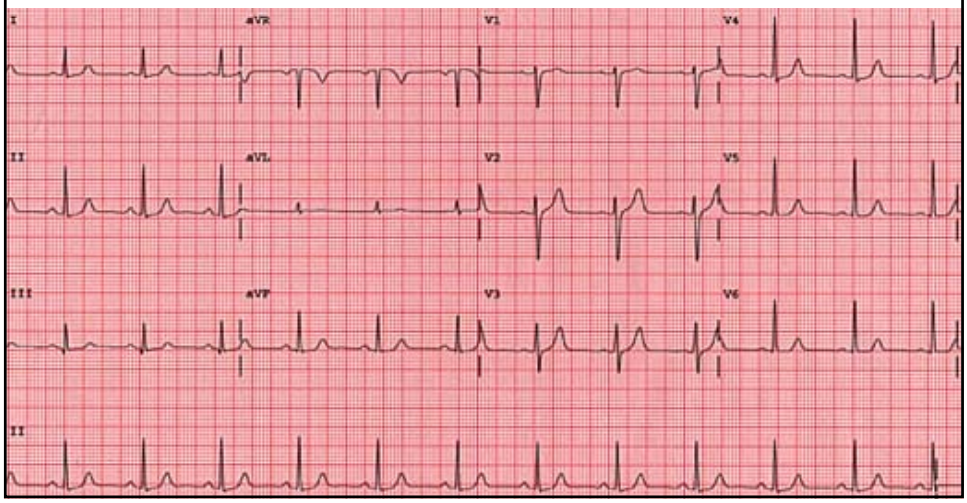
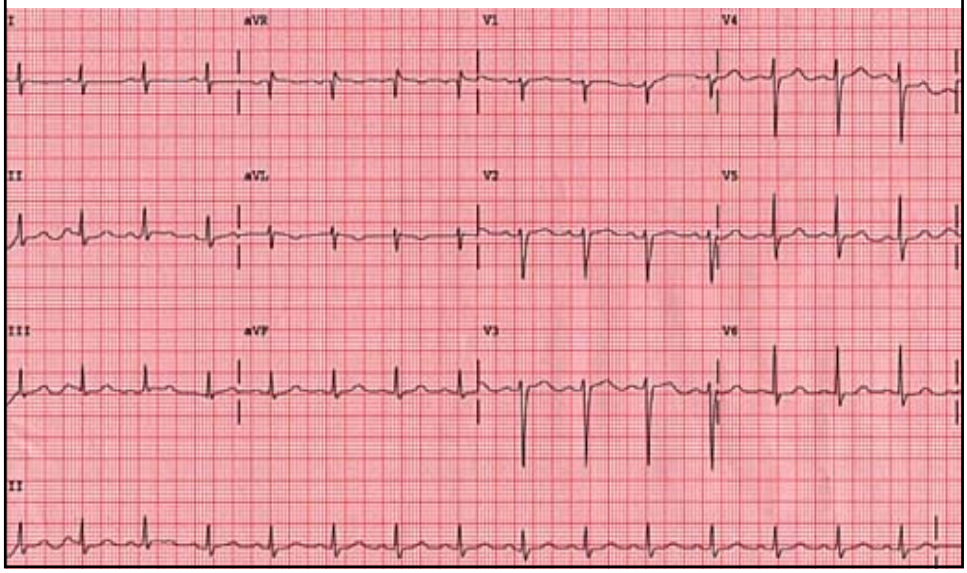
1. Are there P waves?
2. Are they regular?
3. Does every one precede a QRS?
4. Is the PR interval constant?
5. What is the PR interval?



ANSWER

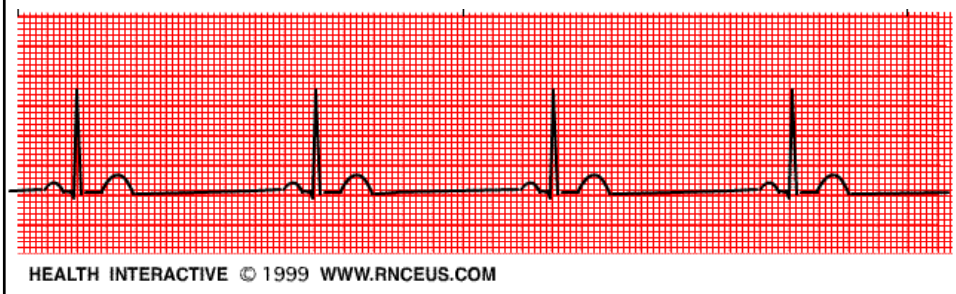
1. Yes
2. regular on electrode { iv}
3. Yes
4. Yes in lead (iV)
5. 0.08

