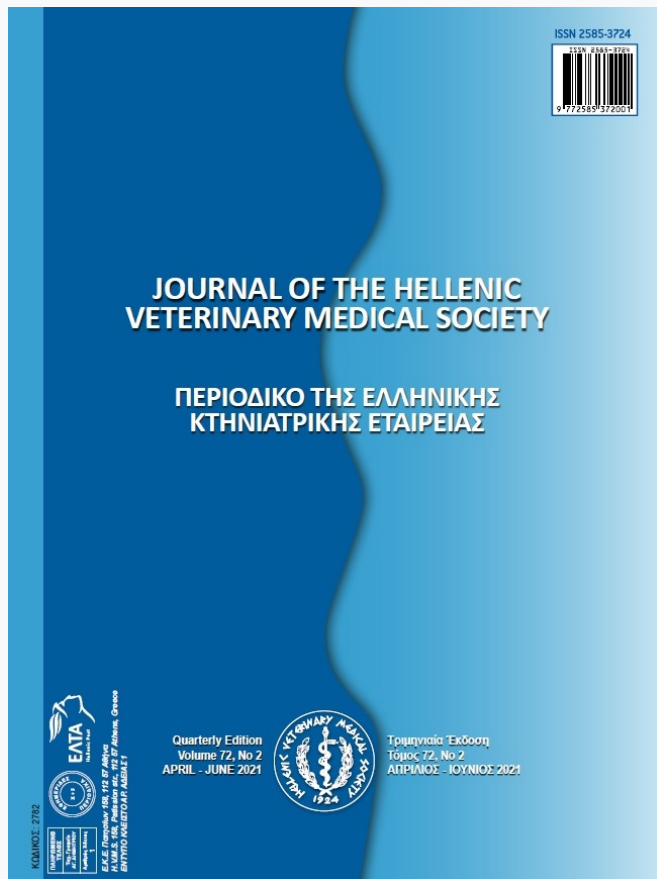


## Journal of the Hellenic Veterinary Medical Society

Vol 72, No 2 (2021)



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doi: [10.12681/jhvms.27513](https://doi.org/10.12681/jhvms.27513)

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### To cite this article:

STANS, J. (2021). Clinical aspects of feline prostate cancer: a literature review. *Journal of the Hellenic Veterinary Medical Society*, 72(2), 2803–2808. <https://doi.org/10.12681/jhvms.27513>

## Clinical aspects of feline prostate cancer: a literature review

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**ABSTRACT:** Feline prostate cancer is a rare condition, which means that the literature is very sparse. This makes it difficult to make sound conclusions about the epidemiology and the effectiveness of the treatment strategies that are utilized. The literature suggests that the condition mainly affects older cats and that these tumours are usually (adeno) carcinomas. Feline prostatic cancer patients often suffer from haematuria, dysuria and inappetence. Both surgery and chemotherapy have been used to treat the condition. Unfortunately, most animals still die within a year. Further research is needed to better understand the epidemiology of the disease and to guide treatment decisions.

**Keywords:** Cats, Feline, Prostate, Cancer, Carcinoma

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*Date of initial submission: 01-08-2020*  
*Date of acceptance: 07-09-2020*

## INTRODUCTION

Prostatic conditions in the cat are rare (*Caney et al., 1998; Tursi et al., 2008*). Prostatic abscesses (*Mordecai et al., 2008*), prostatitis (*Roura et al., 2002*), paraprostatic cysts (*Newell et al., 1992*) and cancer (*Hubbard et al., 1990*) have all been described. Prostatic carcinoma has been mentioned to be the most common prostatic conditions in cats, but remains a rare occurrence (*Hubbard et al., 1990; Caney et al., 1998*). A retrospective study investigating lower urinary tract tumours failed to identify any cases of feline prostate cancer (*Sapierzyński et al., 2007*).

Due to its rarity, the epidemiology and risk factors for feline prostatic neoplasms are poorly understood. Additionally, it is difficult to make the distinction between prostatic carcinoma and urothelial carcinoma that invades the prostate but originates elsewhere (*Tursi et al., 2008*).

