CHAPTER 8

Rhythms

This chapter is dedicated to the discussion of rhythms and arrhythmias. This will be a preliminary introduction to the subject. Individual arrhythmias are discussed in greater detail as they are encountered in the text. We recommend that you read the next section (Major Concepts) once, then proceed to the discussion of the individual rhythms, and finally return to reread Major Concepts. This will help to clarify the terminology.

Major Concepts

There are 10 points you should think about in an organized manner when approaching arrhythmias:

General

1. Is the rhythm fast or slow?
2. Is the rhythm regular or irregular? If irregular, is it regularly irregular or irregularly irregular?

P waves

3. Do you see any P waves?
4. Are all of the P waves the same?
5. Does each QRS complex have a P wave?
6. Is the PR interval constant?

QRS complexes

7. Are the P waves and QRS complexes associated with one another?
8. Are the QRS complexes narrow or wide?
9. Are the QRS complexes grouped or not grouped?
10. Are there any dropped beats?

General

Is the rhythm fast or slow? Many rhythm abnormalities are associated with specific rate ranges. Therefore, it is very important to determine the rate of the rhythm in question. Decide if you are dealing with a tachycardia (> 100 BPM), a bradycardia (< 60 BPM), or a normal rate.

Is the rhythm regular or irregular? Do the P waves and QRS complexes follow a regular pattern with the same intervals separating them, or are the intervals different between some or all of the beats? This is a great tool to help you narrow down the rhythm, as you will see in the upcoming pages.

There is an additional question you must answer if the rhythm is irregular: is it regularly irregular or irregularly irregular? At first glance, this statement can be confusing. A rhythm is regularly irregular if it has some form or regularity to the pattern of the irregular complex. An example would be a rhythm in which every third complex comes sooner than the preceding two. Therefore, the intervals would be long-long-short, long-long-short, in a repeating pattern that is predictable and recurring in its irregularity.

An irregularly irregular rhythm has no pattern at all. All of the intervals are haphazard and do not repeat, with an occasional, accidental exception. Luckily, there are only three irregularly irregular rhythms: atrial fibrillation, wandering atrial pacemaker, and multifocal atrial tachycardia. This is a differential diagnosis that you should commit to memory, as it will get you out of some tight spots.

P Waves

Do you see any P waves? The presence of P waves tells you that the rhythm in question has some atrial or supraventricular component. This is another major branch of the differential diagnosis of arrhythmias. The P waves, generated by the SA node or another atrial pacemaker, will usually reset any pacemaker down the chain.

Are all of the P waves the same? The presence of P waves that are identical means that they are being generated by the same pacemaker site. Identical P waves should have identical PR intervals unless an AV nodal block is present (more later). If the P waves are not identical, consider two possibilities: there is an additional pacemaker cell firing, or there is some other component of the complex superimposed on the P wave, such as a T wave occurring at the same moment as the P wave. The presence of three or more different P wave morphologies with different PR intervals defines either wandering atrial pacemaker or multifocal atrial tachycardia, both described later in this chapter.

Does each QRS complex have a P wave? An abnormal number of P waves in comparison to QRS complexes is an important point in determining whether you are dealing with some sort of AV nodal block.

Is the PR interval constant? Once again, this is extremely useful in identifying a wandering atrial pacemaker or multifocal atrial tachycardia. It is also helpful in evaluating atrial premature contractions (APCs) with and without aberrant conduction (slow conduction from cell to cell that produces abnormally wide QRS complexes).

QRS Complexes

Are the P waves and QRS complexes associated with one another? Is the P wave before a QRS complex responsible for the firing of that QRS (associated with it)? A positive answer to this question will help determine if the entire complex is a normal beat, a premature beat, or a low-grade AV nodal block. In the discussion of ventricular tachycardia, you may note that the presence of capture and fusion beats is critical to the diagnosis. In these cases, the P wave preceding the capture or fusion beat is responsible for the complex, in contrast to the other P waves that are dissociated from their respective QRSs.

Are the QRS complexes narrow or wide? Narrow complexes represent impulses that have traveled down the normal AV node/Purkinje network. These complexes are usually found in supraventricular rhythms, including junctional rhythms. Wide complexes indicate that the impulses that did not follow the normal electrical conduction system, but instead were transmitted by direct cell-to-cell contact at some point in their travels through the heart. These wide complexes are found in ventricular premature contractions (VPCs), aberrantly conducted beats, ventricular tachycardia, and bundle branch blocks.

Are the QRS complexes grouped or not grouped? This is very useful in determining the presence of an AV nodal block or recurrent premature complexes, such as bigeminy (a repeating pattern of a normal complex followed by a premature complex) and trigeminy (a repeating pattern of two normal complexes followed by a premature complex).

Are there any dropped beats? Dropped beats occur in AV nodal blocks and sinus arrest.

Individual Rhythms

Supraventricular Rhythms

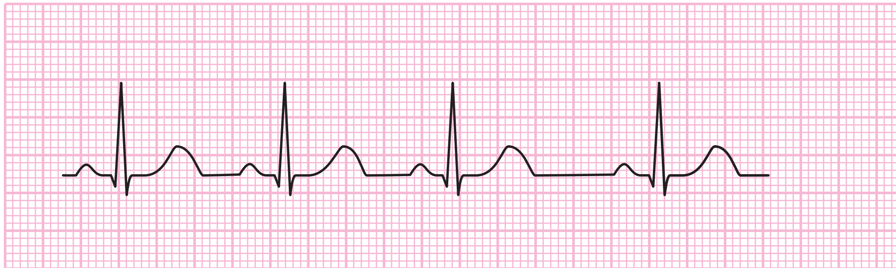
Normal Sinus Rhythm (NSR)

Rate:	60–100 BPM
Regularity:	Regular
P wave:	Present
P:QRS ratio:	1:1
PR interval:	Normal
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:
This rhythm represents the normal state with the SA node as the lead pacer. The intervals should all be consistent and within the normal range. Note that this refers to the atrial rate; normal sinus rhythm (NSR) can occur with a ventricular escape rhythm or other ventricular abnormality if AV dissociation exists.

Figure 8-1: Normal sinus rhythm (NSR).

