FULLY. THERE WERE NO HEART MURMURS PRESENT ON CARDIAC AUSCULTATION.
- BLOOD PRESSURE WAS 180/105 MMHG, HEART RATE WAS 83 BPM AND REGULAR, OXYGEN SATURATION WAS 97%.





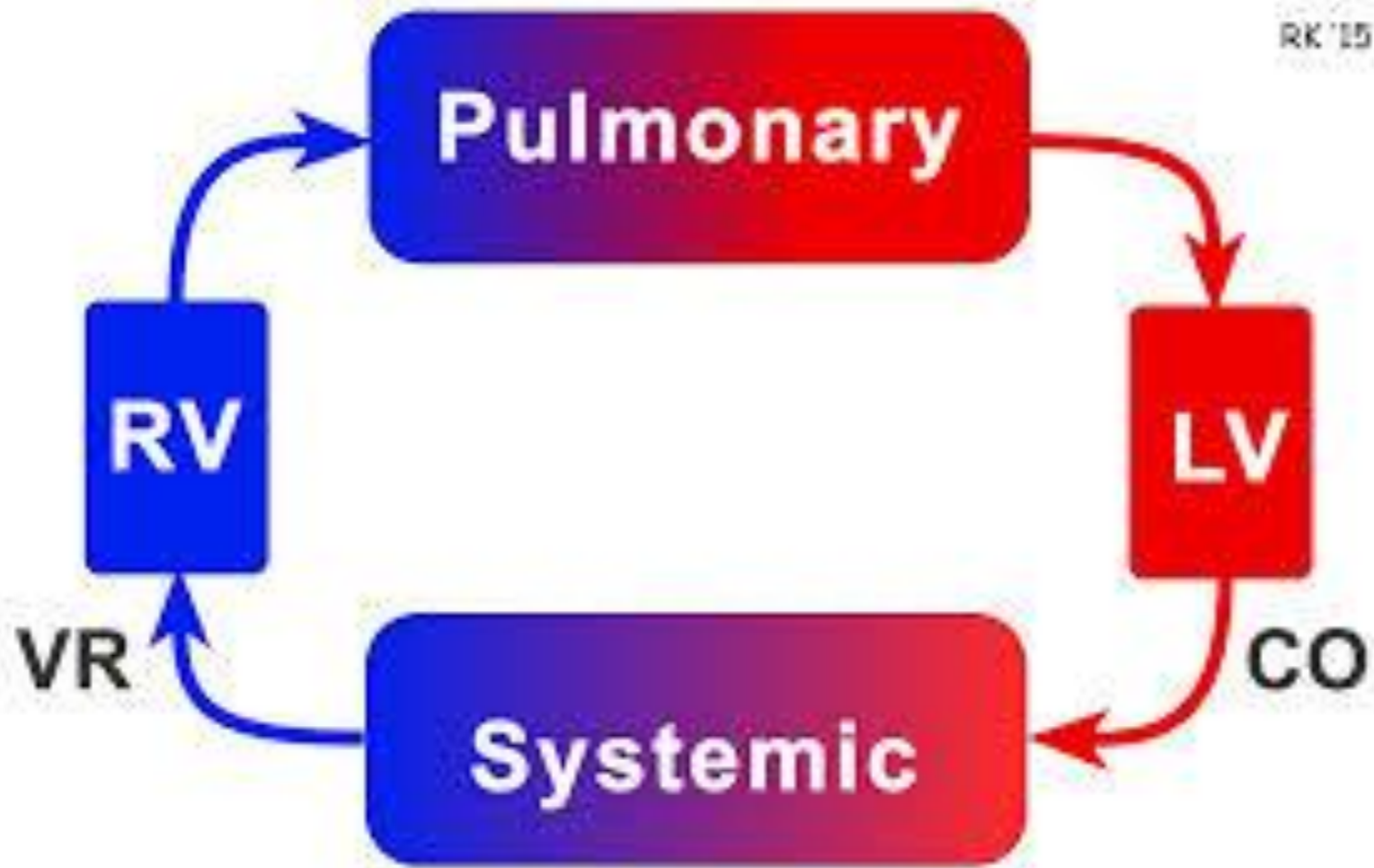
WHAT IS THIS RHYTHM?



TREATMENT FOR ST-SEGMENT ELEVATION

- INITIAL MEDICAL THERAPY DURING STEMI CONSISTS OF:
 - OXYGEN ADMINISTRATION
 - ANTIPLATELET THERAPY (ASPIRIN, THIENOPYRIDINES AND GLYCOPROTEIN IIB/IIIA INHIBITORS)
 - ANTICOAGULATION (HEPARIN OR BIVALIRUDIN)
 - ANGINAL PAIN RELIEF WITH NITRATES AND MORPHINE
 - BETA-BLOCKADE





CASE STUDY #1

A 48-YEAR-OLD FEMALE PATIENT WAS ADMITTED TO OUR HOSPITAL WITH SHORTNESS OF BREATH AND EXTREME FATIGUE DURING DAILY ACTIVITIES, PREVIOUSLY DIAGNOSED AS HYPERTENSION AND CONTROLLED WITH MEDICATION.

