Atrial Rhythms

Wandering Atrial Pacemaker:

This is an arrhythmia originating in pacemakers that shift back and forth between SA node and an ectopic pacemaker in the atria or AV junction.

It is characterized by P waves of varying size, shape, and direction in any one lead.

Diagnostic Characteristics:

Heart Rate:
-60-100, but may be slower

Rhythm:
-usually irregular, but can be regular

Pacemaker Site:
-shifts back and forth between SA node and an ectopic pacemaker in the atria or AV junction

P waves:
-gradually change in size, shape, and direction over duration of several beats
-vary from normal, positive P waves to abnormal, negative P waves, or even become buried in the QRS complex

PR Interval:
-duration usually decreases gradually from about 0.20 second to about 0.12 second or less as the pacemaker site shifts from SA node to lower part of the atria or AV junction
-duration then gradually increases as pacemaker site shifts back to the SA node

R-R Intervals:
-R-R intervals are usually unequal, but can be equal

QRS Complexes:
-QRS typically follows each P wave
-0.10 or less

Clinical Significance:
-usually not clinically significant, and treatment is not indicated
-when heart rate slows excessively, the signs and symptoms, clinical significance, and management are the same as sinus bradycardia

Premature Atrial Contractions:

-A PAC is an extra P-QRS consisting of an abnormal/normal P wave followed by a normal/abnormal QRS complex, occurring earlier than the next expected beat of the underlying rhythm

-PAC's are usually followed by a non-compensatory pause

Diagnostic Characteristics:

Heart Rate:
-HR is that of the underlying rhythm

Rhythm:
-rhythm is irregular when PAC's are present

Pacemaker Site:
-an ectopic pacemaker in any part of the atrial outside the SA node
-PAC's may originate from a single ectopic pacemaker site or from multiple sites in the atria

P waves:
-a PAC is diagnosed when a P wave accompanied by a QRS complex occurs earlier than the next expected P wave

PR Interval:
-may be normal, but usually differ from those of the underlying rhythm
-varies from 0.20 when pacemaker site is near the SA node to 0.12 second when pacemaker site is near the AV junction

R-R Intervals:
-R-R intervals are unequal when PAC's are present

QRS Complexes:
-usually resembles that of the underlying rhythm because conduction of the electrical impulse through the bundle branches is usually unchanged
-usually a QRS complex follows each P wave, but if there is a temporary complete AV block (non-conducted PAC), the QRS will be absent

Frequency and Pattern of PAC's:

1. Isolated
   -PAC's may occur singly (isolated beats)

2. Group Beats
   -may occur in groups of two or more consecutive beats
   -two PAC's in a row are called a couplet
   -when three or more PAC's occur in succession, atrial tachycardia is considered to be present

3. Repetitive Beats
   -PAC's may alternate with the QRS complexes of the underlying rhythm (atrial bigeminy) or occur after every two QRS complexes (atrial trigeminy) or after every three QRS complexes of the underlying rhythm (atrial quadrigeminy)

Cause of the Arrhythmia:
-increase in catecholamines
-infections
-emotion
-stimulants (caffeine)
-sympathomimetic drugs (epinephrine, isoproterenol, norepinephrine)
-electrolyte imbalance
-hypoxia
-digitalis toxicity

-cardiovascular disease (myocardial ischemia, MI, early CHF)

*The electrophysiological mechanism responsible for PAC's is either enhanced automaticity or reentry.

Clinical Significance:

-isolated PAC's may occur in persons with apparently healthy hearts and are not significant
-in persons with heart disease, frequent PAC's may indicate enhanced automaticity of the atria, or a reentry mechanism resulting from a variety of causes
-such PAC's may warn of or initiate more serious supraventricular arrhythmias (atrial tachycardia, atrial fibrillation, Paroxysmal Supraventricular Tachycardia-PSVT)
-if non-conducted PAC's are frequent and heart rate is less than 50, the s/s, clinical significance, and treatment are the same as for symptomatic sinus bradycardia

Atrial Tachycardia:

Atrial tachycardia is an arrhythmia originating in an ectopic pacemaker in the atria with a rate between 160-240 beats per minute.

Diagnostic Characteristics:

Heart Rate:

-atrial rate is usually 160-240, but may be slightly faster or slower
-because atrial tachycardia commonly starts and ends gradually, it is called a non-paroxysmal atrial tachycardia
-by definition, three or more consecutive PAC's are considered to be atrial tachycardia
-vagal maneuvers (increasing vagal/parasympathetic tone) do not terminate atrial tachycardia abruptly nor slow the atrial rate, but they do impede AV conduction and result in an AV block

Rhythm:

-atrial rhythm is essentially regular
-ventricular rhythm is usually regular, but may be irregular

Pacemaker Site:

-an ectopic pacemaker in any part of the atria outside the SA node
-atrial tachycardia may occasionally originate in more than one atrial ectopic pacemaker site

P waves:

-the ectopic P waves in atrial tachycardia usually differ from normal sinus P waves
-they may appear positive, upright if pacemaker site is near the SA node, or negative, inverted if pacemaker site is near the AV junction
-P waves may be buried in the preceding T wave

PR Interval:

-usually normal and constant

R-R Intervals:

-usually equal

QRS Complexes:
-normal

Cause of the Arrhythmia:
-digitalis toxicity
-metabolic abnormalities (including acute alcohol abuse)
-electrolyte disturbances
-hypoxemia
-chronic lung disease
-coronary artery disease (especially after an acute MI)
-rheumatic heart disease