Sinus Arrhythmia

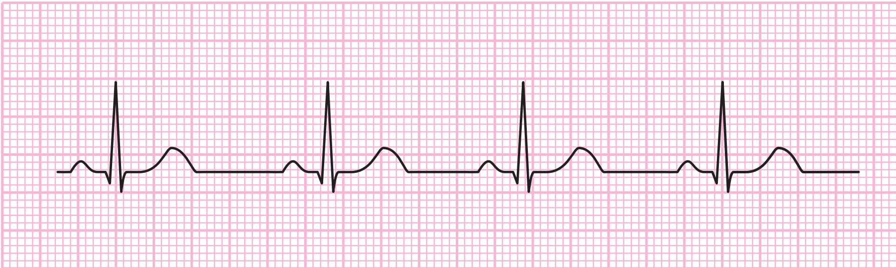


Rate:	60–100 BPM
Regularity:	Varies with respiration
P wave:	Normal
P:QRS ratio:	1:1
PR interval:	Normal
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together (see figure 8.1):
This rhythm represents the normal respiratory variation, becoming slower during exhalation and faster upon inhalation. This occurs because inhalation increases venous return by lowering intrathoracic pressure. Note that the PR intervals are the same; only the TP intervals (the interval from the end of the T wave of one complex to the beginning of the P wave of the next complex) vary with the respirations.

Figure 8-2: Sinus arrhythmia.

Sinus Bradycardia

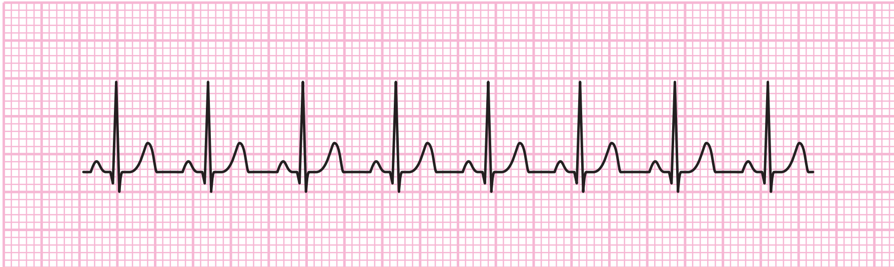


Rate:	Less than 60 BPM
Regularity:	Regular
P wave:	Present
P:QRS ratio:	1:1
PR interval:	Normal to slightly prolonged
QRS width:	Normal to slightly prolonged
Grouping:	None
Dropped beats:	None

Putting it all together:
The sinus beats are slower than 60 BPM. The origin may be in the SA node or in an atrial pacemaker. This rhythm can be caused by vagal stimulation leading to nodal slowing, or by medicines such as beta blockers, and is found normally in some well conditioned athletes. The QRS complex, and the PR and QTc intervals, may slightly widen as the rhythm slows below 60 BPM. However, they will not widen past the upper threshold of the normal range for that interval. For example, the PR interval may widen, but should not widen over the upper range of 0.20 seconds.

Figure 8-3: Sinus bradycardia.

Sinus Tachycardia

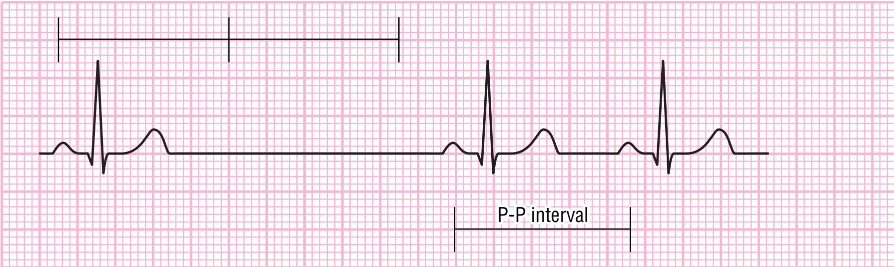


Rate:	Greater than 100 BPM
Regularity:	Regular
P wave:	Present
P:QRS ratio:	1:1
PR interval:	Normal to slightly shortened
QRS width:	Normal to slightly shortened
Grouping:	None
Dropped beats:	None

Putting it all together:
This can be caused by medications or by conditions that require increased cardiac output, such as exercise, hypoxemia, hypovolemia, hemorrhage, and acidosis.

Figure 8-4: Sinus tachycardia.

Sinus Pause/Arrest



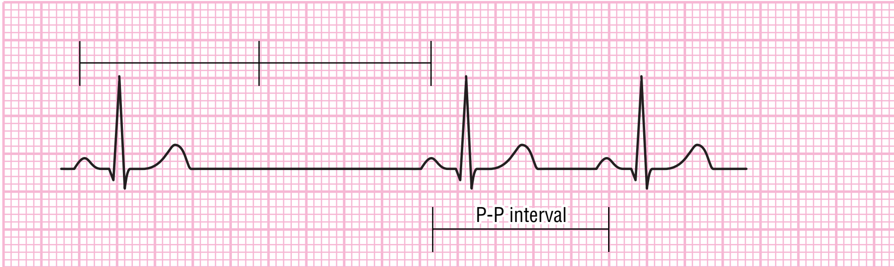
Rate:	Varies
Regularity:	Irregular
P wave:	Present except in areas of pause/arrest
P:QRS ratio:	1:1
PR interval:	Normal
QRS width:	Normal
Grouping:	None
Dropped beats:	Yes

Putting it all together:

A sinus pause is a variable time period during which there is no sinus pacemaker working. The time interval is not a multiple of the normal P-P interval. (A dropped complex that is a multiple of the P-P interval is known as an SA block, discussed next.) A sinus arrest is a longer pause, though there is no clear-cut criterion for how long a pause has to last before it is called an arrest.

Figure 8-5: Sinus pause/arrest.

Sinoatrial Block



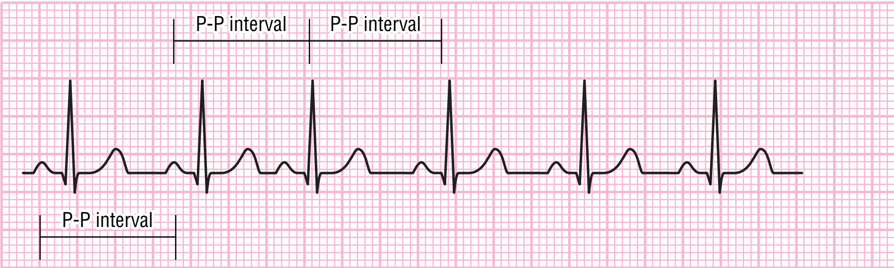
Rate:	Varies
Regularity:	Irregular
P wave:	Present except in areas of dropped beats
P:QRS ratio:	1:1
PR interval:	Normal
QRS width:	Normal
Grouping:	None
Dropped beats:	Yes

Putting it all together:

The block occurs in some multiple of the P-P interval. After the dropped beat, the cycles continue on time and as scheduled. The pathology involved is a nonconducted beat from the normal pacemaker.

Figure 8-6: Sinoatrial block.

