Pyrexia in cats: retrospective analysis of signalment, clinical investigations, diagnosis and influence of prior treatment in 106 referred cases

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Abstract

Objectives To describe the features and diagnoses of a population of cats referred with pyrexia. Other aims were to report, and evaluate the utility of, clinical investigations performed, and describe any effect of treatment before referral on temperature at presentation and ability to make a diagnosis.

Methods Clinical records of cats with pyrexia (≥39.2°C) documented at least twice were retrospectively reviewed. Cases were assigned into disease categories (infectious, inflammatory, immune-mediated, neoplastic, miscellaneous and no diagnosis [pyrexia of unknown origin, PUO]) based on diagnosis. The overall value of clinical investigations was assessed by classifying them as 'enabling', 'assisting' or 'no assistance' in achieving each diagnosis. The effect of treatment before referral was assessed for any association with temperature at presentation and ability to make a diagnosis (PUO versus other disease categories).

Results 106 cases were identified. The most common cause of pyrexia was feline infectious peritonitis (22 cats, 20.8%) and the largest disease category was infectious (41/106, 38.7%). Inflammatory conditions were found in 19 (17.9%), neoplasia in 13 (12.3%), miscellaneous causes in 11 (10.4%) and immune-mediated disease in six (5.7%) cats. No diagnosis was reached in 16 (15.0%) cats, often despite extensive diagnostic investigations. Cytology and histopathology most often 'enabled' or 'assisted' in obtaining a diagnosis. Most cats (91 cats, 85.8%) received treatment before referral, with antimicrobial treatment given to

eighty-seven (82.1%) cats. Prior treatment before referral was not associated with temperature at presentation nor with success in establishing a diagnosis.

Conclusions and relevance This is the first study investigating causes of pyrexia in cats. Infectious diseases were most common and immune-mediated diseases were comparatively rare.

Introduction

Pyrexia (fever) is an increased body temperature secondary to the release of pyrogens and a raised thermoregulatory set point in the anterior hypothalamus[1]. It is part of the non-specific adaptive response of the body to disease and is thought to confer a significant evolutionary advantage. However, there are disadvantages of pyrexia and these tend to outweigh benefits when pyrexia becomes more severe or prolonged[1]. Pyrexia that remains undiagnosed despite investigations is referred to as pyrexia of unknown origin (PUO). Over 200 diseases have been associated with PUO in humans[2]. Precise definitions of PUO vary; extrapolating from human medicine, PUO in dogs and cats has been defined as a temperature of ≥39.2°C (102.5°F) of at least three weeks duration in which no obvious cause is found following at least three visits to the veterinary surgeon and/or three days of hospitalisation (including basic evaluation of history, clinical signs, physical examination and diagnostic testing [complete blood count, serum biochemistry, urinalysis])[1]. Recommendations regarding the diagnostic approach to pyrexia have been described in cats[1, 3, 4], but as no studies investigating causes of pyrexia have been published in cats, such recommendations are experience-based rather than evidence-based. It has been stated that infectious causes are the most common reason for feline pyrexia[3, 5] but no published evidence exists. Immune-mediated disease is known to be the most common cause of pyrexia in dogs[6-8].

The aims of the present study were to describe the population characteristics of cats with pyrexia referred to two veterinary referral centres and to identify the causes of pyrexia. Further objectives were to report the clinical investigations performed and evaluate their usefulness in obtaining a diagnosis, and to describe treatments given before

80 referral and their possible effect on temperature at presentation and ability to reach a
81 diagnosis.

