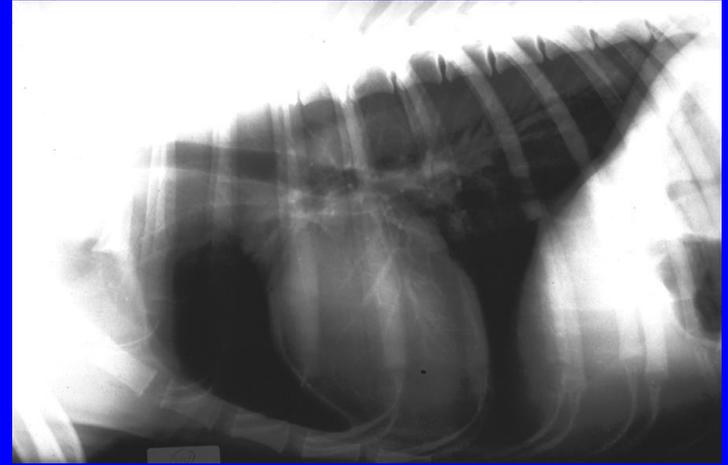


# Radiologie del Cuore e dei Vasi

Massimo Vignoli

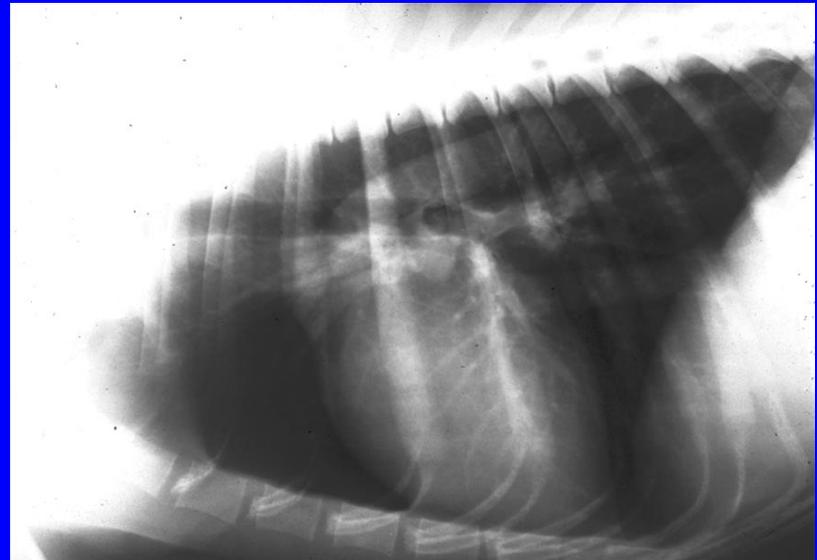
# CUORE



- *Radiologicamente “ombra cardiaca”*
- *proiezioni l-l, v-d, e d-v*
- *differenze di conformazione*
- *differenza insp/esp, sistole/diastole*
- *suddivisione ad orologio secondo Buchanan*

# Differenze tra anatomia radiologica e convenzionale:

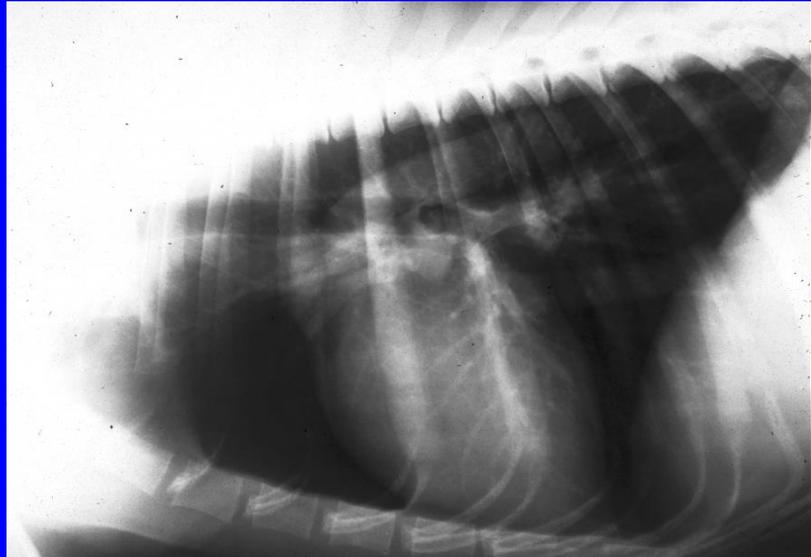
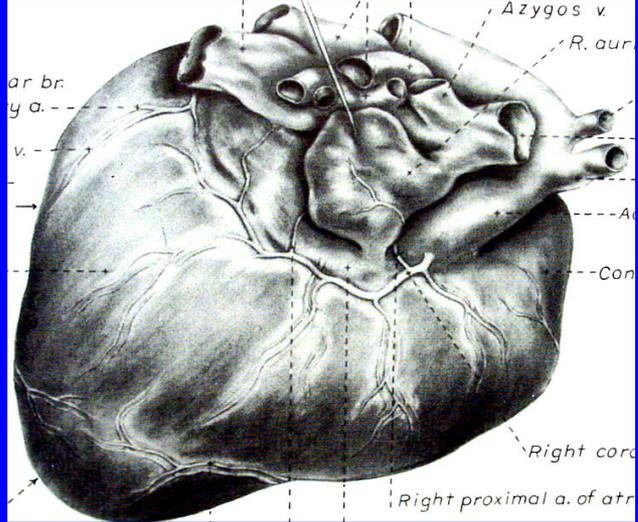
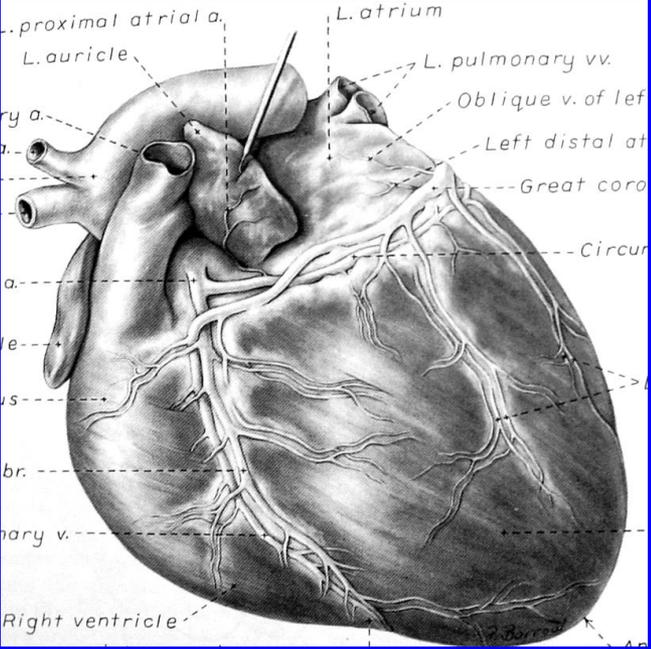
- Proiezione su un piano di organi tridimensionali
- Forza di gravità  
posizionamento
- Movimento organi
- Strutture non visibili radiologicamente

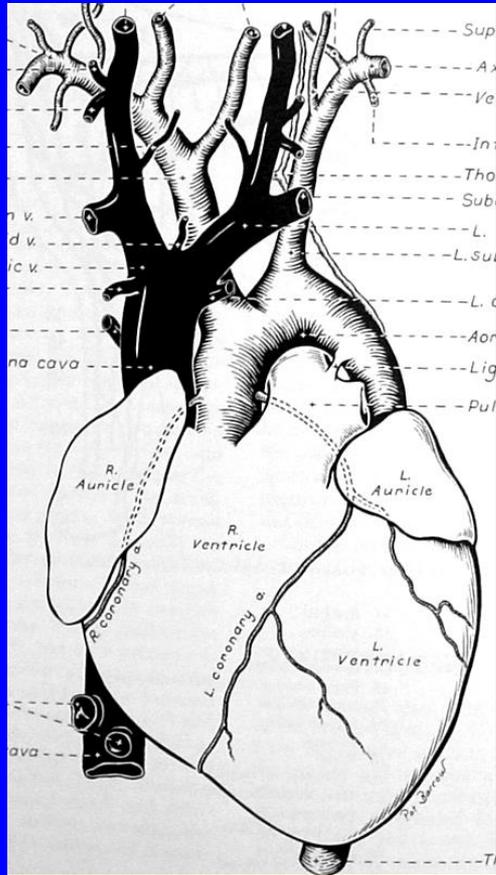


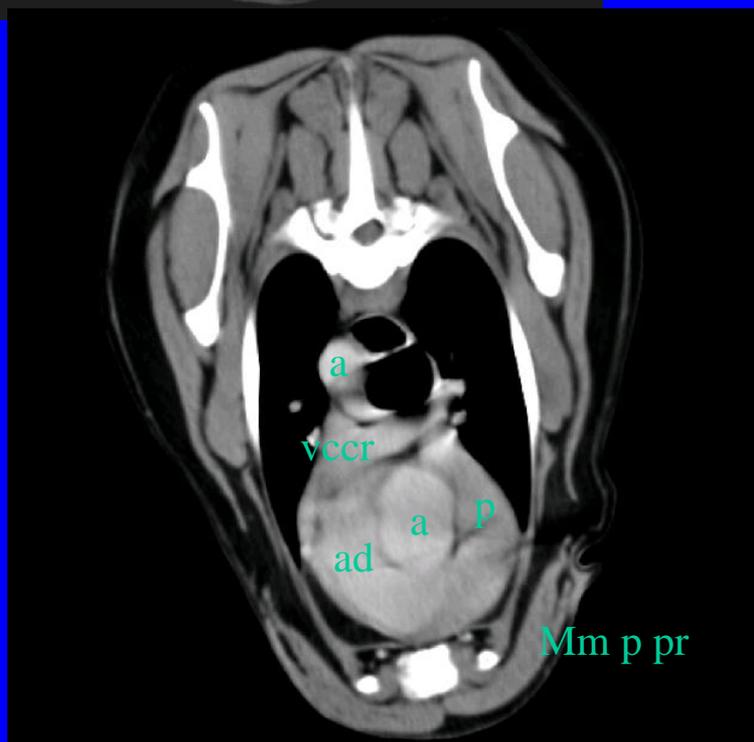
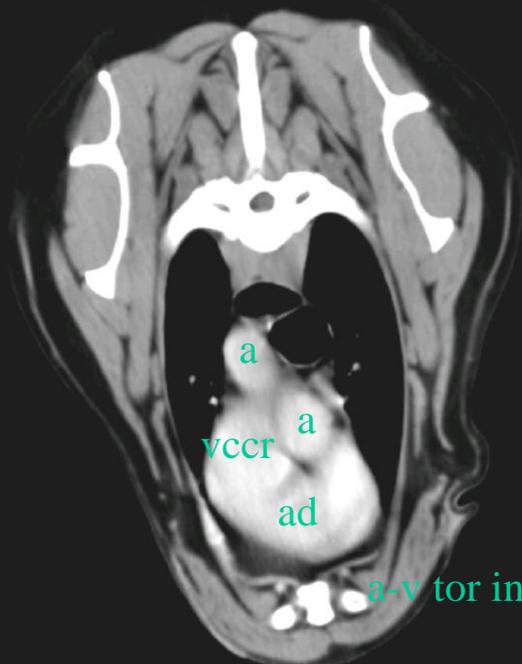
*Le differenze anatomiche dovute  
alla conformazione sono molto  
maggiori rispetto a quelle tra un  
animale sano ed uno malato*

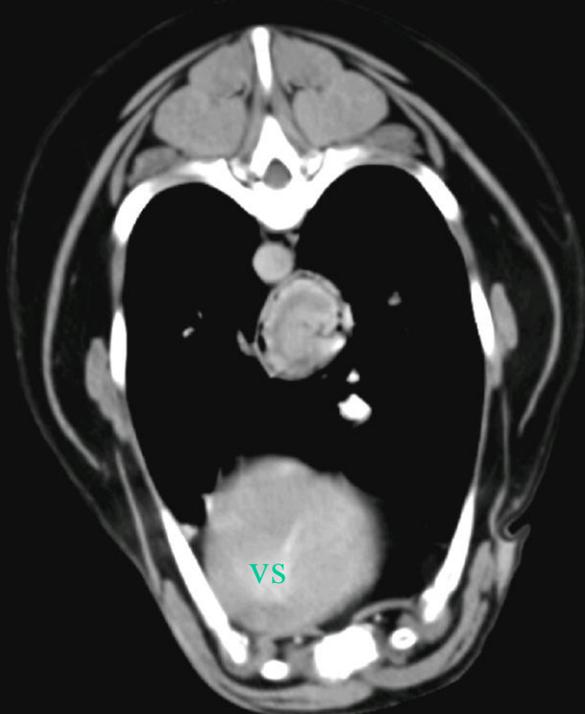
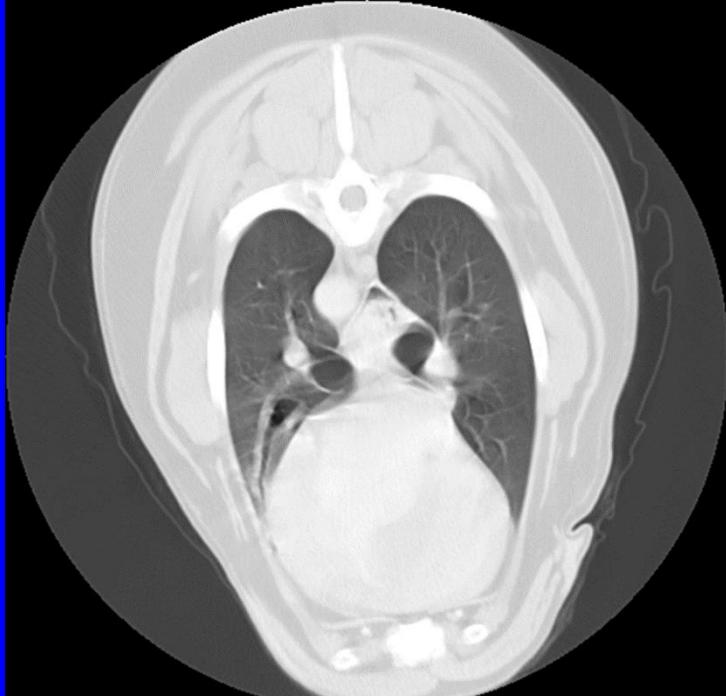
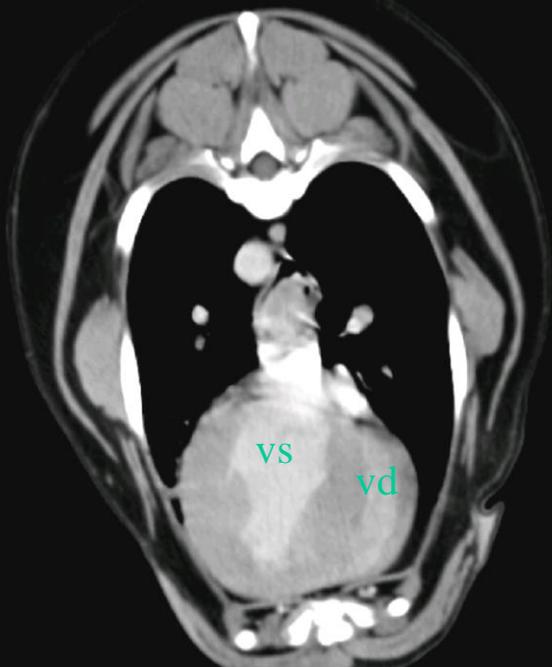
(Suter, 1984)

# Cane

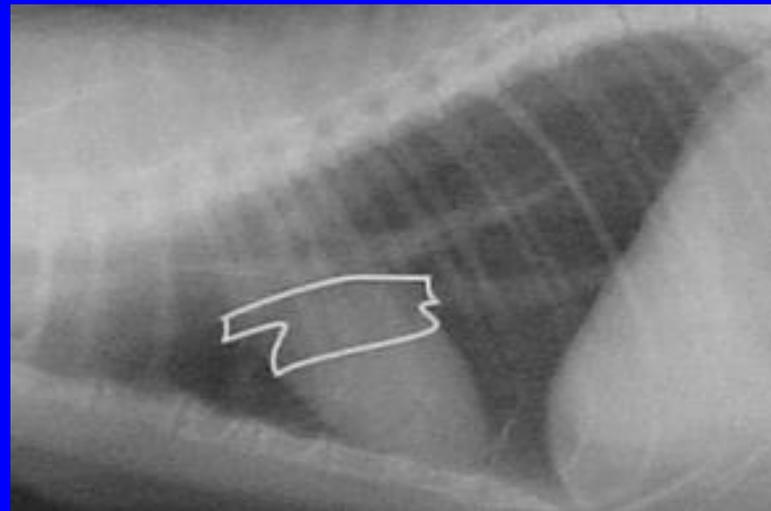
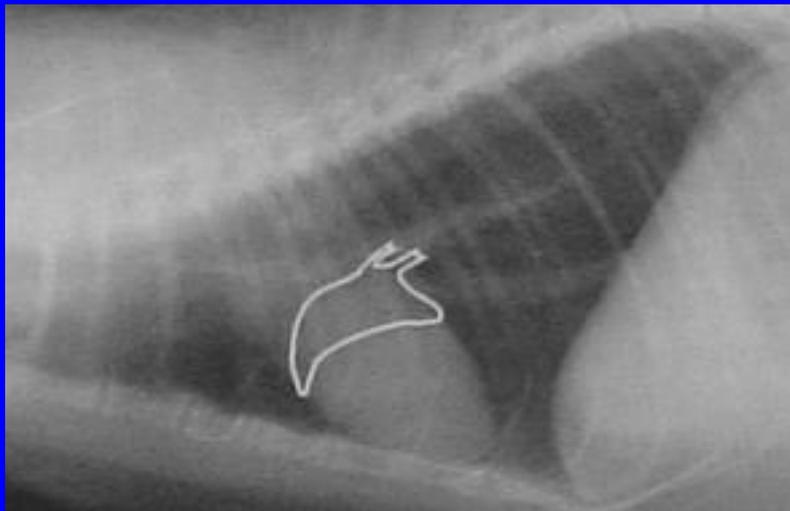




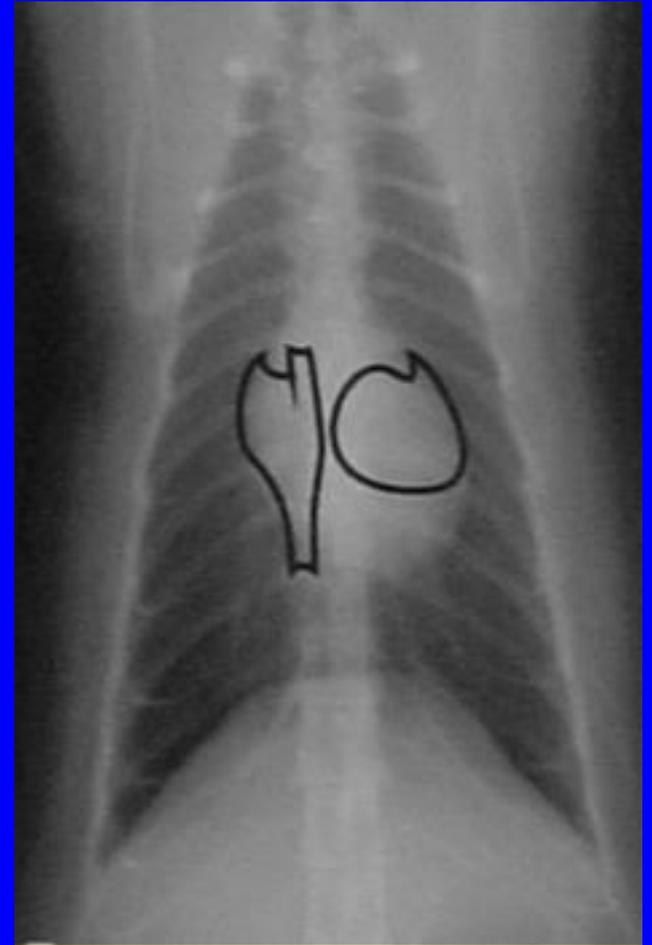
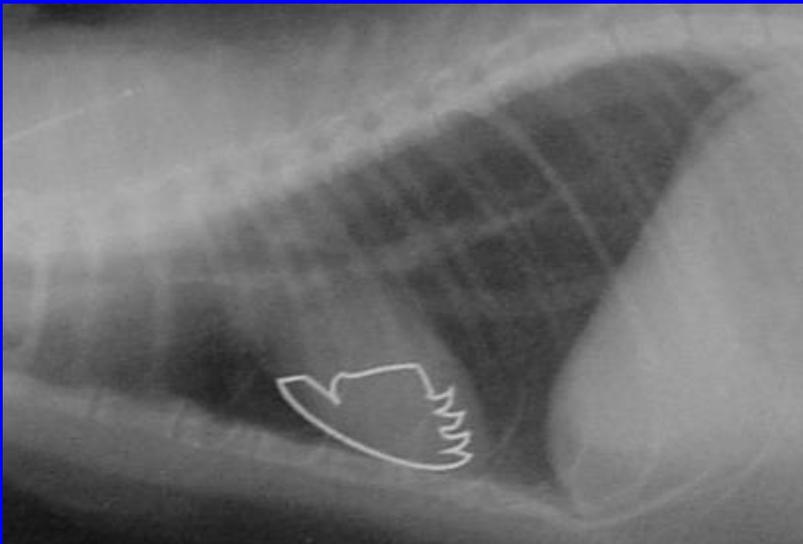
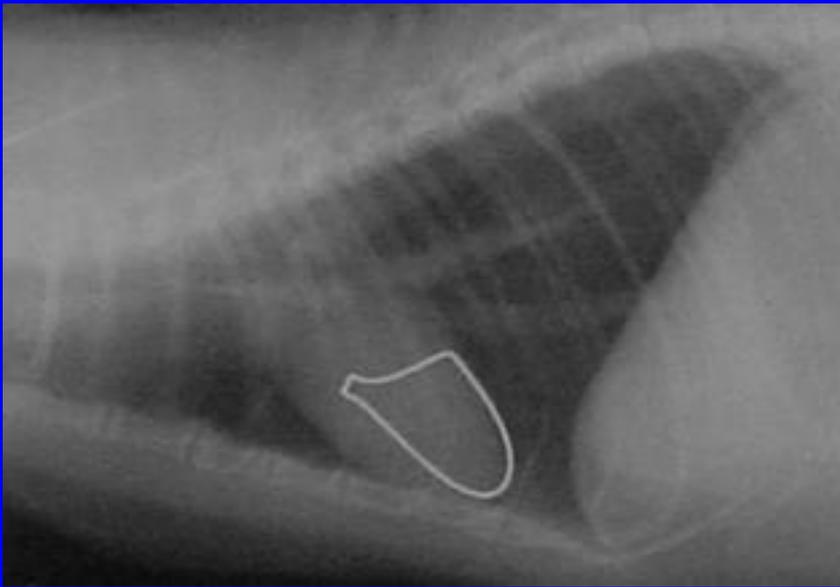




