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Research Article

Utilization of Computed Tomography at the Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital: An Analysis of Preliminary Results on Patient Demographics and Case Distribution

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ABSTRACT

This study examines the distribution of computed tomography (CT) usage at Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital between 2023 and 2024. CT, a widely adopted diagnostic tool in veterinary medicine, allows for detailed imaging of internal organs and anatomical structures, enhancing the diagnosis of complex cases. The present study analyzed data from 143 animals, including dogs, cats, and other species, to assess the frequency of CT scans based on species, age, sex, breed, and imaged anatomical regions. A total of 350 CT scans were reviewed, with dogs (n=87) undergoing the majority of scans (200), followed by cats (n=50) with 175 scans, and other species accounting for 26 scans. Cranium, thorax, and abdomen were the most frequently imaged regions across all species. The study found that older animals, particularly large-breed dogs and male cats, required more imaging, while younger animals (0-6 months) underwent fewer CT scans. The findings emphasize the need for tailored diagnostic approaches based on species, age, and sex to improve early detection and treatment outcomes in veterinary practice. Furthermore, the study highlights the potential for expanding CT use in non-traditional veterinary species, with the goal of improving diagnostic precision. The results provide important insights for enhancing veterinary services through the strategic application of CT imaging.

Keywords: *Computed tomography, diagnostic imaging, veterinary medicine*

Aydın Adnan Menderes Üniversitesi Veteriner Fakültesi Araştırma ve Uygulama Hastanesinde Bilgisayarlı Tomografi Kullanımı: Hasta Demografisi ve Vaka Dağılımı Üzerine Ön Sonuçların Analizi

ÖZET

Bu çalışma, 2023 ve 2024 yılları arasında Aydın Adnan Menderes Üniversitesi Veteriner Fakültesi Araştırma ve Uygulama Hastanesi'nde bilgisayarlı tomografi (BT) kullanımının dağılımını incelemektedir. Veteriner hekimlikte yaygın olarak benimsenen bir tanı aracı olan BT, iç organların ve anatomik yapıların detaylı görüntülenmesine olanak tanıyarak karmaşık vakaların tanısını iyileştirmektedir. Sunulan çalışma, tür, yaş, cinsiyet, ırk ve görüntülenen anatomik bölgeler temelinde BT taramalarının sıklığını değerlendirmek için köpekler, kediler ve diğer türleri de içeren 143 hayvanın verilerini analiz etmiştir. Toplamda 350 BT taraması incelenmiş olup, köpekler (n=87) en fazla tarama (200) gerçekleştirirken, kediler (n=50) 175 tarama ile ikinci sırada yer almakta ve diğer türler 26 tarama ile devam etmektedir. Kafa, toraks ve abdomen, tüm türler arasında en sık görüntülenen bölgeler olmuştur. Çalışma, daha yaşlı hayvanların, özellikle büyük ırk köpekler ve erkek kedilerin daha fazla görüntülemeye ihtiyaç duyduğunu, genç hayvanların (0-6 ay) ise daha az BT taraması geçirdiğini bulmuştur. Bulgular, veteriner pratiğinde erken teşhis ve tedavi sonuçlarını iyileştirmek için tür, yaş ve cinsiyete dayalı özelleştirilmiş tanı yaklaşımlarına ihtiyaç duyulduğunu vurgulamaktadır. Ayrıca, çalışma, tanısal hassasiyeti artırma amacıyla geleneksel olmayan veteriner türlerinde BT kullanımının genişletilmesi potansiyelini de öne çıkarmaktadır. Sonuçlar, BT görüntülemenin stratejik uygulanması yoluyla veteriner hizmetlerin geliştirilmesi için önemli bilgiler sunmaktadır.

Anahtar kelimeler: *Bilgisayarlı tomografi, tanısal görüntüleme, veteriner hekimlik*

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Introduction

Advances in veterinary medicine technologies allow for more precise and detailed assessments of animal health. Among these technologies, computed tomography (CT) has emerged as a critical diagnostic tool, particularly in complex cases. While CT devices are widely used in human medicine, they have also become invaluable in veterinary settings, especially for small animals (cats, dogs) and large animals (horses, cattle). CT provides detailed imaging of internal organs, bony structures, and soft tissues, playing a pivotal role in various areas such as pre-surgical planning, tumor diagnosis, trauma, and fracture evaluations.

