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## **Case report: Mitsie, a rabbit suffering from cutaneous calcinosis circumscripta and chronic renal failure**

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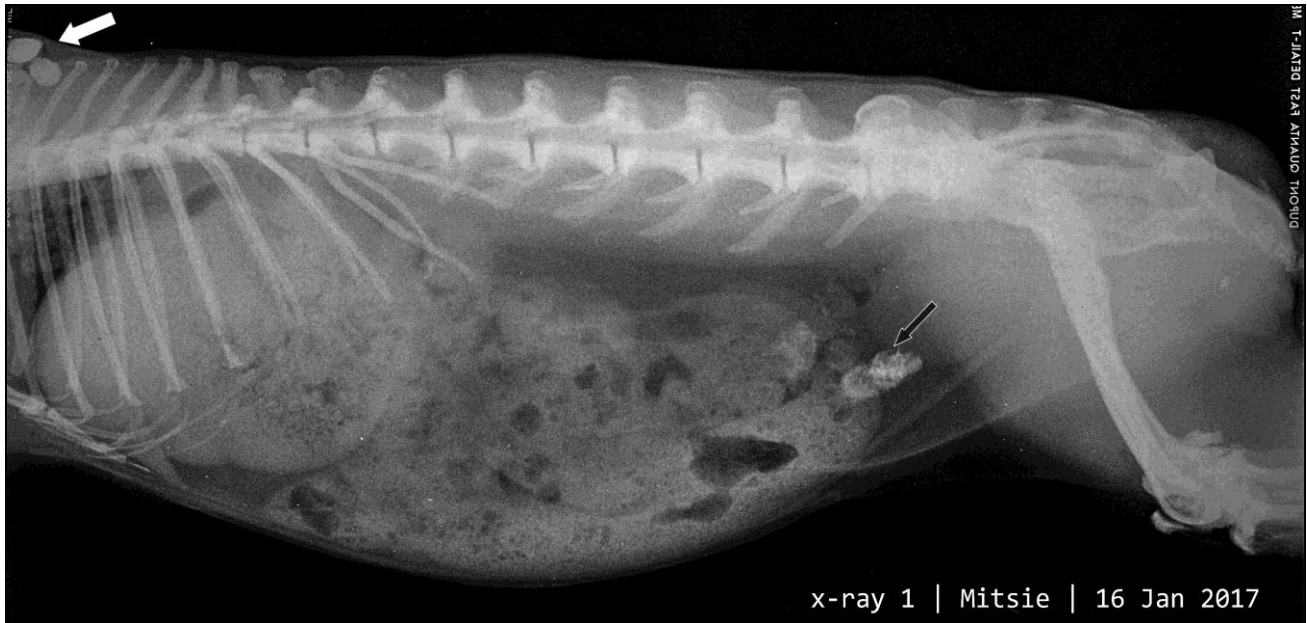
**The term cutaneous calcinosis encompasses a variety of calcium metabolism disorders that lead to the deposit of calcium salts in different layers of the skin and internal organs. The disease is little described in rabbits.**

Cutaneous calcinosis has been identified in humans in the 16th century already, whereas it was described in animals only in the beginning of the 20th century. This

disease has since been found in dogs, cats, horses, pigs, monkeys, etc. Few anecdotal cases have been reported in rabbits, such as skin mineralization along the flanks of a



**Figure 1:** Mitsie is a lop rabbit aged 3 years (right), sterilized, weighing about 2.4 kilos (5.3 pounds). She has not had health problems till now, then suddenly has trouble to hop around. Here Mitsie in her pen with her companion, a neutered male.



**Figure 2:** Calcification in the neck (white arrow) and in the lower abdomen (gray arrow) of a rabbit. The cutaneous nodules in the neck were excised for histopathological examination.

rabbit.

Cutaneous calcinosis does not designate a specific disease, but a pathological process that leads to the deposition of insoluble calcium components (hydroxyapatite crystals) or calcium salts (amorphous calcium phosphate) under the skin. Calcified nodules feel firm or hard plaques start to appear. It has long been regarded as a benign disorder, limited to the different layers of the skin, hence the common names such as calcium gout, tumoral calcinosis, lipocalcinosis or systemic sclerosis (scleroderma). In humans there are two forms of cutaneous calcinosis:

- *Calcinosis circumscripta*, deposits of calcium salts are generally limited, poorly organized and not very thick. They develop in traumatized tissues, tissues undergoing pressure, or bony protrusions like the vertebrae.
- *Calcinosis universalis*, calcium deposits can be generalized throughout the body or remain circumscribed to the skin.

