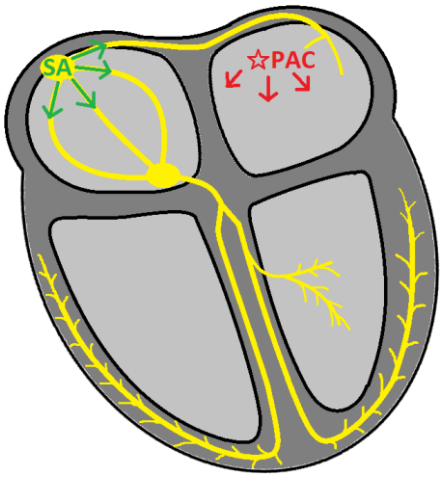
Atrial Rhythms

Premature Atrial Contractions:

The SA Node is the primary pacemaker of the heart but pacemaker cells are not the only cells capable of initiating depolarization. **Ectopy** is the term used to describe a depolarization initiated by cells other than the pacemaker cells in the SA Node. Ectopic depolarizations can interrupt normal Sinus Rhythm resulting in an irregular rhythm. When an early Ectopic depolarization occurs in the atria it is referred to as a **Premature Atrial Contraction** (PAC). PACs can be identified by an early P wave and early QRS which interrupts Sinus Rhythm. Because PACs originate from a different location than the SA Node the depolarization takes a different path across the atria producing a different morphology of P wave (See Figure 4.1). The shapes of these P waves can vary but are usually noticeably different from the normal Sinus P waves. PACs usually have what is called a "**Noncompensatory Pause**", which means they reset the timing of the SA Node causing the subsequent P waves not to map out. The QRS following the early P wave should be relatively narrow, meaning it will be as narrow as the normal Sinus QRS waves. Occasionally a PAC may be blocked as it passes through the AV Node resulting in an early P wave with no QRS. When a PAC is blocked through the AV Node it is referred to as a **Nonconducted PAC** or **Blocked PAC**.

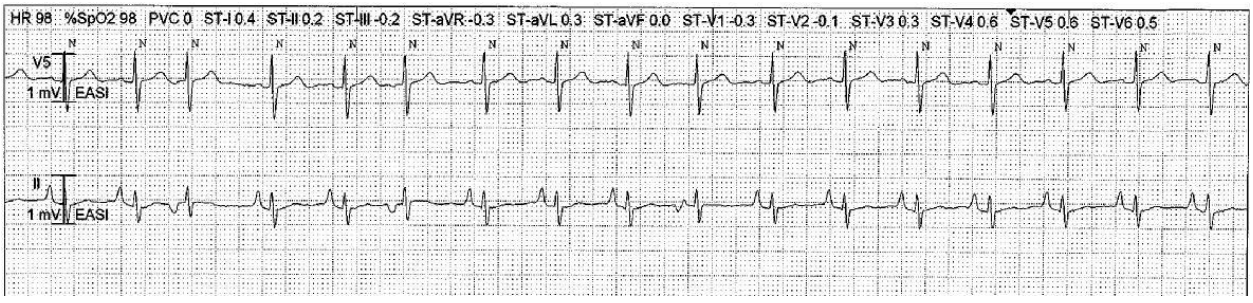
Figure 4.1



Premature Atrial Contraction (PAC)

- Early P wave and QRS
- P Wave has different morphology
  - Round, Peaked, Notched, etc.
- Usually narrow QRS
- Noncompensatory Pause

Example Strip: Premature Atrial Contraction



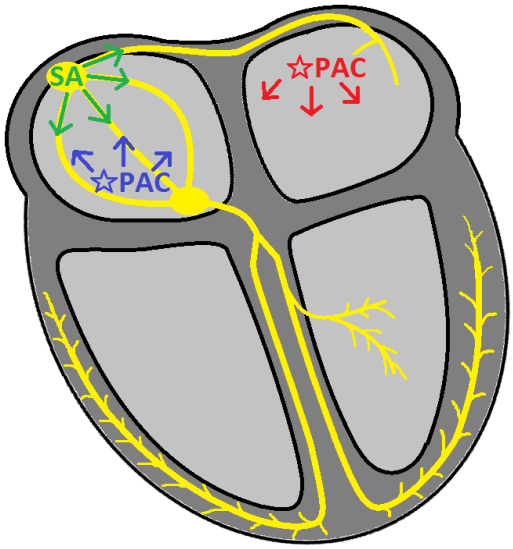
The above strip shows Sinus Rhythm with 3 PACs. The differences in P wave morphology can be observed best in lead II (Bottom Lead). Complexes 3, 6, and 10 are all early and have very different P waves than

the other Sinus complexes. The Sinus P waves are all upright whereas the P waves of the PACs are more inverted or slightly biphasic.