The limited experience with the condition means that there are currently no standard of care or specific guidelines to guide treatment decisions (*Griffin et al., 2018*). Despite this lack of guidelines both surgery and chemotherapy have been used to tackle the disease.

The aim of the current paper is to synthesize the current literature regarding clinical aspects of feline prostatic carcinoma. Additionally, possible directions for future research and their limitations are discussed.

## SEARCH STRATEGY

The PubMed, PubMed Central and Web of Science databases were searched for database-specific variants and combinations of the following keywords: "Feline", "Cat", "Prostate", "Prostatic", "Cancer", "Carcinoma" and "Adenocarcinoma". The indices of Veterinary and Comparative Oncology, Journal of Veterinary Internal Medicine, Journal of Feline Medicine and Surgery and Journal of Feline Medicine and Surgery Open Reports were manually searched. The search engine Google was searched using the same keywords. Papers were selected if they described any case of feline prostate cancer, contained clinical information and had at least an English summary. Finally, the references of the selected publications were screened for further relevant literature.

## IDENTIFIED LITERATURE

The amount of available literature regarding prostatic neoplasms in cats is very limited. The identi-

fied literature consisted exclusively of case reports describing a maximum of two animals. The total number of animals included in this review was ten. Four further cases were identified: a case of prostatic fibroadenoma (*Cotchin, 1984*), two cases of adenocarcinoma and one of unknown histological subtype (*Barsanti and Finco, 1979; Hornbuckle and Kleine, 1980*). Unfortunately, these publications were unable to be sourced and were therefore not included.

No case-control - studies or cohort studies assessing treatment strategies or risk factors were found. Furthermore, no interventional studies or clinical trials assessing therapeutic strategies for any type of feline prostate cancer were identified.

## CASE CHARACTERISTICS

The identified literature was screened for the following characteristics per animal: breed, age, neutering status, histological diagnosis and symptoms. The current review focuses on the characteristics and clinical aspects of the different cases. More information regarding histological, diagnostic and other aspects can be found in the original publications.

Have described a ten-year old, neutered cat with adenocarcinoma. The breed was not specified. The animal suffered for two weeks from haematuria, dysuria and pollakiuria (*Have, 1983*).

In 1990, Hubbard and colleagues (*Hubbard et al., 1990*) described the case of an eleven-year old, neutered cat that suffered from haematuria. The breed was not specified. The animal was diagnosed with prostatic adenocarcinoma.

Caney and colleagues (*Caney et al., 1998*) described two cases of prostatic carcinoma in 1998. The first case concerned a nine-year old domestic longhair that was neutered. The animal suffered seven months from dysuria, haematuria, and increased urinary frequency. Additionally, it was mentioned that there were two instances of urethral obstruction in the two months before admission. The second animal was a seven-year old domestic shorthair that was also neutered. In addition to presenting dysuria and a single instance of haematuria, this animal also showed inappetence, weight loss, lethargy in the seven weeks before admission. Other symptoms included dyschezia and constipation. After exploratory surgery, this cat suffered from urinary incontinence and haematuria.

A case report of a nine-year old domestic shorthair

was published in 2004 (*LeRoy and Lech, 2004*). When the animal presented, it was suffering from diarrhoea. Three months later, the animal was seen again when it suffered from inappetence, vocalization during urination and unusually frequent licking of the perineal region. Eleven months later, the cat was suffering from lethargy, vomiting, weight loss, tenesmus, haematuria and pyuria. The animal was diagnosed with adenocarcinoma.

In a case report, Tursi and colleagues (*Tursi et al., 2008*) described a twelve-year old, neutered domestic shorthair. The cat suffered from inappetence, weight loss, weakness, dysuria, haematuria and dyspnoea and was diagnosed with prostatic adenocarcinoma.

A twelve-year old mixed-breed, neutered cat suffered from dysuria, haematuria, dyschezia and constipation for three weeks (*Zambelli et al., 2010*). The animal showed urinary incontinence two months after having surgery for his sarcomatoid carcinoma.

