

Elektrokardiografi-EKG

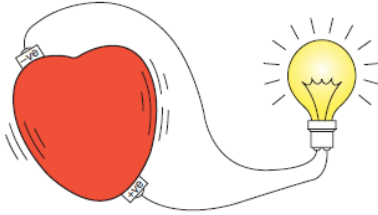
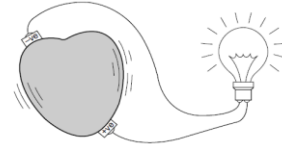


Figure 1.1 An ECG records the 'electricity of the heart'.



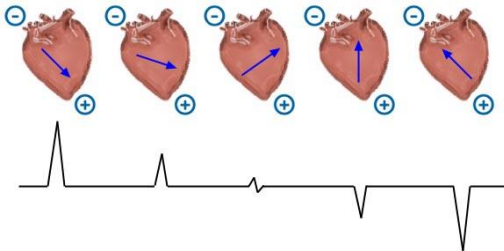
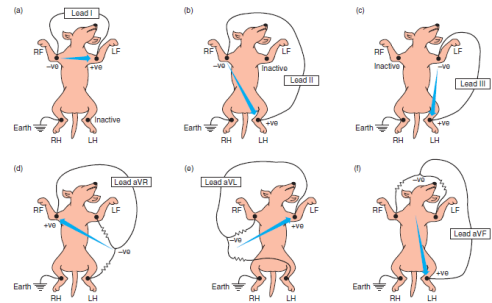
❖ **Elektrokardiograf**, basit bir voltmetre

❖ Kalbin çalışması sırasında oluşan ortalama + ve - electrical activity kaydedilmesi

❖ **Elektrokardiografi** ise kalp kası ve ileti sisteminin çalışmasını incelemek üzere kalpte meydana gelen elektriksel faaliyetin kaydedilmesi.



I. derivasyon
II. derivasyon
III. derivasyon
AVR
AVL
AVF

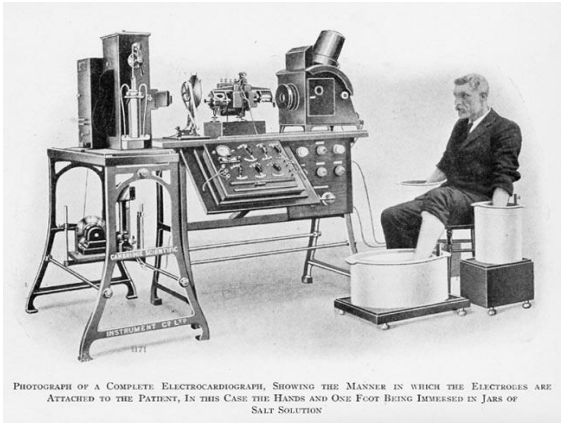


□ Elektriksel depolarizasyon dalgası derivasyonun negatif kutbuna doğru giderse EKG'de negatif, pozitif kutbuna doğru giderse EKG'de pozitif defleksiyon oluşur.



Ekg İle Hangi Anormallikler Teşhis Edilebilir?

- Aritmi
- Elektrolit dengesizliğinin belirlenmesi (K,Ca)
- Kalp odacıklarının büyümesinin değerlendirilmesi
- Tedavinin değerlendirilmesi
- Myokardiyal iskemi/hipoksiyi (infarktüs)
- İlaç intoksikasyonunu (digogsin toksisitesi)
- Torasik-Perikardiyal efüzyonu
- Kalbin axisi değerlendirilir



ECG

- Sadece elektriksel aktiviteyi belirler (EKG)
- Kalbin kasılma gücünü göstermez (EKO)



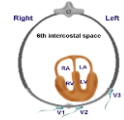
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Elektrotlar

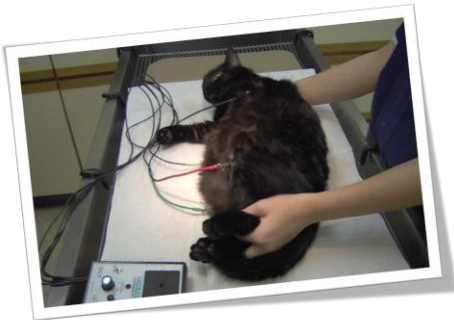
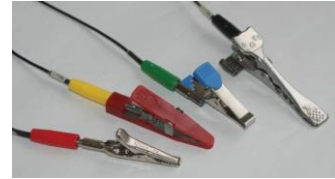
- Extremité
 - Kırmızı-sağ ön extremité
 - Sarı-sol ön extremité
 - Yeşil-sol arka extremité
 - Siyah-sağ arka extremité
- Göğüs
 - V2- 6.interkostal aralık kostrakondral birleşim yeri
 - V3 -6.interkos aralık snenal bölge



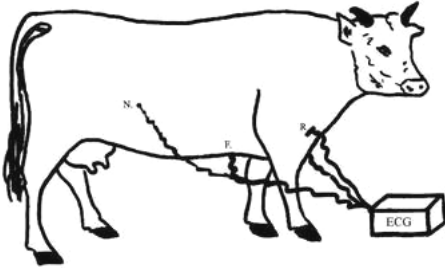
Elektrot bağlanması



Elektrotlar

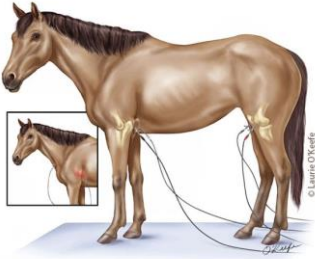


siğir



4 extremite elektrod ile

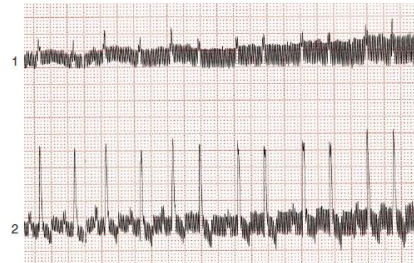
- 1. derivasyon
- 2. **derivasyon**
- 3. derivasyon
- AVR
- AVL
- AVF