Complications may arise when calcinosis affects vital organs and hamper their proper functioning.

The presence of calcium deposits in the body is easily identifiable on radiographs, as they form radiopaque deposits or masses (Figure 2). Four types of calcinosis have been identified:

Dystrophic, which results from an accidental or medical trauma in a damaged, inflamed skin area or a neoplastic skin tumor. Deposits of calcium may be local, with the development of hard nodules (circumscribed calcinosis cutaneous) or generalized with numerous large sized calcium deposits in cutaneous tissues, muscles and tendons. Calcium and phosphate blood levels are generally normal.

Metastatic calcification, which is the consequence of an altered calcium and phosphorus metabolism. The level of calcium and phosphorus increases in the blood. A blood analysis usually reveals an abnormally high level of calcium

(hypercalcemia) and phosphate (hyperphosphatemia) in the blood. Calcium deposits are present in vital organs such as the lungs, kidneys, digestive system and within blood vessels. Deposits of calcium salts are also possible in the skin, with the development of papules, nodules or plaques. In cats, metastatic calcification is often associated with chronic renal failure, its progression towards a terminal stage or may be the result of an overdose of vitamin D, to which rabbits are very sensitive too. In dogs, metastatic calcinosis may be the consequence of an excessively high level of corticosteroids in the blood or of hormones that increase the level of blood calcium (lymphoid tumor, anal gland tumor). Increased corticosteroids can result from neoplasia in the adrenal glands or the pituitary gland or a corticosteroid treatment. Ingestion of certain plants that contain components with properties similar to those of vitamin D such as day-blooming jessamine (*Cestrum diurnum*) or solanum (*Solanum malacoxylon*) may mimic vitamin D poisoning and lead to calcinosis.

Idiopathic calcification, with no known specific triggers or dysfunction of calcium metabolism and without damage to the affected tissues. Calcifications are observed mainly around joints, but also in muscle tissue and in the epidermis of the limb extremities or the scrotum.

Iatrogenic calcification, after an injection or local cutaneous application of a solution containing calcium. The abnormal increase in calcium levels in the skin leads to calcification.

In small animals, the most common forms of calcinosis are dystrophic and idiopathic.

### **Calcinosis cutis circumscripta**

Cutaneous circumscribed calcinosis is a rare disease that was first observed in

animals and later in humans. The term refers to abnormal and circumscribed depositions of calcium in the different layers of the skin, epidermis, dermis and subcutaneous tissues.

The circumscribed deposit of calcium salts in the skin has been differentiated from other forms of the disease:

- Deficiency of the calcium metabolism (renal failure, hypervitaminosis D, hyperparathyroidism) and phosphorus metabolism.
- Secondary calcinosis (injury or tissue trauma).
- Iatrogenic calcinosis, as a consequence of local or generalized hypercalcification after an injection or local application of a medicine containing calcium.

Triggering factors of circumscribed cutaneous calcinosis and its pathogenesis have not yet been fully elucidated to date. A genetic susceptibility is not excluded in some animals. It may also develop in animals suffering from an underlying condition such as kidney failure or kidney dysplasia. A generally observed fact is a sudden raise of the pancreatic enzyme lipase in the blood. This increase is accompanied by a degeneration of the adipose tissue. The tissue is replaced by calcareous deposits.

Therapeutic means are limited to alternative and supportive treatments in order to stabilize the disease or slow down its progression.

Complications may occur. The subcutaneous masses can lead to skin ulceration, accompanied by the release of a chalky-white substance resembling whitish sand. If the wound is not treated, a secondary bacterial infection may develop. Depending on the location of the nodules in the body, they may compress adjacent tissues, such as muscles, affecting

movement and mobility of the animal. When nervous structures get compressed by the mass, it leads to pain or tingling. More rarely, blood circulation is affected by compression of the blood vessels.

### **Diagnosis**

Diagnosis of circumscribed calcosinosis is not easy because the clinical presentation varies from one individual to another, depending on the cause or the presence of an underlying disease. Diagnosis is, however, very important in order to ensure a proper treatment.

A full blood test with analysis of the biochemical parameters helps the detection of abnormalities or an underlying disease.