# Gatto



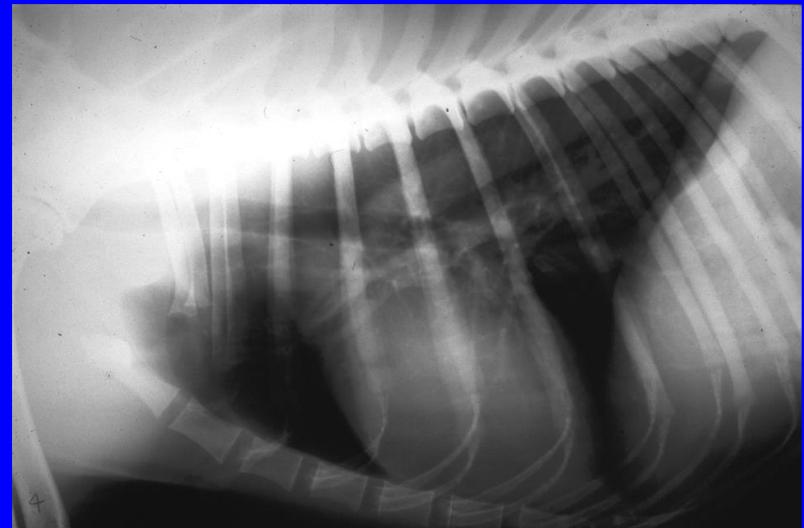
Rishniw Vet. Cl. N. A., 2001

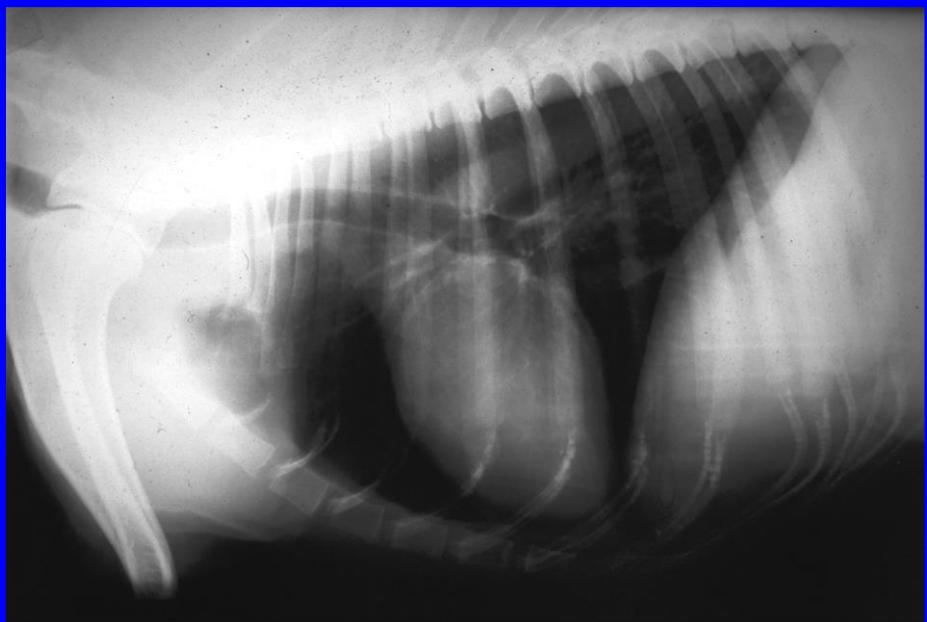


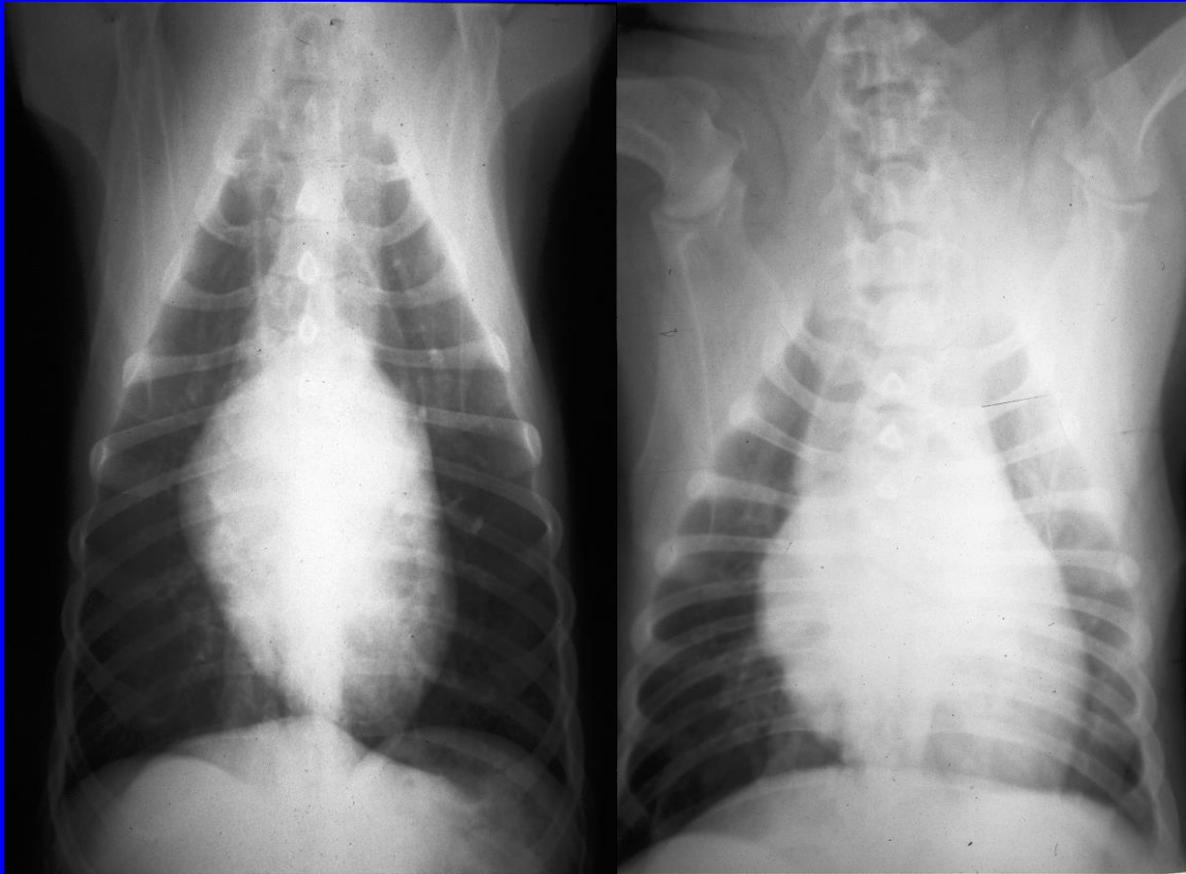
Rishniw Vet. Cl. N. A., 2001

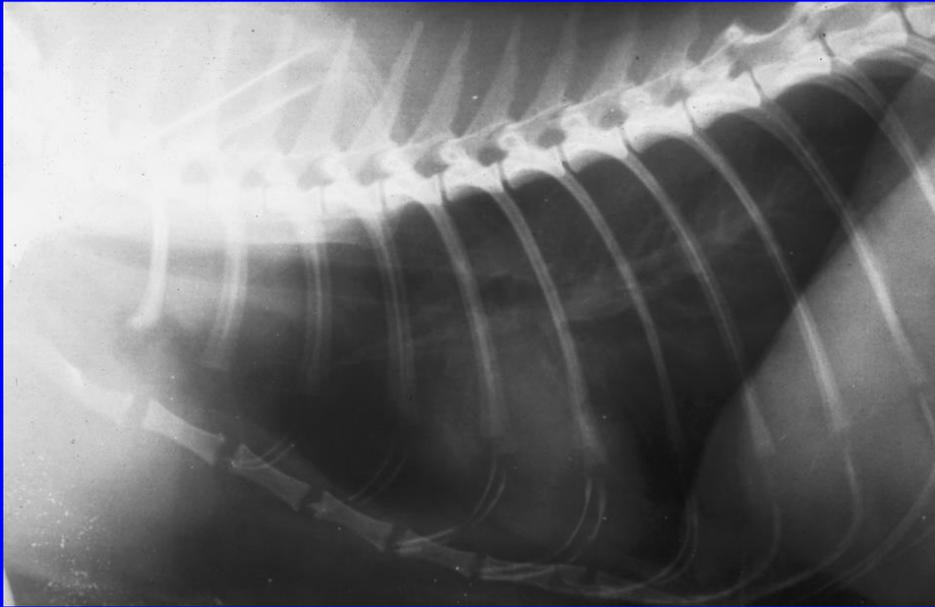
# In base alla conformazione del torace distinguiamo:

- Torace profondo-stretto (Collie, Irish Setter)
- Torace intermedio (P.T., Boxer, Barboncino, gatto)
- Torace breve-largo (Boston Terrier, Bulldog, Bull-mastiff)

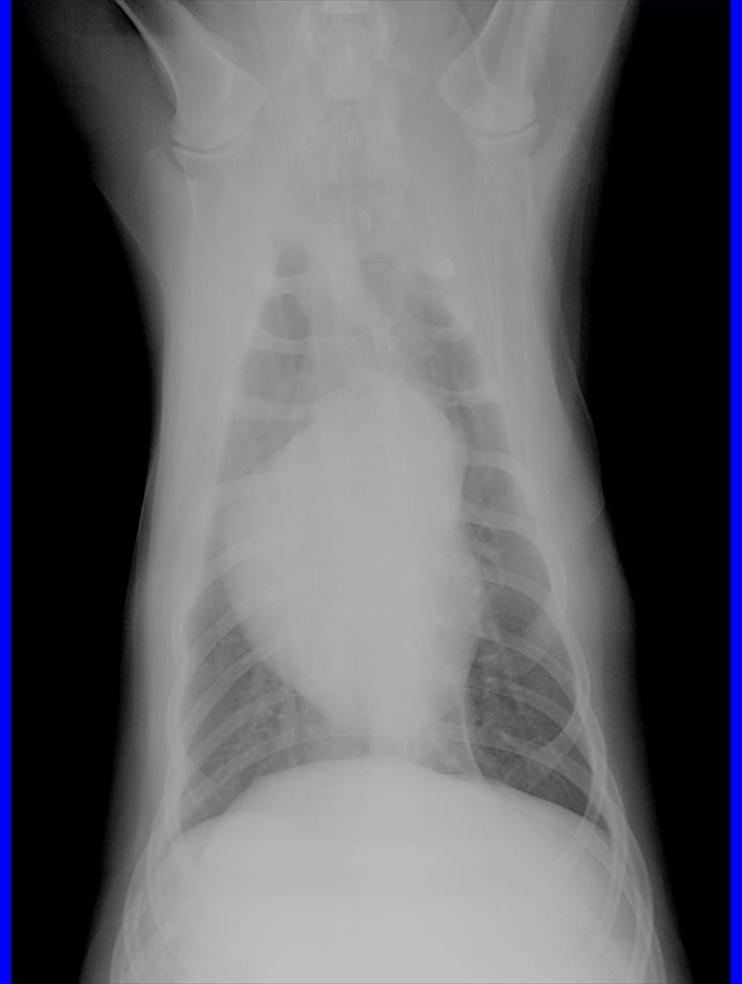




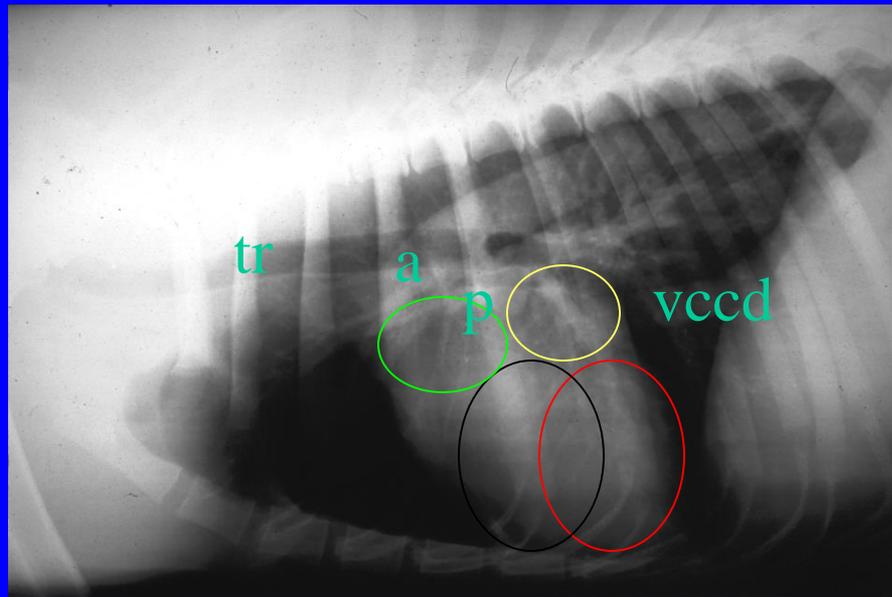
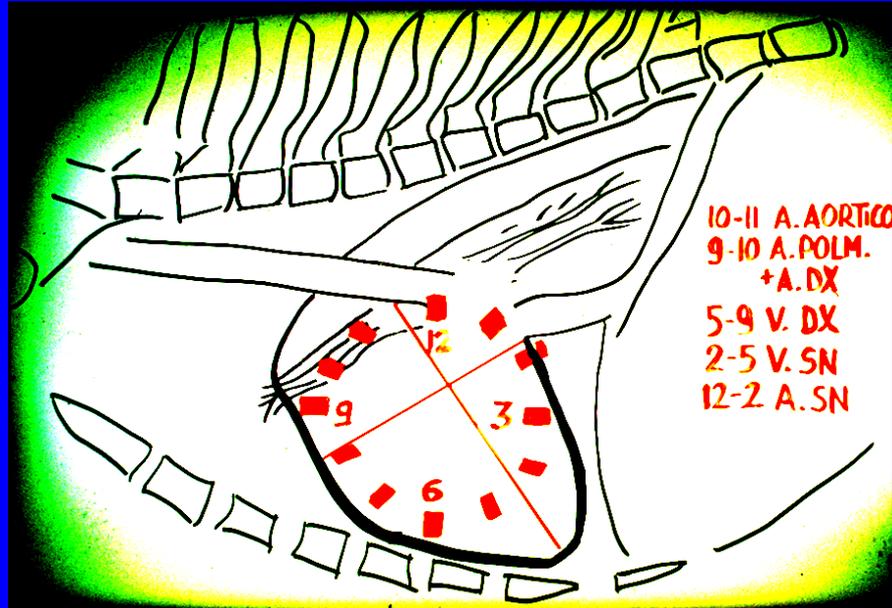


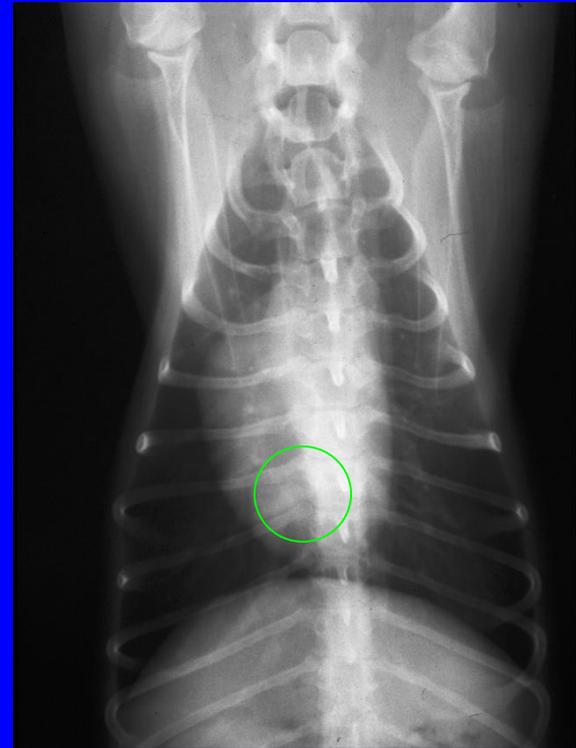
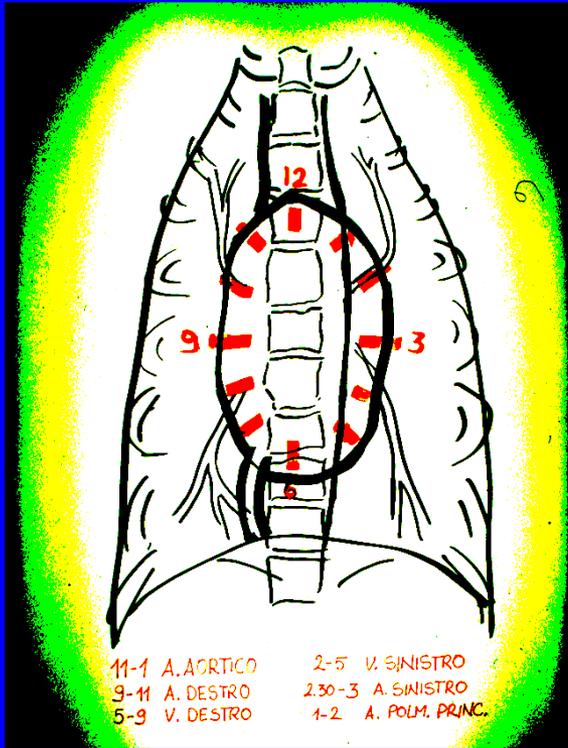


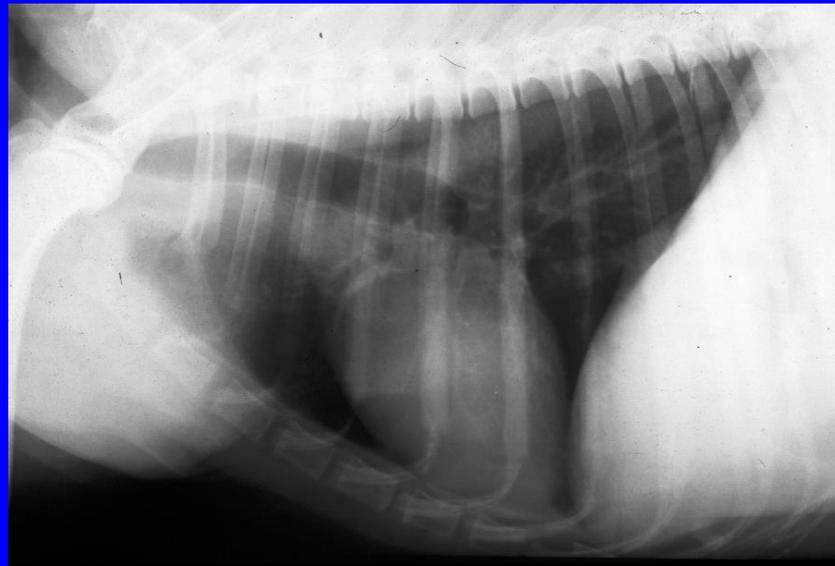
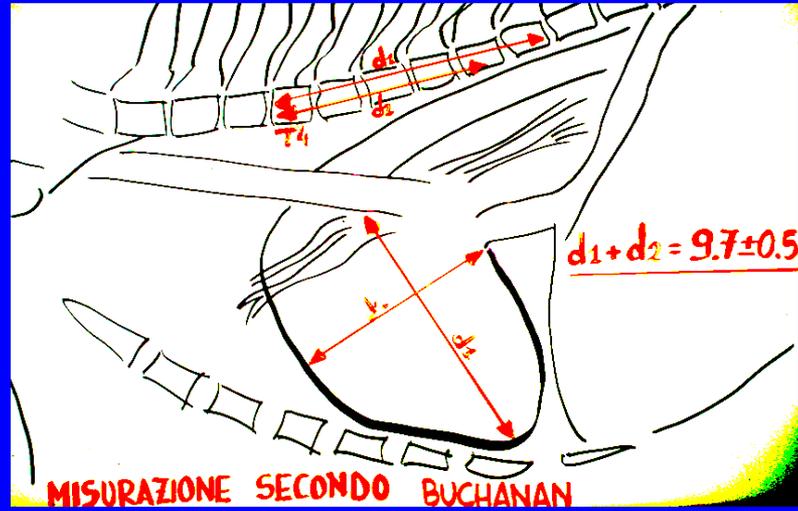
# VDSIS











# ARTERIE/VENE

- ORIGINE: le arterie emergono dal tronco polmonare
- DENSITA':  $a > v$
- MARGINI: arterie leggermente curve e meglio delineate delle vene, vene più corte e tronche, le arterie seguono le diramazioni bronchiali
- TOPOGRAFIA

# TOPOGRAFIA A/V

- *Proiezione latero-laterale:*

*A*

*B*

*V*

- *Proiezione ventro-dorsale: A B V*

# Dimensioni

## Cane:

- $A = V$  o leggermente  $>$  in proiezione ll
- $0.75 \frac{1}{3}$  prox  $4^\circ$  costola (range 0.25 – 1.20)
- Dimensioni  $> 1.20 =$  Patologico

Thrall 1968, 1976

- $A e V =$  alla  $7^\circ$  o  $9^\circ$  in proiezione dv

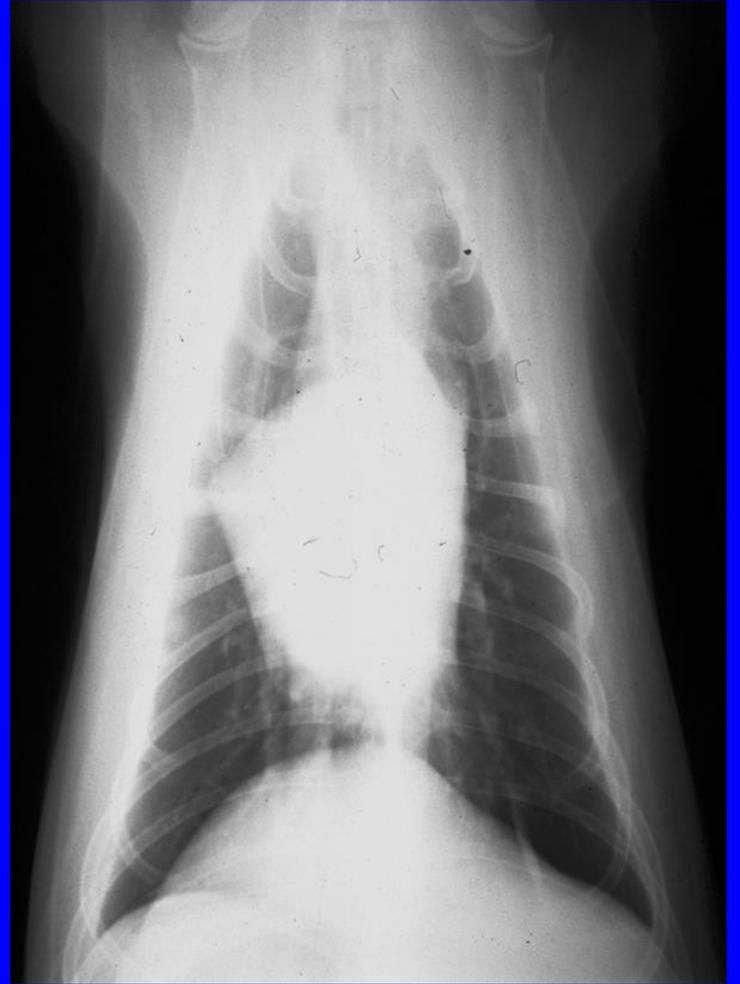
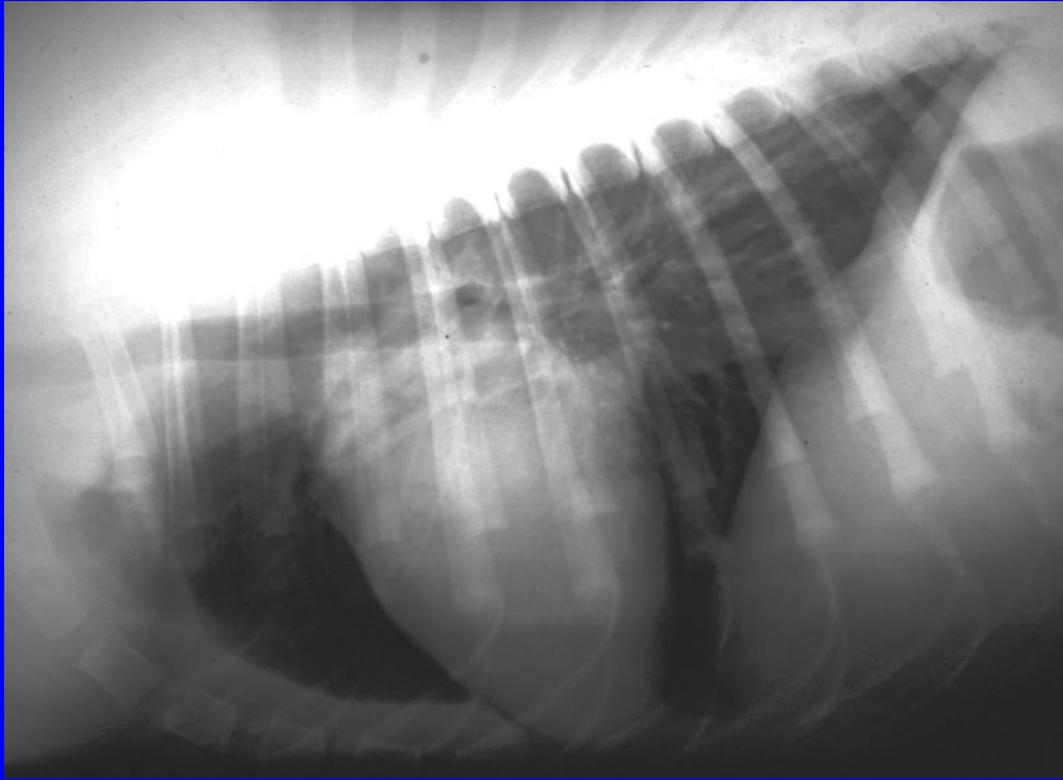
Kittelson and Kienle 1997

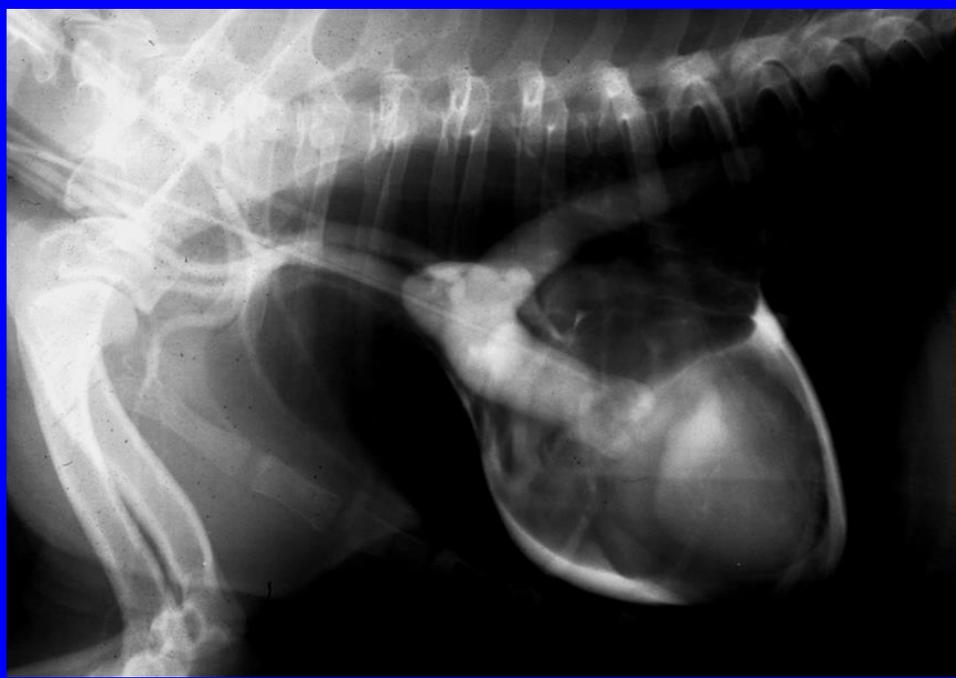
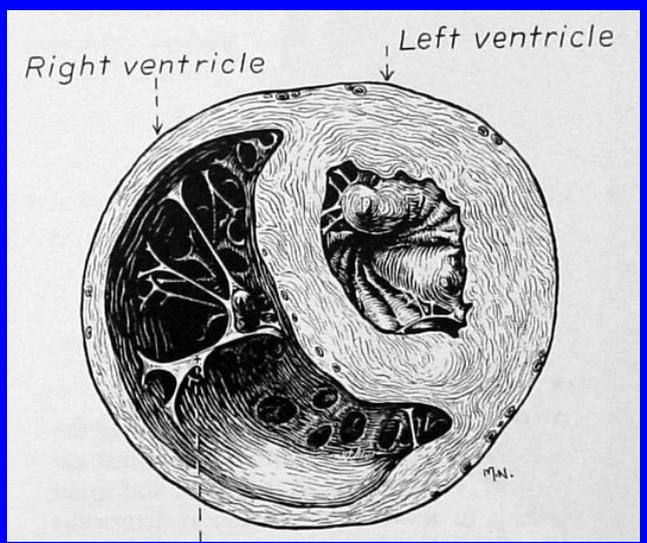
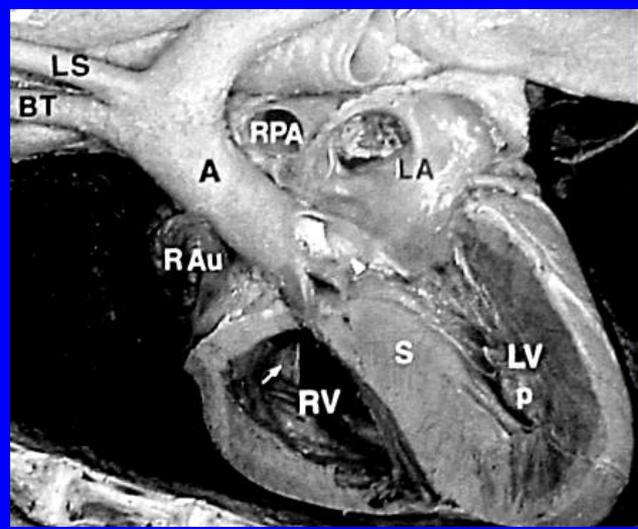
# Dimensioni