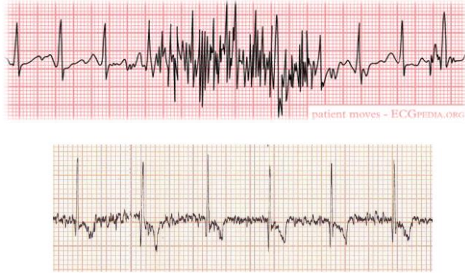
EKG



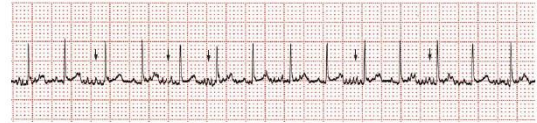
Elektriksel alterans (artefakt)



Kas titremeleri (Artefakt)



Kedide mırlamaya bağlı artefakt



17.3 ECG from a cat with intermittent 'purring' artefact (25 mm/s and 10 mm/mV).

Köpekte Sık solunuma bağlı

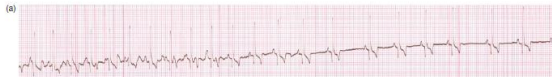


Figure 17.4 A selection of movement artefacts that make interpretation difficult (all tracings at 25mm/s and 1cm/mV, except in Fig. 17.4d). (a) ECG from a panting dog. Note the irregular movement of the baseline, then half way through the recording, the mouth of the dog is closed and the movement artefact stops; P waves are now recognisable.

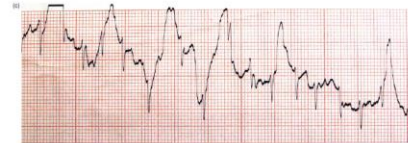


Figure 17.4 (c) ECG from a dog in which the ECG clip connection to the skin was loose and unstable, resulting in so much movement artefact that the tracing was non-diagnostic.

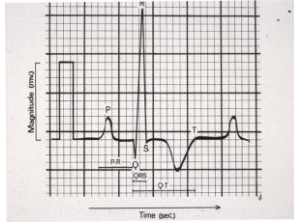
Kesme (artefakt)



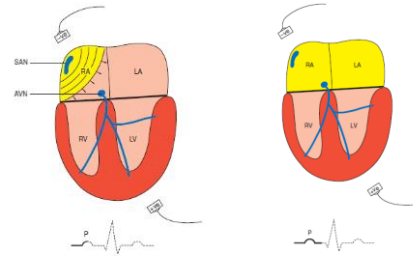
Figure 17.4 (c) ECG from a dog in which the ECG clip connection to the skin was loose and unstable, resulting in so much movement artefact that the tracing was non-diagnostic.

EKG bölümleri

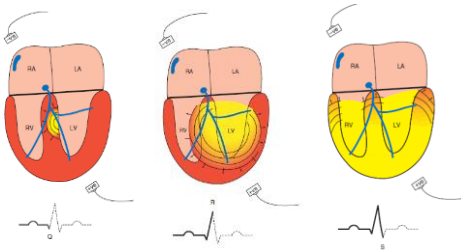
- P dalgası
- PR aralığı
- QRS kompleksi
- Q-T aralığı
- T dalgası



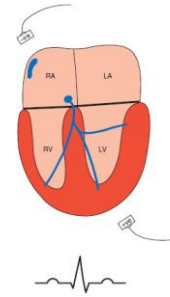
P dalgası



QRS

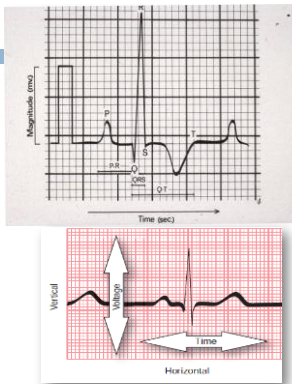


T dalgası

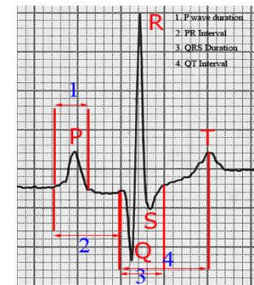
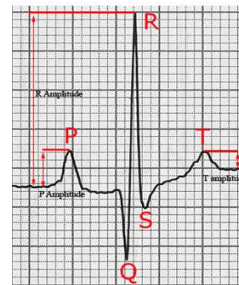


EKG bölümleri

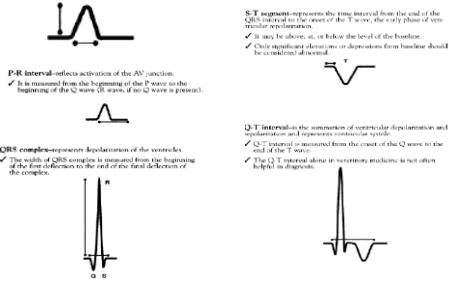
- P dalgası
- PR aralığı
- QRS kompleksi
- Q-T aralığı
- T dalgası