The application of computed tomography in veterinary medicine varies depending on animal species, age, breed, and the specific reasons for clinical presentation, as well as the distribution of diseases. Neurological disorders, orthopedic issues, and oncological cases are among the primary areas where CT is most frequently utilized (Gielen et al., 2012; Puchalski, 2012; Ballegeer, 2016; Keane et al., 2017). The distribution of patients undergoing CT scans in veterinary clinics offers insight into the prevalence of different conditions across species. For instance, trauma cases may dominate in certain animal groups (Dozeman et al., 2020; Sepuya et al., 2022), while tumor diagnoses could be more frequent in others (Keane et al., 2017; Greco et al., 2023). The use of CT also plays an important role in treatment planning and prognosis assessment.

This study aims to analyze the distribution of CT usage at Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital across different animal species, focusing on the frequency of scans based on breed (in dogs), gender, age groups, and specific body regions imaged. The analysis will categorize data into three main groups: dogs, cats, and other animal species, providing insights into the clinical applications of CT in veterinary medicine. By identifying frequently imaged anatomical regions, the study seeks to enhance early diagnosis and preventive treatment strategies, raising awareness of health issues and guiding veterinary services toward priority species.

Table 1. Descriptive statistics of animals undergoing computed tomography (CT) scan at the Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital between 2023 and 2024 (n)

	Sex			Breed (kg)			Age (month)			
Species	**Male**	**Female**	**Unknown**	**Small (0-10)**	**Medium (11-25)**	**Large (26+)**	**0-9**	**10-18**	**19-108**	**109+**
Dog	46	41	0	20	34	33	1	10	49	27
							0-6	**7-35**	**36-83**	**83+**
Cat	25	25	0				3	16	17	14
Other animals	2 (rabbit)	0	4*							

* The sex records of these animals (two reptile, one parrot and one falcon) were missed.

Table 2. The number of tomographic imaging regions in dogs according to sex, breed, and age groups (n, %)

Sex	Breed (kg)	Age (Month)	Region, n (%)						
			Cranium	Cervical	Thoracal	Abdominal	Lumbar	Extremity	Total
Male	Small (0-10kg)	0-9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		10-18	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		19-108	9 (2.57)	8 (2.29)	8 (2.29)	9 (2.57)	8 (2.29)	8 (2.29)	50 (14.29)
		109+	1 (0.29)	1 (0.29)	2 (0.57)	2 (0.57)	1 (0.29)	1 (0.29)	8 (2.29)
	Middle (11-25kg)	0-9	1 (0.29)	1 (0.29)	1 (0.29)	1 (0.29)	1 (0.29)	1 (0.29)	6 (1.71)
		10-18	3 (0.86)	3 (0.86)	4 (1.14)	3 (0.86)	3 (0.86)	3 (0.86)	19 (5.43)
		19-108	10 (2.86)	7 (2.00)	7 (2.00)	7 (2.00)	7 (2.00)	7 (2.00)	45 (12.86)
		109+	3 (0.86)	3 (0.86)	3 (0.86)	3 (0.86)	3 (0.86)	3 (0.86)	18 (5.14)
	Large (26+ kg)	0-9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		10-18	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.29)	0 (0.00)	0 (0.00)	1 (0.29)
		19-108	3 (0.86)	3 (0.86)	6 (1.71)	4 (1.14)	6 (1.71)	4 (1.14)	26 (7.43)
		109+	5 (1.43)	4 (1.14)	4 (1.14)	5 (1.43)	5 (1.43)	4 (1.14)	27 (7.71)
Subtotal			35 (10.00)	30 (8.57)	35 (10.00)	35 (10.00)	34 (9.71)	31 (8.86)	200 (57.14)
Female	Small (0-10kg)	0-9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		10-18	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.29)	1 (0.29)
		19-108	3 (0.86)	2 (0.57)	2 (0.57)	4 (1.14)	2 (0.57)	2 (0.57)	15 (4.29)
		109+	1 (0.29)	1 (0.29)	2 (0.57)	1 (0.29)	1 (0.29)	1 (0.29)	7 (2.00)
	Middle (11-25kg)	0-9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		10-18	2 (0.57)	2 (0.57)	2 (0.57)	2 (0.57)	2 (0.57)	4 (1.14)	14 (4.00)
		19-108	7 (2.00)	6 (1.71)	8 (2.29)	6 (1.71)	6 (1.71)	7 (2.00)	40 (11.43)
		109+	4 (1.14)	2 (0.57)	2 (0.57)	2 (0.57)	2 (0.57)	2 (0.57)	14 (4.00)
	Large (26+ kg)	0-9	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		10-18	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
		19-108	5 (1.43)	3 (0.86)	3 (0.86)	4 (1.14)	3 (0.86)	2 (0.57)	20 (5.71)
		109+	8 (2.29)	7 (2.00)	6 (1.71)	6 (1.71)	6 (1.71)	6 (1.71)	39 (11.14)
Subtotal			30 (8.57)	23 (6.57)	25 (7.14)	25 (7.14)	22 (6.29)	25 (7.14)	150 (42.86)
Total			65 (18.57)	53 (15.14)	60 (17.14)	60 (17.14)	56 (16.00)	56 (16.00)	350 (100.00)