Clinical Significance:
-s/s depend on the presence or absence of heart disease, nature of the heart disease, ventricular rate, and duration of the arrhythmia
-frequently it is accompanied by feelings of palpitations, nervousness, or anxiety
-when the ventricular rate is very rapid, the ventricles are unable to fill completely during diastole, resulting in a significant reduction of the cardiac output and a decrease in perfusion of the brain and other vital organs (dizziness, confusion, lightheadedness, SOB, syncope, angina, CHF, MI)
-a rapid heart rate increases the workload of the heart and oxygen requirements of the myocardium (increase myocardial ischemia, frequency and severity of CP, cause CHF, hypotension, cardiogenic shock, or predispose patient to serious ventricular arrhythmias)

Atrial Flutter:

Atrial flutter is an arrhythmia arising in an ectopic pacemaker or the site of a rapid reentry circuit in the atrial, characterized by rapid abnormal flutter waves with a sawtooth appearance.

Diagnostic Characteristics:

Heart Rate:
-usually the atrial rate is between 240 and 360 per minute (300 average)
-the ventricular rate is commonly about 150 per minute (half the atrial rate in an uncontrolled (untreated) atrial flutter and about 60-75 in a controlled (treated) atrial flutter

Rhythm:
-atrial rhythm is typically regular, but may be irregular
-ventricular rhythm is usually regular

Pacemaker Site:
-an ectopic pacemaker in part of the atria outside of the SA node
-commonly located low in the atria near the AV node
-activity of the SA node is completely suppressed by atrial flutter

Characteristics of Atrial Flutter Waves:
1. Relationship to Cardiac A/P:
-an atrial flutter (F) wave represents depolarization of the atria in an abnormal direction followed by atrial repolarization
-depolarization of the atria commonly begins near the AV node and progresses across the atria in a retrograde direction

2. Amplitude:
-varies greatly from less than 1 mm to over 5 mm

3. Shape
-atrial F waves have a sawtooth appearance
-typical F wave consists of a negative, V-shaped ectopic atrial wave immediately followed by an upright, peaked atrial T wave
-an isoelectric line is seldom present between the waves

*Atrial fibrillation may occur during atrial flutter and vice versa. This mixture is called atrial flutter-fibrillation

R-R Intervals:
-equal, but can be unequal

QRS Complexes:
-normal

Cause of Arrhythmia:
-chronic (persistent) atrial flutter is most commonly seen in middle-aged and elderly persons with the following conditions:
-advanced rheumatic heart disease
-coronary or hypertensive heart disease
-transient (paroxysmal) atrial flutter usually indicates the presence of cardiac disease, however, it may occasionally occur in apparently healthy persons. It may also be associated with the following:
-cardiomyopathy
-digitalis toxicity
-hypoxia
-acute or chronic cor pulmonale (hypertrophy or failure of R ventricle resulting from disorders of the lungs, pulmonary vessels, or chest wall)
-CHF
-damage to SA node or atria (pericarditis, myocarditis)
-alcoholism

*Atrial flutter may be initiated by a PAC.
*The electrophysiological mechanism responsible for atrial flutter is either enhanced automaticity or reentry.

Clinical Significance:
-s/s of atrial flutter with a fast ventricular response are the same as those of atrial tachycardia
-in 2:1 atrial flutter (in particular) the atria do not regularly contract and empty during the last part of ventricular diastole
-the loss of this "atrial kick" may result in incomplete filling of the ventricles before they contract, causing a reduction of the cardiac output by as much as 25%

Atrial Fibrillation:

Atrial fibrillation is an arrhythmia arising in multiple ectopic pacemakers/sites of rapid reentry circuits in the atria, characterized by very rapid abnormal atrial fibrillation waves and an irregular, often rapid ventricular response.

Diagnostic Characteristics:

Heart Rate:
-typically the atrial rate is 350 to 600 (average 400) fibrillation (f) waves/minute
-ventricular rate is commonly about 160-180 (or as high as 200) in an uncontrolled (untreated) atrial fibrillation and about 60-70 in a controlled (treated) atrial fibrillation

Rhythm:
-atrial and ventricular rhythms are irregularly irregular

Pacemaker Site:
-multiple ectopic pacemakers in the atria outside of the SA node
-pacemaker sites generate electrical impulses chaotically
-activity of the SA node is completely suppressed by atrial fibrillation

Characteristics of Atrial f Waves:
1. Relationship to Cardiac A/P
-atrial f waves represent abnormal, chaotic, and incomplete depolarizations of small individual groups of atrial muscle fibers
-because organized depolarizations of the atria are absent, P waves and organized atrial contractions are absent

2. Amplitude
-varies from less than 1 mm to several millimeters
-if f waves are less than 1 mm they are called fine fibrillatory waves
-if f waves are 1 mm or greater they are called coarse fibrillatory waves

R-R Intervals:
-typically unequal

QRS Complexes:
-typically normal

Cause of Arrhythmia:
-advanced rheumatic heart disease
-hypertensive or coronary heart disease
-cardiomyopathy
-acute myocarditis/pericarditis
-chest trauma
-pulmonary disease
-digitalis toxicity
-excessive ingestion of alcohol and caffeine
-emotional distress

*Whatever the underlying form of heart disease, atrial fibrillation is commonly associated with CHF

*The electrophysiological mechanism responsible for atrial fibrillation is either enhanced automaticity or reentry.

Clinical Significance:
-s/s and clinical significance of atrial fibrillation with a rapid ventricular response are the same as those of atrial tachycardia
-the atria do not regularly contract and empty during the last part of ventricular diastole
-the loss of the atrial kick can cause a reduction of cardiac output by as much as 25%