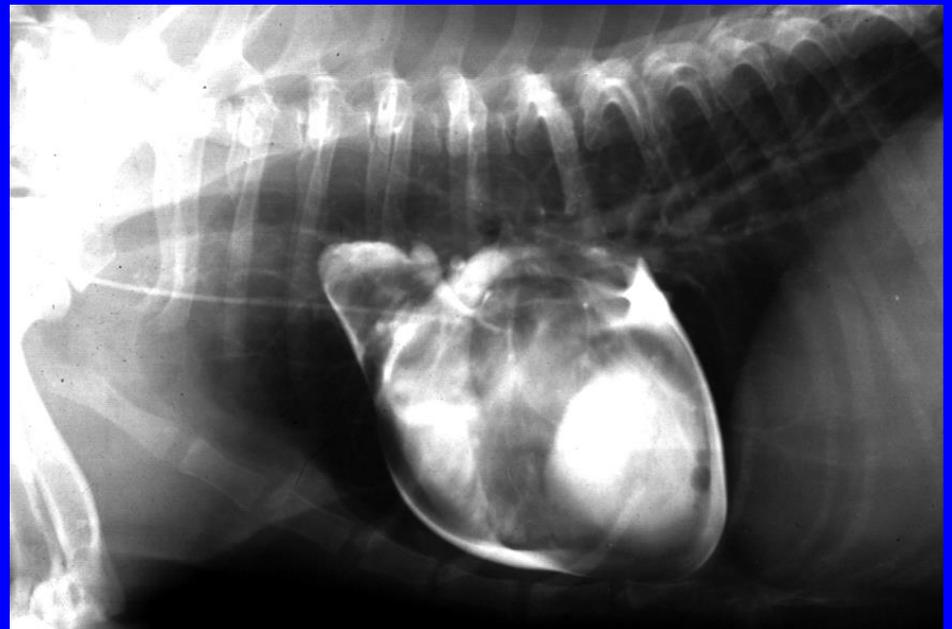
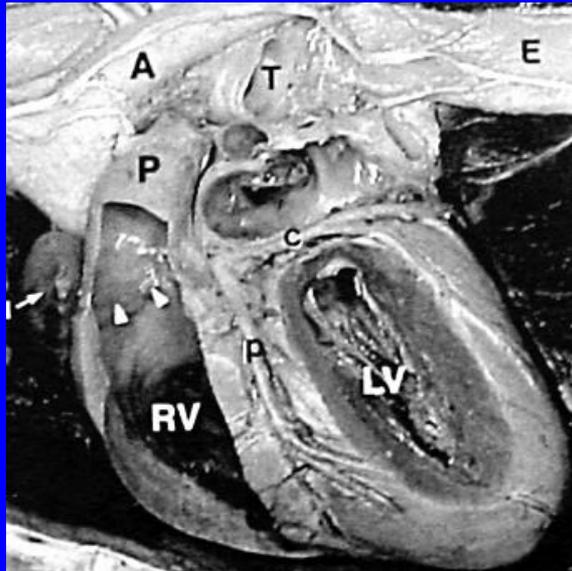
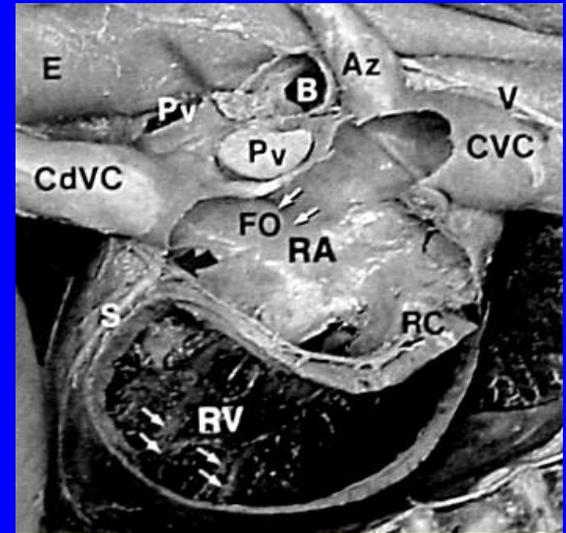
## Gatto:

- $A = V$
- 0.5 – 1.0 1/3 prox 4° costa in proiezione ll
- Nessuna attendibilità per valutazione vasi in vd
- Nessuna differenza tra gatti sani (46) e gatti con patologie cardiache e polmonari (41)

Hayward et al. 2002







# Patologie cardiache congenite

# Patologie congenite

## Cane

- Stenosi polmonare
- Stenosi subaortica
- PDA
- VSD
- ASD
- Displasia valvolare (mitrale, tricuspide)
- Tetralogia di Fallot
- Eisenmenger's syndrome
- Situs inversus
- Ernia pericardio-peritoneale

# Patologie congenite

## Gatto

- VSD
- Displasia valvolare
- ASD
- PDA

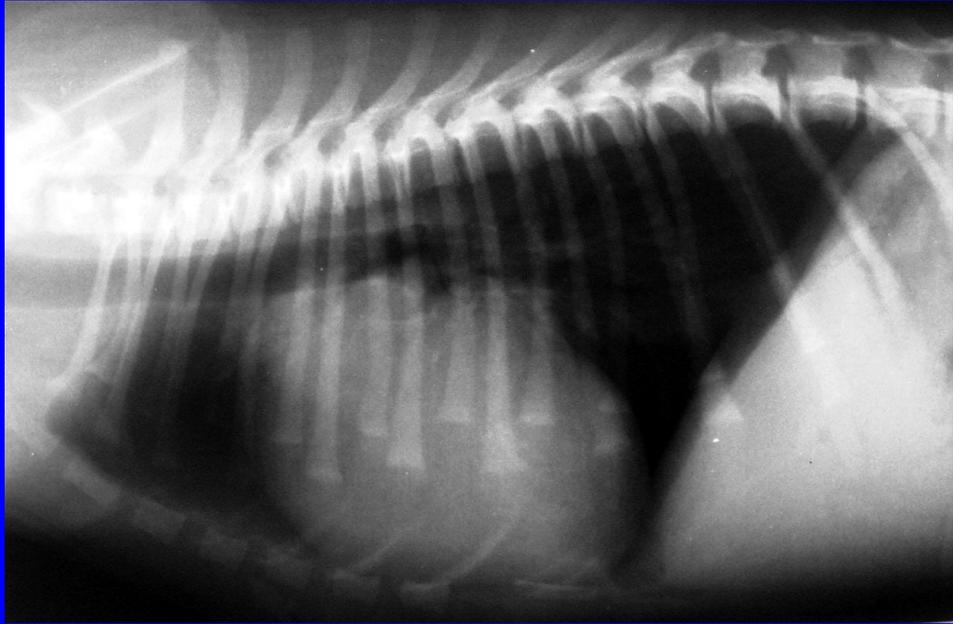
# Stenosi polmonare

- Malformazione della valvola polmonare con ostruzione del tratto di efflusso
- Crea elevata P e conseguente ipertrofia concentrica del ventricolo dx
- Razze: Bulldog, Basset H, Beagle, Boxer, rara nel gatto

## RX:

- Dilatazione arteria polmonare principale in vd per il flusso turbolento (ddx sistole)
- Aumento dimensioni ventricolo dx (P overload)
- Ipertrasparenza dei campi polmonari
- Scompenso: aumento vcc, epatomegalia, ascite, versamento pleurico

## US



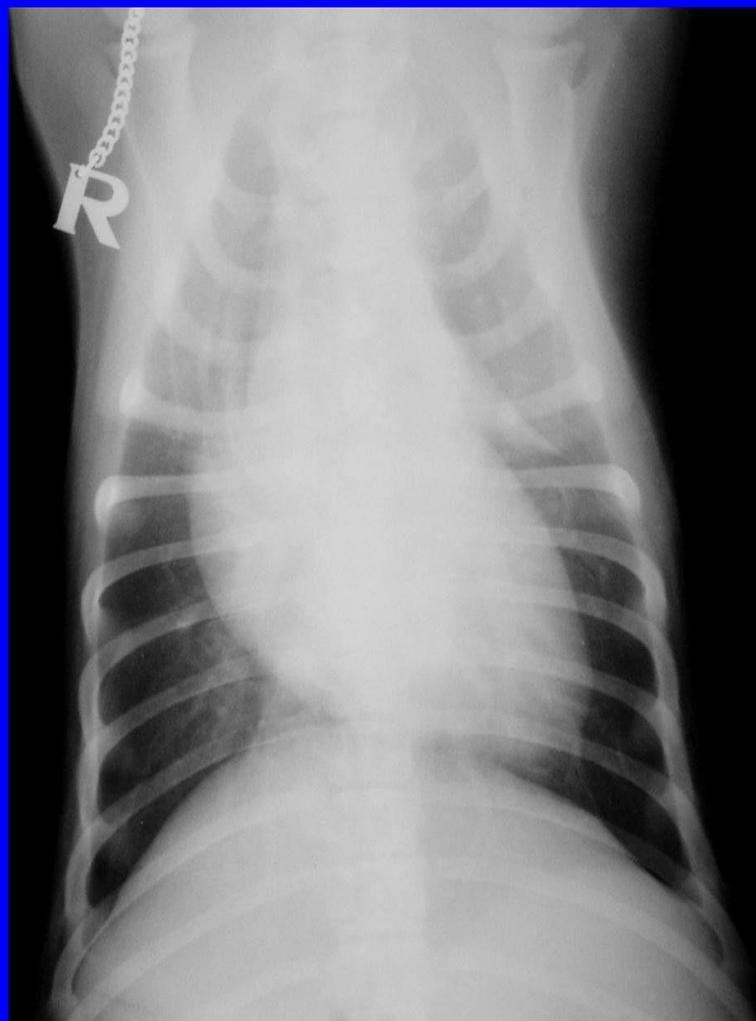
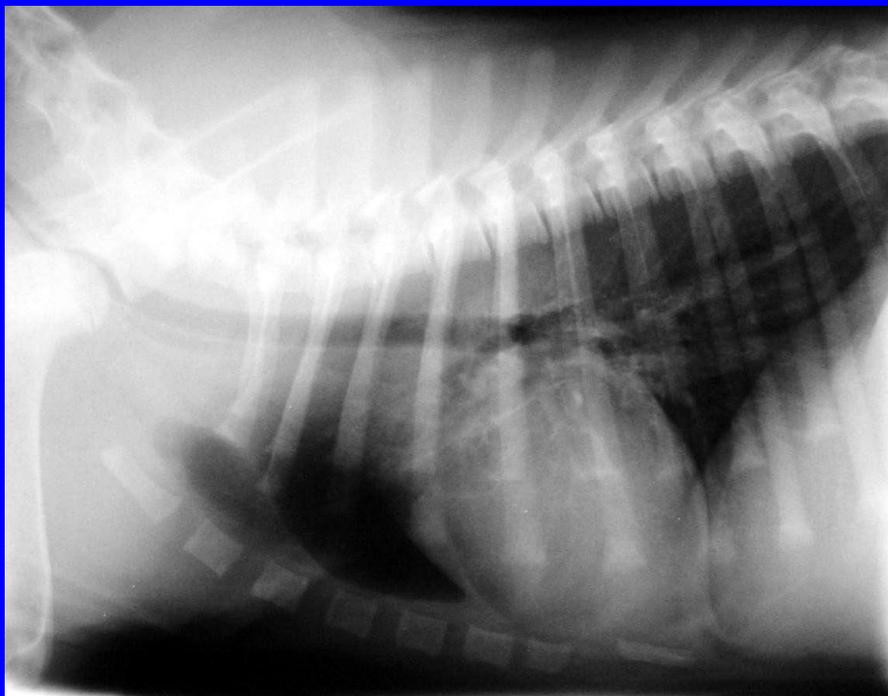
# Stenosi aortica

- 95% subvalvolare, 5% valvolare, rara sopravalvolare
- Aumento P e conseguente ipertrofia concentrica ventricolo sn
- Inadeguato flusso alle coronarie – ischemia miocardica – aritmie – scompenso cardiaco sn (morte improvvisa 30% casi)
- Razze: Boxer, Bull T, PT, gatto

## RX:

- Dilatazione arco aortico in vd per turbolenze
- Allungamento ventricolo sn (P overload)
- Dilatazione atrio sn
- Dilatazione vene polmonari – congestione – scompenso ed edema

## US



# PDA

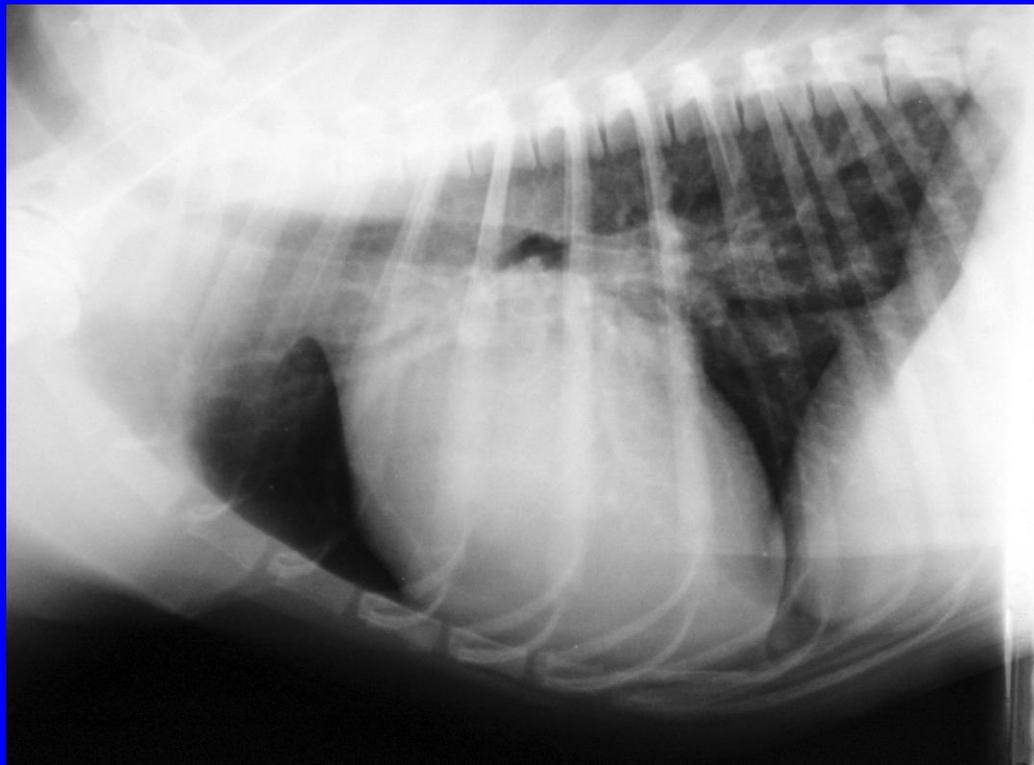
- Mancanza di mm nella parete del dotto di Botallo (chiuso a 3 gg dalla nascita) – shunt sn-dx – sovraccarico del circolo polmonare e del cuore sn
- Razze: Chihuahua, Cocker, PT, raro nel gatto

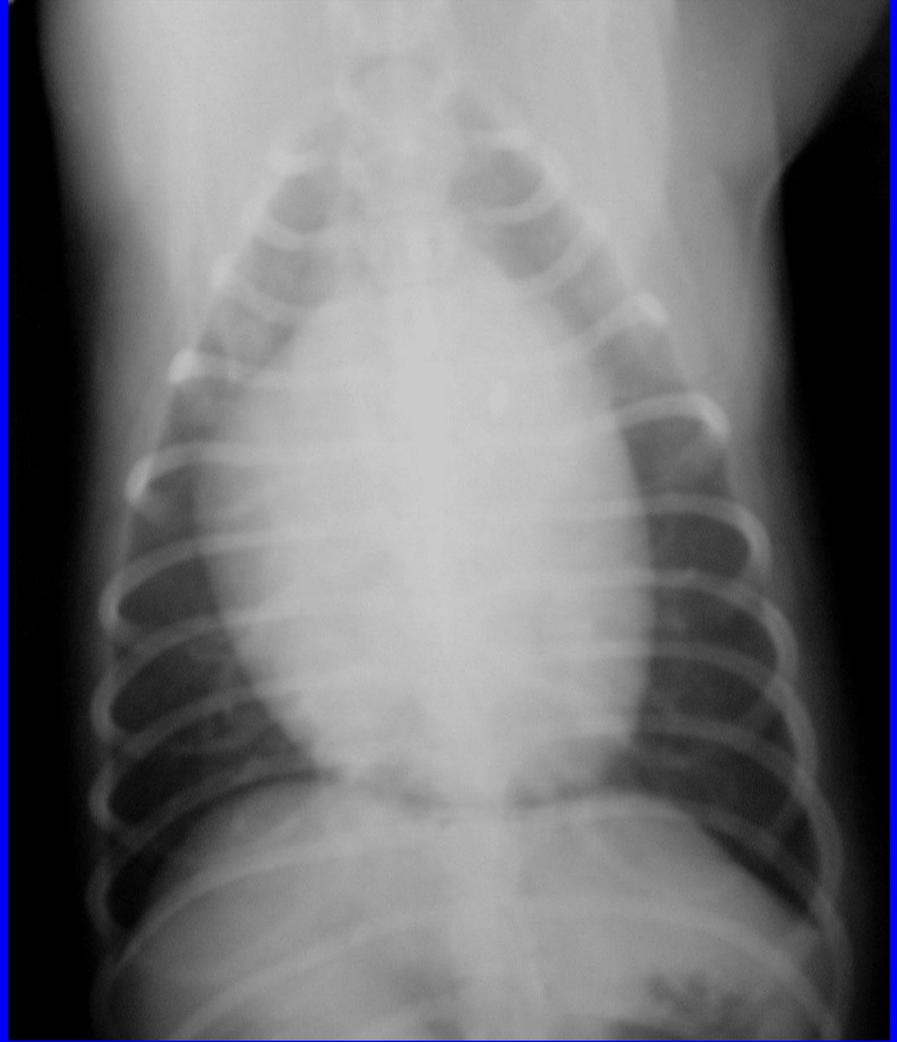
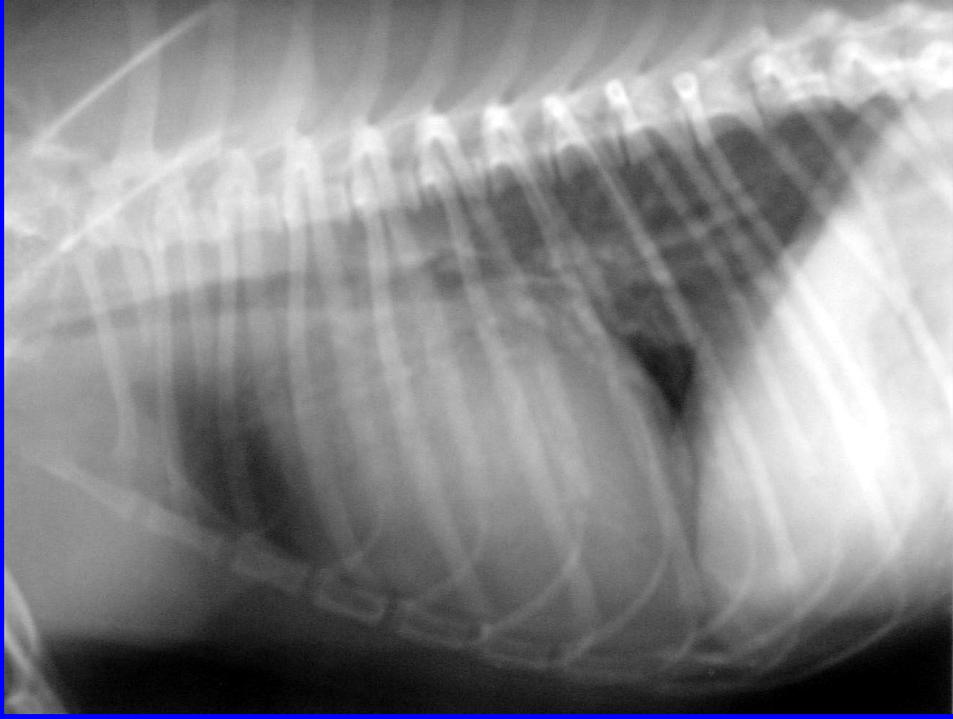
## RX:

- Dilatazione aorta discendente in vd per turbolenze
- Dilatazione arteria polmonare principale per aumento di P e flusso
- Dilatazione atrio e ventricolo sn (V overload)
- Dilatazione arterie (prevalentemente) e vene polmonari

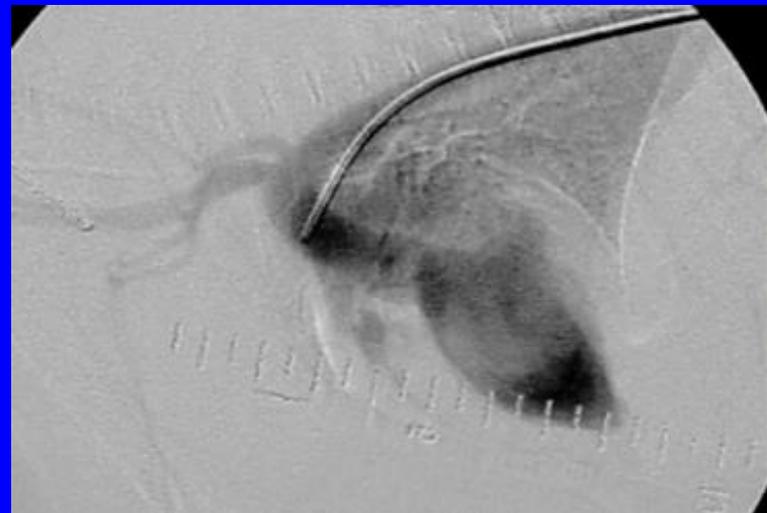
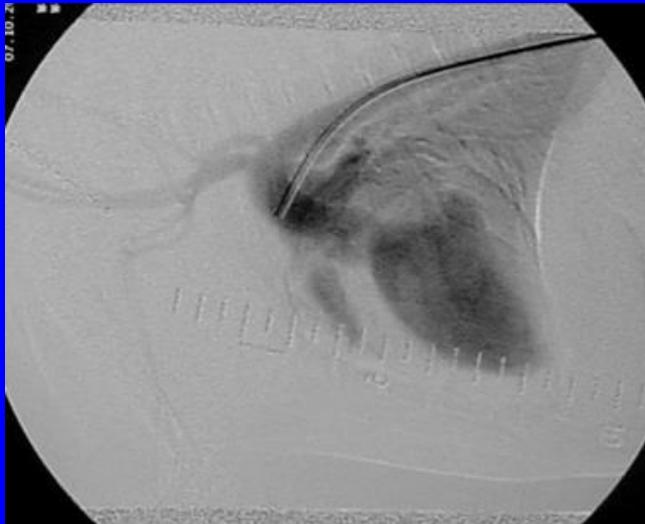
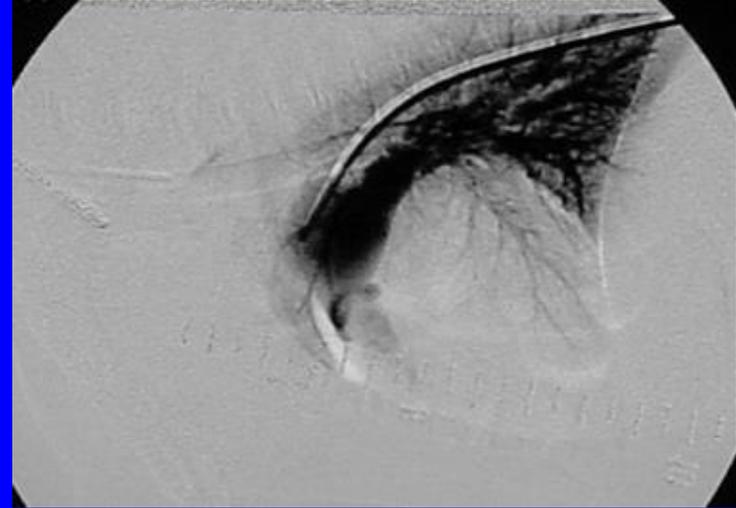
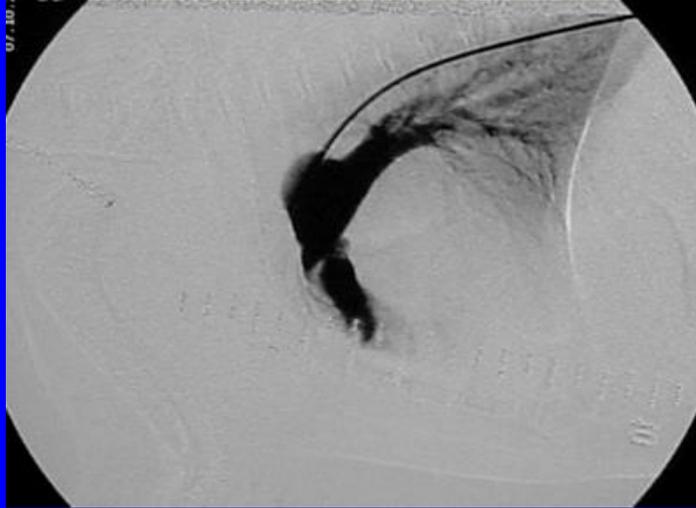
US + mdc, angio, scinti

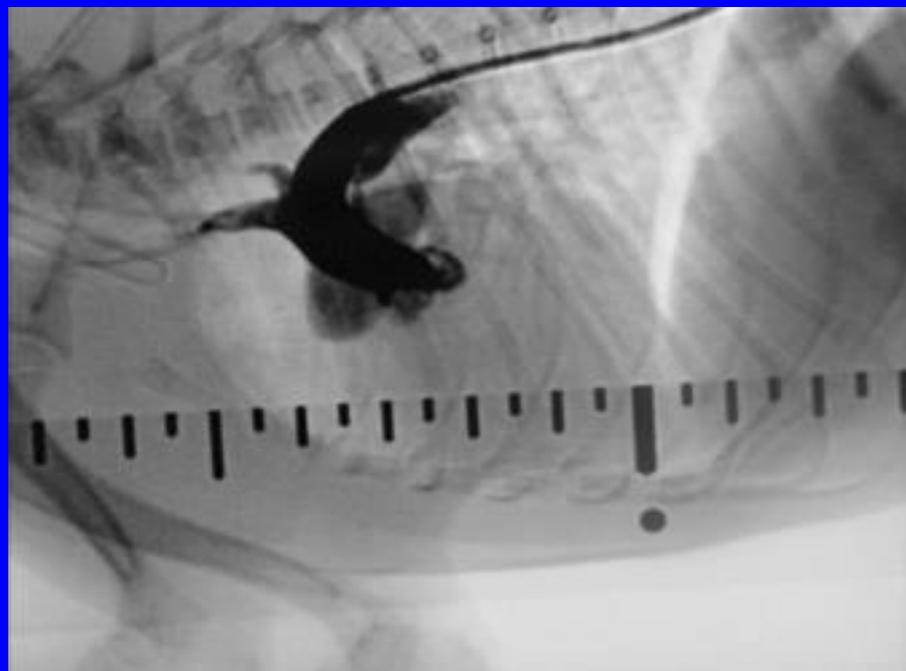
TC!