SHE HAD A HISTORY OF A BLUNT TRAUMA TO HER CHEST IN A CAR ACCIDENT 13 YEARS EARLIER. THERE WAS A HEART MURMUR (GRADE 3) IN THE FOURTH INTERCOSTAL SPACE AT THE LEFT STERNAL BORDER, WHICH INCREASED WITH INSPIRATION, AS WELL AS PRETIBIAL EDEMA AND JUGULAR VENOUS DISTENTION DURING PHYSICAL EXAMINATION.

ELECTROCARDIOGRAPHY SHOWED ATRIAL FIBRILLATION AND RIGHT BUNDLE BRANCH BLOCK. FLAIL TRICUSPID VALVE, RIGHT VENTRICULAR VOLUME OVERLOAD, AND REDUCED RIGHT VENTRICULAR FUNCTION WERE DETERMINED.

RIGHT ATRIAL PRESSURES DEMONSTRATING 8-10MMHG RANGE



WHAT IS THE NORMAL MEAN PRESSURE RANGE FOR THE RIGHT ATRIUM?

- A. 2-6MMHG
- B. 4-18MMHG
- C. 25/5MMHG
- D. 12-16MMHG



TRICUSPID VALVE REGURGITATION

- TRICUSPID VALVE REGURGITATION IS A CONDITION IN WHICH THE VALVE BETWEEN THE TWO RIGHT HEART CHAMBERS (RIGHT VENTRICLE AND RIGHT ATRIUM) DOESN'T CLOSE PROPERLY.
- THE MALFUNCTIONING VALVE ALLOWS BLOOD TO FLOW BACK INTO YOUR HEART'S UPPER RIGHT CHAMBER (RIGHT ATRIUM).
- TRICUSPID VALVE REGURGITATION CAN BE THE RESULT OF A CONDITION YOU'RE BORN WITH (CONGENITAL HEART DISEASE), OR IT CAN OCCUR DUE TO VALVE ABNORMALITIES CAUSED BY OTHER CONDITIONS INCLUDING CHEST TRAUMA.
- IF YOUR CONDITION IS MILD, YOU MAY NOT NEED TREATMENT. YOUR DOCTOR MAY JUST MONITOR YOUR CONDITION. HOWEVER, IF YOU HAVE SEVERE TRICUSPID VALVE REGURGITATION AND YOU'RE EXPERIENCING SIGNS AND SYMPTOMS, TREATMENT MAY BE NECESSARY.



CASE STUDY #2

- A MAN IN HIS 60S WITH LONGSTANDING CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PRESENTS HIMSELF AS A NEW PATIENT.
- HE HAS A MEDICAL HISTORY OF NEW YORK HEART ASSOCIATION (NYHA) CLASS I HEART FAILURE WITH A PRESERVED EJECTION FRACTION OF 60%, HYPERTENSION, HYPERLIPIDEMIA, AND A CEREBROVASCULAR ACCIDENT SIX YEARS AGO WITH NO RESIDUAL DEFICITS.
- HE HAS SMOKED A PACK OF CIGARETTES A DAY FROM THE AGE OF 22 UNTIL QUITTING SMOKING AT AGE 60 WHEN HE HAD A STROKE. HE INDICATES THAT HE HAS BEEN WELL-CONTROLLED ON MAINTENANCE INHALER THERAPY, INCLUDING A LONG-ACTING BETA-AGONIST, LONG-ACTING MUSCARINIC AGENT, AND INHALED CORTICOSTEROID, AND HAS NEVER REQUIRED OXYGEN THERAPY.
- HIS ABILITY TO PERFORM DAILY ACTIVITIES IS NEVERTHELESS SOMEWHAT LIMITED BY EXERTIONAL DYSPNEA
- **RIGHT HEART CATHETERIZATION WAS PERFORMED DEMONSTRATING 35/15 MMHG**



WHAT IS THE NORMAL PRESSURE FOR THE RIGHT VENTRICLE?