Calculate the HR



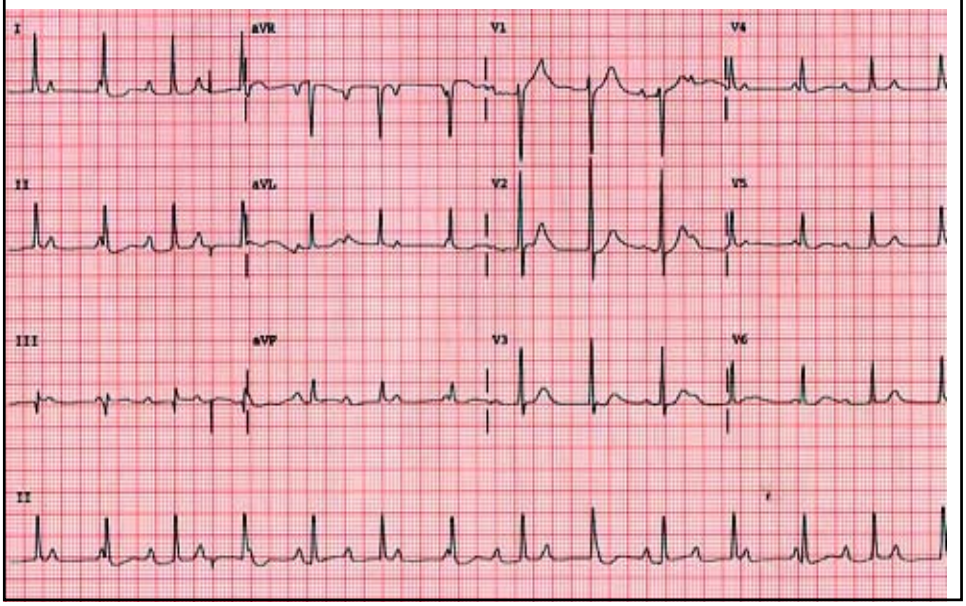
- Ans = 75

1.Estimate the rhythm
2.what is the condition



- 1. sinus bradycardia
- HR = 300/8 = 37.5 < 50bpm

What is the HR lead iv?



- 100

Cardiovascular Calculations

Define the ff terms and write equation(s) relating them:

1. Cardiac output(CO), stroke volume (SV), and heart rate (HR).
2. End-diastolic volume (EDV), End-systolic volume (EDV), stroke volume.
3. Pulse pressure (PP), Diastolic blood pressure, systolic blood pressure, Blood pressure.
4. Mean arterial blood pressure, diastolic pressure, Pulse pressure
5. Stroke volume, pulse pressure
6. Ejection fraction (EF), stroke volume, and end-diastolic volume.
7. Total Peripheral resistance, cardiac output, mean aortic (arterial pressure), and mean atrial pressure.
8. Total Peripheral resistance, cardiac output, and mean arterial pressure.
9. Percentage change in cardiac output, cardiac output at rest, and cardiac output after an exercise.

1. Cardiac output (CO) is the volume of blood ejected by the ventricle in a minute (ml/min).
   Stroke volume (SV) is the volume of blood ejected by the ventricle with each beat (ml/beat).
   Heart rate is the number of beats per minute (beats/min).
   Cardiac output (CO) = stroke volume (SV) x Heart rate (HR)

2. End-diastolic volume (EDV) is the amount of blood collected in a ventricle during diastole or ventricular relaxation.
   End-systolic volume (ESV) = amount of blood remaining in a ventricle after contraction.
   Stroke volume (SV) = EDV - ESV

3. Pulse pressure (PP) is the difference between systolic pressure and the diastolic pressure
   systolic pressure is the highest value for arterial pressure in a cardiac cycle
   Diastolic pressure is the lowest value for arterial pressure in a cardiac cycle
   Pulse pressure = systolic pressure – diastolic pressure
   Blood pressure = systolic pressure / diastolic pressure