The surgical excision of the calcium mass allows its histopathological analysis. It helps confirm the diagnosis and rules out the possibility of local skin cancer with calcification of the tumor.

Magnetic resonance imaging (MRI) or CT-scan imaging can be used to construct 2D or 3D images of anatomical structures, to assess the presence of calcium deposits and their effects on the surrounding tissues.

Cutaneous calcosinosis should be differentiated from mycosis or pulmonary disease such as pseudotuberculosis or tuberculosis.

### **Evolution and prognosis**

Circumscribed cutaneous calcosinosis is a mild disease with few complications. Masses will resorb naturally after a few years. Recurrence is sometimes observed after surgical excision of the mass.

Treatment of cutaneous calcosinosis depends also on secondary complications or an underlying disease. These may render treatment difficult or impossible.

### **Mitsie – a female lop eared rabbit**

Mitsie is a lop rabbit born in January 2014 and weighing 2.4 kg. She has been sterilized at the age of one year and three months. She lives indoors with a castrated male rabbit. Mitsie can behave dominantly and can sometimes be a little aggressive towards her male partner rabbit.

#### Habitat

Mitsie and her partner rabbit live in an apartment, in a large organized pen and, recently, have been given free access to the entire apartment (Figure 1). They can go outside on a terrace every day and have access to an enclosed garden.

#### Health

Mitsie has not suffered any particular health problems up to now. Since young, she has been drinking a lot, roughly 500 ml per day. Since she started to suffer from lower limb weakness, she drinks less (300 ml per day). She never suffered from digestive problems, nor abandoned her cecotrophes.

She is vaccinated against hemorrhagic disease and myxomatosis (Pestorin Mormyx) every 6 months

#### Food

Mitsie eats a healthy diet, with plenty of natural greenery. Her diet is varied, as close as possible to the natural diet of wild rabbits: hay, leaves, fresh or dried herbs of the garden, branches, fresh greenery, dandelion roots, some fresh or dried fruits (home production), vegetable treats, pellets without cereals, and sometimes flax or hemp seeds (2 tsp per month).

Mitsie does not get unhealthy treats from shops and has no salt or mineral block.

#### Disease

Mitsie presents a sudden incoordination of movements and a weakness of the lower

limbs at the age of three (January 2017). She can hop around, but can no longer sit on her lower limbs, jump or run. She can no longer wash her face with both her front feet without falling, but must put a front limb on the ground to keep her balance. She has also become unable to clean the inside of her ears with her hind feet. She continues, however, to run, to chase her companion and her appetite is as usual. Her weight is normal. She does not suffer from seizures.

Since a few months, a solid and hard mass has grown under the skin, on the back (Figure 2). It is not attached to a bony structure and was stable until January 2017 when its shape started to change.

### **Physical checkup and tests 1 - 2**

Mitsie does not get vitamin supplements as often recommended in pet shops. Hypervitaminosis D can, therefore, be excluded.

Radiography: Anesthesia (isoflurane) and radiologic exam. The mass in the back is very radio-opaque. Other regions in the body also show mineralization (Figure 2).

Complete blood test: Increase in the levels of creatinine, calcium and lactate dehydrogenase (LDH) (Table 1).

The level of calcium in the blood is regulated by hormones of the thyroid and parathyroid gland, the parathyroid hormone and calcitonin, respectively. An imbalance (hyperparathyroidism or genetic hypoparathyroidism) can lead to an increase in the level of calcium in the blood and, consequently, to an increase in the level of creatinine. Such imbalance also affects the functioning of the kidneys (renal failure).

A dysregulation of the activity of the adrenal glands, with excessive secretion of corticosteroids, also leads to an elevation of the blood calcium. This disorder is linked to

the presence of tumors. Their presence was ruled out on the various radiographs of Mitsie.

The level of enzyme lactate dehydrogenase is also high. This enzyme is present in different tissues. A trauma causes the release of this enzyme in the blood. An elevation is typically observed in cases of damage to the kidneys, liver, heart, skeletal muscles, or in case of neoplasm.

Four weeks after the first physical checkup and blood test, a new complete blood test is done, accompanied by an IgG and IgM test for *E. cuniculi*. The obtained results confirm those obtained previously (Table 2) and an anemia.

The increase in the level of albumin in the blood and, consequently, that of total proteins, is usually caused by dehydration, e.g., after a long car ride.

