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UNIVERSITE DES FRERES  
MENTOURI CONSTANTINE



معهد العلوم البيطرية

Institut des Sciences Vétérinaires

# Clinical urinary semiology

Dr. Djemai Samir

The urinary system includes the organs that produce and excrete urine:

- Glandular part consisting of the 2 kidneys.
- Excretion pathways, known as urinary pathways.

# Kidneys

The kidneys are mixed tubular parenchymal glands:

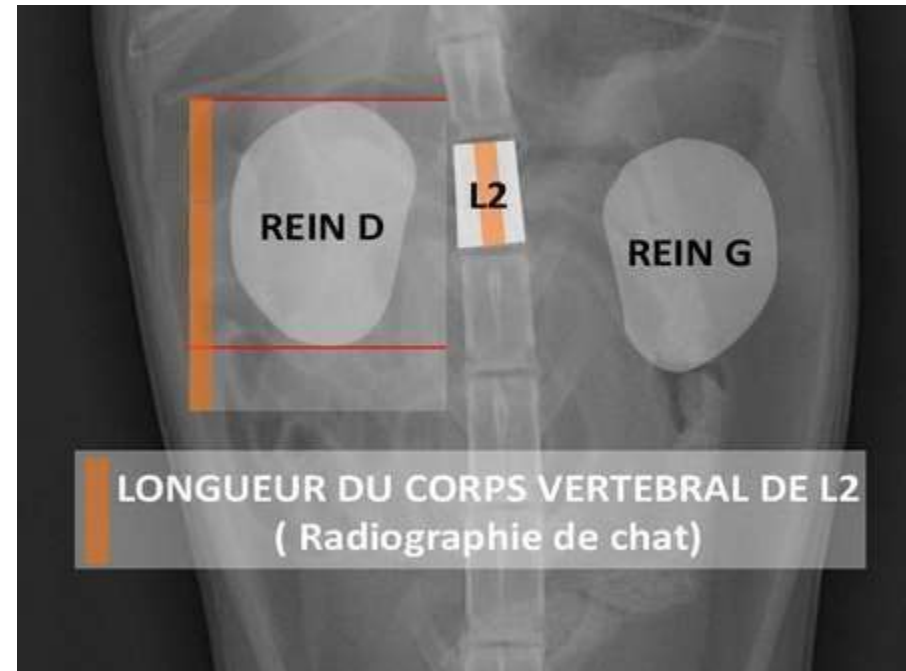
- The anatomical and functional unit is the nephron.
- They have both endocrine and exocrine functions.

□ Thoracolumbar region:  
CN = T13-L2 right  
kidney and L1-L2 left  
kidney.

□ Lumbar: CT = between  
L1-L4

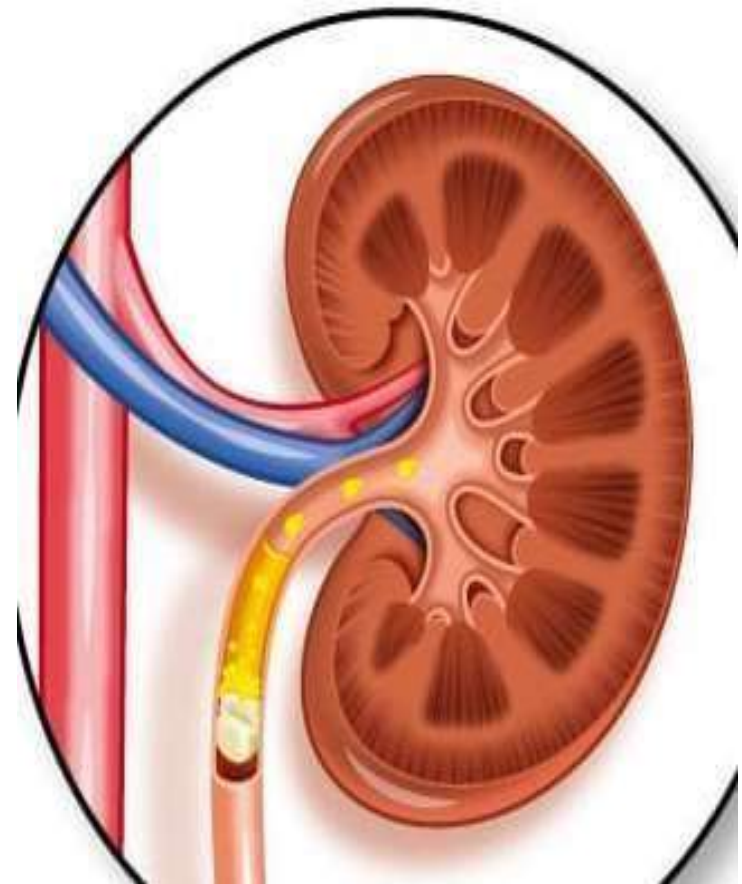
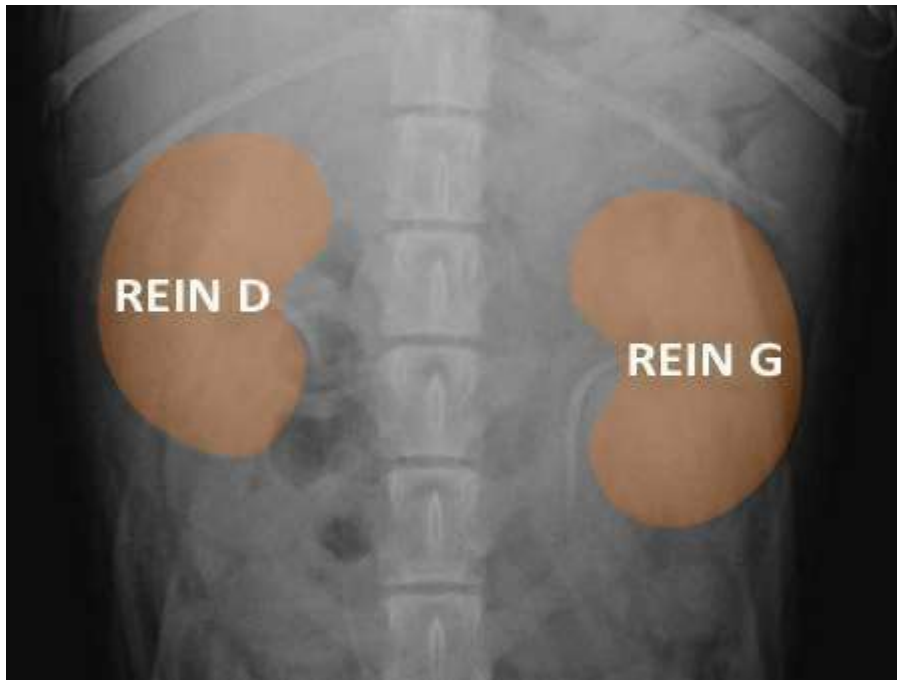
□ The right is in a more  
cranial position (CN,  
CT).

□ The kidney of  
carnivores has a bean

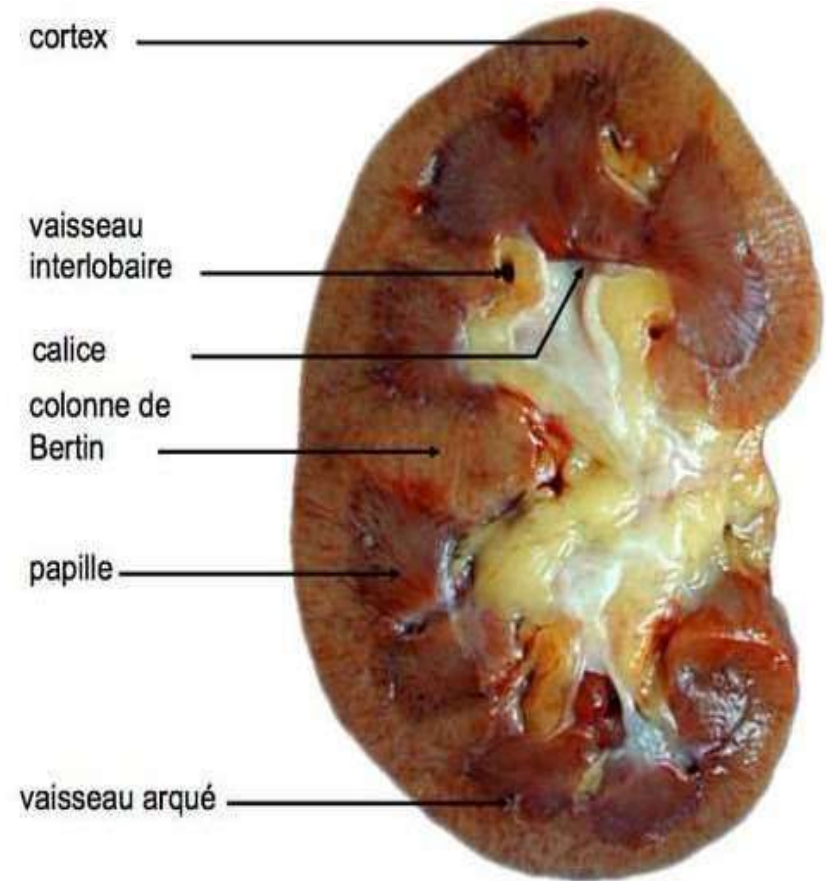
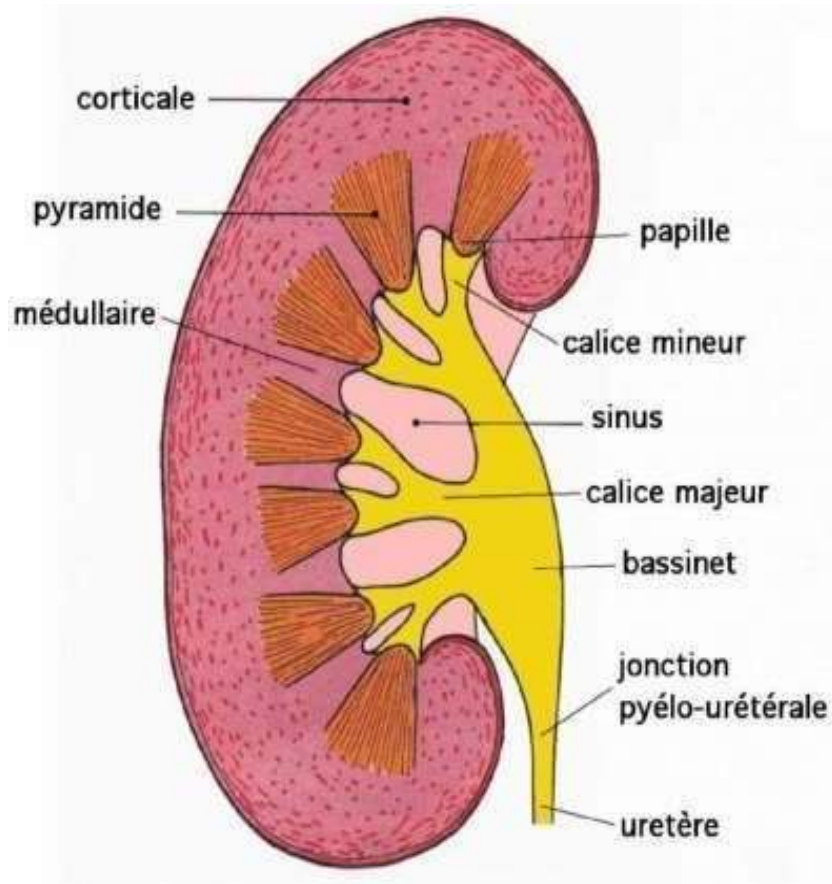


Its medial face, concave, receives the vessels and nerves and gives rise to the ureter at the level of the

hilum.



The renal parenchyma presents 2 concentric zones of different hue and texture: Cortex and medulla.

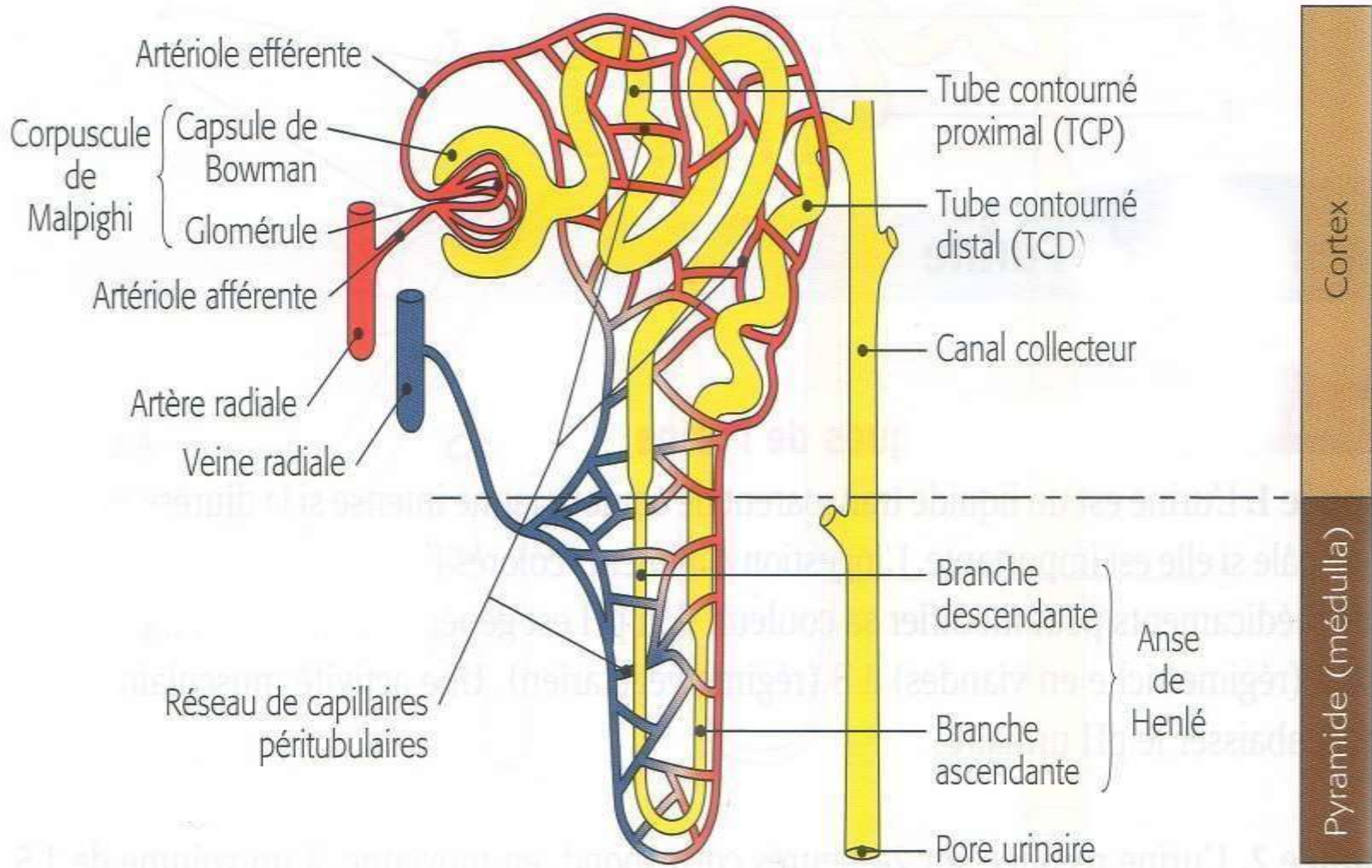


- Cortex

Contains the renal corpuscles and the convoluted tubules and the straight tubules.

