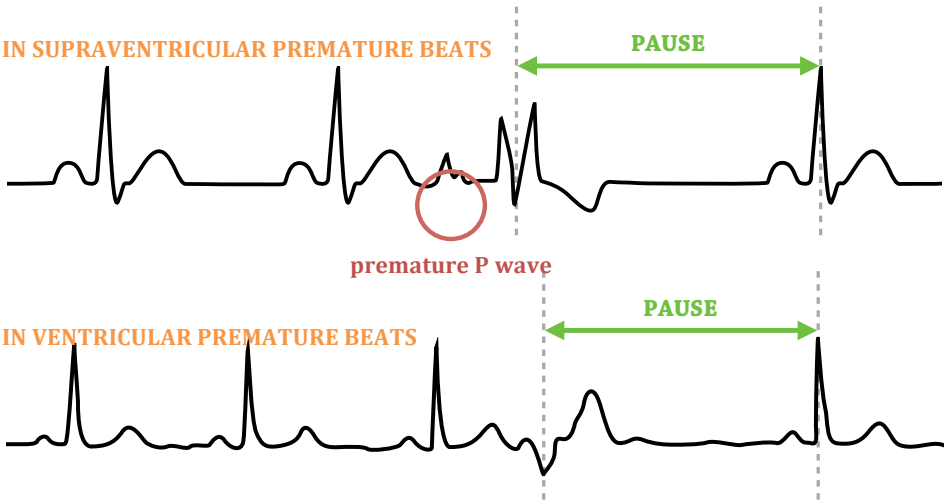
Level 9: Pauses & AV Dissociation

In this level, we are going to learn about pauses and AV dissociation.

Pauses… do we have to worry?

In this section, we are going to talk about five different kinds of pauses that can be seen on the ECG.