Atrial Premature Contraction (APC)



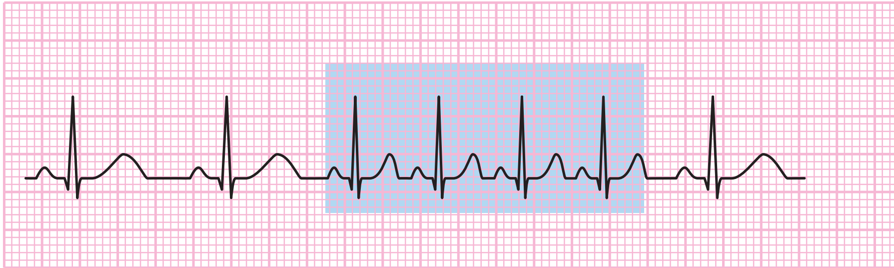
Rate:	Depends on the underlying sinus rate
Regularity:	Irregular
P wave:	Present; in the APC, may be a different shape
P:QRS ratio:	1:1
PR interval:	Varies in the APC, otherwise normal
QRS width:	Normal
Grouping:	Sometimes
Dropped beats:	No

Putting it all together:

An atrial premature contraction (APC) occurs when some other pacemaker cell in the atria fires at a rate faster than that of the SA node. The result is a complex that comes sooner than expected. Notice that the premature beat "resets" the SA node, and the pause after the APC is not compensated; the underlying rhythm is disturbed and does not proceed at the same pace. This noncompensatory pause is less than twice the underlying normal P-P interval.

Figure 8-7: Atrial premature contraction (APC).

Ectopic Atrial Tachycardia



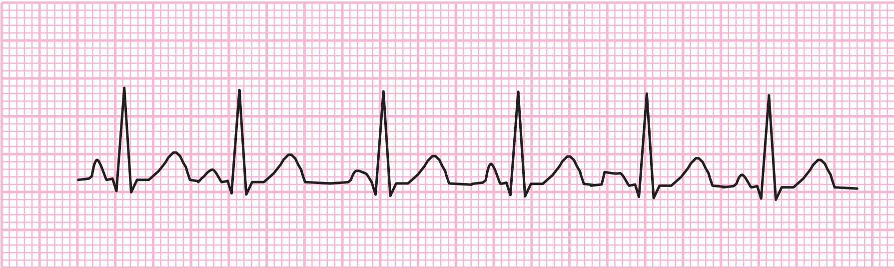
Rate:	100–180 BPM
Regularity:	Regular
P wave:	Morphology of ectopic focus is different
P:QRS ratio:	1:1
PR interval:	Ectopic focus has a different interval
QRS width:	Normal, but can be aberrant at times
Grouping:	None
Dropped beats:	None

Putting it all together:

Ectopic atrial tachycardia occurs when an ectopic atrial focus fires more quickly than the underlying sinus rate. The P waves and PR intervals are different because the rhythm is caused by an ectopic atrial pacemaker (a pacemaker outside of the normal SA node). The episodes are usually not sustained for an extended period. Because of the accelerated rate, some ST- and T- wave abnormalities may be present transiently.

Figure 8-8: Ectopic atrial tachycardia.

Wandering Atrial Pacemaker (WAP)



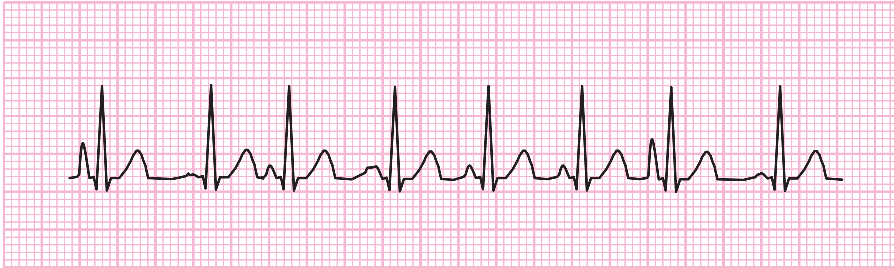
Rate:	100 BPM
Regularity:	Irregularly irregular
P wave:	At least three different morphologies
P:QRS ratio:	1:1
PR interval:	Variable depending on the focus
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

Wandering atrial pacemaker (WAP) is an irregularly irregular rhythm created by multiple atrial pacemakers each firing at its own pace. The result is an ECG with at least three different P wave morphologies with their own intrinsic PR intervals. Think of each pacer firing from a different distance, with a different P wave axis. The longer the distance, the longer the PR interval. The varying P wave axis cases differences in the morphology of the P waves.

Figure 8-9: Wandering atrial pacemaker (WAP).

Multifocal Atrial Tachycardia (MAT)



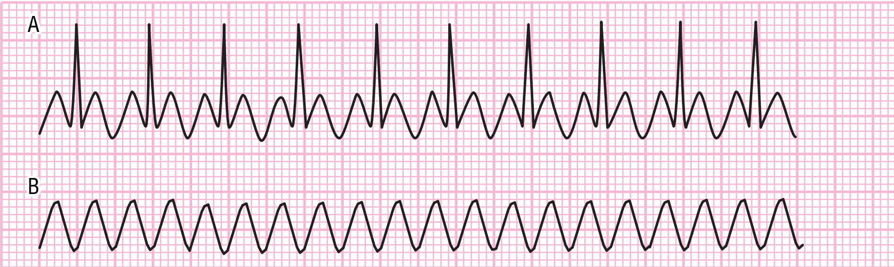
Rate:	Greater than 100 BPM
Regularity:	Irregularly irregular
P wave:	At least three different morphologies
P:QRS ratio:	1:1
PR interval:	Variable
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

Multifocal atrial tachycardia (MAT) is merely a tachycardic WAP. Both MAT and WAP are commonly found in patients with severe lung disease. The tachycardia can cause cardiovascular instability at times and should be treated. Treatment is difficult, and should be aimed at correcting the underlying problem.

Figure 8-10: Multifocal atrial tachycardia (MAT).

Atrial Flutter



Rate:	Atrial rate commonly 250–350 BPM Ventricular rate commonly 125–175 BPM
Regularity:	Usually regular but may be variable
P wave:	Saw toothed appearance, “F waves”
P:QRS ratio:	Variable, most commonly 2:1
PR interval:	Variable
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

The P waves appear in a saw toothed pattern such as those in Figure 8-11. (QRSs have been removed from strip B to reveal P wave shape.) The QRS rate is usually regular and the complexes appear at some multiple of the P-P interval. The usual QRS response is 2:1 (this means that there are 2 P waves for each QRS complex). We call this an atrial flutter with 2:1 block (some of the P waves are blocked and do not cause any ventricular response), and so on. The ventricular response can also occur slower at rates 3:1, 4:1, or higher. Sometimes the ventricular response will be irregular.

