

Basic Rhythm Interpretation.

Learning Package

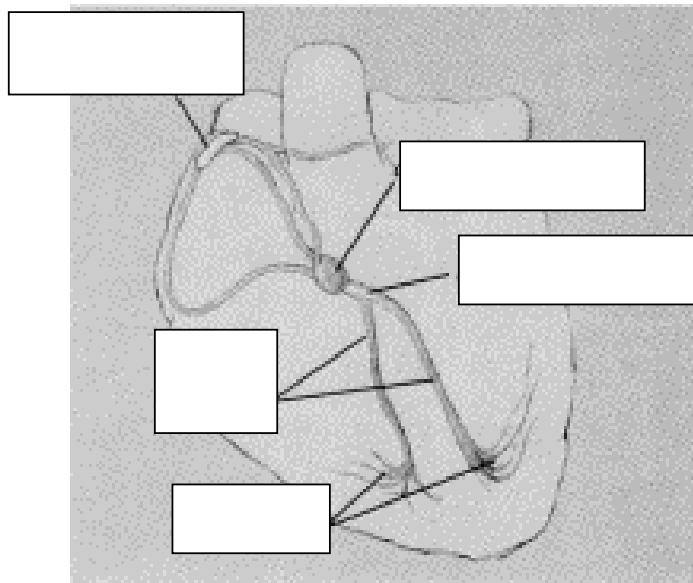
Prior learning

Before undertaking this package it is expected that the learner will have previously completed the Cardiac learning Package.

Cardiac Physiology

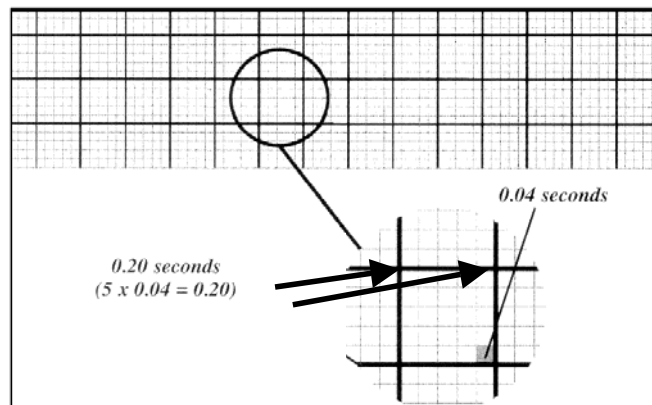


Activity: On the following diagram Label the boxes as to the part of the conduction tissue referred to and the rate (for an adult) of the intrinsic pacemaker for those cells



Recording Paper

The ECG rhythm strip is recorded on standard paper where the horizontal (x) axis records time and the vertical (y) axis records volts. It is essential you have an understanding of the paper as it makes rhythm interpretation easier.



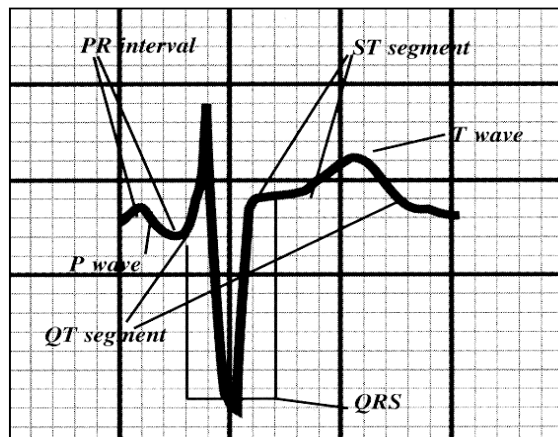
As you can see from the above diagram, the paper is broken up into small squares each measuring 0.04 secs, every fifth square the line is heavier indicating 0.20 second intervals.



Activity: Complete the following

- 7 small squares = ____ secs
- 0.08 seconds is represented by ____ small boxes
- A QRS complex is 1 large square wide Therefore it is ____ seconds in duration
- 3 small squares = ____ secs

Waveforms complexes and intervals

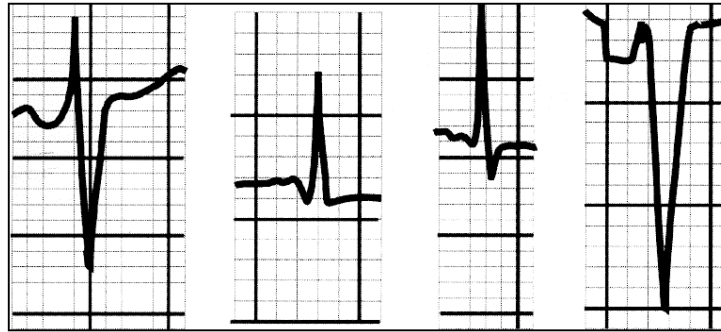


As you know the heart is designed so that electricity uses the conduction system to travel via a set path through the heart muscle. Measurement of time intervals in relation to ECG events allows us to determine if this is occurring correctly.



Activity: Complete the following paragraph.

Electrical depolarisation of the atria is initiated via the ____ node and is represented on the ECG by the ____ wave. The PR interval is the amount of time from the beginning of atrial depolarisation to the beginning of _____ depolarisation. The PR interval is measured from the start of the ____ wave to the start of the ____ complex. Normal PR interval is 0.12-0.20 seconds, this corresponds to ____ to ____ small squares on the ECG paper. The QRS complex represents _____ depolarisation and is normally 1.5 to 3 small squares in duration or ____ to ____ seconds.



The above diagram illustrates how the QRS complex can vary depending on which lead is being viewed.



