**Arrhythmias**

**Definition:**
Arrhythmia is an abnormality of the cardiac rhythm or rate.

**The conducting system of the heart:**
- Under normal condition, the pacemaker of the heart is Sinoatrial node (SAN).
- The cardiac impulses arise from SAN in a rate (60 – 90 beats/min).
- The impulse spreads through the walls of the atria causing them to contract.
- The SAN is considered the pacemaker of the heart because its normal rate (60-90b/m) is faster than other cardiac muscle fibers.
- Next, the impulse reaches the AV node, in which there is a delay of conduction to allow the atria to contract before the ventricles.
- Then, the impulse reaches bundle of Hiss in the interventricular septum, then along the 2 bundle branches (left & right) & finally Purkinje fibers to terminate in the ventricular myocardium causing ventricular contraction.

- Syndmpathetic stimulation $\Rightarrow$ $\uparrow$ the activity of SAN & $\uparrow$ the conduction of AVN.
- Parasympathetic stimulation $\Rightarrow$ $\downarrow$ the activity of SAN & $\downarrow$ the conduction of AVN.
- The ventricles are supplied by sympathetic only (no parasympathetic supply).
- SAN is considered the pacemaker of the heart because its normal rate (60-90b/m) is faster than other cardiac muscle fibers.
- SAN is characterized by its own automaticity (ability to generate impulses) so nerve supply of the heart aims at regulation of heart rate & not initiation of rhythm.
- Normally, the AVN allows passage of impulses from atria to ventricles but not the reverse (no retrograde conduction).

**Clinical classification of arrhythmias:**

- **Regular tachycardia:**
  - Sinus tachycardia.
  - Paroxysmal supra-ventricular tachycardia.
  - Atrial flutter.
  - Ventricular tachycardia.

- **Regular bradycardia:**
  - Sinus bradycardia.
  - Nodal (junctional) rhythm.
  - Partial heart block (1st & type II 2nd degree heart block).
  - Complete heart block (3rd degree heart block).

- **Irregular rhythm:**
  - Premature beats (Extrasystoles).
  - Atrial fibrillation.
  - Type I 2nd degree heart block.
I- **Etiology of any arrhythmia:**

<table>
<thead>
<tr>
<th>Tachyarrhythmia</th>
<th>Bradyarrhythmia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Myocarditis.</td>
<td>6- Sympathomimetics</td>
</tr>
<tr>
<td>2- Ischemic heart disease ( Myocardial infarction ).</td>
<td>7- Thyrotoxicosis</td>
</tr>
<tr>
<td>3- Rheumatic heart disease.</td>
<td></td>
</tr>
<tr>
<td>4- Congenital heart disease.</td>
<td>6- Sympatholytics</td>
</tr>
<tr>
<td>5- Digitalis.</td>
<td>7- Hypothyroidism.</td>
</tr>
<tr>
<td>6- Sympathomimetics .</td>
<td></td>
</tr>
</tbody>
</table>

**Exceptions:**
- Sinus (tachy or brady) arrhythmias: Physiological & pathological causes.
- Atrial flutter or Atrial fibrillation: begin the etiology by: MS then thyrotoxicosis.

II- **Clinical picture:**

- **Symptoms of tachyarrhythmias:**
  - 1- Asymptomatic.
  - 2- Palpitation:
    - Onset:
    - Offset:
    - Duration of the disease: short in serious arrhythmias eg: VT, CHB.
  - 3- Manifestations of LCOP.
  - 4- Precipitation of HF & angina.
  - 5- Features of the cause e.g: MI, Rheumatic heart disease, digitalis toxicity ..........

- **Symptoms of bradyarrhythmias:**
  - The same but no precipitation of angina.

**Exceptions:**
- Atrial fibrillation (AF): add thromboembolism (*number 1*).
- Ventricular tachycardia (VT): add Sudden death.
- Complete heart block: add Syncope.
  - Sudden death.
**Signs:**

1. **Radial pulse**: (test for ventricle)
   a) **Rate**: ↑ (Uncountable pulse) in tachy, ↓ in bradyarrhythmias.
   b) **Rhythm**: all are regular except AF & extrasystoles.
   c) **Response to carotid sinus massage (in tachy)**: ↓ HR in any tachyarrhythmia except arrhythmias that originate in the ventricle.

