Third Degree AV Block

G. No relationship between P waves and QRS complexes: QRS rate slower than P rate

Third-degree (complete) AV block

1. Impulses originate at both SA node (P waves) and below site of block in AV node (junctional rhythm) conducting to ventricles

Atria and ventricles depolarize independently. QRS complexes less frequent; regular at 40 to 55/minute but normal in shape

2. Impulses originate at SA node (P waves) and also below site of block in ventricles (idioventricular rhythm)

Atria and ventricles depolarize independently. QRS complexes less frequent; regular at 20 to 40/minute but wide and abnormal in shape
Third degree AV block (Complete Heart Block)

- EKG
  - P wave และ QRS complexes ไม่สัมพันธ์กัน โดยที่จำนวน P wave จะมากกว่า QRS complexes (atrial rate > ventricular rate; PP interval < RR interval)
  - PP interval = regular; RR interval = regular; totally variable PR interval
- Atrial impulse ไม่สามารถผ่านลงมาจากต้น ventricle ได้โดยสิ้นเชิง
  - QRS เกิดจากจุดไฟฟ้าส่วนต้นจาก AV node
- สาเหตุ: AV node conduction abnormality
  - Coronary ischemia: most common
  - Degenerative process (fibrosis, calcification): common
  - Infiltrative disease
  - Inflammation/autoimmune disease
  - Infection: Infective endocarditis -> valve ring abscess
  - Mechanical injury: post op, post RF ablation
- Congenital
- If unstable → need immediate pacing therapy
Third degree AV block with escape junctional rhythm
AV Dissociation

Helpful in diagnosis of ventricular tachycardia
# Indication for pacing in AV block

<table>
<thead>
<tr>
<th>Asymptomatic</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st degree</td>
<td>Pacing not indicated</td>
</tr>
<tr>
<td>2nd degree</td>
<td>Pacing not indicated in type I with narrow QRS</td>
</tr>
<tr>
<td></td>
<td>Electrophysiological study in type I with wide QRS</td>
</tr>
<tr>
<td></td>
<td>Pacing in type II</td>
</tr>
<tr>
<td>3rd degree</td>
<td>Pacing</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>Pacing regardless of type</td>
</tr>
</tbody>
</table>
Right Bundle Branch Block (RBBB)
Left Bundle Branch Block (LBBB)
<table>
<thead>
<tr>
<th></th>
<th>Lead $V_1$</th>
<th>Leads 1 and $V_6$</th>
<th>QRS duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical RBBB</td>
<td><img src="image" alt="Waveform" /> or <img src="image" alt="Waveform" /></td>
<td><img src="image" alt="Waveform" /> or <img src="image" alt="Waveform" /></td>
<td>$\geq 0.11$ sec</td>
</tr>
<tr>
<td>Typical LBBB</td>
<td><img src="image" alt="Waveform" /> or <img src="image" alt="Waveform" /></td>
<td><img src="image" alt="Waveform" /> or <img src="image" alt="Waveform" /></td>
<td>$\geq 0.12$ sec</td>
</tr>
<tr>
<td>IVCD</td>
<td>None</td>
<td>Neither typical RBBB nor LBBB morphology in the three key leads</td>
<td>$\geq 0.11$ sec</td>
</tr>
</tbody>
</table>
Ventricular Arrhythmia
Ventricular rhythm

- Wide QRS complex (QRS duration > 120 ms)
  - Idioventricular rhythm (escape ventricular rhythm) : rate < 40 BPM
  - Accelerated idioventricular rhythm (slow VT) : rate 40 – 120 BPM
  - Ventricular tachycardia : rate > 120 BPM
    - Monomorphic Vs Polymorphic
    - Sustained (> 30 sec) Vs Non-sustained (<30 sec)
    - Pulseless (unstable) Vs non-pulseless (stable)
- Fibrillatory QRS $\rightarrow$ Ventricular fibrillation (VF)
Idioventricular Rhythm

Escape ventricular rhythm

Usually seen in dying heart or severe metabolic imbalance
e.g. severe hyperkalemia, severe acidosis
Accelerated Idioventricular Rhythm

Usually associated with reperfusion during myocardial infarction
Ventricular Tachycardia (VT)
Polymorphic VT
Ventricular Fibrillation (VF)
Wide Complex Tachycardia

