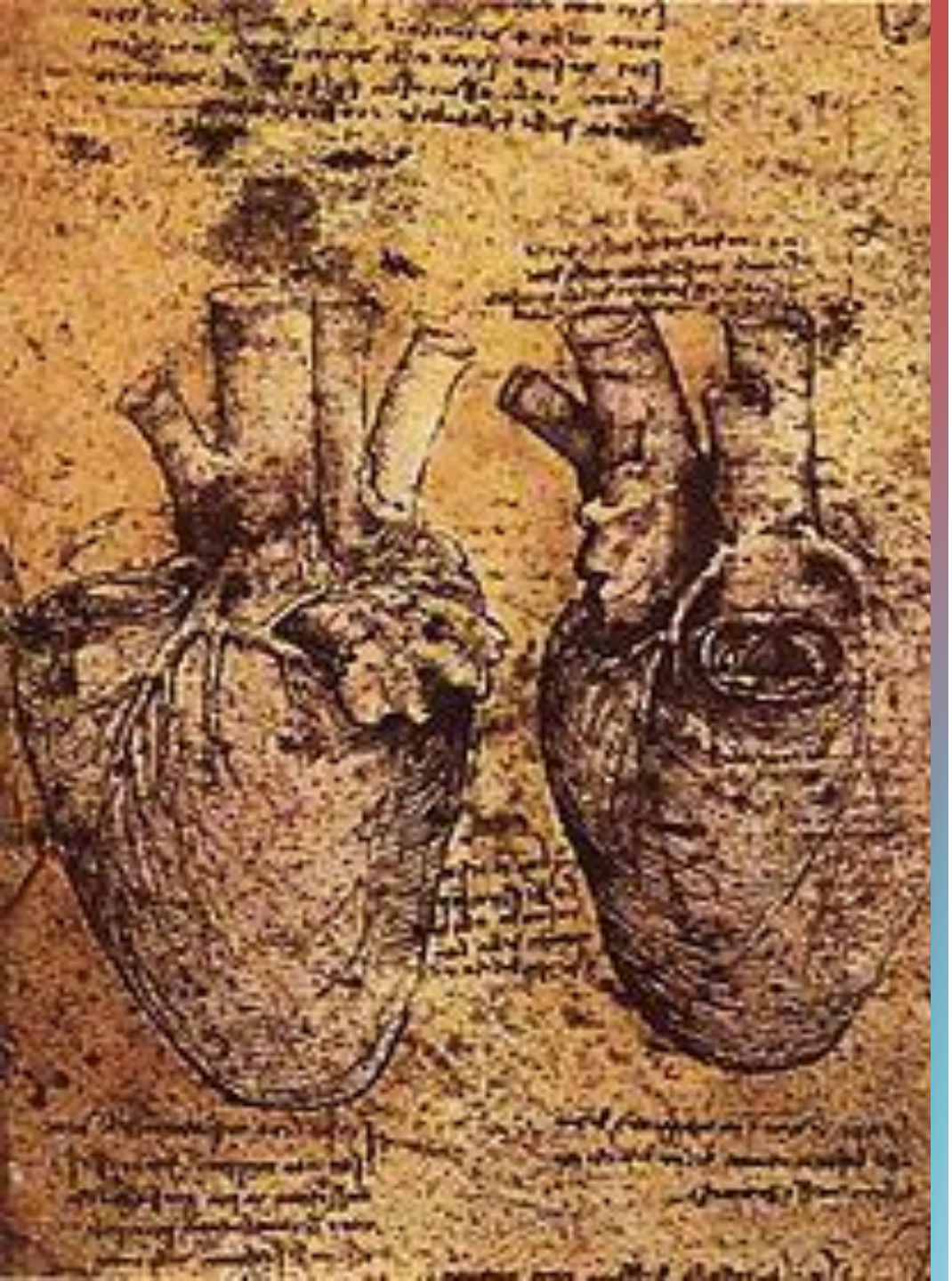


CUORE

The three primary functions of the cardiovascular system are to maintain

1) normal blood pressure and

2) normal cardiac output, both at a

3) normal venous/capillary pressure

Insufficienza cardiaca

- Si verifica solo con una gravissima malattia cardiaca, dato che il cuore è in grado di compensare molto bene quando la condizione è meno grave.
- Il compenso è in primis in forma di ipertrofia
- Un gruppo di malattie cardiache consiste in insufficiete chiusura delle valvole (eg, mitral regurgitation) e shunts (eg, patent ductus arteriosus, ventricular septal defect).

Insufficienza cardiaca

Therefore,

Heart failure is an inability of the heart to maintain:

- normal venous/capillary pressures,
- cardiac output, and/or
- systemic blood pressure that occurs secondarily to severe, overwhelming cardiac disease.

It is most commonly due to a chronic disease that results in a

- severe decrease in myocardial contractility,
- severe regurgitation or shunting, or
- severe diastolic dysfunction.

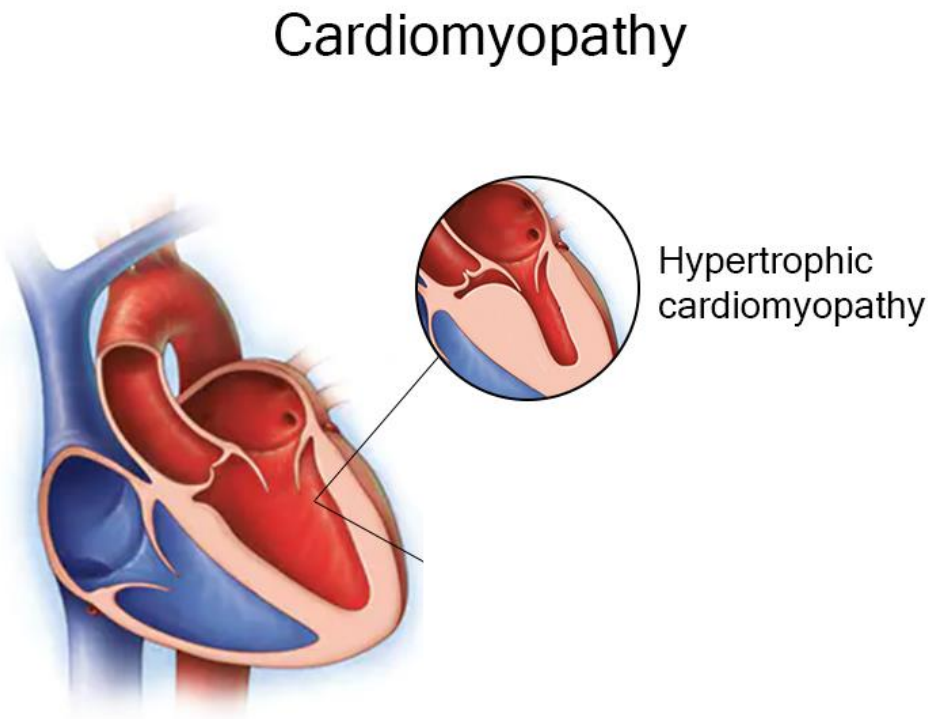
http://tse1.mm.bing.net/th?&id=OIP.Meb9557a63d9894e141a8057fb5ee8df2o0&w=299&h=242&c=0&pid=1.9&rs=0&p=0&r=0

Per compensare queste patologie, i reni trattengono sodio e acqua, per cui c'è un aumento del ritorno venoso al cuore.

L'aumento del ritorno venoso inizialmente aumenta la pressione diastolica che ne causa uno stiramento.

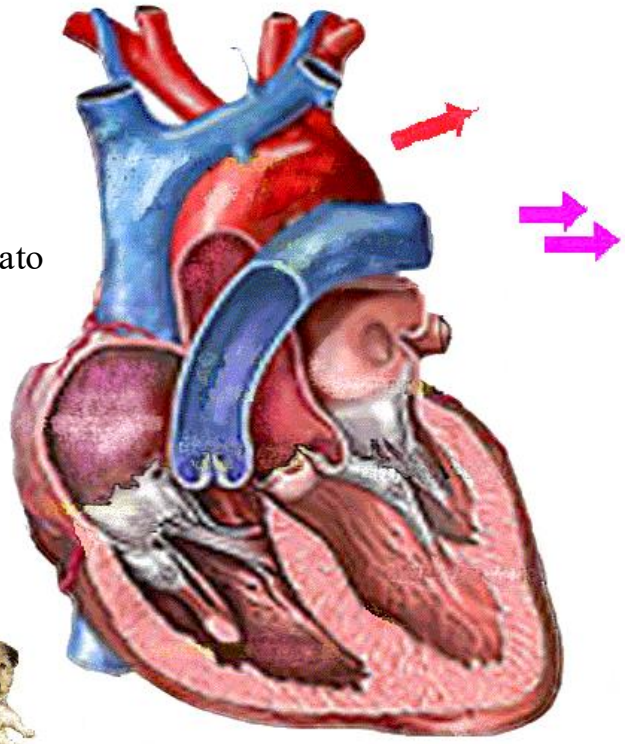
Questo stiramento agisce sulla genetica del miocardio aumentando la produzione di nuovi sarcomeri (elementi contrattili) all'interno dei miociti, aumentandone il volume (ipertrofia)

Con l'aggravarsi della mancata chiusura delle valvole (regurgitation) (mitralica, aortica o tricuspide) i reni trattengono sempre più sodio e acqua e il volume venoso di ritorno al ventricolo continua ad aumentare.



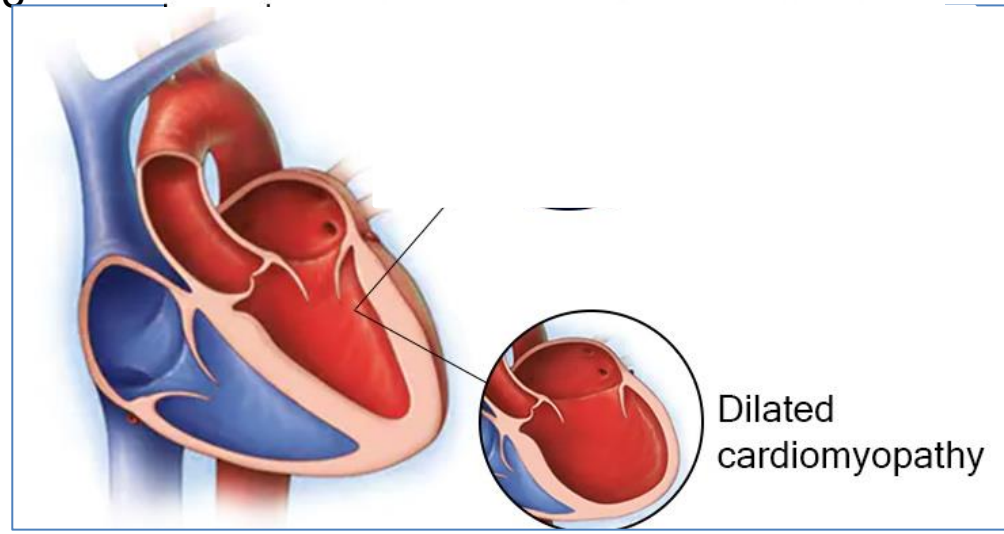
- **Tuttavia la capacità di un ventricolo di aumentare il suo volume è limitata: arrivato ad un certo punto non può più accrescersi**

Cuore leggermente dilatato



- I **reni non possono percepire** il punto e continuano a trattenere sodio e acqua, e il ritorno venoso al ventricolo continua ad aumentare.
- Come conseguenza, la pressione diastolica nel ventricolo continua ad aumentare.

- In diastole le valvole AV sono aperte, perciò un aumento di pressione intraventricolare causa un aumento della pressione nell'atrio, nelle vene e nei capillari del circolo di ritorno.
- L'aumento della pressione nei capillari causa edema edema e versamento, cioè insufficienza cardiaca congestizia (CHF).



Insufficienza cardiaca congestizia,

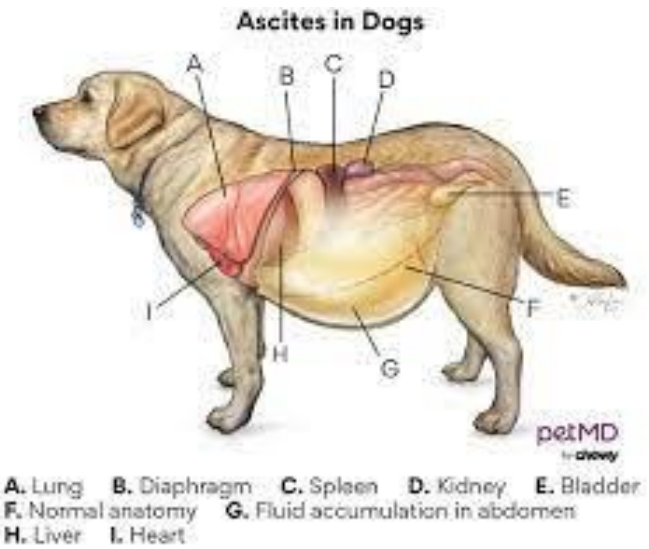
può essere della porzione destra del cuore, di quella sinistra o bilaterale;

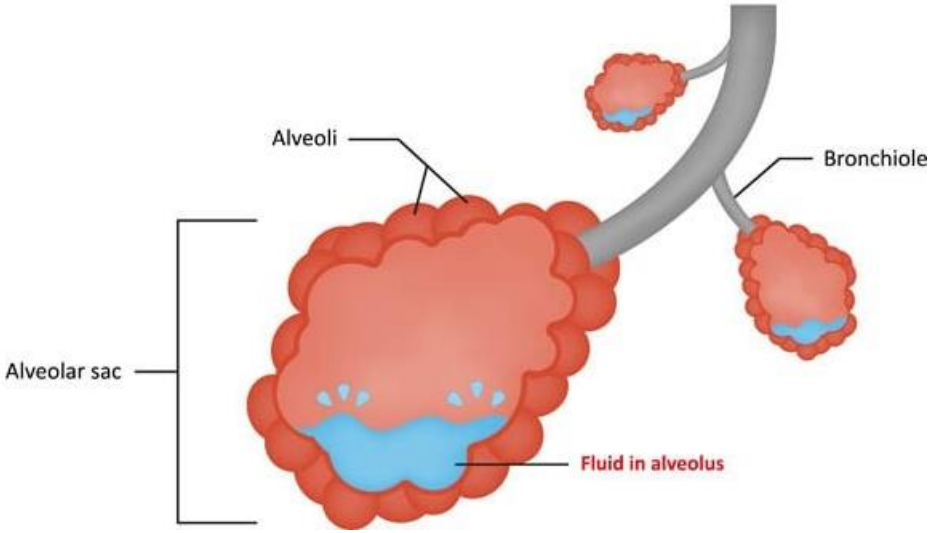
Può insorgere con la dilatazione delle camere e/o ipertrofia cardiaca

- *Right-sided* congestive heart failure is associated with signs of **congestion in the systemic circulation (**i.e., ascites and peripheral edema)

- *left-sided* congestive heart failure causes signs of **congestion in the pulmonary circulation** (i.e., pulmonary edema and dyspnea).