   *Simply*: any arrhythmia contain this word, ventricular, in its name ➔ no effect 😊

   *(no parasympathetic supply)*

   **NB**: In bradyarrhythmias: Response to atropine instead.

2. **Respiratory sinus arrhythmia**: -ve in all arrhythmias except in both sinus tachy & bradyarrhythmias.

   *Simply*: it is –ve in any arrhythmia except when arrhythmia contain this word, sinus ➔ it is +ve. 😊

   **Respiratory sinus arrhythmia**: *(HR is increased during inspiration)*
   - Inspiration ➔ ↑ VR ➔ ↑ of SAN ➔ ↑ HR.
   - This is a physiological process indicating that the pacemaker is the SAN.

3. **Neck vein**: (test for atrium)
   - Rapid A wave in atrial tachyarrhythmias.
   - Loss of A wave in atrial fibrillation.
   - **Cannon** A wave in any arrhythmia containing this word: nodal, either: paroxysmal nodal tachycardia or nodal rhythm.
   - Occasional cannon A wave in: ventricular tachycardia & complete heart block *(Atrio-Ventricular dissociation)*.

   **Cannon A wave**: It means severe increase of the right atrial pressure.
   It is due to ventricular contraction during atrial contraction.

4. **Auscultation**: (first heart sound)
   - Accentuated in any tachycardia.
   - weak in any bradycardia.

   **Exceptions**:
   - Atrial fibrillation.
   - Ventricular tachycardia. Variable \( S_1 \)
   - Complete heart block.
   - Nodal rhythm ➔ accentuated \( S_1 \) inspite of bradycardia.
III- **Investigations:**

1- **ECG:**

*P wave*: represents atrial contraction.
- Normal in sinus arrhythmias.
- Abnormal in any other atrial arrhythmias.
- Flutter wave in atrial flutter.
- Fibrillation waves or even absent P wave in atrial fibrillation.

*PR interval*: represents the passage of impulse from atria to ventricles.
- Short in tachycardia.
- Prolonged in bradycardia.
- AV dissociation in: VT, CHB.

*QRS complex*: represents the ventricular contraction.
- Regular except in AF & extrasystole.
- Deformed (bizarre): in VT & CHB.

2- **Investigations for the cause:**
- Echo: Congenital or valvular heart diseases.
- Thyroid function tests.

**IV- Treatment:**

See later

*NB*: This scheme is more than enough for undergraduates.

To gain experience in the diagnosis and management of tachyarrhythmias, spend time in a coronary care unit.

Paul Marino
Sinus tachycardia

**Definition:**
It is a condition in which the SAN discharges impulses faster than normal (>100 / min)

Notice that SAN is still the pacemaker of the heart

**Etiology:**
- **Physiological:** Exercise, Emotions, Excessive coffee.
- **Pathological:** Hypotension, Hyperdynamic circulation, Hyperthermia, Heart failure
- **Pharmacological:** Adrenaline, Atropine.

**Clinical Picture:**

**Symptoms:**
- The same as scheme.
- Onset & offset: gradual.
- Duration of the disease is usually long as the condition is mostly physiological.

**Signs:**

1. **Radial pulse:**
   - Rate: > 100 / min but usually less than 160 / min.
   - Rhythm: regular.
   - Response to carotid sinus massage: gradual \( \downarrow \) HR
   - Respiratory sinus arrhythmia: +ve.

2. **Neck vein:** Normal rapid waves.

3. **Auscultation:** Accentuated \( S_1 \).

**ECG:**
- Rhythm: regular.
- Rate: 100 – 160 / min.
- P waves: are normal & each P wave is followed by normal QRS.

**Treatment:** usually no need
- Treatment of the cause.
- β blockers & sedatives may be needed.
Paroxysmal supraventricular tachycardia

**Definition:**
It is a paroxysmal condition in which there is an abnormal focus in the atrium - other than SAN - which discharges regular impulses more than SAN (150-250/min).
- This abnormal focus may initiated in any area of the atria (paroxysmal atrial tachycardia)
  or even in AVN (paroxysmal nodal tachycardia).