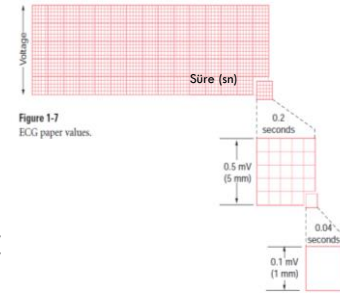
EKG bölümleri



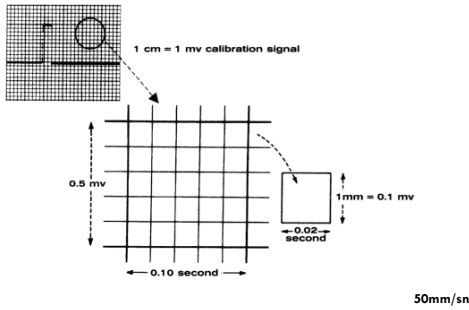
EKG kağıdı



50 mm/sn 1mv
25 mm/sn 1mv



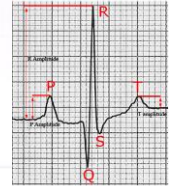
Ekg kağıdı



Ekg

Tablo 27. II. derivasyonda köpek ve kedilerin normal EKG parametreleri

	Köpek	Kedi
Kalp atımı	60-160 bpm (ergilerde) 65-140 bpm (diğer cinsler) 75-180 bpm (küçük cinsler) 220 bpm (yavru)	160-200 bpm 220-260 bpm (yavru kediler ve küçük cinsler)
P dalgası süresi	<0.04 saniye	<0.04 s
P dalgası amplitüdü	<0.4 mV	<0.2 mV
PR aralığı	0.06 s - 0.13 s	0.05-0.09 s
QRS süresi	0.06 s (büyük cinsler) 0.05 s (küçük cinsler)	<0.04 s
R dalgası amplitüdü	3.0 mV (büyük cinsler) 2.5 mV (küçük cinsler)	<0.5 mV
QT aralığı	0.15-0.25 s	0.12-0.18 s
T dalgası	< R dalgası yüksekliğinin 1/3'ü	<0.3 mV
ST segment	<0.2 mV çukuru <0.15 mV yükselişi	Çukuru yok Yükselişi yok
Ortalama eksenel eksen	+40° to +100°	+9° to +60°



ölçüm



Ekg değerlendirilmesi

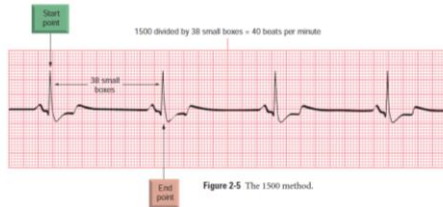
- Kalp atım sayısı normal mi değil mi
- Ritim belirlenmesi- düzenlimi değil mi
- Her atımda bir P dalgası var mı
- Her atımda QRS dalgası var mı
- Her P dalgası QRS ile ilişkili mi
- P ve QRS dalgaları birbirine benziyor mu
- PR aralığı eşit mi
- ST sekmendi değişiklik var mı
- QT aralığı

Kalp sayısının belirlenmesi

25 mm/sn 1mv

Using the 1500 method

- Begin by counting number of small squares between two consecutive R waves and divide 1500 by that number. Remember, this method cannot be used with irregular rhythms.



Methods for determining

Using the 6-second × 10 method

- Multiply by 10 the number of QRS complexes (for the rate) found in a 6-second portion of ECG tracing. The rate in the ECG below is approximately 70 beats per minute.

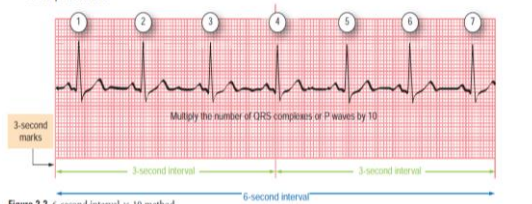


Figure 2-2 6-second interval × 10 method.



Figure 2-8 In this rhythm, the number of small boxes differs between some of the R-R and P-P intervals. For this reason it is considered irregular.

50 mm/sn 1mv

□ 3000/ RR aralığı (küçük kare sayısı)

Kalbin ritmi



Figure 2-7 This rhythm is regular as each R-R and P-P interval is 21 small boxes apart.

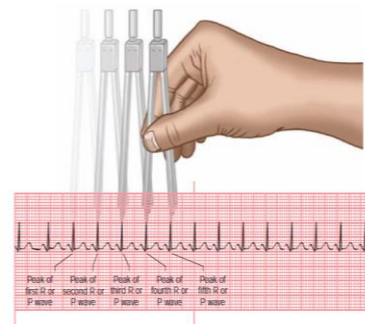


Figure 2-9 Use of calipers to identify regularity.

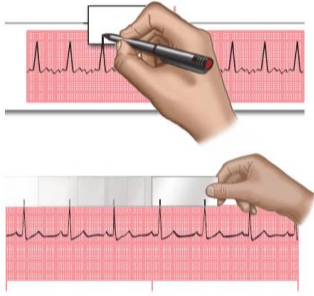


Figure 2-10 Use of paper and pen to identify regularity.

Sinüs ritim

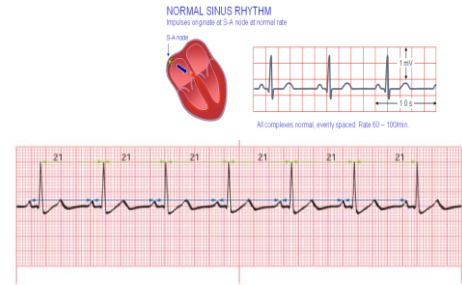


Figure 2-7 This rhythm is regular as each R-R and P-P interval is 21 small boxes apart.

Sinüs taşikardi

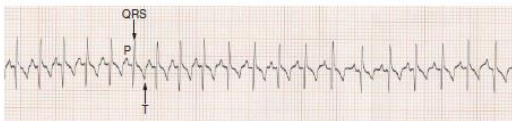


Figure 3-4 ECG from nervous Weimaraner. There is a sinus tachycardia at 210/min (25 mm/s and 5 mm/mV).