- A. 12/16/14
- B. 25/5
- C. 75/15/15
- D. 40/15



CASE STUDY ELEVATED RIGHT VENTRICULAR PRESSURES

- PULMONARY HYPERTENSION USUALLY WORSENS DURING EXERCISE, SLEEP AND EXACERBATION.
- PULMONARY VASCULAR REMODELING IN COPD IS THE MAIN CAUSE OF INCREASE IN PULMONARY ARTERY PRESSURE
- THOUGHT TO RESULT FROM THE COMBINED EFFECTS OF:
 - HYPOXIA
 - INFLAMMATION
 - LOSS OF CAPILLARIES IN SEVERE EMPHYSEMA





OPIOID ABUSE AND OVERDOSE



CASE STUDY: MEET CASEY

- A 23-YEAR-OLD FEMALE FOUND IN CAR
- THE PATIENT IS UNRESPONSIVE, LIMP AND CYANOTIC. HER AIRWAY APPEARS TO BE CLEAR OF OBSTRUCTION.
- SHE IS BREATHING SHALLOWLY AT FOUR BREATHS/MINUTE WITH AUSCULTATED RALES IN THE BASES OF BOTH LUNGS.
- PULSE OXIMETRY READS 65% ON ROOM AIR.



VITALS AND MORE HISTORY

HEART RATE: 106 BEATS/MIN. AND IRREGULAR

BLOOD PRESSURE: 92/64 MMHG

CO2: 70 MMHG

BLOOD GLUCOSE: 80 MG/DL

TEMPERATURE: 99.60

FURTHER PHYSICAL EXAM REVEALS PINPOINT PUPILS, AND BOTH HER UPPER EXTREMITIES APPEAR TO BE COVERED WITH WHAT LOOK LIKE NEEDLE TRACKS, MULTIPLE ABSCESSSES, AND BRUISES IN VARIOUS STAGES OF HEALING. HER SKIN TURGOR IS POOR WITH SIGNS OF MALNUTRITION AND DEHYDRATION. TWO TRANSDERMAL MEDICATION PATCHES ARE FOUND ON THE BACK OF HER RIGHT THIGH.



OPIOID TOXICITY DISCUSSION

- OPIOID TOXICITY SHOULD BE SUSPECTED WHEN CNS DEPRESSION, RESPIRATORY DEPRESSION, AND PUPILLARY CONSTRICTION ARE PRESENT
- THE HUMAN BODY HAS THREE MAIN OPIOID RECEPTORS, LOCATED IN SENSORY NERVES, MAST CELLS AND IN CELLS OF THE GI TRACT.
- STIMULATION OF THESE RECEPTORS GENERALLY RESULTS IN EUPHORIA, DECREASED PERCEPTION OF PAIN AND DROWSINESS.



INITIAL OPIOID OVERDOSE MANAGEMENT

- ACUTE MANAGEMENT
- NONPHARMACOLOGIC MANAGEMENT: INITIAL MANAGEMENT OF AN OPIOID OVERDOSE SHOULD ENCOMPASS SUPPORT FOR THE PATIENT'S AIRWAY, BREATHING, AND CIRCULATION.
- IN PATIENTS WITH APNEA OR A RESPIRATORY RATE <12 BREATHS PER MINUTE, THE AIRWAY SHOULD BE OPENED VIA THE JAW-THRUST OR CHIN-LIFT TECHNIQUE, FOLLOWED BY OXYGENATION AND VENTILATION WITH A BAG-VALVE MASK OR ENDOTRACHEAL INTUBATION, IF NEEDED.
- IF BREATHING AND MENTAL STATUS DO NOT IMPROVE, NALOXONE SHOULD BE ADMINISTERED BY ANY APPROPRIATE ROUTE AVAILABLE.



NALOXONE ADMINISTRATION

NALOXONE IS A COMPETITIVE, SHORT-ACTING OPIOID RECEPTOR ANTAGONIST USED FOR THE REVERSAL OF OPIOID OVERDOSE.

THIS AGENT IS CONSIDERED FIRST-LINE TREATMENT FOR OPIOID OVERDOSE AND IS INDICATED FOR COMPLETE OR PARTIAL REVERSAL OF OPIOID EFFECTS INDUCED BY NATURAL OR SYNTHETIC OPIOIDS, INCLUDING RESPIRATORY DEPRESSION.

NALOXONE MAY BE ADMINISTERED VIA THE INTRAVENOUS (IV), INTRAMUSCULAR (IM), SUBCUTANEOUS (SC), INTRANASAL, ENDOTRACHEAL, OR PULMONARY ROUTE.

ORALLY ADMINISTERED NALOXONE UNDERGOES SIGNIFICANT FIRST-PASS METABOLISM THAT RESULTS IN MINIMAL EFFECTIVENESS; THEREFORE, ITS USE IS NOT RECOMMENDED DURING OVERDOSE.



Naloxone Dosing Information for the Treatment of Opioid Overdose

Adult (Nonopioid-Dependent)

- IV, IM, SC: initial dose of 0.4-2 mg; repeat doses may be required every 2-3 minutes; up to 10 mg
- IM, SC (Evzio): 0.4 mg or 2 mg (1 autoinjector) as single dose; may require repeat doses every 2-3 minutes until emergency medical care arrives
- Intranasal: 2 mg (1 mg per nostril); may be repeated every 3-5 minutes until respiratory depression subsides

Adult (Opioid-Dependent)

- IV, IM, SC: Initial dose of 0.1-0.2 mg to avoid acute withdrawal; repeat doses may be required every 2-3 minutes

Child

- Age <5 years or ≤20 kg: 0.1 mg/kg/dose; repeat doses may be required every 2-3 minutes
- Age ≥5 years or >20 kg: 2 mg/dose; repeat doses may be required every 2-3 minutes

Source: References 4, 6, 7, 9.