Notice that the heart neglects the SAN & follows the focus

**Etiology:**
- Physiological: excessive coffee, smoking.
- Pathological: the same as scheme.

**Clinical picture:** (in between the attacks the heart is normal)

**Symptoms:**
- The same as scheme.
- Sudden onset & offset.
- Duration of the disease: usually long history as the condition is mostly physiological.
- Duration of the attack: Variable, usually few minutes but may lasts for hours.
  - PSVT that lasts for more than 50% of the day is considered a permanent PSVT.

**Signs:** during the attack

1- Redial pulse:
- Rate: 150 – 250 beats/min. (uncountable).
- Rhythm: regular.
- Response to carotid massage: sudden ↓ HR.
- Respiratory sinus arrhythmia: -ve. (SAN is not the pacemaker)

2- Neck vein:
- Atrial tachycardia: Normal rapid waves.
- Nodal tachycardia: Cannon A waves.

3- Auscultation: Accentuated S₁.

**ECG:**
- P wave:
  - In atrial tachycardia: deformed.
  - In nodal tachycardia: absent or inverted.
- QRS: rapid, regular with normal shape.
**Treatment**:  
*During the attack*

1- Vagal stimulation : Carotid sinus massage or pressure on eye ball.
2- **Drugs**: A B C D  
   Adenosine, β blockers, Ca channel blockers (verapamil), Digitalis. ( IV )  
3- If there is no response or if the patient is hemodynamically unstable : DC cardioversion

---

**Atrial Flutter**

**Definition**:  
It is a condition in which there is an abnormal focus in the atrium that discharges rapid regular impulses (250 – 350/min), but due to **physiological block** of AVN, not all atrial impulses are conducted to the ventricles – only ½, ⅓, ¼, ... of the atrial impulses will pass to the ventricles.

**Notice that not all atrial impulses are conducted to the ventricles**

**Etiology**: *doesn’t occur in normal heart*

The same as scheme but begin with: **Mitral stenosis & thyrotoxicosis**.

**Clinical picture**:  
**Symptoms**:  
- The same as scheme.
- Sudden onset & offset.
- Duration of the disease: Short, it is a *transient* arrhythmia between normal sinus rhythm & atrial fibrillation.

**Signs**:  
1- **Radial pulse**:  
   - **Rate**: Variable according the degree of AV conduction, 150, 100, 75 beats/min.
   - **Rhythm**: regular.
   - **Response to carotid massage**: ↓ HR in mathematical pattern due to ↑ AV block from 2:1 to 3:1 to 4:1. So, HR ↓ from 150 to 100 to 75 beats/min.
   - **Respiratory sinus arrhythmia**: -ve ( SAN is not the pacemaker )

2- **Neck vein**: number of A waves is double, triple or quadruple the pulse rate according to the degree of AVN conduction.

3- **Auscultation**: Accentuated S1.
**ECG:**

( *Saw tooth appearance*)

- **P waves**: abnormal, replaced by multiple small flutter (f) waves before each QRS.
- **QRS**: normal, regular, at a rate of \( \frac{1}{2}, \frac{1}{3} \) or \( \frac{1}{4} \) the atrial rate according to AVN conduction.

**Treatment:**

1. **Drugs**: to control the ventricular rate (↓ AVN conduction)
   - β blockers, Ca channel blocker (*verapamil*) or *digitalis*.
2. **DC cardioversion**: if the patient is hemodynamically unstable.

**Ventricular tachycardia**

**Definition:**

It is a paroxysmal condition in which there is abnormal focus in the ventricle that discharge impulses more than SAN (150 – 250 / min).

- Since the focus is in the ventricle & there is no retrograde conduction in the AVN, so ventricles will follow the ectopic focus & atria will follow the SAN (*AV dissociation*)

Notice that there is no retrograde conduction in the AVN

**Etiology:** *Occur in patient with established heart disease*

- The most common cause is ischemic heart diseases (*myocardial infarction*).
- Other causes: the same as scheme.

**Clinical picture:**

**Symptoms:**

- The same as scheme.
- Sudden onset & offset.
- Duration of the disease: short history because it is a serious condition.
- Duration of the attack:
  - *Sustained VT*: more than 30 seconds (hemodynamically unstable)
  - *Non sustained VT*: less than 30 seconds.
- **Sudden death**: if converted to ventricular fibrillation.
**Signs:**

1- Redial pulse:
   - **Rate**: 150 – 250 / min (*uncountable*).
   - **Rhythm**: regular.
   - **Response to carotid massage**: no effect (*no parasympathetic supply to ventricles*).
   - **Respiratory sinus arrhythmia**: -ve.