Sinüs taşikardi! Korku, heyecan, ağrı, ateş, hipertirodizm, şok, hipotansiyon, anemi ve koroner kalp yetmezliği sebepler arasındadır	Kalp atım hızı >160 (köpek), (>180 oyuncak ırklarda). Kalp atım hızı >220 (kedi) Normal P dalgaları Normal QRS kompleksi Kalp atım oranının artması ile P dalgaları T dalgalarının önünden kaybolur. Oküller basıncı uygulaması kalın geçici yavaşlatılması sağlar. (vagal ton artışı)
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Sinüs bradikardi

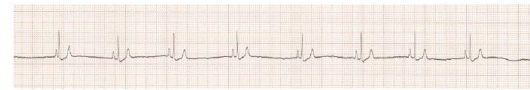


Figure 3-5 ECG from a cat following sedation, showing a sinus bradycardia at 50/min (25 mm/s and 10 mm/mV).

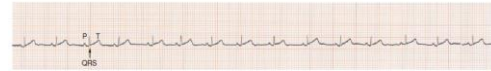
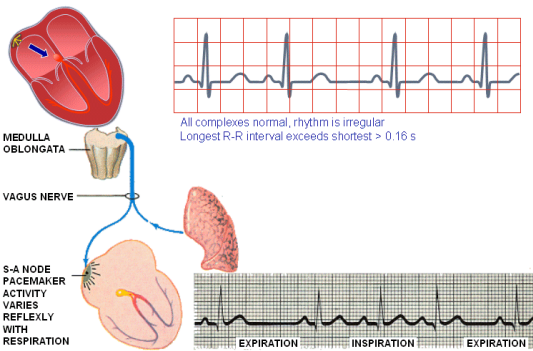


Figure 3-6 ECG from a cat following sedation, showing a sinus bradycardia at 110/min (25 mm/s and 10 mm/mV).

Sinüs bradikardi Vagal tonus artışı kranial hastalık, yaralama ve hipotirodizm	Kalp atım <70 (köpek) Kalp atım <160 (kedi) Normal P dalgaları Normal QRS kompleksi
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SINUS ARRHYTHMIA

Impulses originate at S-A node at varying rate



Sinüs aritmi

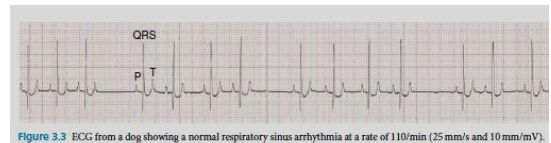
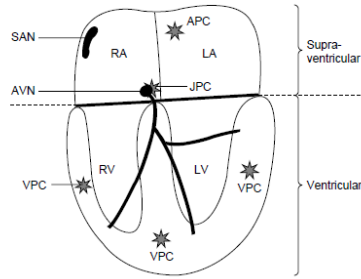


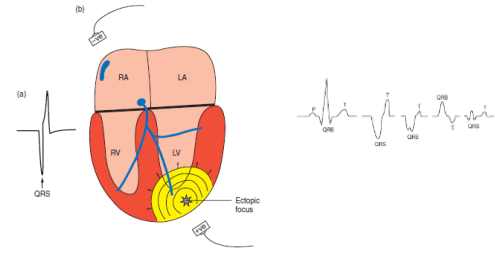
Figure 3-3 ECG from a dog showing a normal respiratory sinus arrhythmia at a rate of 110/min (25 mm/s and 10 mm/mV).

Ritim	Ana özellikleri
Sinüs aritmi Köpeklerde normaldir fakat kedilerde olmamalıdır	Respirasyon ile kalp atım sayısı değişir Normal p dalgaları olduğu halde yükseklik çeşitli olabilir (geçici ritim düzenleyici) Normal QRS kompleksi

Ektopi



Ventriküler Ektopi



Ventriküler ektopi

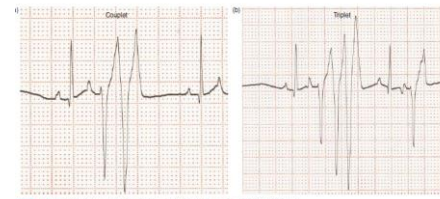
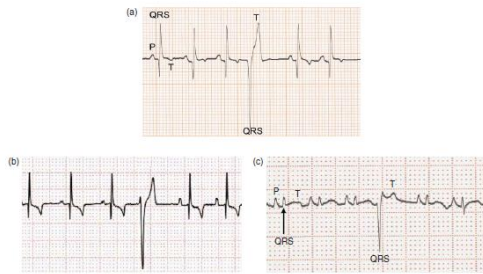
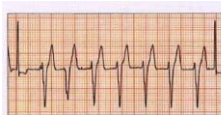


Figure 5.5 (a, b) ECGs from two dogs showing grouping of VPCs; these are termed a couple (a) and a triplet (b).

Ventriküler taşikardi



Ventriküler taşikardi
Paroksizmal veya devamıdır.
Genellikle taşikardilerin
etiolojisi göz önüne alınmalıdır.

Ventriküler atım >120
üçlü veya daha fazla
seriler halinde.
Ventriküler premature
kompleksler sürekli ve
kalıcıdır. Paroksizmal
ventriküler taşikardi
periodyal, normal
sinüs ritminin yeniden
başlamadan durmasını
takip eder. P dalgaları
ilgisizdir, anormal
QRS kompleksleri geniş
ve biçimsizdir.