# SchnanoF4M





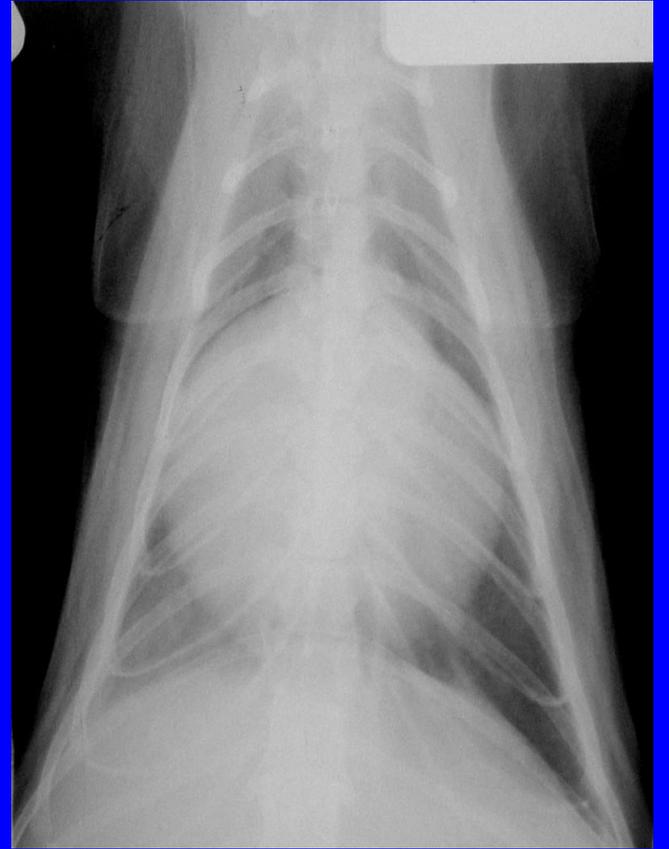
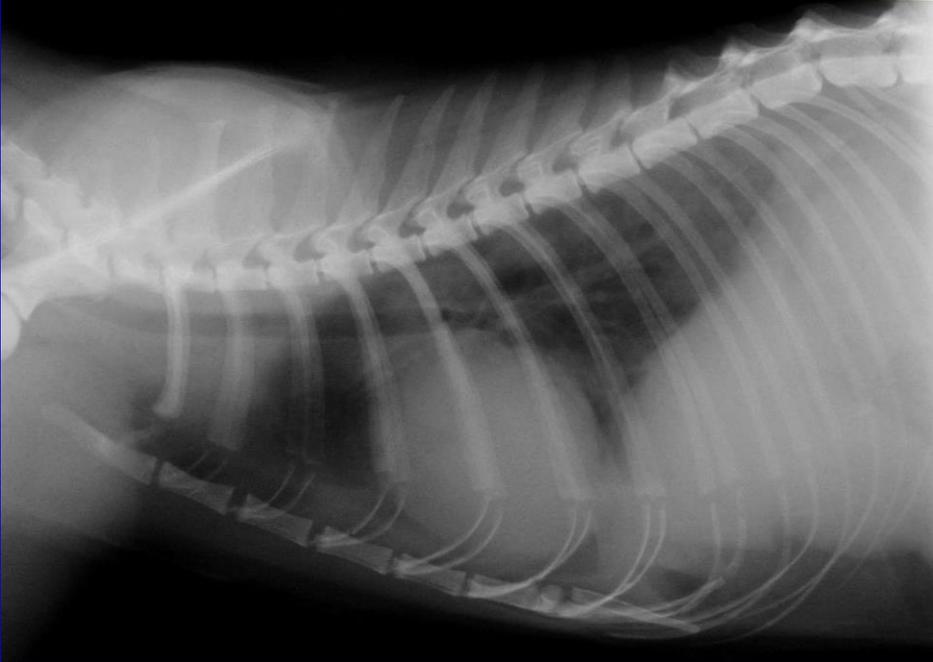
# Westy, m, 3 mos - PDA



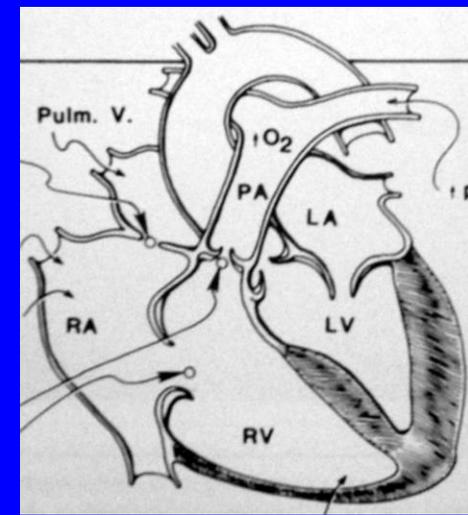
# VSD

- Apertura tra ventricolo dx e sn subito sotto la valvola aortica – sangue direttamente in PA in sistole
- Razze: Bulldog, Spaniels, GATTO
- **RX:**
- Lieve aumento ventricolo dx
- Aumento vasi polmonari
- Possibile bulging arteria polmonare in vd
- Dilatazione atrio e ventricolo sn (V overload)
- Congestione, edema

**US + mdc, angio, scinti**

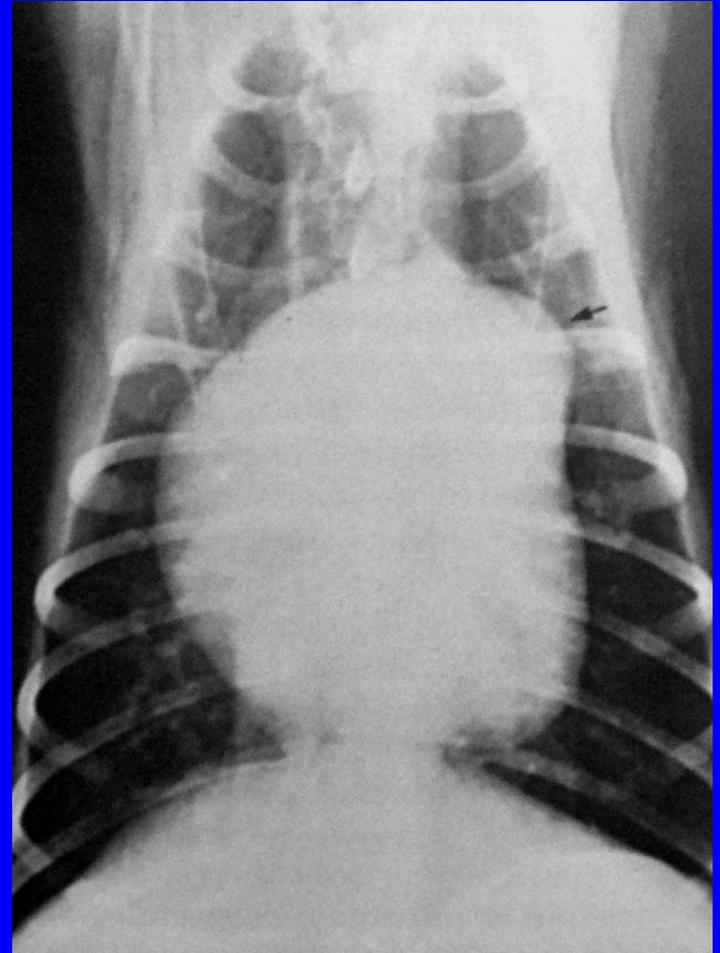
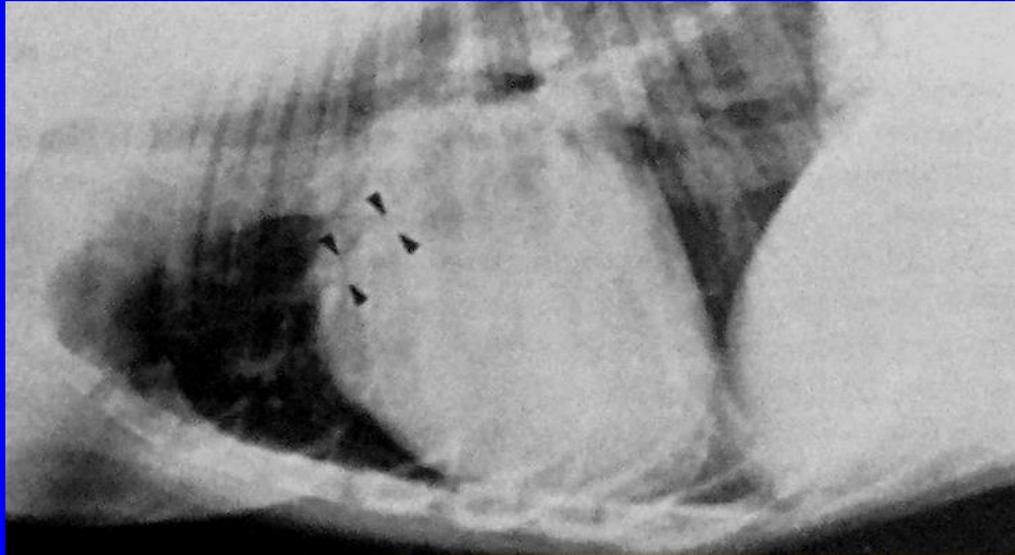


# ASD



- Raro. Solitamente associato a PS
- Patent foramen ovale – shunt sn-dx – overload cuore dx – scompenso cardiaco dx
- **RX:**
- Cardiomegalia
- Polmone ipervascolare

**US + mdc, angio**

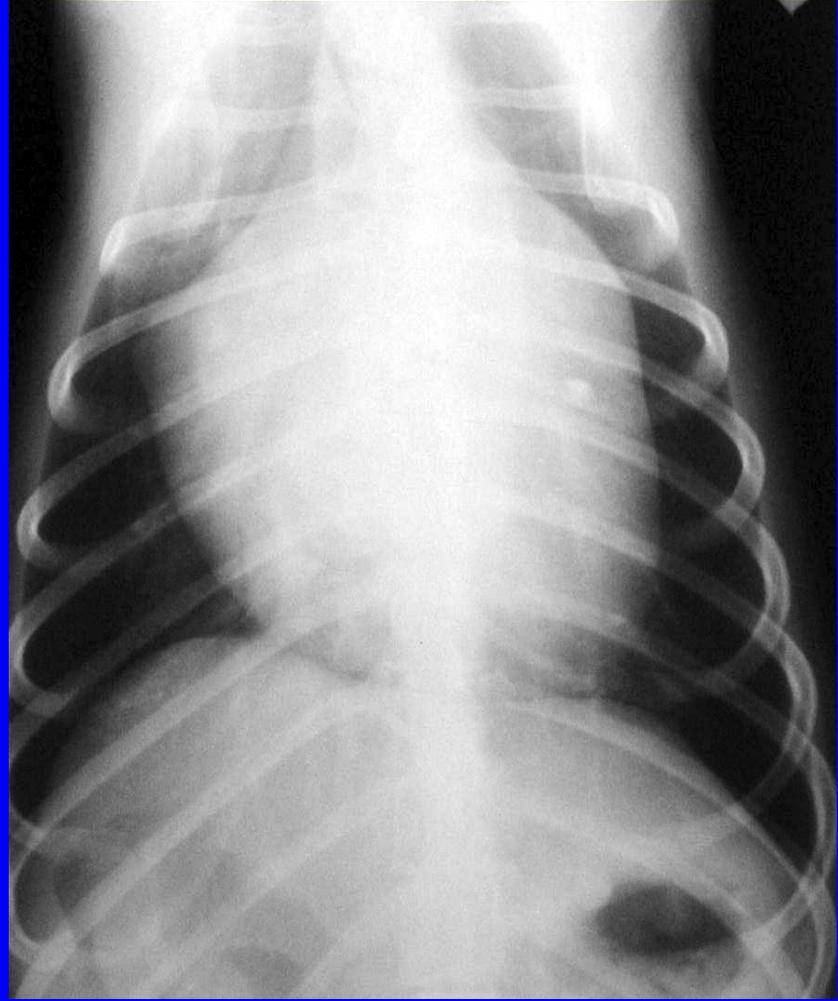
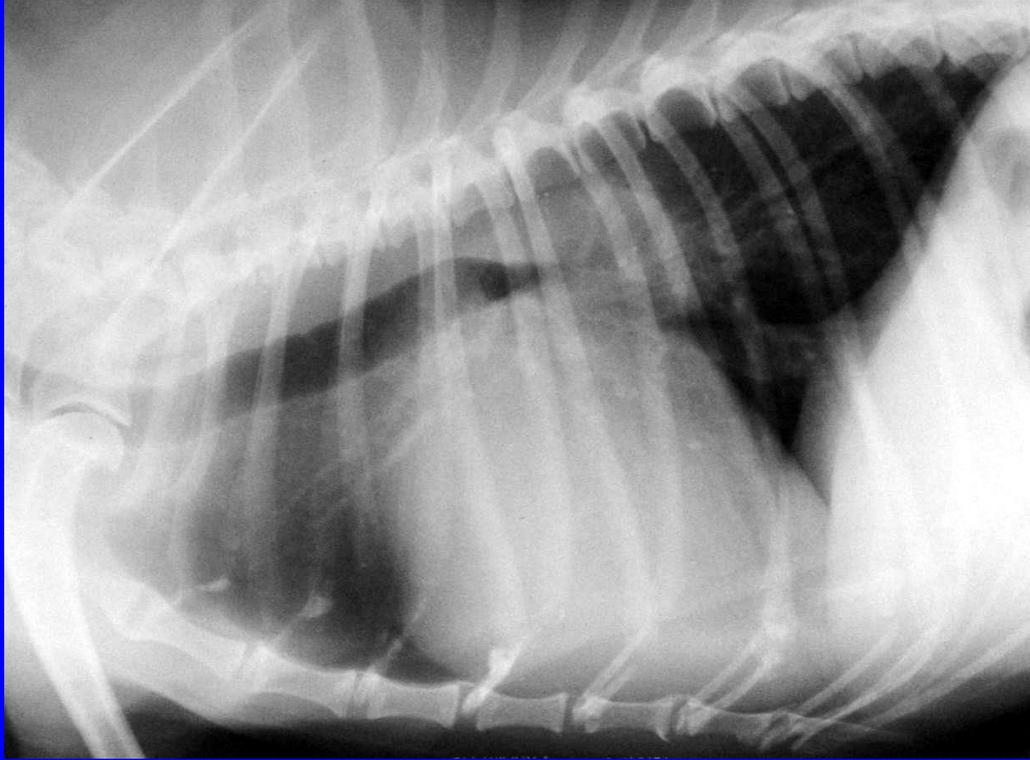


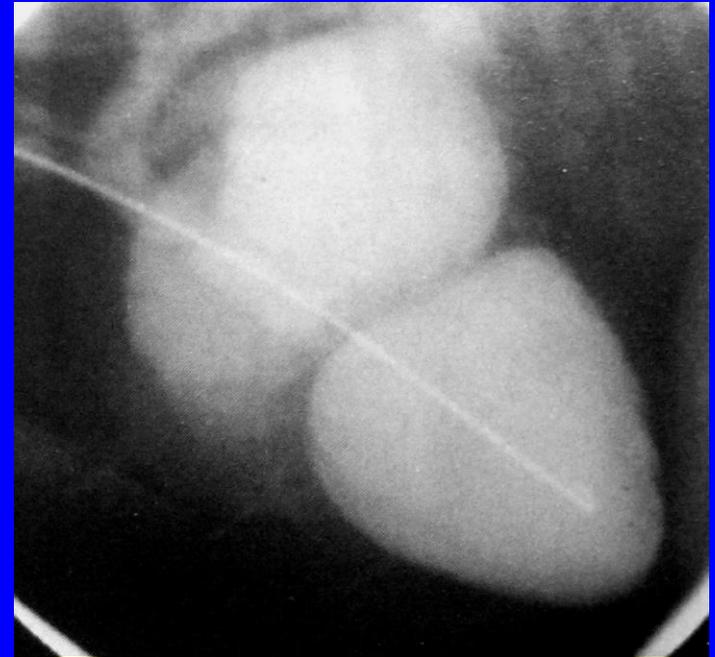
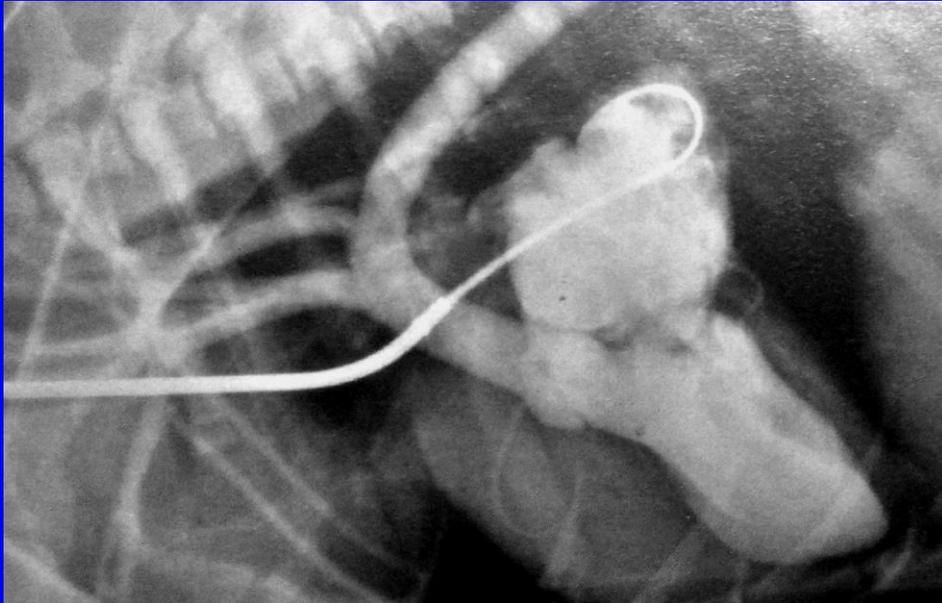
In Fox, Sisson, Moise. Textbook of Canine and Feline Cardiology 1999

# Displasie valvolari

- Rigurgito + frequente della stenosi
- Soggetti giovani
- V overload cuore sn o dx (ipertrofia eccentrica)
- Frequente nei gatti
- Scompenso cardiaco sn o dx

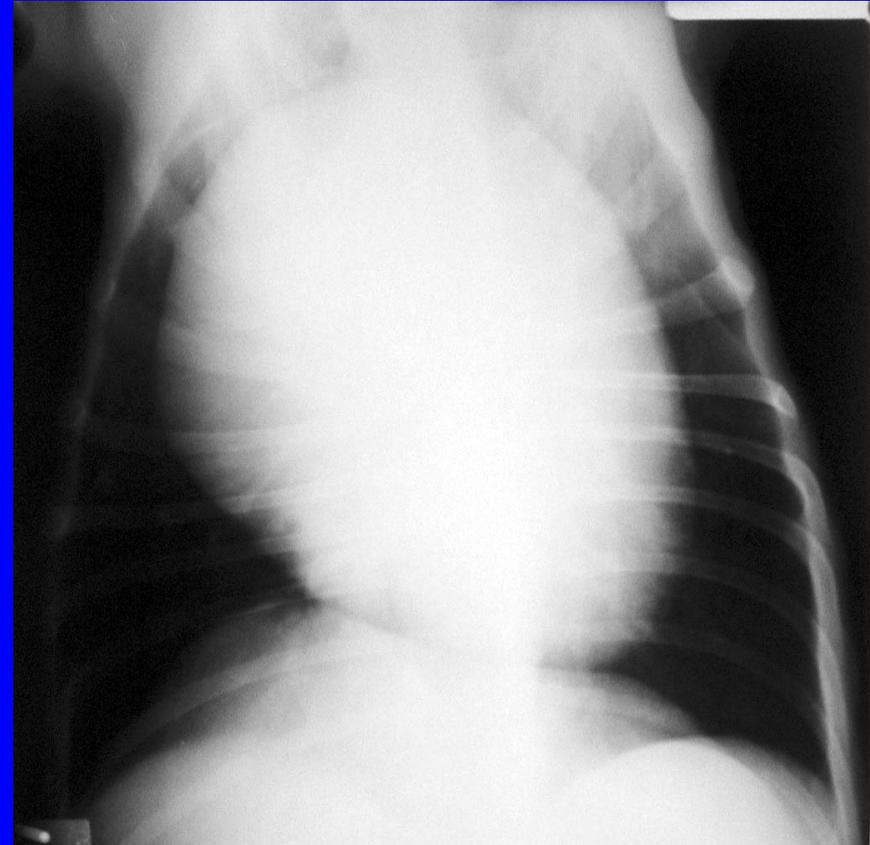
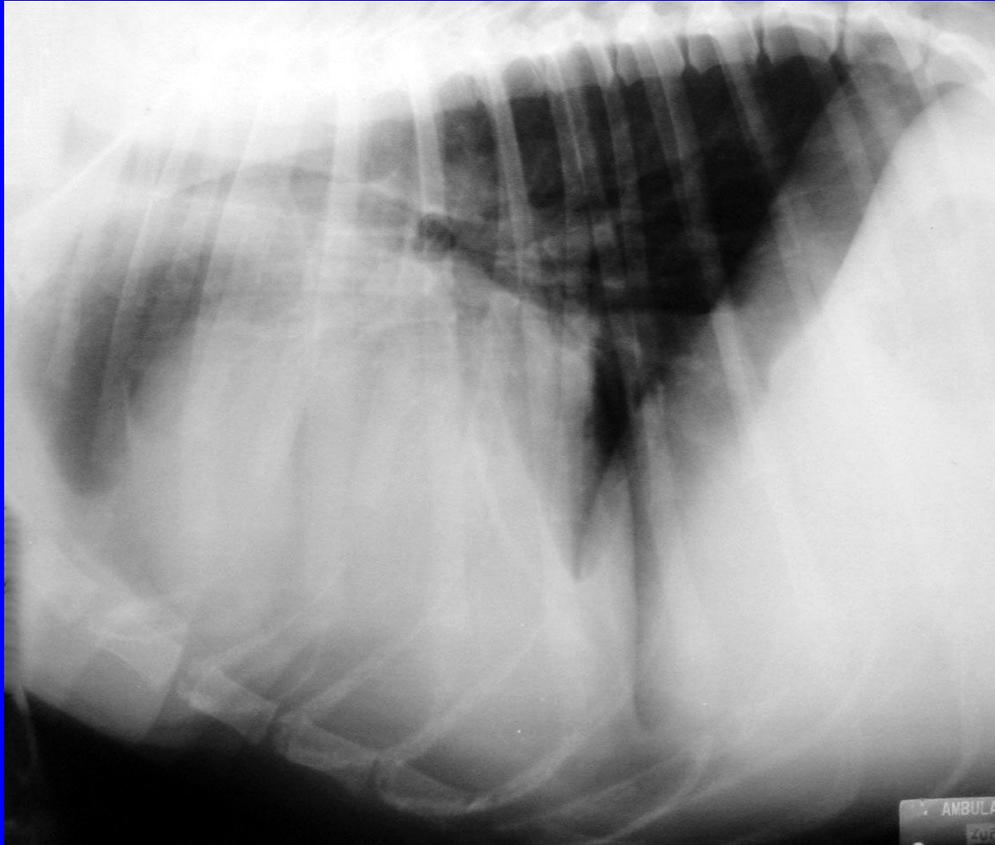
US





In Fox, Sisson, Moise. Textbook of Canine and Feline Cardiology 1999

# Ticuspide



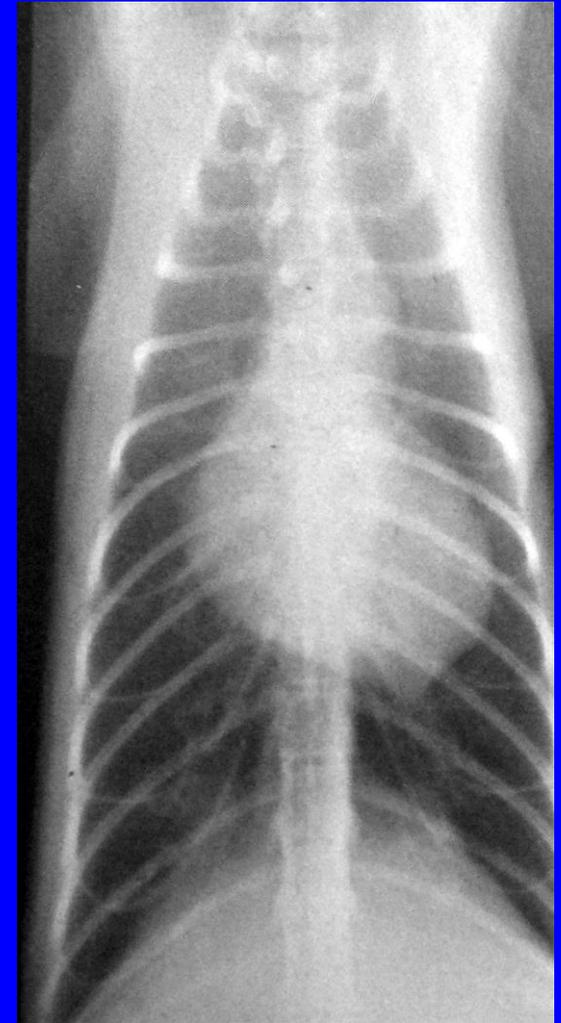
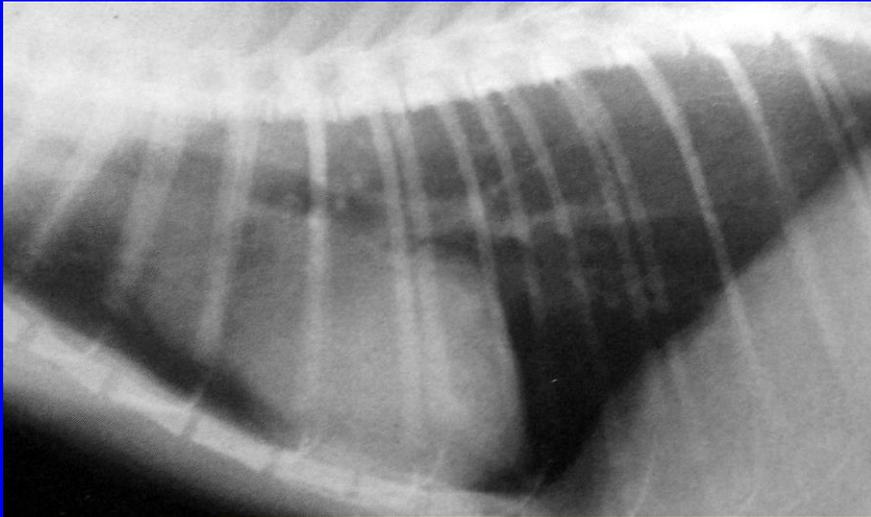
# Tetralogia di Fallot

- PS, RVH, VSD, overriding aorta (ASD-penta)
- Sistole – shunt dx-sn – sangue poco O<sub>2</sub> in aorta – cianosi – policitemia
- Razze: Bulldog, Keeshound