ETHICAL CHALLENGES

- A 77-YEAR-OLD MAN WHOSE MEDICAL HISTORY INCLUDES TREATED HYPERTENSION AND HYPERCHOLESTEROLEMIA, PREVIOUS HEAVY ALCOHOL INTAKE, AND MILD COGNITIVE IMPAIRMENT
- REQUIRED 15 DAYS OF TREATMENT IN THE ICU FOR SEPTIC SHOCK DUE TO FECAL PERITONITIS FROM A PERFORATED SIGMOID COLON.
- COMPLICATIONS DURING HIS ICU STAY INCLUDED ARDS, MILD DISSEMINATED INTRAVASCULAR COAGULATION AND ACUTE HEPATIC NECROSIS.
- AFTER BEING TRANSFERRED TO THE SURGICAL FLOOR, HE HAD AN UNWITNESSED FALL FROM HIS BED, AND CRANIAL CT SHOWED AN ACUTE SUBDURAL HEMATOMA WITH UNDERLYING HEMORRHAGIC CONTUSION ON THE LEFT SIDE AND 5-MM DISPLACEMENT OF THE MIDLINE INTRACRANIAL STRUCTURES.



ETHICAL CHALLENGES

- HE WAS TAKEN TO THE OPERATING ROOM AND UNDERWENT A CRANIOTOMY FOR EVACUATION OF THE SUBDURAL HEMATOMA.
- TWELVE DAYS AFTER THIS PROCEDURE, DURING WHICH HE RECEIVED NO SEDATIVE MEDICATIONS, HE REMAINS IN A COMA WITH A BEST MOTOR RESPONSE OF ABNORMAL FLEXION ON THE LEFT SIDE.
- HE IS STILL RECEIVING MECHANICAL VENTILATION.
- THE CONSENSUS OPINION OF TREATING CLINICIANS IS THAT HE WILL MOST LIKELY NOT MAKE A FUNCTIONAL RECOVERY.



WHICH OF THE FOLLOWING OPTIONS WOULD YOU FAVOR TO DETERMINE THE FURTHER TREATMENT OF THIS PATIENT?

- 1. MEET WITH THE FAMILY AND TELL THEM THERE IS NO HOPE OF RECOVERY AND YOU WILL BE DISCONTINUING MECHANICAL VENTILATION.
- 2. MEET WITH THE FAMILY WITH THE GOAL OF ASCERTAINING THE PATIENT'S WISHES REGARDING THE CONTINUATION OF ACTIVE MEDICAL TREATMENT
- 3. PLACEMENT IN A NURSING HOME WITH A HIGH LEVEL OF CARE
- 4. MEET WITH THE FAMILY AND ASK THEM WHETHER THEY WOULD LIKE THE PATIENT TO HAVE A TRACHEOSTOMY.
- 5. SEND THE CASE TO HOSPITAL ETHICS COMMITTEE AND ASK WHAT THEY THINK.



Richmond Agitation-Sedation Scale (RASS)

RASS Score	Term	Description
4+	Combative	Combative, violent, immediate danger to staff
3+	Very agitated	Pulls or removes tubes or catheters, aggressive
2+	Agitated	Frequent nonpurposeful movement, fights ventilator
1+	Restless	Anxious but movements not aggressively vigorous
0	Alert and Calm	
-1	Drowsy	Not fully alert but has sustained eye opening/contact 10 sec or more to voice
-2	Light Sedation	Briefly awakens to voice with eye contact less than 10 sec
-3	Moderate Sedation	Movement or eye opening to voice (no eye contact)
-4	Deep Sedation	No response to voice but movement or eye opening to physical stimuli
-5	Unarousable	No response to voice or physical stimuli





QUESTIONS ON RASS SCORE

- 1. WHAT IS THE BEST SCORE TO WEAN A PATIENT FROM MECHANICAL VENTILATION?
- 2. WHAT IS SCORE WHEN THE PATIENT IS “ALERT AND CALM”?
- 3. WHAT IS THE SCORE WHEN THE PATIENT IS IN “DEEP SEDATION; NO RESPONSE TO VOICE, BUT MOVEMENT OR EYE OPENING TO PHYSICAL STIMULATION”?
- 4. WHAT IS THE SCORE OF THE PATIENT “FREQUENT NON-PURPOSEFUL MOVEMENT, FIGHTS VENTILATOR”?

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