2- Neck vein:
   - Normal 'A' wave.
   - Occasional cannon A wave (*because occasionally the atria & ventricles may contract together*).

3- Auscultation: Variable S₁, occasionally cannon sounds.

**ECG:**

- **QRS**: rapid, regular & **wide abnormal** (bizarre) shaped.
- **P waves**: normal rate & shape
  - may comes before or after the QRS and also may be hidden by the QRS.
- **No fixed relation between P waves & QRS complexes** (*atrio ventricular dissociation*).

**NB**: Any wide QRS complex tachycardia in any patient with primary heart disease is considered & treated as VT until proved otherwise.

**Treatment:**

**During the attack:**

- **If the patient is hemodynamically unstable**: Immediate cardioversion (*start at 100 J & repeat if needed & add 100 J to each successive shock*).
- **If the patient is hemodynamically stable**:
  - Amiodarone (IV): 150 mg IV over 10min & follow with 1mg/min infusion for 6 hours.
  - Lidocaine (IV).

- Recently, amiodarone has replaced lidocaine as the antiarrhythmic drug of choice in terminating VT.
- Adenosine is not effective in VT.  

**In between the attacks**:

- **albi**
  - Amiodarone.
  - Lidocaine.
  - β blockers.
  - Implantable Cardioverter defibrillator (ICD): in resistant cases.
**Torsades de points:** *(French for twisting of the points)*

- It is a multifocal VT characterized by QRS complexes that change in amplitude & appear to be twisting around the isoelectric line of the ECG & associated with prolonged QT interval.
- AE : Antiarrhythmic drugs & electrolyte disorders (hypokalemia, hypomagnesemia, hypocalcemia)
- Treatment : Mg & ventricular pacing may be needed.

**DD of regular tachycardia:**

<table>
<thead>
<tr>
<th></th>
<th>Sinus tachycardia</th>
<th>PSVT</th>
<th>Atrial flutter</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etiology</td>
<td>Physiological:3E</td>
<td>Excessive coffee &amp; smoking</td>
<td>MS</td>
<td>MI</td>
</tr>
<tr>
<td></td>
<td>Pathological :4H</td>
<td></td>
<td>Pathological:scheme</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pharmacological:2 A</td>
<td></td>
<td>Thyrotoxicosis</td>
<td></td>
</tr>
<tr>
<td>Complaint (palpitation)</td>
<td>Gradual onset</td>
<td>Acute onset</td>
<td>Acute onset</td>
<td>Acute onset</td>
</tr>
<tr>
<td></td>
<td>Gradual offset</td>
<td>Acute offset</td>
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<td>Acute offset</td>
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<td></td>
<td>Long history</td>
<td>Long history</td>
<td>Short history</td>
<td>Short history</td>
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<td></td>
<td></td>
<td></td>
<td><em>(transient)</em></td>
<td><em>(serious)</em></td>
</tr>
<tr>
<td>Radial pulse:</td>
<td>Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate</td>
<td>100 – 160 /m</td>
<td>150 – 250 /m</td>
<td>Variable(150,100,..)</td>
<td>150 – 250 /m</td>
</tr>
<tr>
<td>Rhythm ☺</td>
<td>Regular</td>
<td>Regular</td>
<td>Regular</td>
<td>Regular</td>
</tr>
<tr>
<td>Response to carotid massage</td>
<td>+ve ( gradual ↘ )</td>
<td>+ve ( sudden ↘ )</td>
<td>+ve ( mathematical )</td>
<td>- ve</td>
</tr>
<tr>
<td>Respiratory sinus arrhythmia</td>
<td>+ve</td>
<td>-ve</td>
<td>-ve</td>
<td>- ve</td>
</tr>
<tr>
<td>Neck vein</td>
<td>Rapid &amp; normal</td>
<td>Atrial: rapid ,normal</td>
<td>Multiple a wave :</td>
<td>Normal with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nodal : cannon</td>
<td>2,3,4 time the radial rate</td>
<td>occasional cannon</td>
</tr>
<tr>
<td>S₁</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>variable</td>
</tr>
<tr>
<td>ECG</td>
<td>Rapid normal</td>
<td>Atrial:</td>
<td>P wave : flutter waves</td>
<td>Wide bizarre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P waves are deformed</td>
<td>QRS : ½, ¼, ⅔ the P waves.</td>
<td>QRS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QRS : normal shape</td>
<td>Nodal: absent P wave</td>
<td>AV dissociation.</td>
</tr>
<tr>
<td>Treatment</td>
<td>ttt of the cause β blocker</td>
<td>Vagal stimulation</td>
<td>drugs: B, C, D</td>
<td>Cardioversion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drugs : A,B,C,D</td>
<td>Cardioversion</td>
<td>Amiodarone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cardioversion</td>
<td>Lidocaine.</td>
<td></td>
</tr>
</tbody>
</table>
Sinus bradycardia