Materials and Methods

This study analyzed the records of patients who underwent CT scanning at Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital between 2023 and 2024. The collected data included demographic informations such as species, sex, age, and breed, as well as the anatomical regions (cranium, cervical, thoracal, abdominal, lumbar, and extremity) imaged during the CT procedures. In this study, age determination for dogs was based on tooth wear time (Sutton et al., 2018). For cats, age determination was based on tooth eruption times and dietary changes (Little, 2011). Dog breeds were categorized into small (0-10 kg), medium (11-25 kg), and large (26 kg and above) groups according to their weight classification (Butković et al. 2001). The obtained data were presented using standard descriptive statistics to summarize the distribution and frequency of imaging across different animal species.

Results

The descriptive statistics of the animals in the study, classified by species, sex, weight, and age, are summarized in Table 1. A total of 87 dogs were identified, with 46 males and 41 females. Based on body weight, 20 dogs were classified as small (0-10 kg), 34 as medium (11-25

Table 3. The number of tomographic imaging regions in cats according to sex and age groups (n, %)

Sex	Age (Month)	Region, n (%)						
		Cranium	Cervical	Thoracal	Abdominal	Lumbar	Extremity	Total
Male	0-6	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	7-35	5 (2.86)	6 (3.43)	5 (2.86)	6 (3.43)	6 (3.43)	5 (2.86)	33 (18.86)
	36-83	7 (4.00)	5 (2.86)	6 (3.43)	6 (3.43)	5 (2.86)	5 (2.86)	34 (19.43)
	84+	4 (2.29)	4 (2.29)	5 (2.86)	7 (4.00)	4 (2.29)	4 (2.29)	28 (16.00)
Subtotal		16 (9.14)	15 (8.57)	16 (9.14)	19 (10.86)	15 (8.57)	14 (8.00)	95 (54.29)
Female	0-6	2 (1.14)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (1.14)
	7-35	7 (4.00)	3 (1.71)	5 (2.86)	3 (1.71)	3 (1.71)	3 (1.71)	24 (13.71)
	36-83	6 (3.43)	4 (2.29)	4 (2.29)	6 (3.43)	4 (2.29)	4 (2.29)	28 (16.00)
	84+	4 (2.29)	4 (2.29)	5 (2.86)	5 (2.86)	4 (2.29)	4 (2.29)	26 (14.86)
Subtotal		19 (10.86)	11 (6.29)	14 (8.00)	14 (8.00)	11 (6.29)	11 (6.29)	80 (45.71)
Total		35 (20.00)	26 (14.86)	30 (17.14)	33 (18.86)	26 (14.86)	25 (14.29)	175 (100.00)

kg), and 33 as large (26 kg and above). The age distribution revealed that the majority of dogs (n=49) were between 19-108 months, followed by 27 dogs older than 109 months, 10 dogs aged 10-18 months, and one dog in the 0-9 month category. For the cats, there were 25 males and 25 females. Age data revealed that 17 cats were aged 36-83 months old, 16 were 7-35 months old, 14 were older than 83 months, and 3 were in the 0-6 months old. The group of other animals consisted of 2 male rabbits and 4 additional animals (two reptiles, one parrot, and one falcon), though sex records for these four were missing.

The distribution of tomographic imaging regions in dogs based on sex, breed (based on weight), and age is shown in Table 2. A total of 350 scans were conducted across different anatomical regions, with the cranial region having the highest number of scans (n=65, 18.57%), followed by the thoracic and abdominal regions, each accounting for 60 scans (17.14%). The lumbar and extremity regions contributed equally with 56 scans (16%), and cervical scans represented 15.14% of the total. The majority of scans were performed on medium (11-25 kg) and large (26 kg and above) breed dogs, particularly in the 19-108 months age group. Notably, large dogs aged 109 months and older accounted for a significant number of scans, especially in the cranial (n=5, 1.43%), lumbar (n=5, 1.43%), and extremity regions (n=4, 1.14%). Small dogs (0-10 kg) underwent fewer scans overall, with the majority concentrated in the 19-108 months age range (n=50, 14.29%). In terms of sex, both male and female dogs exhibited a similar distribution of scans across all regions. However, slightly more scans were performed on male dogs (n=200, 57.14%) compared to females (n=150, 42.86%). A notable finding is the higher number of cranial and lumbar scans in large females aged 109 months and older (n=8, 2.29%), suggesting an increased need for imaging in this demographic.

