Introduction

ECG is the most important diagnostic tool!!!
Life threatening Arrhythmia

- **Lethal:**
  - VF, VT, PEA, ASYSTOLE

- **Non Lethal:**
  - TOO FAST or TOO SLOW
ARRHYTHMIA

- **Tachyarrhythmias**
  - HR > 100 x/min

- **Bradiarrhythmias**
  - HR < 60 x/min
Normal Conduction System

- Sinus node
- Internodal pathways
- AV Node
- Bundle of His
- Right Bundle Branch
- Bachmann’s bundle
- Left Bundle Branch
- Post. division
- Ant. division
- Purkinje fibers
Physiologic Basis of Pacemaker Cells
Mechanisms of Arrhythmia

- Automaticity
- Reentry
- Trigger Activity
Principles of Arrhythmia Recognition and Management

- Treat the Patient ..., not the Monitor !!!!
- Evaluate the patient’s symptoms and clinical signs
  - Ventilation
  - Oxygenation
  - Heart rate
  - Blood pressure
  - Level of consciousness
  - Look for signs of inadequate organ perfusion
HOW TO READ ECG RHYTHM

QRS Complex ?

(+)

Fast / Slow ?

(-)

Asystole

VF

Wide / Narrow complex

-Takikardia/
-Bradicardia

-Wide ? (Ventricular ? )
(Consult the expert is advice )

-Narrow ? (Supra ventricular)
(Consult the expert is considered)
QRS regular /irregular?

P wave?

P wave and QRS complex
Connection?

Irregular: A fib, A flutter, MAT, AF + WPW, multifocal VT,

Normal / abnormal P wave?

- 1 “P” followed by 1 “QRS”? /
  more “P” than “QRS”
- Appropriate distance between
  P wave and QRS complex
Tachy-Arrhythmia
Tachy-Arrhythmia

The first step
- Determine if the patient’s condition is stable or unstable

The second step
- Obtain a 12-lead ECG to evaluate the QRS duration (i.e., narrow or wide).

The third step
- Determine if the rhythm is regular or irregular
If the patient becomes **unstable** at any time, proceed with **synchronized cardioversion**.

If the patient develops pulseless arrest or is unstable with polymorphic VT, treat as VF and deliver **high-energy unsynchronized shocks** (ie, defibrillation doses).
Tachycardia

Narrow–QRS-complex (SVT) tachycardias (QRS <0.12 second) in order of frequency

— Sinus tachycardia
— Atrial fibrillation
— Atrial flutter
— AV nodal reentry
— Accessory pathway–mediated tachycardia
— Atrial tachycardia (ectopic and reentrant)
— Multifocal atrial tachycardia (MAT)
— Junctional tachycardia
Narrow QRS tachycardia (QRS duration less than 120 ms)

Regular tachycardia?

Yes

Atrial fibrillation
Atrial tachycardia/flutter with variable AV conduction
MAT

No

Visible P waves?

Yes

Atrial rate greater than ventricular rate?

Yes

Atrial flutter or Atrial tachycardia

Short (RP shorter than PR)

RP shorter than 70 ms

AVNRT

No

Analyze RP interval

Long (RP longer than PR)

Atrial tachycardia
PJRT
Atypical AVNRT

No

Atrial fibrillation
Atrial tachycardia/flutter with variable AV conduction
MAT
Tachycardia

Wide–QRS-complex tachycardias (QRS > 0.12 second)

— Ventricular tachycardia (VT)
— SVT with aberrancy
— Pre-excited tachycardias (advanced recognition rhythms using an accessory pathway)

Most wide-complex (broad-complex) tachycardias are ventricular in origin
Wide QRS-complex tachycardia (QRS duration greater than 120 ms)

Regular or irregular?

Regular

Is QRS identical to that during SR?
If yes, consider:
• SVT and BBB
• Antidromic AVRT†

Vagal maneuvers or adenosine

Previous myocardial infarction or structural heart disease? If yes, VT is likely.

1 to 1 AV relationship?

Yes or unknown

QRS morphology in precordial leads

Typical RBBB or LBBB

Precordial leads
• Concordant*
• No R/S pattern
• Onset of R to nadir longer than 100 ms

VT

RBBB pattern
• qR, Rs or Rr' in V1
• Frontal plane axis range from +90 degrees to -90 degrees

VT

LBBB pattern
• R in V1 longer than 30 ms
• R to nadir of S in V1 greater than 60 ms
• qR or qS in V6

VT

Irregular

Atrial fibrillation
Atrial flutter / AT with variable conduction and
a) BBB or
b) antegrade conduction via AP

Atrial tachycardia
Atrial flutter

ACC guidelines 2003
Initial Evaluation and Treatment of Tachyarrhythmias

- The evaluation and management of tachyarrhythmias is depicted in the ACLS Tachycardia Algorithm.
ACLS Tachycardia Algorithm

1. **TACHYCARDIA With Pulses**
   - Assess and support ABCs as needed
   - Give oxygen
   - Monitor ECG (identify rhythm), blood pressure, oximetry
   - Identify and treat reversible causes

2. **Symptoms Persist**
   - **Is patient stable?**
     - Unstable signs include altered mental status, ongoing chest pain, hypotension or other signs of shock
     - Note: rate-related symptoms uncommon if heart rate <150/min
   - **Perform immediate synchronized cardioversion**
     - Establish IV access and give sedation if patient is conscious; do not delay cardioversion
     - Consider expert consultation
     - If pulseless arrest develops, see Pulseless Arrest Algorithm

3. **Establish IV access**
   - Obtain 12-lead ECG (when available) or rhythm strip
   - Is QRS narrow (<0.12 sec)?