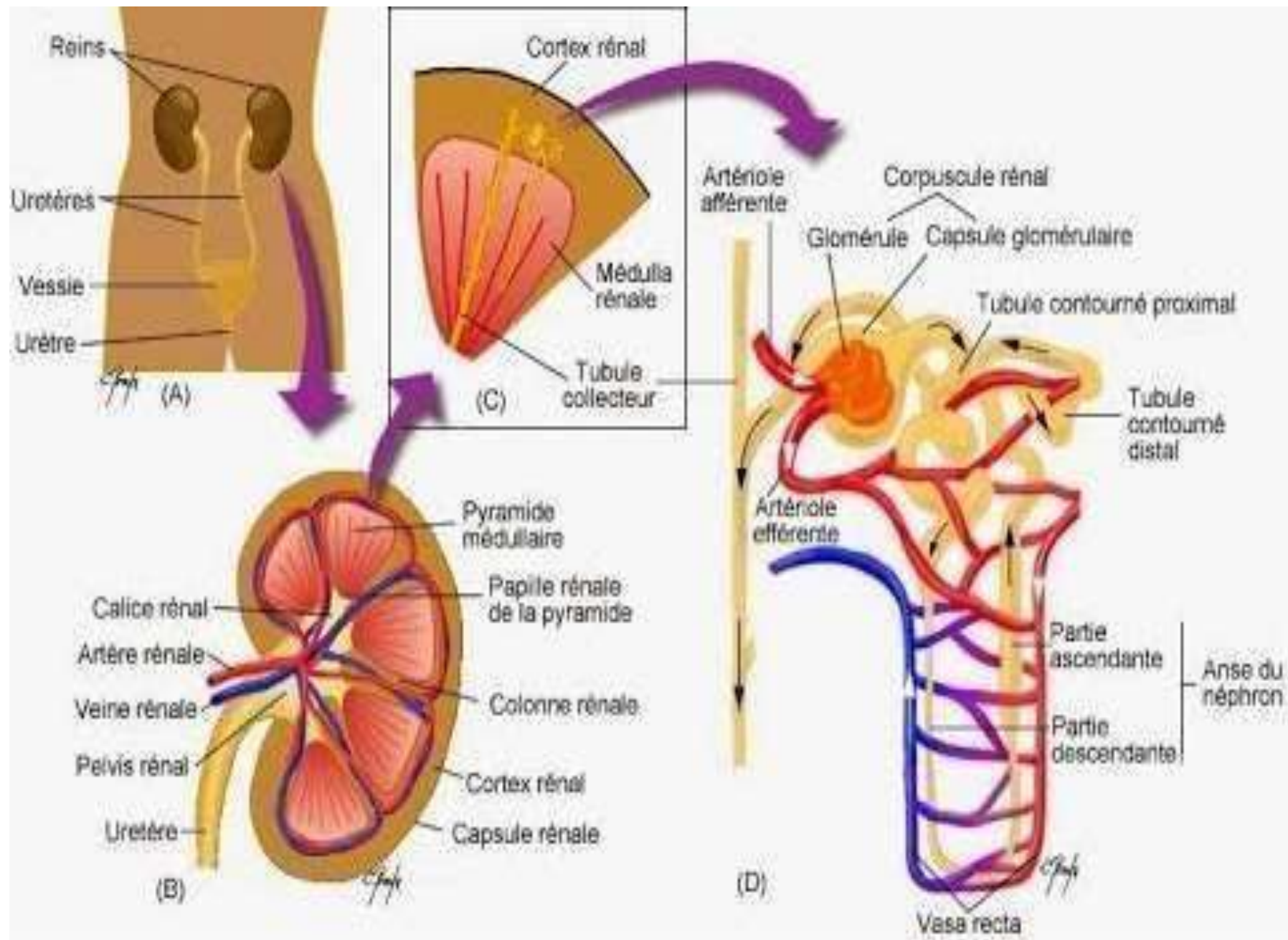
- Medulla

Contains the Henlé loops

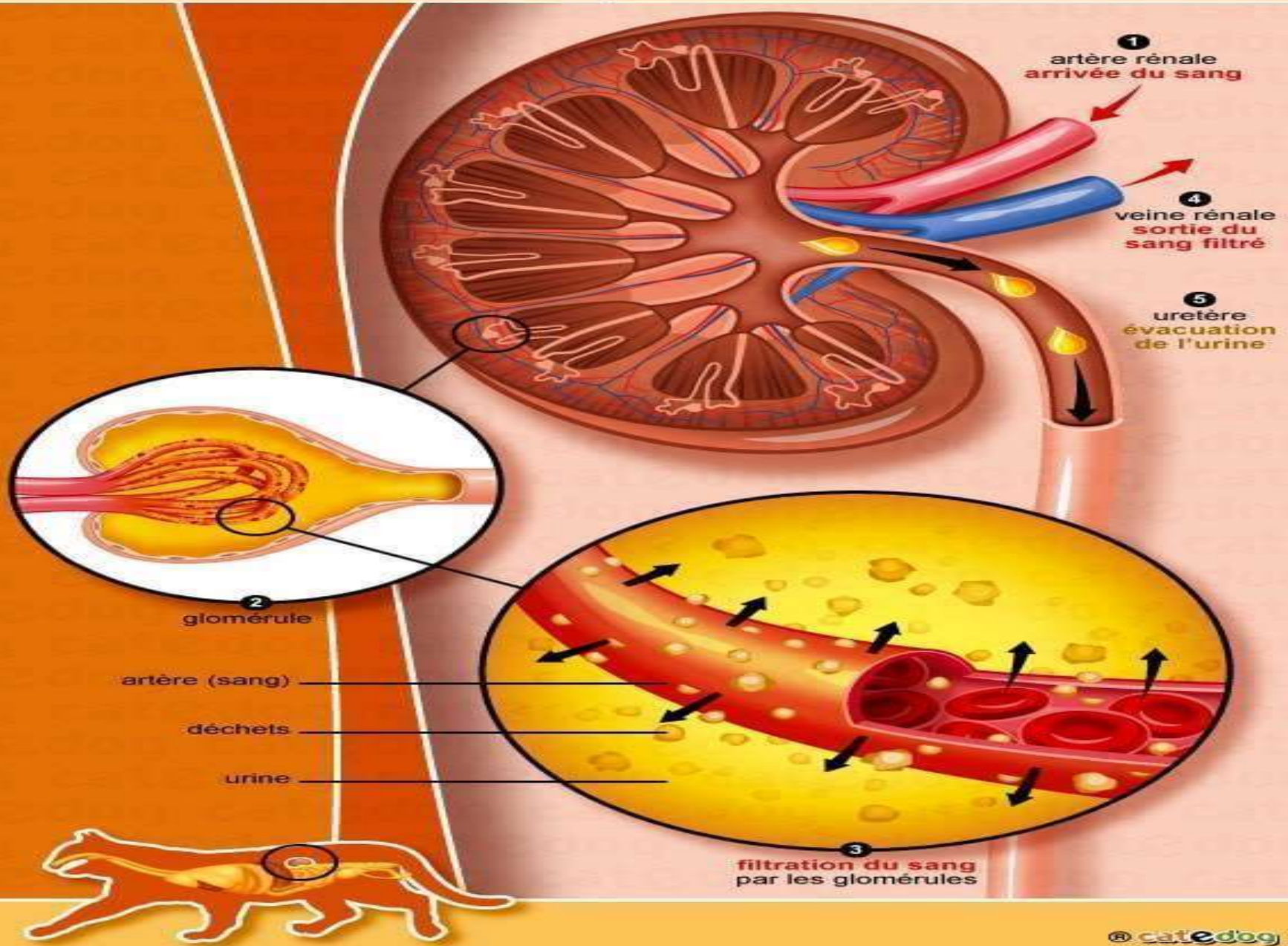


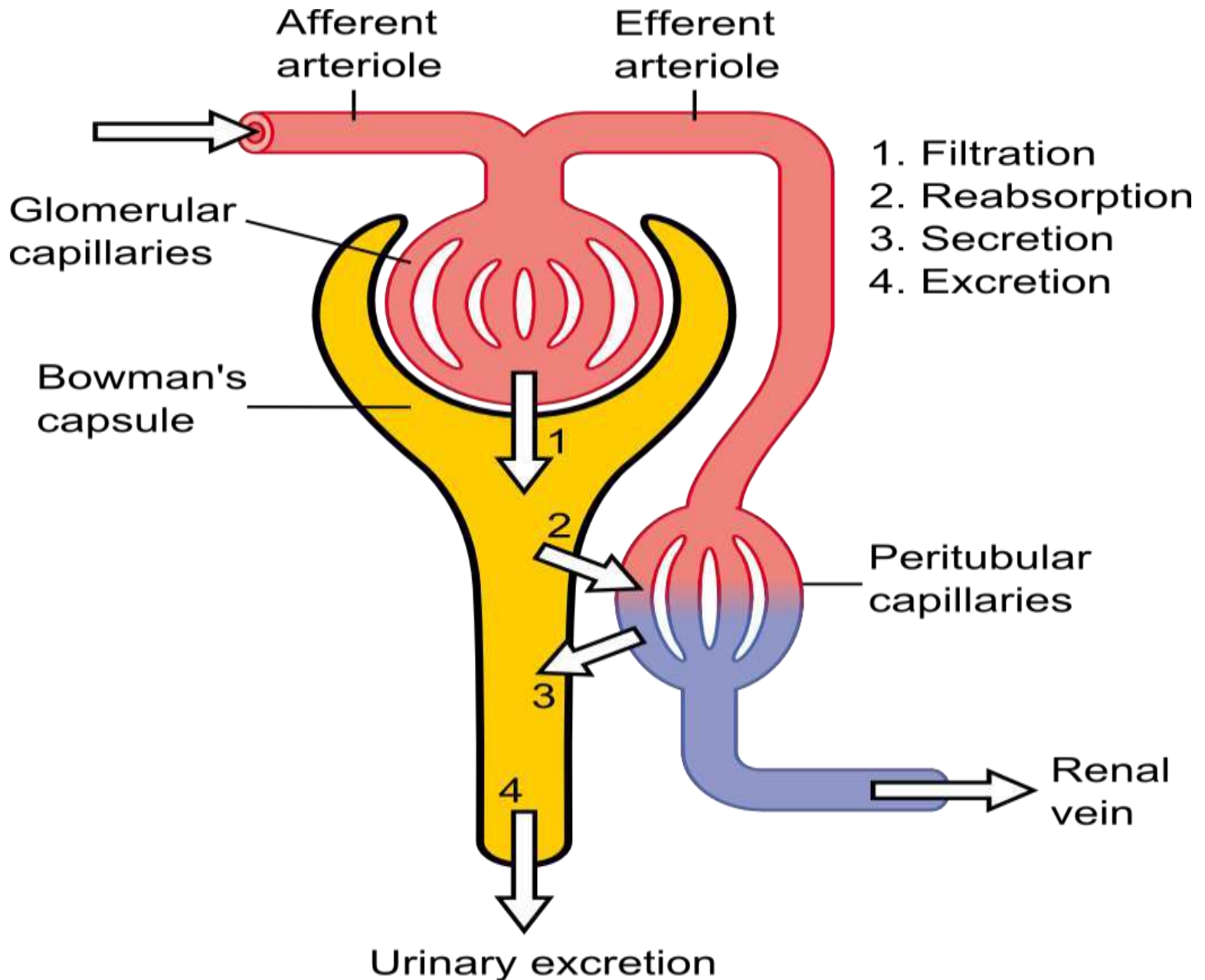
Nephrons are the functional units of the kidneys of vertebrates; a dog's kidney contains about 1 million nephrons, of which 85% are cortical nephrons:

## **Production of urine.**



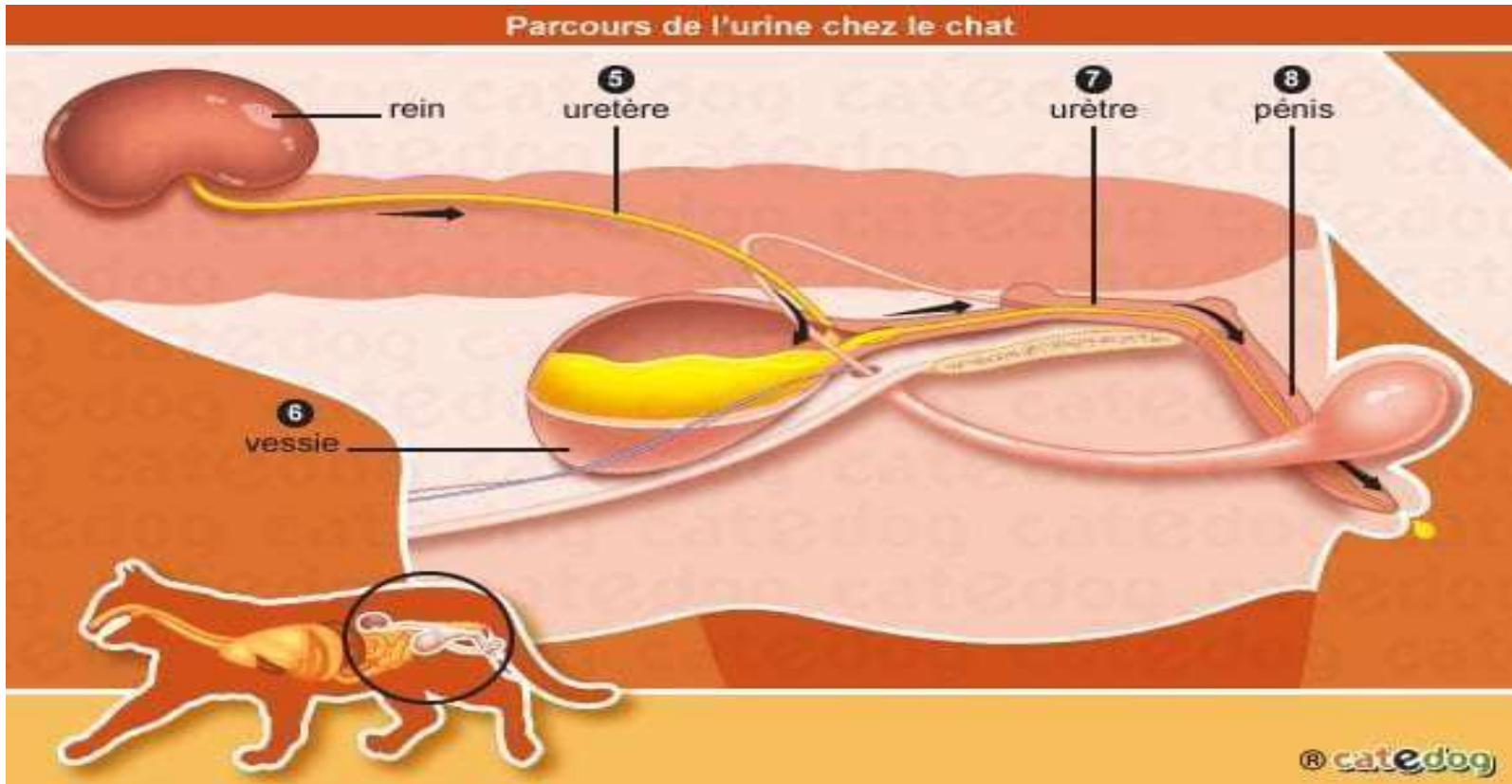
# La filtration du sang dans les reins du chat





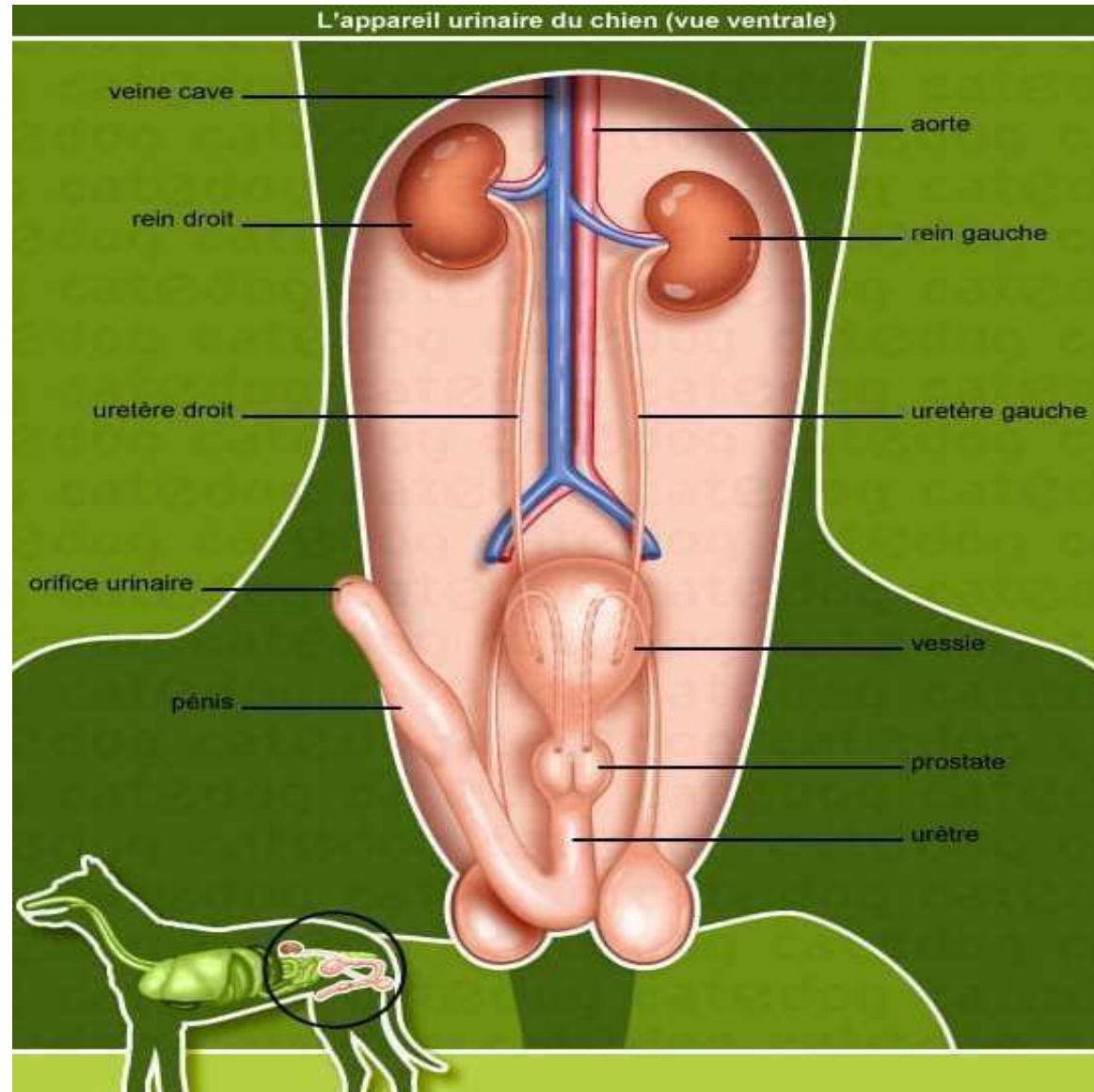
$$\text{Excretion} = \text{Filtration} - \text{Reabsorption} + \text{Secretion}$$

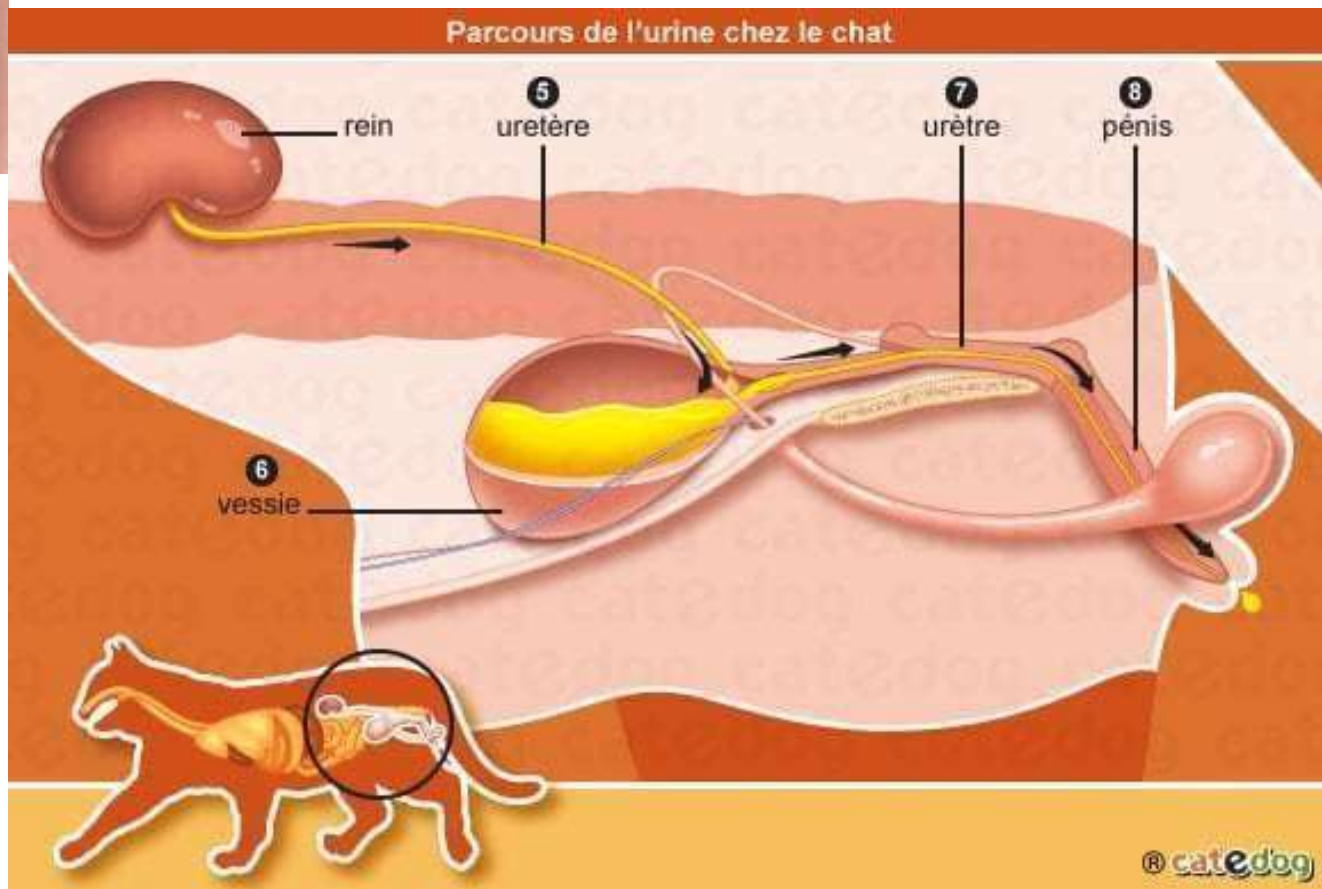
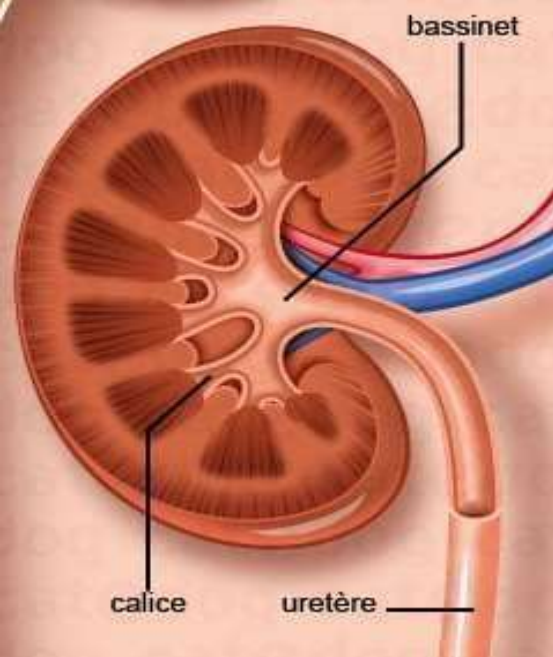
Urine, resulting from blood filtration, is then expelled through the ureter (5) to the bladder (6) then the urethra (7) and finally the penis (8).