Activity; measure the QRS duration for each of the above complexes

Assessment and rate calculation

Assessment of rhythm strips in an effort to make a diagnosis must always be done in a systematic fashion, this ensures that nothing will be missed and the correct diagnosis is made. The components of interpretation are:

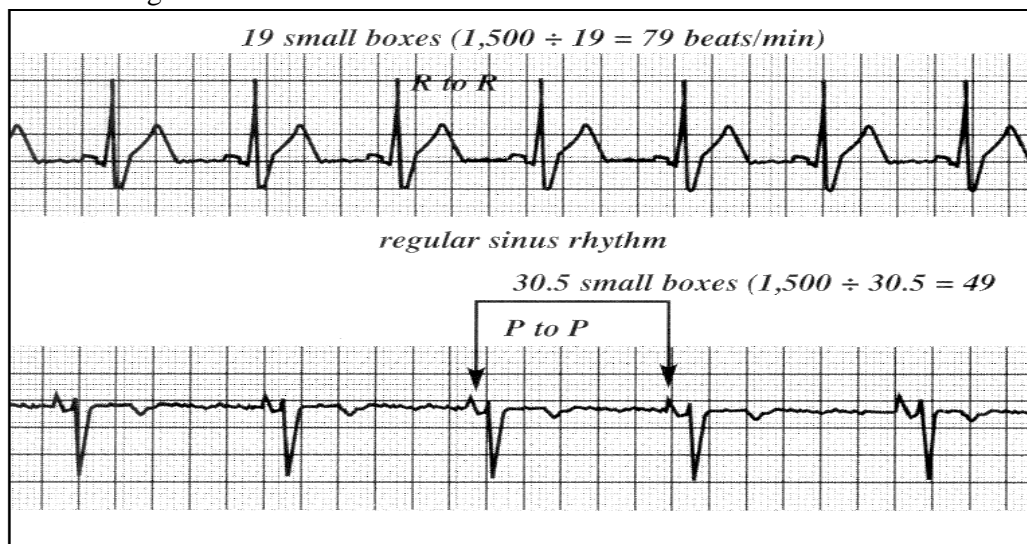
- Rate
- Rhythm
- P wave
- P-R interval
- QRS complex

Now Let's look at each of these components in detail

Rate:

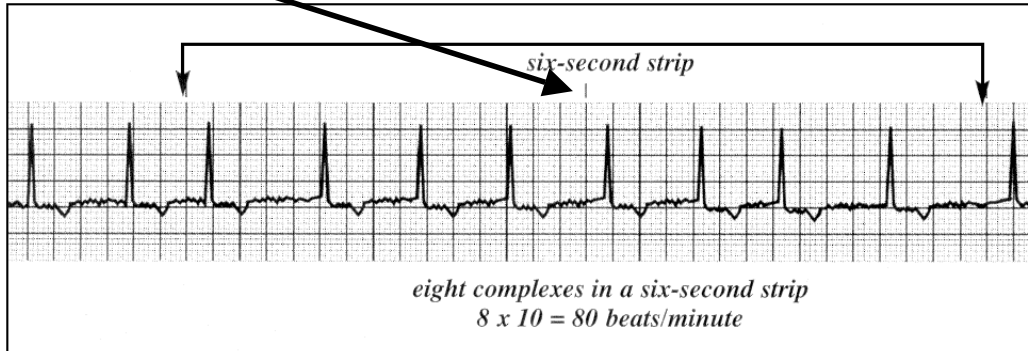
To determine rate two methods can be employed

- Counting small boxes between R-R intervals



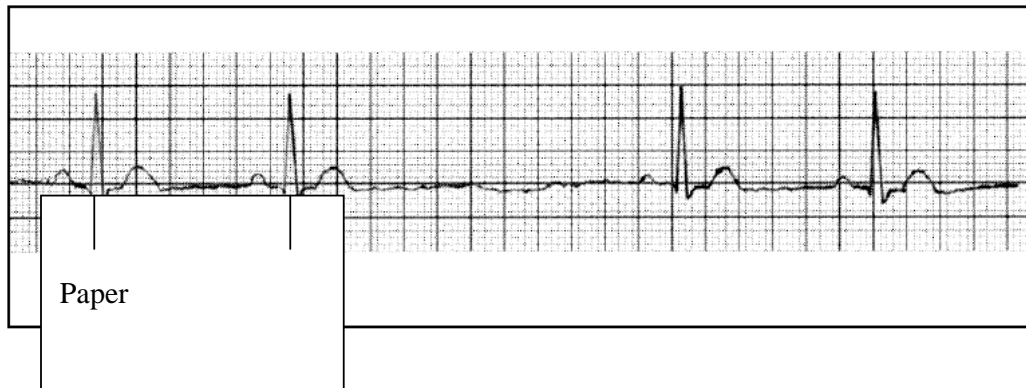
- Counting the number of QRS complexes in a six-second strip. Most printers will automatically print a six second strip if an alarm is triggered, also on standard paper a small mark is left a three second intervals, so six seconds is between three of these marks.

Three second marker

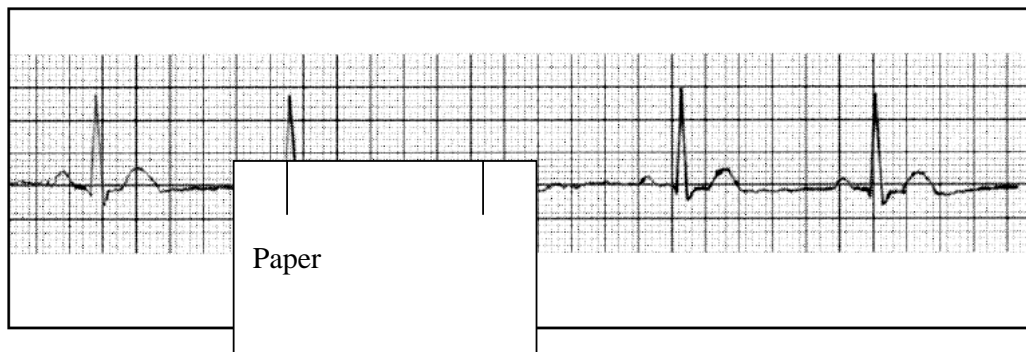


Rhythm

Since all impulses originating from pacemaking cells of the heart, (SA, AV, Purkinje fibre's) are regular by nature, ascertain with the rhythm is regular or irregular. To ascertain regularity take a piece of paper and place it on your rhythm strip, mark off on the paper two consecutive QRS complexes.