The slight elevation of eosinophils may indicate an inflammatory reaction or a parasitosis.

Urine pH test: The test is done by means of urine reagent strips for urinalysis, which allow the measurement of the urinary pH. The results confirm an alkaline pH between 8 and 9. This value is normal for rabbits (pH = 7.6-8.8) and for herbivorous animals in general.

IgG test: Positive (> 1: 1280) for the neuroparasite *Encephalitozoon cuniculi*, indicating that Mitsie has been in contact with this parasite at some point in her life. An IgM test to determine whether a rabbit suffers from an active phase of the parasite was carried out later. The result is negative, therefore no active parasitosis.

### **Suggested treatment**

Administration of meloxicam, in the case that Mitsie suffers from arthritis of the hind

Test	Vysledek / Result	Sign	Referencni rozhrani / Reference value	Jednotka / Unit	Poznamka / Remark
<b>Rabbit Profile/Guinea Pig Profile</b>					
Urea (BUN)	7.4		4.6 - 10.3	mmol/l	c)
Creatinine	229	+	71 - 159	umol/l	c),1)
Total protein	66		54 - 75	g/l	c)
GGT	4		1 - 13	U/l	c)
AST (GOT)	21		< 249	U/l	c)
GLDH	3			U/l	c)
Glucose	8.5		4.2 - 8.6	mmol/l	c)
Fructosamine	407		314 - 527	umol/l	c)
CK	367		100 - 500	U/l	c)
LDH	181	+	34 - 129	U/l	c)
Triglycerides	6.6	+	2.8 - 4.4	mmol/l	c)
Calcium	4.9	+	3.1 - 3.9	mmol/l	c)
Phosphate	2.0		1.2 - 2.0	mmol/l	c)
<b>Haemogram</b>					
Leukocytes	3.9	-	6 - 12	G/l	c)
Erythrocytes	4.3		4 - 7	T/l	c)
Haemoglobin concentration	9.7		8 - 15	g/dl	c)
Packed cell volume (PCV)	31		30 - 50	%	c)
MCV	71		59 - 75	fl	c)
MCH	22.6		19.5 - 24.7	pg	c)
MCHC	31.7		31.1 - 34.8	g/dl	c)
Thrombocytes	289		115 - 940	G/l	c)
<b>Differential blood count</b>					
2 nucleated red blood cells/100 leukocytes					
Basophils	0		1 - 7	%	c)
Eosinophils	2		0 - 4	%	c)
Band neutrophils	0			%	c),2)
Segmented neutrophils	26		20 - 75	%	c)
Lymphocytes	63		30 - 85	%	c)
Monocytes	9	+	1 - 4	%	c)
Basophils (absolute)	0			/ul	
Eosinophils (absolute)	78			/ul	
Band neutrophils (absolute)	0			/ul	
Segmented neutrophils (abs)	1019			/ul	
Lymphocytes (absolute)	2470			/ul	
Monocytes (absolute)	353			/ul	
Atypical cells	0		0	%	c)
Anisocytosis	+	+	0		c)
Polychromasia	++	+	0		c)
E. cuniculi antibodies in serum IFT (Immunofluorescence test)	>1:1280	+	< 1:80	Titer	3)

**Table 1 :** Results of the full blood test done immediately after the onset of weakness in the lower limbs.

limbs. No improvement was observed after administration of meloxicam (post-surgery).

Excision of the hard mass in the back (Figure 3). Histopathological analysis of the

mass did confirm a mineralization of soft tissue similar to circumscribed calcinosis, the presence of inflamed and granulomatous tissues.

Post-surgical radio-  
graphies (Figure 4). The calcification present in the lower abdomen is still present.

**4 weeks later...**

Mitsie's condition is deteriorating. She moves around with more and more difficulty and no longer enters her litter box easily. She often lies down and rests. Mistie weighs 2.3 kilos.

Vitamin supplements and herbs are added to her diet:

- Vitamin C (50 mg/day);
- Yeast beta-glucans (50 mg /day) to stimulate the immune system.
- Milk thistle (*Silybum marianum*), about 10-15 drops per day, subsequently decreased;
- Root and dried leaves of dandelion (*Taraxacum officinale*), for its diuretic properties and action on the kidneys;
- Dried nasturtium leaves (*Tropaeolum sp.*), for its effects on the urinary and immune systems;



**Figure 3:** Surgical excision of the mass in the neck of Mitsie. Histopathological examination has confirmed circumscribed calcinosis.