Methods

The clinical databases of feline patients referred to the Small Animal Hospital, University of Bristol and the Small Animal Hospital, University of Glasgow January 2011-June 2015 were retrospectively searched to identify cats with pyrexia. Databases and clinician case logs were searched using the terms 'pyrexia', 'pyrexic', 'PUO' and 'fever'. Case records were then retrospectively reviewed (SS) and appropriate details entered into a spreadsheet (Excel for Windows, Microsoft). Details regarding signalment, history, physical examination and minimum database were obtained in all cats. Peak temperature documented by the referring veterinarian within the past month and temperature at presentation to the referral centre were recorded. Further diagnostic investigations were performed depending on clinical presentation and the attending clinician's discretion. To be included pyrexia (rectal temperature ≥39.2°C ([102.56°F]) had to have been documented at least twice (to reduce the risk of cats with stress hyperthermia being included), including at least once at the referring veterinary practice. Cases were excluded if records were inadequate.

The study was approved by the University of Bristol's Animal Welfare and Ethical Review Body (veterinary investigation number [VIN] 16/019) and the University of Glasgow's Research Ethics Committee (37a/16).

Treatment before referral

Any drug administered by the referring practice after the initial documentation of pyrexia was recorded. As this included a large range of drugs, individual agents were grouped into therapeutic classes: non-steroidal anti-inflammatory drugs (NSAIDs),

antimicrobials, corticosteroids, opioid analgesics, 'supportive' gastrointestinal medications (e.g, antiemetics, antacids), and miscellaneous drugs.

Diagnostic investigations

Investigations performed by the referring veterinarian and at the referral centre were recorded. For the purpose of analysis, neutrophilia was graded as mild (12 to <20 x 10^9/l), moderate (20 to <30 x 10^9/l) or severe (≥30 x 10^9/l); neutropenia was defined as <4 x 10^9/L. Anaemia was classified as mild (PCV 20 to ≤24%), moderate (15 to <20%), or severe (<15%). Increases in alanine aminotransferase (ALT) were graded as mild (<2 times upper reference range), moderate (≥2 to 3 times), or severe (>3 times). Hypoalbuminaemia was classified as mild (20 to <24 g/l), moderate (16 to <20 g/l), or severe (<16 g/l).

Imaging techniques included ultrasonography, radiography, CT, MRI and endoscopy. Cytological examination was performed on fine needle aspirates from any abnormal masses or enlarged lymph nodes. Feline immunodeficiency virus (FIV) antibody and feline leukaemia virus (FeLV) antigen testing was initially performed using Petchek ELISA (IDEXX) or FeLV/FIV SNAP (IDEXX), with polymerase chain reaction (PCR) testing and/or virus isolation performed if results were positive.

Each diagnostic investigation was retrospectively categorised as: 'enabled' a diagnosis, 'assisted' a diagnosis, or of 'no assistance'[7]. In cases where a negative result contributed to a diagnosis, the test was reported as 'assisted' a diagnosis. A complete blood count and serum biochemistry were performed in all cats, their usefulness in obtaining a diagnosis was not examined.

Cause of pyrexia: disease groups

Cats were retrospectively assigned into one of the following disease groups based on final diagnosis: infectious, inflammatory, immune-mediated, neoplasia, miscellaneous and no diagnosis reached (PUO). Where more than one disease process from different categories was diagnosed, the disease attributed to be the cause of the pyrexia was classified. When this was unclear, cases were defined as miscellaneous.

Outcome

Whether cats survived to discharge, were euthanased or died was recorded.

Statistical analysis

Statistical analysis was performed using SPSS for Windows v23 (IBM Corp). Descriptive statistics were prepared for all evaluated variables. Kolmogorov-Smirnov tests were used to test for normality; continuous variables were reported as means and standard deviations (sd) if normally distributed, and as medians and ranges if not normally distributed.

Overall treatment before referral (yes/no) was assessed for association with temperature at presentation using a T-test. Treatment was assessed for association with success in making a diagnosis (i.e, PUO [no diagnosis] vs all other disease categories [diagnosis reached]) using χ^2 test. Significance was defined as $P<0.05$.

Results

One hundred and six cats met the inclusion criteria.