- In small animals, *pleural effusion* is usually associated with bilateral congestive heart failure.



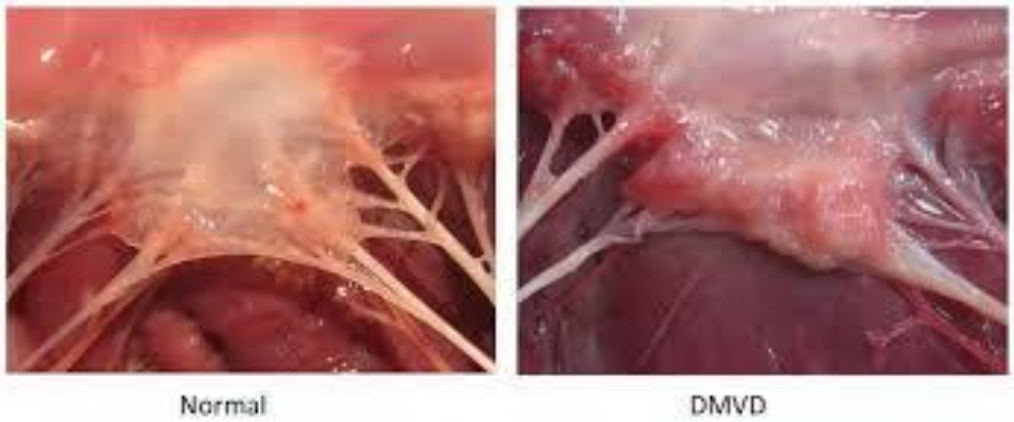


- In ***sistole***, una parte del sangue che dovrebbe essere immesso in aorta, viene rimandato indietro attraversola mitrale dal ventricolo sinistro all'atrio sinistro.

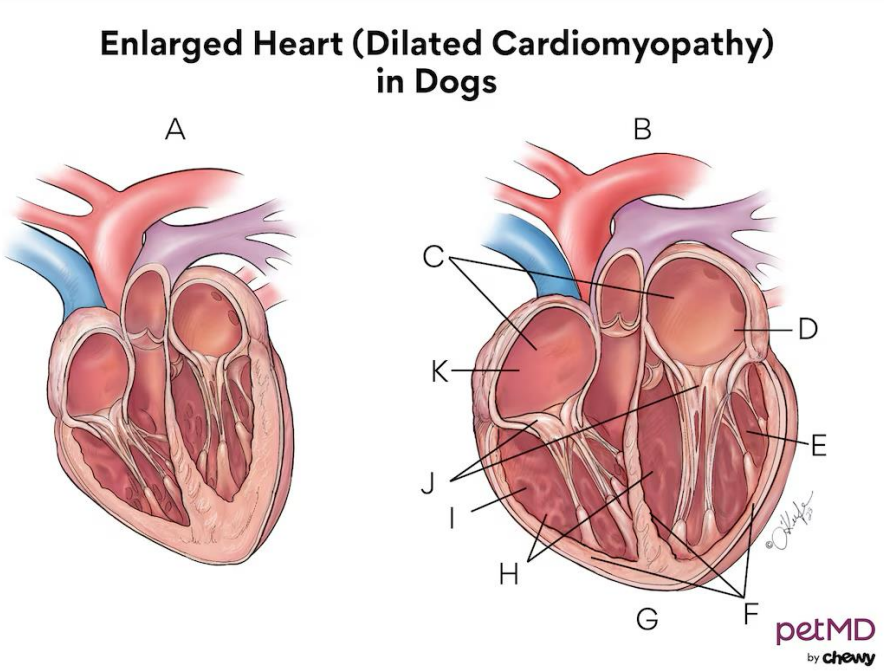
- Quando l'insufficienza è da lieve (< 50% of the blood flow goes backward) a moderata (50%–75% goes backward), il ventricolo sinistro è in grado di compensare aumentando di volume (volume overload) e aumentando il volume sistolico totale espulso.

- Quando l'insufficienza è grave (> 75% backward flow), i meccanismi compensatori possono essere vanificati, causando un aumento della pressione atriale sinistra e quindi edema polmonare.

Systolic Dysfunction
La più commune patologia che altera la sistole è ***l'insufficienza mitralica*** (mitral regurgitation).



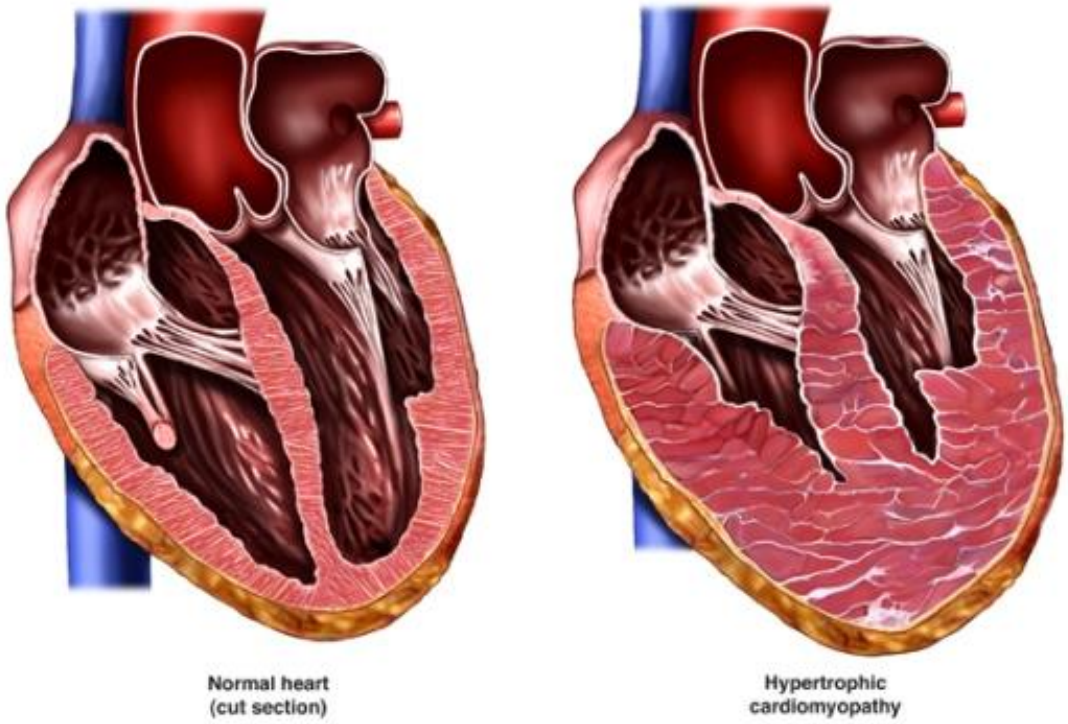
- Un altro esempio di disfunzione sistolica è la ***cardiomiopatia dilatativa (DCM),*** in cui una malattia miocardica provoca una diminuzione della contrattilità miocardica (insufficienza miocardica).
- La diminuzione della contrattilità miocardica provoca un aumento del diametro/volume sistolico della camera ventricolare sinistra (il muscolo è più debole e non riesce a contrarsi completamente durante la sistole).



Diastolic Dysfunction

l'insufficienza cardiaca può riconoscersi anche quale risultante di una inabilità del cuore di espandersi e riempirsi a sufficienza nella diastole –

i.c. **DIASTOLICA** – quest'ultima dovuta a: ipertrofia del ventricolo sinistro,
fibrosi miocardica o pericardite costrittiva.




HMM! I THINK YOU'VE GOT A GRADE 6 OLD LAD!
BOOM
BOOM
BOOM
frazzle
© 2012 FRAZZLED CAT PRODUCTIONS.

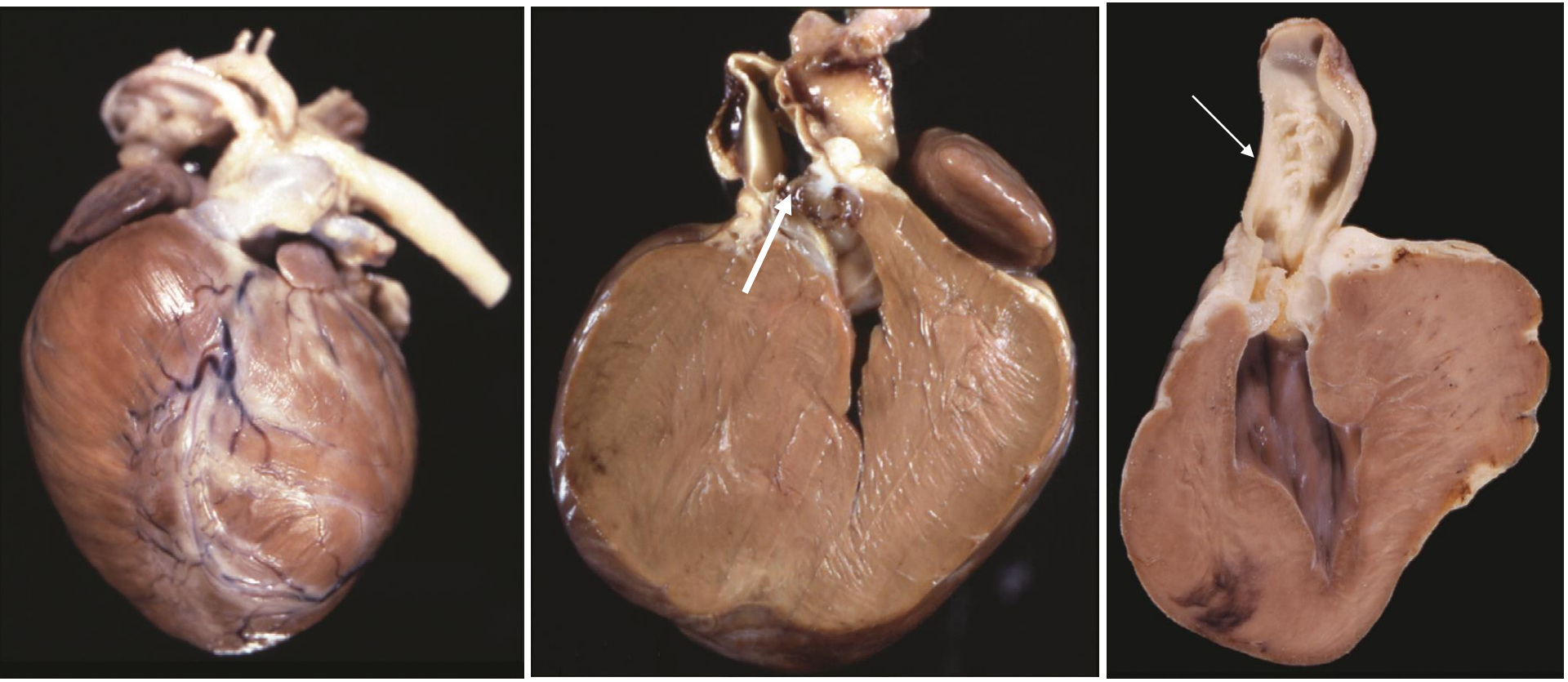
The cardiovascular system is a closed circuit.

Thus, although left-sided and right-sided failure can occur independently, failure of one side (particularly the left) often produces excessive strain on the other, terminating in global heart failure.