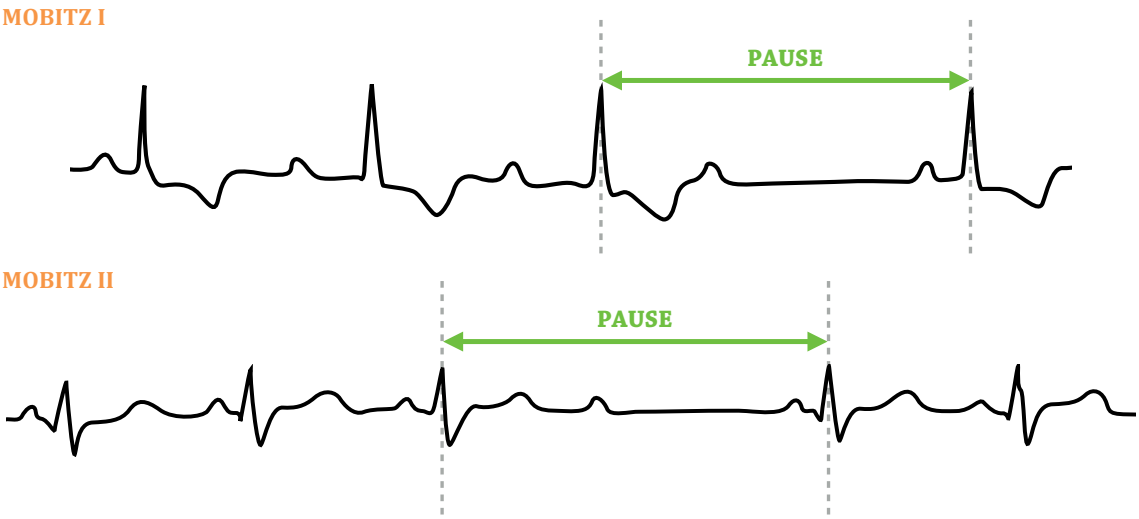
#1: Compensatory Pauses



In this case it is an SPB with a BBB morphology

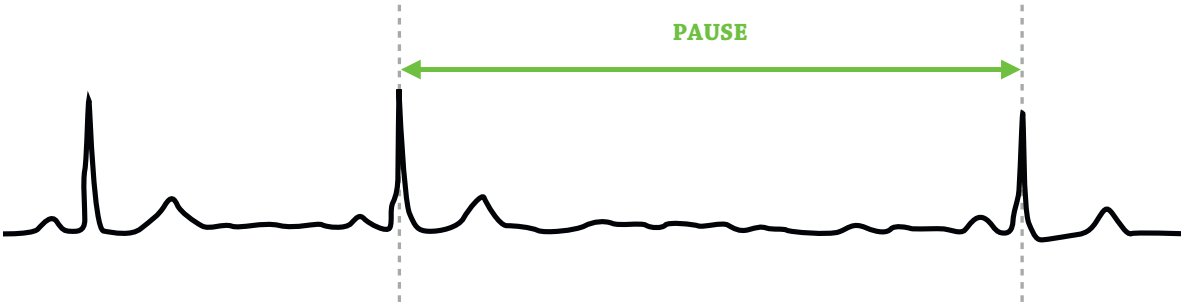
We have already seen the compensatory pause following many ectopic beats. The pause itself is not the problem, although that's what the patient actually feels when a premature beat occurs. The abnormal thing to worry about is the premature beat. Whether we try to do something about it is a clinical decision and depends upon many factors in each patient.

#2: Pauses in second degree AV block



We have already encountered pauses in second degree AV block, in Mobitz type I as well as in Mobitz type II. These pauses are part of the arrhythmia and should not bother us by themselves. Persisting second degree AV block, however, may become symptomatic. Therefore, the indication for pacemaker implantation should be carefully considered.

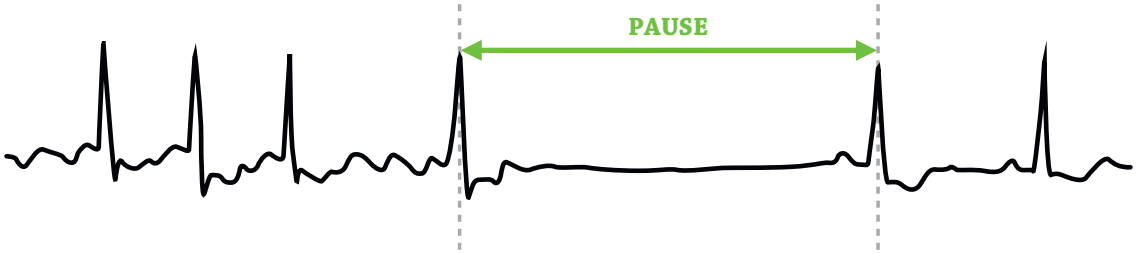
#3: Sino-auricular block (i.e., sino-atrial block)



Another type of pause is the so-called **empty pause**, which can be seen in **sino-auricular block** or **sinus arrest**. In this situation no other abnormality (e.g., a premature beat, rhythm switch, or a non-conducted atrial beat) apart from the pause can be identified on the ECG. All we see is a long pause without any electrical activity in it.

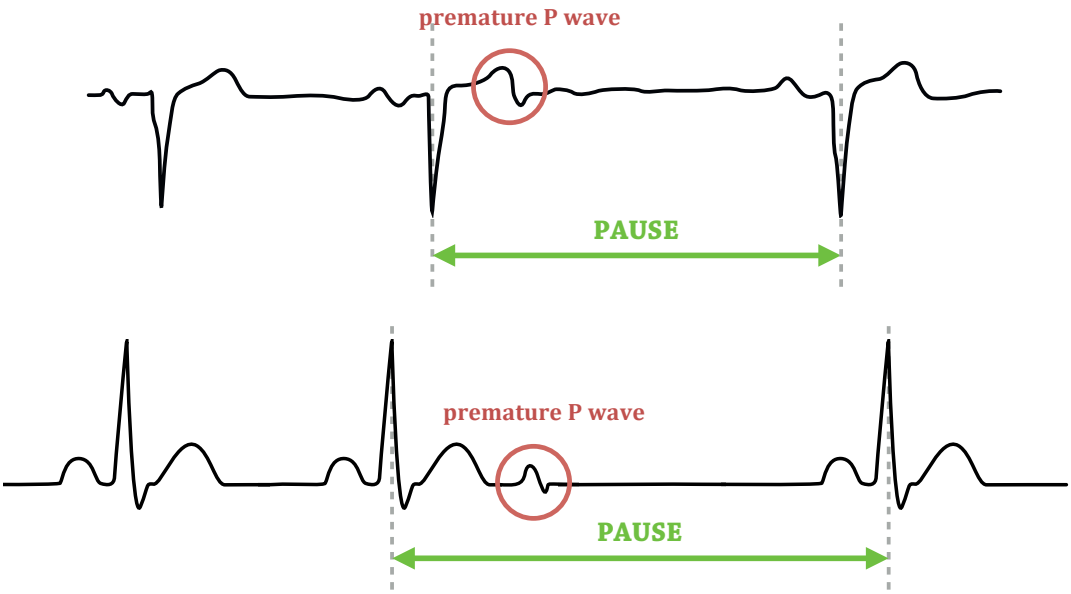
When we say sino-auricular block, we assume that the sinus node has produced an electrical impulse at the proper moment, but that this impulse was not conducted into the surrounding atrial myocardium. One other possible explanation for a pause like this is **sinus arrest**, a situation in which the sinus node does not work at all. Since we cannot record the sinus activity on the surface ECG, we cannot differentiate between these two types of pauses. If only one beat is omitted, it's called **intermittent SA block**, and the patient would hardly feel anything. If the pause gets longer and if we do not get any stimulation by an escape beat from a junctional or ventricular center, then dizziness or even syncope occur. A combination of this intermittent conduction problem in the sinus node with the tendency to intermittent atrial tachycardias typically suggests that **sick sinus syndrome is present**.