# Urinary tract

The urinary tracts are paired at the kidneys and unpaired distally.





# **Clinical urinary semiology**

# **I. Disorders of urine emission**

## a. Urinary disorders

1. Pollakiuria
2. Dysuria
3. Stranguria

## B. Change in the appearance of urine

1. Hematuria
2. Hemoglobinuria
3. Bilirubinuria
4. Cloudy urine

## C. Incontinence disorders

1. Definition
2. Semiological approach

## II. Urination disorders

### a. Oligo-anuria

1. Confirm oligo-anuria
2. Excretory anuria or secretory anuria?

### B. Polyuria - polydipsia

1. Investigate PUPD
2. Confirm PUPD
3. Identify the cause of PUPD

# The interest in the identification and interpretation of

## urinary clinical signs:

- is not limited to the mere diagnosis of urinary tract disorders,
- it extends to many systemic diseases (e.g.: hemostasis disorders, diabetes mellitus, heart failure, Cushing's syndrome, etc.).

# **I. URINE ELIMINATION DISORDERS**

- Contenance is the ability to store urine in the bladder.
- Micturition is the release of urine thus stored.

# Warning signs

Comment savoir si votre chat souffre  
**d'un trouble urinaire ?**



## Repérez les signes

- ✓ Urine dans des endroits inappropriés
- ✓ Difficulté à uriner
- ✓ Sang dans les urines
- ✓ Miaulements lorsqu'il urine

## **A. MICTURITION DISORDERS**

### **1. POLLAKIURIE**

Frequent urination in small amounts.

Pollakiuria is a sign of cystitis. (inflammation of  
the bladder wall).

It is necessary to distinguish pollakiuria:

- the normal marking behavior in males.
- from polyuria (urination in large amounts).
- from dysuria.



## **2. DYSURIE**

Difficulté à uriner (miction lente avec effort).

La dysurie est également un symptôme clé en cas de cystite ;

Cependant on peut également l'observer dans des affections

urétrales obstructives (urétrite, calculs urétraux,

hypertrophie prostatique, tumeur urétrale, etc.).

Il convient alors de localiser l'origine de cette dysurie :

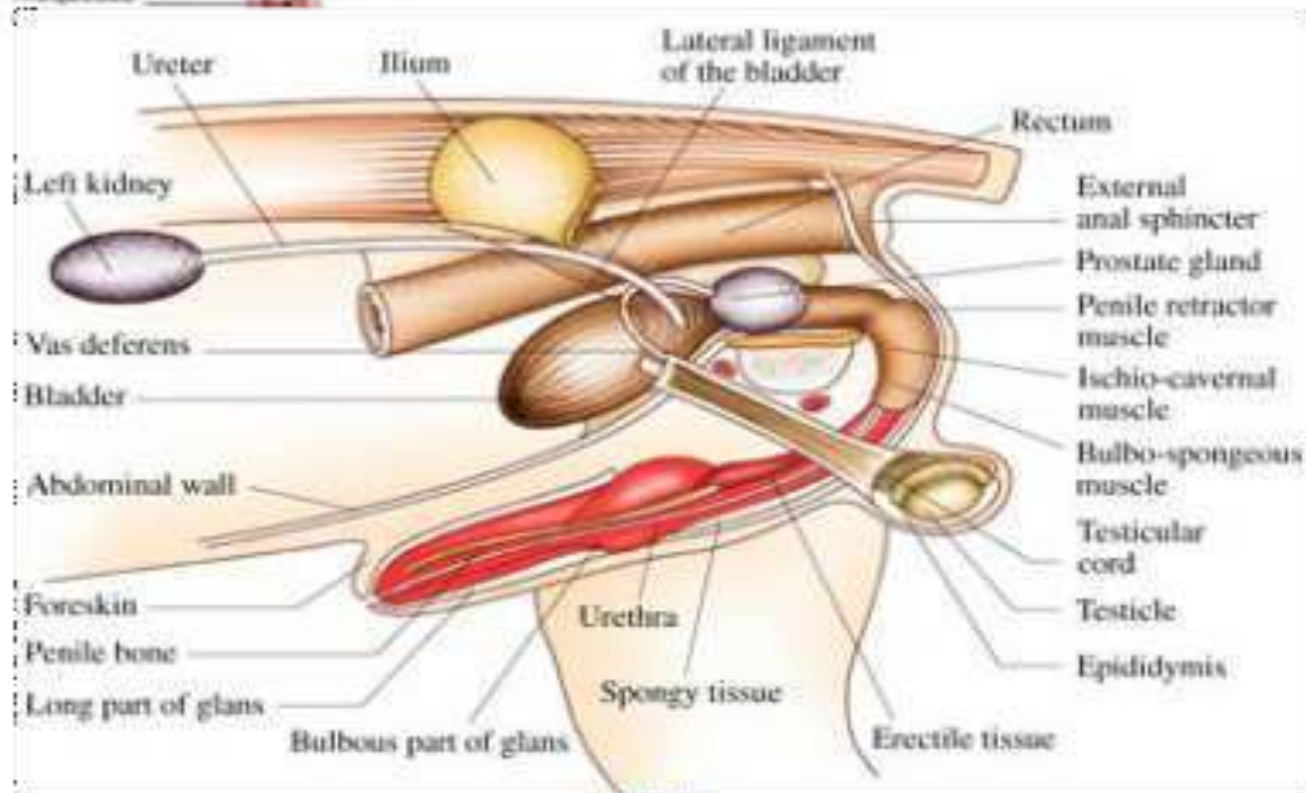
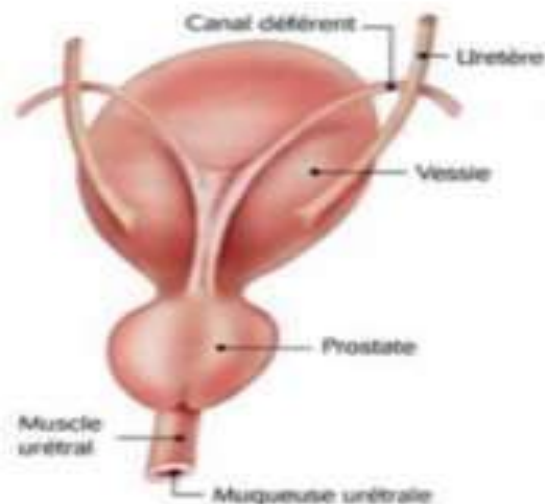
- **Le toucher prostatique**

(s'intégrant systématiquement à l'examen clinique du mâle vieillissant)

Renseignera sur la taille et la forme de la prostate.

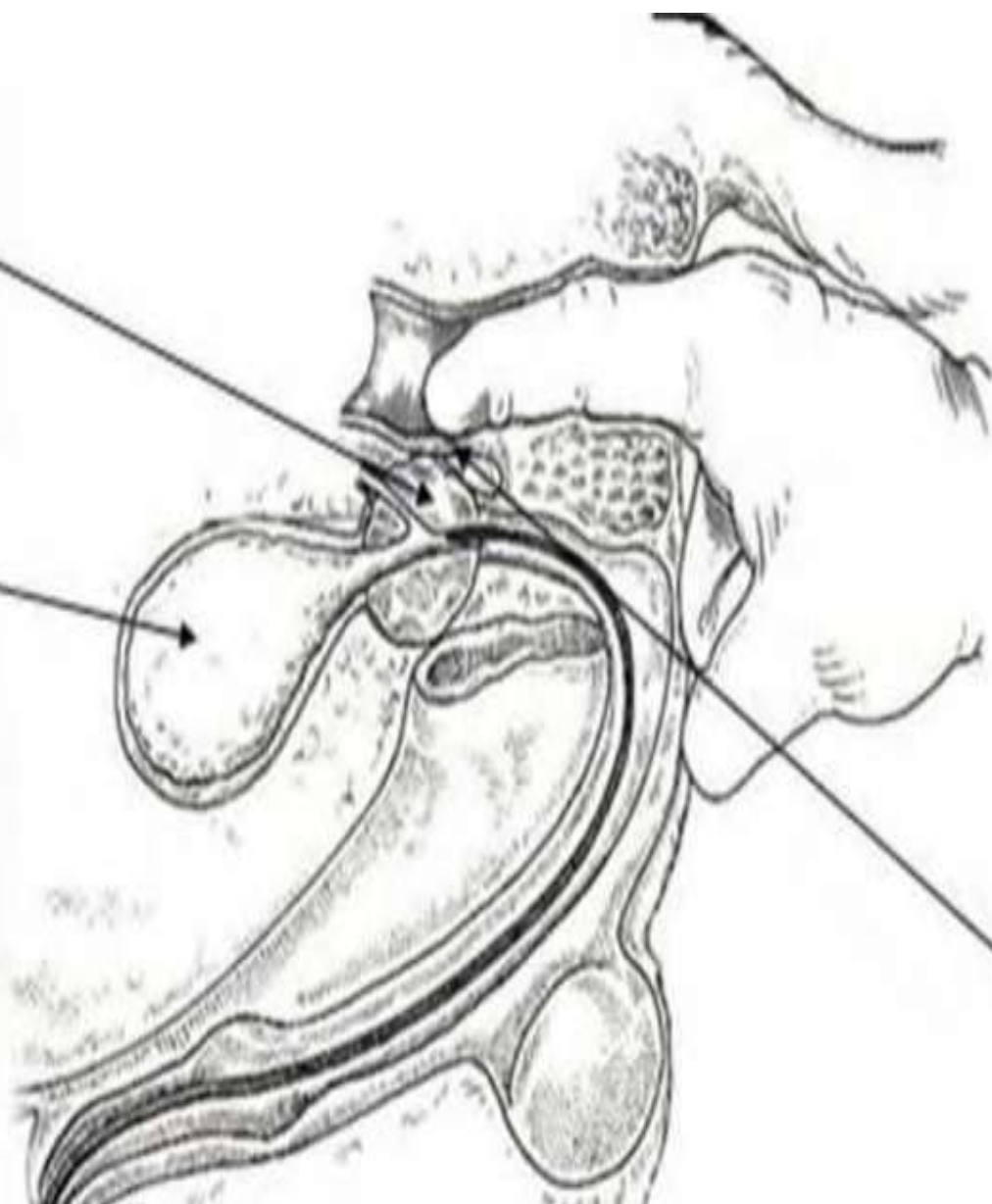
Vue dorsale

Vue ventrale

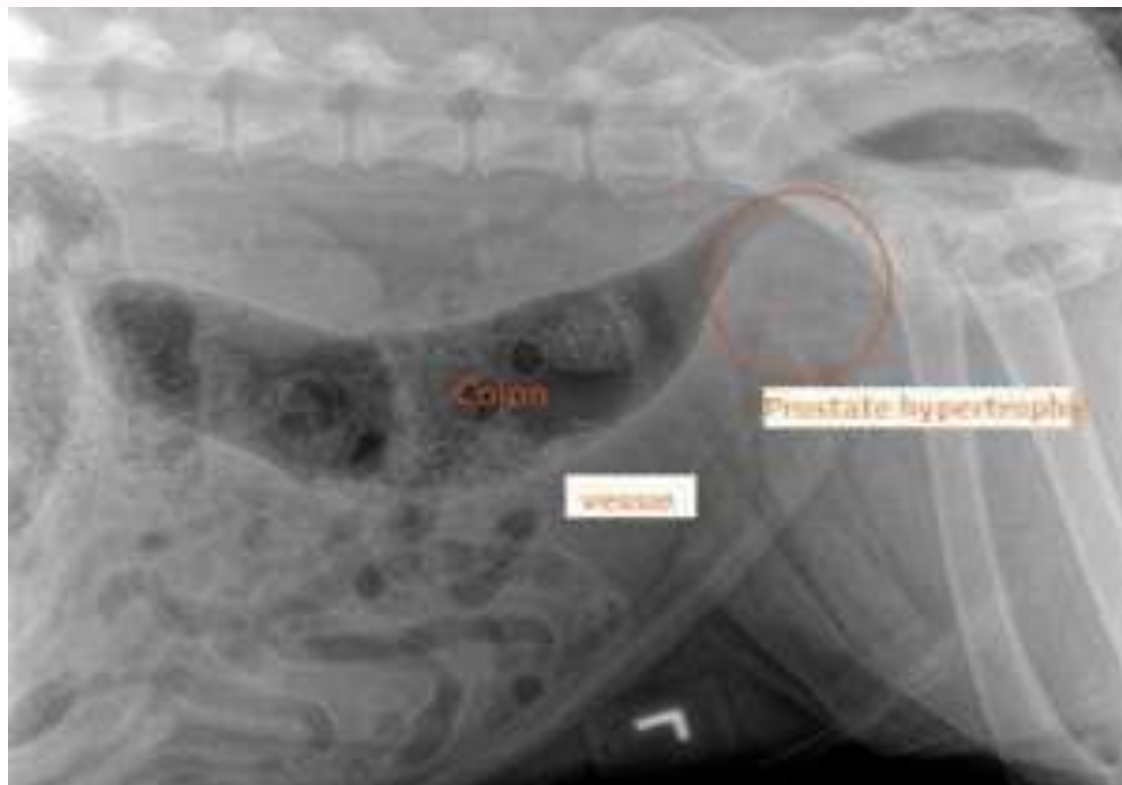
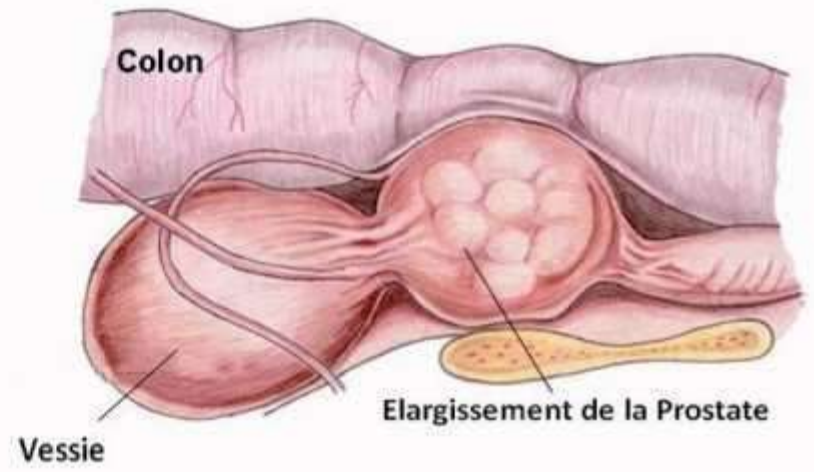
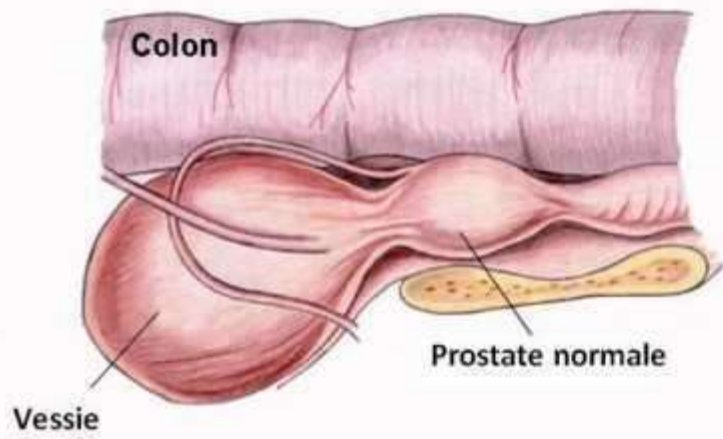