4. **Stable**

5. **Unstable**
Synchronized Cardioversion and Unsynchronized Shocks

Synchronized cardioversion is recommended to treat
(1) unstable SVT due to reentry
(2) unstable atrial fibrillation
(3) unstable atrial flutter
(4) unstable monomorphc (regular) VT
Synchronized Cardioversion and Unsynchronized Shocks

- If possible, establish IV access before cardioversion and administer *sedation* if the patient is conscious.
- Consider expert consultation.
Syncrhronized Cardioversion

Initial recommended doses:

- Narrow regular: 50-100 J
- Narrow irregular: 120-200 J biphasic or 200 J monophasic
- Wide regular: 100 J
- Wide irregular: defibrillation dose (NOT synchronized)
Cardioversion is **not** likely to be effective for treatment of

- Junctional tachycardia
- Ectopic or multifocal atrial tachycardia

- these rhythms have an *automatic focus*, arising from cells that are spontaneously depolarizing at a rapid rate
- shock delivery to a heart with a rapid automatic focus may increase the rate of the tachyarrhythmia
Brady-Arrhythmia
Bradycardia

- Defined as a heart rate of <60 beats per minute
- A slow heart rate may be physiologically normal for some patients
- While initiating treatment, evaluate the clinical status of the patient and identify potential reversible causes
Bradycardia

- Identify signs and symptoms of poor perfusion and determine if those signs are likely to be caused by the bradycardia
  - hypotension
  - acute altered mental status
  - Chest pain
  - congestive heart failure
  - seizures
  - syncope
  - other signs of shock related to the bradycardia
Bradycardia

- Bradycardia:
  - Profound sinus bradikardia, SA block
  - Junctional rhythm
  - AV block

- Causes of bradycardia:
  - Medications
  - Electrolyte disturbances
  - Structural problems resulting from acute myocardial infarction and myocarditis.
Bradycardia Algorithm

1. **BRADYCARDIA**
   - Heart rate <60 bpm and inadequate for clinical condition

2. • Maintain patent airway; assist breathing as needed
   • Give oxygen
   • Monitor ECG (identify rhythm), blood pressure, oximetry
   • Establish IV access

3. **Signs or symptoms of poor perfusion caused by the bradycardia?**
   (eg, acute altered mental status, ongoing chest pain, hypotension or other signs of shock)
Bradycardia Algorithm

4A
Observe/Monitor

Adequate Perfusion

Poor Perfusion

4

- Prepare for transcutaneous pacing; use without delay for high-degree block (type II second-degree block or third-degree AV block)
- Consider **atropine** 0.5 mg IV while awaiting pacer. May repeat to a total dose of 3 mg. If ineffective, begin pacing
- Consider **epinephrine** (2 to 10 µg/min) or **dopamine** (2 to 10 µg/kg per minute) infusion while awaiting pacer or if pacing ineffective

5

- Prepare for **transvenous pacing**
- Treat contributing causes
- Consider expert consultation

Reminders
- If pulseless arrest develops, go to Pulseless Arrest Algorithm
- Search for and treat possible contributing factors:
  - Hypovolemia
  - Hypoxia
  - Hydrogen ion (acidosis)
  - Hypo-/hyperkalemia
  - Hypoglycemia
  - Hypothermia
  - Toxins
  - Tamponade, cardiac
  - Tension pneumothorax
  - Thrombosis (coronary or pulmonary)
  - Trauma (hypovolemia, increased ICP)
Therapy

Atropine

- First-line drug for acute symptomatic bradycardia (Class IIa)
- Improved heart rate and signs and symptoms associated with bradycardia
- Useful for treating symptomatic sinus bradycardia and may be beneficial for any type of AV block at the nodal level.
Atropine

- The recommended dose for bradycardia is 0.5 mg IV every 3 to 5 minutes to a maximum total dose of 3 mg.
- Doses <0.5 mg may paradoxically result in further slowing of the heart rate.
- Atropine administration should not delay implementation of external pacing for patients with poor perfusion.
Therapy

Atropine

- Use cautiously in the presence of acute coronary ischemia or myocardial infarction; increased heart rate may worsen ischemia or increase the zone of infarction.

- Atropine may be used with caution and appropriate monitoring following cardiac transplantation. It will likely be ineffective because the transplanted heart lacks vagal innervation.
Therapy

**Pacing** (Transcutaneous pacing, TCP)

- **Class I** intervention for symptomatic bradycardias
- **Indication**: started immediately for patients
  - Unstable, particularly those with high-degree block
  - If there is no response to atropine
  - If atropine is unlikely to be effective
  - If the patient is severely symptomatic
Therapy

**Pacing** (Transcutaneous pacing, TCP)

- Can be painful and may fail to produce effective mechanical capture
- Use analgesia and sedation for pain control
- Verify mechanical capture and re-assess the patient’s condition
- If TCP is ineffective (eg, inconsistent capture)
  - prepare for transvenous pacing
  - consider obtaining expert consultation
Therapy

Alternative Drugs to Consider

- **Second-line** agents for treatment of symptomatic bradycardia
- They may be considered when the bradycardia is unresponsive to atropine and as temporizing measures while awaiting the availability of a pacemaker.
Epinephrine

- Used for patients with symptomatic bradycardia or hypotension after atropine or pacing fails (Class IIb).
- Begin the infusion at 2 to 10 µg/min and titrate to patient response.
- Assess intravascular volume and support as needed.
Both α- and β-adrenergic actions

Dopamine infusion (at rates of \(2\text{ to }10 \, \mu\text{g/kg per minute}\)) can be added to epinephrine or administered alone.

Titrate the dose to patient response.

Assess intravascular volume and support as needed.
Thank you for your attention!!