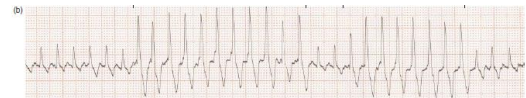


Figure 5.4 (a & b) ECGs from two dogs showing differing durations of ventricular tachycardia (VT). Four or more VPCs (a) constitutes a VT and paroxysmal VT is of short duration (b).

Ventriküler taşikardi

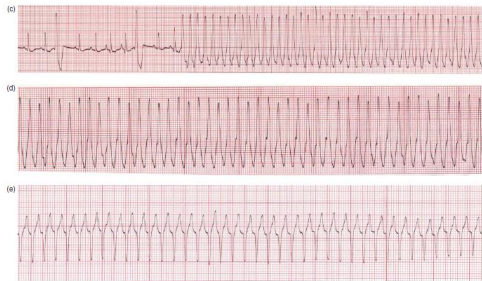
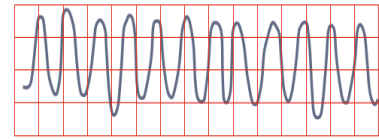
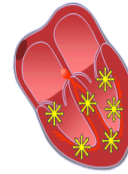


Figure 5.4 (a-c) ECG tracings from two dogs (a, b) and a cat (c) showing different durations of ventricular tachycardia (VT). A non-sustained VT is less than 30 seconds.

VENTRICULAR FIBRILLATION

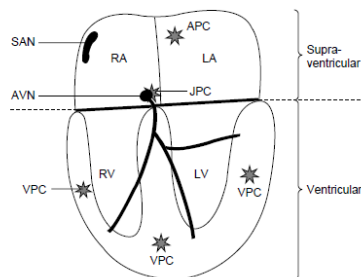
Chaotic ventricular depolarization



Rapid, wide irregular ventricular complexes

□ Incompatible with life

Ektopi



Supra ventriküler

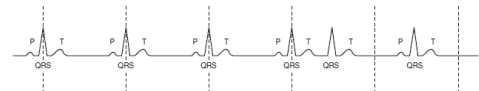


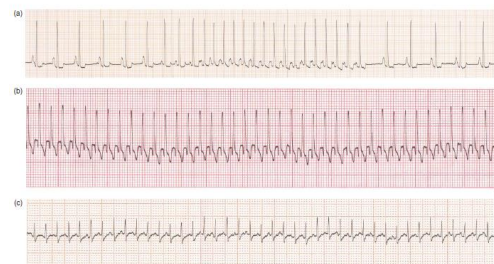
Figure 4.9 Illustration of a supraventricular premature complex (fifth beat), which is recognised mainly by its premature timing. The morphology of the QRS and T are the same for both the sinus complex and the SPPC because they both have passed through the AV node and depolarised the ventricles normally.

Supraventriküler ektopi



Figure 4.10 (a, b) ECGs from dogs showing supraventricular premature complexes (arrows). Note that recognition is by the premature timing of the QRS and T, which have the same morphology as those of the normal sinus complex (25 mm/s and 10 mm/mV).

Supraventriküler taşikardi



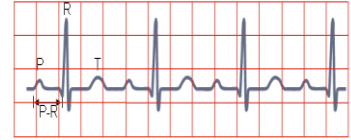
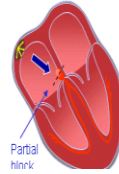
Kalp bloğu

- Kalp bloğu veya Atrioventriküler blok

1. Derece blok

A-V BLOCK, FIRST DEGREE

Atrioventricular conduction lengthened



1. Derece blok

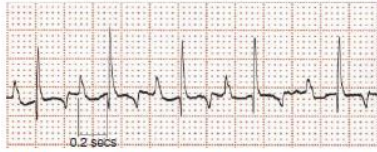


Figure 7.4 ECG from a miniature Schnauzer showing a prolonged P-R interval of 0.18 to 0.2 s, this is first-degree AV block (25 mm/s and 10 mm/mV).

Birinci derece AV blok
Vagal tonus artışı

Normal sinüs ritimi,
P dalgaları ve QRS
kompleksleri normal,
P-R aralığı >0.13 sn (köpek)
veya >0.09 sn (kedi)

2. derece blok, tip-I



İkinci derece AV blok
Vagal tonus artışı ve AV
düğümü hastalığı

Normal kalp ritiminde
yavaşlama. Bazı P dalgaları
QRS kompleksleri ile eşsiz.
Normal P dalgaları
Normal QRS kompleksi
(tip A)
Birbirini izleyen P-R
aralıklarının kademeli olarak
uzaması, P dalgasının
ventriküllere iletilmemesi
(Mobitz tip I)
P-R aralığı sabit fakat
AV düğümünün ventrikül
stimülasyonunda aralıklı
yeterliyi vardır (Mobitz tip 2)
QRS kompleksleri anormal
olabilir (tip B)

In 2nd-degree AV heart block, Type I (Wenckebach), impulses arise from the SA node but their passage through the AV node is progressively delayed until the impulse is blocked.

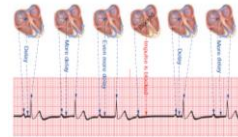


Figure 7.4
2nd-degree AV block, Type I.

2. derece blok, tip-II

In 2nd-degree AV heart block, Type II, impulses arise from the SA node but some are blocked in the bundle of His or bundle branches.

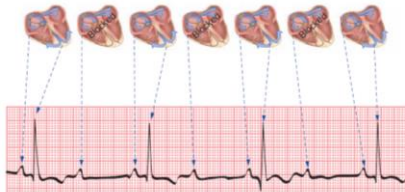


Figure 7.6
2nd-degree AV block, Type II.