Wide QRS:
Is Rhythm Regular? Expert consultation advised

Regular

If ventricular tachycardia or uncertain rhythm
- Amiodarone
  150 mg IV over 10 min Repeat as needed to maximum dose of 2.2 g/24 hours
  Prepare for elective synchronized cardioversion
If SVT with aberrancy
- Give adenosine (go to Box 7)

Irregular

If atrial fibrillation with aberrancy
- See Irregular Narrow-Complex Tachycardia (Box 11)
If pre-excited atrial fibrillation (AF + WPW)
- Expert consultation advised
- Avoid AV nodal blocking agents (eg, adenosine, digoxin, diltiazem, verapamil)
- Consider antiarrhythmics (eg, amiodarone 150 mg IV over 10 min)
If recurrent polymorphic VT, seek expert consultation
If torsades de pointes, give magnesium (load with 1-2 g over 5-60 min, then infusion)
Defibrillation: Shockable Arrhythmia

- VT: Ventricular Tachycardia (Monomorphic)
- VT: Ventricular Tachycardia (Polymorphic)
- VF: Ventricular Fibrillation
Differential Diagnosis for Ventricular Rhythm

1. Pacemaker rhythm (ventricular pacing)
2. SVT/AF with aberrant conduction
3. SVT/AF with pre-existing bundle branch block
4. SVT/AF with pre-excitation (Wolf-Parkinson-White syndrome: WPW)

บางครั้ง ECG ในกรณี 2,3,4 อาจจะแยกจาก VT ได้ยากมากหรือแยกไม่ได้ เลยจาก ECG เพียงอย่างเดียว ถ้าไม่แน่ใจโดยเฉพาะถ้าผู้ป่วยมี unstable wide complex tachycardia พิจารณาวิเคราะห์เหมือน VT
Ventricular Pacing Rhythm

Transvenous pacemaker produces beat in right ventricle. Not supraventricular, and therefore wide QRS.

Pacemaker spike (may be small; sometimes missed)
Supraventricular Rhythm with Intraventricular Conduction Defect (IVCD), including right or left bundle branch block.

- Supraventricular origin of impulse
- Bundle branch block

**B. QRS > 0.10 second**

1. Intraventricular conduction defect (IVCD), including right or left bundle branch block

- Wide QRS (>2½ small boxes), often notched, preceded by P wave with normal PR interval
- Conduction below block by slow spread from uninvolved side
SVT with aberrant conduction
AF with pre-existing LBBB
Supraventricular Rhythm with accessory conduction

2. Wolff-Parkinson-White (preexcitation) syndrome

Impulses originate at SA node and preexcite peripheral conduction system and ventricular muscle via bundle of Kent without delay at AV node. (In type B, impulses may pass via posterior accessory bundle)

After normal delay at AV node, impulses also arrive at ventricles via normal route to continue depolarization

P wave is immediately followed by short delta wave, producing slurred upstroke on wide QRS with short or no PR interval
AF with WPW
Supraventricular Rhythm with

A. QRS < 0.10 second
Supraventricular rhythm with normal intraventricular conduction

Supraventricular origin of impulse
may be sinus, atrial or junctional

Impulse travels rapidly along conduction system

Brief (narrow) QRS duration (<2½ small boxes)
Quick Approach to Rhythm

• Look for QRS
  – No QRS identified: Asystole, VF, connector problems
  – QRS identified → Identify heart rate
    • Normal resting heart rate: 60 – 100 bpm
    • Tachycardia: >100 bpm
    • Bradycardia: <60 bpm
  – Regular or irregular
    • Totally irregular → likely AF
  – Wide or narrow QRS complex
    • Wide QRS complex: Ventricular rhythm e.g. VT; pre-existing BBB or aberrant conduction; pre-excitation (WPW), pacemaker rhythm
Quick Approach to Rhythm

• Look for P wave and association of P wave to QRS (PR interval)
  – P wave: not identified
    • P wave hidden in T wave, QRS complex, small P wave
    • No P wave with flat line: sinus arrest, sinus block
    • No P wave with fibrillation/flutter wave: AF, A flutter
  – P wave: identified
    • Is it sinus P wave? – P wave + in II, III, aVF
      – Not sinus P wave: ectopic atrial rhythm (bradycadia or normal HR),
        atrial tachycardia (tachycardia)
    • Retrograde P wave?
      – Junctional rhythm, SVT, VT
    • Association of P wave to QRS --> PR interval is consistent?
      – No association: AV Block Vs AV dissociation
      – Some association but not consistent: 2nd degree AVB
      – Consistent association but long PR: 1st degree AVB