Move paper along strip and line up marks with QRS, if the rhythm is regular the marks will always line up, if it is irregular they will not, see below.



P waves:

- Are they present or absent
- All P waves should be similar in size and shape

P-R interval:

- Is it normal **0.12-0.20 secs (3-5 small squares)**
- If its too long it may mean the impulse from the SA node is having problems travelling to the AV node

QRS width:

- Is it normal **0.06-0.12 secs (<3 small squares)**
- QRS complexes that are longer than 0.12 seconds mean that the impulse is either not using the bundle branches for movement around the ventricular muscle mass or are using the bundle branches in an abnormal way.

Rhythm interpretation:

- Based on your findings above a diagnosis can then be made

Note

When considering arrhythmia assessment in infants and children the same simple criteria needs to be considered. Ask yourself?

1. Is the child clinically stable or shocked?
2. Is the rate too fast or too slow for this child?
3. Is the rhythm regular or irregular?
4. Are the QRS complexes narrow or broad?

Remember that any arrhythmia seen in the adult patient can also occur in the paediatric patient. However the most common dysrhythmias seen in children are different from those seen in adults. In children the most common dysrhythmias are: supraventricular tachycardia, bradycardia and sinus arrhythmia.



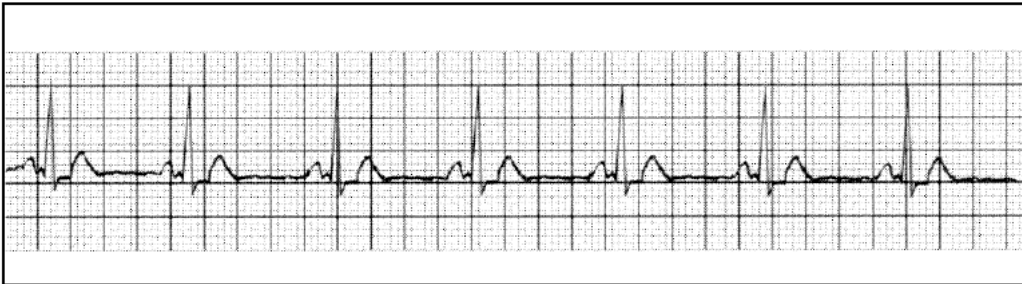
Activity: As you go through the following definitions for each rhythm, take time to measure the rate, rhythm and intervals for practice.

Prior to doing this you may need to review the expected normal values for pulse, respiration and BP across the age continuum.

Supra ventricular rhythms

Sinus rhythm

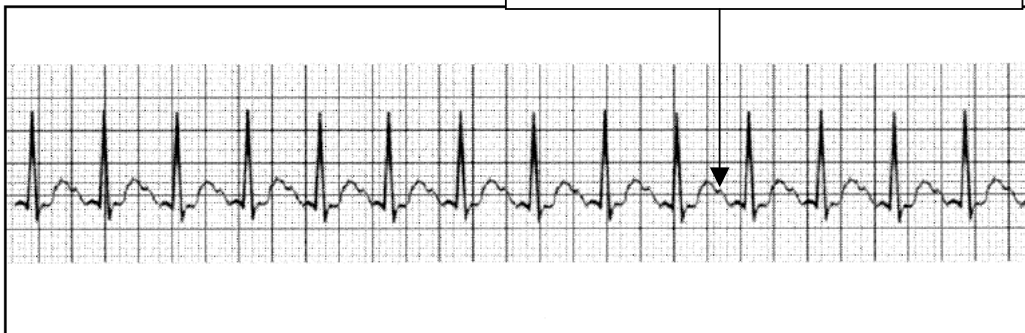
- Rate Usually from 60-100 beats per minute
- Rhythm Regular
- P Waves Normal. One and only one before each QRS
- PR interval Normal
- QRS duration Normal



Sinus Tachycardia (adult)

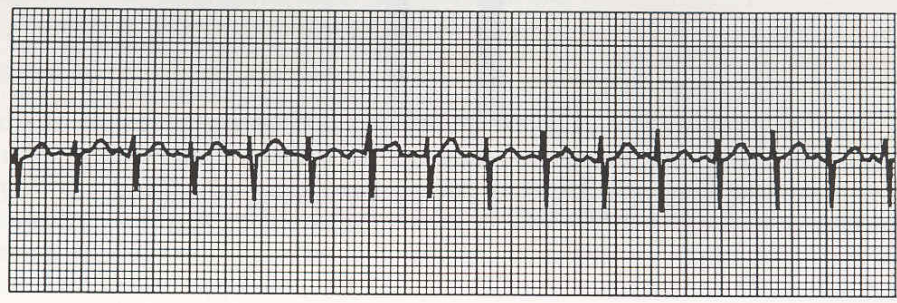
- Rate Usually from 100-160 beats per minute
- Rhythm Regular
- P Waves Normal. One and only one before each QRS
- PR interval Normal
- QRS duration Normal

NB note P wave partially buried in T-



Sinus Tachycardia in the Paediatric Patient

- Rate Can be as high as 220 beats per minute in an infant
- Rhythm Regular
- P Waves Normal. One and only one before each QRS
- PR interval Normal
- QRS duration Normal