Signalment

Of the 106 cats, the most common breed was domestic (69 [65.1%]; 64 [60.4%] domestic shorthair, five [4.7%] domestic longhair); the remaining 37 (34.9%) cats were pedigrees. These comprised seven (6.6%) Ragdolls, six (5.7%) Bengals, six (5.7%) British shorthairs, five (4.7%) Birmans, four (3.8%) Maine coons, three (2.8%) Siamese, and one each (0.9%) of Balinese, Devon Rex, Korat, Oriental, Persian and Russian Blue. Median age was 4.0 years (10 weeks–15 years).

History and treatment before referral

Diagnosis was known or suspected at the time of referral in 11 (10.3%) cats; these tended to be infectious (e.g, pyothorax, pyelonephritis, cellulitis), lymphoma (2 cats), or structural disease (e.g, ureteral obstruction, intestinal intussusception). Regarding cats with feline infectious peritonitis (FIP), two of 22 referring veterinarians mentioned FIP as a possible diagnosis at referral. Ninety-one cats (87.5%) received treatment before referral; treatment data were unavailable for two cases. Treatment had been given within 24-hours of referral in 77 (74.0%) cats. Antimicrobials were administered in 87 cats (83.7%) (Table 1); of these, 54 received one antimicrobial, 28 received antimicrobials from two different classes, and five from three different classes. Almost two-thirds of cats received NSAIDs (67/104, 64.4%) and approximately one-quarter received corticosteroids (25/104, 24.0%). Opioid analgesia was administered to 30 cats (28.8%), 26 cats (25.0%) received

gastrointestinal support medication, and 20 cats (19.2%) received other miscellaneous drugs.

Mean (±sd) peak temperature documented before referral was 40.1°C (±0.5°C). Pyrexia was reported to be present for a median of four days (1-168 days) before presentation. Eighty one cats (76.4%) were pyrexic at referral and mean temperature at presentation was 39.7°C (±0.6°C). Overall treatment before referral was not associated with temperature at presentation (P=0.543), nor with success in reaching a diagnosis (P=0.999).

Diagnostic investigations

The number of cats in which diagnostic investigations were performed and the usefulness of investigations in obtaining a diagnosis are shown in Table 2. Complete blood count and serum biochemistry were performed in all cats (results were unavailable in two cases). The most common abnormalities were neutrophil abnormalities and anaemia on complete blood count, and increased ALT and hypoalbuminaemia (Table 3) on serum biochemistry.

Disease categories

Final diagnoses and disease categories are listed in Table 4. Infectious disease represented the largest category (41/106, 38.7%). Within this category, FIP was diagnosed in 22 cases. Inflammatory (non-infectious) disease comprised the second most common disease category (19/106, 17.9%) and neoplastic disease third (13/106, 12.3%). Pyrexia was

attributable to miscellaneous conditions in 11 cats (10.4%). Immune-mediated disease was the smallest disease category (6/106, 5.7%). No diagnosis (PUO) was established in 16 cases (15.1%). The median ages of cats in each disease category are described in Table 5.

Outcome

Cats were hospitalised for a mean of 5.0 days (±3.2 days). Over two-thirds of cats (71/106, 67.0%) survived to discharge, 31 (29.2%) cats were euthanased and four (3.8%) died during hospitalisation.

Discussion

This is this first published survey describing causes of pyrexia in referred cats. To the authors' knowledge, there are no similar surveys of pyrexic cats in first opinion practice. Our study will therefore provide a useful comparison for future, ideally prospective, studies of pyrexic cats in both the first opinion, and referral, setting. Using the same grouping system previously described in a canine study[7], we found infection to be the most common disease category. In contrast, immune-mediated disease was most commonly diagnosed in referral populations of pyrexic dogs[6, 7]. Infection is the most common cause for pyrexia in people[2].