Cause di Deficit sistolico

- Ipertrofia cardiaca (es. da stenosi dell'arteria polmonare)
- Miocarditi infettive
- Miocardiopatie tossiche
- Miocardiopatie ischemiche
- Miocardiopatie nutrizionali
- Miocardiopatie endocrine
- Miocardiopatie neoplastiche

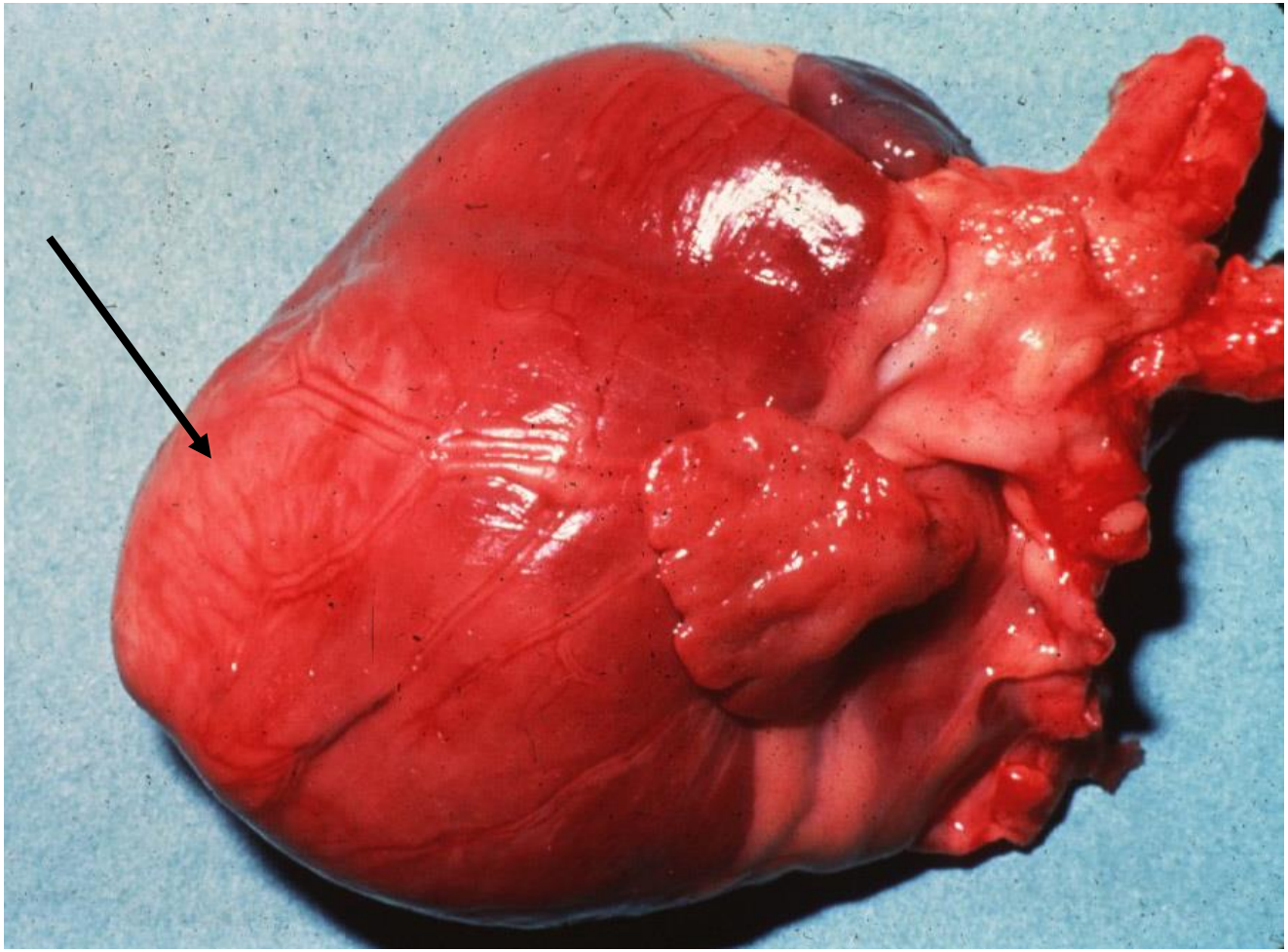
Pulmonic Stenosis, Heart, Pulmonary Artery, Dog. A, Closed heart, and **B,** sectioned heart. Note the prominent concentric right ventricular *(RV)* hypertrophy resulting from **pressure overload**. The orifice of the pulmonic valve *(arrows)* is markedly narrowed. **C,** Sectioned heart, there is poststenotic dilation *(D)* of the pulmonary artery with irregular intimal thickenings
(Courtesy Atlantic Veterinary College, University of Prince Edward Island.)