Sinus Bradycardia Adult

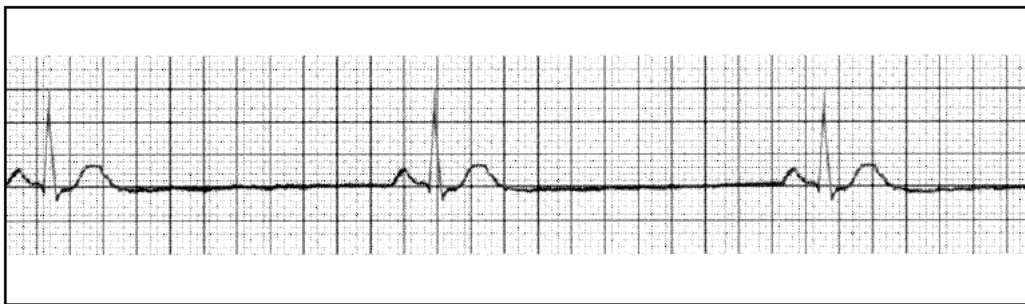
Rate Usually 40-60 beats per minute, but may be slower

Rhythm Regular

P Waves Normal. One and only one before each QRS

PR interval Normal

QRS duration Normal



Sinus Bradycardia in the Paediatric Patient

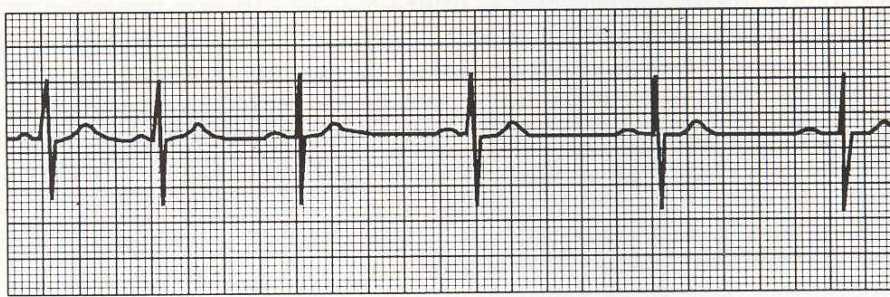
Rate A sinus rate that is below normal for age, for example: below 100 beats per minute in newborns, 80 beat per minute in infants and 60 beats per minute in older children

Rhythm Regular

P Waves Normal. One and only one before each QRS

PR interval Normal

QRS duration Normal



Premature Atrial Contraction (PAC)

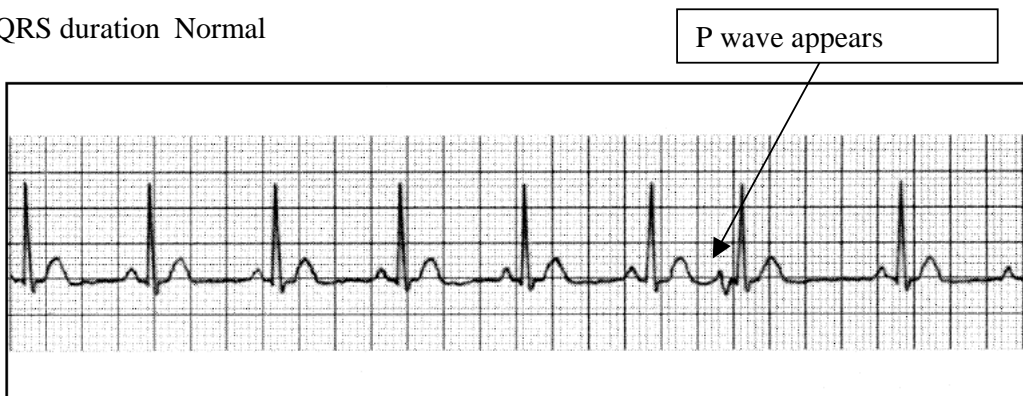
Rate Usually normal

Rhythm Except for the atrial contraction that occurs prematurely, the remaining rhythm is entirely normal.

P Waves predominantly Normal except for p wave preceding PAC differs from normal P wave

PR interval Normal

QRS duration Normal



Supra ventricular Tachycardia Adult

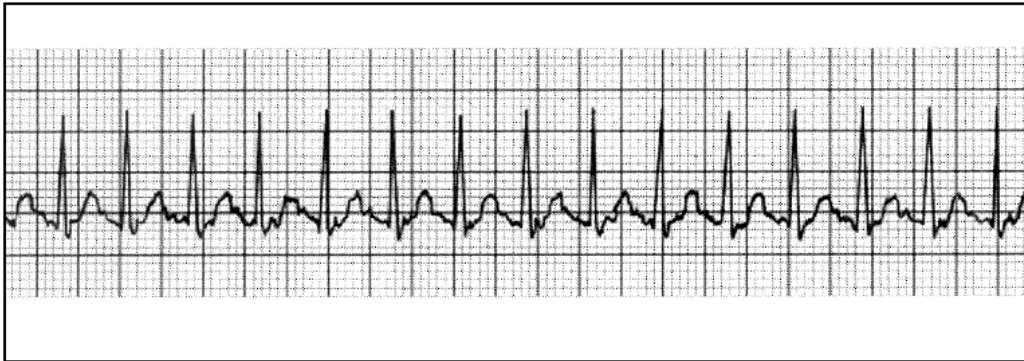
Rate 140 - 250 per minute

Rhythm regular QRS

P Waves not distinguishable

PR interval not measurable

QRS duration Normal



Supraventricular Tachycardia in the Paediatric Patient

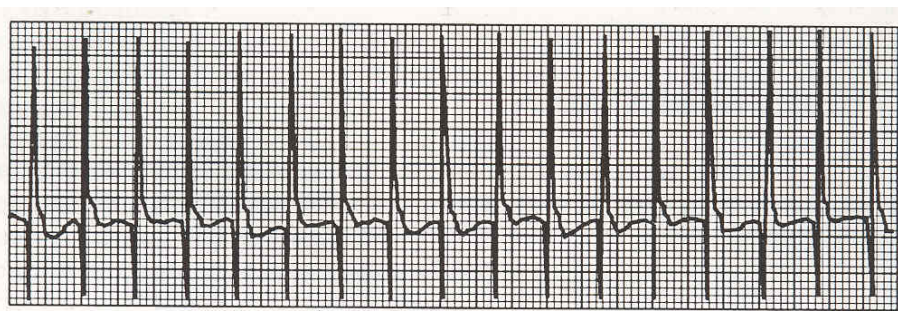
Rate Over 220 beats per minute and often up to 300 beat per minute in an infant.