Definition:
It is a condition in which the SAN discharges impulses by a rate less than 60 / min

Etiology:
- Physiological: During sleep, Athletes.
- Pathological: Obstructive jaundice, Hypothyroidism.
- Pharmacological: β blockers, Ca channel blockers, Digitalis.

Clinical picture:
Symptoms: usually asymptomatic
- The same as scheme (notice that there is no precipitation of angina)
- Onset & offset: gradual.
- Duration of the disease is usually long as the condition is mostly physiological.

Signs:
1- Radial pulse:
  - Rate: < 60 / min.
  - Rhythm: regular.
  - Response to exercise or atropine: gradual ↑ HR
  - Respiratory sinus arrhythmia: +ve.

2- Neck vein: Slow – normal shape.

3- Auscultation: Weak S1.

ECG:
- Rhythm: regular.
- Rate: < 60/min.
- P waves: are normal & each P wave is followed by normal QRS.

Treatment: usually no need
- Treatment of the cause.
- Atropine may be needed.
- Artificial pacemaker may be needed in sever chronic cases or when sinus brady- cardia is a part of Sick Sinus Syndrome.

Nodal (Junctional) rhythm

Definition:
- It is a condition in which the heart is controlled by the AVN.
- Here, the impulses reach the atria & ventricles in the same time.

Etiology:
The same as scheme (the most common causes are digitalis & MI)
Clinical picture:

Symptoms:
- The same as scheme.
- Sudden onset & offset.
- Duration of the disease: usually short history except if congenital.

Signs:
1- Radial pulse:
- Rate: slow (40–50/min).
- Rhythm: regular.
- Response to exercise or atropine: gradual ↑ HR.
- Respiratory sinus arrhythmia: -ve. (SAN is not the pacemaker)

2- Neck vein: Cannon A waves.

3- Auscultation: accentuated S₁ (cannon sounds), it’s an exception in bradyarrhythmia.

ECG:
- P wave is inverted, may be before, under or after QRS complex
- HR is slow

- P waves: Inverted & come approximately at the same time with QRS so may be absent
- QRS: Slow, regular with normal shape.

Treatment:
- Treatment of the cause.
- Atropine.
- Artificial pacemaker may be needed in severe cases.

Heart Block

Types:
- Sino atrial block: failure of impulse to conduct between the SAN & the atria.
- AV block: failure of impulse to conduct between the atria & the ventricles.
- Bundle branch block (BBB): either in left or right bundles.

Atrio ventricular (AV) block

First degree heart block: (Just delayed conduction)
- PR interval is longer than 0.2 second.
- All impulses from SAN are conducted to the ventricles.
- Etiology: physiologically during sleep or pathologically as in myocarditis.
- Usually asymptomatic.
Second degree heart block:
In this condition some impulses from the atria don’t reach the ventricles, this causes “dropped beats”. There are two types:

**Type I 2\textsuperscript{nd} degree (Mobitz I, Wenckebach block):**
- Progressive prolongation of PR interval leading finally to the dropout of a QRS complex & then the cycle is repeated. (notice that there is irregular pulse).
- This condition is not too serious and may occur physiologically during sleep in athletes.

**Type II 2\textsuperscript{nd} degree (Mobitz II):**
- Intermittently skipped ventricular beat
  - The AVN transmits one impulse for each 2, 3, or 4 or more atrial impulses.
  - This block may be fixed (e.g. 2:1 all the time) or variable (irregular).