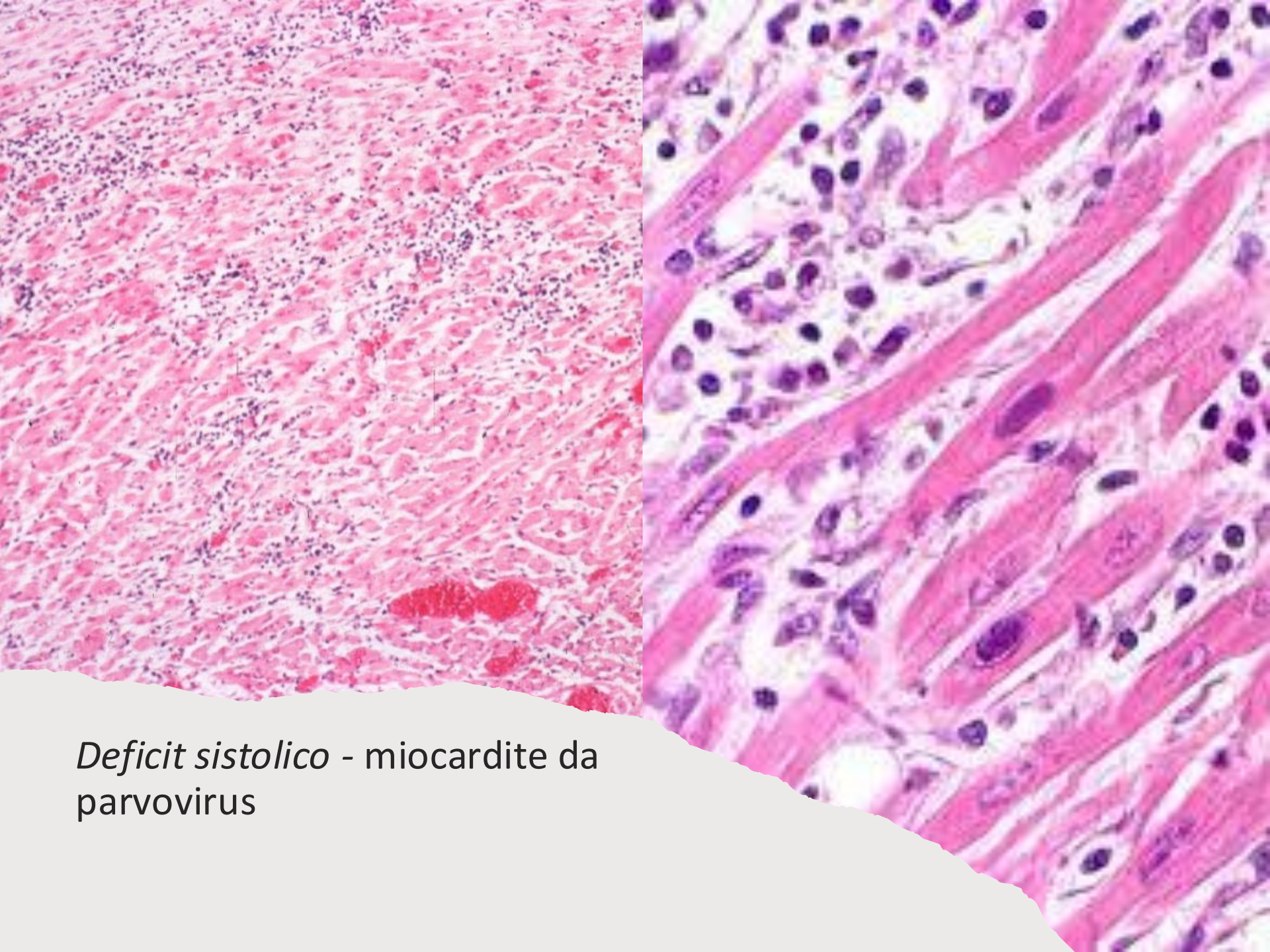
Deficit sistolico

- Miocarditi infettive

parvovirosi



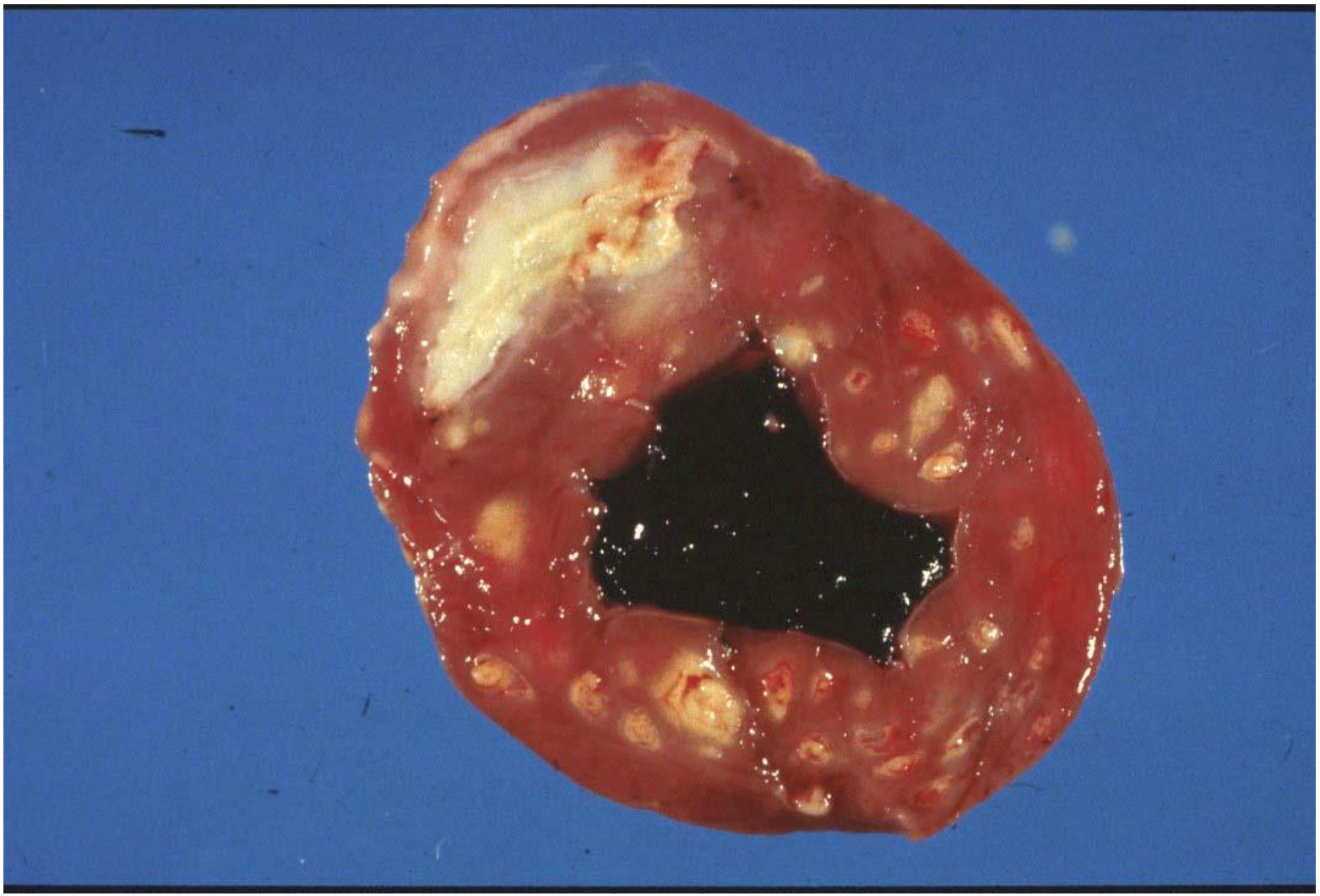
Noah's arkive



Deficit sistolico - miocardite da parvovirus

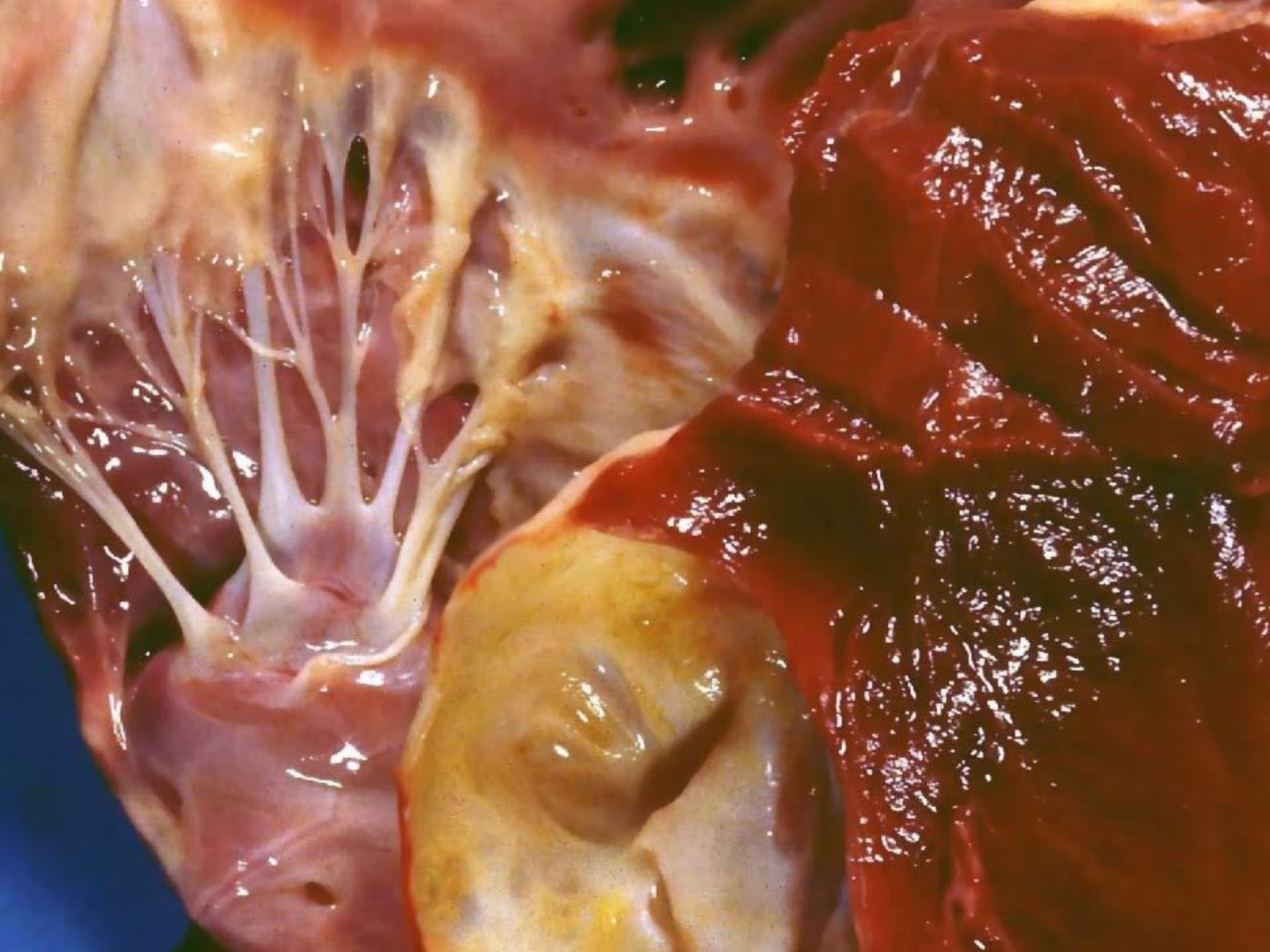
Deficit sistolico

Miocardite infettiva: Stafilococco aureo in ovino

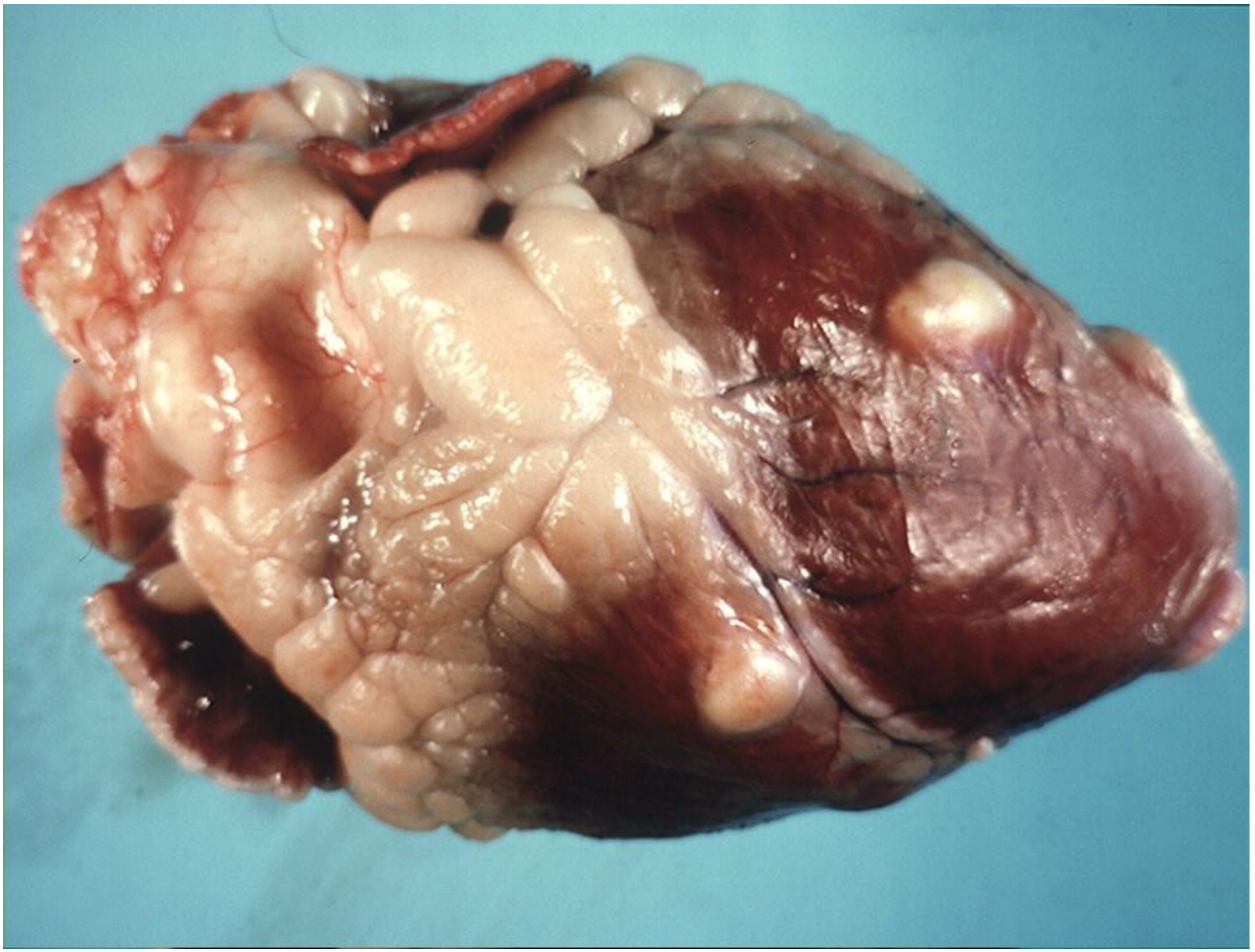


Noah's arkive


gettyimages
Credit: poweroforever



Deficit sistolico - Miocardite da Cysticercus ovis in ovino



Noah's arkive

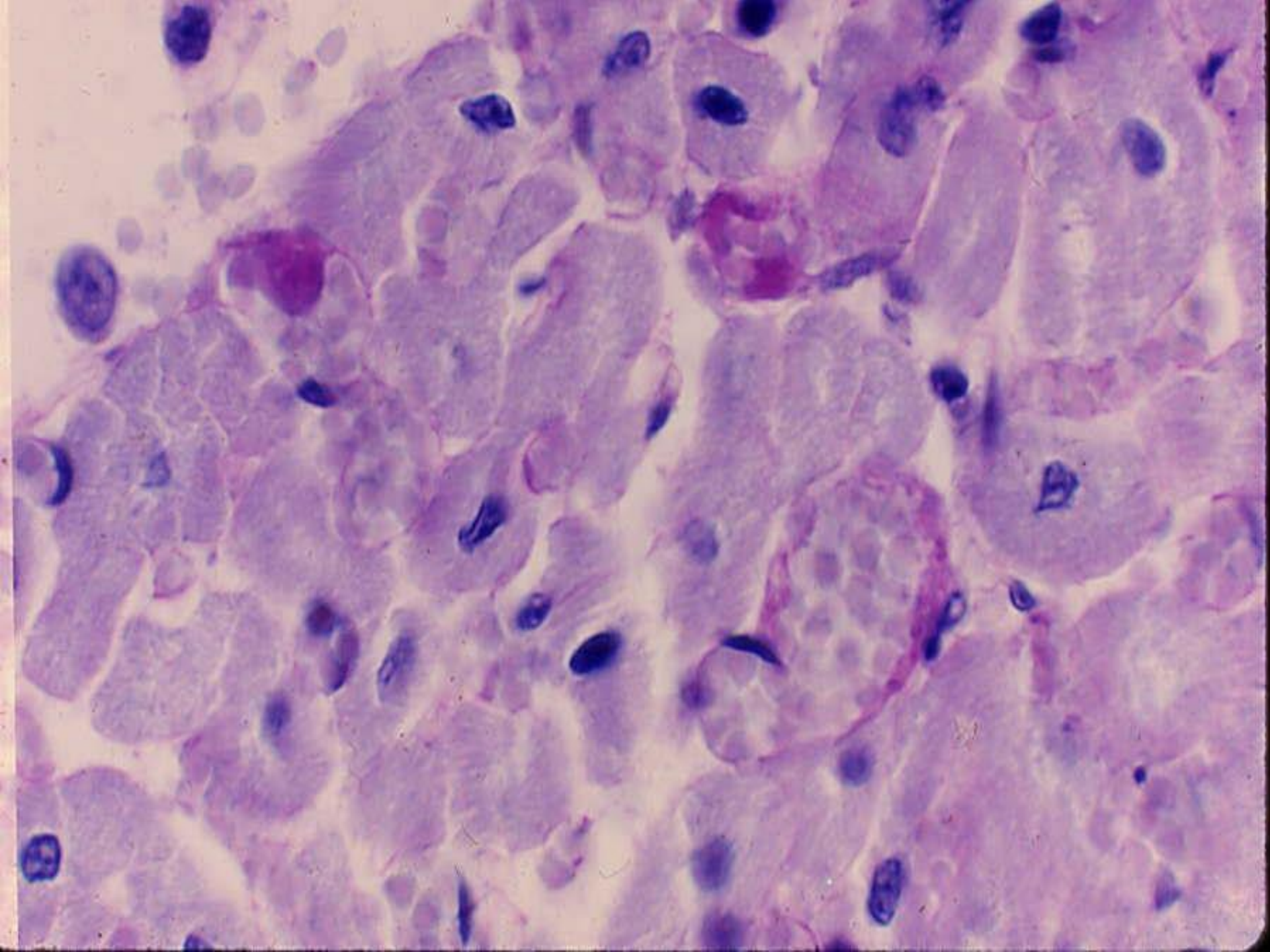
Miocardite micotica da **Aspergillus fumigatus**

Deficit sistolico

Miocardiopatie nutrizionali

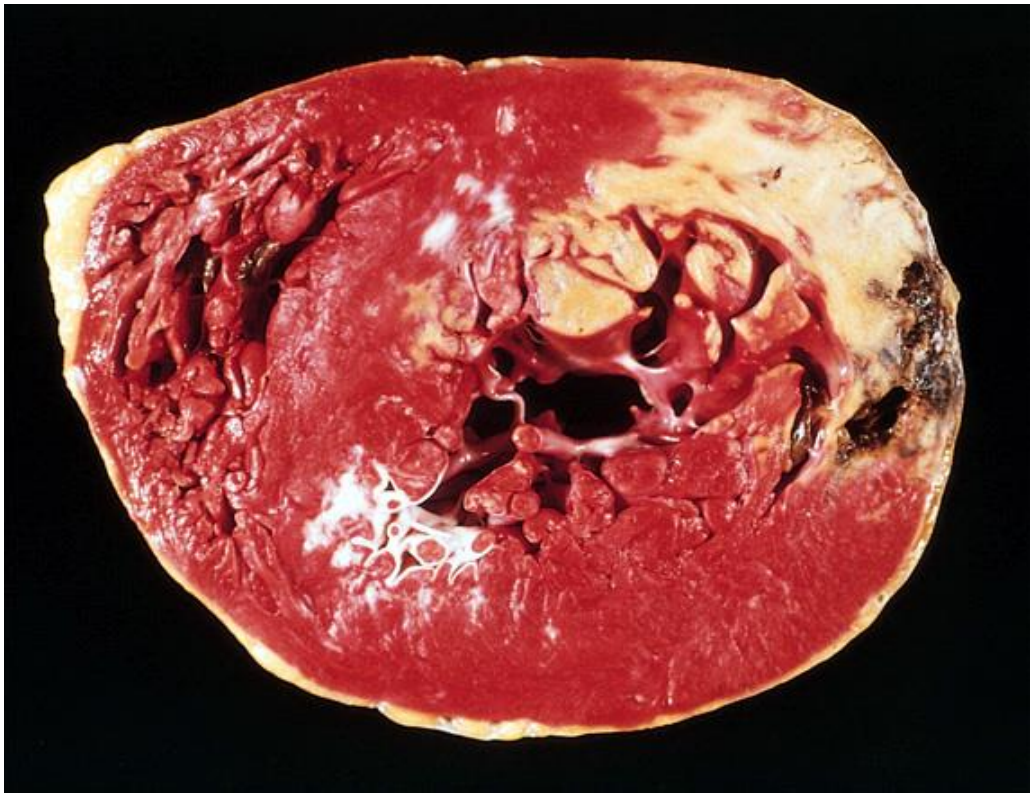
Da carenza di:

- - vit. E e selenio (suino e bovino)
- - deficit di taurina (gatto)
- - deficit di carnitina (cane)