Rhythm regular QRS

P Waves once the heart rate exceeds 200 beats per minute usually not distinguishable

PR interval not measurable

QRS duration Normal



Atrial Flutter

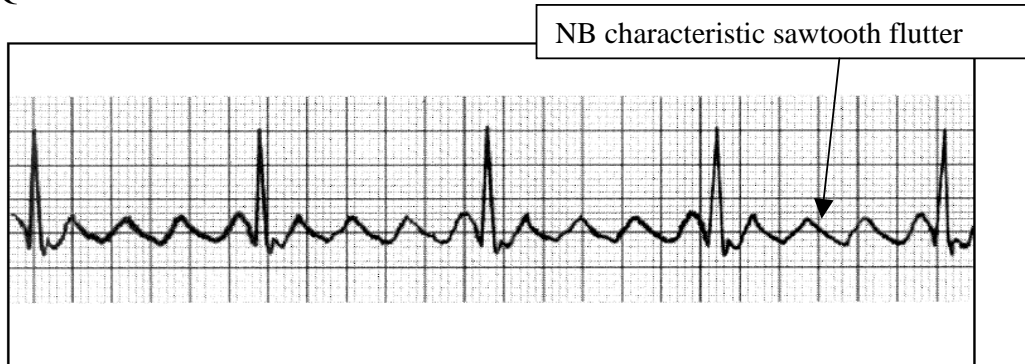
Rate the ventricular rate may vary from 60 - 150 depending on the number of atrial Impulses passing through the AV node

Rhythm the ventricular rhythm is most often regular. However, as a result of variations in the degree of block in the AV node from time to time, the ventricular rhythm may become somewhat irregular

P Waves there are characteristic atrial oscillations described as "saw tooth" waves, which are easily identifiable. These waves (called flutter waves) occur regularly at a rate of 250 - 400 per minute

PR interval not measurable

QRS duration Normal



Atrial Fibrillation

Rate Heart rate varies according to the ventricular response. It may be under 100 beats per minute (controlled atrial fibrillation) or faster (uncontrolled atrial fibrillation)

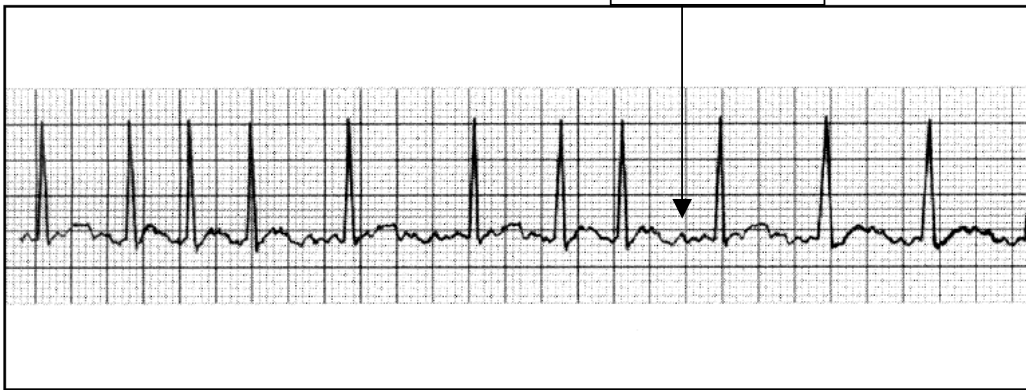
Rhythm Ventricular rhythm is totally irregular

P Waves There are no true P waves, but there are rapid, small irregular waves not resembling each other called "f" (fibrillatory) waves

