AV Conduction Blocks

Overview:

If a delay or interruption in impulse conduction occurs within the AV node, bundle of His, or His-Purkinje system, the resulting dysrhythmia is called an atrioventricular (AV) block.

AV blocks have been traditionally classified in two ways:

1. according to degree of the block (and/or)
2. according to the site of the block

Remember, the PR interval reflects depolarization of the R and L atria (P wave) and the spread of the impulse through the AV node, bundle of His, R and L bundle branches, and Purkinje fibers.

The PR interval is the key to differentiating the *type* of block.

The key to differentiating the *level* (location) of the block is the width of the QRS complex and, in second and third degree blocks, the rate of the escape rhythm.

First Degree AV Block:

First degree atrioventricular block is an arrhythmia in which there is a constant delay in the conduction of electrical impulses, usually through the AV node.

Impulses from the SA node to the ventricles are *delayed*, not blocked, for the same period before they are conducted to the ventricles.

It is characterized by abnormally prolonged PR intervals that are greater than 0.20 second *and constant*.

Diagnostic Characteristics:

Heart Rate:
-heart rate is that of the underlying sinus or atrial rhythm

Rhythm:
-rhythm is that of the underlying rhythm

Pacemaker Site:
-that of the underlying rhythm

P waves:
-P waves are identical and precede each QRS complex

PR Intervals:

-**PR intervals are prolonged (greater than 0.20 second) and usually do not vary from beat to beat**

R-R Intervals:

-those of the underlying rhythm

QRS Complexes:

-usually normal
-less than 0.10 second
-**AV conduction ratio is 1:1 (a QRS follows each P wave)**

Cause of Arrhythmia:

-first degree block usually represents a delay in the conduction of the electrical impulses through the AV node, and thus the QRS complexes are typically normal
-acute inferior or right ventricular MI because of the effect of an increase in vagal tone and ischemia on the AV node
-ischemic heart disease in general
-excessive vagal (parasympathetic) tone from whatever cause
-digitalis toxicity
-administration of amiodarone, beta blockers, or calcium channel blockers
-electrolyte imbalance (hyperkalemia)

Clinical Significance:

-first degree AV block produces no signs or symptoms per se and usually requires no specific treatment
-it can progress to higher-degree blocks
-if associated with a bradycardic rate and symptomatic, treatment is the same as bradycardia

Second-Degree AV Blocks: Overview:

In the early 20th century a European physician named Wenckebach described two types of second-degree AV blocks based on jugular pulse tracings.

In 1924, a German electrocardiographer named Mobitz identified the same dysrhythmias previously described by Wenckebach.

Mobitz termed the rhythms type I (later called Mobitz Type I) and type II (later called Mobitz II).

When some, but not all, atrial impulses are blocked from reaching the ventricles, second-degree AV block results.

Second-degree AV block is classified as type I or type II depending on the location of the block:

Type I—above the bundle of His
Type II—below the bundle of His

Second-Degree, Type I AV Block (Wenckebach or Mobitz Type I):

Second-degree, Type I AV block (Wenckebach) is an arrhythmia in which there is a progressive delay following each P wave in the conduction of electrical impulses through the AV node until conduction is completely blocked.

This arrhythmia is characterized by progressive lengthening of the PR intervals until a QRS complex fails to appear after a P wave.

The sequence is repetitive

Diagnostic Characteristics:

Heart Rate:
-atrial rate is that of the underlying sinus or atrial rhythm
-ventricular rate is typically less than that of the atria

Rhythm:
-atrial rhythm is essentially regular
-ventricular rhythm is usually irregular

Pacemaker Site:
-that of the underlying rhythm

P waves:
-identical and precede the QRS complexes when they occur

PR Intervals:
-**the PR intervals gradually lengthen until a QRS complex fails to appear after a P wave**
(dropped beat)
-following the pause, the sequence begins again

R-R Intervals:
-R-R intervals are unequal
-as the PR intervals gradually lengthen, the R-R intervals typically decrease gradually until the dropped beat (non-conducted P wave)

QRS Complexes:
-typically normal
-commonly the AV conduction ratio is 5:4, 4:3, or 3:2

Cause of Arrhythmia:

-Second-degree Type I most commonly represents defective conduction of the electrical impulses through the AV node

-acute inferior or right ventricular MI because of the effect of an increase in vagal tone and ischemia on the AV node

-ischemic heart disease in general

-excessive vagal (parasympathetic) tone from whatever cause

-digitalis toxicity

-administration of amiodarone, beta blockers, or calcium channel blockers

-electrolyte imbalance (hyperkalemia)

Clinical Significance:

-it is usually transient and reversible

-it produces few, if any, symptoms per se

-it can progress to higher blocks

Second-Degree, Type II AV Block (Mobitz Type II):

Second-degree, Type II AV block is an arrhythmia in which a complete block of conduction of the electrical impulses occurs in one bundle branch and an intermittent block in the other.

The conduction delay in second-degree, Type II AV block occurs below the AV node, either at the bundle of His or at the level of the bundle branches.

This produces (1) an AV block characterized by regularly or irregularly absent QRS complexes and (2) a bundle branch block.

Diagnostic Characteristics:

Heart Rate:

-atrial rate is that of the underlying sinus, atrial, or junctional rhythm

-ventricular rate is typically less than the atrial rate

Rhythm:

-atrial rhythm is essentially regular

-ventricular rhythm is usually irregular

Pacemaker Site:

-that of the underlying rhythm

P waves:

-P waves are identical and precede the QRS complexes when they occur

-because the SA node is generating impulses in a normal manner, each P wave occurs

at a regular interval, but not every P wave will be followed by a QRS

PR Intervals:

-**PR intervals may be normal or prolonged, but are usually constant**

R-R Intervals:

-may be equal or unequal

QRS Complexes:

-may be normal or abnormal because of a bundle branch block

Cause of Arrhythmia:

-Second-degree, Type II AV block usually occurs below the bundle of His in the bundle branches

-it represents an intermittent block of conduction of the electrical impulses through one bundle branch and a complete block in the other

-commonly it is the result of extensive damage to the bundle branches following an acute anterior MI

Clinical Significance:

-the signs and symptoms of second-degree, Type II AV block with excessively slow heart rates are the same as those in symptomatic sinus bradycardia

-it can progress to complete heart block (third-degree)

-Atropine is usually not effective or used in treating a type II AV block

-pacing is the treatment of choice

Third-Degree AV Block (Complete AV Block):

Third-degree AV block is the complete absence of conduction of the electrical impulses through the AV node, bundle of His, or bundle branches.

It is characterized by independent beating of the atria and ventricles.

Diagnostic Characteristics:

Heart Rate:

-atrial rate is that of the underlying sinus, atrial, or junctional rhythm

-ventricular rate is typically 40-60 beats per minute (may be as slow as 30 to 40)

-ventricular rate is usually slower than the atrial rate

Rhythm:

-atrial rhythm may be regular or irregular

-ventricular rhythm is essentially regular

-**the atrial and ventricular rhythms are independent of each other (AV dissociation)**

Pacemaker Site:

-if P waves are present, they may have originated in the SA node or an ectopic site in the atria or AV junction

-pacemaker site of QRS complexes is an escape pacemaker site in the AV junction, bundle branches, Purkinje network, or ventricular myocardium, below the AV block

P waves:

-when present, they have no relation to the QRS complexes

PR Intervals:

-**vary widely because P waves and QRS complexes occur independently**

R-R Intervals:

-usually equal

QRS Complexes:

-QRS complexes typically exceed 0.12 second and are bizarre if the pacemaker site is in the ventricles or if pacemaker is in the AV junction and a bundle branch block is present

-QRS complexes can be normal (0.10 or less) if pacemaker site is above the bundle branches in the AV junction and no bundle branch block is present

Cause of Arrhythmia:

-it is commonly caused by a complete block of conduction of the electrical impulses through the AV node

-acute inferior or R ventricular MI

-ischemic heart disease in general

-excessive vagal (parasympathetic) tone from whatever cause

-digitalis toxicity

-administration of amiodarone, beta blockers, or calcium channel blockers

-electrolyte imbalance (hyperkalemia)

Clinical Significance:

-signs and symptoms are the same as symptomatic bradycardia (but more ominous)

-pacing is *immediately* indicated

-Atropine should not be used for complete heart block