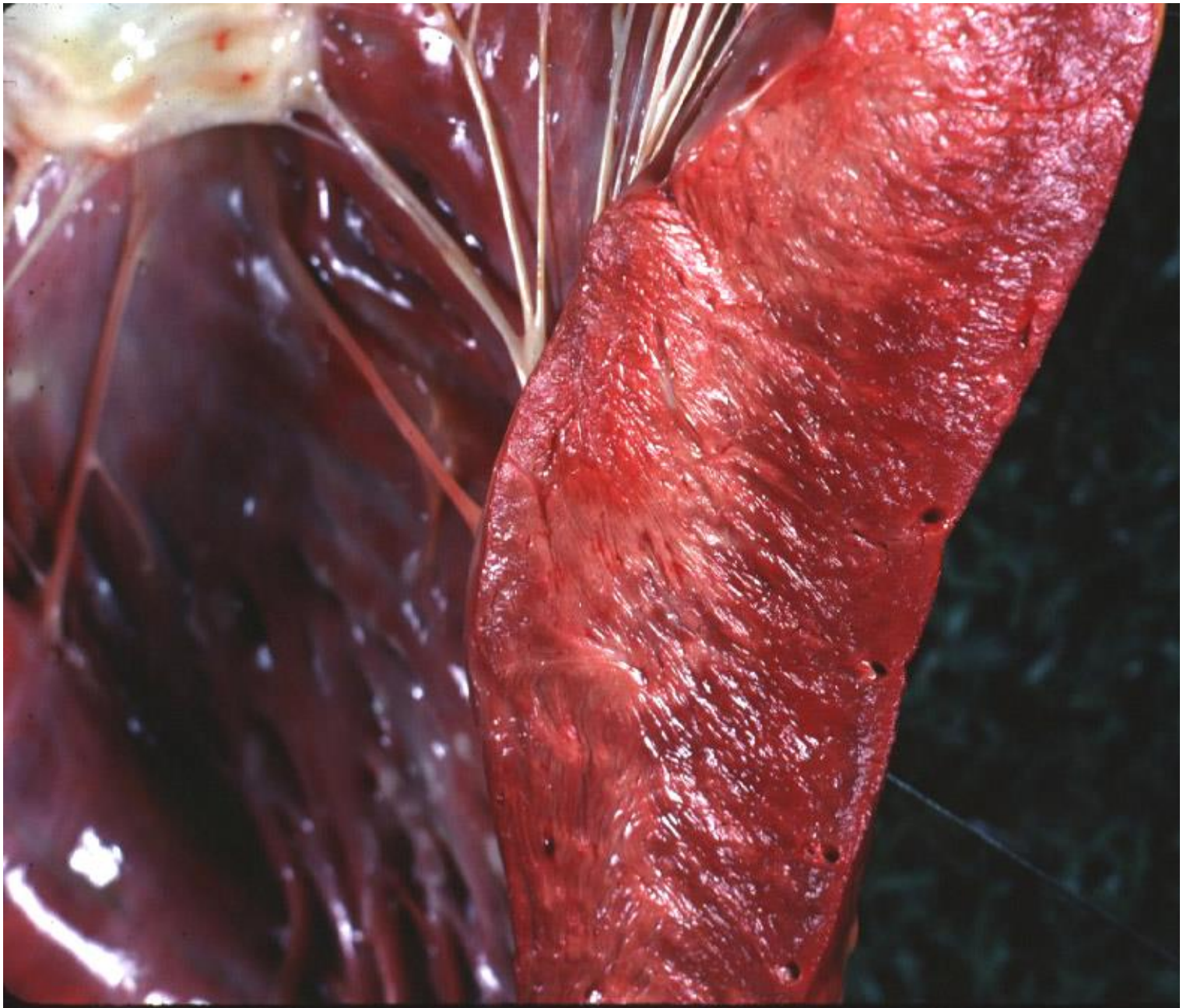


Deficit sistolico

- Miocardiopatie ischemiche



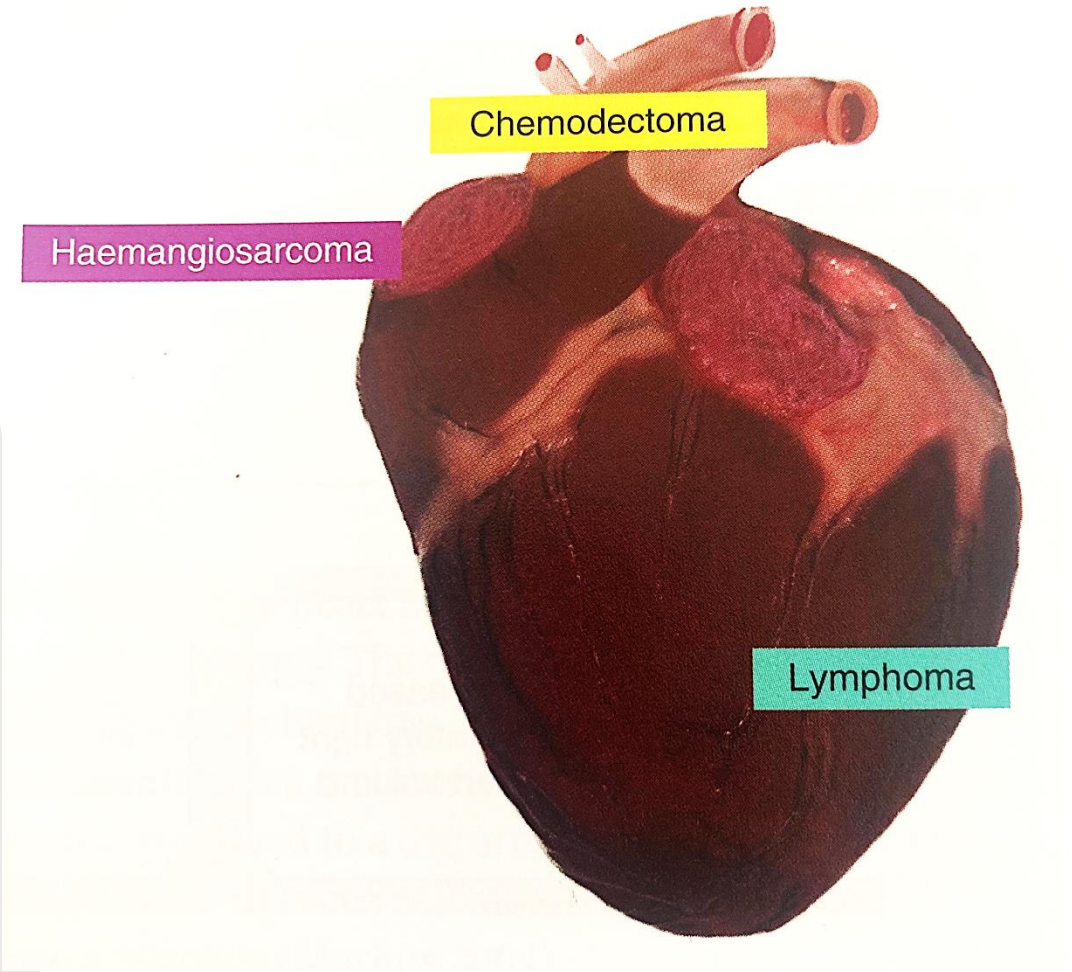
Deficit sistolico Miocardiopatie tossiche (Monensin)