Looking more closely at these cases, you will see that they also occur at some multiple of the P-P interval. The rate of the intervals, however, can vary, with some occurring at a rate of 2:1 and some occurring at a rate of 3:1, and so on. We call this atrial flutter with varying 2:1 and 3:1 block. This is an example: the ratios will vary depending on the rhythm. Rarely, you will have a truly variable ventricular response that does not fall on any multiple of the P-P interval. We call this an atrial flutter with a variable ventricular response.

In closing, keep in mind that the sawtoothed appearance may not be obvious in all 12 leads. Whenever you see a ventricular rate of 150 BPM, look for the buried P waves of an atrial flutter with 2:1 block!

Figure 8-11: Atrial flutter.

Atrial Fibrillation

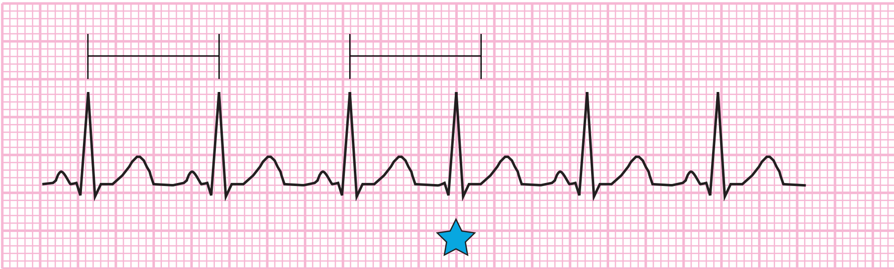
Rate:	Variable, ventricular response can be fast or slow
Regularity:	Irregularly irregular
P wave:	None; chaotic atrial activity
P:QRS ratio:	None
PR interval:	None
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

Atrial fibrillation is the chaotic firing of numerous pacemaker cells in the atria in a totally haphazard fashion. The result is that there are no discernible P waves, and the QRS complexes are innervated haphazardly in an irregular pattern. The ventricular rate is completely guided by occasional activation from one of the pacemaking sources. Because the ventricles are not paced by any one site, the intervals are completely random.

Figure 8-12: Atrial fibrillation.

Junctional Premature Contraction (JPC)



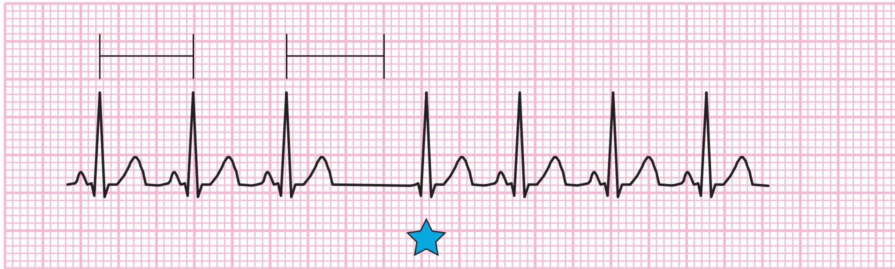
Rate:	Depends on underlying rhythm
Regularity:	Irregular
P wave:	Variable (none, antegrade, or retrograde)
P:QRS ratio:	None; or 1:1 if antegrade or retrograde
PR interval:	None, short, or retrograde; if present does not represent atrial stimulation of the ventricles.
QRS width:	Normal
Grouping:	Usually none, but can occur
Dropped beats:	None

Putting it all together:

A junctional premature contraction (JPC) is a beat that originates prematurely in the AV node. Because it travels down the normal electrical conduction system of the ventricles, the QRS complex is identical to the underlying QRSs. JPCs usually appear sporadically, but can occur in a regular, grouped pattern such as supraventricular bigeminy or trigeminy. There may be an antegrade or retrograde P wave associated with the complex. An antegrade P wave is one that appears before the QRS complex. The PR interval is very short in these cases, and P-wave axis will be abnormal (inverted in leads II, III, and aVF; more on these types of P waves in Chapter 9). A retrograde P is one that appears after the QRS complex.

Figure 8-13: Junctional premature contraction (JPC).

Junctional Escape Beat



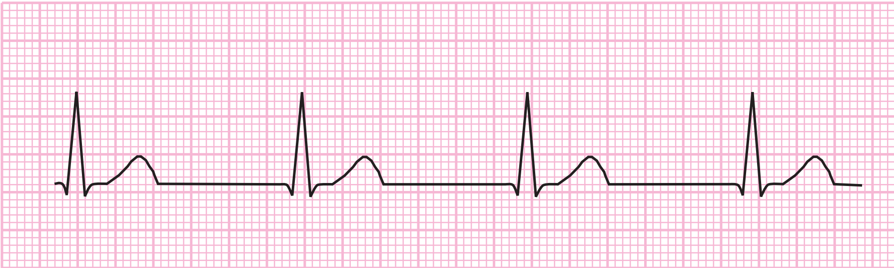
Rate:	Depends on underlying rhythm
Regularity:	Irregular
P wave:	Variable (none, antegrade, or retrograde)
P:QRS ratio:	None; or 1:1 if antegrade or retrograde.
PR interval:	None, short, or retrograde; if present, does not represent atrial stimulation of the ventricles.
QRS width:	Normal
Grouping:	None
Dropped beats:	Yes

Putting it all together:

An escape beat occurs when the normal pacemaker fails to fire and the next available pacemaker in the conduction system fires in its place. Remember that this is discussed in Chapter 1. The AV nodal pacer senses that the normal pacer did not fire. So when its turn comes up and it reaches its threshold potential, it fires. The distance of the escape beat from the preceding complex is always longer than the normal P-P interval.

Figure 8-14: Junctional escape beat.

Junctional Rhythm



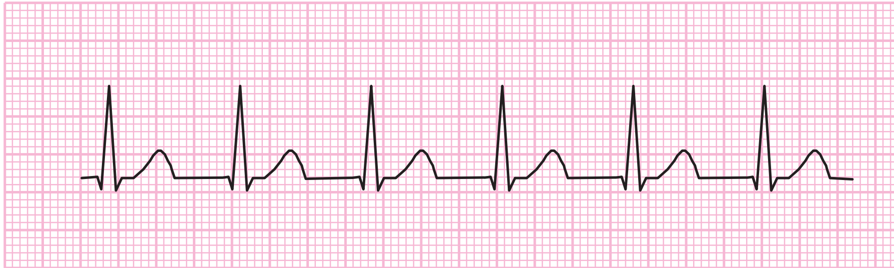
Rate:	40–60 BPM
Regularity:	Regular
P wave:	Variable (none, antegrade, or retrograde)
P:QRS ratio:	None; or 1:1 if antegrade or retrograde
PR interval:	None, short, or retrograde; if present, does not represent atrial stimulation of the ventricles.
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

A junctional rhythm arises as an escape rhythm when the normal pacemaking function of the atria and SA node is absent. It can also occur in the case of AV dissociation or third-degree AV block (more on this later).