**Complete heart block (3rd degree):**
- In this condition all impulses from the atria don’t reach the ventricles, so, the ventricles will be controlled by idioventricular rhythm.

Notice that the atria are controlled by SAN & the ventricles are controlled by idioventricular rhythm. (Atrioventricular dissociation)

- Idioventricular rhythm may originate anywhere from AVN to the bundle branches or Purkinje fibers. (*The closer the origin to AVN, the faster the rate*)

**Etiology:** The same as scheme plus idiopathic fibrosis of AVN.

**Clinical picture:**

**Symptoms:**
- The same as scheme. Plus 2 S
- Syncope “Adams-Stokes attacks”
- Sudden death.

**Signs:**
1- Redial pulse:
- Rate: 30-40/min.
- Rhythm: regular.
- **Response to atropine**: -ve (ventricular escape phenomenon).
- **Respiratory sinus arrhythmia**: -ve.

2- **Neck vein**: normal with occasional cannon A waves.

3- **Auscultation**: Variable $S_1$ with occasional sounds.

**ECG**:

- **QRS**: slow, regular & **wide abnormal** (bizarre) shaped.
- **P waves**: normal rate & shape.
- No fixed relation between P waves & QRS complexes (**Atrioventricular dissociation**)

**Treatment**:

- Treatment of the cause.
- Atropine.
- Artificial pacemaker: the treatment of choice.

**In one word**:

- **Sinus bradycardia**: is the same like **sinus tachycardia** but slow.
- **Nodal rhythm**: is the same like **Paroxysmal nodal tachycardia** but slow.
- **Complete heart block**: is the same like **ventricular tachycardia** but slow.

**Atrial fibrillation**

**Definition**:

It is a condition in which there are rapid **irregular** impulses (400-600/min) arise from the atria by multiple ectopic foci (**so the atria don’t contract effectively**) & due to physiological delay at AVN, not all impulses are conducted to the ventricles.

Notice that there are multiple foci ending in ineffective atrial contraction

**Etiology**:

- **Mitral stenosis & thyrotoxicosis**.
- **Constrictive pericarditis & Cardiac surgery**.
- **Lone AF (idiopathic)**: especially in elderly.
- Other causes: like scheme.
Clinical picture:

Symptoms:
- The same as scheme.
- Palpitation: rapid, irregular & may be paroxysmal or sustained.
- Duration of the disease: may be long.
  (the patients may accommodate for a new rhythm & palpitation disappears)
- Thromboembolism: ineffective atrial contraction predisposes to stasis of blood and may lead to thrombosis & systemic emboli (e.g. hemiplegia)

Signs:
1- Redial pulse:
- Rate: usually rapid (100 – 150 /min) may be slow as in patients on digitalis.
- Rhythm: marked irregularity (you can’t count 4 successive regular beats)
  - Pulse deficit (apical pulse - radial pulse): > 10/min.
- Response to carotid massage: may ↓HR due to decreased AV conduction.
- Respiratory sinus arrhythmia: -ve.

NB: If the radial pulse becomes regular & slow in a case of AF: CHB is suspected.
  If the radial pulse become regular & rapid in a case of AF: VT is suspected.

2- Neck vein: absent A wave.
3- Auscultation: Variable intensity of S1.

ECG:

- P wave: absent & replaced by fibrillation (F) waves.
- QRS: normal in shape but irregular in rhythm.

Treatment:
The acute management of AF involves 3 strategies:

1- Reversion to normal sinus rhythm:
- Methods: Electrical cardioversion.
  - Drugs: quinidine, flacinide, propafenone or amiodarone.
- Indication:
  - Recent onset of AF.
  - No history of recent embolism.
  - No significant left atrial enlargement.
Precautions:
- Anticoagulant must be given at least 2 weeks before reversion to decrease the risk of embolization.
- Discontinuation of digitalis before electrical cardioversion is a must.

2- Control of ventricular rate: by β blocker, Ca channel blocker or Digitalis.

3- Prevention of thromboembolism: by warfarin or aspirin.

**NB:** - In some cases atrial fibrillation is better treated by anticoagulant therapy & control of ventricular rate without any trial to return to sinus rhythm.
- Recurrent AF is treated by long use of propafenone, flacinide or amiodarone.