Lapshin and Kondratova presented a case report of prostatic adenocarcinoma in a cat in 2015 (*Lapshin and Kondratova, 2015*). The animal was a nine-year old, intact Siberian that suffered from acute urinary retention, stranguria, general depression, drop-by-drop urination, anorexia and haematuria during the course of its disease.

In a book by Villalobos and Kaplan (*Villalobos and Kaplan, 2017*), two cases were mentioned. A thirteen-year old domestic short-hair suffered from prostatic cancer of unknown histological type. Whether the animal was neutered and what its symptoms were, was not specified. A second cat was sixteen years old and was diagnosed with carcinoma. It suffered from urinary obstruction. Whether it was neutered, was not specified.

In the most recent case report, de Oliveira and colleagues (*de Oliveira et al., 2019*) present the case of a six-year old, intact domestic shorthair that was diagnosed with prostatic carcinoma. The cat presented with dysuria, haematuria, inappetence, constipation, lethargy and prostration.

Due to the small number of reports, it is difficult to make generalisations about the case characteristics to the whole population of feline prostate cancer patients. However, a few observations can be made. The median age of the animals diagnosed with prostate cancer in the reported cases was 10.5 years (range 6 – 16 years). This supports the hypothesis that prostate cancer occurs mainly in older cats. It is also apparent

from the literature that most diagnosed tumours are carcinomas, more specifically adenocarcinomas. Several breeds were described, mainly domestic shorthairs. Prostate cancer was diagnosed in both neutered and intact animals. Finally, several symptoms can be identified that are often present in cats diagnosed with prostate cancer. Haematuria, dysuria and inappetence occur often in animals suffering from the disease.

## TREATMENT AND OUTCOMES

From the identified case reports, the treatment strategy, clinical outcome and the location of possible metastases were extracted per animal. Treatment for alleviating symptoms (e.g. catheterisation for restoring urinary outflow) and diagnostic procedures (e.g. retrograde contrast urethrocytogram) were performed in most animals and are not specifically described in this review.

The treatment strategy of the cat in the case report of Hawe (*Hawe, 1983*) was not specified. The animal was euthanized, and lung metastases were identified.

The cat in the 1990 case report (*Hubbard et al., 1990*) was initially treated with a prostatectomy. Afterwards, doxorubicin (30mg/m<sup>2</sup>) and cyclophosphamide (300 mg/m<sup>2</sup>) were given. After four treatments, the chemotherapy was stopped due to proteinuria. The animal was euthanized ten months after the prostatectomy due to a recurrence of the tumour. Metastasis to the lungs and pancreas was identified.

The nine-year old domestic longhair in the case report of Caney and colleagues (*Caney et al., 1998*) was treated with ampicillin (11 mg/kg daily) and betamethasone (0.03 mg/kg daily) for two weeks when a provisional diagnosis of urethritis was made. A little over two weeks, later, a provision transitional cell carcinoma diagnosis was made, and ampicillin and betamethasone treatment was continued. Three months later, the animal was euthanised due to quickly worsening symptoms. No sign of metastasis to medial iliac lymph nodes was discovered. Microscopic metastases to the lungs where however identified. The seven-year old domestic shorthair in the same case report (*Caney et al., 1998*) was treated with antibiotics and glucocorticoids which did not resolve the symptoms. A prostatic -, urethral mass or urethritis was suspected after retrograde positive contract urethrography. Four days later, the cat was euthanised due to a worsening of its condition. No sign of metastasis to the medial iliac lymph nodes or lungs was discovered.

Three months after first presentation, the cat in the publication of Leroy and Lech (*LeRoy and Lech, 2004*) underwent an orchiectomy. Eight months later, it underwent surgery again for a urethral transection and removal of the mass. At the same time, chemotherapy was initiated (enrofloxacin 15 mg daily and cephalexin 100 mg every 12 hours).

No treatment strategy was explicitly mentioned in the article of Tursi and colleagues (*Tursi et al., 2008*). The animal was euthanized when its condition deteriorated. The time at which this occurred was not specified. Metastasis to the lungs and myocardium was identified. There was also infiltration of the mediastinal lymph nodes.