Wandering Atrial Pacemaker:

When a rhythm has 3 or more distinct P wave morphologies it is referred to as **Wandering Atrial Pacemaker (WAP)**. The three distinct P wave morphologies represent three different locations in the atria initiating atrial depolarization. One of the morphologies will likely represent the SA Node; whereas the other P wave morphologies will represent separate ectopic depolarizations (See Figure 4.2). Wandering Atrial Pacemaker will have very irregular R-R intervals when frequent PACs are present. When WAP has a heart rate of > 100 bpm it is often referred to as **Multifocal Atrial Tachycardia (MAT)**.

Figure 4.2



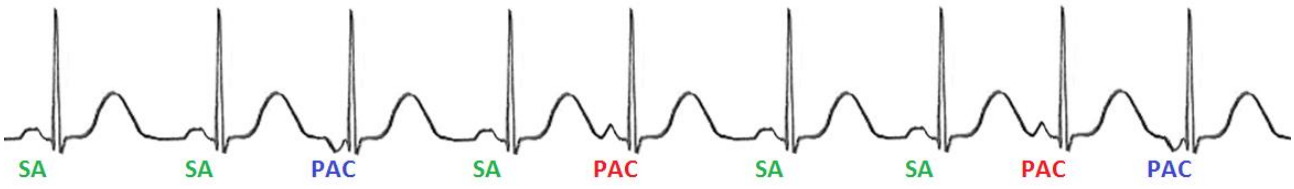
<u>Wandering Atrial Pacemaker (WAP)</u>

- 3 or more different P wave morphologies
- Irregular R-R intervals
- P wave for every QRS (1:1 ratio)

<u>Multifocal Atrial Tachycardia (MAT)</u>

- 3 or more different P wave morphologies
- Irregular R-R intervals
- P wave for every QRS (1:1 ratio)
- HR > 100 bpm

Example Strip: Wandering Atrial Pacemaker



The above strip shows three distinct P wave morphologies indicating three different points of origin, as illustrated in figure 3.2.

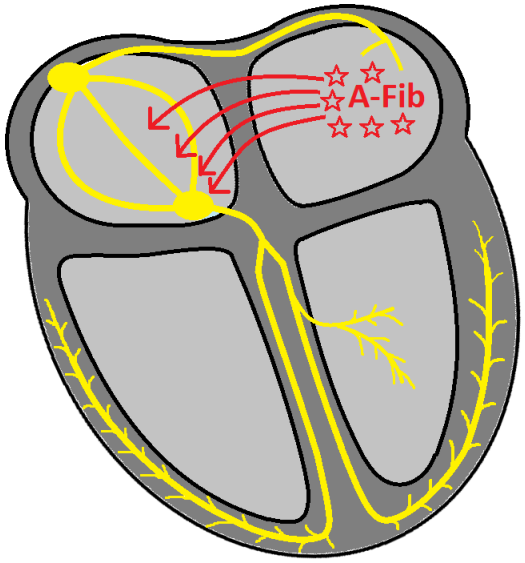
Atrial Fibrillation:

Atrial Fibrillation (A-Fib) is a rhythm resulting from very rapid atrial depolarization usually originating in the left atrium. Many text books describe the atrial rate as >350, >400, or 0 bpm because it is not measurable. Sinus Rhythm has a 1:1 conduction ratio so if the atrial rate is 75 bpm the ventricular rate will also be 75 bpm. If the patient converts to A-Fib with an atrial rate of 400 bpm will there ventricular rate also be 400 bpm? Fortunately in the event of rapid atrial arrhythmia the AV Node acts as a surge protector, blocking the majority of those unwanted depolarizations. If the AV Node did not have this ability everyone who converted to A-Fib would also go into Ventricular Fibrillation, which is a fatal arrhythmia. The actual ventricular rate/response will then depend on how many depolarizations the AV Node allows to reach the ventricles. If the ventricular rate is > 100 bpm this is a Rapid Ventricular Response (RVR), 60-100 bpm is a Controlled Ventricular Response (CVR), and < 60 bpm is a Slow Ventricular Response (SVR).