**Prostate**

**Vessie**



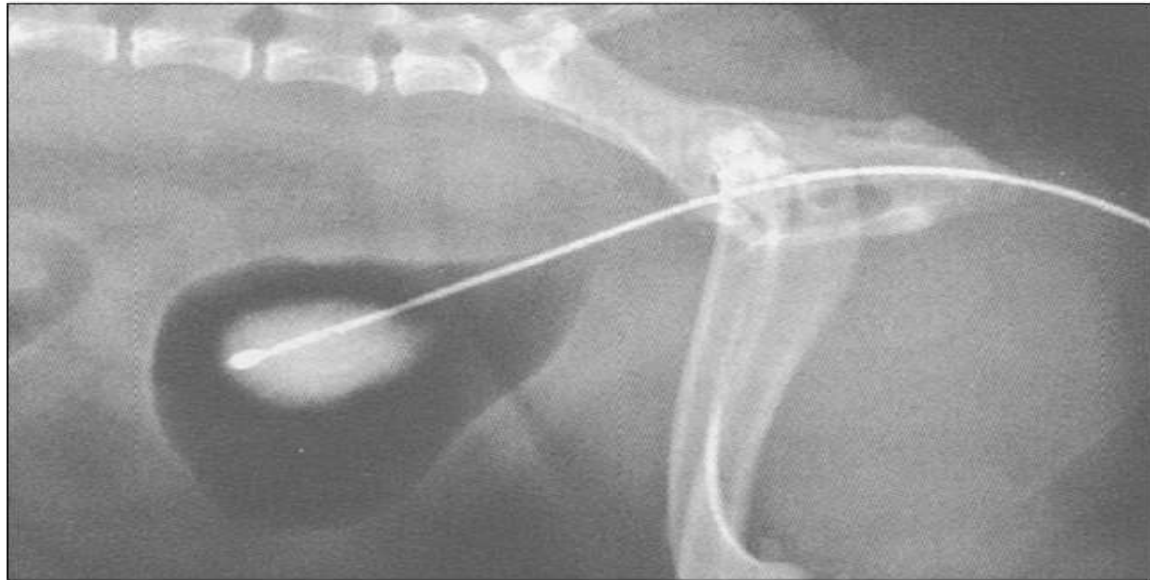
**Plancher du  
rectum**

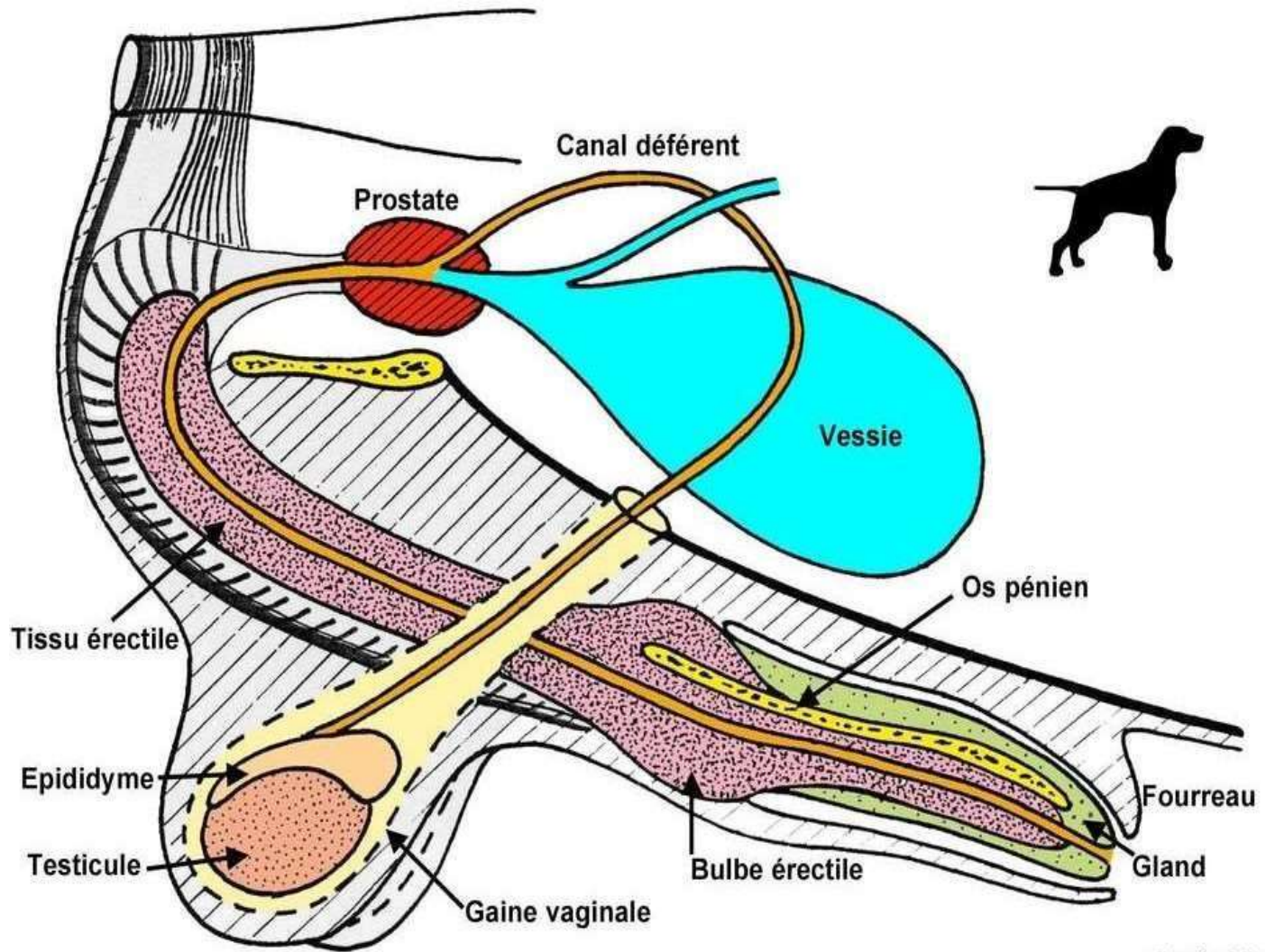


- **The bladder survey**

By urethral catheterization, it is possible to search for an obstacle to the passage of the catheter, usually behind the penile bone in males.

Figure n° 6 : POSITIONNEMENT CORRECT D'UNE SONDE URINAIRE CHEZ LE CHAT  
(d'après Elliott et Grauer, 2006)





d'après Mia

➤ If the catheter manages to overcome the obstacle, one can often feel a creaking due to its friction against stones.

After the removal of the catheter, it is not uncommon to collect some stones.

➤ If the catheter bumps against the obstacle, it is necessary

to attempt a new probing with a catheter of very small diameter.

In case of failure, one will resort to  
cystocentesis

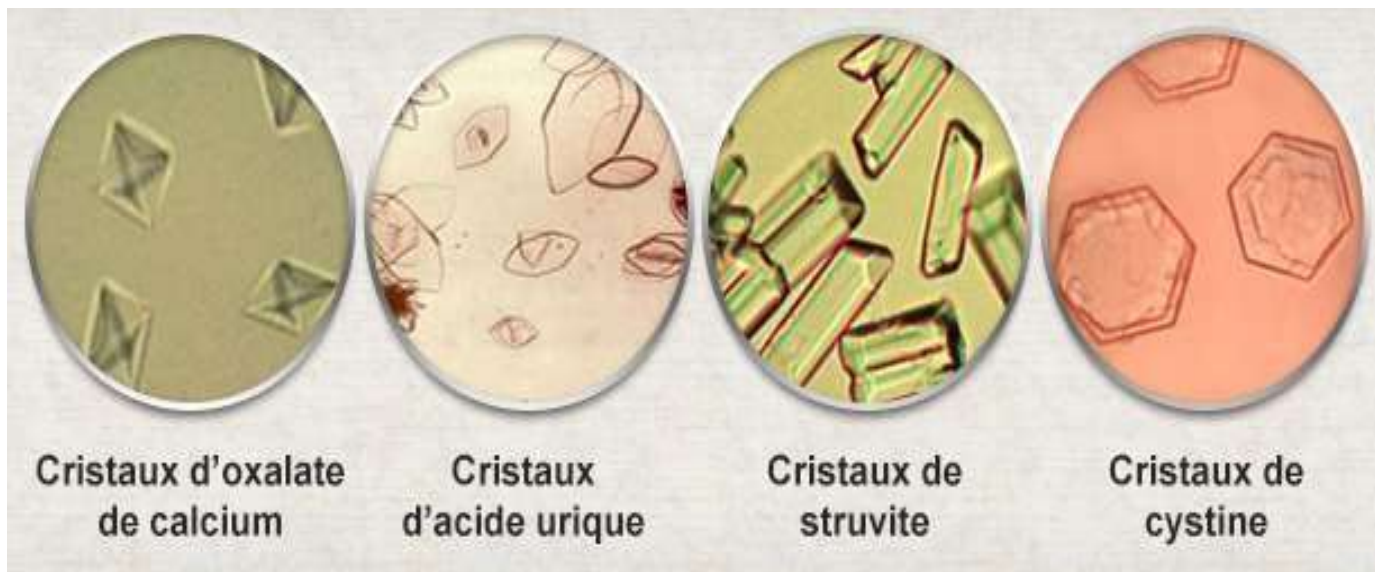
to relieve the animal and to collect urine

for analysis.



- **The biological analysis of urine**

Will inform about the possible presence of crystals (and their nature), but also about the existence of leukocytes or bacteria, etc.



NB:

The line between pollakiuria and dysuria is sometimes thin:

a cat whose urethra is partially obstructed by crystals will  
have difficulty urinating (dysuria).

Frequently tries to urinate and will only be able to produce  
a small amount of urine (which mimics pollakiuria).

It is also worth noting that in this situation, the owner often consults for constipation.

Indeed, the position taken by the cat is almost the same in both cases (Constipation and dysuria).



### **3. STRANGURIE**

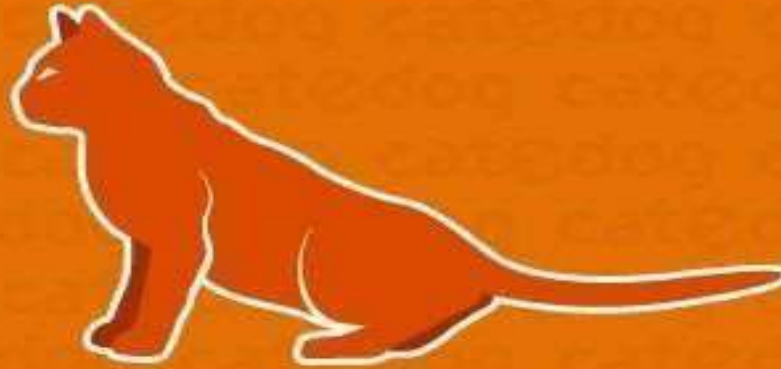
Pain during urination.

Strangury is difficult to objectify.

It generally accompanies dysuria, and it is the latter that should then be explored.

## Les troubles urinaires chez le chat

### Position normale de miction



### Position douloureuse de miction



## **B. CHANGES IN URINE APPEARANCE**

Several elements can give urine an abnormal appearance.

## **Normal color**

- The color of normal urine ranges from clear to dark yellow.
- This yellow coloration primarily comes from: urochrome pigment, a small amount of uncombined urobilin, and uroerythrin.
- These pigments are constantly excreted in the urine.



A red urine is an important reason for  
consultation.

This discoloration is obviously never normal:

**3 factors can contribute to such an appearance:**

Whole blood, hemoglobin, myoglobin, and it is

macroscopically impossible to differentiate them.

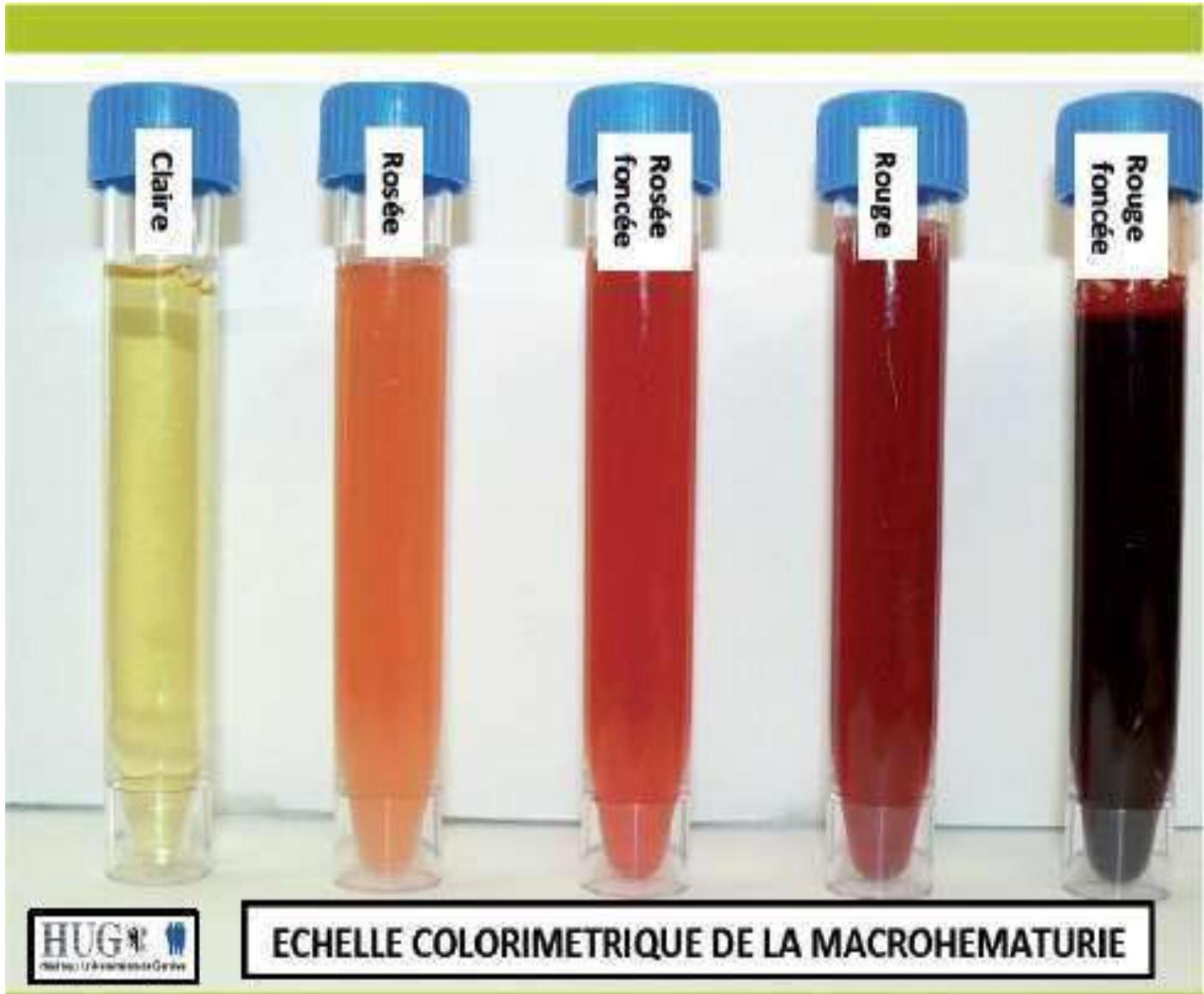


# 1. HEMATURIA

Presence of blood in the urine.

(Or presence of an abnormally high number of erythrocytes in the urine).

Hematuria can be macroscopic (confirmed with test strips for example).

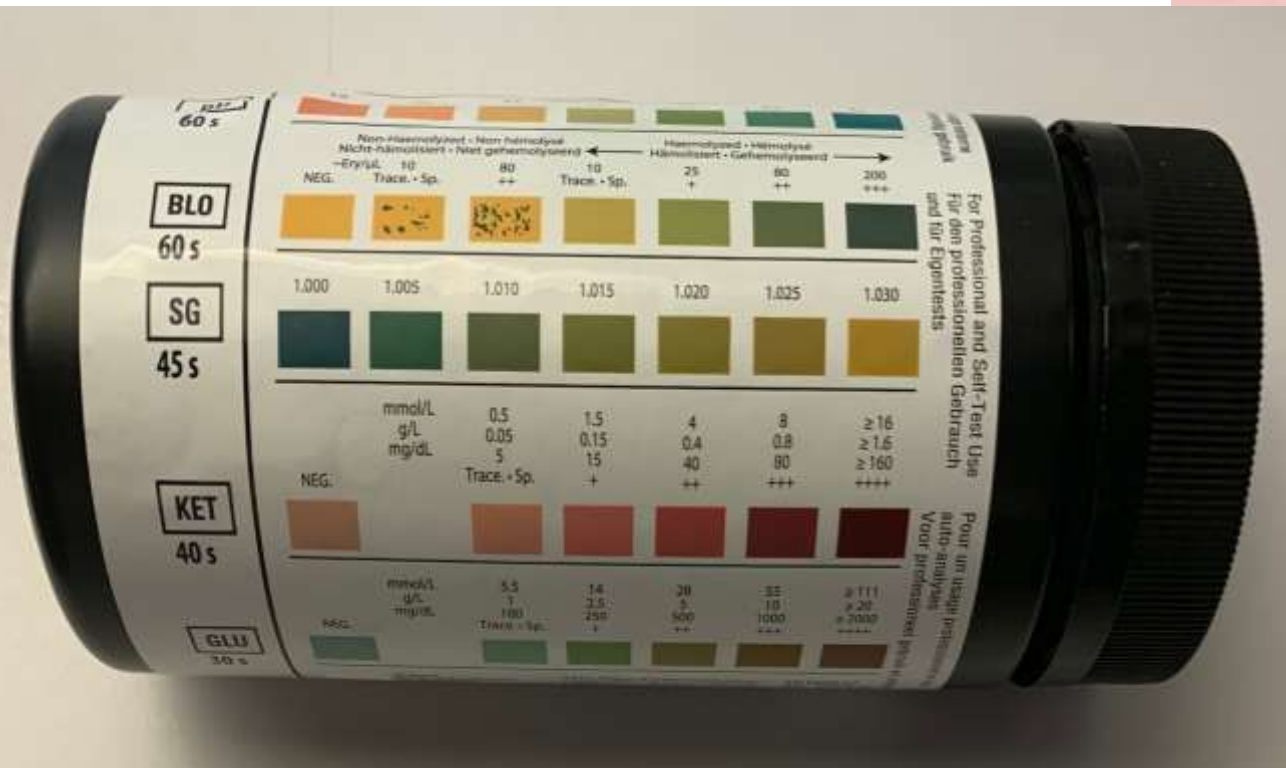
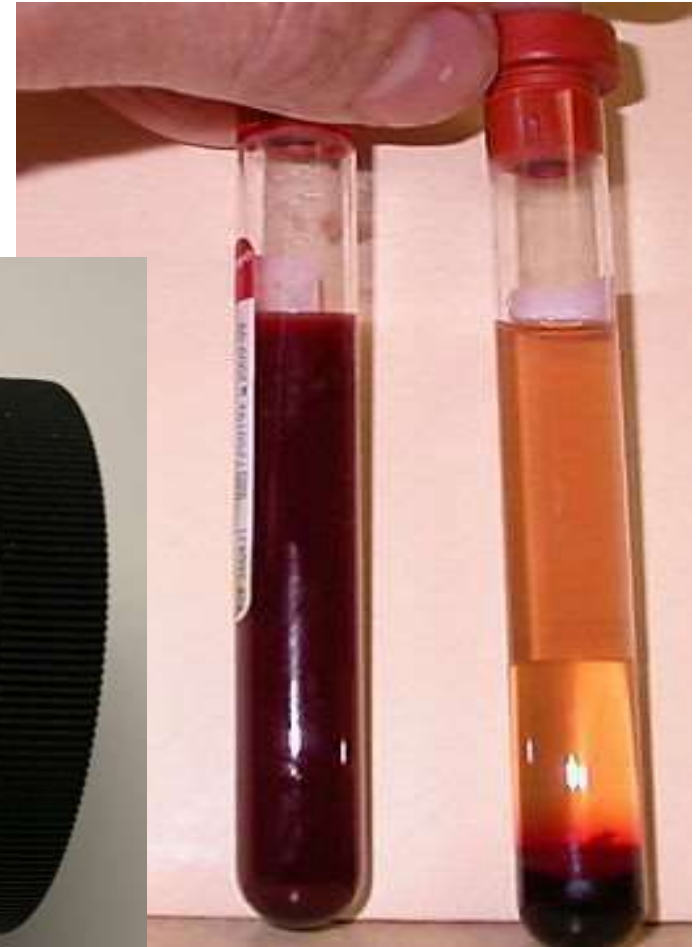


**ECHELLE COLORIMETRIQUE DE LA MACROHEMATURIE**

Hematuria can only be confirmed following the microscopic observation of red blood cells in the urinary sediment.