4. **Mean arterial pressure = diastolic pressure + 1/3 pulse pressure**

5. **Stroke volume (SV) = 2 x pulse pressure**

5. **Ejection fraction (EF) = stroke volume (SV) / end-diastolic volume(EDV)**
   where Ejection fraction = fraction of end diastolic volume ejected in one stoke

7. **Total peripheral resistance (TPR) = (MAP – RAP) / CO**
   where
   MAP = mean aortic (arterial) pressure (mmHg)
   RAP = mean right arterial pressure (mmHg)
   CO = Cardiac output (blood flow in of the left ventricle)

8. **TPR = MAP/CO in a steady state.**

9. **Percentage change in cardiac output = 100% x (Post exercise Cardiac output) – Cardiac output at rest) / (Cardiac output at rest)**

CARDIOVASCULAR CLCULATIONS

1. Cardiac output (CO) is the volume of blood ejected by the ventricle in a minute (ml/min).
   Stroke volume (SV) is the volume of blood ejected by the ventricle with each beat (ml/beat).
   Heart rate is the number of beats per minute (beats/min).
   Cardiac output (CO) = stroke volume (SV) x Heart rate (HR)

2. End-diastolic volume (EDV) is the amount of blood collected in a ventricle during diastole or ventricular relaxation.
   End-systolic volume (ESV) = amount of blood remaining in a ventricle after contraction.
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- Given the ff data

HR post exercise = 100bpm
Resting Blood pressure = 100/60
Resting pulse rate = 60pulses/45secs
% change in CO = 400%
Right atrial pressure = 3mmHg
Calculate the ff:
1. Resting HR 2). Resting PP 3). Resting stroke volume
4). Resting CO 5). Post CO just after exercise
6). Post stroke volume 7). Post PP
8). Mean arterial blood pressure at rest
9). Total peripheral resistance at rest

Answers

- **1. HR = PULSE RATE = 60 pulses / 45 s = 60 x 60 / 45 = 80bpm**
  Ans: HR= 80bpm
- **2. PP = SBP – DBP**
- **100 – 60 = 40mmHg Ans: PP = 40mmHg**
- **3. Rest SV = 2 x PP at rest = 2 x 40 = 80 ml/min**
- **Ans: Rest SV = 80ml/beat**
- **4. Rest CO = Rest SV x HR at rest**
- **= 80 x 80 = 6400ml/beat = 6.4L/min**
- **Ans: CO at rest = 6400ml/min**
- **5. Let y = Post CO**
- **% change in CO = 100% x (Post CO - Rest CO) / (Rest CO)**
  400% = 100% x (y- 6400) /(6400)
  y = 32000ml/min
  Ans: CO just after exercise = 3.2 L/min

6. **Post SV = Post CO/ Post HR = 32000/100 = 320ml /beat**
   Ans: Post SV = 320ml/beat

7. **Post PP = Post SV /2 = 320/2 = 160mmHg**
   Ans : Post PP = 160mmHg
8. **Mean arterial pressure (MAP) at rest = DBP at rest + 1/3 PP at rest**
   = 60 + (1/3) x 40 = 73.33mmHg
   Ans: MAP = 73.33mmHg
9. **Total Peripheral resistance at rest (TPR) = (MAP – RAP) / (CO at rest)**
   where RAP = Right atrial pressure
   MAP = mean arterial pressure
   = (73.33- 3) /6400
   = 0.011mmHg/ml/min
   Ans : TPR at rest = 0.011mmHg/ml/min

- The ff data were obtained from Mr. K
  Stroke volume is 70ml/beat;
  Systolic blood pressure at rest is 120mmHg;
  Cardiac output just after exercise is 6 times his cardiac output at rest.
  Pulse rate = 30 pulses in 20 seconds.

Calculate the ff:

1). HR at rest 2). CO at rest
3). CO just after the exercise
4). % change in CO due to the exercise
5). PP at rest 6). Mr. K's blood pressure at rest
7). Mean arterial blood pressure (MAP) at rest

- Answers

1. **HR = 30pulses/ 20s = (30 x60/20)beat/min = 90bpm**
   Ans : HR = 90bpm
2. **CO at rest = (SV at rest) x HR = 70 x 90 = 63000ml/min**
   Ans : CO at rest = 6.3L/min
3. **CO post ex. = 6 times CO at rest**
   = 6 x 6300 = 37800ml/min
   Ans : CO post ex. = 37.8L/min
4. **% change in CO = 100% x (Post CO – CO at rest)/ (CO at rest)**
   = 100% x (37800 – 6300)/ 6300
   = 500%
   Ans: % change in CO = 500%
5. **PP at rest = (SV at rest) / 2**
   = 70/2 = 35mmHg
   Ans : PP at rest = 35mmHg