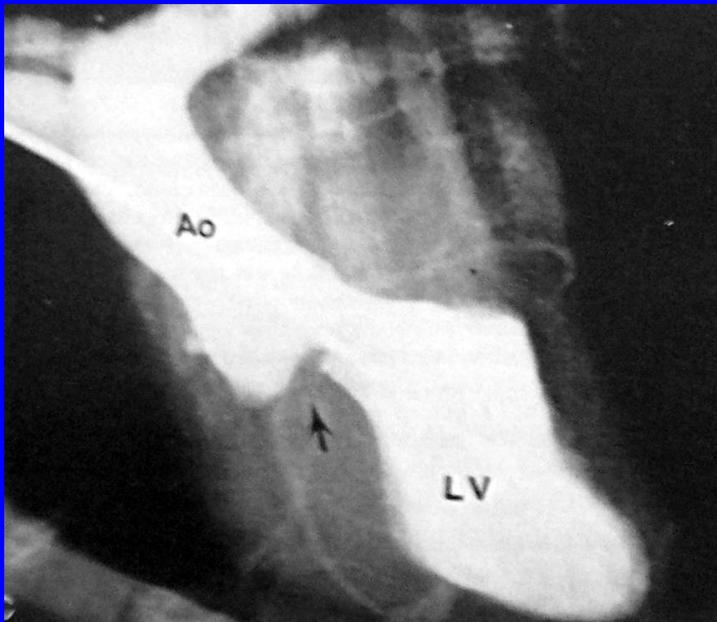
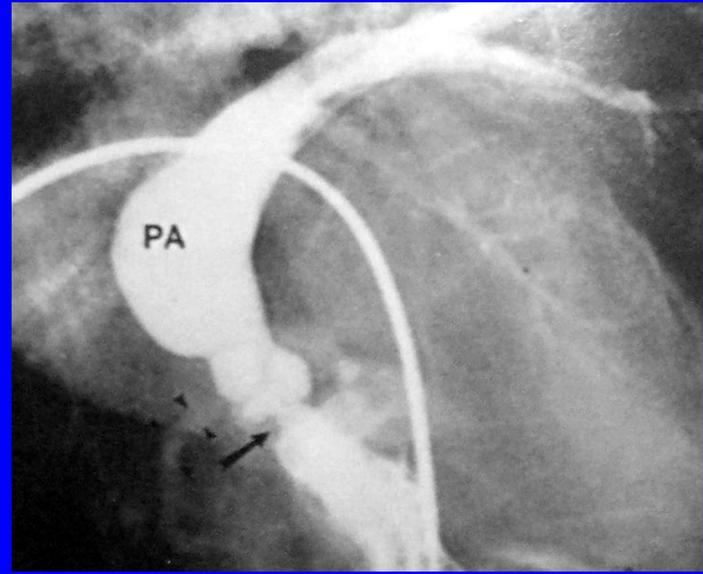
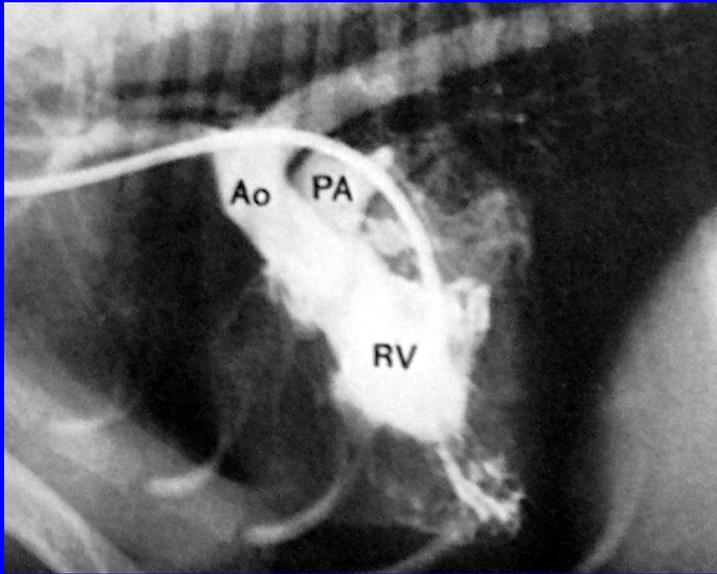
## RX:

- Ipertrofia ventricolo dx
- Shifting dell'apice cardiaco dorsalmente in laterale
- Ipertrasparenza dei campi polmonari
- Possibile dilatazione post-stenotica della PA

US, angio selettiva ventricolo dx



In Fox, Sisson, Moise. Textbook of Canine and Feline Cardiology 1999



In Ettinger & Feldman. Textbook of Veterinary Internal Medicine 1995

# Situs inversus

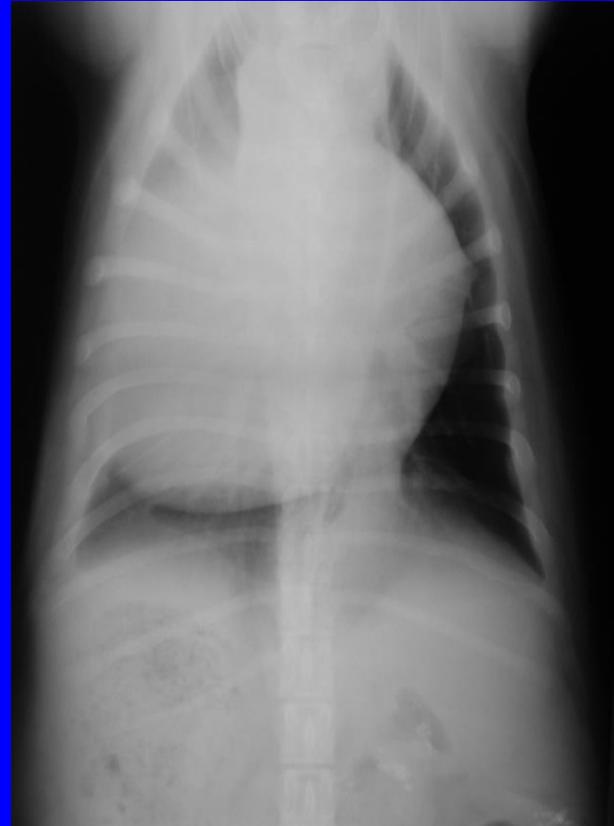
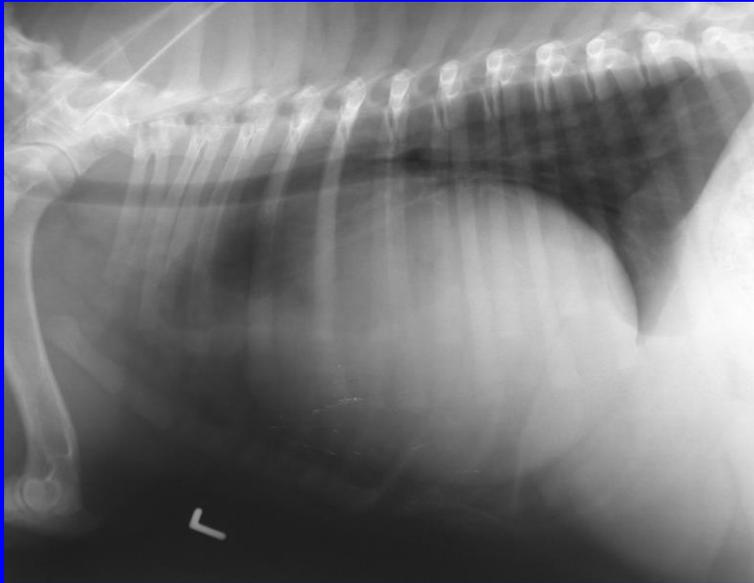
- Asintomatica
- Associata a sinusite, bronchite-bronchiectasia (discinesia ciliare) nella Kartagener's syndrome

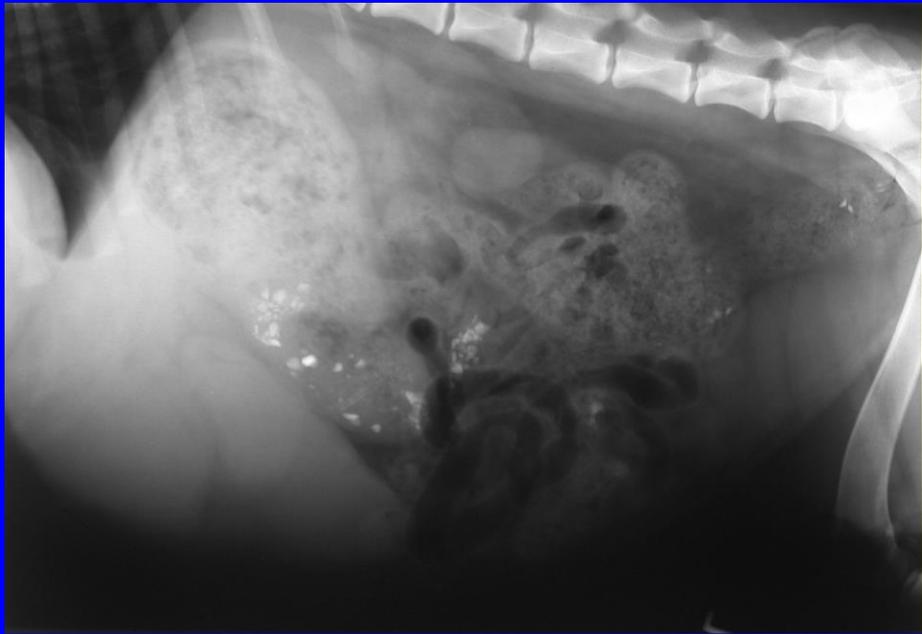
## RX:

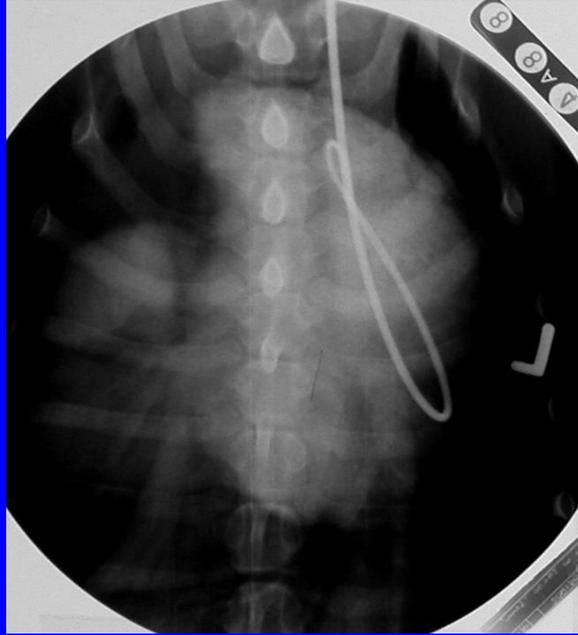
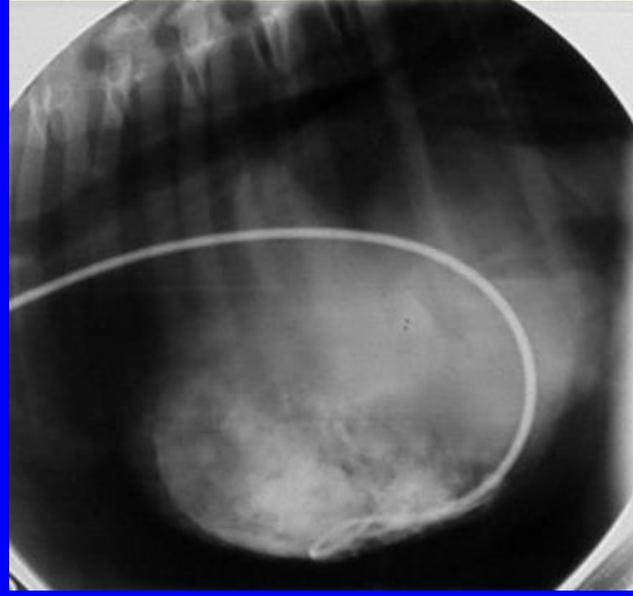
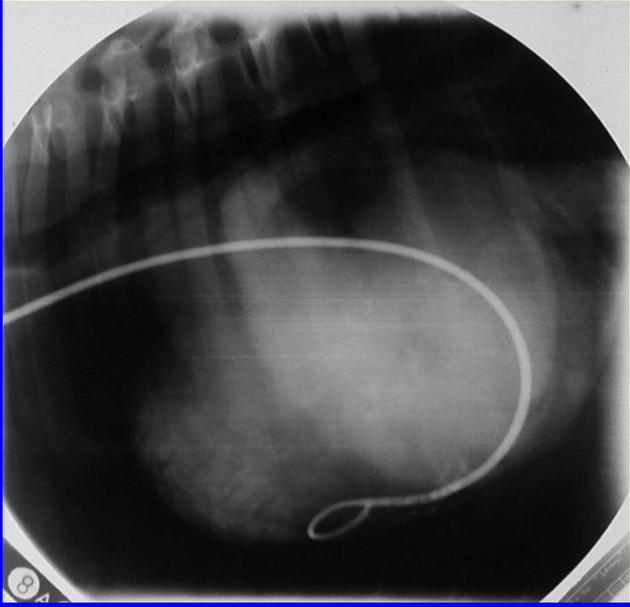
- Ombra cardiaca invertita (apice a dx)
- Tutti gli organi invertiti
- DDx: errore tecnico (lettera in posizione sbagliata)

## Angio

# GRF10A





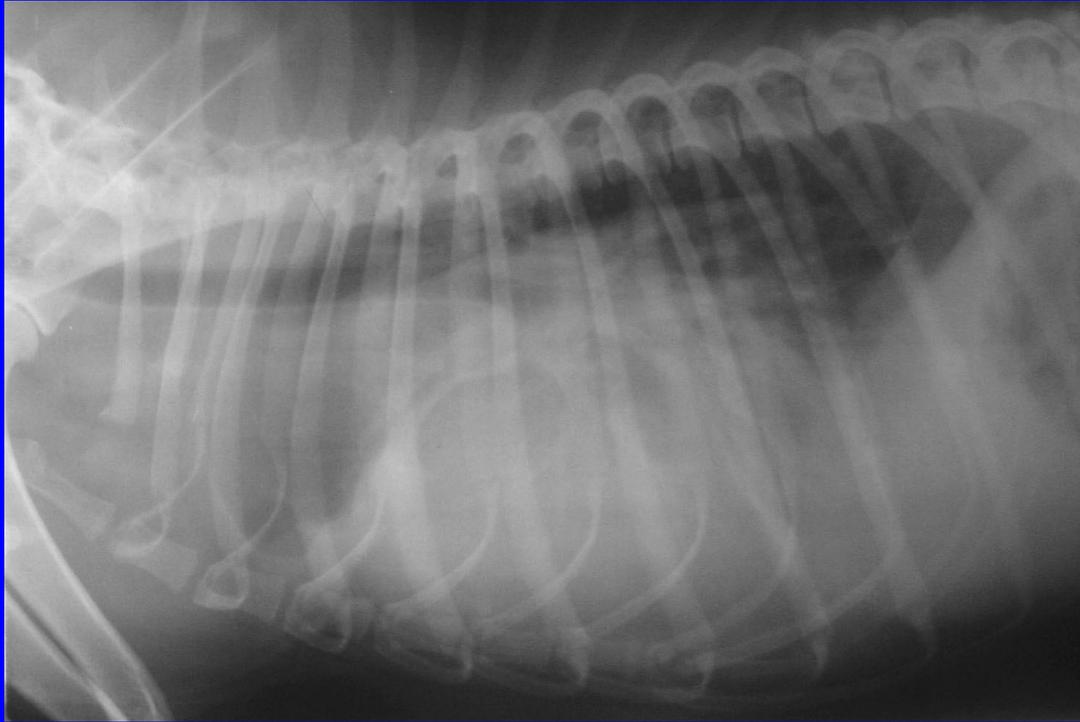


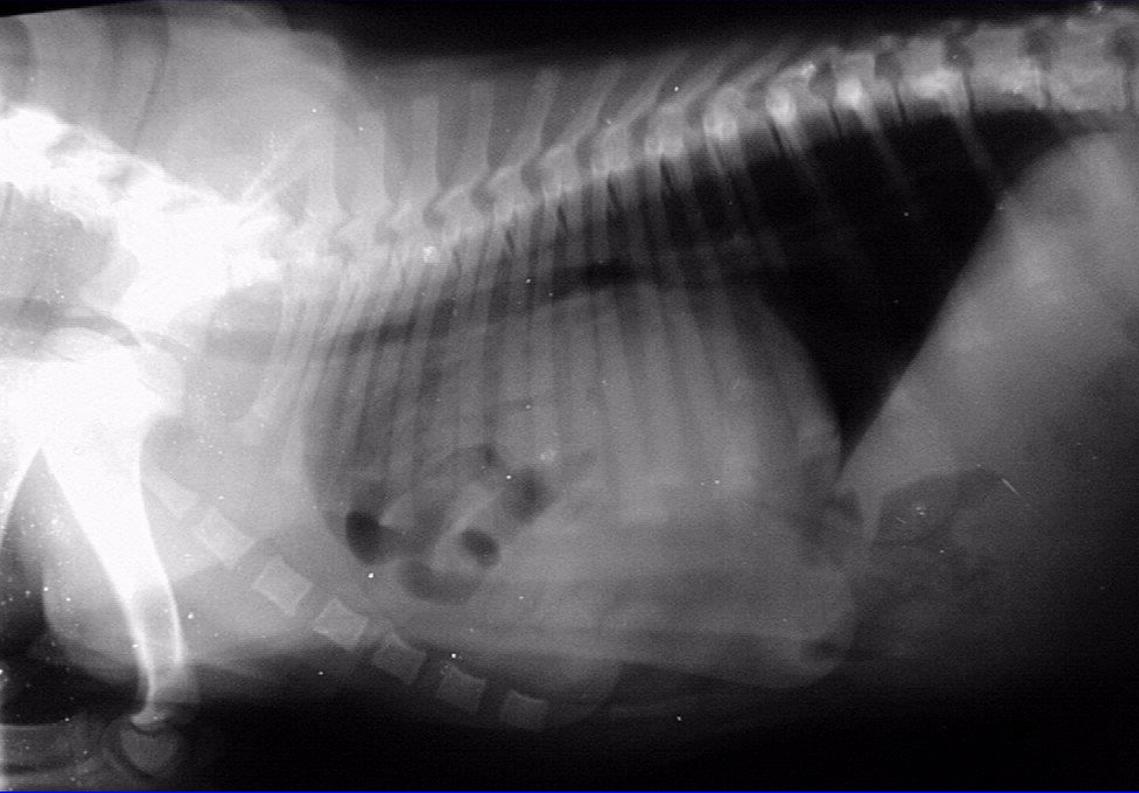
# Ernia peritoneo-pericardica

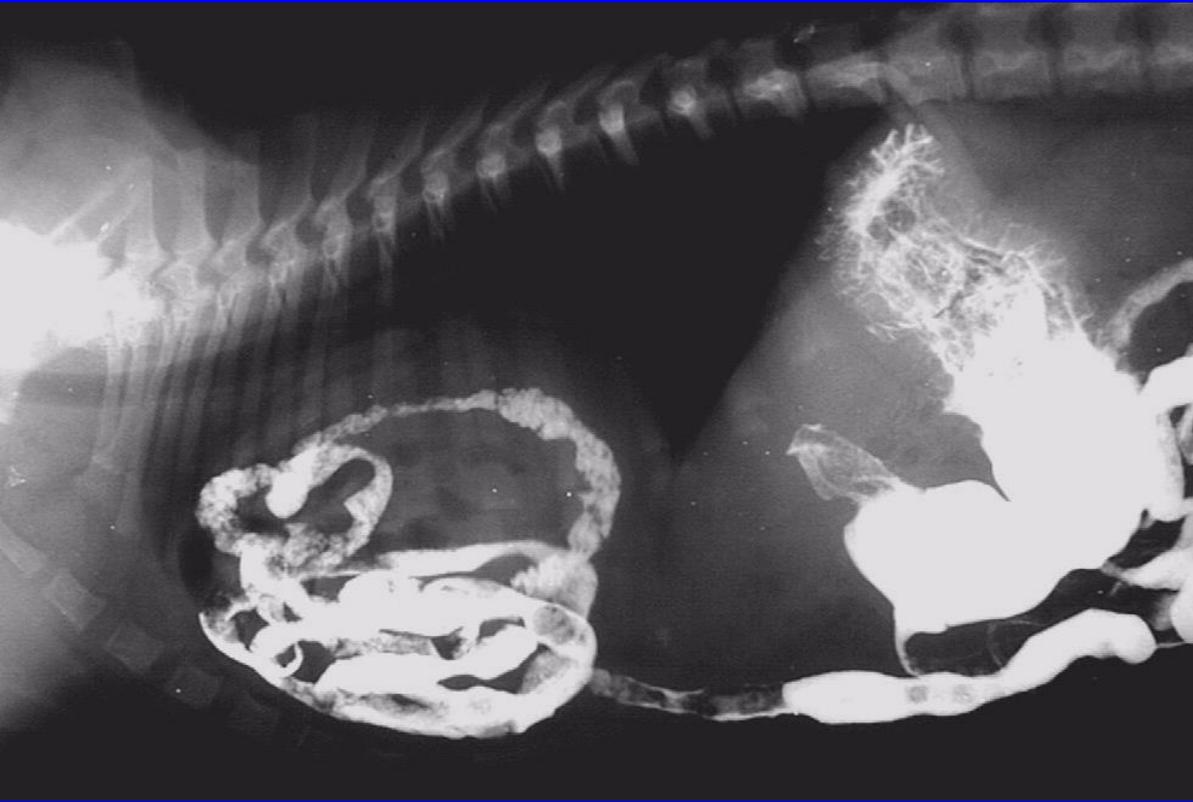
- Spesso reperto occasionale

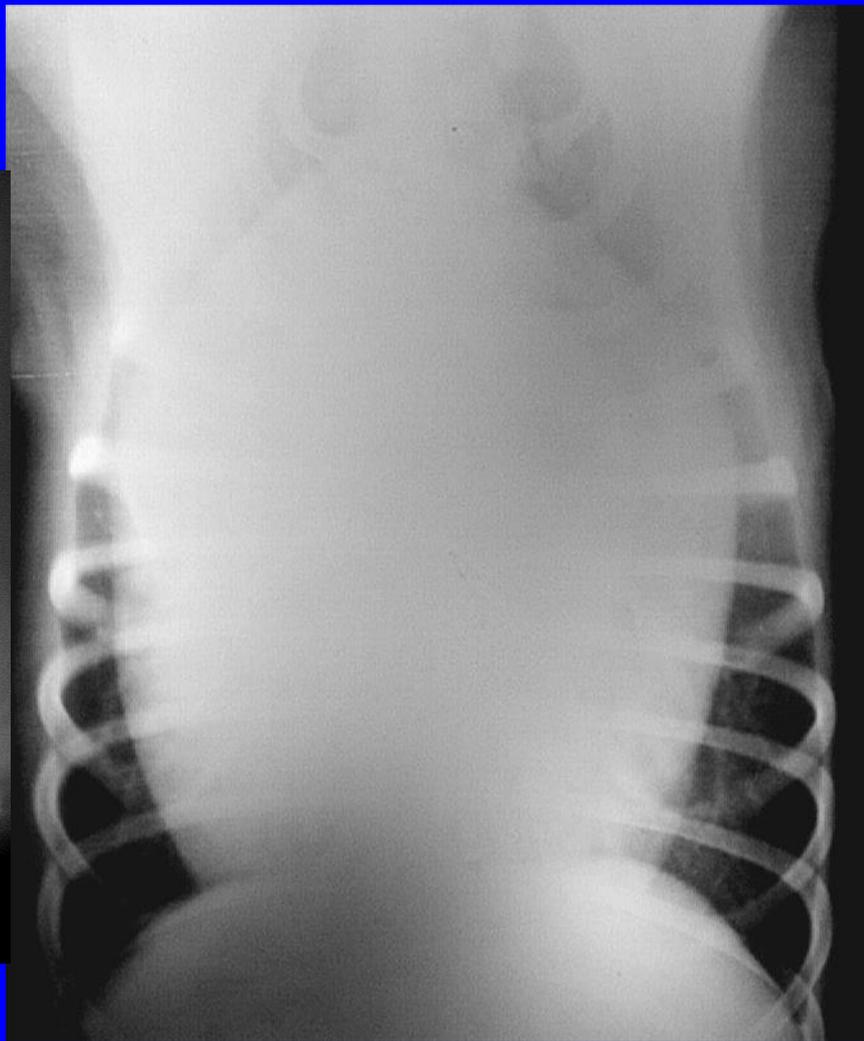
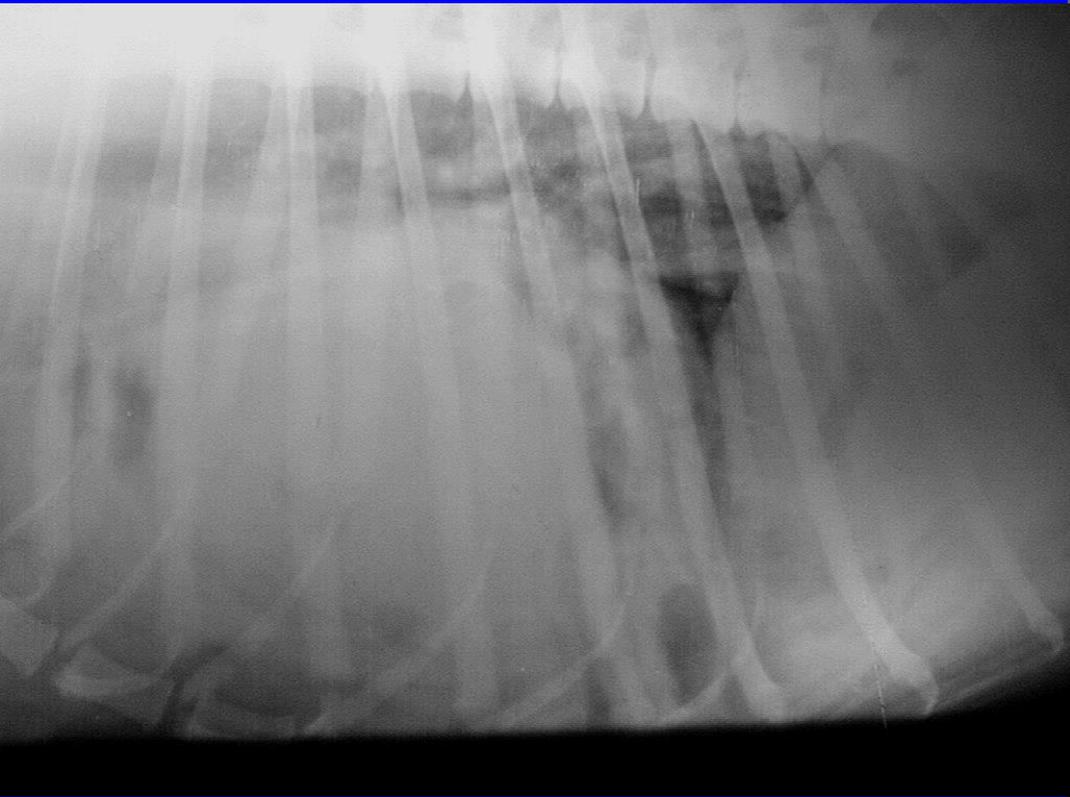
## RX:

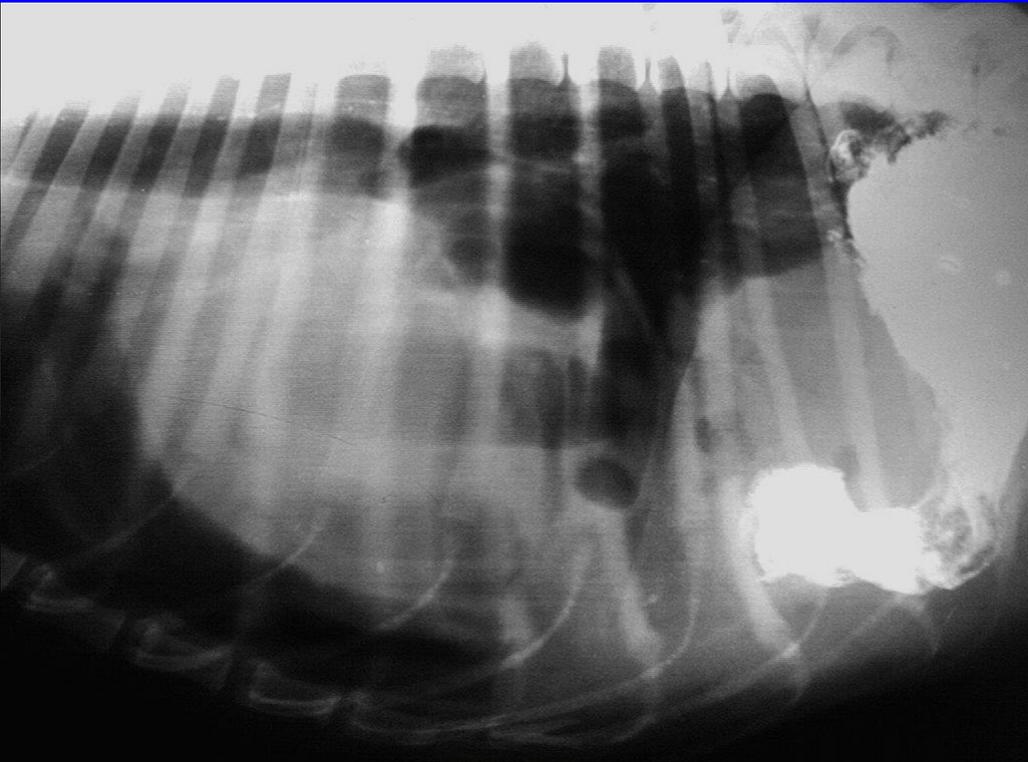
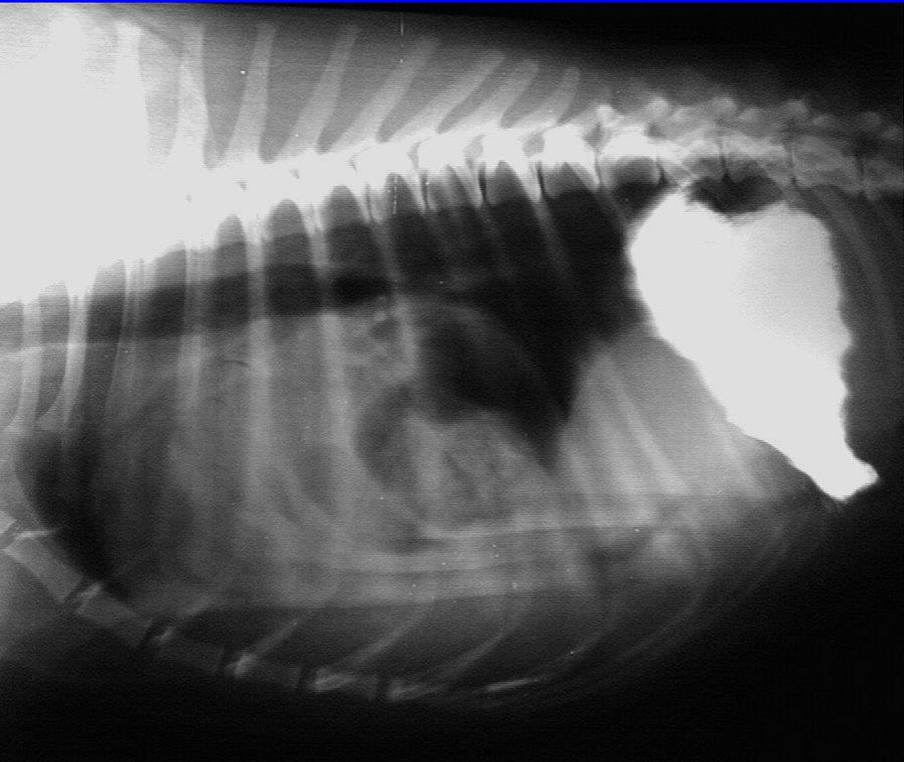
- a) Cardiomegalia
- b) Anse intestinali ripiene di gas o ingesta

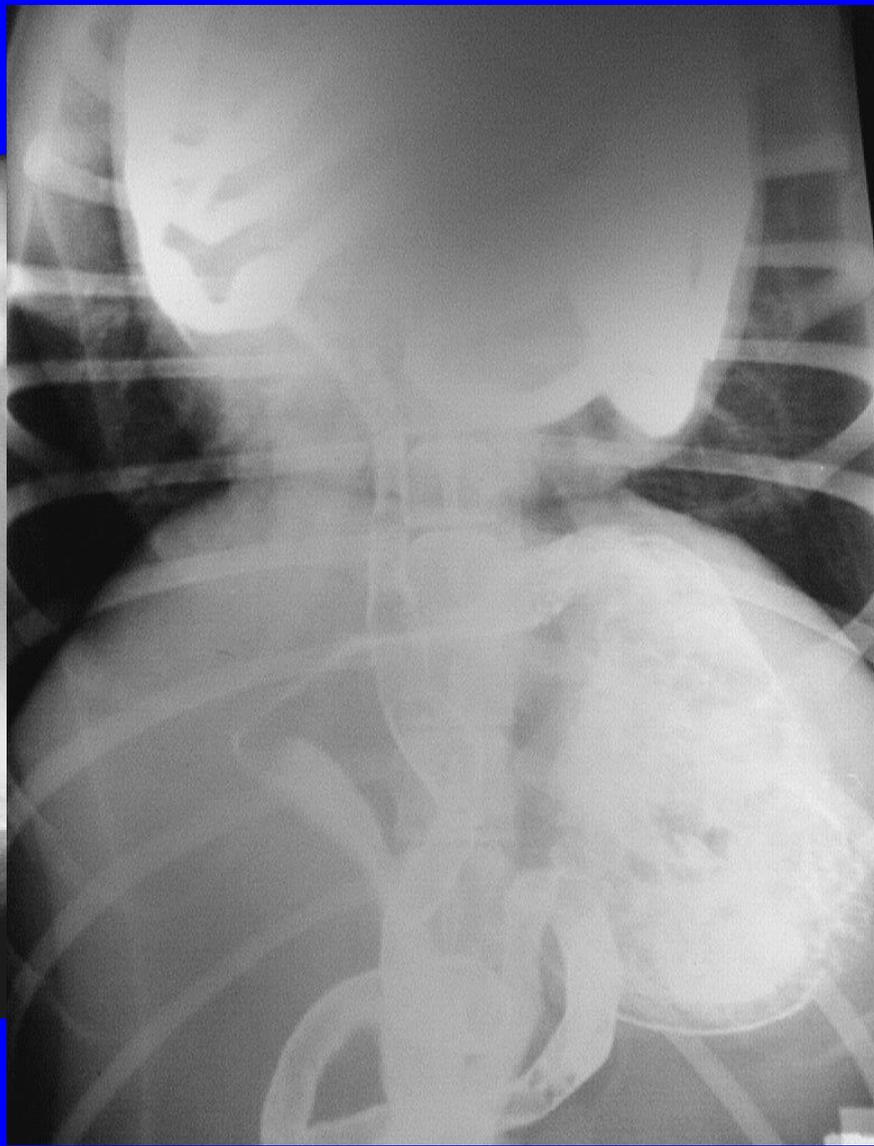
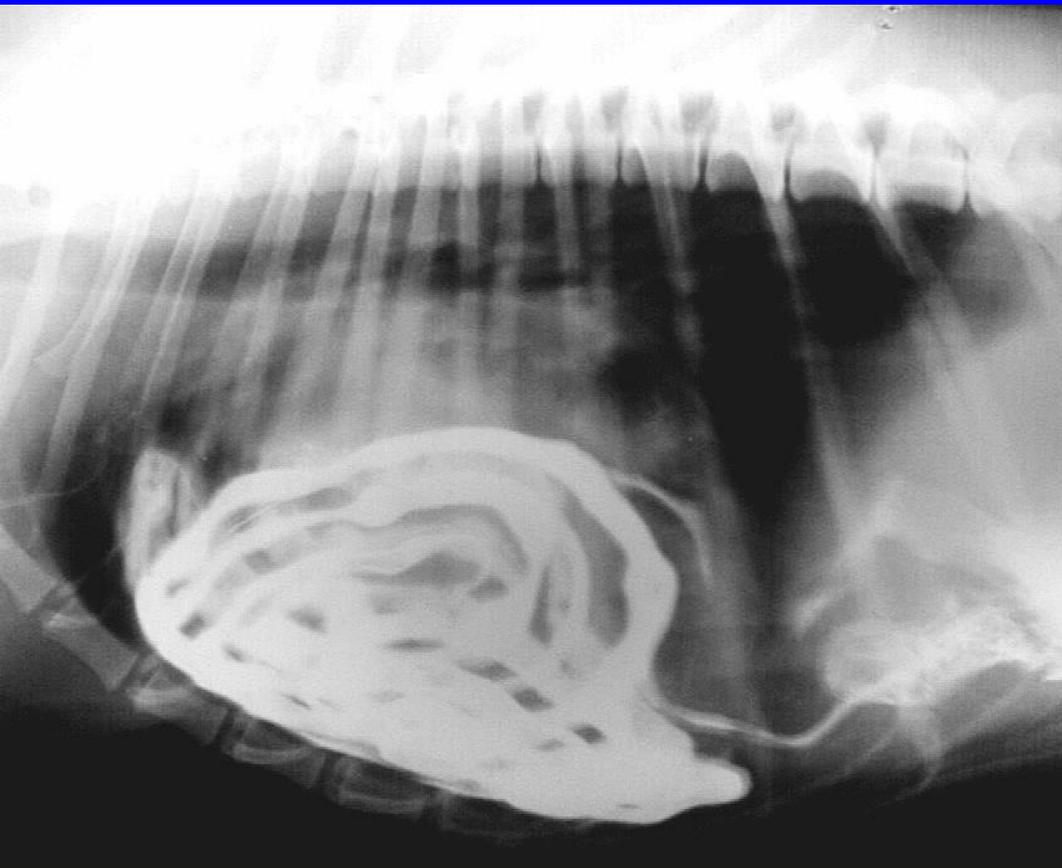












# Patologie cardiache acquisite

# Patologie acquisite

- Valvulopatie croniche degenerative
- Endocardite infettiva
- Dirofilariasi
- Cardiomiopatia dilatativa
- Cardiomiopatia ipertrofica, restrittiva, ipertiroidismo
- Patologie del pericardio

# Degenerazione valvolare

- Insufficienza mitrale > tricuspide
- Stenosi rara
- Degenerazione mixomatosa della valvola in cani anziani – malformazione o mal funzionamento dei mm papillari e corde tendinee – rigurgito in atrio sn – V overload

## RX: 4 fasi

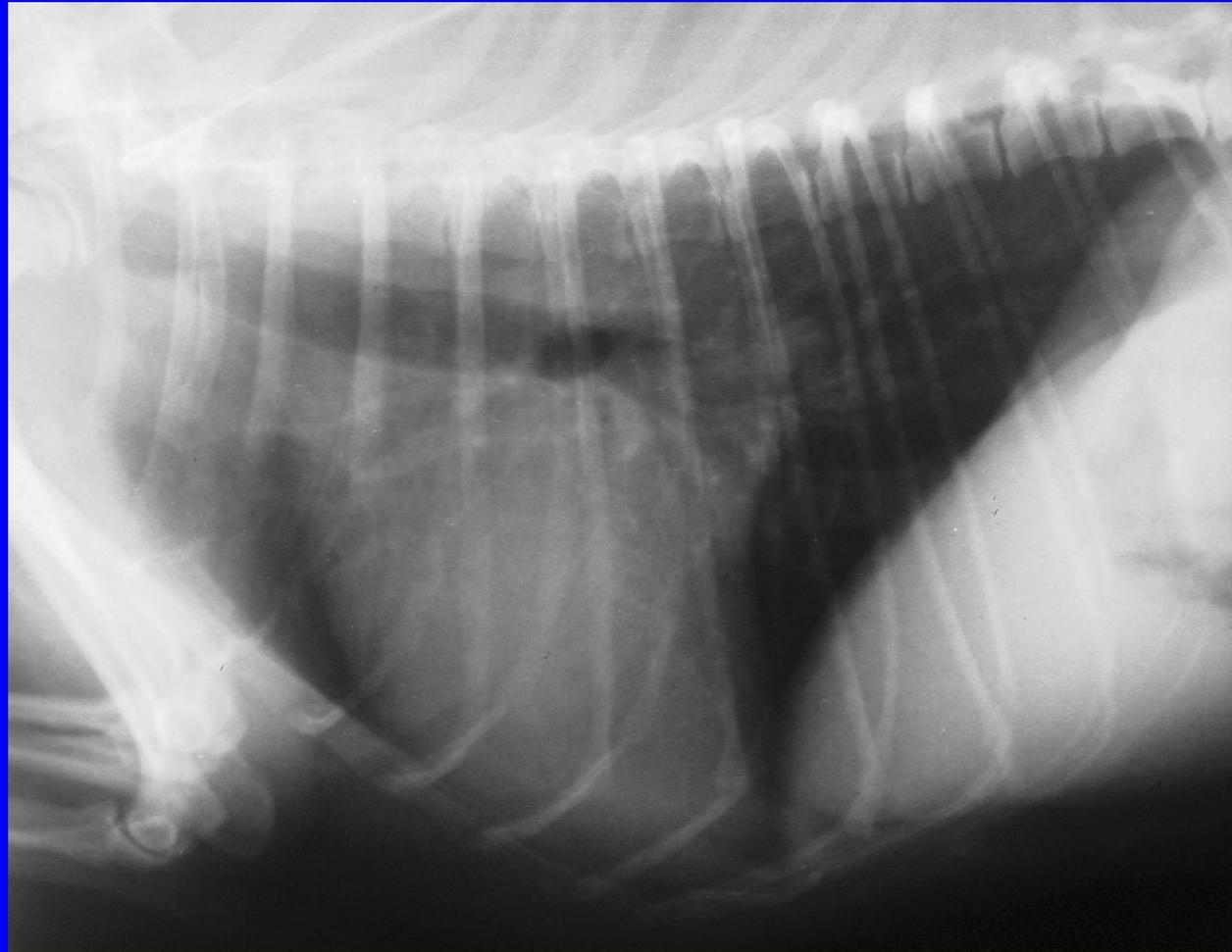
- a) dilatazione atrio sn
  - b) dilatazione atrio + ventricolo sn
  - c) a + b + dilatazione vv p (e ventricolo dx)
  - d) edema polmonare
- Trachea spostata dorsalmente
  - Scompenso cardiaco sn o dx o entrambi

## US

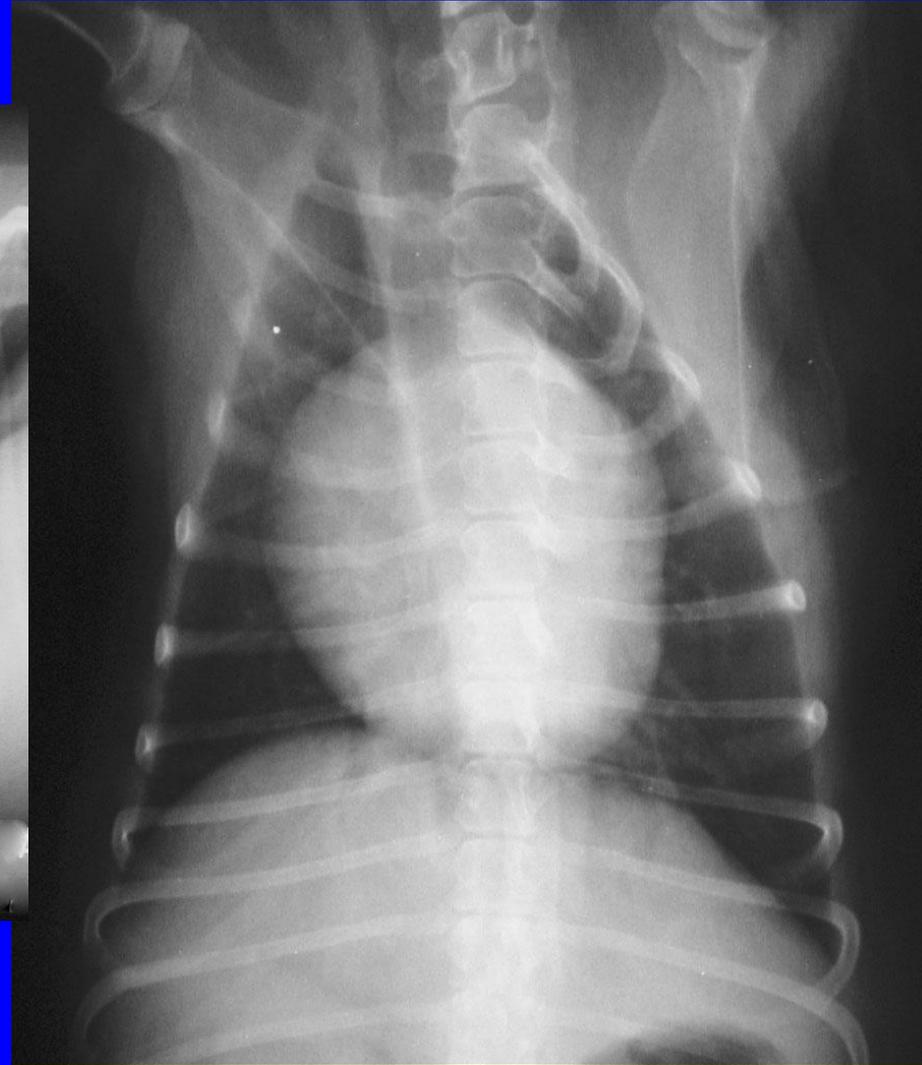
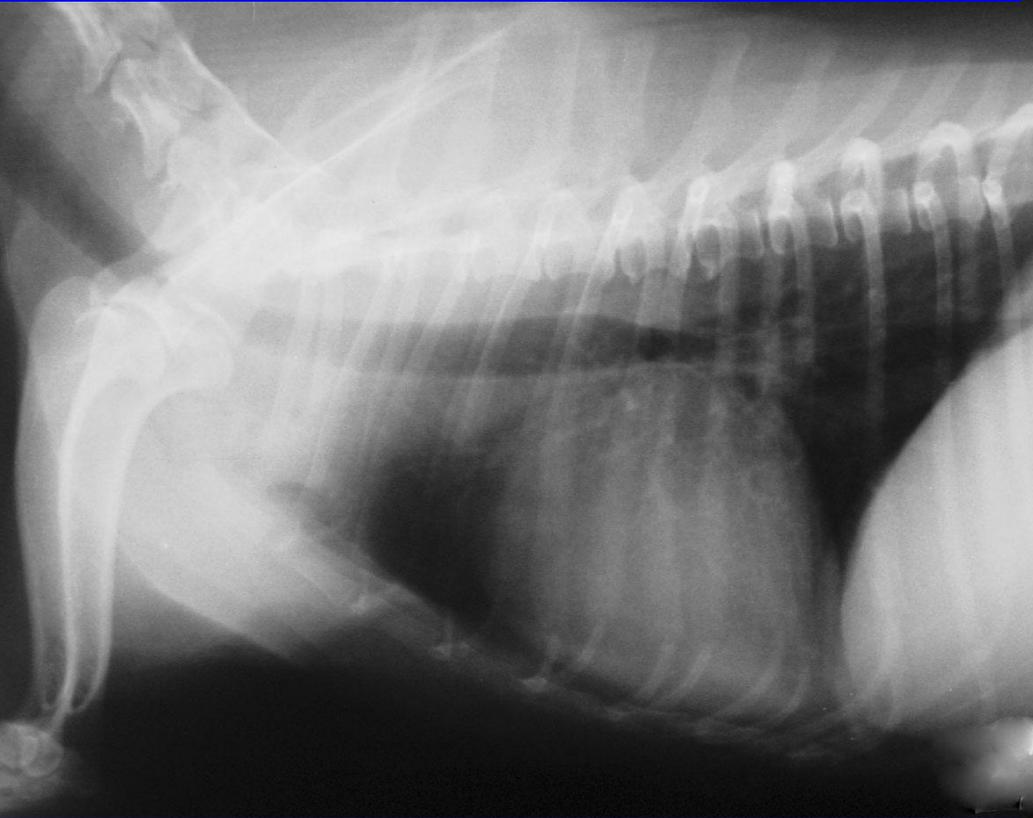
# Endocardite infettiva

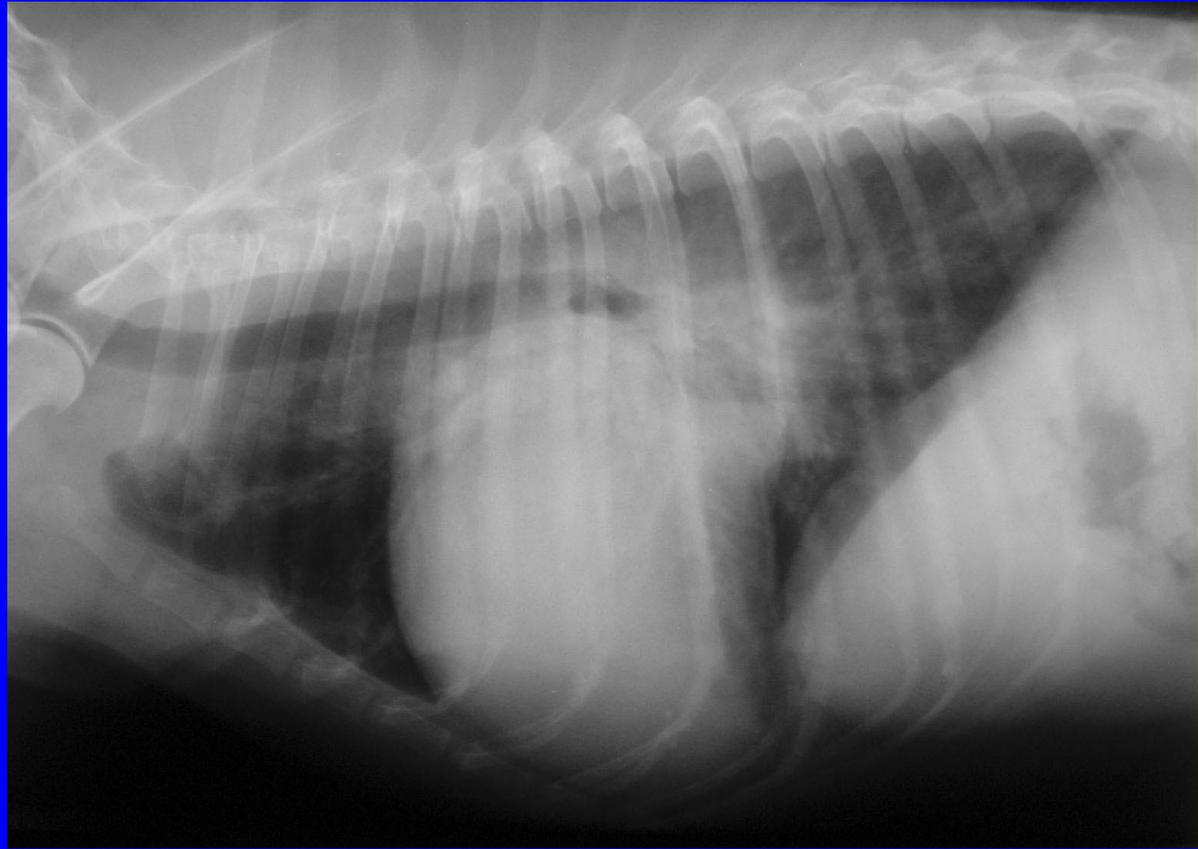
- Mitrale o aorta o entrambe. Raro a dx
- Rigurgito mitralico – V overload cuore sn
- RX come degenerazione valvolare
- Interessa soggetti più giovani!!!!