Ou

Bandelettes urinaire.



NB:

- De bonnes conditions de prélèvement s'imposent pour une interprétation juste.
- Comme les érythrocytes peuvent originer de n'importe quel endroit du tractus génito-urinaire, le mode de prélèvement de l'urine est très important à considérer.
- Un échantillon récolté par miction naturelle ne pourra pas établir l'origine de la perte sanguine.

➤ La cystocentèse sera donc plus indiquée.

La cystocentèse ne pourra infirmer une participation rénale à cette perte sanguine mais elle éliminera cependant le système génital et le tractus urinaire distal (à moins évidemment qu'il y ait deux problèmes).



## Photo 2A - Cystocentèse classique

La vessie est palpée puis immobilisée à travers et contre la paroi abdominale d'une main sans pression excessive. Le remplissage de la vessie, la taille de l'animal et son embonpoint déterminent la difficulté du geste.



L'aiguille est introduite au milieu de la vessie, obliquement avec un angle de 45° en direction du trigone vésical.

La ponction se fait sur la ligne médiane chez le chat et chez la chienne.

La ponction se fait sur la ligne paramédiane chez le chien mâle.

## Photo 2D

Une aspiration douce est effectuée, puis l'aiguille est retirée





Photo 3A

Un contrôle échoguidé facilite la réalisation du geste. La vessie est repérée par échographie ; son niveau de remplissage est estimé.

Photo 3B

L'aiguille est introduite crânialement à la sonde échographique, dans le même plan que celle-ci et selon le même principe que précédemment.



Photo 3C

L'échographie permet de visualiser le trajet de l'aiguille et de confirmer la présence de son extrémité dans la lumière vésicale.



Une hématurie macroscopique :

- A lesion of the urinary tract.
- or a bleeding disorder.

Depending on the timing of the hematuria reported by the owners, it is possible to deduce some indications about the level where the urinary lesion is located:

- The presence of hematuria outside of urination ('false hematuria') is pathognomonic of a urethral injury (if the lesion were located higher, the blood would mix with the urine and therefore be emitted during urination).

Among the causes of lesions, urethral  
prioritize thinking of conditions,  
prostate in males. including issues  
with the

- The presence of hematuria throughout all the

Micturition is in favor of a renal origin (or possibly vesical).

- Hematuria at the end of micturition suggests rather

a vesical origin (calculi, cystitis, tumors, etc.).

The causes of hematuria are multiple:

- They can originate from the kidney (acute leptospirosis, acute tubular necrosis, glomerulopathy)
- from the bladder (uroliths, neoplasm, inflammation),
- from the genital tract (especially inflammation)
- and from coagulation problems (thrombocytopenia).

## Common Causes

Dog

- +++ Cystitis/Urethritis
- ++ Prostatic disease
- ++ Hypersexuality (male)
- ++ Urolithiasis
- ++ Urinary tract tumours
- ++ Trauma
- ++ Coagulopathies

Cat

- +++ Cystitis/Urethritis
- ++ FUS/FLUTD
- ++ Urolithiasis
- ++ Urinary tract tumours
- ++ Trauma
- ++ Coagulopathy

**FLUTD: Feline Lower Urinary Tract Disease.**

**FUS Feline Urological Syndrome (previously used term, now FLUTD).**

## **2. HEMOGLOBINURIA**

Presence of hemoglobin in the urine.

In case of hemoglobinuria, the urine remains  
uniformly colored brown-red.

The presence of hemoglobin in the urine indicates the existence of hemolysis.

- This hemolysis can be intra-vesical: this occurs in the case of urinary stasis (urinary retention), due to alkalization of urinary pH.
- But most often, hemoglobinuria reveals intra-vascular hemolysis; Hemolytic anemia: of parasitic origin (babesiosis), toxic origin, or toxin-related (snake venom), immunological, infectious origin, etc.

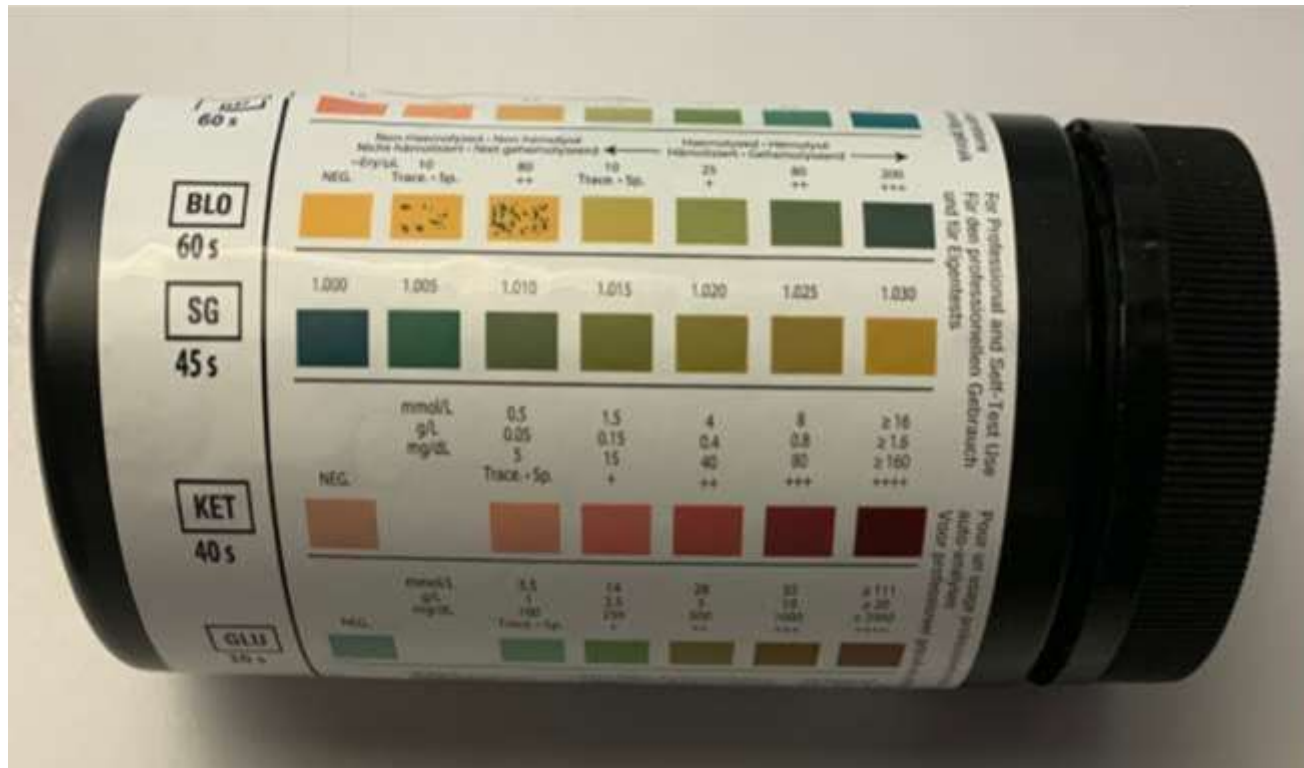
To distinguish from hematuria, it is hemoglobinuria, enough to centrifuge the urine:

- in the case of hematuria, the red blood cells collect at the bottom of the tube, and the supernatant urine appears normal again.
- in the case of hemoglobinuria, the sample retains its appearance from before centrifugation, namely a yellow-orange (or red) color

Highlighting hematuria after centrifugation.



Urine test strips can also be used to distinguish between hematuria and hemoglobinuria.



### 3- Myoglobinuria

- Passage of myoglobin into the urine, which then takes on a red to dark brown color.
- Myoglobinuria can be confused with hemoglobinuria.



Myoglobin is the muscle pigment that acts in the transport of oxygen within the muscle.

This pigment, depending on its concentration in the urine, colors the urine from orange to black-brown.

This phenomenon is observed following more or less significant muscle distress leading to the rupture of the cellular integrity of the myocyte.

## *The historical protocol:*

After collecting a macroscopically colored sample (red, brown,...) of urine colored

1) Centrifuge (500 revolutions/minute) for 5 minutes the urine sample.

If the supernatant is not colored pink/red/brown it suggests hematuria,

If the supernatant is colored pink/red/brown

2) Add 2.8 g of Ammonium Sulfate to 5 ml of supernatant (amount corresponding to urine saturation at 80% in ammonium sulfate) and centrifuge again:

If the supernatant is clear and the precipitate is brown it suggests hemoglobinuria.

If the supernatant remains colored pink/red/brown, this suggests myoglobinuria.

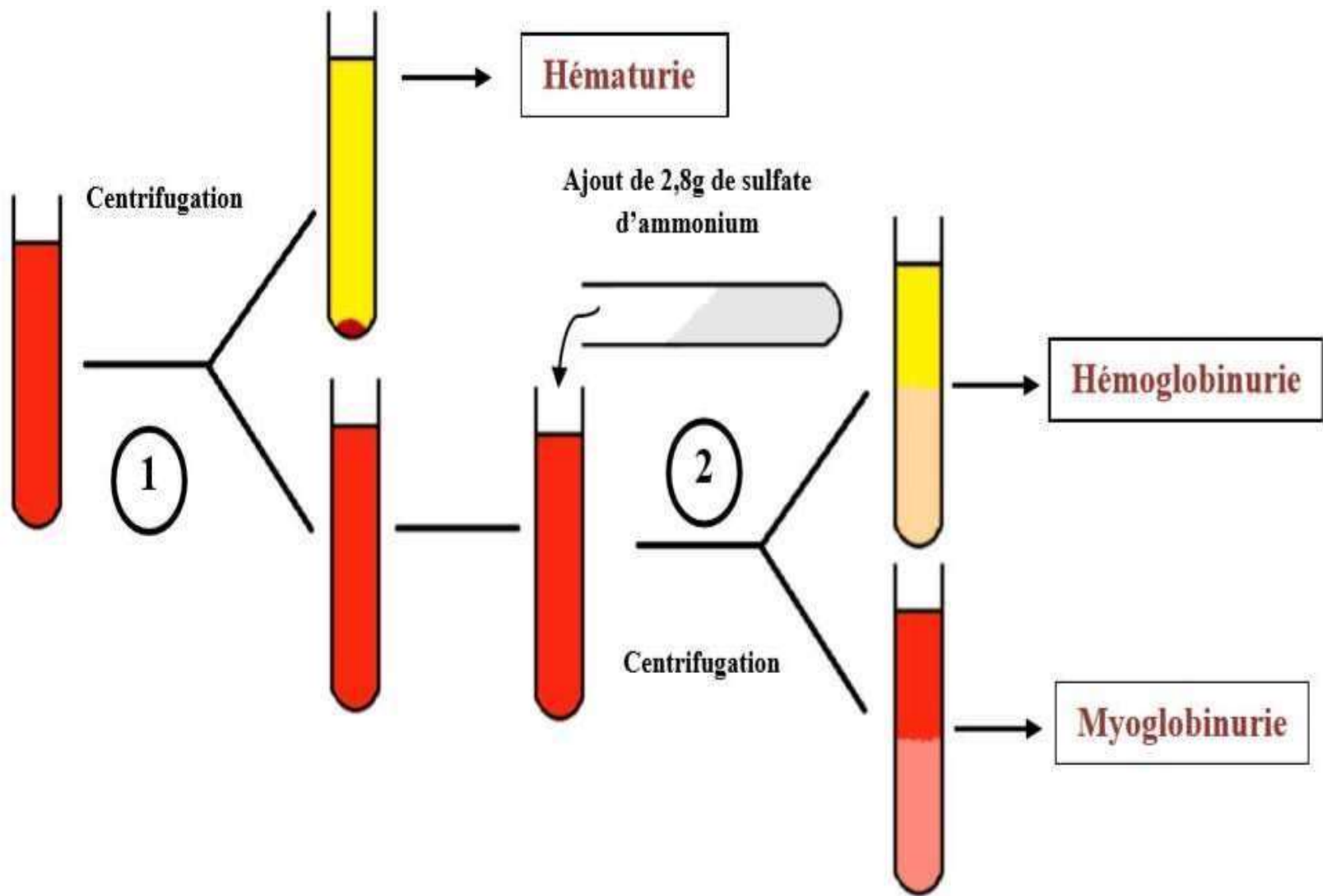


Figure 22 : Schéma explicatif du protocole de différenciation macroscopique des hématuries, hémoglobinuries et myoglobinuries

## 4. BILIRUBINURIA

- Presence of bilirubin in the urine.
- If hemoglobinemia increases, bilirubinemia does as well, leading to the elimination of bilirubin in the urine, giving it a strong yellow to yellow-green coloration.
- Strips +++++

- The presence of bilirubin in the urine indicates an obstruction of the bile flow (obstructive jaundice), or hepatitis (parenchymal jaundice).
- The simultaneous presence of hemoglobinuria and bilirubinuria suggests intravascular hemolysis (e.g., during piroplasmosis).



There are species-specific characteristics.

Indeed, the dog's kidney is capable of conjugating free bilirubin  
and thus making it soluble.

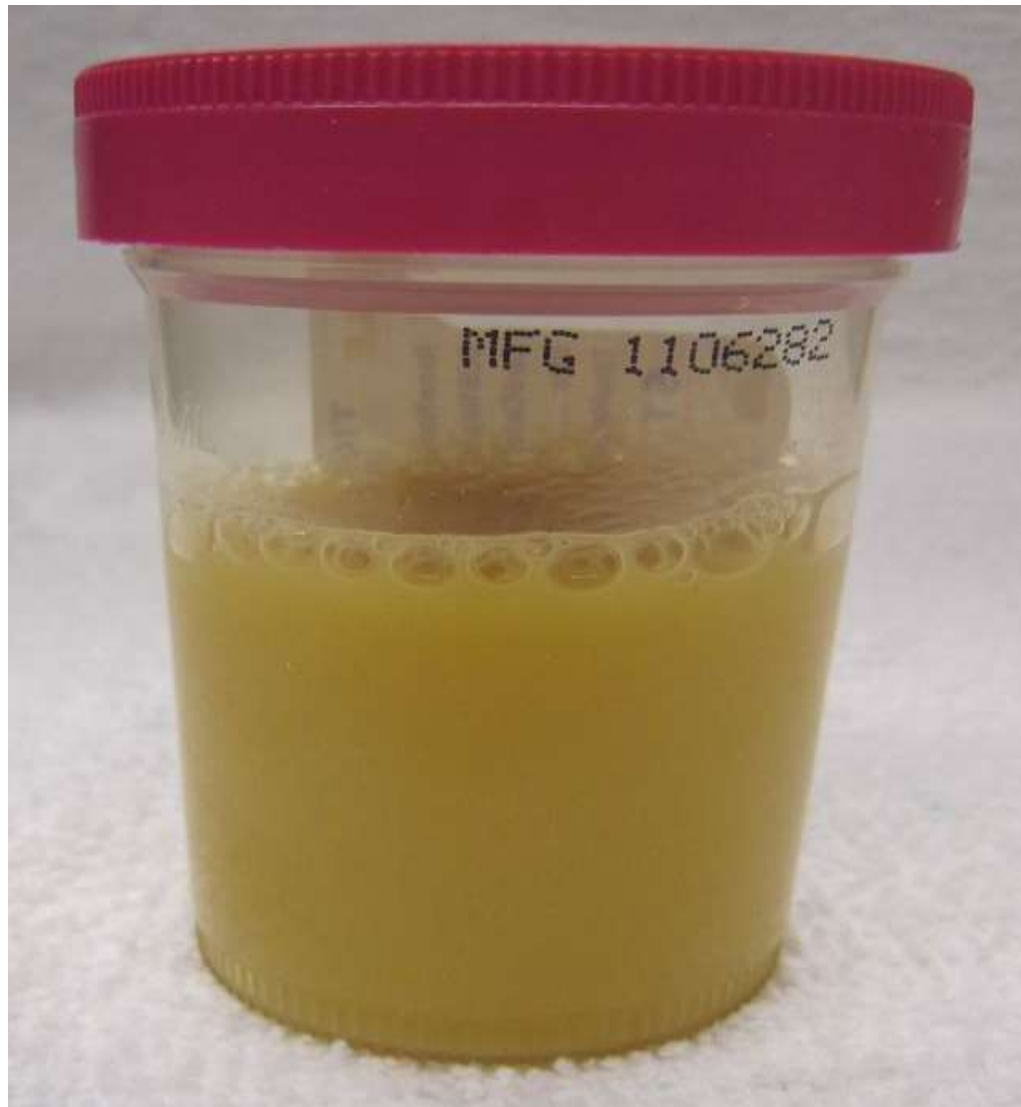
One may therefore observe in dogs a discrete bilirubinuria  
(detected on urine strips) under normal conditions.

On the other hand, in cats, there are no possibilities for conjugation:  
a bilirubinuria is therefore always pathological.

## **4. CLOUDY URINE**

Cloudy urine most often indicates massive leukocyturia, a sign accompanying urinary infections.

In some cases, in males, the cloudy appearance of the urine may be caused by prostatic or seminal secretions.



# Urine colors.

Colorless, Pale yellow (light yellow, or straw), Yellow, Dark yellow, Amber, Pink, Red, Brown, Dark Brown, Brown-Black, Yellow-Green, Pink-Yellow



## **C. INCONTINENCE DISORDERS**

Incontinence disorders are dominated by urinary incontinence.

# **Urinary incontinence**

Loss of voluntary control over urination.