Before being referred, the cat described by Zambelli and colleagues (*Zambelli et al., 2010*) was treated with antibiotics and urinary acidification. After referral, a prostatectomy was performed and amoxicillin 15 mg/kg every 48h was given for 7 days postoperatively. Two years after the surgery, this animal was not showing any problems related to recurrence of the disease or metastasis. This is currently the only case where it seems possible that the animal was cured.

The treatment of the Siberian cat in Lapshin and Kondratova's article (Lapshin and Kondratova, 2015) was aimed to alleviate symptoms. It was euthanized when the owner was unable to continue therapy. Whether or not metastasis was present, was not specified.

The first cat in the text of Villalobos and Kaplan (*Villalobos and Kaplan, 2017*) underwent debulking surgery and open cystotomy. Afterwards, it received mitoxantrone and piroxicam for recurrent disease. The animal survived for one year. The presence of metastases was not discussed. The second cat was treated with mitoxantrone every 21 days and piroxicam 1 mg daily. After six of these cycles, carboplatin was initiated. The cat lived for one more year and presented with cutaneous metastases in the last six months.

The cat in the case report of Oliveira (*Oliveira et al., 2019*) underwent a laparotomy for tumour excision. Because of the involvement of the urethra, a urethral anastomosis was performed to allow for a continued urine flow. Four hours after surgery, the animal died. The authors state that the death was not related to complications related to the surgical procedure. There was no sign of pulmonary metastasis in this animal.

Due to the lack of research investigating a causal relationship between treatment strategies and survival outcome, no definitive conclusions can be made regarding the effectiveness of the different treatments. Both the use of surgery, mainly prostatectomy and chemotherapy have been described. Currently there has only been a single case where the animal was alive at the time of the publication of the article. In all other cases, the animal died within a year, often due to euthanasia. Metastasis was often identified at the time of necropsy, usually to the lungs, but metastasis to other regions such as the pancreas and myocardium was also described. Some animals were also free of metastasis. On several occasions, there was infiltration of mediastinal lymph nodes.

## FUTURE RESEARCH

The currently literature regarding feline prostatic neoplasms is very limited and suffers from a lack of internal validity. This precludes any conclusion regarding the general effectiveness of a specific treatment strategy. A first step in improving the knowledge of this condition is to collect information about cases of feline prostate cancer in a more systematic way. A larger collection of case reports and case series could provide better information about the epidemiology of the disease and current treatment practices.

In parallel, a multi-institutional retrospective study could also provide more insight into the epidemiology of the condition but could also investigate associations between treatment strategies utilized for feline prostatic neoplasms and survival outcomes. With a large retrospective study, the associations between the utilization of treatment strategies and post-treatment complications could be investigated. For example, it could be interesting to assess the association between prostatectomy and post-operative urinary incontinence in feline prostatic cancer patients.

Based on the current, limited evidence for any treatment strategy, it may not be justified to perform a prospective clinical trial at this point. It is currently not clear what treatment strategy should be tested in such a trial. Furthermore, due to the very limited incidence of the condition, a clinical trial may not be feasible due to the difficulty of reaching a sufficient sample size.

## CONCLUSION

The literature regarding feline prostate cancer is very sparse and consists mainly of single case reports.

This makes it difficult to make sound conclusions about the epidemiology and the effectiveness of the treatments strategies that are utilized. The literature suggests that the condition mainly affects older cats and that these tumours are usually (adeno)carcinomas. Feline prostatic cancer patients often suffer from haematuria, dysuria and inappetence. The current treatment strategies, surgery and/or chemotherapy, often fail to cure the condition. Further research is needed to establish causal links between treatments strategies and survival outcomes.

#### **CONFLICT OF INTEREST**

The author declares that there is no conflict of interest.

#### **ACKNOWLEDGEMENTS**

The author would like to thank K. Crevits and M. Delanghe for their valuable feedback prior to submission.

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