In terms of specific conditions, FIP was the most common diagnosis. Diagnosis was based on compatible clinicopathological findings and positive feline coronavirus immunostaining[9,10]. Intermittent fever is one of the earliest signs of FIP[9] and in one study body temperature exceeded 39.5°C in 81% of cats with FIP, and over 40°C in almost half of cases[10]. FIP remains a difficult disease to definitively diagnose, perhaps in part due to the fluctuating nature of pyrexia meaning fever and clinical signs may falsely appear to respond to antimicrobials, delaying investigation and/or diagnosis. The high prevalence of FIP in this population where so many cats had received antimicrobials (±NSAIDs) highlights the condition as the most common cause of pyrexia refractory to empirical treatment. It is important to note that the prevalence of FIP may be abnormally high as the participating institutions actively participate in FIP research, possibly resulting in a biased population; it has been suggested that differences in disease category prevalence in canine studies has been in part due to particular interests of the authors[6, 11].

Apart from FIP, few other specific infections were diagnosed in this study, despite FIV/FeLV testing, *Toxoplasma gondii* serology and other infectious disease PCR tests being commonly performed. This likely reflects the low prevalence of specific infectious diseases in the UK, especially at referral level, although it may also reflect inappropriate test selection by the clinician. The poor overall diagnostic value of routine serological and immunological tests is well known in human medicine and there is debate over the minimal serological tests indicated in PUO patients, due to the low prevalence of implicated diseases[2].

Inflammatory (non-infectious) conditions comprised the second most common disease category in pyrexic cats, and interestingly, were almost as common as infectious causes when FIP cases were not considered. The widespread use of antimicrobials in this population may have resulted in infectious causes being incorrectly classified as inflammatory (e.g, sterile versus non-sterile cellulitis, bacterial versus non-bacterial cholangiohepatitis). This is a limitation inherent in the retrospective nature of the study and may have resulted in an underestimation of infectious disease prevalence.

Neoplasia as a cause for pyrexia was seen in 12.3% cats, comparable to figures described in pyrexic dogs (9.5%[6] and 7.6%[7]). Unsurprisingly, as the most common feline neoplasm, lymphoma was the most prevalent neoplasm in this study. Primary pulmonary tumours were the second most frequent, found in three cats, and have previously been reported to cause pyrexia[11], likely because of their propensity to become necrotic due to their often large and solid nature.

246 Immune-mediated disease appears to be a less common cause for pyrexia in cats
247 than in dogs[6-8], with only immune-mediated haemolytic anaemia and immune-mediated
248 polyarthritis diagnosed in our population.

249 Despite often extensive investigations, a definitive diagnosis was not reached in
250 15% of cases., comparable to canine studies[6, 7]. We hypothesise that cats with PUO had
251 self-limiting infections or transient inflammatory foci. In the present study, although most
252 cats were referred without a known diagnosis (and often referred to as having PUO by the
253 referring veterinarian), a cause was found in 85% of cases. The term 'PUO' should
254 therefore be reserved for cases where extensive diagnostics have failed to identify the
255 cause. Not all cases of PUO in this study met the definition proposed by Ramsey & Tasker
256 (2017)[1], as only four out of 16 cats had a duration of illness of more than three weeks. This
257 is perhaps not surprising as investigations and treatment are likely to be instigated much
258 earlier than three weeks in order to reduce patient morbidity.

259 Due to the retrospective nature of the study and assessment of survival data to
260 discharge only, it was not possible to assess if PUO was associated with outcome. Overall
261 survival to discharge (67.0%) was comparable however to a high (70%) survival rate
262 reported in dogs with miscellaneous causes for pyrexia[6]. The majority of humans with
263 PUO will eventually spontaneously recover[12].

264 No association between treatment and success in reaching a diagnosis was found.
265 Treatment before referral was not associated with temperature at presentation, in contrast
266 to dogs where prior treatment reduced the prevalence of pyrexia at the time of referral[7].
267 As pyrexia associated with FIP is expected to be refractory to treatment, the association of

268 treatment before referral was also assessed in non-FIP cats only, and no significant
269 association was found (unpublished data). Battersby *et al.* (2006) also reported that the
270 treatment of pyrexia was associated with a longer time to diagnosis[7]. Because of this, and
271 the proposed protective benefit of pyrexia, it has been recommended to reserve antipyretic
272 drugs for cases where body temperature exceeds 41°C or clinical signs attributable to fever
273 are severe[1].