It is enough that sometimes urine is emitted involuntarily (during walking or during sleep, for example) to speak of incontinence;

the existence of normal urinations does not exclude the diagnosis of incontinence.

NB:

The existence of a pathological entity called "vesico-sphincteric dyssynergy" during which the animal assumes the position, contracts its bladder muscle, but urine cannot be emitted due to a spasm of the urethral sphincter: the bladder and sphincter do not work in synergy.

The clinical presentation is dominated by dysuria and sometimes incontinence.

# **SEMIOTIC APPROACH**

L'incontinence est un trouble dont l'exploration est  
réputée difficile.

L'approche classique consiste à différencier les  
incontinences neurogènes des incontinences non  
neurogènes.

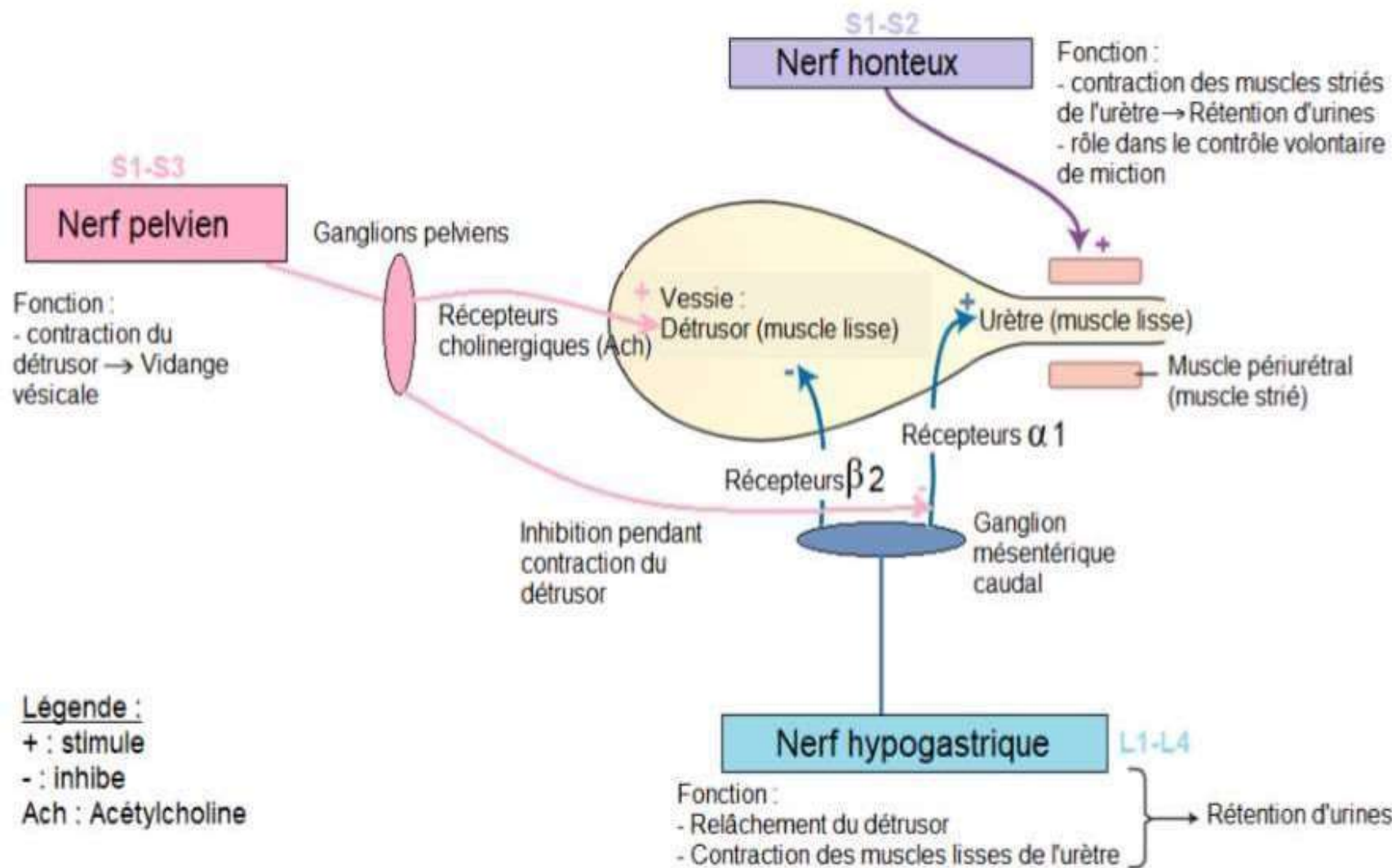


Figure 4 : Innervation motrice de la vessie (schéma modifié à partir du Tobias, Johnston 2012, volume 2, section XI, chap. 116, p.1980)

Toutes les incontinences ont une composante neurogène.

Nous utilisons une approche sémiologique qui consiste à répondre à 5 questions : 4 concernent l'anamnèse, 1 concerne la clinique.

1. S'agit-il vraiment d'une incontinence ?
2. L'animal est-il capable d'avoir des mictions normales ?
3. L'incontinence est-elle permanente ?
4. Quand est apparue l'incontinence ?
5. S'agit-il d'une incontinence à vessie pleine or one incontinence with an empty bladder?

# 1. Is it really incontinence?

Before exploring a sign, it is important to ensure its reality.

It is common for an owner to talk about incontinence:

- for a puppy (or kitten) still untrained,
- in cases of nocturia in an old dog or cat,
- in cases of polyuria.

This refers to situations where the animal cannot, or does not want to, hold it in. The urination happens here with full awareness.

By definition, incontinence implies an involuntary release of urine.

As a result, if an owner complains about the presence of urine in the house in the morning, you will seek to find out whether it was emitted voluntarily or not:

- The incontinent animal urinates underneath itself, in its bed.
- We talk about enuresis to refer to nocturnal incontinence.
- In the case of nocturia (voluntary urination during the night) or polyuria, the animal leaves a large puddle of urine, often some distance from its resting place.

## 2. Is the animal capable of normal urination?

- In an animal capable of normal urination, we can estimate that the Central Nervous System (which governs the emission of urine) is intact; therefore, we will look for involvement of the Autonomic Nervous System or a mechanical injury.

➤ A dog unable to have normal urination is strongly suspected to have central neurological damage (spinal cord or brain); the Signs of this impairment should be sought (perineal reflex, etc.).

However, one must consider the possibility that the bladder is completely shunted (case of bilateral ureteral ectopia).

### 3. Is the incontinence permanent?

- If the incontinence is permanent, it must be assumed that the bladder is shunted (e.g., ectopic ureter).

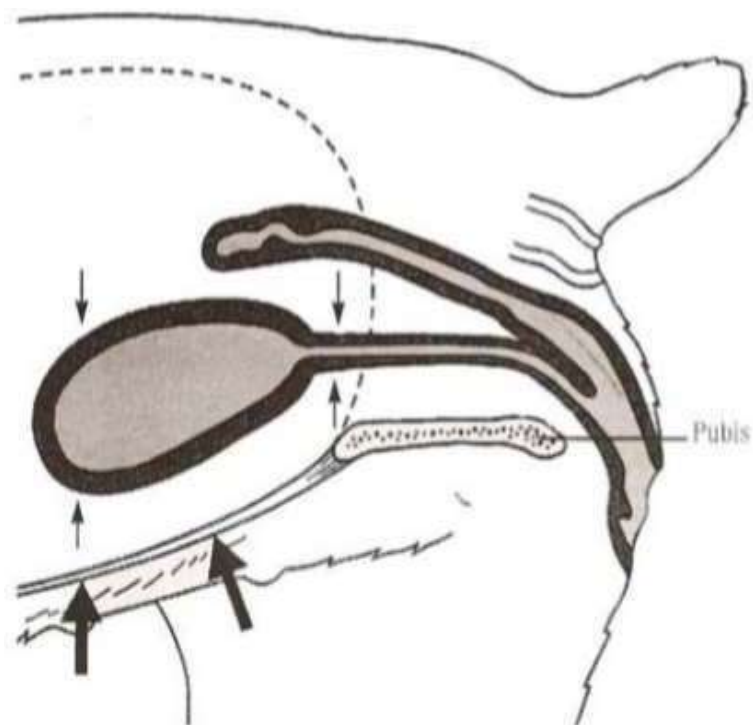
**Ureteral ectopia: Congenital malformation of the urinary tract = Extravascular termination of one or both ureters.**

Instead of ending at the level of the vesical trigone, they open at the level of the vesical neck, the urethra, the vagina, or the uterus in females. In the male, the urethra is at the prostatic level, and the canals are differentiated in the male.

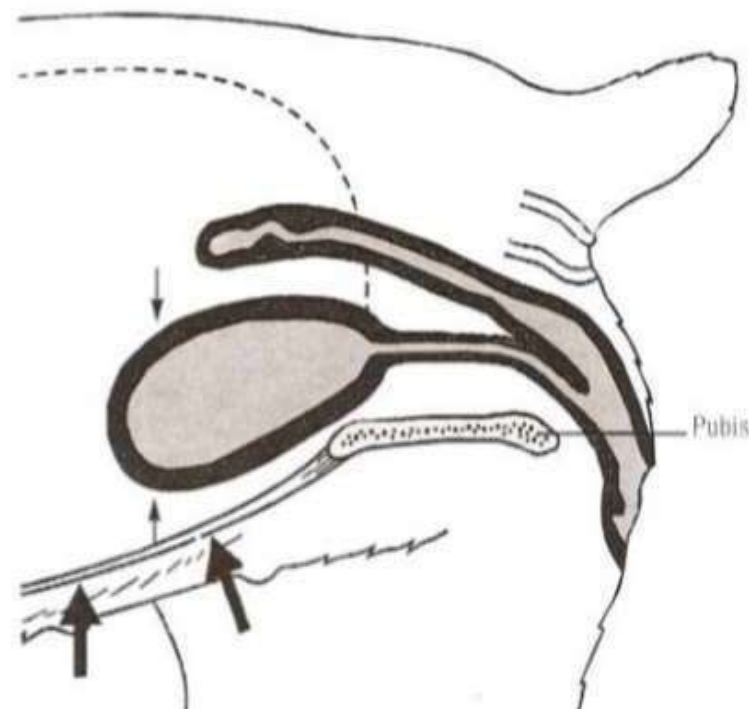


*Female dog : vaginal-urethrography (view lateral). Ectopic ureter opening into the vagina is associated with an intrapelvic bladder. UE: Ectopic ureter, V: vagina, VI: intrapelvic bladder, U: urethra.*

- If incontinence becomes less noticeable after a voluntary micturition, one must assume the existence of a decrease in bladder retention capacity:
  - the bladder muscle cannot distend (case of the pelvic bladder).



**Figure 15** : Répartition des forces de pression lors de décubitus latéral sur la vessie et l'urètre lorsqu'ils sont en position physiologique.  
 Simian-Salvay<sup>[96]</sup>.



**Figure 16** : Répartition inégale des forces de pression lors de décubitus latéral sur la vessie et l'urètre proximal lors de « vessie pelvienne ».  
 Simian-Salvay<sup>[96]</sup>.

- the sphincter urethral contracts

insufficiently (case of the  
sphincteric, of post-  
incompetence

castration).

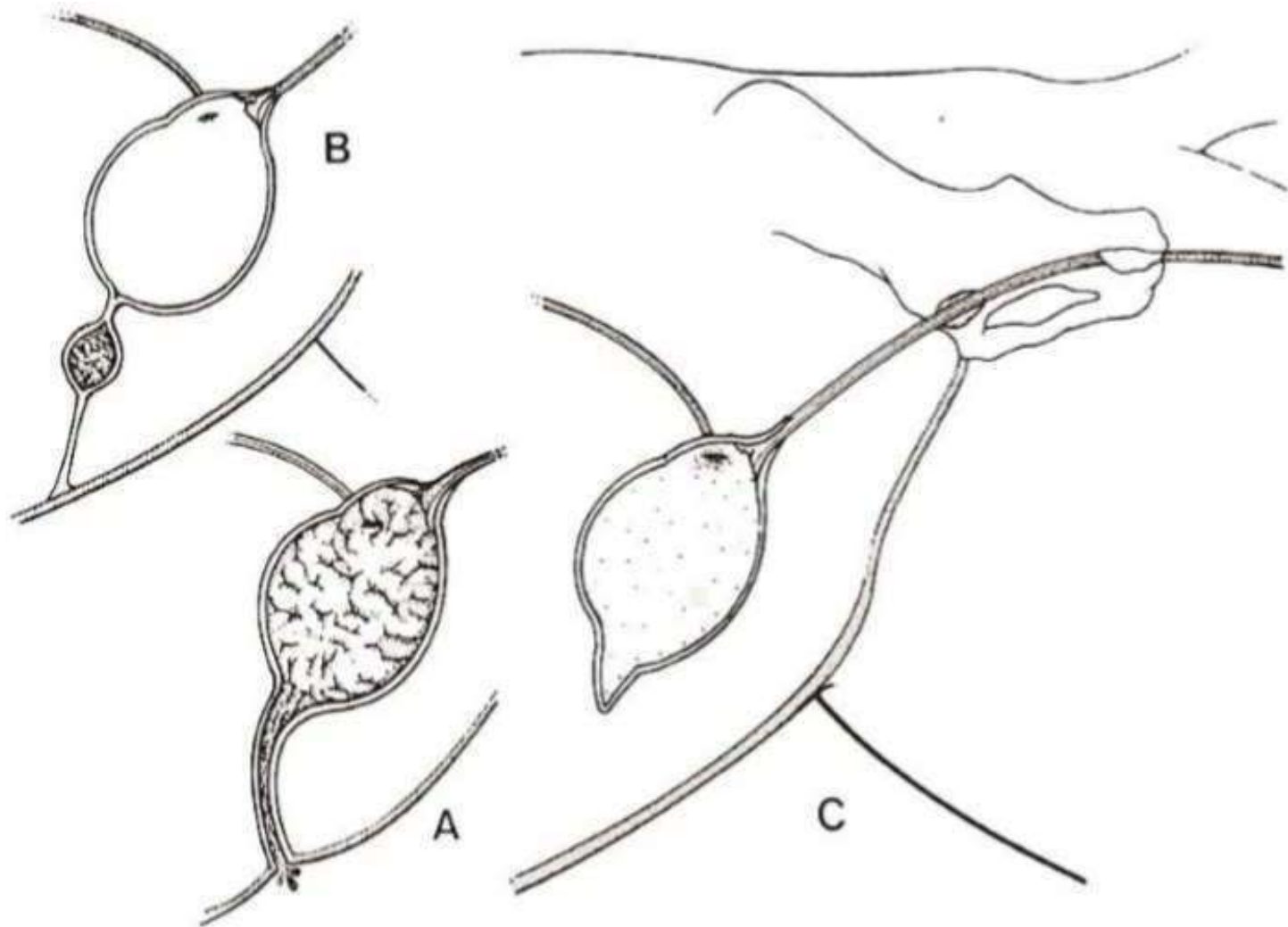
#### 4. When did incontinence appear?

The knowledge of the moment incontinence allows to distinguish the appearance of incontinenes that have always existed (most often resulting from congenital malformations) acquired incontinenes.

## ➤ Congenital malformations

- The main malformations are: congenital
  - the ectopic ureter and
  - the sphincter incompetence.

- The persistence of the Allantois duct, often reported in the literature, is actually exceptional and poses no diagnostic problem:
  - urine is emitted at the level of the umbilicus.
- More classic is the existence of a diverticulum of the Allantois in the cranial vesical region, a source of recurrent infections sometimes manifesting as incontinence.



**Figure 14 :** Les anomalies congénitales de l'ouraque.

**A :** Persistance du canal de l'ouraque, **B :** Kyste du canal de l'ouraque,  
**C :** Diverticule de l'ouraque.

## ➤ Acquired incontinences

The moment of appearance of acquired incontinences can guide the diagnosis:

- Sphincter incompetence typically manifests at puberty.
- The onset of incontinence after oophorectomy is very indicative of hormonal incontinence.
- History of abdominal surgery (especially septic, metritis or pyometra...) should raise concerns about the formation of adhesions.
- The prior identification of a urinary condition (prostatic pathology, bladder stones, ...) should lead to the consideration that the incontinence is a complication of this condition.



- Empty bladder

If incontinence occurs while the bladder is empty or partially filled, 2 mechanisms may be considered:

- the bladder muscle contracts too easily (pelvic bladders, spastic bladders),
- the sphincter does not contract enough  
(hormonal sphincter-wise, incontinence incompetence).

- Full bladder

If the bladder is full at the time of incontinence,

2 other mechanisms will be considered:

- the bladder muscle does not contract enough (atonic bladders, dysautonomia),
- the sphincter contracts too much (thoracolumbar disc herniation).



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## **II. URINATION DISORDERS**

### **A. OLIGO-ANURIA**

Oliguria is a decrease in the amount of urine produced.

In extreme cases, it is referred to as anuria in the complete absence of urine production.

From a semiological perspective, little distinction is made between oliguria and anuria, and the term 'oligo-anuria' is commonly used.

# **PROCEDURE TO FOLLOW**

The semiology of oligo-anuria primarily aims to confirm this sign, then to determine the excretory or secretory nature in order to finally identify the cause.

# 1. CONFIRM ANURIA

It is difficult for an owner to accurately assess the amount of urine produced by their animal; this is why it is important to confirm an impression of oliguria, particularly by trying to find out if the animal has been able to urinate without its owner noticing.

We will then look for a physiological origin of this oligoanuria (high temperatures, fluid restriction, ...).

In the hospitalized animal, an indwelling urinary catheter allows for urine collection and precise quantification of urine production.

Physiological urinary production = 1 to 2 ml / kg / hour.

## 2. SECRETORY ANURIA or EXCRETORY ANURIA

?

The second stage of exploring oligoanuria is to determine the excretory or secretory origin of the disorder: is it a cessation of urine production or an inability to pass the urine produced?