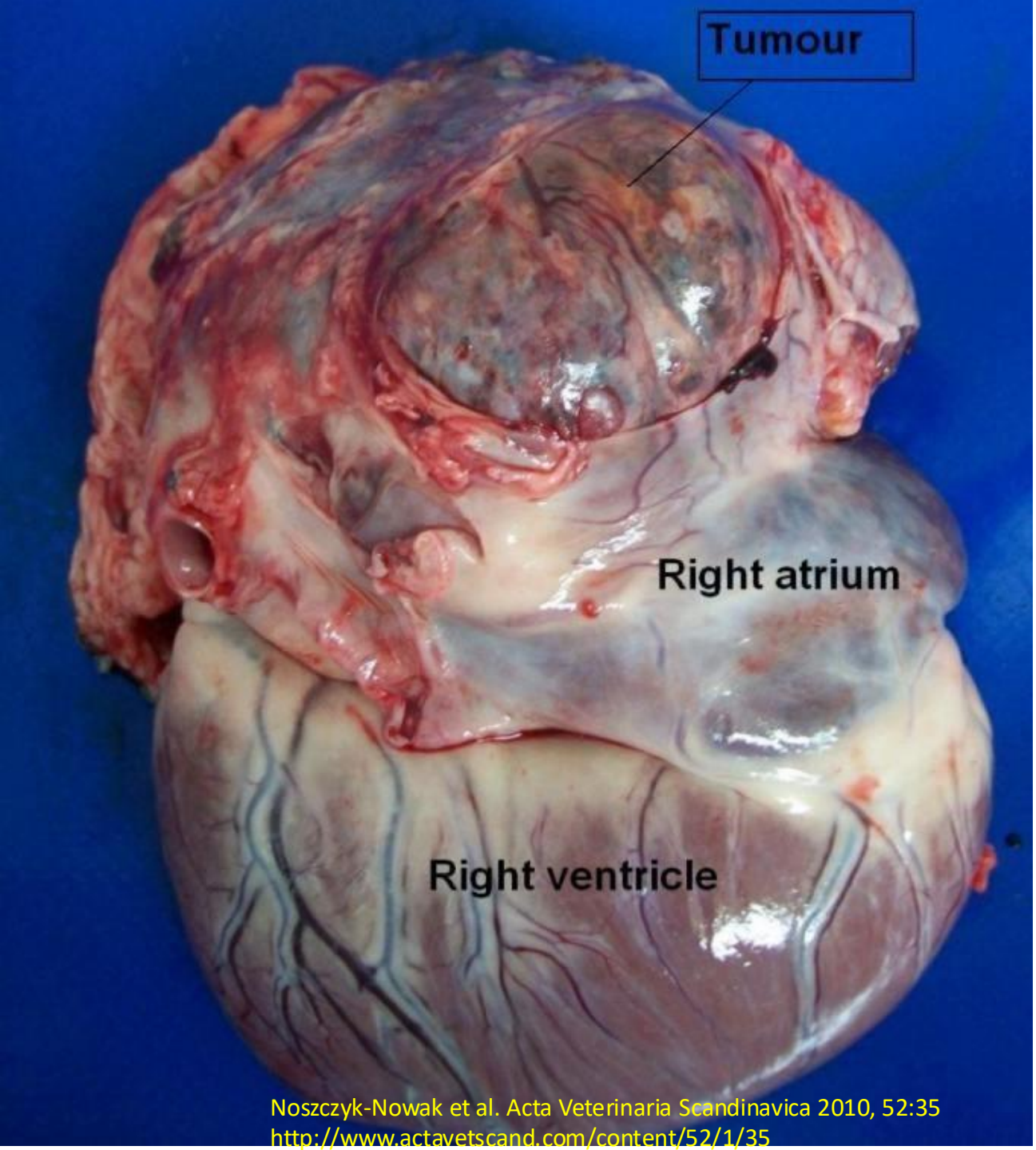


Noah's arkive

I tumori nel cane

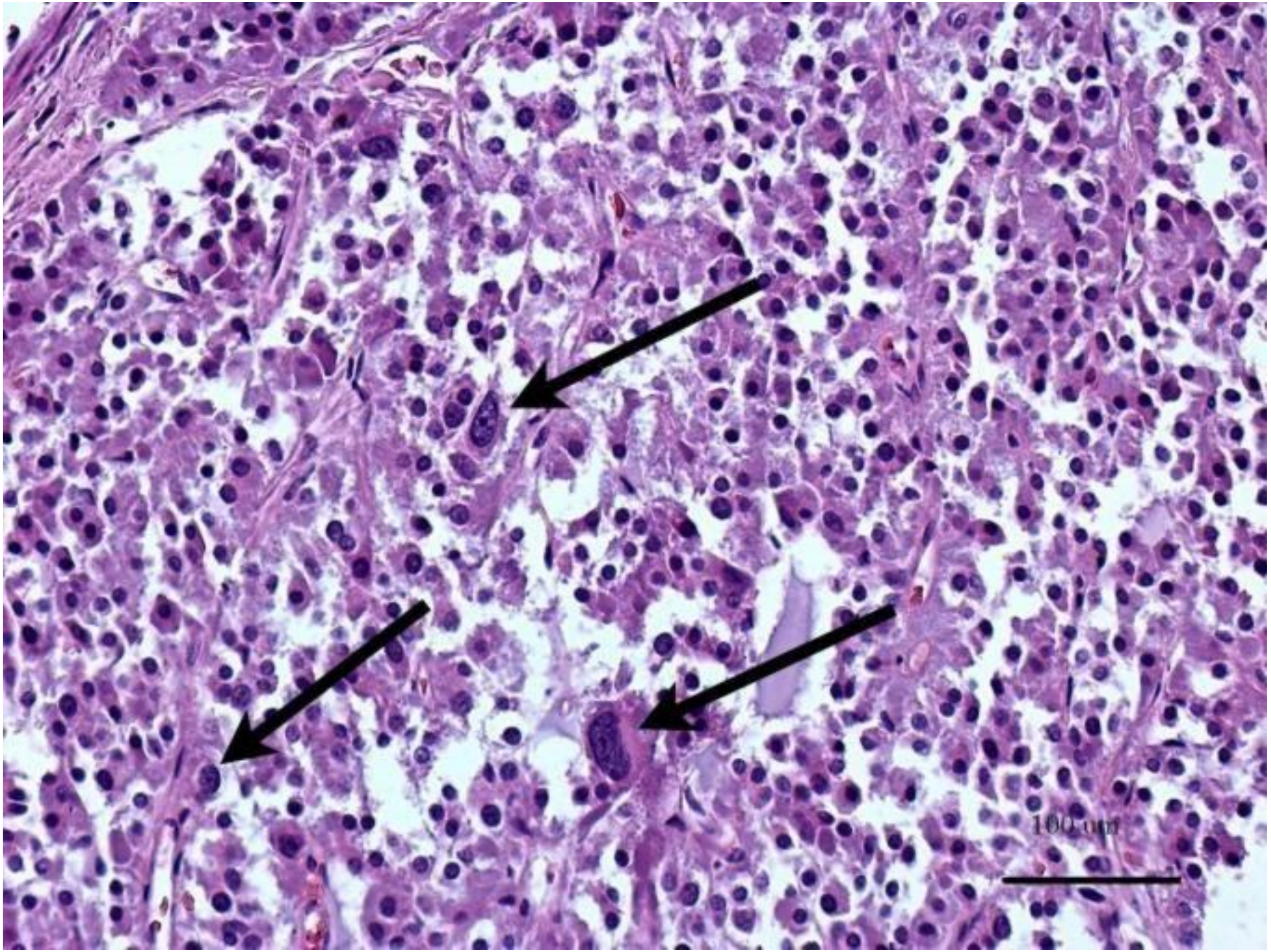
hanno una localizzazione specifica

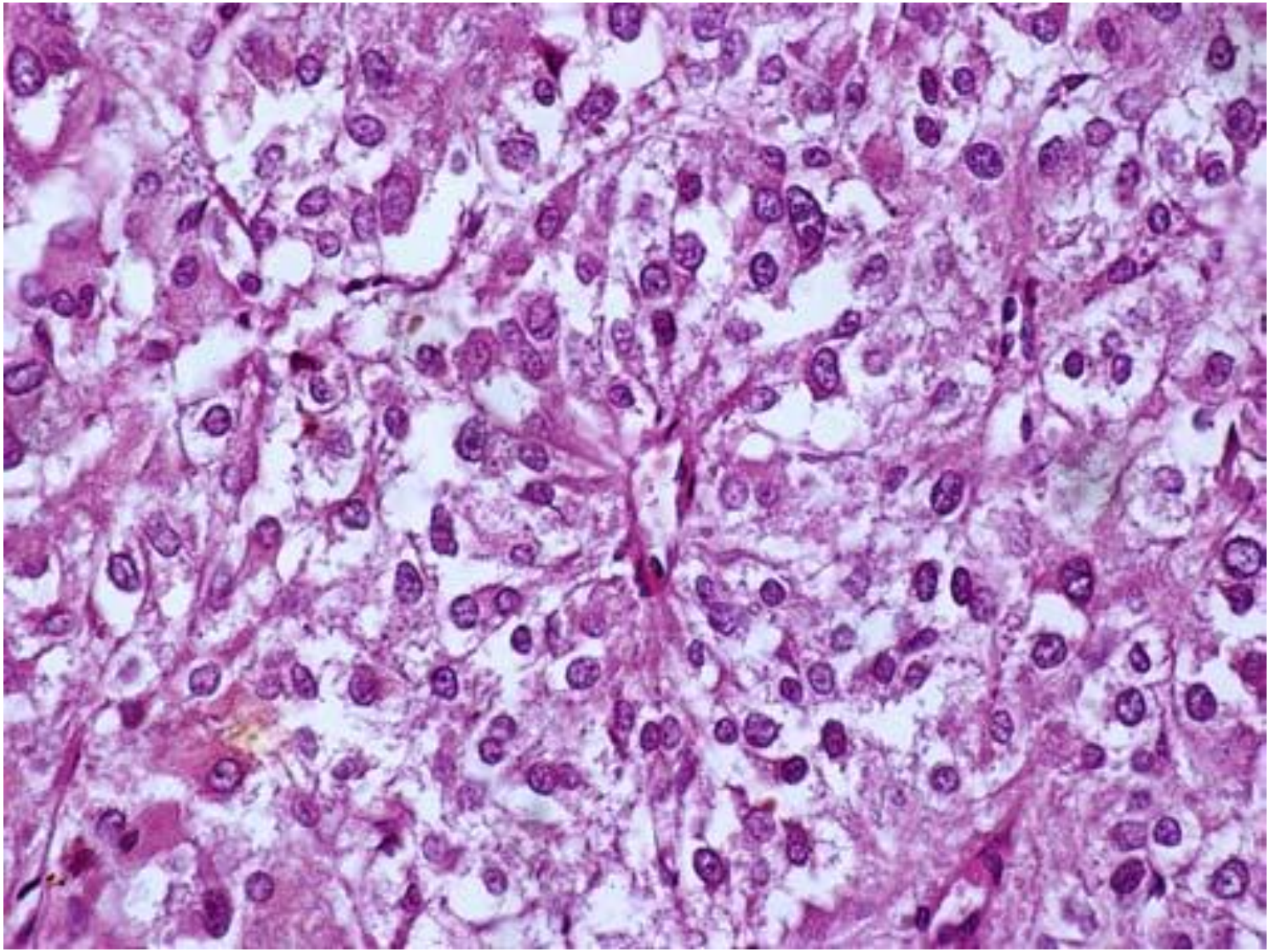




Noszczyk-Nowak et al. Acta Veterinaria Scandinavica 2010, 52:35
http://www.actavetscand.com/content/52/1/35

Case of a 12-year-old boxer dog, with an infiltrating tumour in cardiac base and dilated cardiomyopathy

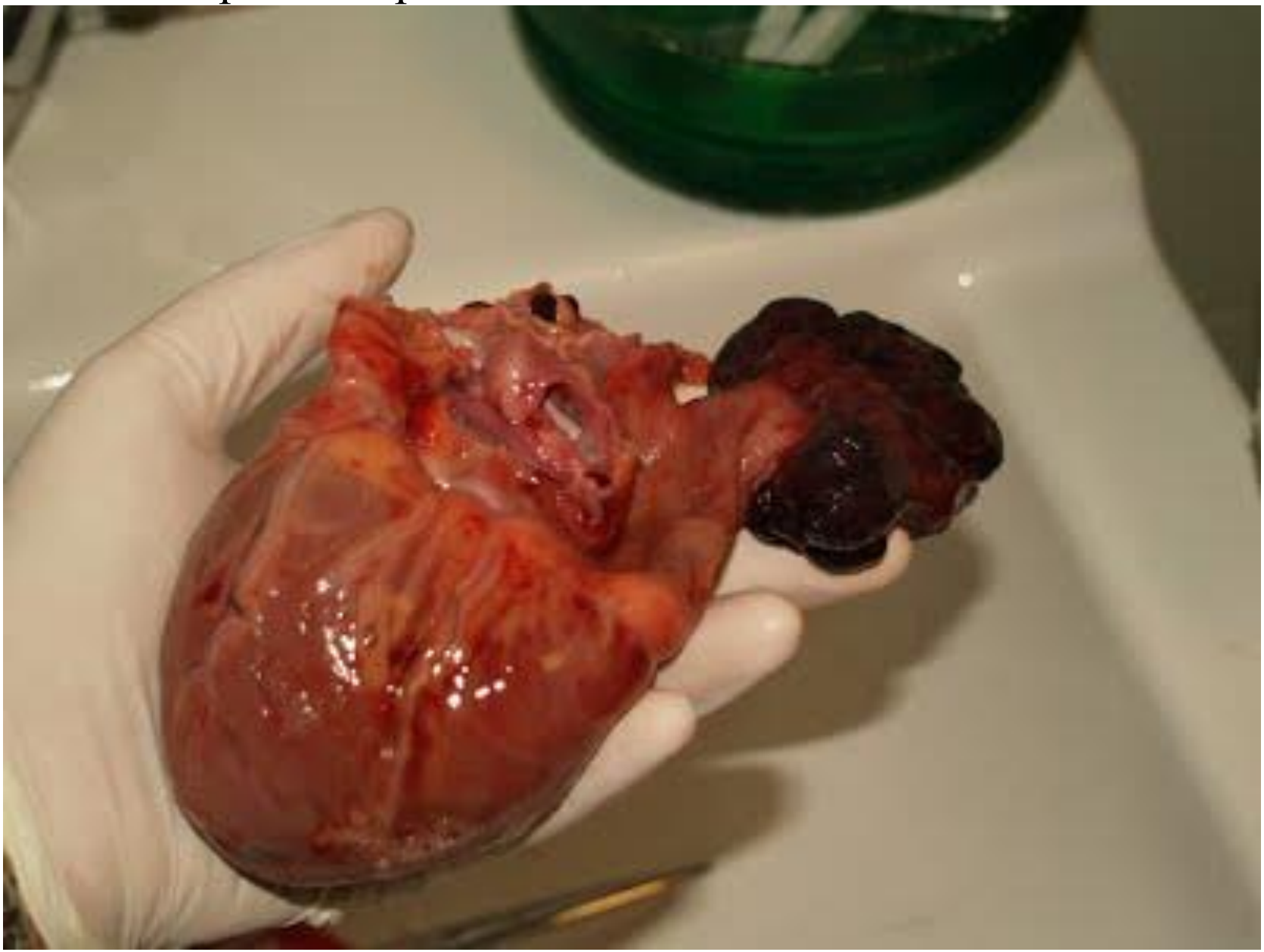

100 um



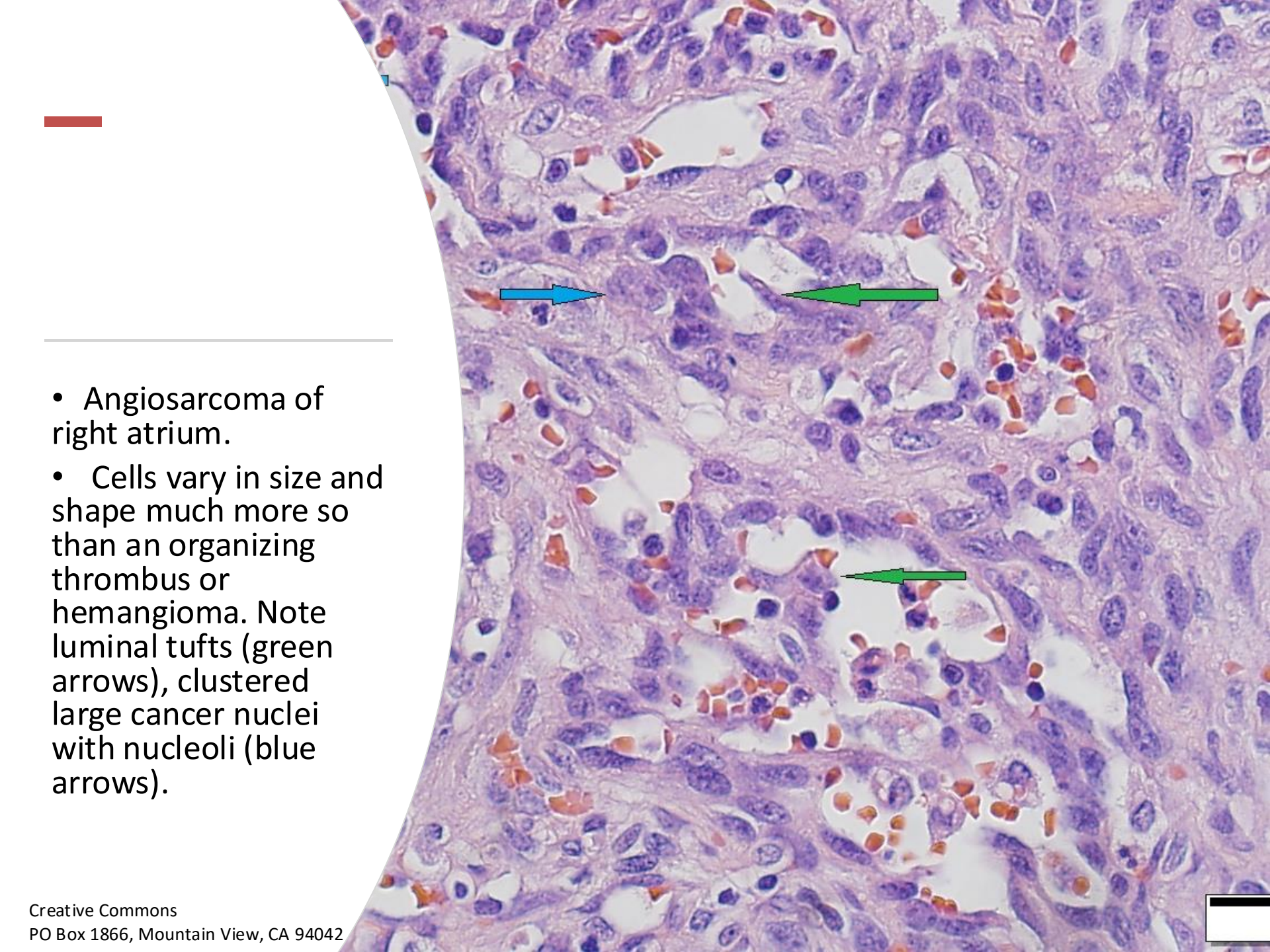
Chemodectoma cells radially arranged around blood vessels. HE, 400x

Noszczyk-Nowak et al. Acta Veterinaria Scandinavica 2010, 52:35
http://www.actavetscand.com/content/52/1/35

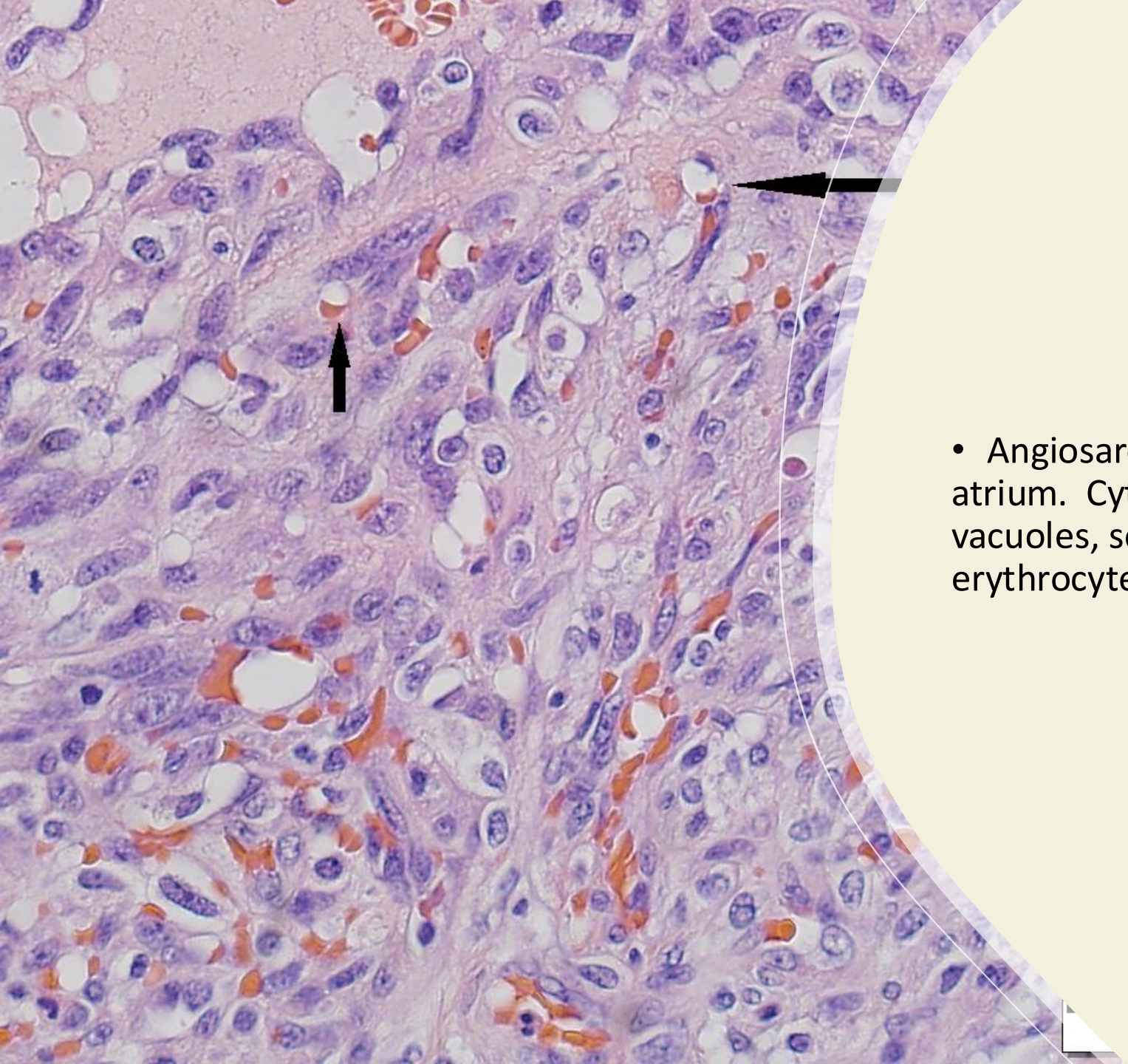
Miocardiopatie neoplastiche



http://www.clinicaveterinariaponente.it/_/rsrc/1424978324206/CASI-CLINICI/tumori-cardiaci/foto1.JPG?height=300&width=400