2. derece blok, tip-II



Figure 7.6 ECG from a Labrador, which shows alternating sinus complexes with non-conducted P waves (arrowed) (second-degree AV block). The 2:1 relationship is an example of Mobitz type II (25 mm/s and 10 mm/mV).

3. Derece kalp bloğu, Tam kalp bloğu



Üçüncü derece AV blok

P dalgaları ve QRS kompleksleri arasında ilişki yoktur. P dalgaları QRS kompleksi içinde kaybolabilir. Kalp atımı < 60 (köpek). Kalp atımı < 100 (kediler). QRS kompleksleri normal veya anormal olabilir. (Ventriküler kaçak kompleksleri)

3. Derece blok (Tam kalp Bloğu)

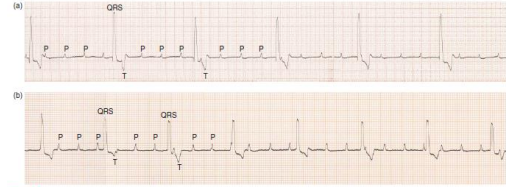


Figure 7.7 ECGs from a Lurcher (a) and a Wire Haired Fox terrier (b) with complete (third-degree) AV block with a nodal escape rhythm (both at 25 mm/s and 5 mm/mV).

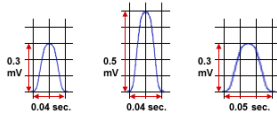
Kalp genişlemeleri-EKG görüntüsü

- Sağ atrial genişleme
- Sol atrial genişleme
- Sağ ventricular genişleme
- Sol ventricular genişleme

Kalp Oda büyümesi

- Sol atrial büyüme -- geniş "P" dalgaları
- Sağ atrial büyüme -- uzun "P" dalgaları
- Sol ventriküler büyüme -- uzun "R" dalgaları; geniş "QRS" kompleksleri; slurred "ST" segmenti
- Sağ ventriküler büyüme -- derin "S" dalgaları; derin "Q" dalgaları

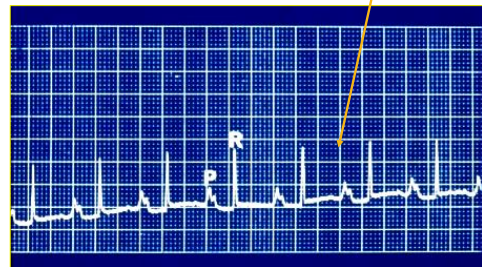
Atrial büyümeler



- Sol atrium büyümesi **geniş P "P mitrale"**
(Köpekerde ve kedilerde $P > 0.04$ sn, büyük ırk köpekerde $P > 0.045$ sn)
- Sağ atrium büyümesi **uzun P "P pulmonale"**
(Köpekerde $P > 0.4$ mV, kedilerde $P > 0.2$ mV)
- Biatrial (Sol ve Sağ atrium) genişlemesi hem uzun hem de geniş P

Oda büyümesi

- **Sol atrial büyüme -- geniş "P" dalgaları**



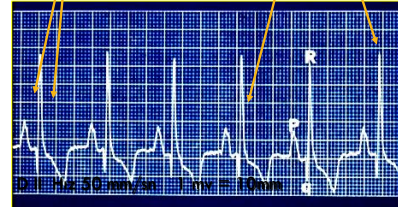
Oda Büyümesi

▣ **Sağ atrial** büyüme – uzun “P” dalgaları



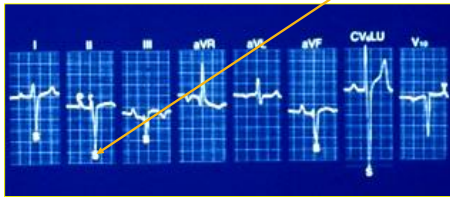
Oda büyümeleri

▣ **Sol ventriküler** büyüme -- uzun “R” dalgaları; geniş “QRS” kompleksleri; “ST” segmenti yok



Oda büyümeleri

▣ **Sağ ventriküler** büyüme -- derin “S” dalgaları; derin “Q” dalgaları



Hız 50 mm/sn Sens 1 mv = 10mm

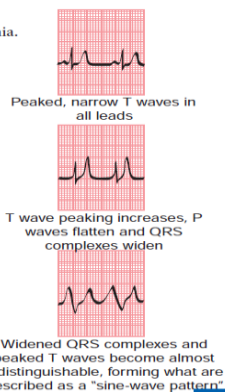
ECG Electrolyte değişiklikleri

- ▣ Hypokalemi
- ▣ Hyperkalemi
- ▣ Hyperkalsemi
- ▣ Hypokalsemi

Figure 11-8
ECG effects seen with hyperkalemia.

Hyperkalemia

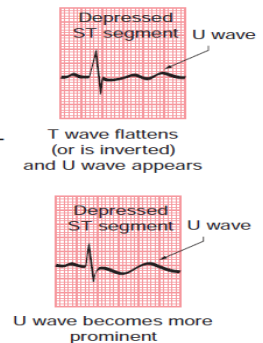
- ECG changes seen with hyperkalemia include:
 - Peaked T waves (tenting).
 - Flattened P waves.
 - Prolonged PR interval (1st-degree AV heart block).
 - Widened QRS complex.
 - Deepened S waves and merging of S and T waves.
 - Concave up and down slope of the T wave.
 - Sine-wave pattern.



Electrolyte imbalances

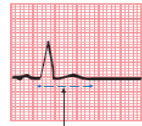
Hypokalemia

- ECG changes seen with serious hypokalemia include:
 - ST segment depression.
 - Flattening of the T wave.
 - Appearance of U waves.
 - Prolongation of the QT interval.