274 Broad-spectrum antimicrobials are widely recommended for all cases of
275 unexplained pyrexia in dogs and cats[1, 3, 11], and in keeping with this recommendation,
276 antimicrobials were the most commonly administered drugs given before referral in this
277 study, in over 80% of cats. Furthermore, nearly one-third of all cats had received drugs
278 from multiple antimicrobial classes by the time of referral. The prevalence of bacterial
279 infections as a cause of pyrexia in first opinion veterinary practice may be sufficiently high
280 to warrant such treatment, although no evidence exists to support this. Witholding
281 antimicrobials in stable patients where fever is acute and mild is recommended in human
282 medicine[12]. Of note, despite infections being regarded as (and shown to be in this study)
283 the most common cause of feline pyrexia, almost one-quarter of cats had received
284 corticosteroids before referral.

285 A wide range of diagnostic investigations were employed to discern the cause of
286 pyrexia. Complete blood count and serum biochemistry were performed in all cases but
287 the most common abnormalities found (neutrophilia, increased ALT, anaemia and
288 hypoalbuminaemia) were non-specific. Abdominal ultrasonography was the most
289 commonly performed diagnostic procedure which 'enabled' or 'assisted' with a diagnosis

in over half of the cats in which it was employed. Thoracic imaging (radiography and/or CT) was performed in over half of cats and appeared to be less useful than abdominal ultrasonography. Echocardiography was performed in approximately one-third of cats but only assisted with diagnosis in one cat (diagnosed with myocarditis); indeed it was seemingly performed in the majority of cases to assess for concurrent cardiac disease due to the detection of a heart murmur or gallop sounds, as well as to assess for endocarditis. Our data suggests that diagnostic imaging selection in pyrexic cats should depend on localising signs (eg, MRI of the brain 'assisted' or 'enabled' a diagnosis in all cases presented with neurological signs) rather than seeking abnormalities without appropriate localisation.

Fluid (pleural or peritoneal) analysis was a highly useful diagnostic test when performed, likely due to its importance in aiding FIP diagnosis. Cytology and histopathology were widely employed and were very useful diagnostic procedures, in agreement with canine studies[6-8]. Bacterial culture (eg, of fluid, tissue) 'enabled' or 'assisted' with a diagnosis in approximately one-third of cases in which it was performed, although false negative results may have occurred due to previous antimicrobial therapy or difficulty in culturing certain organisms (e.g. *Mycoplasma* spp.). Interestingly, blood culture was performed in only one cat and even though this test is often recommended when investigating feline pyrexia[3, 11] it does not appear to be a principal test required for diagnosis. Feline pancreatic lipase immunoreactivity was performed in over one-quarter of cats, likely due to its widespread availability as a bench-side test and due to the non-specific clinical signs of feline pancreatitis (anorexia, lethargy). Its usefulness in obtaining

312 a diagnosis was fairly low, however, perhaps due to pancreatitis being an uncommon
313 cause of pyrexia, and/or due to the test's limitations in diagnosing chronic or mild forms
314 of the condition[13].

315 The study's population comprised referral cases and therefore likely contained
316 cases where fever did not spontaneously resolve or respond to empirical treatment, where
317 localising signs were absent, where simple diagnostic tests failed to identify a cause, or
318 alternatively where a diagnosis was known but intensive management was required.
319 Ultimately many patients were found to have relatively common conditions (e.g,
320 pancreatitis, lymphoma, cellulitis) and merely had an unusual or early manifestation of
321 these diseases that hindered diagnosis prior to referral.