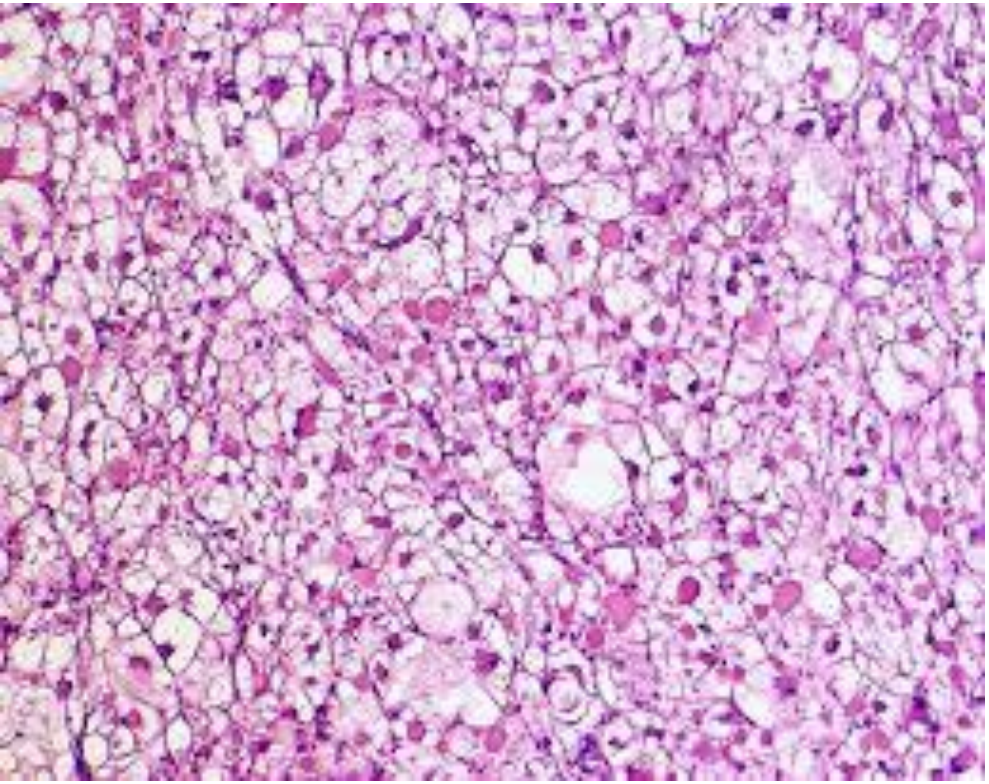
- Angiosarcoma of right atrium.
- Cells vary in size and shape much more so than an organizing thrombus or hemangioma. Note luminal tufts (green arrows), clustered large cancer nuclei with nucleoli (blue arrows).



- Angiosarcoma of right atrium. Cytoplasmic vacuoles, some with erythrocytes (arrows).

Noah’s arkive

Rhabdomyoma

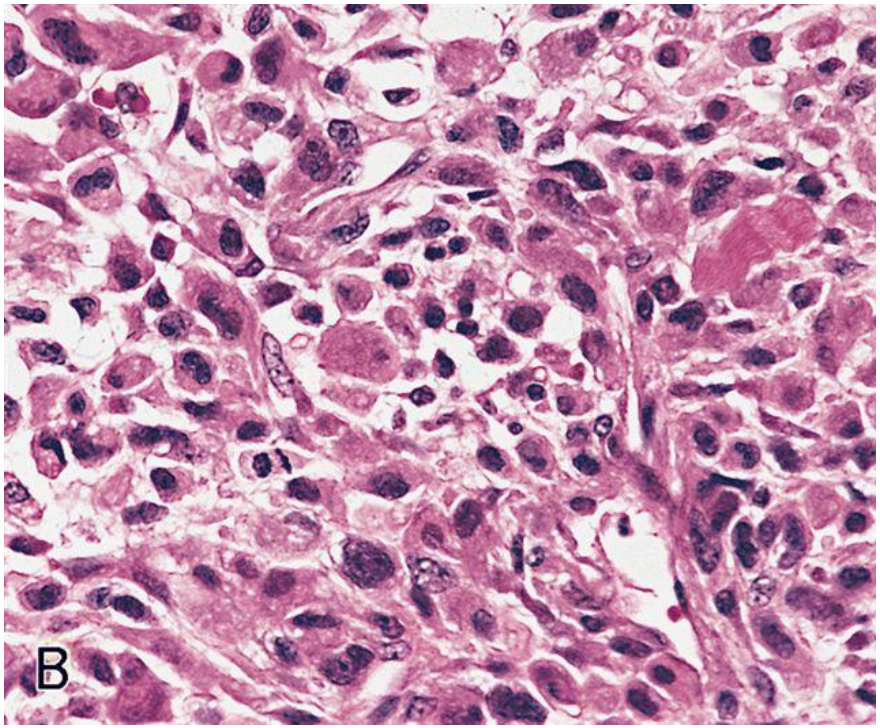


Cardiac rhabdomyomas are composed of **large vacuolated cells** with **abundant glycogen** - so called **"spider cells."** This appearance is caused by **centrally placed nucleus** from which **myofibrils radiate to the cell membrane**. **PAS** stain is **strongly positive** due to glycogen.

This photomicrograph shows atrial rhabdomyoma in a 1 y/o male. **Image courtesy of: Dr. Jose Bellasai, Professor of Pathology, Univ. National & Univ. Catholic of Asuncion, Paraguay.**

WebPathology.

Rhabdomyosarcoma



Tumor cells with polygonal atypical cells with distinctly eosinophilic cytoplasm. AFIP images

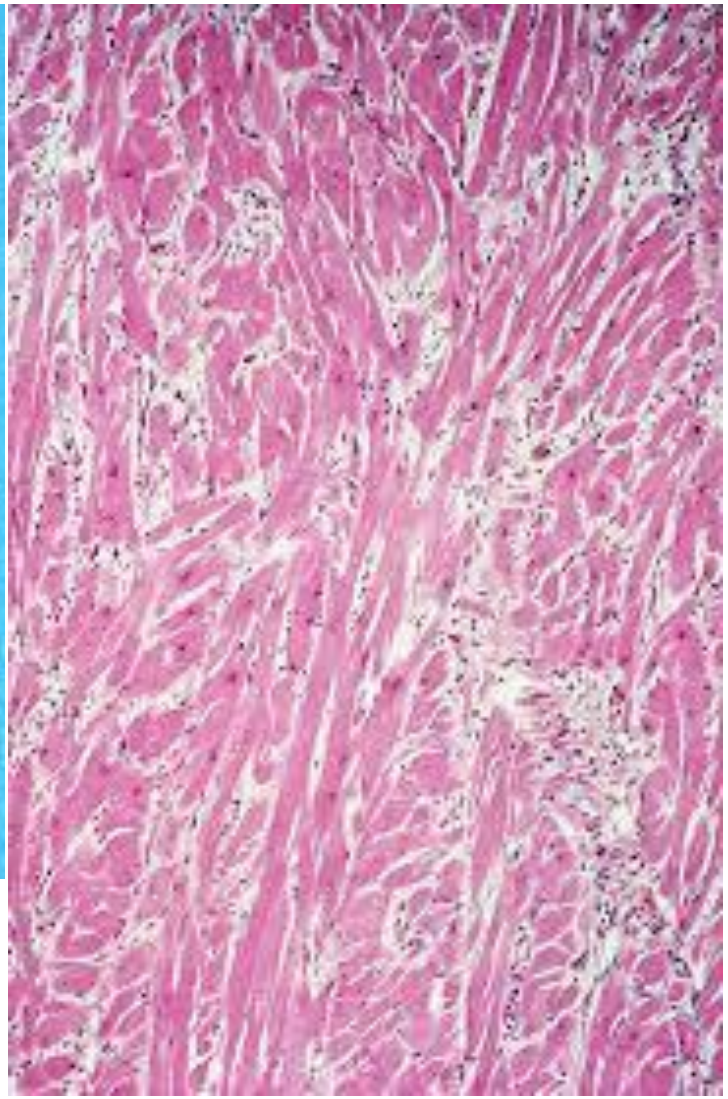
Deficit diastolico

Ridotto riempimento cardiaco

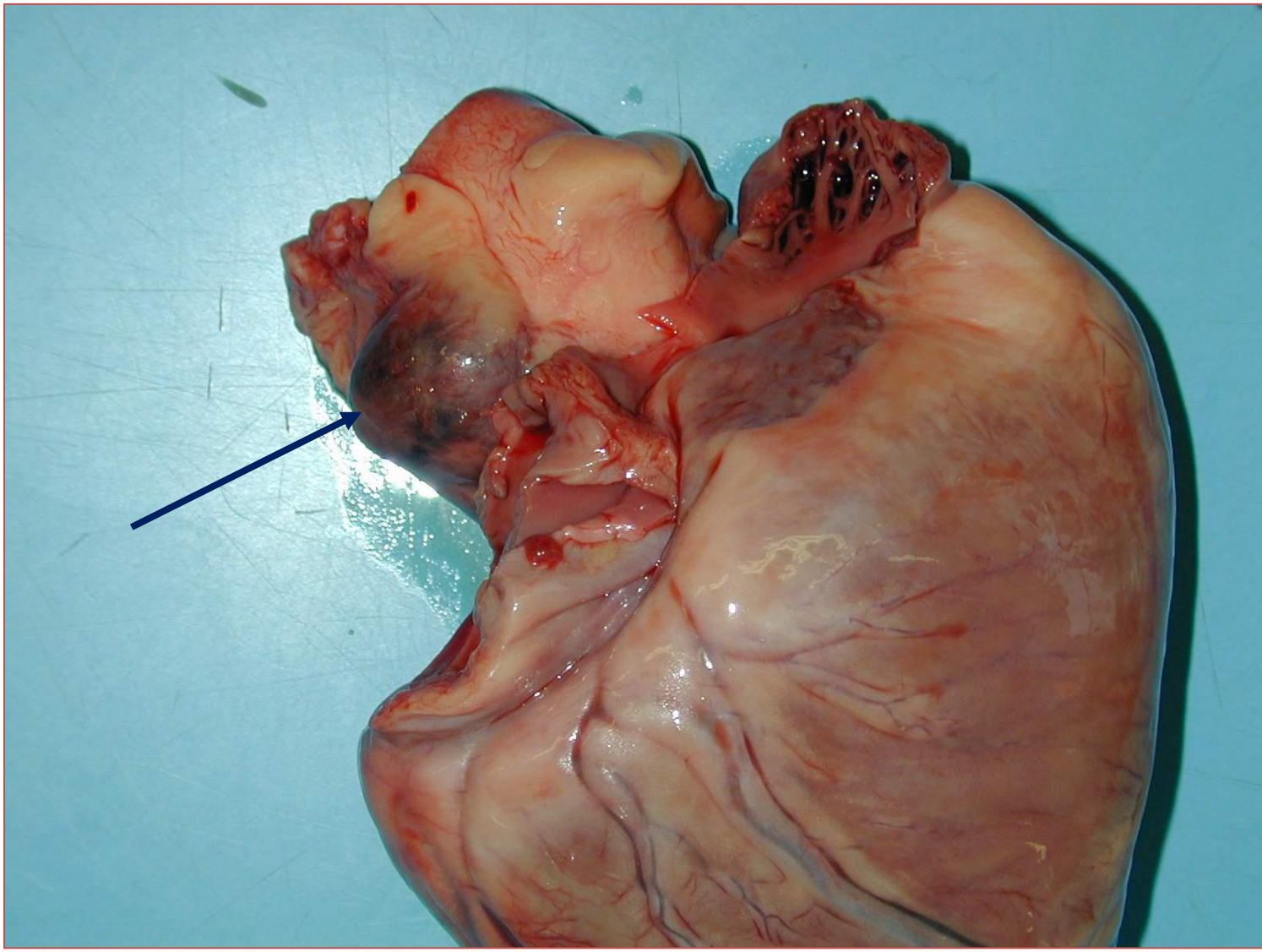
- Versamento pericardico
- Pericardite costrittiva
- Cardiomiopatia ipertrofica
- Patologie ostruttive intracavitarie
- Patologie compressive extracavitarie