#4: Preautomatic pauses



A pause can also occur in the setting of a **rhythm switch** (e.g., when an atrial tachycardia terminates and sinus rhythm takes over the pacemaker function again, as can be seen in the example above). Such pauses are called **preautomatic pauses**. In these cases the sinus node takes some time to wake up again and take over its normal pacemaker function. If this pause gets long enough to make the patient symptomatic, this would be another feature of the **sick sinus syndrome**. Patients with sick sinus syndrome are not easy to manage: when we treat the tendency for atrial tachycardias with antiarrhythmic drugs or with medications to slow down their heart rate, we might on the other hand increase the tendency for bradycardia and pauses. Therefore, sometimes we have to combine adequate medication with pacemaker therapy in these cases.

#5: Non-conducted premature atrial beats



We already encountered another type of pause in the last module when we saw the supraventricular ectopic beat which was not conducted into the ventricles at all. Here we see a pause with two typical features:

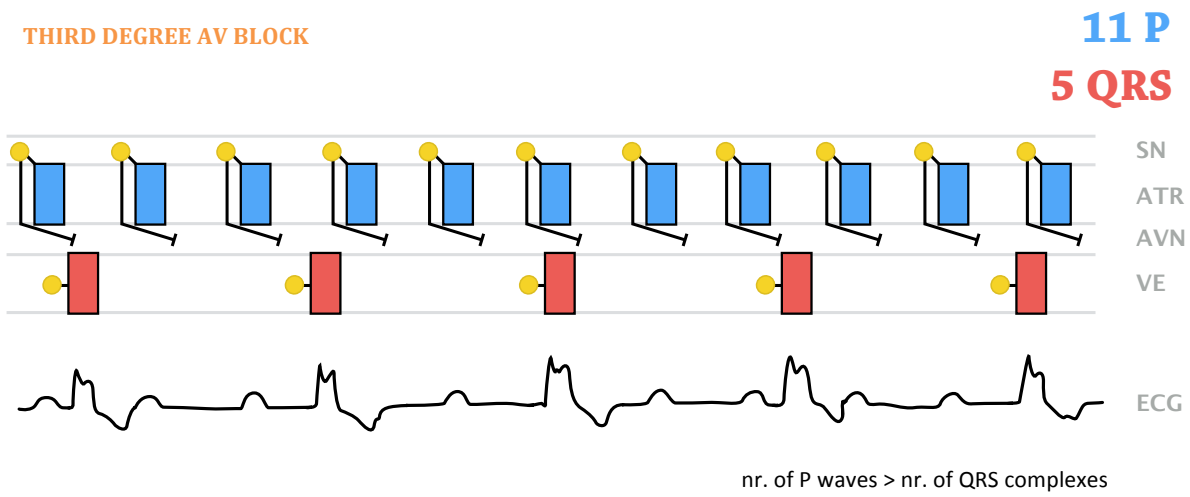
1. The duration of this pause is somewhat shorter than two regular R-to-R intervals.
2. When looking very carefully we can often identify the premature P hidden somewhere in the T wave of the preceding normal beat or in the isoelectric line following the preceding T wave.

Here again the pause is not the problem—it is the premature beat that could worry us. Whether we would consider treatment or not depends upon the individual circumstances of the patient and how often these events occur. A Holter ECG (an ambulatory ECG device for continuous rhythm monitoring) may also help with this decision.

AV dissociation vs. complete AV block

AV dissociation literally means that atria and ventricles are dissociated in terms of their respective pacemaker. In other words there is one pacemaker producing impulses for the atria (normally the sinus node), and a second one producing impulses for the ventricles (a stimulating center in the ventricular myocardium or in the junctional region). This usually results in the fact that P waves and QRS complexes occur independently of each other. We have seen similar findings in the case of complete AV block.