322 Limitations of this study are largely due to its retrospective nature. Future studies
323 should focus on a prospective cohort of cats being referred with pyrexia. A larger number
324 of cases would also enable statistical tests to be performed to further investigate features
325 of the different disease categories and the diagnostic investigations performed.
326 Appropriate cases may have been missed due to the search methods employed (e.g,
327 misspelling of pyrexia) and incomplete records meant that some cases had to be excluded.
328 Interpretation of records was required in some instances to determine the final diagnosis
329 and disease category classification. Follow-up data were limited in that only survival to
330 discharge was known in the majority of cases. Finally, despite the endeavour to exclude
331 hyperthermic cats, it is still possible that some cases (particularly cats with respiratory
332 impairment) may have been hyperthermic. Furthermore, a few conditions diagnosed in
333 this study have not been previously associated with pyrexia (e.g, renal pseudocysts,

uroliths, gastrointestinal foriegn bodies); while it is feasible pyrexia may occur in these conditions due to inflammation and/or associated infection, hyperthermia cannot be fully excluded. Rectal temperature in healthy cats can reach 39.3°C in the veterinary consultation room due to stress[14]. The inclusion criteria of two or more documented episodes of increased rectal temperature was used in an attempt to exclude cases with stress hyperthermia.

Conclusions

This is the first descriptive study investigating cases of feline pyrexia. A diligent search for an infectious cause, particularly FIP, remains a priority in the investigation of cats with pyrexia. In contrast to dogs, immune-mediated disease is a rare cause for feline pyrexia. Abdominal ultrasonography and cytology are likely to be useful and readily available diagnostic procedures. The administration of more than one antimicrobial class was common in this population.

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Table 1. Antimicrobials administered before referral in a population of 106 cats with pyrexia

One antimicrobial administered (n=54)	
AC	35
Cefovecin	9
Fluoroquinolone	4
Clindamycin	4
Two antimicrobials administered (n=28)	
AC / fluoroquinolone	12
AC / metronidazole	6
AC / cefovecin	3
AC / doxycycline	3
AC / clindamycin	1
Fluoroquinolone / cefovecin	1
Fluoroquinolone / TMPS	1
Fluoroquinolone / clindamycin	1
Three or more antimicrobials administered (n=5)	
AC / cefovecin / metronidazole	2
AC / cefovecin / clindamycin	2
AC / cefovecin / doxycycline / fluoroquinolone	1

AC = amoxicillin-clavulanic acid; TMPS = trimethoprim sulfonamide
Numbers (n) indicate number of cats

368
369 **Table 2. Utility of diagnostic tests/investigations performed in 106 cats with pyrexia**

Test	Number of cats in which test was performed (percentage)	Number of cats in which test 'Enabled a diagnosis' (percentage)	Number of cats in which test 'Assisted a diagnosis' (percentage)
Urinalysis	46 (43.4%)	0	2 (4.3%)
Urine culture	31 (29.2%)	3 (9.7%)	0
FeLV/FIV testing	74 (69.8%)	FIV positive = 3 (4.0%)	0
Feline PLI	28 (26.4%)	3 (10.7%)	0
Abdominal ultrasonography	74 (69.8%)	11 (14.9%)	28 (37.8%)
Abdominal CT	9 (8.5%)	0	1 (11.1%)
Thoracic radiography	39 (36.8%)	0	7 (18.9%)
Thoracic CT	26 (24.5%)	1 (3.8%)	6 (23.1%)
Echocardiography	33 (31.1%)	0	0 (concurrent cardiomyopathy = 3)
MRI	7 (6.6%)	1 (14.3%)	6 (85.7%)
Other imaging (e.g, CT/radiography of head, joints)	7 (6.6%)	1 (14.3%)	6 (85.7%)
Endoscopy	Bronchoscopy 6 (5.7%) GI endoscopy 3 (2.8%) Rhinoscopy 1 (0.9%)	1 (16.7%)	3 (30%)
Bacterial culture (non-urine e.g, fluid, tissue)	31 (29.2%)	5 (16.1%)	5 (16.1%)
Cytology	43 (40.6%)	16 (25.4%)	12 (27.9%)
Body cavity fluid analysis	30 (28.3%)	5 (16.6%)	19 (63.3%)
Histopathology	26 (24.5%)	13 (50.0%)	7 (26.9%)
Faecal tests (culture, parasitology)	8 (7.5%)	0	3 (37.5%)