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**Premature beats (Extrasystoles)**

**Definition:**
It is an ectopic impulses arising from the atria, AVN or ventricles before the expected next beat causing what is called premature beat.
- Premature beats occur during relative refractory period (RRP)

Notice that the premature beat is followed by compensatory pause & forceful contraction

**Etiology:**
- Physiological: Emotions, smoking or excessive coffee.
- Pathological: The same as scheme.

**Clinical Picture:**

**Symptoms:**
- Asymptomatic in most cases.
- Occasional irregular palpitation.

**Signs:**

1- Radial pulse:
- Rate: normal, tachy or bradycardia.
- Rhythm: Occasional irregularity.
  - Pulse deficit: < 10 / min.
- Response to exercise: the irregularity disappears due to ↓ in diastolic period.
2- **Neck vein**: normal wave with occasional irregularity.
3- **Auscultation**: normal sounds with occasional irregularity.

**ECG**: ventricular premature beats are wide bizarre QRS not preceded by P wave & followed by compensatory pause.

**Treatment**:
1- Reassurance.
2- Treatment of the cause.
3- In chronic stable cases: Amiodarone, β blocker, Ca channel blocker or quinidine.
4- Lidocaine (IV) in emergency cases.

**Wolf-Parkinson-White (WPW) syndrome**:
- It is accessory pathway that connects the atrium & ventricle & can bypass the AVN.
- So, AF is a very serious arrhythmia in these patients, it may lead to ventricular fibrillation.
- WPW is associated with thyrotoxicosis, mitral valve prolapse, HCM & more common in men.
- **Treatment**: Amiodarone, β blocker. Radiofrequency ablation is the treatment of choice.
- Digitalis & verapamil should be avoided (↑ conduction through the accessory pathway).

![Treatment of arrhythmias](image)

**I- Pharmacological (Antiarrhythmic drugs)**:

<table>
<thead>
<tr>
<th>CLASS</th>
<th>DRUGS</th>
<th>MAIN USES</th>
</tr>
</thead>
<tbody>
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<td>Na channel blockers</td>
<td></td>
</tr>
<tr>
<td>(slows the depolarization)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class IA</td>
<td>Qunidine, Procainamide.</td>
<td>Broad spectrum.</td>
</tr>
<tr>
<td>Class IB</td>
<td>Lidocaine, Phenytoin.</td>
<td>Venticular arrhythmias.</td>
</tr>
<tr>
<td>Class IC</td>
<td>Flacainide, Propafenone.</td>
<td>Broad spectrum.</td>
</tr>
<tr>
<td><strong>Class II</strong></td>
<td>β blockers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Propranolol, Atenolol, Esmolol</td>
<td>Tachyarrhythmias.</td>
</tr>
<tr>
<td><strong>Class III</strong></td>
<td>K channel blockers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amiodarone, Bretylium.</td>
<td>Broad spectrum.</td>
</tr>
<tr>
<td><strong>Class IV</strong></td>
<td>Ca channel blockers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verapamil, Diltiazem.</td>
<td>Atrial tachyarrhythmias.</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>Adenosine (↓ automaticity &amp; conductivity)</td>
<td>PSVT</td>
</tr>
<tr>
<td></td>
<td>Digitalis (↓ automaticity &amp; conductivity)</td>
<td>Atrial tachyarrhythmias</td>
</tr>
</tbody>
</table>
Side effects of antiarrhythmic drugs:

- **Proarrhythmias**: new arrhythmias induced by the drug.
- **Quinidine**:
  - Allergy & hypotension.
  - Cinchonism (headache, vomiting, tinnitus & blurring of vision).
  - Digitalis toxicity.
- **Lidocaine**: 3m
  - Mental confusion.
  - Myocardial depression.
  - Muscle twitching.
- **Amiodarone**: due to its tendency to accumulate in body tissue it may lead to:
  - CNS: Dizziness, depression, tremors.
  - Corneal deposits.
  - Thyroid dysfunctions (hyper or hypo thyroidism).
  - Pulmonary fibrosis.
  - Elevation of hepatic enzymes.
  - Constipation.
  - Skin pigmentation.

II- Non pharmacological:

- DC cardioversion.
- Implantable cardioverter defibrillator (ICD).
- Radiofrequency catheter ablation.
- Artificial pacemaker (temporary, permanent).