PR interval not measurable

QRS duration Normal

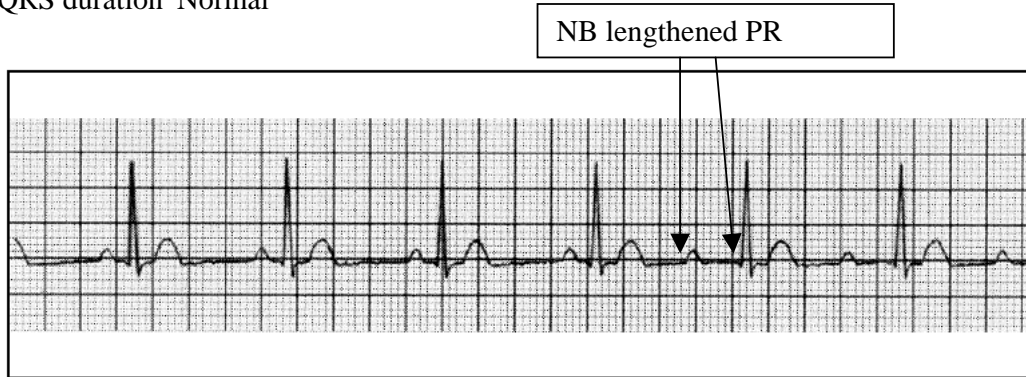
NB f waves



Heart blocks

First degree Heart Block

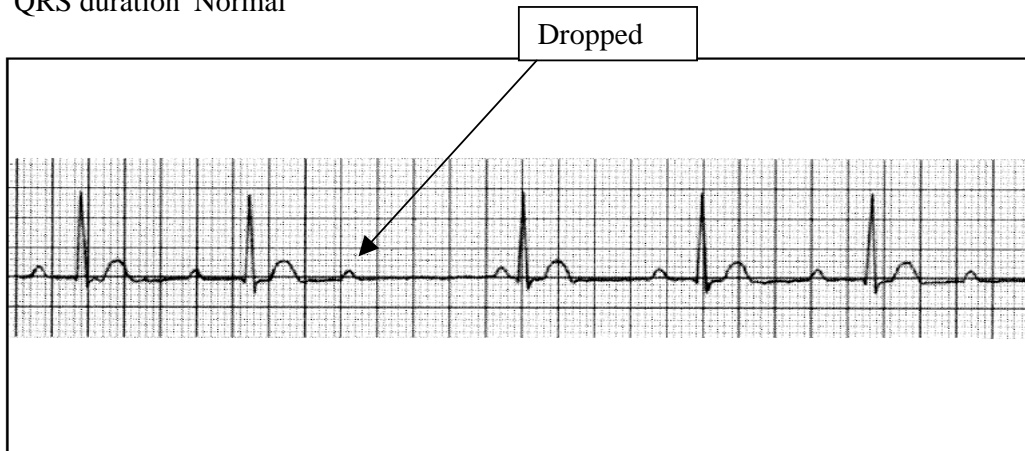
- Rate Usually normal
- Rhythm regular
- P Waves normal
- PR interval greater than 0.20 sec
- QRS duration Normal



Second Degree Heart Block

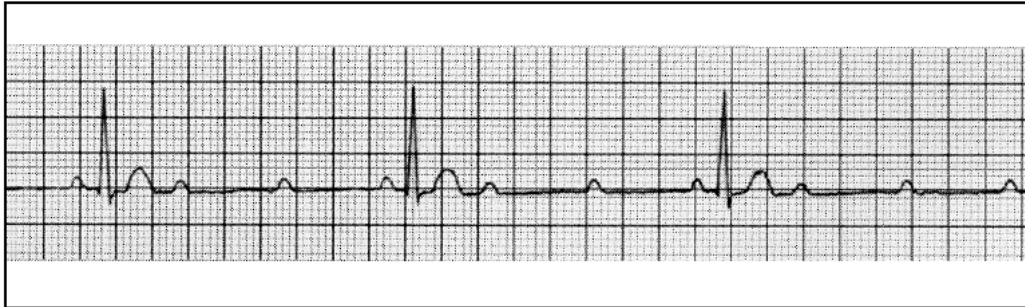
Type 1 a) Wenckbach

- Rate Atrial rate is normal but ventricular rate is slower than normal
- Rhythm Usually irregular
- P Waves Normal but some P waves are not followed by QRS complexes
- PR interval Progressively lengthens until one P wave is not followed by a QRS complex and then the cycle starts again
- QRS duration Normal



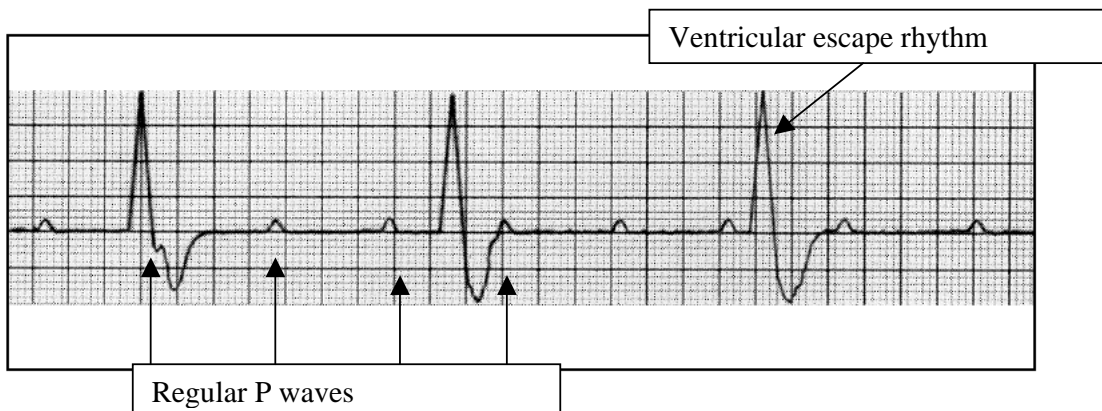
Type 1 b) 2:1 AV Block

- Rate Atrial rate is usually normal. The ventricular rate is slow and is one half, one third or one quarter the atrial rate
- Rhythm; Regular or irregular
- P Waves Normal but more P waves than QRS complexes
- PR interval on conducted beats is constant throughout strip. May be normal or long
- QRS duration Normal



Complete Heart Block

- Rate Atrial rate usually normal but ventricular rate is slower and depends upon the site of the escape pacemaker
- Rhythm; Atrial rate is regular and ventricular rhythm is regular. (P-P and R-R) intervals are constant
- P Waves Normal but more P waves than QRS complexes
- PR interval is constantly changing. P waves have no relationship to QRS complexes. P waves may be superimposed on QRS complexes
- QRS duration If escape pacemaker is junctional then less than 0.12 seconds. If pacemaker is ventricular then greater than 0.12 seconds. The escape pacemaker is described as idiojunctional or idioventricular