Test	Number of cats in which test was performed (percentage)	Number of cats in which test 'Enabled a diagnosis' (percentage)	Number of cats in which test 'Assisted a diagnosis' (percentage)
PCR (blood, tissue, saliva)	FCoV 15 (14.2%) Haemoplasma 8 (7.5%) *Mycoplasma felis* 5 (4.7%) FCV 5 (4.7%) FHV 4 (3.8%) *Toxoplasma gondii* 4 (3.8%) *Bordetella bronchiseptica* 4 (3.8%) *Tritrochomonas foetus* 1 (0.9%) *Mycobacteria* species 1 (0.9%)	6 (12.8%)	13 (27.7%)
Serology	*T. gondii* 22 (20.8%) FCoV 19 (18.8%)	2 (4.9%)	17 (41.4%)
Other tests performed but not further described	Alpha-1 glycoprotein, serum troponins, serum electrophoresis, bile acids, thyroxine, coagulation testing, serum cobalamin/folate, serum ammonia, electrocardiogram, gamma interferon testing, Coombs' testing, Ziehl Neelsen staining		

370
371 FeLV = Feline leukemia virus, FIV = Feline immunodeficiency virus, PLI = pancreatic
372 lipase immunoreactivity, GI = gastrointestinal, FCoV = Feline coronavirus, FCV = Feline
373 calicivirus, FHV = Feline herpesvirus PCR = polymerase chain reaction
374

Table 3. Most common complete blood count and serum biochemistry abnormalities detected in 104 cats with pyrexia

Laboratory parameter	Number of cases
Neutrophil abnormalities	50
Mild neutrophilia	13
Moderate neutrophilia	14
Severe neutrophilia	9
Band neutrophilia (normal overall neutrophil count)	7
Neutropenia	7
Anaemia	39
Mild	18
Moderate	17
Severe	4
Increased alanine transaminase (ALT)	48
Mild	37
Moderate	9
Severe	2
Hypoalbuminaemia	32
Mild	14
Moderate	14
Severe	4

Neutrophilia: mild (12 to <20 x 10^9/l), moderate (20 to <30 x 10^9/l), severe (≥30 x 10^9/l). Neutropenia: <4 x 10^9/L. Anaemia: mild (PCV 20 to ≤24%), moderate (15 to <20%), severe (<15%). ALT: mild (<2 times upper reference range), moderate (≥2 to 3 times), severe (>3 times). Hypoalbuminaemia: mild (20 to <24 g/l), moderate (16 to <20 g/l), severe (<6 g/l).

Table 4. Final diagnosis and disease category classification for 106 cats with pyrexia

Disease group	Diagnosis	Number of cats
Infectious	FIP	22
	Cellulitis/otitis (media)	4
	Pyothorax	3
	Pyelonephritis/UTI	3
	Lower airway inflammation with *M.felis*	2
	Neutrophilic cholangiohepatitis	2
	Campylobacter enteritis	2
	Bronchopneumonia	1
	Brain empyema	1
	Hepatic abscess	1
	TOTAL	**41 (38.7%)**
Inflammatory	Pancreatitis	5
	Sterile peritonitis	3
	Sterile lymphadenitis/panniculitis/cellulitis	3
	Inflammatory lower airway disease	3
	Lymphocytic cholangiohepatitis	2
	Inflammatory CNS disease	2
	Myocarditis	1
	TOTAL	**19 (17.9%)**
Neoplasia	Lymphoma	6
	Pulmonary carcinoma	3
	Leukaemia (not characterised)	2
	Pulmonary metastases, primary neoplasm not identified	1
	Gastrointestinal adenocarcinoma	1
	TOTAL	**13 (12.3%)**
Immune-mediated	Immune-mediated haemolytic anaemia	3
	Immune-mediated polyarthritis	3
	TOTAL	**6 (5.7%)**
Miscellaneous	Intestinal obstruction (foreign body)	3
	Bone marrow disorder (not characterised)	2
	Ureterolithiasis/urolithiasis	2
	Intussusception	1
	Peri-renal pseudocysts	1
	Trauma	1
	Hippocampal necrosis	1
	TOTAL	**11 (10.4%)**
No diagnosis (PUO)	**TOTAL**	**16 (15.0%)**