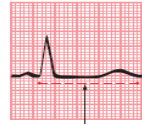


Hypercalcemia/ Hypocalcemia

- Alterations in serum calcium levels mainly affect the QT interval.
- Hypocalcemia prolongs the QT interval while hypercalcemia shortens it.
- Torsades de pointes, a variant of ventricular tachycardia, is seen in patients with prolonged QT intervals.



Short QT interval

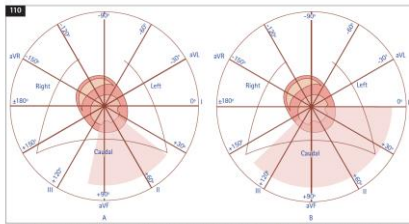


Prolonged QT interval

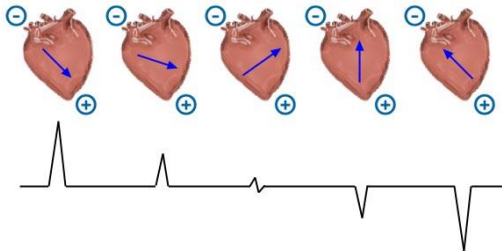
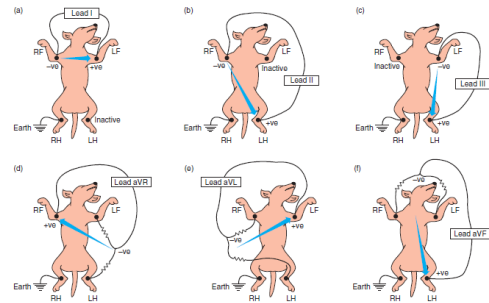
Digoxininin ECG üzerine etkisi

- Bradycardia
- 1. derece kalp block
- Arrhythmia
- ST-T segment değişiklikler

Kalbin aksisi

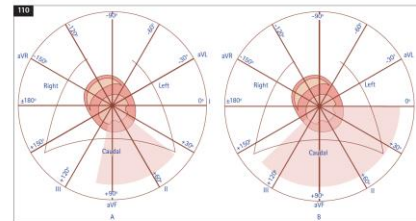


110 Diagram illustrating frontal plane leads and the normal MSA ranges for dogs (A) and cats (B). Conventional a degree locations around the circle are indicated for all leads (see text). Each lead is labeled at its positive pole. (Modified from Ware WA (2003) Diagnostic tests for the cardiovascular system. In: Small Animal Internal Medicine (3rd edn). (eds RW Nelson, CS Couto) Mosby, St Louis, p 14, with permission.)



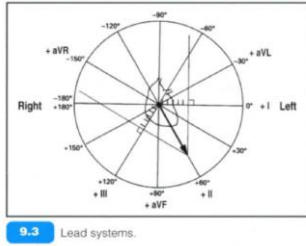
- Elektriksel depolarizasyon dalgası derivasyonun negatif kutbuna doğru giderse EKG'de negatif, pozitif kutbuna doğru giderse EKG'de pozitif defleksiyon oluşur.

Kalbin aksisi

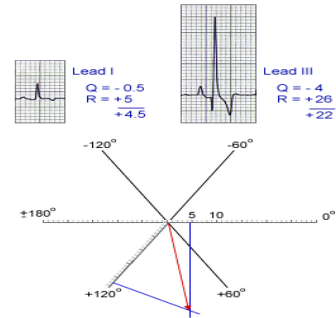


110 Diagram illustrating frontal plane leads and the normal MSA ranges for dogs (A) and cats (B). Conventional a degree locations around the circle are indicated for all leads (see text). Each lead is labeled at its positive pole. (Modified from Ware WA (2003) Diagnostic tests for the cardiovascular system. In: Small Animal Internal Medicine (3rd edn). (eds RW Nelson, CS Couto) Mosby, St Louis, p 14, with permission.)

Kalbin aksisi

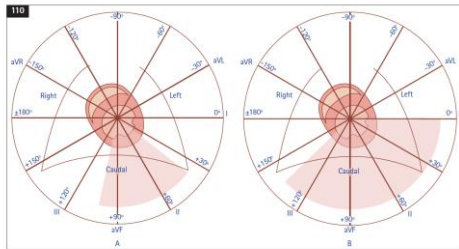


Mean Electrical Axis:



Köpek: +40 +100

Kedi: 0 +160

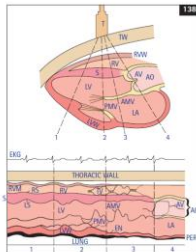


110 Diagram illustrating frontal plane leads and the normal MEA ranges for dogs (A) and cats (B). Conventional + degree locations around the circle are indicated for all leads (see text). Each lead is labeled at its positive pole. (Modified from Vane WA (2003) Diagnostic tests for the cardiovascular system. In: Small Animal Internal Medicine (3rd edn). (eds Rill Nelson, CD Casati) Mosby, St Louis, p.14, with permission.)

Kalbin ultrasonografisi Ekokardiografi (Eko)

- Kalbin diagnostik ultrasonografisidir.
- Kardiyak **anotomi ve fonksiyon** hakkında kalitatif ve kantitatif bilgi sağlayan güvenli noninvaziv bir tekniktir.
- 2D (B mode)
- M mode (Motion mod)
- Dopler

Kalbin ultrasonografisi



Kalbin ultrasonografisi

İki Boyutlu (2 Dimensional 2-D)

- kalple ilgili anatomik ayrıntıları tanımlar

M-Mod (Motion modülasyon)

- kalp bölümlerinin ölçümünü,
- duvar kalınlıklarının hesaplanması
- kardiyak siklus süresince EKG'ye bağlı hareketin zamanlaması ve özelliklerini belirler.