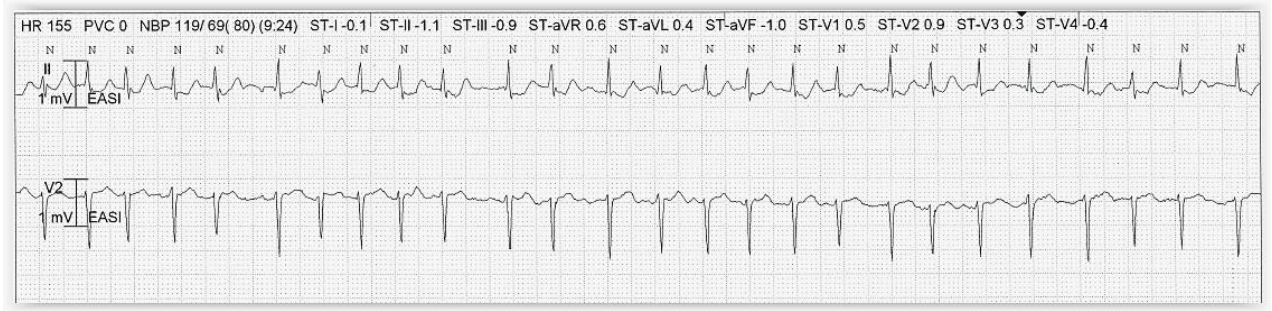
Atrial Fibrillation

- Atrial Rate >350 bpm or not measurable
- No P waves
- Fibrillating baseline
- Relatively narrow QRS
- Irregular R-R intervals
- Ventricular Rate will vary
    - RVR > 100 bpm
    - CVR 60-100 bpm
    - SVR < 60 bpm

Figure 4.3



Example Strip: Atrial Fibrillation w/ RVR



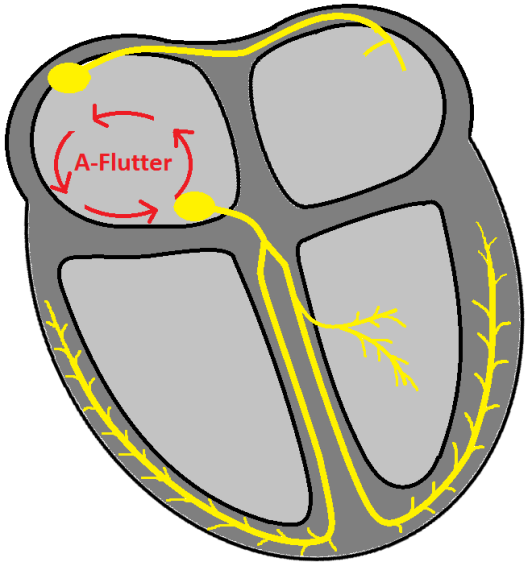
Atrial Flutter:

Atrial Flutter is a rapid atrial arrhythmia usually originating in the right atrium. Atrial flutter is caused by the formation of a reentry pathway which causes a continuous cycle of atrial depolarization. The rapid cycle of depolarization result is a baseline which resembles a saw-tooth pattern. The atrial rate is expected to be between 250-350 bpm. Like with Atrial Fibrillation not every atrial depolarization reaches the ventricles because they are blocked by the AV Node. The AV blocking can cause a variable or fixed AV conduction ratio.