- Flax and hemp seeds (1 teaspoon per week).

Subsequently other supplements or herbs with known medicinal properties are added:

- Dried Echinacea root;
- Folic acid;
- Resveratrol, a polyphenol present in certain fruits such as grapes, blackberries or peanuts;
- Vitamin B complex, for the nervous system;
- Nettle seeds;
- A few frozen cranberry or aronia berries.

- Fresh parsley, leaves and sometimes the root;
- Pumpkin seeds (during one week);
- Oat grains, little amount, helps the functions of the kidneys and bladder;

**Analysis of the blood tests**

A concomitant increase in the levels of calcium, creatinine, triglycerides and lactate



**Figure 4:** Radiography taken after the surgical excision of the mass, showing increased calcification of the bone structures, vertebra, different organs and blood vessels.

dehydrogenase, as observed in Mitsie (Table 1), may also result from a decreased activity of the thyroid (hypothyroidism) and parathyroid glands. In case of hereditary hypothyroidism, the presence of red blood cells of different sizes (moderate anisocytosis) may be observed in the blood.

Hypothyroidism is also characterized by excessive thirst, a desire to drink all the time. This is the case of Mitsie.

### **Check-up and tests 3**

A clinical examination confirms that Mitsie is thin (2/5). The digestive system contains fewer ingested foods than a healthy rabbit. The muscle mass is much decreased. Cardiac function seems normal, without arrhythmia or murmurs.

The new blood test confirms the previous results, with some variations (Table 2).

New radiographs and a CT scan have been taken from Mitsie. Those of the head do not show any abnormality. Middle/inner ear infection is ruled out. Those of the abdomen confirm the deposition of calcium in soft tissues, as well as the mineralization of blood vessels (aorta) and bones:

- Bone density has increased in the bones
- Vertebrae with blurred contour, a sign of excessive calcification.

The shape of kidneys is atypical, abnormally round and not as a "bean". The skin is less elastic.

CT scan. The images show a calcification of the neural tube. Consequently, the diameter of the tube is decreased, compressing the nerves. Cause of the weakness of the hind feet?

The obtained images also show a calcification of the cartilaginous tissue of the ears.

### **Suggested treatment**

Subcutaneous fluids and heart medication (enalapril).

Limit food rich in calcium.

### **Prognosis**

Prognosis is guarded because there is no treatment.

The suggested treatment is hard on the body in case of renal failure. Phytotherapy and supplements are preferred.

The amount of fresh food is increased in order to raise the intake of water and try to reduce the calcium concentration, with parsley and dill every day, Roman salad or, sometimes, wheat germ. Mitsie also eats plants with medicinal properties in order to stimulate blood circulation (hawthorn and ginkgo) or reduce blood pressure (hibiscus flower).

### **Summary of supplements and herbal remedies given to Mitsie**

More herbs and supplements have been introduced to her diet for their anti-inflammatory, protective or stimulating properties of the renal or hepatic functions, or stimulating the cardiac function. Here is a summary:

#### Supplements:

- Ubiquinone + ubiquinol (CoQ10);
- Vitamin B and B12 complex;
- Vitamin K, possible reversion of calcification;
- Vitamin C;
- Magnesium;
- Folic acid;
- P5P (pyridoxal-5-phosphate).