Junctional arrhythmia's

Junctional Rhythm

Rate Slow, usually between 40 and 60 per minute

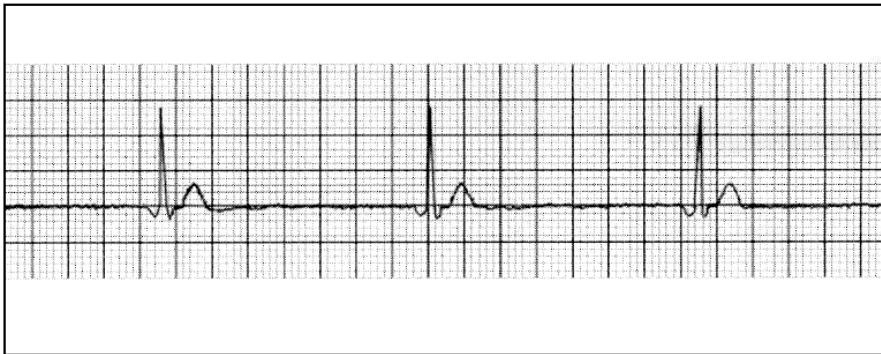
Rhythm; regular

P Waves abnormal; usually inverted. They may occur

- before the QRS
- after the QRS
- may not be visible
- being buried within the QRS or absent due to atrial standstill

PR interval generally short if measurable

QRS duration Normal



Ventricular arrhythmia's

Premature Ventricular Beats

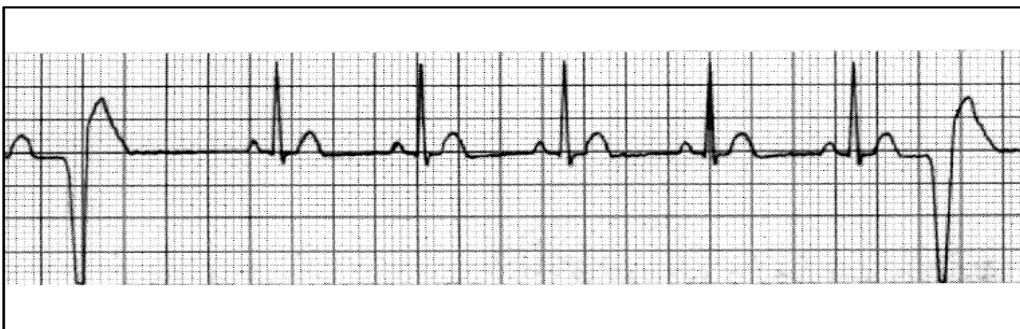
Rate Usually normal, but PVC's can occur at any rate

Rhythm; regular, except for ectopic beats

P Waves Not identifiable in the ectopic beat because the impulse originates in the ventricle and not in the SA node or atrium

PR interval normal on conducted beats not measurable on ectopic beats

QRS duration Always widened and distorted in shape. The configuration of QRS complex depends on the site of the ventricular stimulus



Ventricular Tachycardia/Flutter

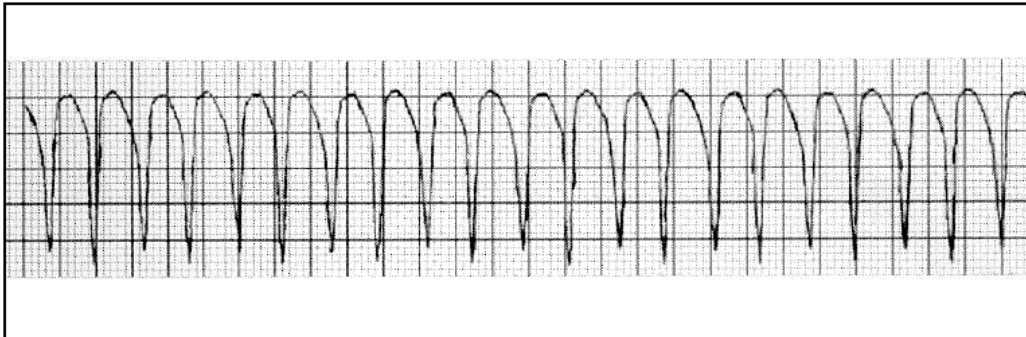
Rate Usually between 140-200 beats a minute

Rhythm; regular

P Waves usually buried within the QRS complex and seldom can be identified

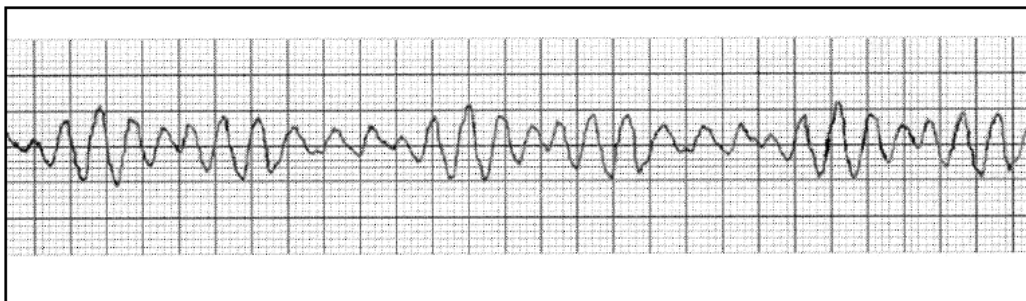
PR interval not measurable

QRS duration wide slurred complexes typical of repetitive ventricular beats



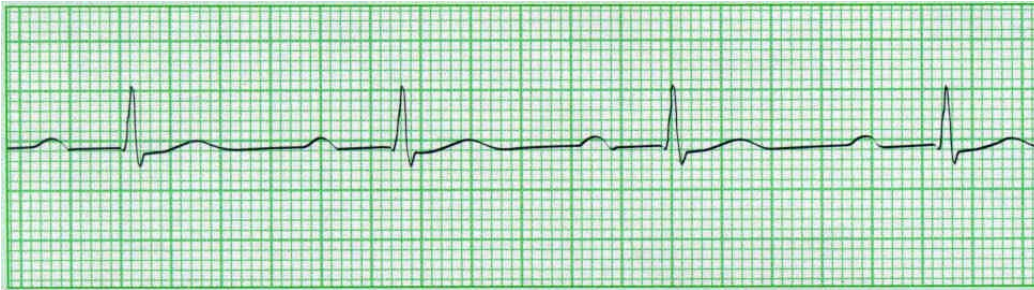
Ventricular Fibrillation

- The ECG pattern is characterised by a rapid, repetitive series of chaotic waves originating in the ventricles that have no uniformity and are bizarre in configuration.
- PQRST waves cannot specifically be identified. The complexes differ from each other and occur in a completely irregular fashion.
- This gross irregularity can hardly be mistaken for any other arrhythmia. The only other possibility to account for such gross distortion is a disorder of the monitor or the electrocardiograph machine