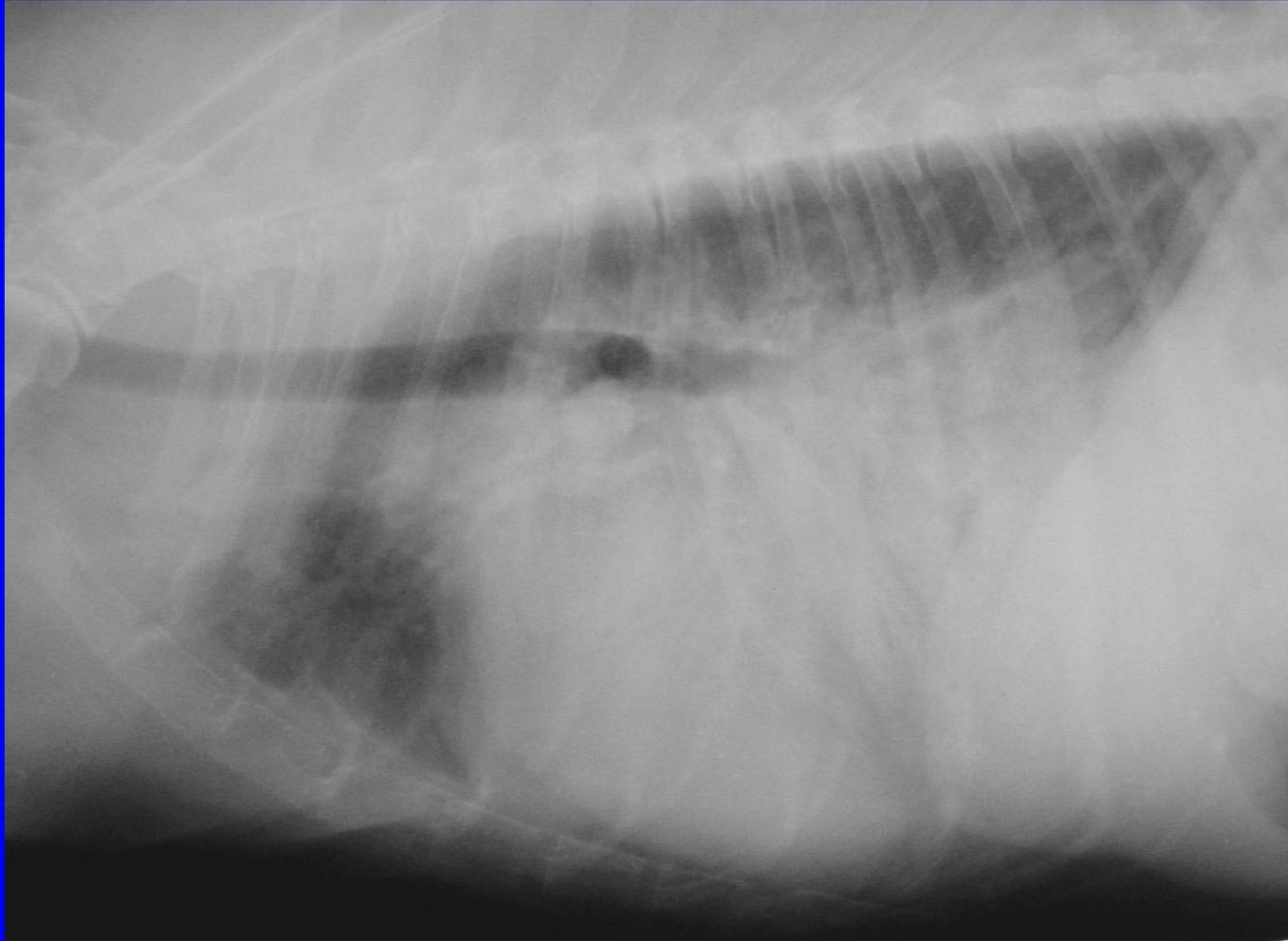
US: mitrale molto iperecogena, ispessita ed irregolare



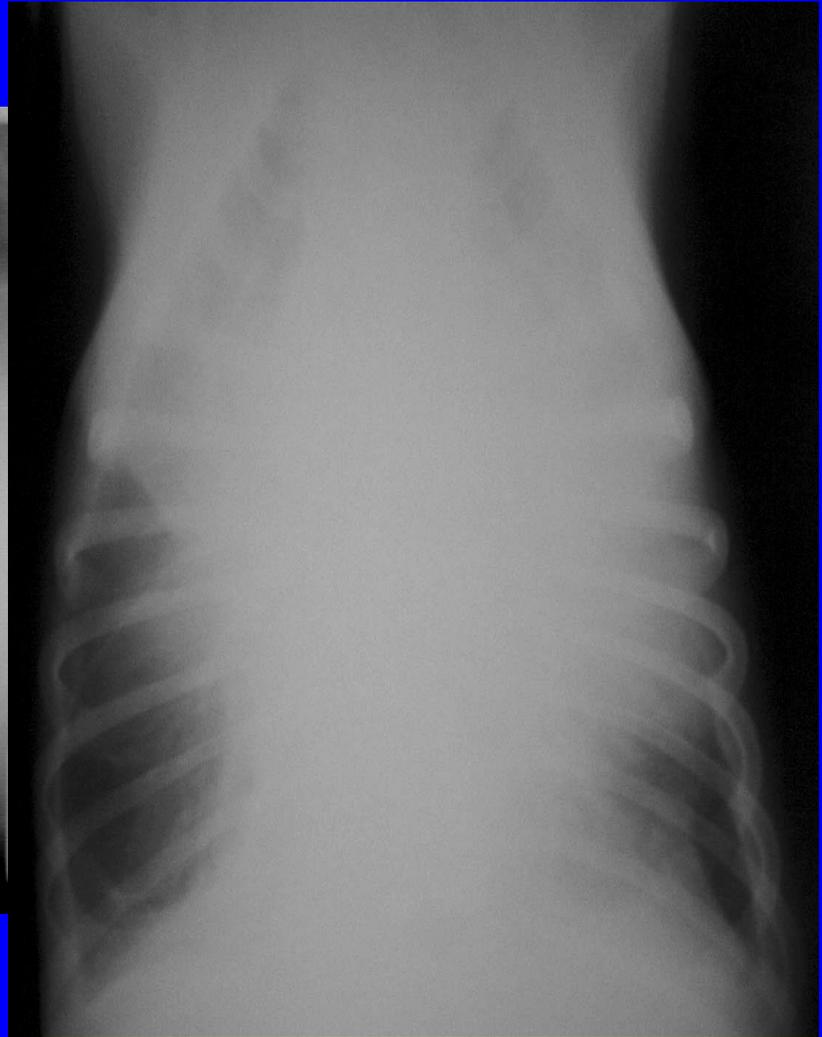


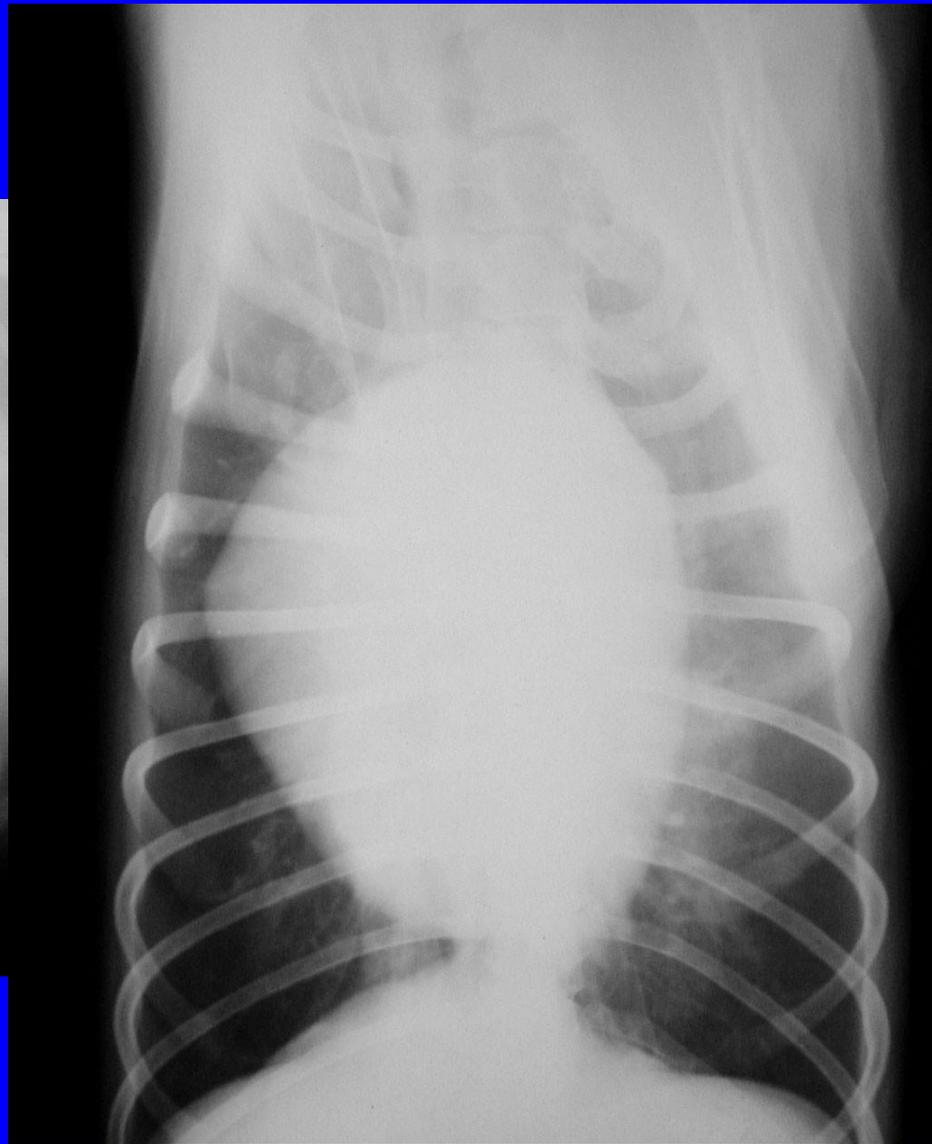
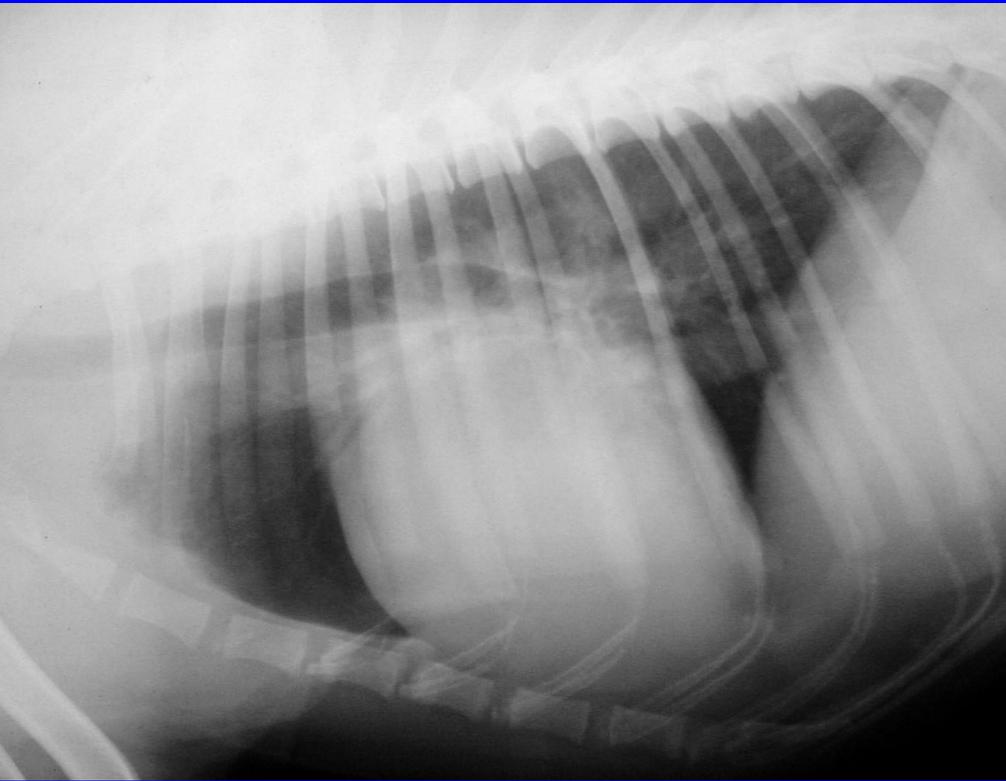




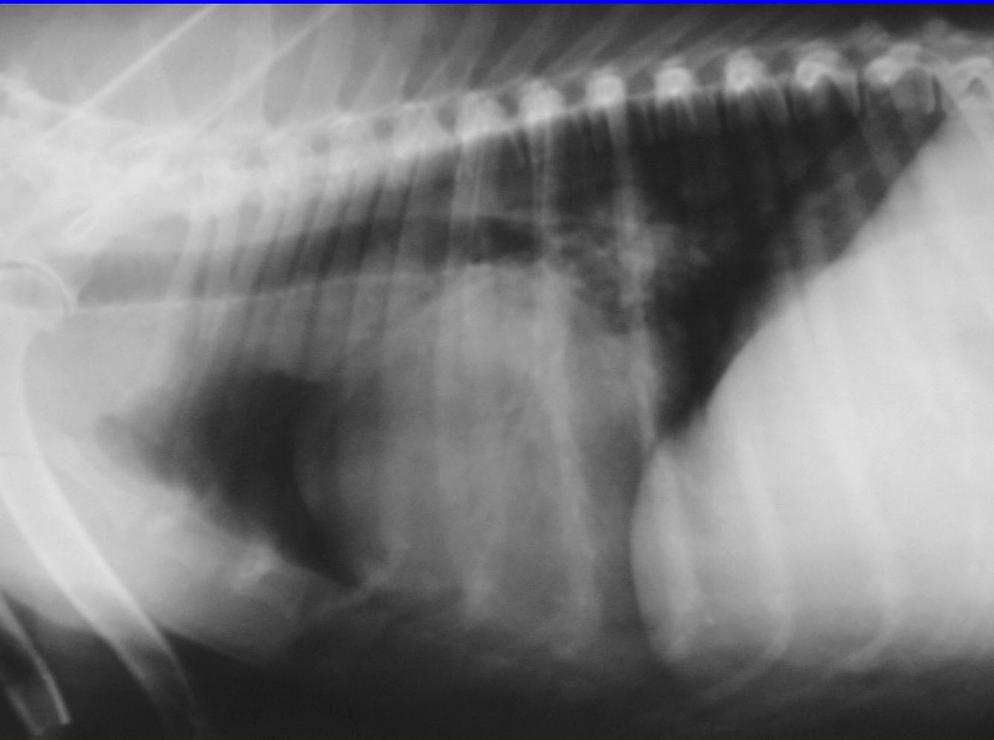


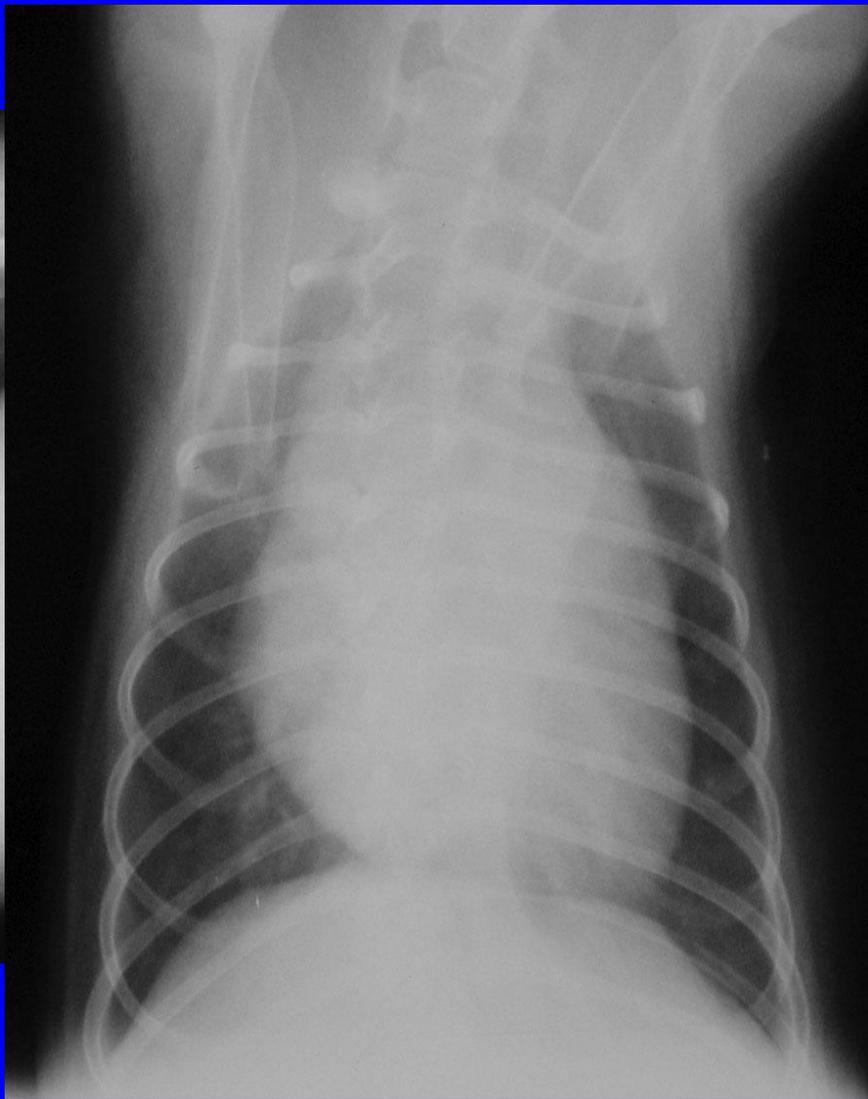
dx

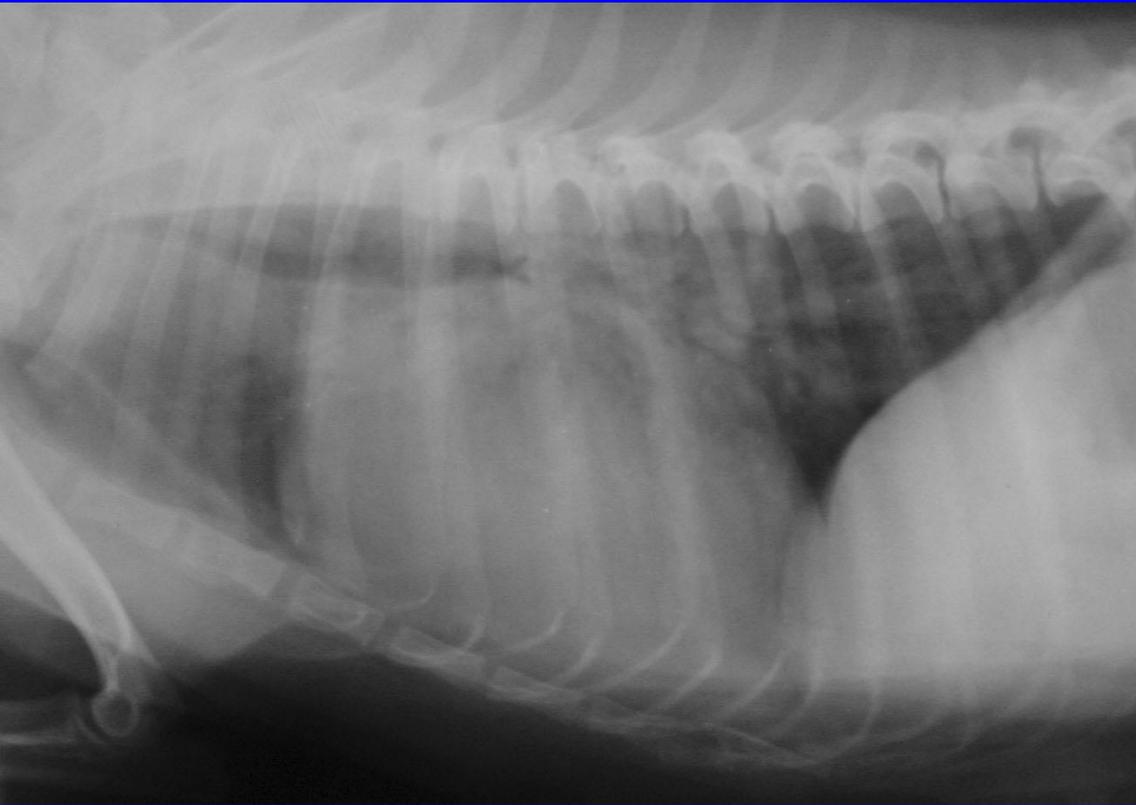




Sn + dx







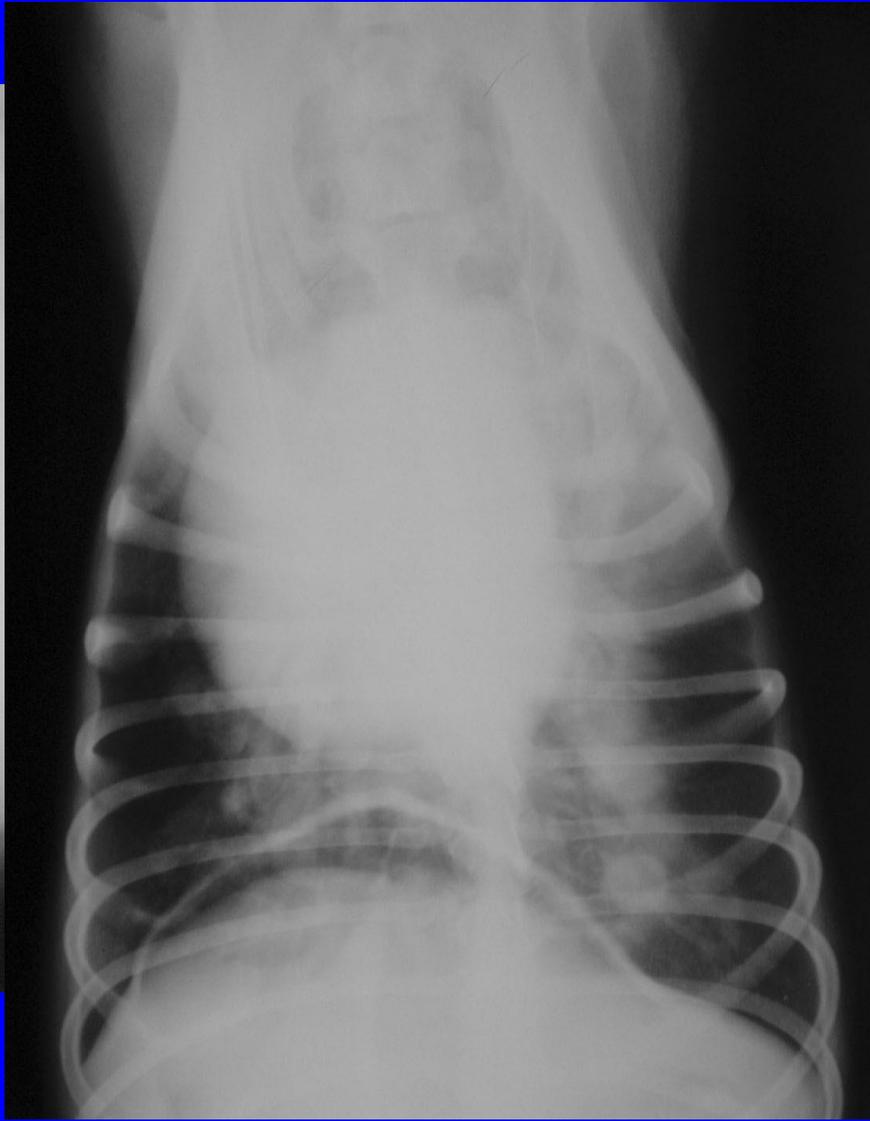
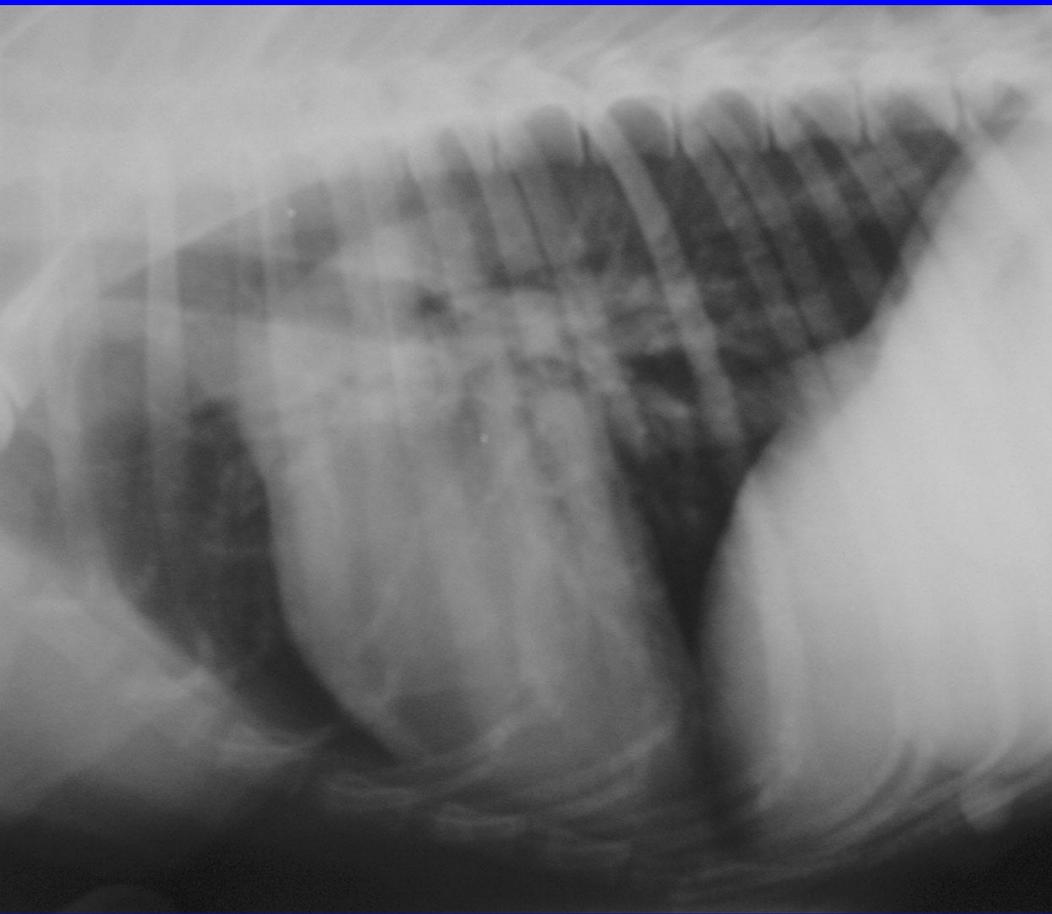
# Dirofilariosi

- Causa più importante di “cor pulmonale” nel cane
- Parassiti in PA e ventricolo dx – ostruzione fisica al flusso del sangue – flusso turbolento – danno intima arteriosa – aumenta compromissione flusso laminare – aumenta P polmonare – fibrosi perivascolare

## RX:

- Ipertrofia ventricolo dx (P overload)
- Dilatazione PA in vd (flusso turbolento)
- Arterie polmonari dilatate, tortuose, troncate
- Infiltrato interstiziale-alveolare (allergia o trombosi)
- Scompenso cardiaco dx (vcc, epatomegalia, vers pleurico, ascite)

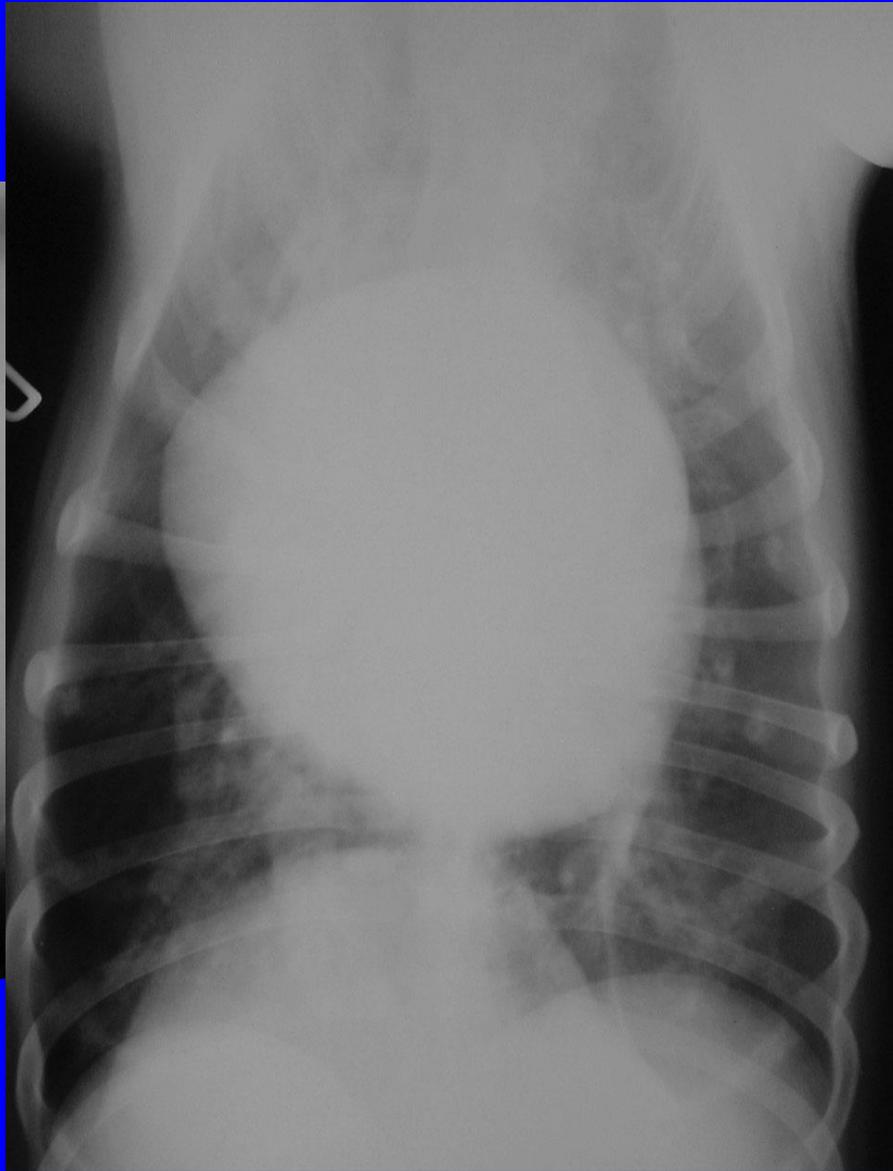
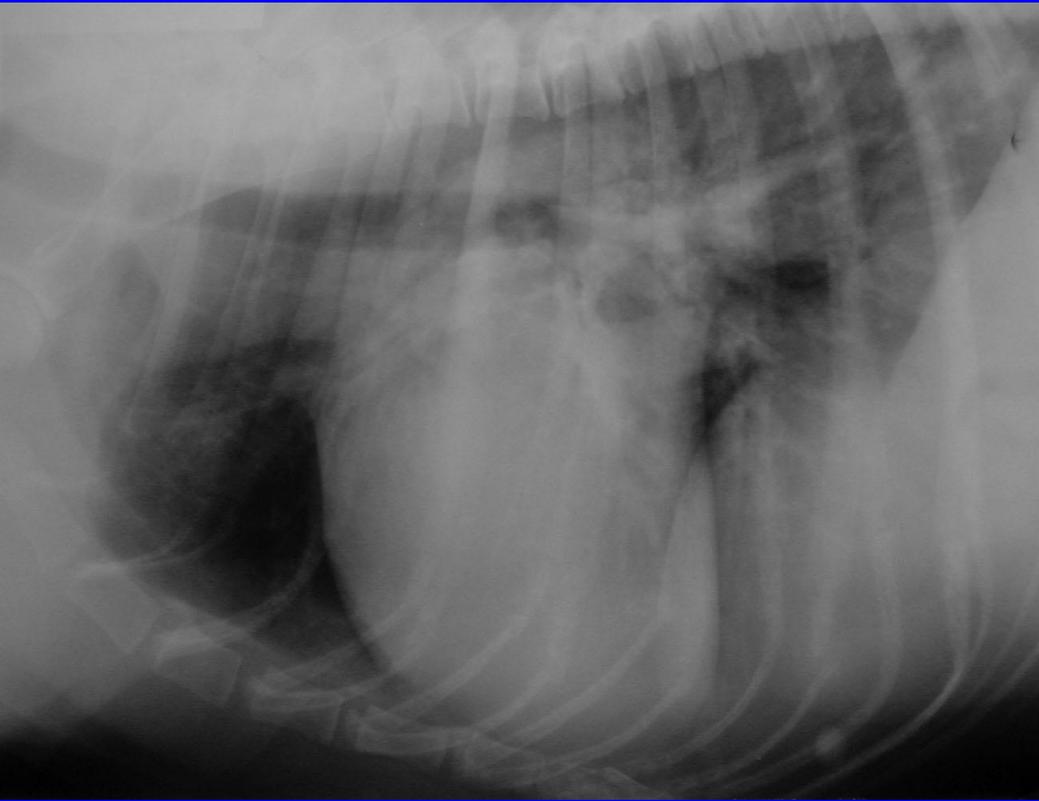
## US