CV

6. **Blood pressure (BP) = Systolic pressure (SBP)/ diastolic pressure (DBP)**
   but Pulse Pressure (PP) = SBP –DBP
   35 = 120 – DBP
   DBP = 120 - 35 = 85mmHg
   Therefore BP = 120/85
   Ans: Blood pressure at rest = 120/85
7. **Mean arterial pressure at rest (MAP) = DBP + (1/3) x PP**
   = 85 + (1/3) x 35 = 96.67mmHg
   Ans: Mean arterial pressure at rest = 96.67mmHg

The following data were collected from Mr X.

Blood pressure = 120/60

Heart rate = 60bpm

Cardiac output post exercise is six times cardiac output during resting.

Calculate the cardiac output after the exercise.

cv

Solution

Given BP = 120/60, HR at rest = 60bpm

CO post = 6 x CO at rest

But CO at rest = (SV at rest) x HR at rest

= (2 x PP) x 60

= [2 x (SBP- DBP)] x 60

= [2 x (120-60)] x 60

= 7200 = 7.2L/min

Therefore CO post = 6 x CO at rest

= 6 x 7.2L = 43.2L/min

Ans: Cardiac output (CO) post ex. = 43.2L/min

The ff data were collected from Mr. Y:

- The amount of blood remaining in the left ventricle after contraction was 60ml.
- The blood pressure was 140/90.
- Heart rate was 45beats in 45 seconds.

Calculate the ff:

1. Stroke volume
2. Cardiac output
3. Mean arterial blood pressure
4. End diastolic volume
5. Ejection fraction

cv

Answers

1. Given : ESV = 60ml ; BP = 140/90, HR = 45 pulses/45s.
HR = 45 x60/45 = 60bpm
Required to calc. SV = 2x PP---------- (1)
But PP = SBP-DBP = 140 -90 = 50mmHg ---------- (2)
Substitute (2) into (1),
Ans: SV = 2 x 50 = 100ml/beat

2. CO = SV x HR
=100 x 60 = 6000ml/min
Ans : cardiac output = 6L/min

3. Mean arterial pressure (MAP) = DBP + (1/3) x PP
= 90+ [(1/3) x 50] = 106.67mmHg
ans: MAP = 106.67mmHg

4. EDV = ?
from the formula , SV = EDV- ESV
EDV= SV + ESV
EDV = 100+60 = 160ml
Ans : End diastolic volume = 160ml

The ff data were collected in a case:
Systolic pressure (aorta) = 124mmHg
Diastolic pressure (aorta) = 82mmHg
R-R interval is between R waves on EKG = 800msec
Left ventricular end-diastolic volume = 140ml
Left ventricular end-systolic volume = 70ml
Mean pulmonary arterial pressure = 15mmHg
Right atrial pressure = 2mmHg
Left atrial pressure = 5mmHg
O2 consumption (whole body) = 20ml/min
O2 content of systemic arterial blood = 0.20ml O2 /ml blood
O2 content of pulmonary arterial blood = 0.152mlO2/ml blood
Calculate the ff:

1. The mean arterial pressure
2. The stroke volume, cardiac output, and ejection fraction of left ventricle.
3. Calculate the cardiac output using the Fick principle
4. What is the total peripheral resistance
5. What is the peripheral vascular resistance

Answers

1. 96mmHg
2. SV = 70ml
   HR = 1/cycle length = 1/800msec = 1/0.8sec = 75beats/min
   CO = 70 x 75bpm = 520ml/min
   E.F = SV/EDV = 70/140 = 0.5 or 50%
3. O2 consumption = cardiac output x (o2) pv – CO x (02)p-artery
   CO = 02 cosumption /(02)pv - (O2) p-artery
   = 250/ (0.2- 0.152)
   = 5208
4. TPR = (mean arterial pressure – right atrial pressure) / average CO
   = (96mmHg- 2mmHg) / 5229
   = 0.018mmHg/ml/min

5. Peripheral vasc resistance = (mean pulmonary pressure – left atrial pressure) /CO
   = (15mmHg – 5mmHg) / 5229
   = 0.0019mmHg/ml/min