Activity Interpret the following strips using the above as a resource



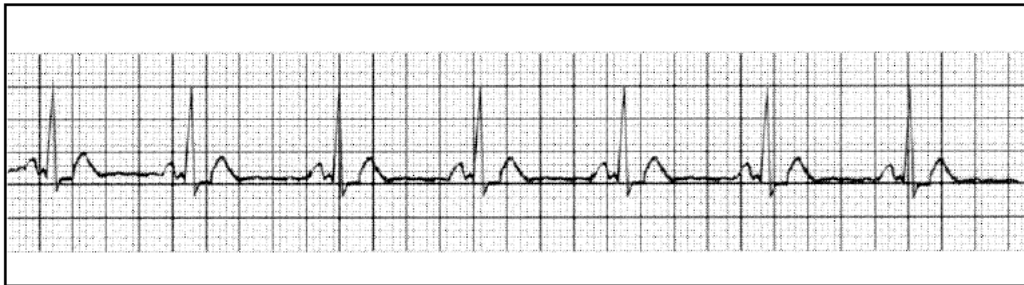
Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____



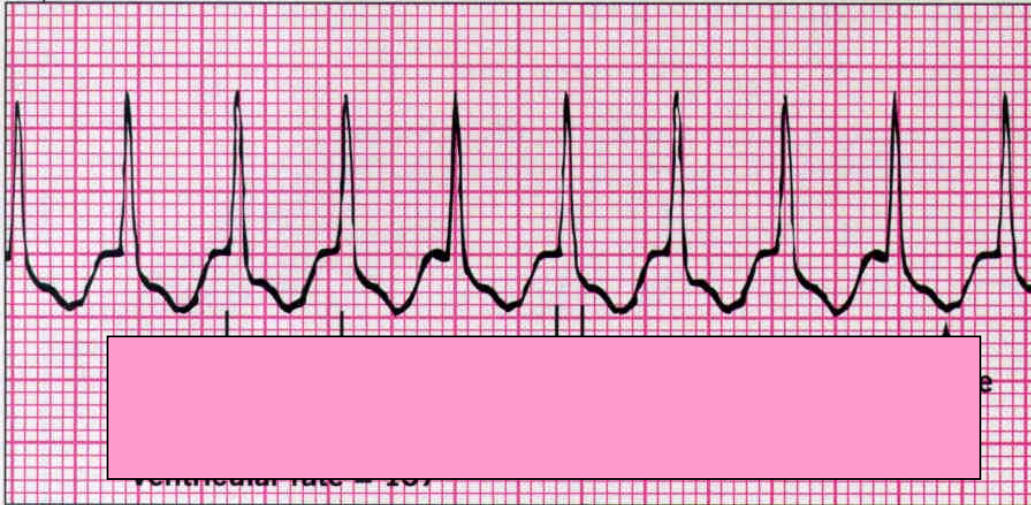
Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____



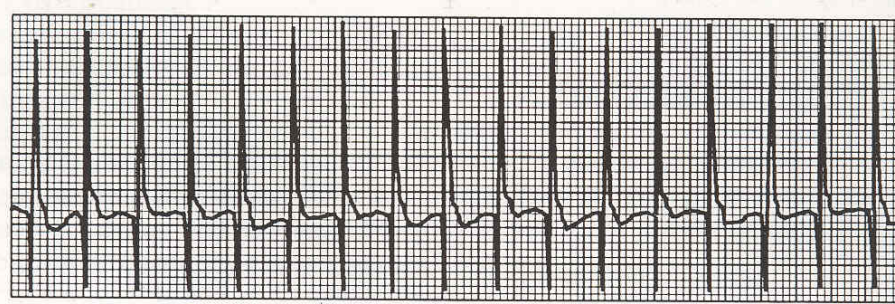
Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____



Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____

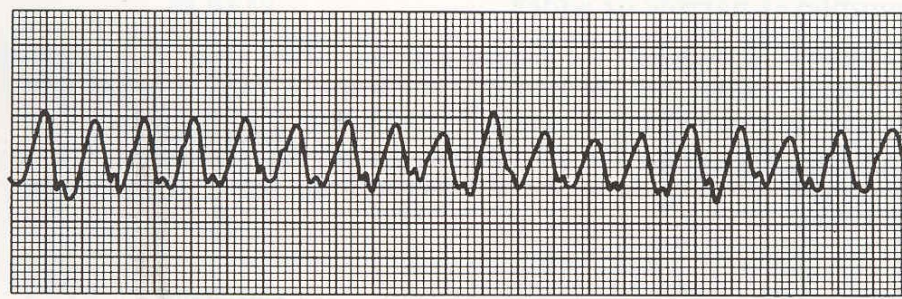


Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____



Paediatric Example: 7 year old child

Rate _____
Rhythm; _____
P Waves _____
PR interval _____
QRS duration _____
Interpretation _____



Paediatric Example: 7 year old child

Rate _____

Rhythm; _____

P Waves _____

PR interval _____

QRS duration _____

Interpretation _____

References

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