Figure 8-15: Junctional rhythm.

Accelerated Junctional Rhythm



Rate:	60–100 BPM
Regularity:	Regular
P wave:	Variable (none, antegrade, or retrograde)
P:QRS ratio:	None; or 1:1 if antegrade or retrograde
PR interval:	None, short, or retrograde; if present, does not represent atrial stimulation of the ventricles.
QRS width:	Normal
Grouping:	None
Dropped beats:	None

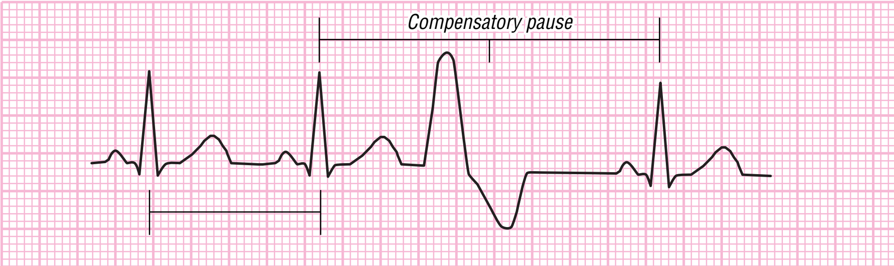
Putting it all together:

This rhythm originates in a junctional pacemaker that, because it is firing faster than the normal pacemaker, takes over the pacing function. It is faster than expected for a normal junctional rhythm, pacing in the range of 60–100 BPM. If it exceeds 100 BPM, it is known as junctional tachycardia. As with other junctional pacers the P waves can be absent or conducted in an antegrade or retrograde fashion.

Figure 8-16: Accelerated junctional rhythm.

Ventricular Rhythms

Ventricular Premature Contraction (VPC)



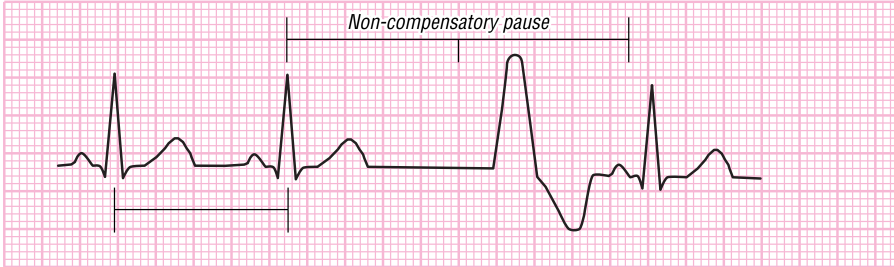
Rate:	Depends on the underlying rhythm
Regularity:	Irregular
P wave:	Not present on the VPC
P:QRS ratio:	No P waves on the VPC
PR interval:	None
QRS width:	Wide (=0.12 seconds), bizarre appearance
Grouping:	Usually not present
Dropped beats:	None

Putting it all together:

A VPC is caused by the premature firing of a ventricular cell. The ventricular pacer fires before the normal SA node or supraventricular pacer, which causes the ventricles to be in a refractory state (not yet repolarized and unavailable to fire again) when the normal pacer fires. Hence, the ventricles do not contract at their normal time. However, the underlying pacing schedule is not altered, so the beat following the VPC will arrive on time. This is called a *compensatory pause*.

Figure 8-17: Ventricular premature contraction (VPC).

Ventricular Escape Beat



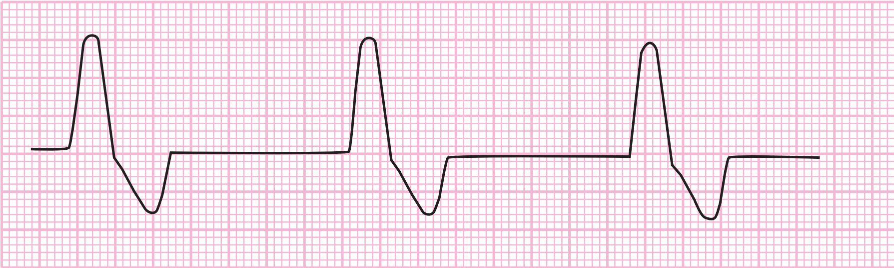
Rate:	Depends on the underlying rhythm
Regularity:	Irregular
P wave:	None in the VPC
P:QRS ratio:	None in the VPC
PR interval:	None
QRS width:	Wide (=0.12 seconds), bizarre appearance
Grouping:	None
Dropped beats:	None

Putting it all together:

A ventricular escape beat is similar to a junctional escape beat, but the focus is in the ventricles. The pause is *non-compensatory* in this case because the normal pacer did not fire. (This is what led to the ventricular escape beat.) The pacer then resets itself on a new timing cycle, and may even have a different rate.

Figure 8-18: Ventricular escape beat.

Idioventricular Rhythm



Rate:	20–40 BPM
Regularity:	Regular
P wave:	None
P:QRS ratio:	None
PR interval:	None
QRS width:	Wide (≥0.12 seconds), bizarre appearance
Grouping:	None
Dropped beats:	None

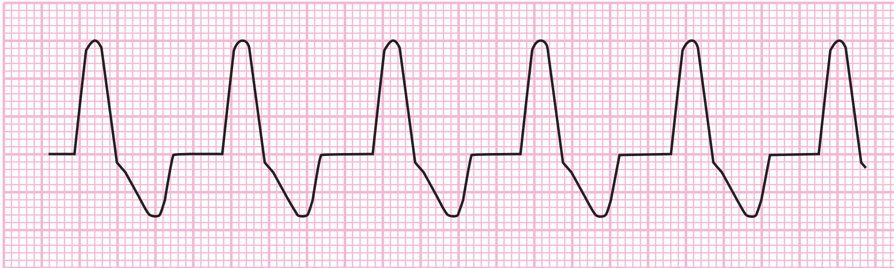
Putting it all together:
Idioventricular rhythm occurs when a ventricular focus acts as the primary pacemaker for the heart. The QRS complexes are wide and bizarre, reflecting their ventricular origin. This rhythm can be found by itself, or as a component of AV dissociation or third-degree heart block. (In these latter cases, there may be an underlying sinus rhythm with P waves present.)

Figure 8-19: Idioventricular rhythm.

CLINICAL PEARL

We usually try to stay away from treatment, but a word of caution: Do not treat this rhythm with antiarrhythmics! If you are successful in eliminating your last pacemaker, what do you have? Asystole.