➤ Elimination defect

Excretory oligoanuria has 2 main causes,  
which are mechanical:

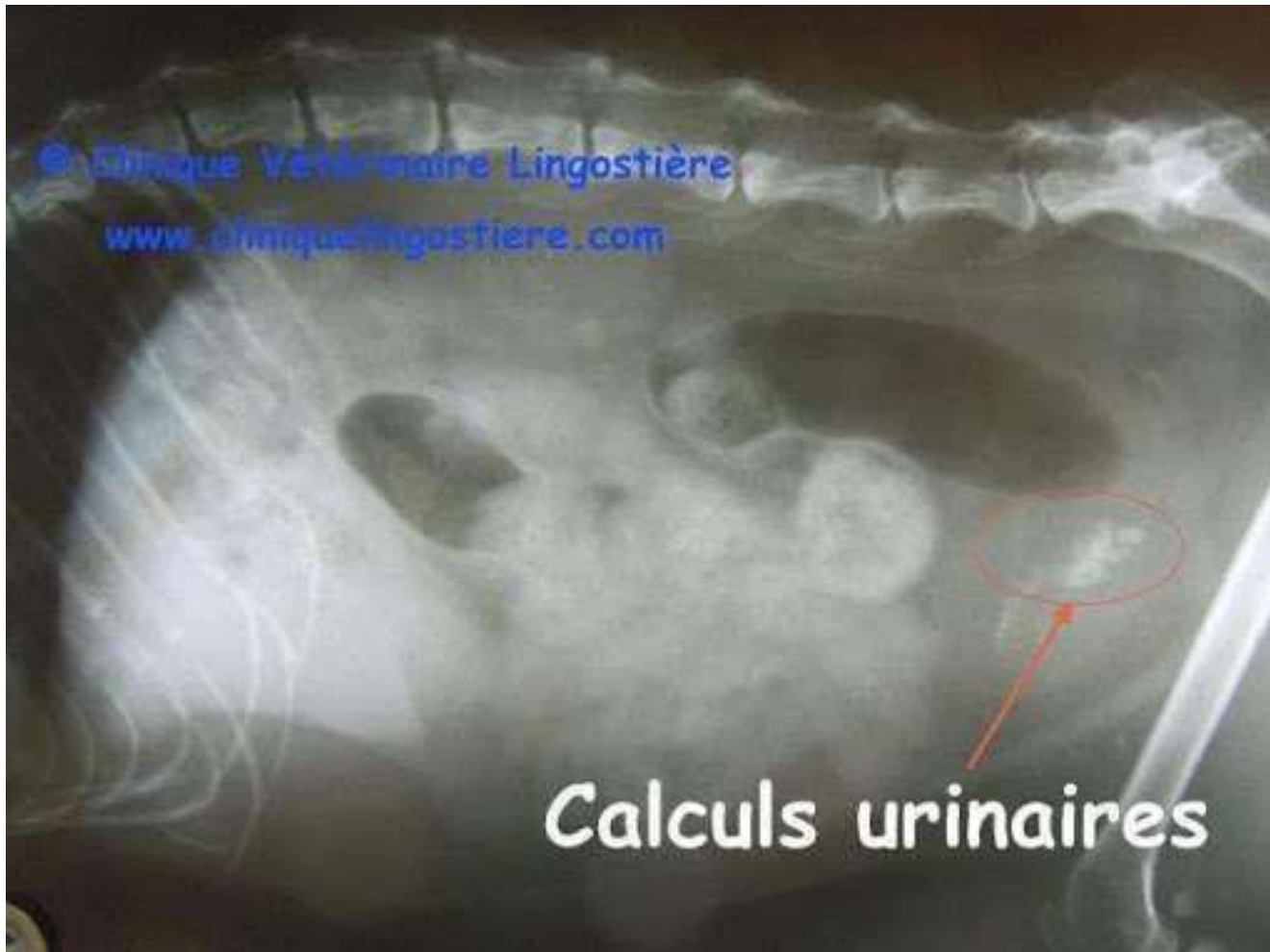
- an obstruction in the urinary tract,
- a rupture of the urinary tract.

# 1. Obstruction of the urinary tract

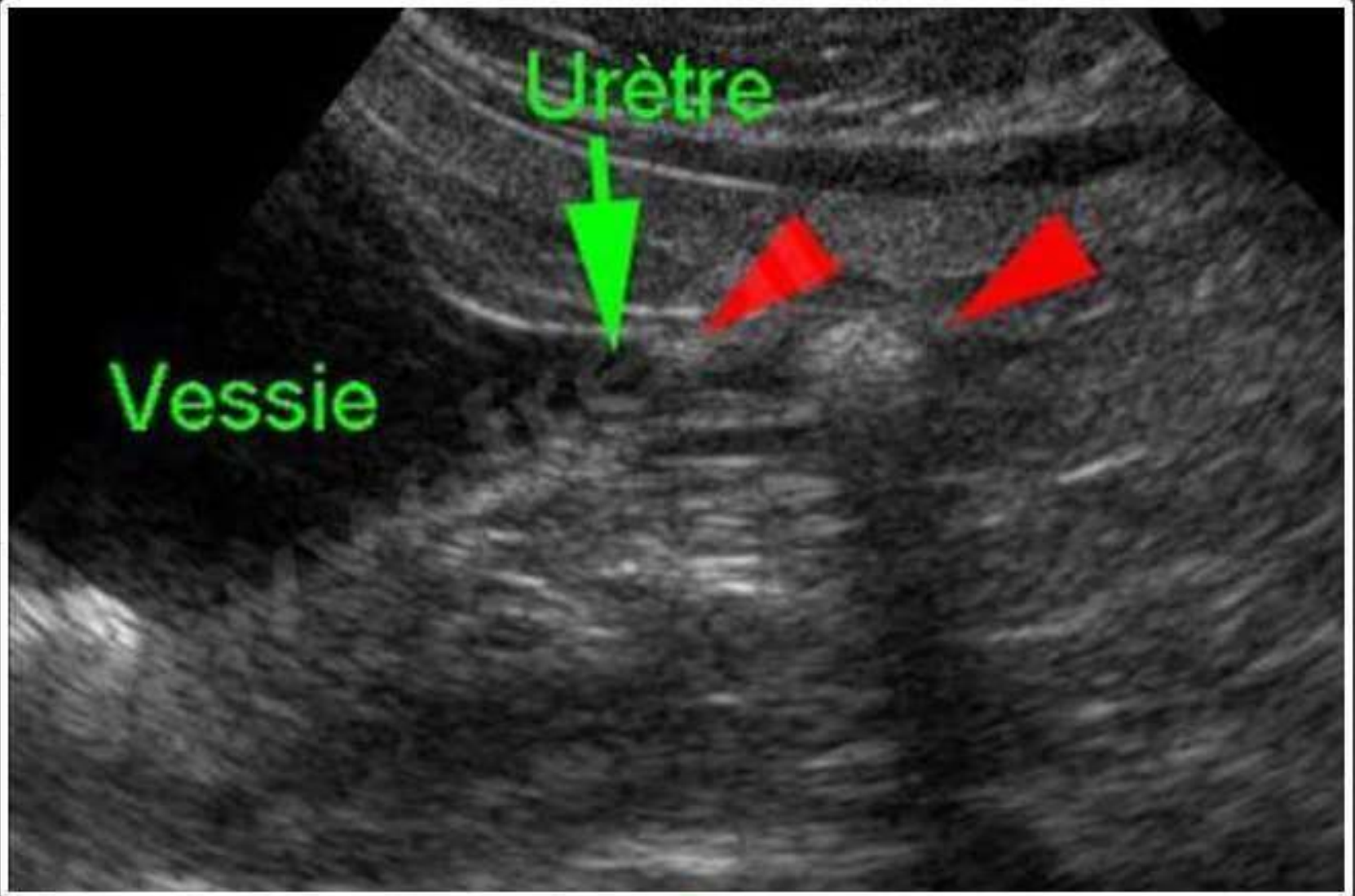
- vesical or urethral stones (++++),
- prostatic pathology in dogs (++),
- vaginal tumor in female dogs (++),
- urethral tumor, ...

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**Calculs urinaires**



Echographie de l'abdomen d'un chat souffrant de calculs urinaires empêchant l'animal d'uriner. Les calculs (flèche) obstruent la sortie de la vessie (urètre)



In this situation, anuria is usually accompanied  
by dysuria.

Abdominal palpation often reveals a vesical  
globe.



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## 2. Rupture of the urinary tract

The rupture of the urinary tract

concerns

generally involves the bladder and

the urethra.

A trauma is most often the cause.

- Bladder rupture:

- after an accident, especially in case of pelvic fracture. => It is therefore essential to check urine output in accident victims!

- cystocentesis on a full bladder with a moving animal:

abdominal palpation too forceful in the presence of a bladder globe.

=> Handle with care animals showing a bladder globe.

- Urethral rupture:
  - bladder catheterization in a male cat obstructed:  
the metal chuck can slide into the probe's  
opening and tear the urethra!



NB:

- An excretory anuria is the origin of acute kidney failure (AKI) post-renal within a few hours to a few days, which must be differentiated from other AKIs.
- In cases of excretory anuria (post-renal AKI), hyperkalemia is sometimes observed, which can be the cause of cardiac rhythm disturbances.

➤ Production defect

Anuria is practically characteristic of urinary excretion disorders.

Disorders of urinary 'secretion' are rather manifested by oliguric conditions.

Excretory oligouria is observed in 3 situations:

# 1. PRE-RENAL AKI

In cases of low blood flow to the kidney, it cannot function properly, referred to as PRE-RENALE ou d'IRA fonctionnelle.

La mise en jeu des mécanismes économisateurs d'eau (rénine, angiotensine, aldostérone) conduit à une oligurie (l'anurie est exceptionnelle).

Parmi les causes de bas débit sanguin, il faut s'attacher à rechercher particulièrement une déshydratation extra-cellulaire :

- persistance du pli de peau,
- enfoncement des globes oculaires,
- weak and thin pulse,
- cold extremities,
- elevated hematocrit,
- hypovolemic shock ...

- Heart failure classically complicates with pre-renal kidney failure but insidiously; oliguria is not observed in this situation.
- In the case of pre-renal AKI, uremia is moderately elevated ( $> 0.6$  g/l in dogs and cats but  $< 2$  g/l) while creatinine levels remain normal or slightly elevated ( $< 20$  mg/l).
- Urea = (normal [g/l]: dog=0.2-0.5; cat=0.4-0.6). Creatinine = (normal [mg/l]: dog=10-20; cat=10-20).

## 2. PRE-RENAL AKI

- Pre-renal AKI results from a sudden injury to the renal parenchyma.
- This is the case, for example, with nephritis.
- 
- We need to focus on looking for signs of kidney impairment: proteinuria,

In case of acute renal failure, the uremia is high (always  $> 1$  g/l) and can reach 3 or even 6 g/l; similarly, the creatinine level always exceeds 20 mg/l, often approaching 50 mg/l and exceeding 100 mg/l in some cases.

Urea = (normal [g/l]: dog=0.2-0.5; cat=0.4-0.6). Creatinine = (normal [mg/l]: dog=10-20; cat=10-20).

### 3. THE TERMINAL STAGE OF CRF

The terminal stage of chronic kidney failure (CRF) mimics acute renal failure.

It is characterized by the disappearance of polyuria polydipsia (PUPD) observed during the steady state phase of the disease, replaced by oligoanuria and accompanied by a set of symptoms (digestive, respiratory, or neurological) falling within what is called 'uremic syndrome' and ending in a few days with death.

Note:

- To distinguish terminal stage CRF from acute renal failure, it is important to look for the existence of a previous PUPD before anuria, as well as other signs of CRF.

- Whether the AKI is pre-renal or post-renal, it leads to the onset of renal AKI.
- AKI is generally reversible, but the nephrons destroyed in this process are lost.
- The kidney functions (in the case of AKI) because it only requires a limited number of nephrons and due to an adaptation of the remaining nephrons; everything that is lost is permanent.

- Consequently, the presence of oligoanuria, a precursor sign of any AKI, should prompt us to immediately determine its origin in order to early implement the etiological treatment.

## EN RESUME

(et très schématiquement)

Anurie + dysurie : obstacle

Anurie + trauma : rupture des voies urinaires

Anurie + mauvais état général : I.R.

\* déshydratation, choc : IRA pré-rénale

\* protéinurie, pyurie, ... : IRA rénale

\* PUPD antérieure : IRC terminale

## B. POLYURO- POLYDIPSIA

Polyuria is defined as urine production greater than 50 ml/kg/day.

In practice, while this polyuria often motivates consultation, it remains difficult to objectify because it requires a one-day hospitalization.

with urine collection in a metabolism cage.

It is easier to measure water consumption.



Polydipsia is defined as a water consumption greater than 100 ml/kg/day.

Normal water consumption ranges between 20 and 40 ml/kg/day.

In practice, it is this polydipsia that can easily be quantified by the owner.

# SEMANTIQUE

- Polydipsia inevitably translates to a greater emission of urine (unless there are known fluid losses, such as digestive losses).

- Similarly, polyuria will require the animal to increase its water intake under threat of dehydration.
- As a result, polyuria and polydipsia are very often associated, which is why we speak of the "polyuro-polydipsia" syndrome ("PUPD" in our jargon).

# IMPORTANCE

The PUPD syndrome is extremely common      frequent in  
in carnivore medicine (dog and cat).

If the list of causes is relatively short, we will see  
that they are diseases which, due to their prevalence and  
severity, represent pathological dominants in carnivores.

## CONDUCT TO FOLLOW

A PUPD is explored in 3 steps:

1. Search for the PUPD,
2. Confirm the PUPD,
3. Determine the cause of the PUPD.

# 1. SEARCH FOR THE PUPD

The search for a PUPD should be systematic during consultations, even during a vaccination consultation, especially in an elderly animal.

Given the frequency of PUPD and the severity of its causes, its search should be consistent.

There should not be a consultation without the veterinarian asking: "Is your animal drinking more than usual?"

Indeed, it happens that this syndrome is not  
mentioned by the owner.

However, its knowledge has an interest:

- diagnostic: PUPD is a major syndrome that always deserves to be explored as its investigation is easy and rich in insights.
- therapeutic: depending on the identified cause, some treatments may be contraindicated.
- prognostic: life expectancy varies depending on the responsible disease.

## 2. CONFIRM PUPD

### a) Confirmation of polyuria

Polyuria should not be confused with:

- pollakiuria: the frequency of urination is increased but the total amount of urine produced remains the same;
- incontinence: the animal does not position itself to urinate.
- uncleanliness or marking behavior: the amount of urine is normal but the animal positions itself in inappropriate places.

In practice, it is more common for the owner to consult for incontinence while the animal presents with polyuria.

Thus, nocturia (urination at night) indicates the existence of polyuria.

should be considered voluntary

## b) Confirmation of polydipsia

It is polydipsia that is most often reported by owners (the dog often drinks in the house, near its owners, while it urinates alone outside).

Example: If the owner doesn't think to refill the water bowl, the dog looks to drink from the tap, in the toilet, or in puddles.

To be confirmed, a PUPD must be quantified.

Normal water consumption is between 20 and 40 ml/kg/day.

We talk about polydipsia for a consumption  $> 100$  ml/kg/day, which is more than 1 liter/day for a 10 kg dog.

However, it is exceptional for owners to quantify this consumption.

On the other hand, they often indicate that the animal drinks 2 or 3 times more than usual, which is a good

It is not uncommon for owners to report polydipsia, specifying that the animal does not urinate more:

In the absence of recognized water losses (vomiting, diarrhea, heat, ...) this eventuality is not plausible and leading to the conclusion reflects poorly of the observation by the owner.

On the contrary, because there are  
there are several dogs (or or  
cats) animals can drink from several  
sources, owners may not notice  
polydipsia.

### 3. DETERMINE THE CAUSE OF THE PUPD

PUPD should never be fought; it is its cause

that should be addressed.

**IL NE FAUT JAMAIS RESTREINDRE LA  
CONSOMMATION D'EAU D'UN ANIMAL**

➤ Main

causes of PUPD in order of

frequency:

### Chez le chien

1. L'insuffisance rénale chronique
2. Le pyomètre ou la métrite
3. L'hypercorticisme
4. Le diabète sucré
5. Les diabètes insipides

-----

beaucoup plus rarement

6. L'insuffisance hépatique
7. L'hypercalcémie

## Chez le chat

1. L'insuffisance rénale chronique
2. Le pyomètre ou la métrite
3. Le diabète sucré
4. L'hyperthyroïdie

## *Iatrogenic causes*

Before exploring these different causes, it is important to check if the origin is not iatrogenic, that is to say due to treatment instituted by the veterinarian (or the owner).

Among these iatrogenic causes:

1. diuretics
2. corticosteroids
3. solution infusions
4. the relief of urinary obstruction
5. the intake of salt in the diet.

NB:

In the case of prescribing diuretics or corticosteroids, it should not be omitted to inform owners that their dog or cat will urinate more (and thus drink more), which may cause nocturia.

# A. CHRONIC RENAL

# RENAL

## FAILURE (CRF)

Is defined as the progressive, irreversible inability of the kidney to perform its functions.

L'IRC est la cause la plus fréquente de PUPD :  
80 % des PUPD sont dus à une IRC.

# Pathogenesis

PUPD reflects the kidney's inability to concentrate the urine where there is a decrease in urinary density which becomes less than 1.025.

PUPD appears early, it is observed from the onset phase of the CKD and becomes more pronounced during the stable phase.

CKD is generally observed in older dogs (or cats) whose appetite becomes capricious, who lose weight and become lethargic.

This is accompanied by digestive signs (vomiting, diarrhea, oral ulcers, etc.) that will need to be investigated.

# Diagnosis

The definitive diagnosis involves the measurement of uremia and creatininemia, whose values are increased:

- Urea > 1 g / l (0.2-0.5g/l : CT; 0.4-0.6g/l : CT).

Creatininemia > 20 mg / l (10-20 mg / l : CNL ; CT)

## **B. PYOMETRA**

Accumulation of pus in the uterus during metoestrus, with an impact on the body (kidney, liver in particular) and numerous extragenital manifestations (including PUPD) inversely proportional to the degree of cervical dilation.

In case of an open cervix, vulvar discharge  
may be observed.

In case of a closed cervix, no discharge:  
which  
induces a more significant impact on the  
general condition.

# Clinical signs that may be observed during pyometra.

<b>Signes cliniques</b>	<b>Fréquence d'observation</b>
<b>Ecoulements vulvaires</b>	<b>85%</b>
<b>Léthargie, abattement</b>	<b>62%</b>
<b>Anorexie, dysorexie</b>	<b>42%</b>
<b>Polyuro-polydipsie</b>	<b>28%</b>
<b>Vomissements</b>	<b>15%</b>
<b>Nycturie</b>	<b>5%</b>
<b>Diarrhée</b>	<b>5%</b>
<b>Distension abdominale</b>	<b>5%</b>

During metritis and even more so during  
pyometra, we

observe polyuria resulting from a decrease  
in the kidney's ability to respond to ADH  
(vasopressin, or antidiuretic hormone).

The pathogenic mechanism is poorly understood.

Vulvar discharge during a pyometra in a female dog. Generally purulent in nature.





Too often people the

confuse pyometra with  
metritis.