Mitsie - female rabbit - blood tests		more info <a href="http://mitsie.prukskova.com">http://mitsie.prukskova.com</a>			
Laboratory		IDEXX	Laboklin	Brno VFU (university)	Laboklin
Date taken		16 Jan 2017	16 Feb 2017	23 Feb 2017	19 Apr 2017
note		while on isofluran		stressed, 2+ hours in car	stressed, hard to draw blood sample
Parameter	units	Reference value	Reference value	different units, no reference values	Reference value
AP (ALP, Alkaline phosphatase)	U/l		151 < 397	151 2.57 $\mu\text{kat/l}$	60 < 397
GLDH	U/l	3	1.5 < 19		2.7 < 19
g-GT (GGT, $\gamma$ -GT)	U/l	1 1 - 13	5.4 0-13	6 0.10 $\mu\text{kat/l}$	4.6 0-13
AST (GOT)	U/l	21 < 249	6.2 < 28	9.64 0.16 $\mu\text{kat/l}$	12.4 < 28
CK	U/l		85 < 958		410 < 958
Total protein (TP)	g/l	66 54 - 75	+ 74.6 49-74	67	70.5 49-74
Urea	mmol/l	7.4 4.6 - 10.3	4.8 2.1-8.4	8.6	8.1 2.1-8.4
Creatinine	$\mu\text{mol/l}$	229 71 - 159	+ 174 34-166	253.4	+ 260 34-166
Phosphate (PHOS)	mmol/l	2 1.2 - 2.0	1.3 0.8-3.2	1.64	+ 2.1 0.8-3.2
Magnesium	mmol/l		1.3 0.9-1.7		1.7 0.9-1.7
Calcium (Ca)	mmol/l	4.9 3.1 - 3.9	+ 5.3 3.1-3.9	5.09	+ 5 3.1-3.9
Sodium	mmol/l		144 138-155	153	148 138-155
Potassium	mmol/l		5.5 3.7-6.3	4.6	+ 6.5 3.7-6.3
Fructosamins	$\mu\text{mol/l}$	407 314 - 527	474.1 < 527		+ 452.3 < 527
Bile Acid	$\mu\text{mol/l}$		2.48 < 77.6		3.31 < 77.6
Albumin	g/l		+ 68.4 36-57	34.4	+ 62.9 36-57
ALT (GPT)	U/l			17.05 0.29 $\mu\text{kat/l}$	+ 14.5 < 61
Total bilirubin (TBIL)	$\mu\text{mol/l}$			< 0.9	1 0.3 - 2.5
Chloride	mmol/l		- 86 93-109	100.6	- 84 93-109
Cholinesterase	U/l				1681 < 3564
Glucose	mmol/l	8.5 4.2 - 8.6	6.9 5.8-14.8	9.2	5.8 5.8-14.8
Triglycerides	mmol/l	+ 6.6 2.8 - 4.4	+ 4.99 0.5-3.4	4.76	+ 4.68 0.5-3.4
Lactate	mmol/l			5.06	
Cholesterol	mmol/l			0.98	
Amylase (AMYL)	U/l			345.6 5.76 $\mu\text{kat/l}$	
Lipase (LIPA)	U/l			771 12.85 $\mu\text{kat/l}$	
Creatine Kinase (CK)	U/l	367 100 - 500		200 3.34 $\mu\text{kat/l}$	
Lactate Dehydrogenase (LDH)	U/l	+ 181 34 - 129		47.4 0.79 $\mu\text{kat/l}$	
<b>Blood Count</b>					
Erythrocytes (Red blood cell, RBC)	T/l	4.3 4 - 7	- 4.87 5.9-8.1	3.8 3.8 $\times 10^{12}/l$	- 4.53 5.9-8.1
Hematocrit (HT, Packed cell volume, PCV)	l/l	0.31 0.31 - 0.348	0.36 0.36-0.55	0.28	- 0.33 0.36-0.55
Hemoglobin	g/l	97 80 - 150	- 108 113-171	85	- 100 113-171
Leucocytes (White Blood Cells, WBC)	G/l	- 3.9 6 - 12	- 2.6 3.0-11.9	3.76 3.76 $\times 10^9/l$	- 2.4 3.0-11.9
Neutrophils (Segmented neutrophils)	%	26 20 - 75	25 15-60	45.8	25 15-60
Lymphocytes	%	63 30 - 85	62 32-81	42.8	59 32-81
Monocytes	%	+ 9 1.4	8 < 12	8	10 < 12
Eosinophils	%	2 0 - 4	+ 2 < 1	0.5	+ 3 < 1
Basophiles	%	0 1 - 7	3 < 7	2.9	3 < 7
Band Neutrophils	%	0	0 0	0	0 0
Hypochromasia			neg. neg.		neg. neg.
Anisocytosis			neg. neg.		neg. neg.
Thrombocytes (Platelets, PLT)	G/l	289 115 - 940	419 193-725	490 490 $\times 10^9/l$	262 193-725
MCV (Mean Corpuscular Volume)	fl	71 59 - 75		72.4	
MCH (Mean Corpuscular Hemoglobin)	pg	22.6 19.5 - 24.7		22.4	
MCHC (Mean Corpuscular Hemoglobin Conc.)	g/dl	31.7 31.1 - 34.8		30.9 309 g/l	
RDW (Red Blood Cell Distribution Width, RDW-CV)	%			13.9	
PDW	fl			7.4	
MPV	fl			7.3	
PCT (Thrombocrit)	l/l			0.0036 163.4 $\times 10^9/l$	
Reticulocytes	%			4.3	
LFR	%			51.5	
MFR	%			28.4	
HFR	%			20.1	
<b>Differential Blood Count</b>					
Neutrophils	G/l	1019 $\mu\text{l}$	- 0.7 0.82-5.03	1.72	- 0.6 0.82-5.03
Lymphocytes	G/l	2470 $\mu\text{l}$	1.6 1.58-7.87	1.61	- 1.4 1.58-7.87
Monocytes	G/l	353 $\mu\text{l}$	0.2 < 0.76	0.3	0.2 < 0.76
Eosinophils	G/l	78 $\mu\text{l}$	+ 0.1 < 0.08	0.02	+ 0.1 < 0.08
Basophils	G/l	0 $\mu\text{l}$	0.1 < 0.52	0.11	0.1 < 0.52
Bands	G/l	0 $\mu\text{l}$	0 0	0	0 0
Anisocytosis		+			
Polychromasia		++			
<b>Encephalitozoon cuniculi (IFAT)</b>					
IgM			< 1:80 < 1:80	negative	
IgG		>1:1280 < 1:80	1:1280 < 1:80		