Accelerated Idioventricular Rhythm

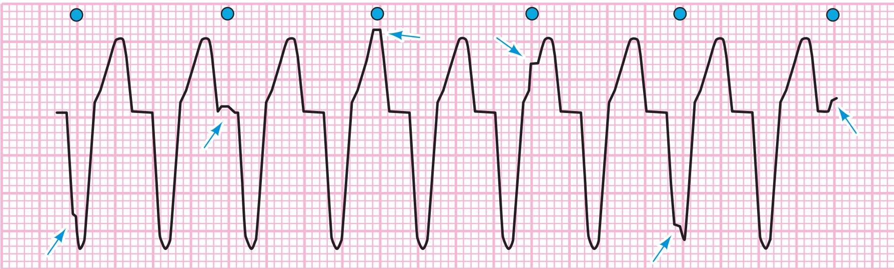


Rate:	40–100 BPM
Regularity:	Regular
P wave:	None
P:QRS ratio:	None
PR interval:	None
QRS width:	Wide (≥0.12 seconds), bizarre appearance
Grouping:	None
Dropped beats:	None

Putting it all together:
This is, basically, a faster version of an idioventricular rhythm. There are usually no P waves associated with it, in keeping with the ventricular source of the pacing. However, they can be present in AV dissociation or third-degree heart block.

Figure 8-20: Accelerated idioventricular rhythm.

Ventricular Tachycardia (VTach)



Rate:	100–200 BPM
Regularity:	Regular
P wave:	Dissociated atrial rate
P:QRS ratio:	Variable
PR interval:	None
QRS width:	Wide, bizarre
Grouping:	None
Dropped beats:	None

Putting it all together:

Ventricular tachycardia (VTach) is a very fast ventricular rate that is usually dissociated from an underlying atrial rate. In Figure 8-21, you will notice irregularities of the QRS morphologies at regular intervals. These irregularities are the underlying sinus beats. (Blue dots indicate sinus beats, and arrows pinpoint the irregularities.) There are many criteria related to VTach, which we'll take a look at now.

Figure 8-21: Ventricular tachycardia (VTach).

Capture and Fusion Beats Occasionally, a sinus beat will fall on a spot that allows some innervation of the ventricle to occur through the normal ventricular conduction system. This forms a fusion beat (Figure 8-22), which has a morphology somewhere between the abnormal ventricular beat and the normal QRS complex. This type of complex is literally caused by two pacemakers, the SA node and the ventricular pacer. Because two areas of the ventricle are being stimulated simultaneously, the result is a hybrid — or fusion — complex with some features of both. It may help to think of this in terms of the following analogy. If you mix a blue liquid with a yellow liquid, the result is a green liquid. A fusion beat is like the green liquid; it is the fusion of the two complexes.

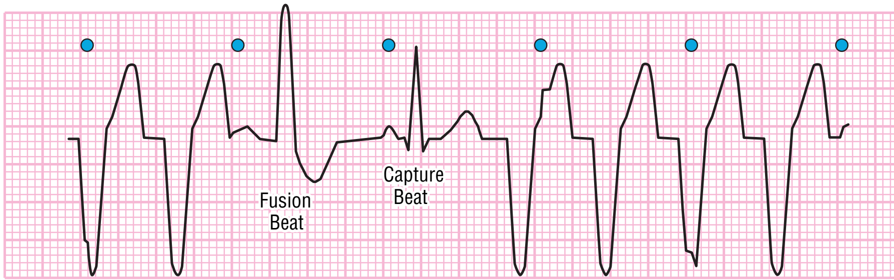


Figure 8-22: Fusion and capture beats in VTach.

A capture beat, on the other hand, is completely innervated by the sinus beat and is indistinguishable from the patient's normal complex. Why is it called a capture beat instead of a normal beat? Because it occurs in the middle of the chaos that is VTach, and is caused by chance timing of a sinus beat at just the right millisecond to "capture" or transmit through the AV node and depolarize the ventricles through the normal conduction system of the heart.

Fusion and capture beats are hallmarks of ventricular tachycardia; you will usually see them if the strip is long enough. If you see these types of complexes with a wide-complex, tachycardic rhythm, you have diagnosed VTach.

More VTach Indicators There are some additional signs we should look at. You don't need to remember the names, but you should know about Brugada's and Josephson's signs (Figure 8-23). Brugada's sign is that, in VTach, the interval from the R wave to the bottom of the S wave is ≥

0.10 seconds. Josephson's sign, which is just a small notching near the low point of the S wave, is another indicator of VTach.

Some additional aspects in VTach include a total QRS width of ≥ 0.16 seconds, and a complete negativity of all precordial leads (V_1-V_6). Why are we spending so much time on VTach? It is a life-threatening arrhythmia that is difficult to diagnose under the best of circumstances.

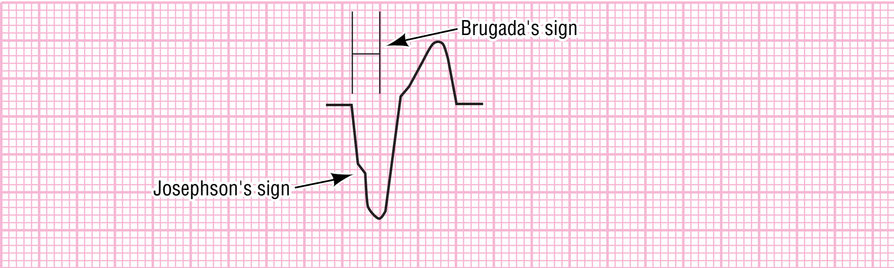


Figure 8-23: Brugada's and Josephson's signs in VTach.

CLINICAL PEARL

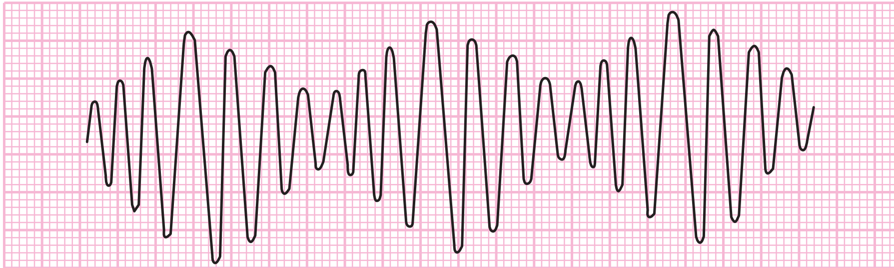
A word to the wise: When confronted with any wide-complex tachycardia, treat it as VTach unless you have very strong evidence to the contrary. Do not assume it is a supraventricular tachycardia with aberrancy, a common error with potentially disastrous consequences.