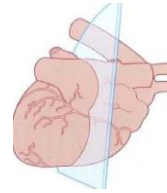
Doppler. Doppler ekokardiografi kalp bölümleri ve kapaklar arasında ve büyük damarlardaki kan akımı hakkında bilgi verir.

- Doppler ekokardiografi, 2D ve M-mod ekokardiografisini tamamlayıcı niteliktedir

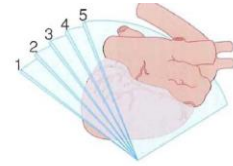
pozisyon



2-D

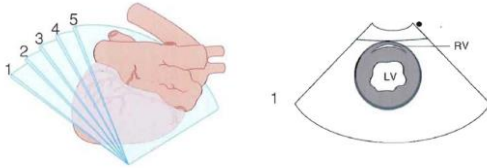


Uzun eksen



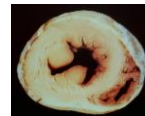
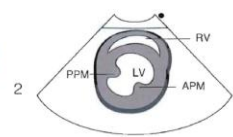
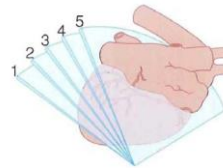
Kısa eksen

1 -Apeks

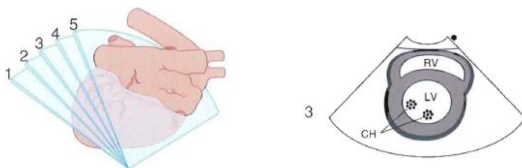


Sol kısa eksen

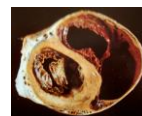
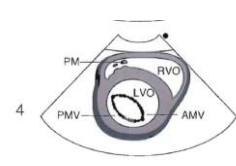
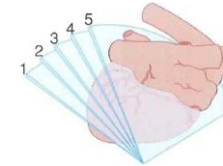
2-M. papillaris



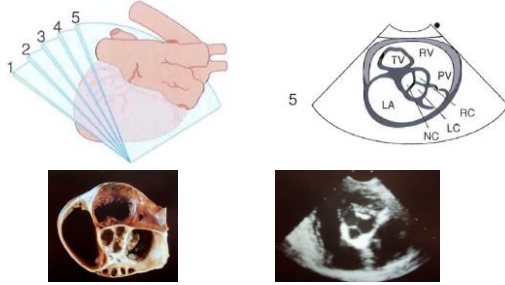
3-Corda tendinea



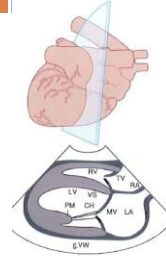
4-Mitral kapak



5-Aorta



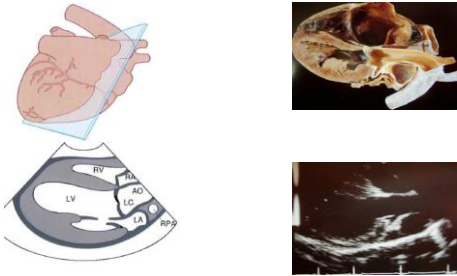
Uzun eksen 1



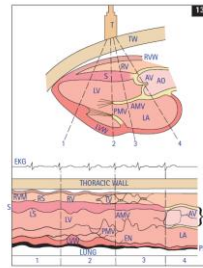
201 Normal bir köpek kalbinin ultrason görüntüsü. Sol kolon: ultrason görüntüsü kalbin uzun eksenini gösterir ve sağ parasistolal pozisyonunda alınır. Görüntü 1 sol atrium ve mitral kapak için uygun yerdir.



Uzun eksen 2 (Aorta)

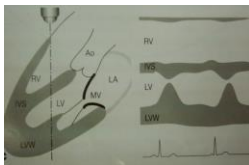


M-mode



- ☐ 1-Musculus Papillaris
- ☐ 2-Chordae Tendineae
- ☐ 3-Mitral Kapaklar
- ☐ 4-Aort Kökü ve Kapağı

1-Musculus Papillaris



2-Chordae Tendineae

Kısa tendin ölçümü

Sol ventrikül boyutları, ultrason yaydın ile sol ventrikül tendin dizesindeki kısa eksen yollarından papiller kasa anıza yollarından bulunur. Çizim ve kısa eksen her ölçümde de ben ve tekrarlanabilir ölçüm yapılmalıdır. Ölçüm, M-mod karesi in doğru yollarından yapılır. M-mod karesinde ölçüm her tendin için her iki yönde yapılır.

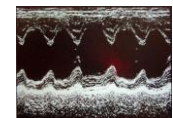
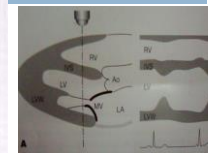
- LVID-S Sol ventrikül sistolik diastol sonu
- LVID-D Sol ventrikül diastolik sonu
- %FS Kalbin oran (Fraksiyonel kasılma)

$$FS\% = \frac{LVID-S}{LVID-D} \times 100$$

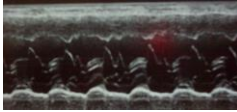
- LVID-S Sol ventrikül sistolik diastol sonu
- LVID-D Sol ventrikül diastolik sonu
- LVID-S İnterventriküler septum-diastol sonu
- LVID-D İnterventriküler septum-diastol sonu



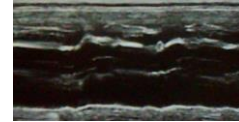
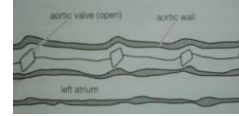
202 Sol ventrikül yapıların ölçümü için, sol ventrikülün M-mod ekokardiyogramı.



3-Mitral Kapaklar



4-Aort Kökü ve Kapağı



Doppler