**Table 2:** Summary of the results obtained from the 4 blood tests.

Plants stimulating the urinary system and the kidneys:

- Fresh parsley (*Petroselinum crispum*);
- Dandelion root (*Taraxacum officinale*);
- Oat (*Avena* sp.);
- Pumpkin seeds (*Cucurbita pepo*);
- Bearberry (*Arctostaphylos uva-ursi*);
- Resveratrol;
- Dried root or alcoholic extract of astragalus (*Astragalus membranaceus*);
- Different kinds of sage (*Salvia* sp., *Salviae radix*, *Salvia miltiorrhiza*);
- Nettle seeds (*Urtica dioica*).

Plants stimulating the liver and kidneys:

- Milk-thistle (*Silybum marianum*).

Plants stimulating the urinary and immune systems:

- Nasturtium (*Tropaeolum* sp.).

Plants stimulating the immune system:

- Echinacea root and plant (*Echinacea* sp.);
- Yeast beta-glucan.

Plants stimulating the circulatory system, the heart and the kidneys:

- Hawthorn dry leaves or extract (*Crataegus* sp.);
- Dried leaves of ginkgo (*Ginkgo biloba*);
- Cordyceps mushroom.

Plants stimulating the kidneys and the thyroid in case of hypothyroidism:

- Licorice (*Glycyrrhiza* sp.);
- Echinacea root and plant (*Echinacea* sp.);
- Siberian ginseng (*Eleutherococcus* sp.);
- Birch leaf (*Betula alba*);
- Flax seeds (*Linum usitatissimum*).

**8 weeks after the first signs of muscular hind-limb weakness...**

Mistie seems to be getting better. She goes back and forth jumping into a box filled with herbs.

A few days later, she jumped onto the shelf in her pen, at a height of 30 cm from the ground (Figure 5). She has been unable to do so since the onset of her illness.

The physical condition of Mitsie continues to improve, although a blood test performed 3 months later confirms the results obtained previously (Table 2) and a slight anemia.



**Figure 5:** After starting a treatment with herbal remedies, Mitsie's physical condition improved. Out of a blue, she jumps onto the shelf of her enclosure, at a height of 30 cm from the ground.

Videos can be viewed here:

<http://mitsie.pruskova.com/Mitsie-rabbit.htm>

### **Conclusion**

The cause of cutaneous calcinosis has not been investigated, deducing that it is the result of renal insufficiency. Dysplasia of the kidney cannot be excluded, but can only be determined after the death of the animal (necropsy). Unfortunately, a hormonal disorder does not seem to have been considered.

The results obtained for the different biochemical parameters – a concomitant increase in the levels of calcium, creatinine, triglycerides and lactate dehydrogenase, may, however, also be the result of a dysfunction of the thyroid and parathyroid glands. Anisocytosis may be one of the signs of anemia, which is confirmed by the latest blood tests. Anemias of all types are observed in individuals suffering from a thyroid dysfunction. Hypothyroidism is also characterized by excessive thirst, which is also the case of Mitsie.

### **Acknowledgement**

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