REMINDER:

Criteria for diagnosing ventricular tachycardia:

- Wide-complex tachycardia
- Fusion and capture beats
- Duration of the QRS complex ≥ 0.16 seconds
- AV dissociation
- Complexes in all of the precordial leads are negative
- Josephson's and Brugada's signs

Torsade de Pointes



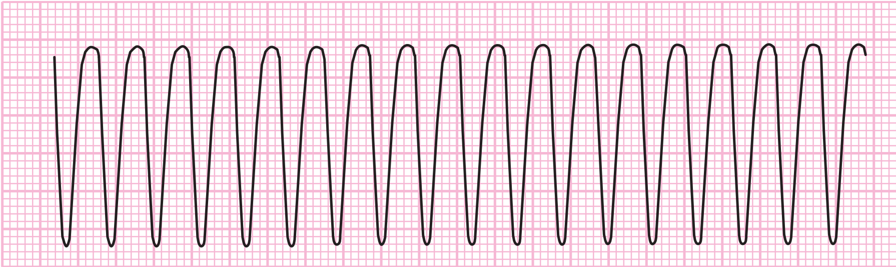
Rate:	200–250 BPM
Regularity:	Irregular
P wave:	None
P:QRS ratio:	None
PR interval:	None
QRS width:	Variable
Grouping:	Variable sinusoidal pattern
Dropped beats:	None

Putting it all together:

Torsade de pointes occurs with an underlying prolonged QT interval. It has an undulating, sinusoidal appearance in which the axis of the QRS complexes changes from positive to negative and back in a haphazard fashion. (The name, torsade de pointes, means twisting of points). It can convert into either a normal rhythm or ventricular fibrillation. Be very careful with this rhythm, as it is a harbinger of death!

Figure 8-24: Torsade de pointes.

Ventricular Flutter



Rate:	200–300 BPM
Regularity:	Regular
P wave:	None
P:QRS ratio:	None
PR interval:	None
QRS width:	Wide, bizarre
Grouping:	None
Dropped beats:	None

Putting it all together:

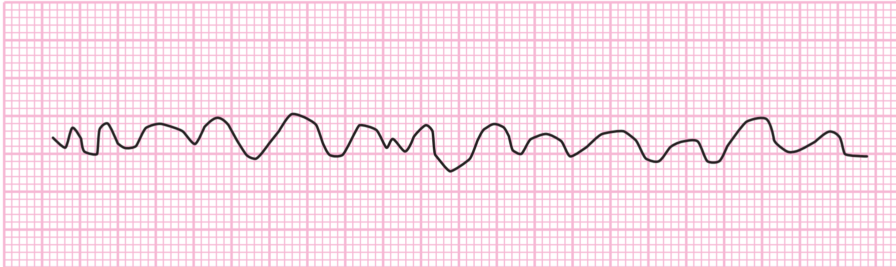
Ventricular flutter is very fast VTach. When you can no longer tell if it is a QRS complex, a T wave, or an ST segment, then you have VFlutter. The beats are coming so fast that they fuse into an almost straight sinusoidal pattern with no discernible components.

Figure 8-25: Ventricular flutter.

CLINICAL PEARL

When you see VFlutter at a rate of 300 BPM, you should think about the possibility of Wolf-Parkinson-White syndrome (WPW) with 1:1 conduction of an atrial flutter. (We know this may not mean much now, but it will later on.)

Ventricular Fibrillation (VFib)



Rate:	Indeterminate
Regularity:	Chaotic rhythm
P wave:	None
P:QRS ratio:	None
PR interval:	None
QRS width:	None
Grouping:	None
Dropped beats:	No beats at all!

Putting it all together:

If you were going to draw a picture of cardiac chaos, this would be it. The ventricular pacers are all going haywire and firing at their own pace. The result is that you have many small areas of the heart firing at once with no organized activity. The heart literally looks like shaking gelatin. This is a very bad rhythm (cardiac arrest), and you should try to get your patient out of this as soon as possible.

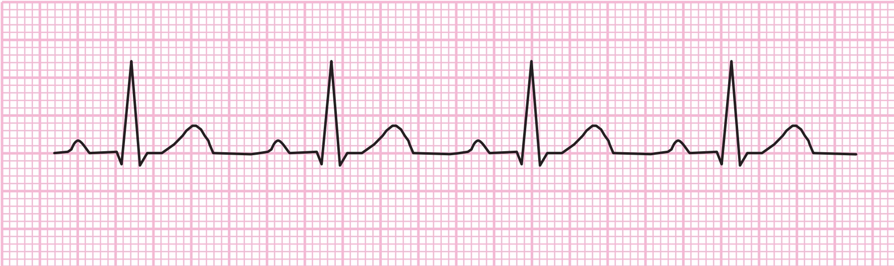
Figure 8-26: Ventricular fibrillation (VFib).

CLINICAL PEARL

If your patient looks fine and is wide awake and looking at you, a lead has fallen off and this is artifact, not VFib.

Heart Blocks

First-Degree Heart Block



Rate:	Depends on underlying rhythm
Regularity:	Regular
P wave:	Normal
P:QRS ratio:	1:1
PR interval:	Prolonged > 0.20 seconds
QRS width:	Normal
Grouping:	None
Dropped beats:	None

Putting it all together:

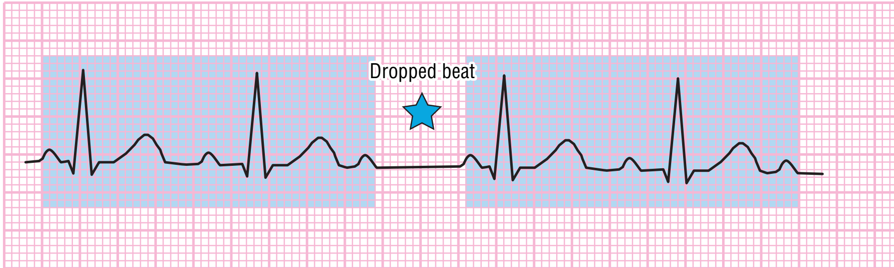
First degree heart block occurs from a prolonged physiologic block in the AV node. This can occur because of medication, vagal stimulation, disease, among others. The PR interval will be greater than 0.20 seconds.

Figure 8-27: First-degree heart block.

NOTE

A word of caution about the nomenclature of blocks: The rhythm disturbances we are looking at here are *AV nodal blocks.* There are also *bundle branch blocks,* a very different phenomenon. This can be confusing for beginners, but bear with us through the AV blocks and we'll get to bundle branch blocks later.