# Cardiomiopatia dilatativa

- Cardiomiopatia primaria
- Anomalo funzionamento miocardio – aumento P atriale e ventricolare – dilatazione atrio-ventricolare (ipertrofia eccentrica) – scompenso cardiaco
- **RX:**
  - Cardiomegalia generalizzata
  - Atrio sn e vv p dilatati
  - Scompenso sn o dx (gatto vers pleurico)

**US**



# Cardiomiopatia ipertrofica

- Frequente nel gatto
- Ipertrofia concentrica – dimin compliance ventricolo sn in diastole – dilatazione atrio sn – scompenso

## RX:

- dilatazione atriale sn (cuore a Valentina)
- Dilatazione vv p
- Edema polmonare e versamento pleurico (gatto)

## US

**DDX:** cardiomiopatia restrittiva; ipertiroidismo

# Cardiomiopatia restrittiva

- Gatto
- Diminuito riempimento ventricolare a causa di rigidità dell'endocardio o pareti – aumenta P di riempimento – congestione polmonare e sistemica

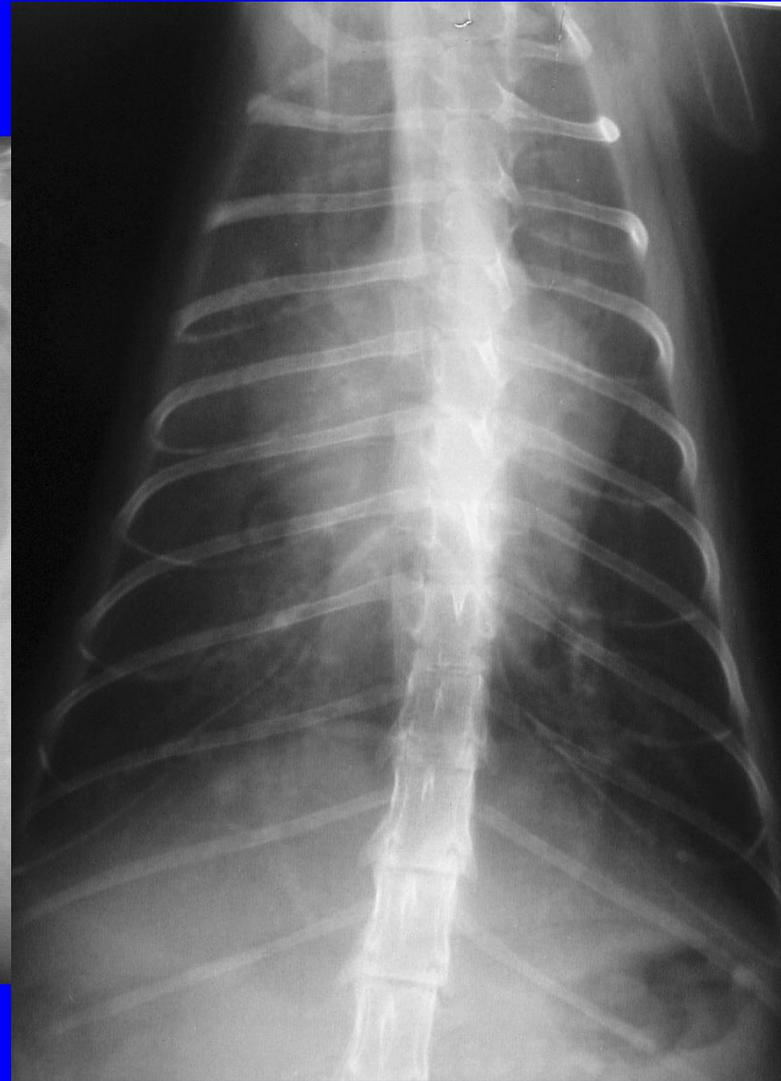
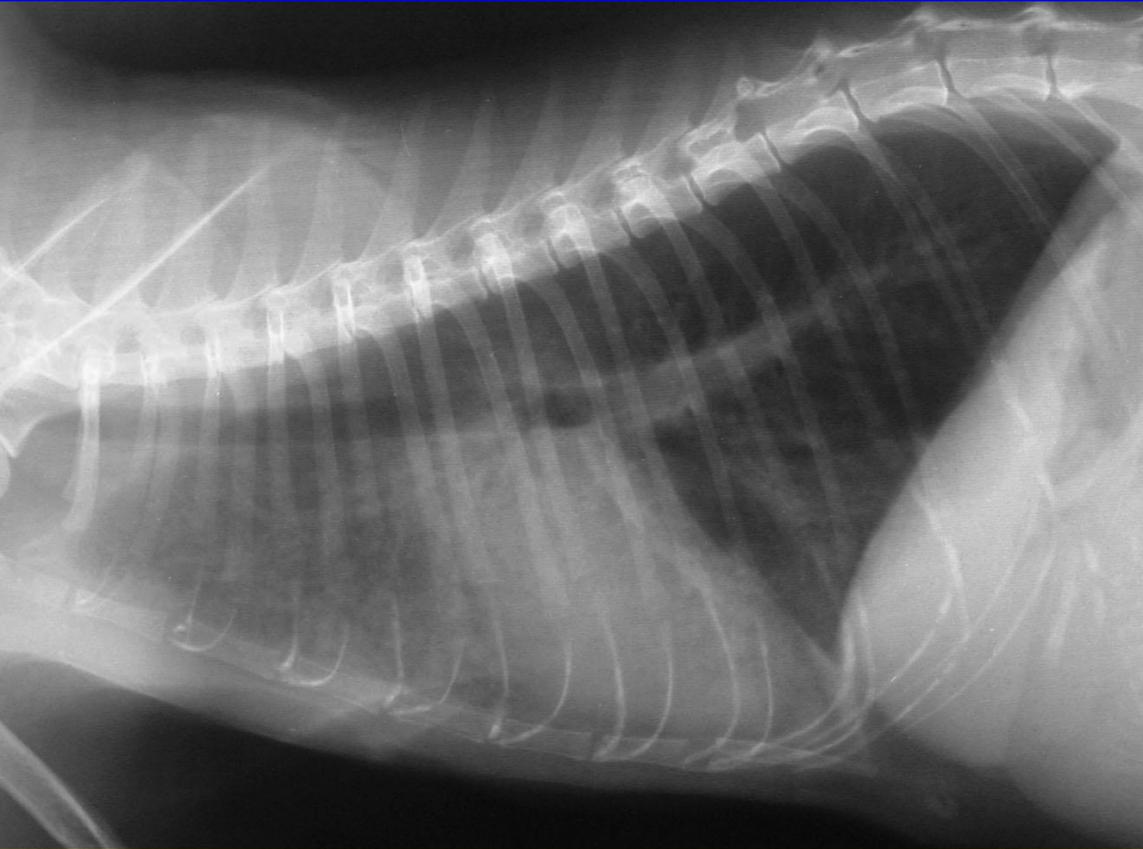
# Iperteroidismo

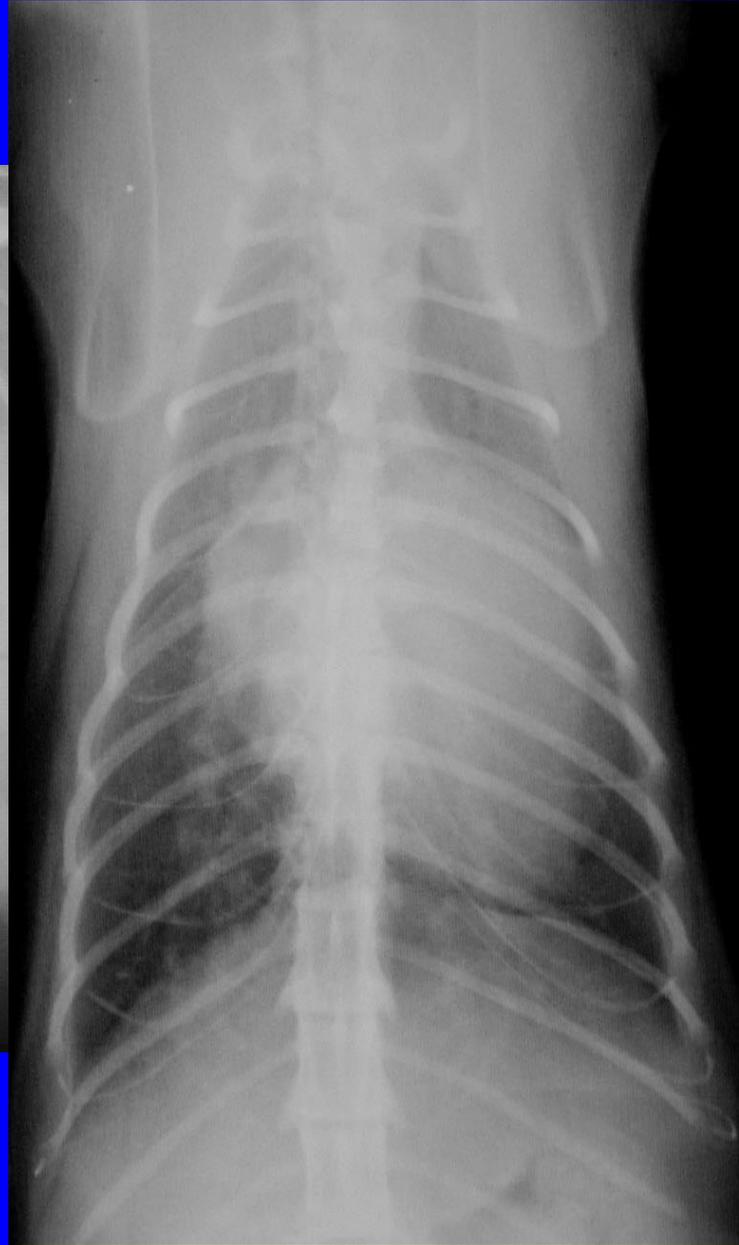
- Gatto > cane
- Vasodilatazione periferica ipermetabolica – stato circolatorio iperdinamico – V overload – ipertrofia ventricolo sn – CHF
- T3-T4 hanno anche effetto diretto sul miocardio

## RX:

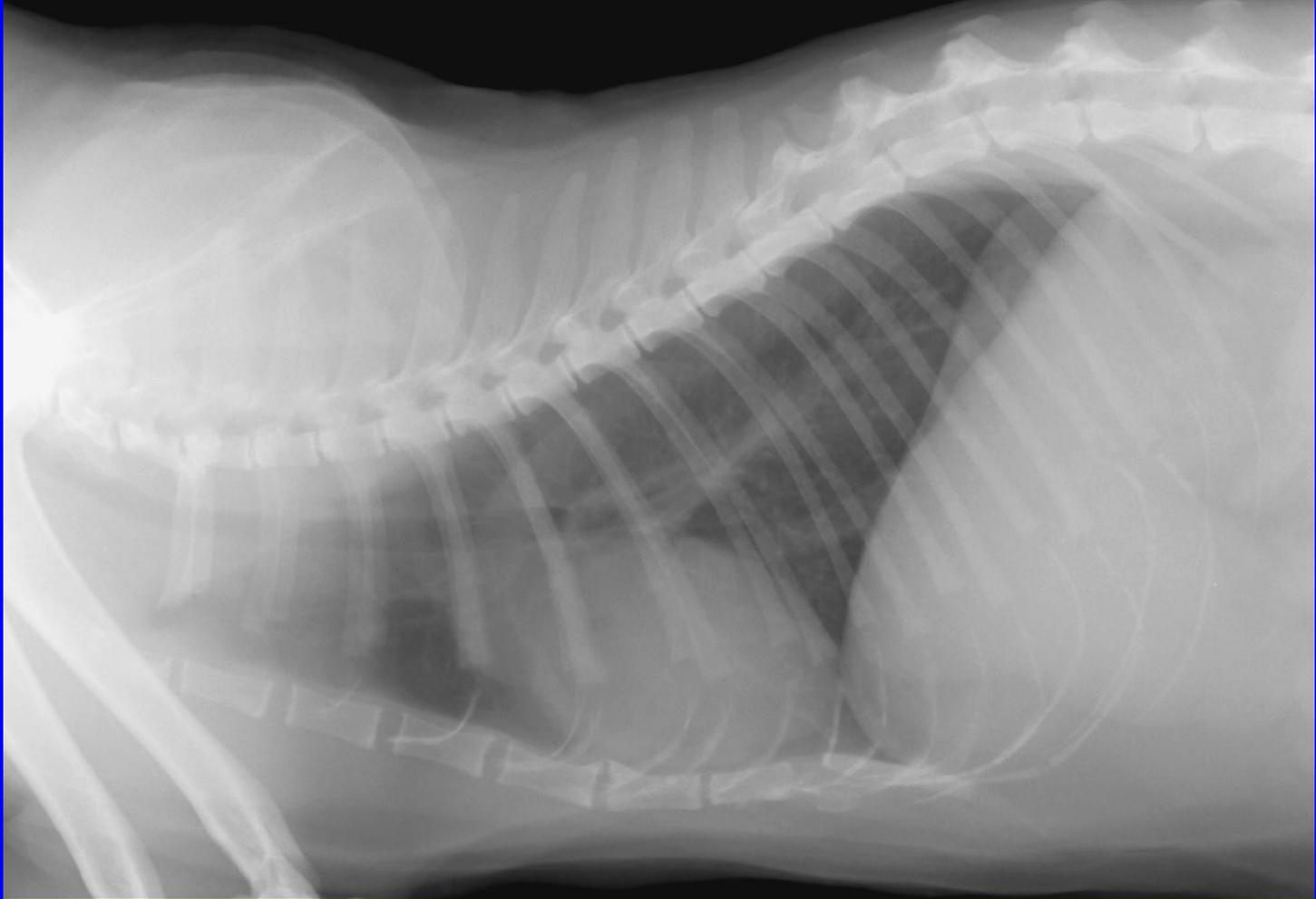
- Come HCM
- Iperperfusione polmonare

## US





ganzi

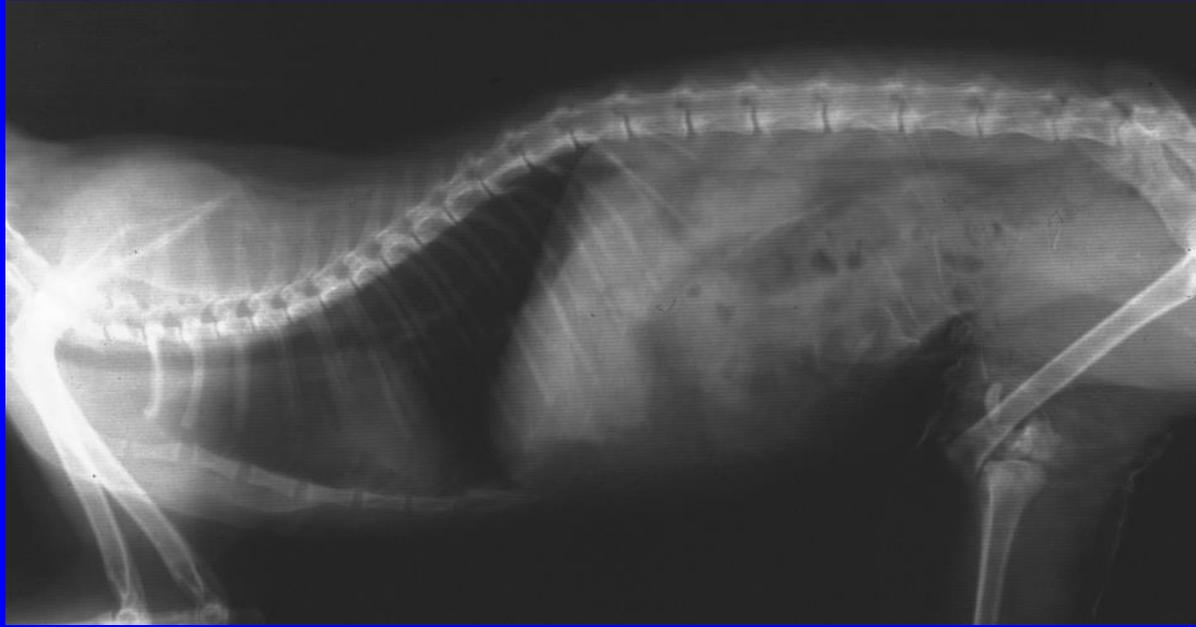


# Microcardia

- Cause:
- Ipovolemia
- Addison
- Atrofia da disuso (squilibrio elettrolitico)

## RX:

- Cuore diminuito di dimensioni
- Campi polmonari ampi
- Polmone ipertrasparente



# Patologie del pericardio

- Versamento pericardio – aumenta P pericardio – aum P diastole ( $>$  atrio dx) – diminuito riempimento ventricolare – tamponamento – scompenso cardiaco
- Cause versamento: idiopatico, neoplasia, FIP, linfosarcoma nel gatto, scompenso dx, ecc..
- **RX:**
- Aumento della silhouette cardiaca (rotonda)
- Scompenso cardiaco sn o dx

**US + aspirazione (attenzione se emang atrio dx)**

Citologia poco sensibile

**pH liquido:**

- se  $<$  7.0 – infiammatorio-benigno

- se  $>$  7.0 – non infiammatorio-maligno

# Patologie del pericardio

## Neoplasie:

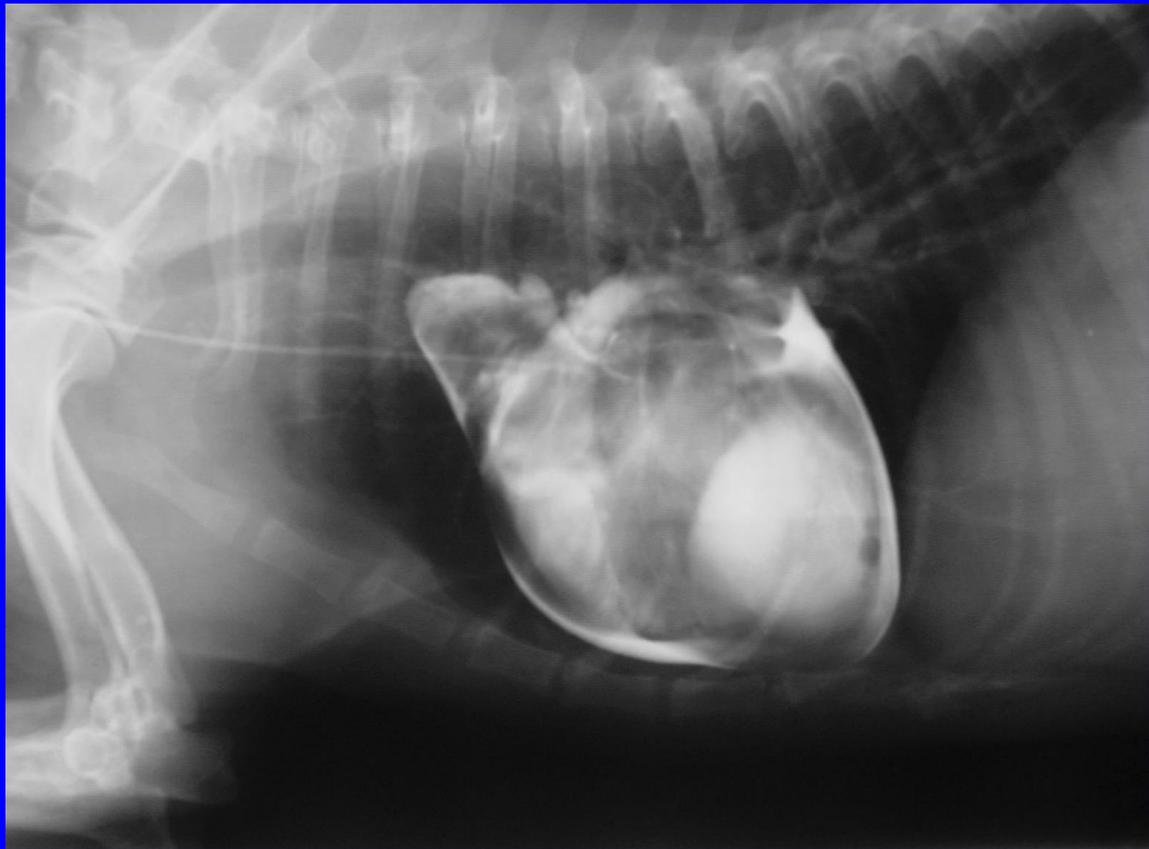
- Emangiosarcoma atrio dx
- Tumori base cuore (chemodectoma; Ca tiroideo ectopico)
- Mixoma
- Mesotelioma

DDx: ascesso; cisti

# Patologie del pericardio

## Pericardite costrittiva

- Pericardio ispessito e fibrotico
- Cattivo riempimento ventricolare dx
- Tamponamento cardiaco con o senza versamento pleurico



# Cardiomegalia DD

## Generalizzata

- Cani atletici
- Grasso nel mediastino
- Sovraccarico di liquidi
- Bradicardia
- Anemia cronica
- End-stage, scompenso sn per insuff valvolare
- Condizioni congenite
- Cardiomiopatia dilatativa idiopatica
- Cardiomiopatia ipertrofica, restrittiva, ipertiroidismo
- Fibroelastosi
- Deficienza nutrizionale (carnitina, taurina)
- Tossici (doxorubicina)
- Acromegalia nel gatto
- Patologie da accumulo (glicogeno, lipidosi)
- Neoplasia
- Miocardite
- Patologie immunomediate
- Patologie del pericardio

# Cardiomegalia DD atrio sn

## Sovraccarico di volume (volume overload)

- Insufficienza mitralica (endocardiosi, endocardite batterica, dilatazione annulo atrio-ventricolare in corso di dilatazione ventricolare, displasia mitralica, rottura mm papillari)
- Disfunzione diastolica del ventricolo sn con raccolta di sangue nell'atrio
- PDA
- VSD
- Difetto aorto-polmonare
- Fibroelastosi (Siamese, Burmese)

# Cardiomegalia DD atrio sn

- Sovraccarico pressorico (pressure overload)
- Ipertrofia ventricolare che determina insuff mitralica (stenosi aortica, cardiomiopatia ipertrofica)
- Stenosi valvolare congenita
- Neoplasia atriale o ventricolare che interferisce sul flusso transvalvolare

# Cardiomegalia DD ventricolo sn

## Volume overload

- Insuff mitralica
- Insuff aortica
- PDA
- VSD
- Difetto del cuscono endocardiale (canale atrioventricolare persistente)

# Cardiomegalia DD ventricolo sn

## Pressure overload

- Stenosi aortica
- Ipertensione sistemica
- Cardiomiopatia ipetrofica
- Coartazione (restringimento) dell'aorta

# Cardiomegalia DD atrio dx

## Volume overload

- **Insuff tricuspide** (endocardiosi, displasia, dilatazione annulo atrioventricolare per dilatazione ventricolo dx, anomalia di Ebstein-anomalia valvolare con inserzione spostata distalmente nel ventricolo dx, endocardite batterica, rottura corde tendinee)
- **ASD**
- **Fistola arteriovenosa nel corpo**

# Cardiomegalia DD atrio dx

## Pressure overload

- Ipertrofia ventricolo dx (stenosi polmonare, tetralogia di Fallot)
- Neoplasia atriale o ventricolare con interferenza sul flusso transvalvolare
- Cor pulmonale (dirofilariasi)
- Stenosi congenita tricuspide

# Cardiomegalia DD ventricolo dx

## Volume overload

- Insuff tricuspide
- Insuff polmonare
- VSD
- ASD
- Difetto del cuscino endocardiale (canale atrioventricolare persistente) (> gatto)
- Fistola arteriovenosa nel corpo

# Cardiomegalia DD ventricolo dx

## Pressure overload

### Secondario a scompenso sn

- Stenosi polmonare
- Ipertensione polmonare-cor pulmonale (dirofilariasi, angiostrongilosi, grave patologia polmonare es. COPD o tromboembolismo)
- Sindrome di Eisenmenger (ipertensione polmonare con shunt dx-sn-----cianosi!)
- Difetti combinati (es Fallot)
- Arteria coronaria dx singola----stenosi polmonare costrittiva secondaria

# Tromboembolismo

- Nel cane associato a dirofilariosi – arterie polmonari
- Nel gatto associato a cardiomiopatia ipertrofica – aorta
- Sindrome da ipercoagulabilità
- RX torace:
- Ipertrasparenza campi polmonari
- Pattern alveolare dopo 24 ore (> lobi caudodorsali)

CUF1A