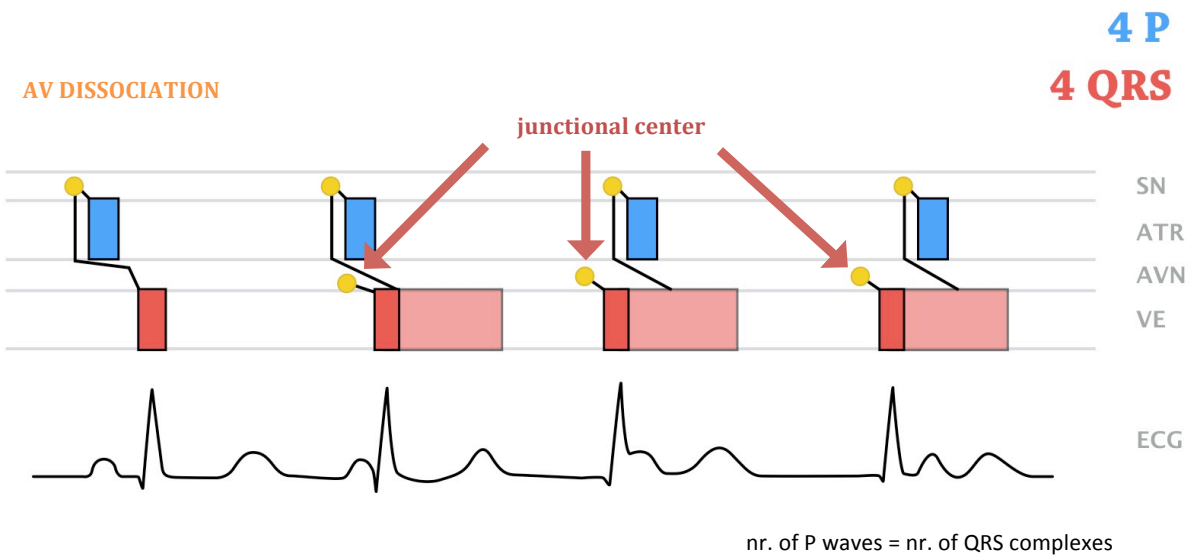
Here's a tracing of **third degree AV block** to refresh your memory:



nr. of P waves > nr. of QRS complexes

We are no longer surprised to find P waves preceding a QRS with extremely short PR intervals, and to find other P waves hidden within the QRS or within the ST segment. We know that PR intervals are usually variable, and most importantly that **the number of P waves exceeds the number of QRS complexes**.

This type of AV dissociation is generally called complete AV block or third degree AV block. However, it is generally agreed upon in electrocardiography to reserve the term "AV dissociation" to a very special form of arrhythmia, which is shown in the following example.



nr. of P waves = nr. of QRS complexes

The rate of the junctional center overtakes the sinus rate. The sinus impulse (i.e., P waves) can no longer activate the ventricles because they have already been activated by the junctional center. If the sinus rate speeds up again, it will take over the pacemaker function again.

There are two key characteristics in this tracing:

1. The PR interval continuously decreases.
2. P waves can be found before, in, or shortly after the QRS complexes (i.e., they seem to be "traveling" through the QRS complexes).

These findings could technically also be found in cases of complete AV block. The important difference, however, is that in AV dissociation **the number of P waves and the number of QRS complexes on the tracing are practically identical**.

The ladder diagram also shows us that P waves 2 to 4 could not activate the ventricles because they had already been activated by an ectopic junctional focus.

Since the rate of the junctional focus overtook the sinus rate after the first beat, it became the primary pacemaker. None of the sinus impulses could activate the ventricles from that point on.

Since the junctional impulses depolarize the ventricles just like the sinus impulses—through the normal conduction system—the shape of the QRS complexes is narrow and completely normal (unlike most cases of third degree AV block in which QRS complexes are broad).

The pattern of this AV dissociation is therefore only determined by the respective pacing rate of the sinus node and of the junctional center. If the rate of the junctional center exceeds the sinus rate, AV dissociation is present. If the sinus node speeds up again and its rate exceeds the junctional rate, the patient will be in sinus rhythm again.

As you can imagine, the patient with this type of arrhythmia will practically have no symptoms at all, because the heart rate stays more or less unchanged and there are no extra beats or unexpected pauses. It is more a problem for the doctor reading the ECG tracing and being puzzled by the strange behavior of the P waves travelling into and through the QRS complex.