Mobitz I Second-Degree Heart Block (Wenckebach)



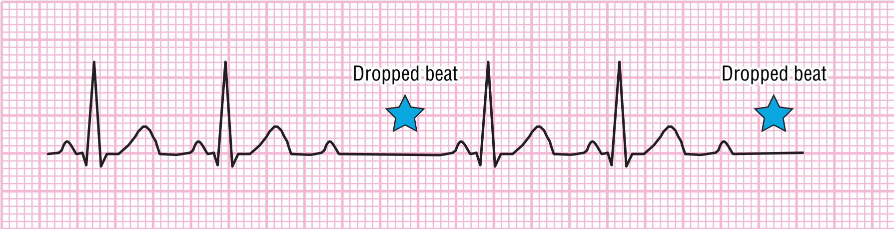
Rate:	Depends on underlying rhythm
Regularity:	Regularly irregular
P wave:	Present
P:QRS ratio:	Variable: 2:1, 3:2, 4:3, 5:4, etc.
PR interval:	Variable
QRS width:	Normal
Grouping:	Present and variable (see blue shading in Figure 8-28)
Dropped beats:	Yes

Putting it all together:

Mobitz I is also known as Wenckebach (pronounced WENN-key-bock). It is caused by a diseased AV node with a long refractory period. The result is that the PR interval lengthens between successive beats until a beat is dropped. At that point the cycle starts again. The R to R interval, on the other hand, shortens with each beat. We'll discuss Mobitz I further in Chapter 10.

Figure 8-28: Mobitz I second-degree heart block (Wenckebach).

Mobitz II Second-Degree Heart Block



Rate:	Depends on underlying rhythm
Regularity:	Regularly irregular
P wave:	Normal
P:QRS ratio:	X:X–1; e.g. 3:2, 4:3, 5:4, etc. The ratio can also be variable on rare occasions.
PR interval:	Normal
QRS width:	Normal
Grouping:	Present and variable
Dropped beats:	Yes

Putting it all together:

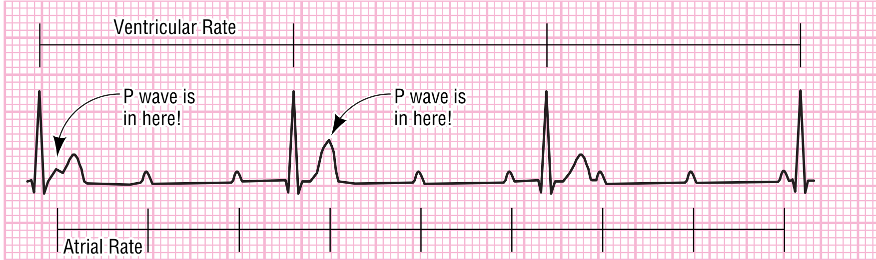
In Mobitz II, there are grouped beats with one beat dropped between each group. The key point to remember is that the PR interval is the same in all of the conducted beats. This rhythm is caused by a diseased AV node, and is a harbinger of bad things to come — namely, complete heart block.

Figure 8-29: Mobitz II second-degree heart block.

CLINICAL PEARL

What if there is a 2:1 ratio of Ps to QRSs? Is this Mobitz I or Mobitz II? In reality, you can't tell. This example is named a 2:1 second-degree block (no type is specified). Because you can't tell, assume the worst — Mobitz II. You cannot go wrong by being overly cautious with a patient's life.

Third-Degree Heart Block



Rate:	Separate rates for the underlying (sinus) rhythm and the escape rhythm. They are dissociated from one another.
Regularity:	Regular, but P rate and QRS rate are different
P wave:	Present
P:QRS ratio:	Variable
PR interval:	Variable; no pattern
QRS width:	Normal or wide
Grouping:	None
Dropped beats:	None

Putting it all together:

This is complete block of the AV node; the atria and ventricles are firing separately each to its own drummer, so to speak. The sinus rhythm can be bradycardic, normal, or tachycardic. The escape beat can be junctional or ventricular and so their morphology will vary.

Figure 8-30: Third-degree heart block.

NOTE

Semantics alert: If there are just as many P waves as there are QRSs, but they are dissociated, it is known as AV dissociation rather than third-degree heart block.

CHAPTER IN REVIEW

1. Sinus arrhythmia is a normal respiratory variant. True or False.

2. A regular rhythm with a heart rate of 125 BPM with identical P waves occurring before each of the QRS complexes is:
A. Sinus bradycardia
B. Normal sinus rhythm
C. Ectopic atrial tachycardia
D. Atrial flutter
E. Sinus tachycardia

3. If an entire complex is missing from a rhythm strip but the underlying rhythm is unchanged and maintains the same P–P or R–R interval (excluding the dropped beat), it is known as:
A. Sinus bradycardia
B. Atrial escape beat
C. Sinus pause
D. Sinoatrial block
E. Junctional escape beat

4. An irregularly irregular rhythm of 65 BPM with at least three varying P-wave morphologies and PR intervals is known as:
A. Atrial fibrillation
B. Wandering atrial pacemaker
C. Multifocal atrial tachycardia
D. Atrial flutter
E. Accelerated idioventricular rhythm

5. In atrial flutter, the flutter waves usually occur at a rate of 250–350 BPM. True or False.

6. Atrial fibrillation is an irregularly irregular rhythm with no discernable P waves in any lead. True or False.

7. An irregularly irregular rhythm at 195 BPM with no discernable P waves is known as:
A. Atrial fibrillation with a rapid ventricular response
B. Multifocal atrial tachycardia
C. Atrial flutter
D. Ectopic atrial tachycardia
E. Accelerated idioventricular rhythm

8. An accelerated junctional rhythm is a junctional rhythm over 100 BPM. True or False.

9. An idioventricular rhythm is caused by a ventricular focus acting as the primary pacemaker. The usual rate is in the range of 20–40 BPM. True or False.

10. Ventricular tachycardia is associated with:
A. Capture beats
B. Fusion beats
C. Both A and B
D. None of the above

11. A wide-complex tachycardia should always be considered and treated as ventricular tachycardia until proven otherwise. True or False.

12. Ventricular fibrillation has discernable complexes on close examination of the strip. True or False.

13. A grouped rhythm with PR intervals that prolong until a beat is dropped is known as:
A. Wandering atrial pacemaker
B. First-degree heart block
C. Mobitz I second-degree heart block, or Wenckebach
D. Mobitz II second-degree heart block
E. Third-degree heart block

14. A grouped rhythm with dropped QRS complexes occurring either regularly or variably is known as:
A. Wandering atrial pacemaker
B. First-degree heart block
C. Mobitz I second-degree heart block, or Wenckebach
D. Mobitz II second-degree heart block
E. Third-degree heart block

15. A rhythm with dissociated atrial and ventricular pacemakers, in which the atrial beat is faster than the ventricular rate, is known as:
A. Wandering atrial pacemaker
B. First-degree heart block
C. Mobitz I second-degree heart block, or Wenckebach
D. Mobitz II second-degree heart block
E. Third-degree heart block

1. True **2.** E **3.** D **4.** B **5.** True **6.** True **7.** A **8.** False
9. True **10.** C **11.** True **12.** False **13.** C **14.** D **15.** E

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