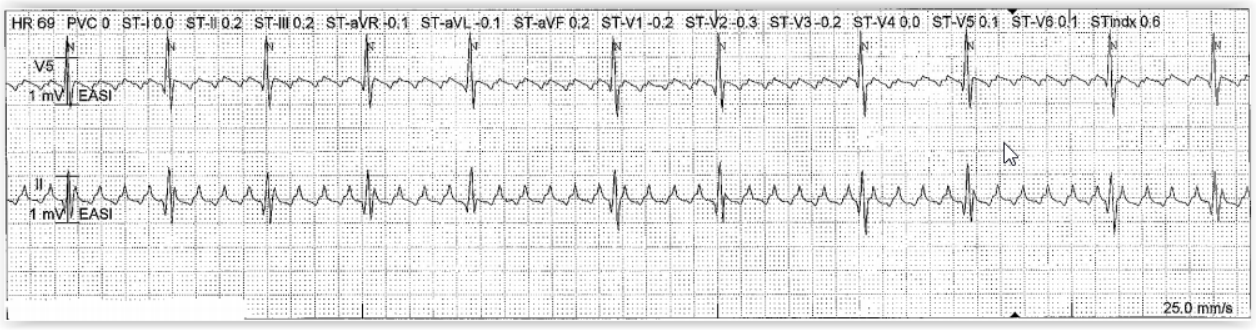
Atrial Flutter

- Atrial Rate 250-350 bpm
- No P waves
- Saw-toothed baseline
- Regular or Irregular R-R intervals
- Variable AV Conduction (2:1, 3:1, 4:1 etc.)
- Ventricular Rate will vary
    - RVR > 100 bpm
    - CVR 60-100 bpm
    - SVR < 60 bpm

Figure 4.4



Example Strip: Atrial Flutter



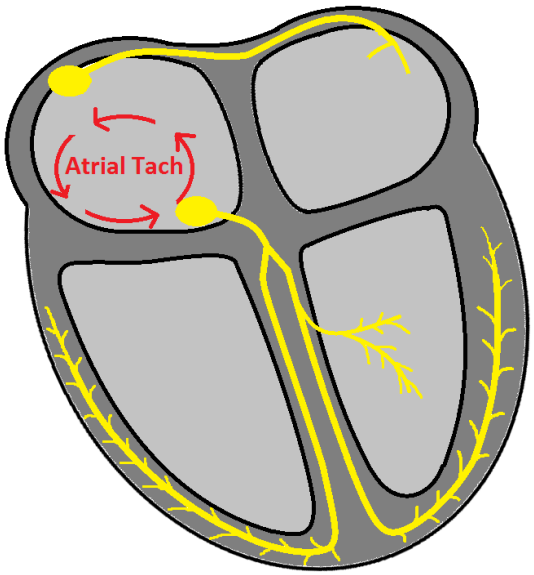
Atrial Tachycardia:

Atrial Tachycardia has similar characteristics as Atrial Flutter except the atrial rate is 150-250 bpm. Because the atrial rate is slower it may fall within the range the AV Node allows to pass without blocking, meaning it may have a 1:1 conduction ratio or it could be variable. Atrial Tachycardia with block may sometimes be mistaken for 2° or 3° AV Block covered in a later chapter. When Atrial Tachycardia has a 1:1 conduction ratio it may be difficult to distinguish it from other rapid atrial arrhythmias.

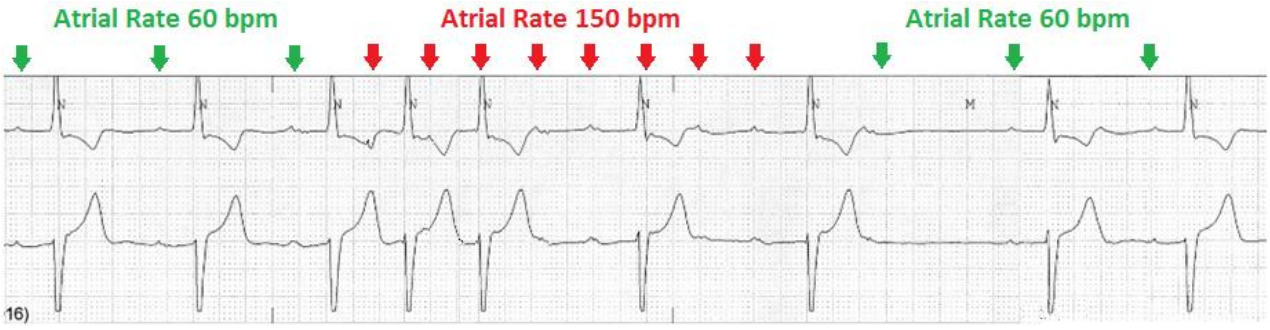
Atrial Tachycardia

- Atrial Rate 150-250 bpm
- Regular or Irregular R-R intervals
- AV Conduction may be 1:1 or variable if block is present.
- Ventricular Rate will vary
  - RVR > 100 bpm
  - CVR 60-100 bpm
  - SVR < 60 bpm