391 FIP = Feline infectious peritonitis, UTI = urinary tract infection, CNS = central nervous
392 system, PUO = pyrexia of unknown origin

Disease groups	All cats	Infectious	Inflammatory	Neoplasia	Miscellaneous	Immune-mediated	No diagnosis (PUO)
Median (range) age (years)	4.0 (0.2 – 15)	2.5 (0.1-15.0)	5.0 (0.6-12.0)	8.0 (1.0-14.0)	3.0 (0.6-8.0)	8.5 (1.0-13.0)	3.0 (0.1-14.0)

Table 5. Median age of 106 cats with pyrexia, as classified by disease category

PUO = pyrexia of unknown origin

References

1.Ramsey IK and Tasker S. Fever. In: Ettinger S, Feldman EC and Cote E, (eds.). *Textbook of Veterinary Internal Medicine*. 8th ed.: Elsevier, 2017, p. 195-203.

2.Knockaert DC, Vanderschueren S and Blockmans D. **Fever of unknown origin in adults: 40 years on**. *J Intern Med*. 2003; 253: 263-75.

3.Flood J. **The Diagnostic Approach to Fever of Unknown Origin in Cats**. *Comp Cont Ed Vet*. 2009; 31: 26-31.

4.Nelson RW and Couto CG. Fever of undetermined origin. *Small Animal Internal Medicine*. Canada: Elsevier, 2014, p. 1279-82.

5.Lappin M. Pyrexia and Hyperthermia. In: Harvey AM and Tasker S, (eds.). *BSAVA Manual of Feline Practice A Foundation Manual*. Gloucester: British Small Animal Veterinary Association, 2013, p. 287-9.

6.Dunn KJ and Dunn JK. **Diagnostic investigations in 101 dogs with pyrexia of unknown origin**. *J Small Anim Pract*. 1998; 39: 574-80.

7.Battersby IA, Murphy KF, Tasker S and Papasouliotis K. **Retrospective study of fever in dogs: laboratory testing, diagnoses and influence of prior treatment**. *J Small Anim Pract*. 2006; 47: 370-6.

8.Chervier C, Chabanne L, Godde M, Rodriguez-Pineiro MI, Deputte BL and Cadore JL. **Causes, diagnostic signs, and the utility of investigations of fever in dogs: 50 cases**. *Can Vet J*. 2012; 53: 525-30.

9.Pedersen NC. **A review of feline infectious peritonitis virus infection: 1963-2008**. *J Feline Med Surg*. 2009; 11: 225-58.

10.Riemer F, Kuehner KA, Ritz S, Sauter-Louis C and Hartmann K. **Clinical and laboratory features of cats with feline infectious peritonitis - a retrospective study of 231 confirmed cases (2000-2010)**. *J Feline Med Surg*. 2016; 18: 348-56.

11.Lunn KF. Fever. In: Greene CE, (ed.). *Infectious Diseases of the Dog and Cat*. 4th ed. USA: Elsevier, 2012, p. 1115-23.

12.Mourad O, Palda V and Detsky AS. **A comprehensive evidence-based approach to fever of unknown origin**. *Arch Intern Med*. 2003; 163: 545-51.

13.Forman MA, Marks SL, De Cock HE, et al. **Evaluation of serum feline pancreatic lipase immunoreactivity and helical computed tomography versus conventional testing for the diagnosis of feline pancreatitis**. *J Vet Intern Med*. 2004; 18: 807-15.

14.Quimby JM, Smith ML and Lunn KF. **Evaluation of the effects of hospital visit stress on physiologic parameters in the cat**. *J Feline Med Surg*. 2011; 13: 733-7.