Pyometra is indeed caused by a

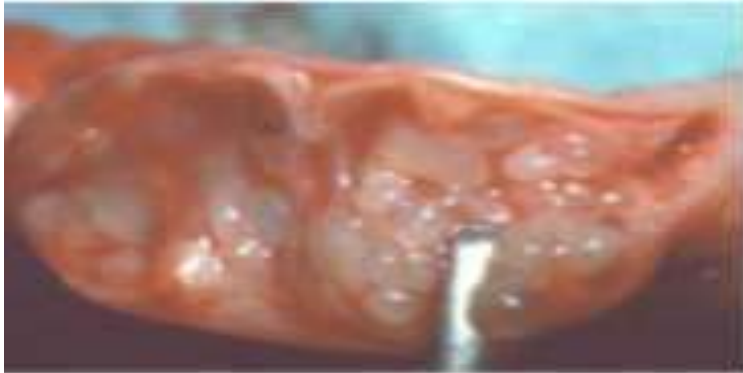
«Glandular cystic hyperplasia»:

significant development of the uterine

glands.

# 4 different stages of glandular cystic hyperplasia (HGK).

**HGK Stade 1**



**HGK Stade 2**



**HGK Stade 3**



**HGK Stade 4**

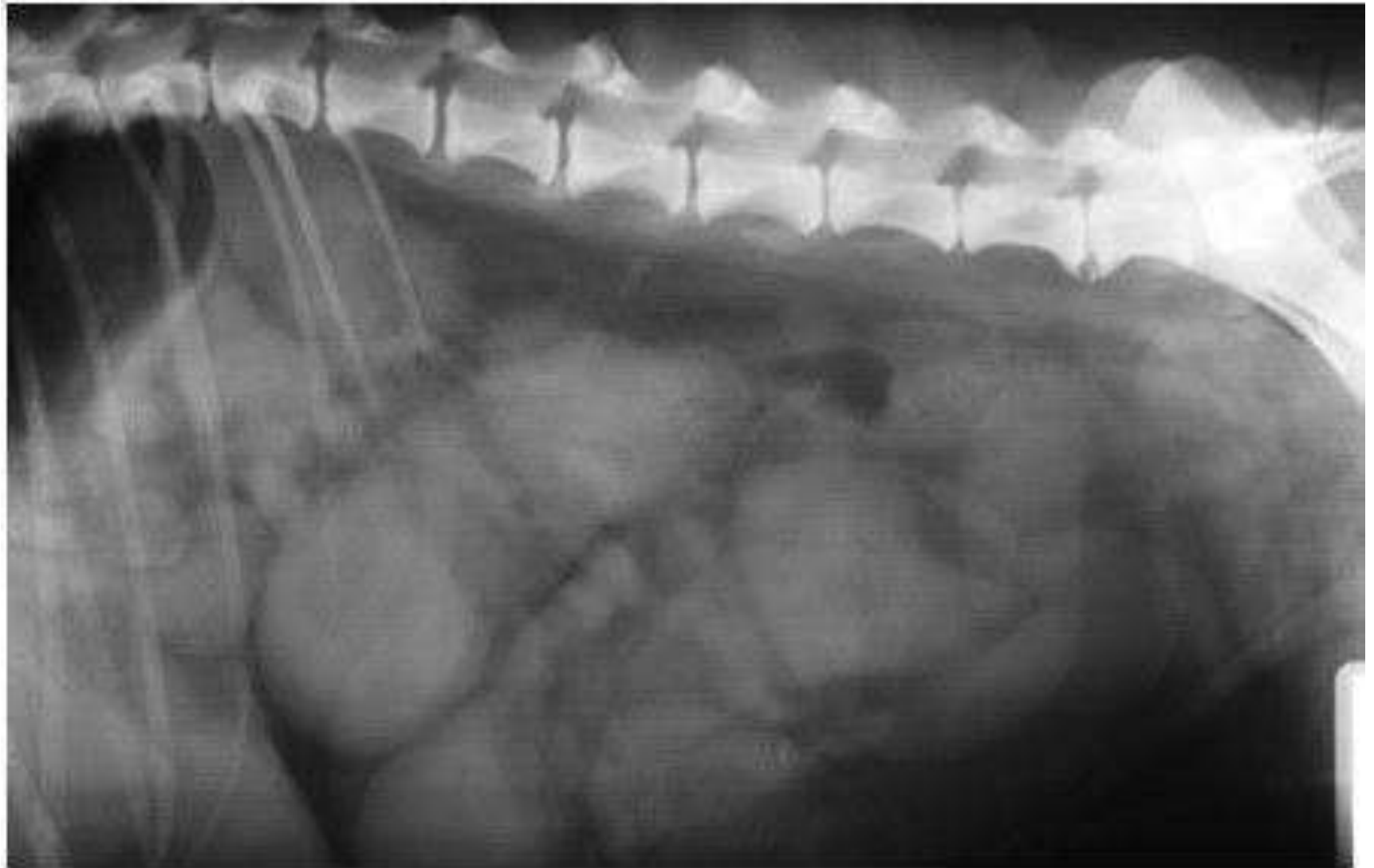


# Diagnosis

After suspicion based on clinical and epidemiological data,

ultrasound and X-ray

most often allow for confirmation of the diagnosis.



Radiographie d'un pyomètre: les zones blanches allongées, oblongues et arrondies sont les cornes utérines gonflées par l'infection.

Dilatation sévère de l'utérus  
avec un contenu liquidien  
discrètement échogène

Paroi utérine interne  
irrégulière



Graisse péritonéale  
hyperéchogène

Service d'imagerie EMVA

Condition originating from a hormonal disorder  
(of sex hormones), triggered  
by prolonged stimulation of the uterus by  
progesterone (often in the two months following  
the last heat).

# Management

- The treatment options for pyometra are the same for cats and dogs.
- Medical management is not highly recommended, especially for cats.
- Fluid therapy should be initiated to correct dehydration or shock.
- Ovariohysterectomy is the treatment of choice.
- In severely ill animals, the uterus is the source of endotoxemia and should be removed as soon as possible.
- Surgery should be performed as soon as the animal is rehydrated and stable (in terms of cardiovascular condition).

- If the reproductive potential of the animal (especially a female dog) is crucial for the owner, medical management may be considered.
- Medical management should not be considered for severely ill females.
- Medical management is less effective and has a higher complication rate in females with a closed-cervix pyometra.
- It is generally recommended to limit medical management to female dogs with an open-cervix pyometra and without systemic disease.

- Medical management involves the use of PGF2 alpha.
- Bitches in the second month of dioestrus (> 30 days after oestrus) will respond better to treatment, as the corpus luteum is more mature and thus easier to lyse.

- Recommended procedure:
  - The bitch should be placed on broad-spectrum systemic antibiotics.
  - PGF2 alpha (for example Lutalyse®); 0.25 mg/kg SC every 24 hours for 3 to 5 days.
  - Side effects include panting, salivation, tremors, vomiting, and diarrhea.
  - Side effects diminish after repeated doses, as the bitch seems to become refractory.

- After medical management, the general condition of the bitch should improve quickly.
- The bitch is reevaluated two weeks after treatment.
- The amount of fluid in the uterus should be significantly reduced or absent, the white blood cell count should be decreased, and there should be no discharge or only a clear serous or mucous discharge.
- In the absence of these signs of resolution, the bitch should undergo a second series of injections or have an ovariohysterectomy.

## **C. Acute metritis**

Metritis corresponds to the inflammation  
suppurative of the entire uterine wall  
(myometrium and endometrium).

Generally caused by a  
bacterial infection.

The causative germs: E.coli; Proteus sp;  
Staphylococcus sp; streptococcus sp.

Observed after an abnormal delivery (1 week postpartum).

It follows: Abortion, placental or fetal retention, poor hygiene during delivery, obstetric maneuvers, fetal mortality accompanied by maceration.

General symptoms: hyperthermia,  
lack of interest in puppies, apathy,  
diarrhea, vomiting, state of  
shock, lack of appetite.

Symptoms local: discharge vulvar

purulent and foul-smelling (often brown-red in

color), lack of milk (agalactia), sometimes

mastitis.



*Photo : metrite post partum*

Serious complication that may occur:

- State of shock, dehydration, renal failure, gangrene and uterine rupture, peritonitis, septicemia, etc.
- Toxic milk syndrome.

# Management

The objectives of postpartum metritis treatment = to resolve dehydration, shock, and sepsis, to treat uterine infection, to eliminate any retention of fetal and placental tissue and, in significant cases, to preserve reproductive function.

## Drug treatment of postpartum metritis:

- Balanced IV electrolyte solution depending on the degree of dehydration.
- Broad-spectrum antibiotics:
  - ❑ Cephalosporins, amoxicillin-clavulanic acid (dogs, 12.5-25 mg/kg PO, every 12 hours; cats, 62.5 mg/kg PO, every 12 hours). Possibility of administering every 8 hours in case of Gram-negative infections, or oxacillin (22-40 mg/kg PO, every 8 hours) to be initiated while awaiting culture and antibiogram results.
  - ❑ Injectable antibiotics may be administered if the patient is in a critical state.
  - ❑ The choice of antibiotics is limited in nursing newborns (passage into milk).

➤ Pour l'évacuation utérine :

❑ <48 heures après la parturition = ocytocine 0,5 à 1,0 UI IM, à répéter toutes les 1 à 2 heures si nécessaire.

❑ > 48 heures ou de réponse insuffisante à l'ocytocine = PGF2 $\alpha$  100  $\mu$ g/kg SC, toutes les 12 heures ou cloprosténol 1 à 3  $\mu$ g/kg SC toutes les 12 à 24 heures pendant 3 à 7 jours jusqu'à ce que l'échographie révèle une absence de liquide dans la lumière utérine.

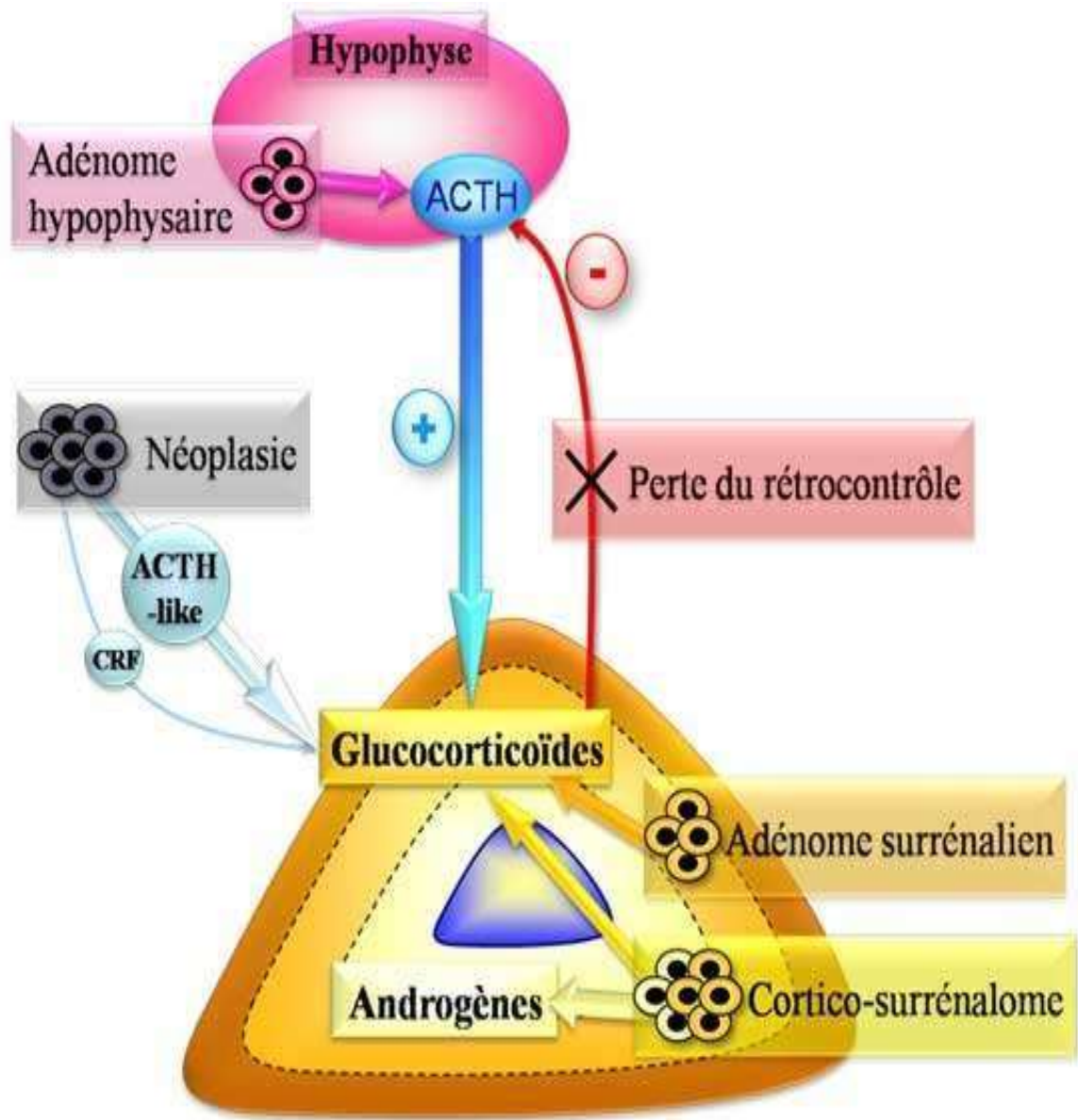
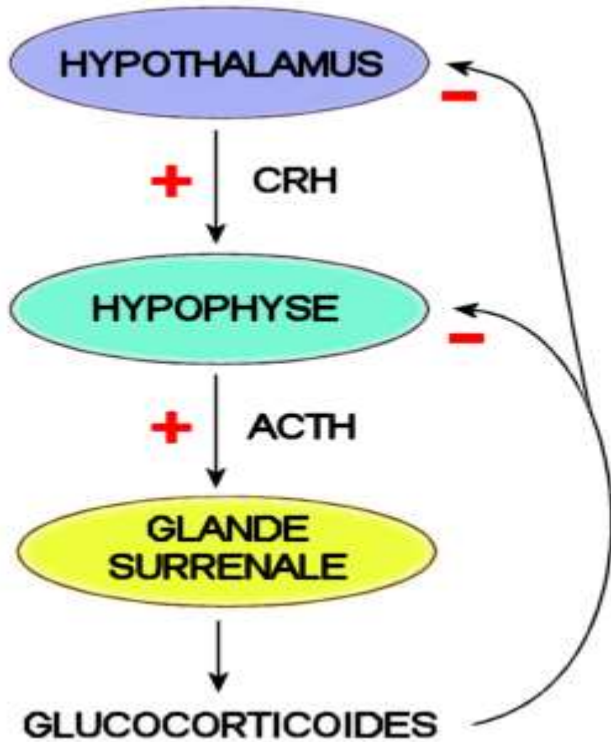
❑ Il est recommandé d'évaluer la paroi utérine pour vérifier son état avant l'administration de PGF2 $\alpha$  afin de prévenir une rupture utérine en cas de paroi fine ou endommagée.

## **C. LE SYNDROME DE CUSHING**

Le syndrome de Cushing est une maladie endocrinienne très fréquente chez le chien qui résulte d'une production excessive de cortisol endogène.

### **Pathogénie**

Le cortisol agissant au niveau hypothalamique et provoque une diurèse accrue accompagnée d'une polydipsie compensatrice.



# Cushing's syndrome

# Diagnosis

The clinical picture of Cushing's syndrome is

extremely rich: PUPD, polyphagia, symmetrical

bilateral alopecia, abdominal distension,

amyotrophy, thin skin with comedones, cutaneous

calcinosis, hypogenitalism, etc.









**Lesions of cutaneous calcinosis on a dog's back**

# Diagnosis

To confirm Cushing's syndrome, the veterinarian will begin with a general examination of the dog's health.

They may then undertake clinical tests:

- Blood tests to measure plasma cortisol levels.
- The stimulation test of the adrenal glands with ACTH, the hormone responsible for the overproduction of cortisol.
- The suppression test of cortisol production with dexamethasone.

- Cholesterol measurement, as it typically increases in dogs affected by the disease of Cushing.
- Blood glucose measurement, which can also slightly increase in this case.
- Ultrasound and CT scan for final confirmation if needed.

## **D. DIABETES MELLITUS**

Diabetes mellitus is a group of metabolic disorders characterized by a chronic resulting from a secretion defect or action of insulin or both anomalies associated hyperglycemia of diseases

Causes serious injuries affecting many parts of the body, particularly the nerves and blood vessels.

# Pathogenesis

Normally, the total filtered glucose at the level of the kidney is reabsorbed.

If the blood sugar exceeds 1.8 g / l, the reabsorption capacities are exceeded and there is glycosuria.

The presence of glucose in the urine is responsible for an osmotic diuresis causing polyuria and subsequently polydipsia.

## **Diagnosis**

The definitive diagnosis involves repeated blood sugar measurements.

## **D. DIABETES INSIPIDUS**

Diabetes insipidus is characterized by a PUPD syndrome resulting from the kidney's inability to respond

to the action of HAD= ADH.

Clinically, diabetes insipidus is characterized by an enormous consumption of water in an animal that usually shows no other disorder.

# Pathogenesis

The pathogenesis depends on the type of diabetes

insipidus. There are distinctions:

- Central diabetes insipidus resulting from a defect in ADH secretion.
- Nephrogenic diabetes insipidus, resulting from a defect in the ADH receptor.
- Polydipsia, a behavioral disorder characterized by a very high water consumption.

# Diagnosis

The diagnosis of diabetes insipidus is simple: based on the enormous water consumption confirmed by the very low urine density (close to or even less than 1.005).

The diagnosis of the type of diabetes insipidus involves by the performing 2 tests:

- a water restriction test
- an ADH test.

## The water restriction test

Faced with a deprivation of water, the dog concentrates its urine (the urine density rises), it is deduced that it possesses the hormone and the receptors: it is a potomania.

Be careful, this test is dangerous, the risk of death by dehydration is very significant; this test must be performed under medical supervision and should not exceed a few hours.

The ADH test

In the opposite case, it is necessary to perform a

HAD test (MINIRIN ND).

If by introducing the hormone the dog concentrates its urine, it is considered that ADH is deficient and it is concluded that there is pituitary diabetes.

If the urine density remains low, it is concluded that there is nephrogenic diabetes.

## **Ce qu'il faut retenir de la PUPD**

- \* La PUPD est un syndrome fréquent qui mérite toujours d'être recherché et exploré, d'autant plus que ses causes sont restreintes et souvent graves.
- \* Un diagnostic est généralement possible sur la base des commémoratifs, de l'anamnèse et de l'examen clinique dans lequel figure l'analyse des urines.
- \* Des examens complémentaires restreints et judicieusement choisis confirmeront ou écarteront ces hypothèses cliniques.
- \* La PUPD est le signe d'appel d'une IRC, dominante pathologique en médecine des carnivores.
- \* Il ne faut jamais restreindre la consommation d'eau d'un animal.