Figure 4.5



Example Strip: Atrial Tach w/ Block

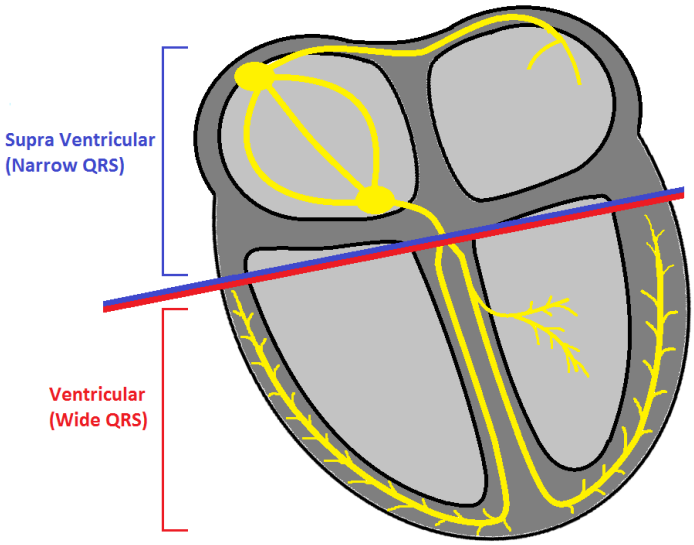


Supraventricular Tachycardia (SVT):

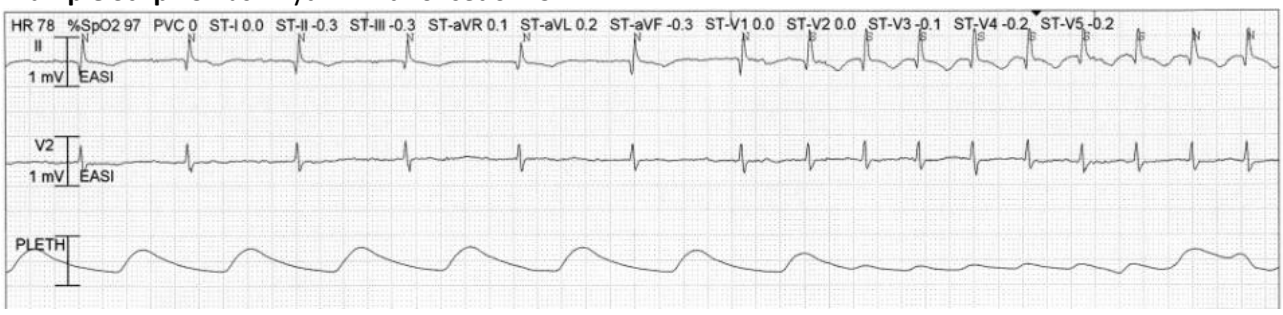
Supraventricular Tachycardia (SVT) is a term used to describe any tachycardia originating from above the ventricles. Since it is often difficult to clearly identify rapid atrial rhythms the term SVT may be used when it is not possible to identify a rhythms origin. For example, if a patient were placed on telemetry monitoring with an initial heart rate of 165 bpm with regular R-R intervals and narrow QRS complexes, it might be very difficult to tell if the rhythm is Sinus Tachycardia, Junctional Tachycardia, Atrial Flutter or some other reentrant tachycardia. When labeling a rhythm SVT you are saying it is not possible to identify the rhythm but it is not Ventricular Tachycardia. Rhythms which originate from above the ventricles have a relatively narrow QRS whereas ventricular arrhythmias have wide QRS complexes (See Ventricular Arrhythmia Chapter). Atrial Fibrillation technically qualifies as an SVT however its irregularity usually gives it away, unless the ventricular response is so rapid it appears regular. If it's possible to witness the beginning of the SVT and it begins suddenly this is referred to as Paroxysmal Supraventricular Tachycardia (PSVT).

Supraventricular Tachycardia (SVT)

- Ventricular Rate usually > 150 bpm
- Regular R-R intervals
- Relatively Narrow QRS
- Rhythm of Atrial Origin
    - Sinus Tachycardia
    - Atrial Fibrillation
    - Atrial Flutter
    - Atrial Tachycardia
    - Junctional Tachycardia
    - Other Reentrant Tachycardias



Example Strip: Sinus Rhythm with onset of PSVT.



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