Cardiomiopatia ipertrofica

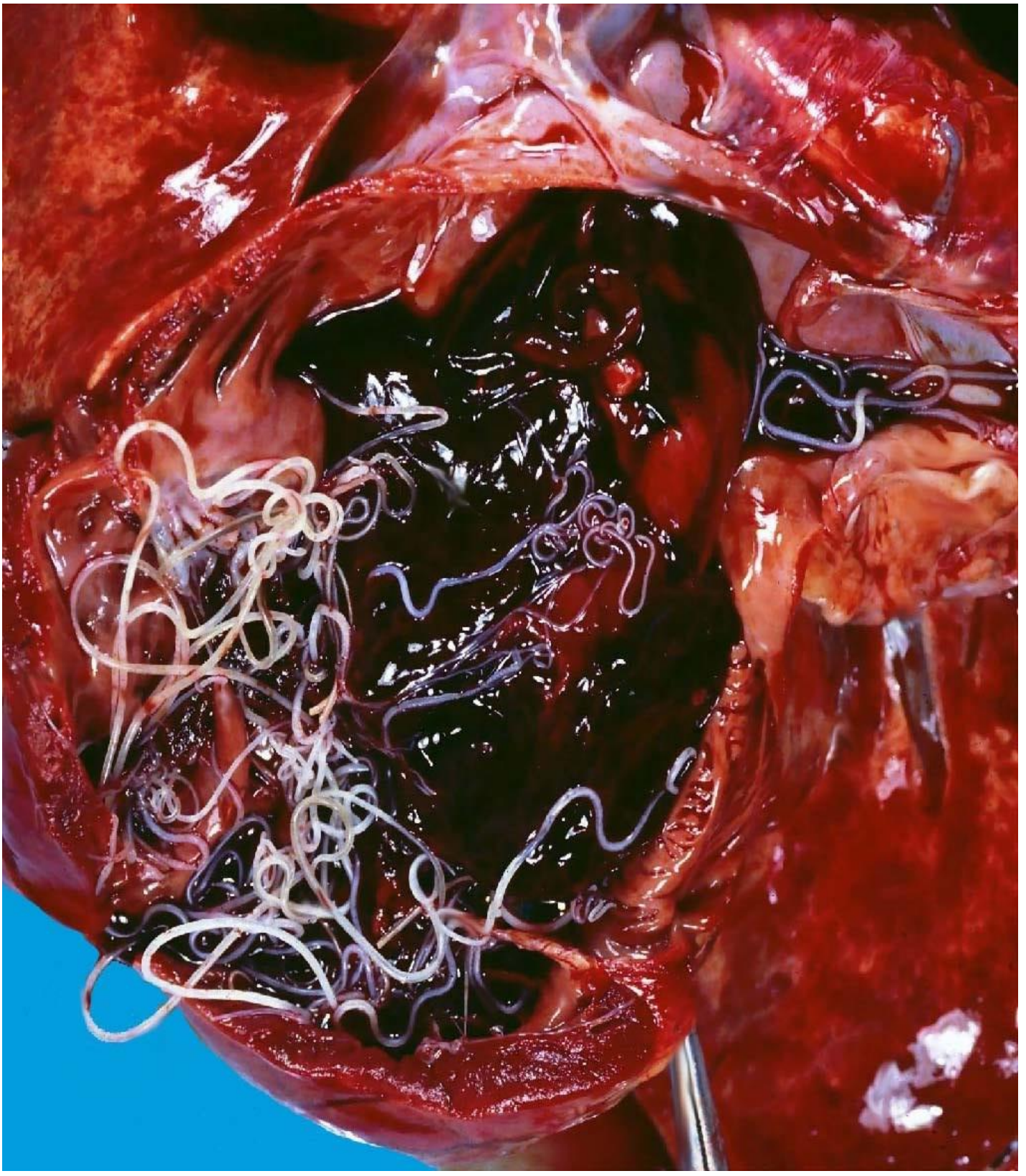
http://ars.els-cdn.com/content/image/1-s2.0-S0021997515003151-gr2-3.jpg



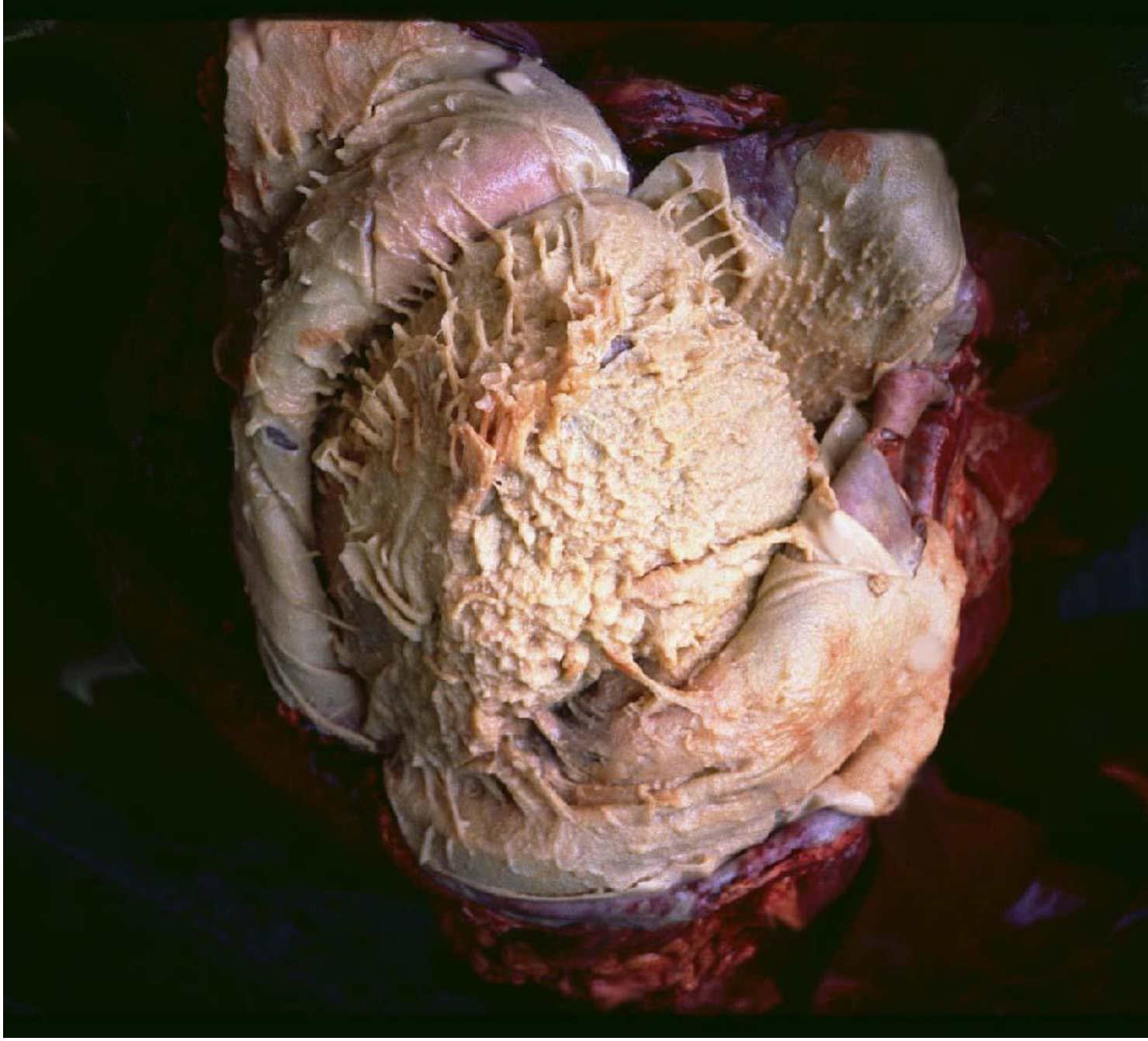
Tumore alla base del cuore



Deficit diastolico



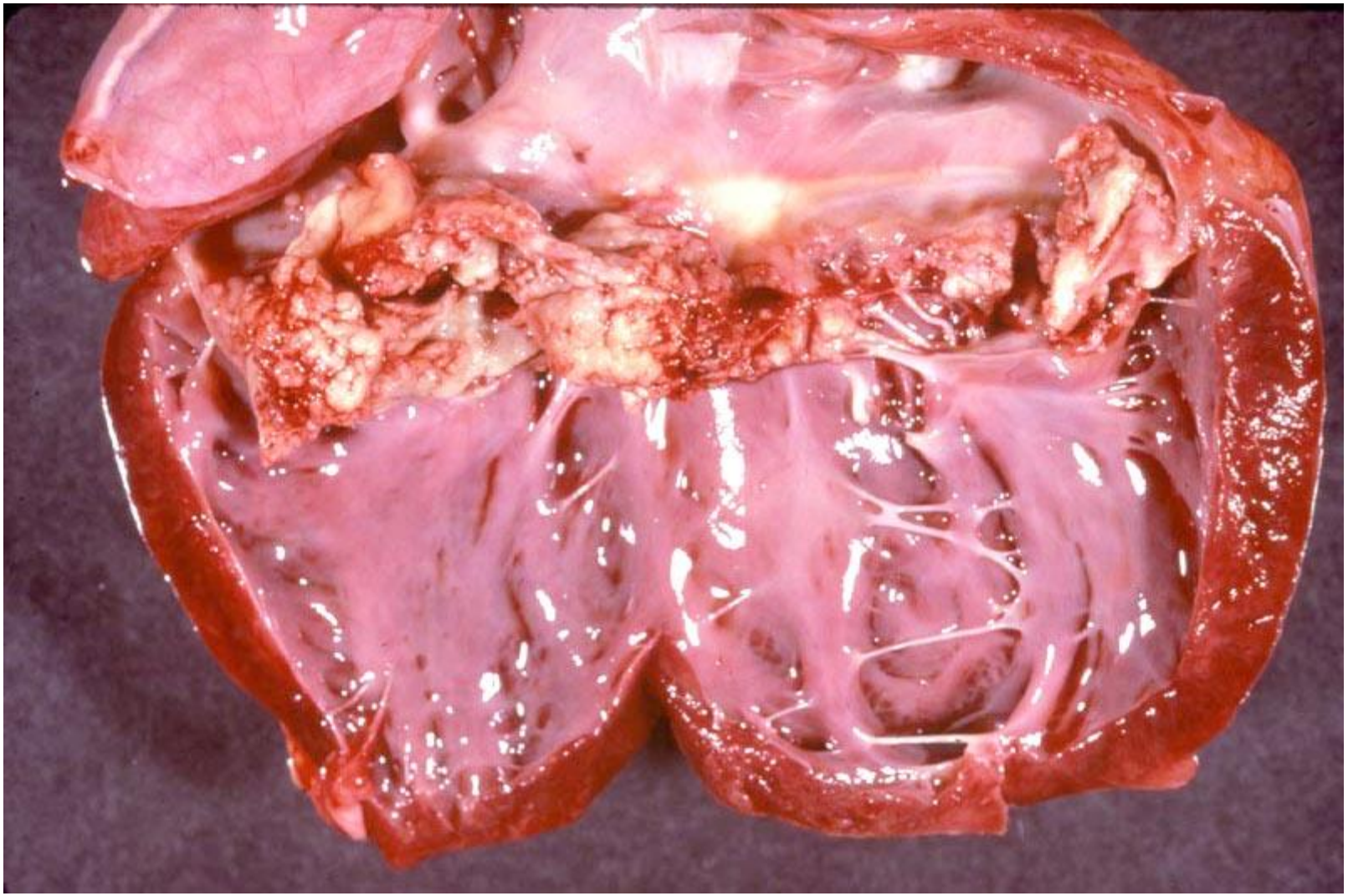
Deficit diastolico



Insufficienza valvole atrio-ventricolari (sovraccarico di volume)

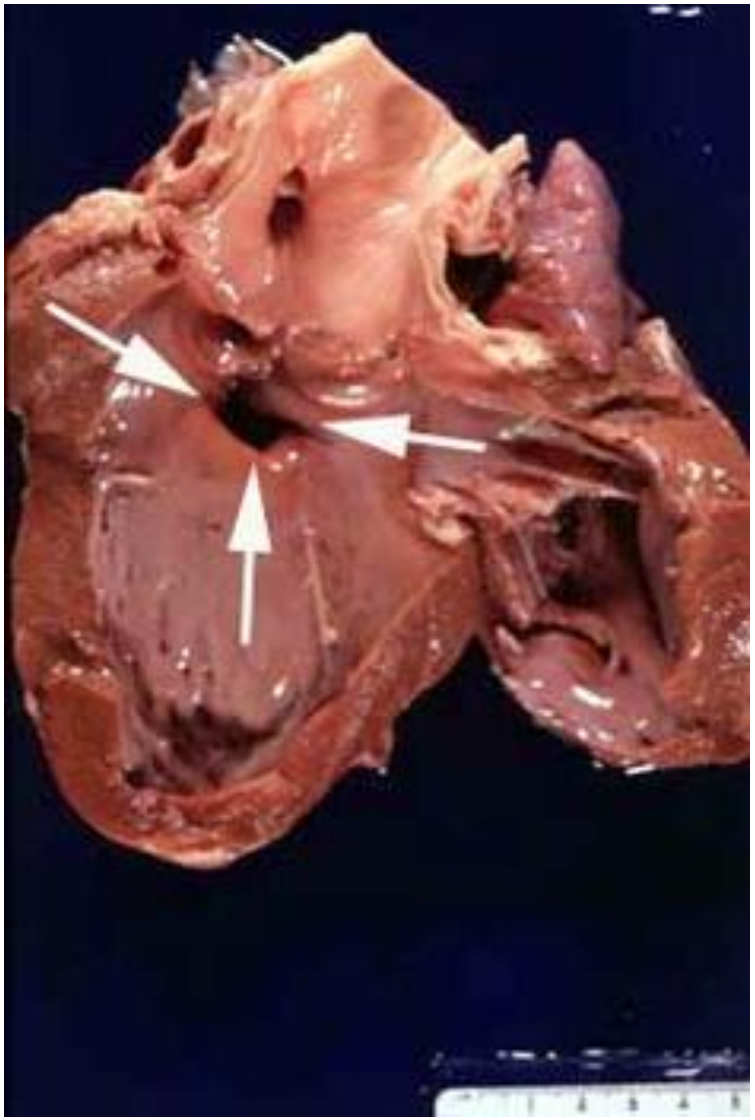
Dog. Warty proliferations on valve containing fibrin, inflammatory cells, bacteria. Often associated with septic emboli to kidneys and elsewhere

http://research.vet.upenn.edu/Portals/61/Gallery/Album/49/vegetative_endocarditis.jpg



Bovino. Endocardite cronica vegetante

Malattie congenite (Sovraccarico volume)



http://vet.uga.edu/ivcvm/courses/VPAT5200/01_circulation/hyperemia/images/f08898arro.jpg

This is called "ventricular septal defect in the heart of a foal." It is a congenital abnormality. If it is large enough, heart failure happens.

In this condition, heart failure begins as right heart overload. Why?

Because the pressure is higher on the left side of the heart so every time the heart contracts, some left ventricle blood gets added to the already full right ventricle. When the right ventricle can't pump all the blood, liver congestion develops. Fairly soon the left heart fails also and then there is pulmonary congestion as well.