The distribution of tomographic imaging regions in cats, based on sex and age were presented in Table 3. A total of 175 scans were performed across different regions, with cranial scans accounting for the highest percentage (n=35, 20%), followed by abdominal scans (n=33, 18.86%) and thoracic scans (n=30, 17.14%). Cervical, lumbar, and extremity regions contributed similarly, with each accounting for 14.29% to 14.86% of the scans. Male cats underwent more scans overall, particularly in the cranial (9.14%), cervical (8.57%), and abdominal (10.86%) regions. In contrast, female cats had a similar distribution across regions, with the highest number of scans occurring in the cranial (10.86%) and thoracic (8%) regions. Cats aged 7-35 months accounted for the highest number of scans, with 33 (18.86%) across various regions, while older cats (aged 84+ months) represented a significant portion of cranial, lumbar, and abdominal scans.

The distribution of tomographic imaging regions in other

Table 4. The number of tomographic imaging regions in other animal species (n, %)

Species	Region, n (%)						
	Cranial	Cervical	Thoracal	Abdominal	Lumbar	Extremity	Total
Avian	1 (3.85)	1 (3.85)	2 (7.69)	1 (3.85)	1 (3.85)	1 (3.85)	7 (26.92)
Rabbit	2 (7.69)	2 (7.69)	2 (7.69)	2 (7.69)	2 (7.69)	2 (7.69)	12 (46.15)
Reptile	1 (3.85)	1 (3.85)	2 (7.69)	1 (3.85)	1 (3.85)	1 (3.85)	7 (26.92)
Total	4 (15.38)	4 (15.38)	6 (23.08)	4 (15.38)	4 (15.38)	4 (15.38)	26 (100.00)

animal species is presented in Table 4. A total of 26 scans were performed across avian, rabbit, and reptile species. The thoracic region accounted for the highest number of scans (n=6, 23.08%), while cranial, cervical, abdominal, lumbar, and extremity regions each contributed equally, with 4 scans each (15.38%). Rabbits underwent the most tomographic scans (n=12, 46.15%), with equal distribution across all anatomical regions. Avian and reptile species each accounted for 7 scans (26.92%), with thoracic scans being the most common in both species (7.69%).

Discussion

This study evaluated the demographic distribution and tomographic imaging practices among animals at Aydın Adnan Menderes University Faculty of Veterinary Medicine Research and Application Hospital from 2023 to 2024, comprising a total of 143 animals and 350 tomographic images. In a previous study by Caspanello et al. (2023) reported five hundred and sixty-one CT exams on 512 dogs and 49 cats were reported in six years. Similarly, the majority of subject animal in the present study were dogs (n=87) with 200 scan, followed by cats (n=50) with 175 scan, and a minor representation from other species, including rabbits (n=4) and reptiles (n=2), which collectively accounted for 26 scan. The present findings indicate that the utilization of the CT scan is in alignment with the previous reports in aid of diagnostic validations, aside from diversity in animal species such as rabbits and reptiles.

The use of CT in veterinary medicine is becoming increasingly prevalent. This auxiliary diagnostic method offers numerous advantages in patient treatment by providing valuable information to practitioners. Additionally, it enables surgeons to visualize detailed anatomical structures in patients requiring surgical intervention, facilitating more precise and less invasive procedures. In the postoperative phase, CT allows for the assessment of complications and the evaluation of surgical success (Ando et al., 2012; Iwanaga et al., 2016; Del Busto et al., 2020; Griffeuille et al., 2021; Cohen et al., 2023). However, the data presented in the current study do not describe the specific advantages of CT for patients. Future research should investigate the benefits of CT across various animal species and diseases, potentially enhancing this diagnostic modality through advancements in software, specialization, and apparatus development.

The CT using in horses (Zimmerman et al., 2022) and cattle (Nuss et al., 2011) have been stated in the literature. The records from our hospital reveal that computed tomography (CT) scans have been performed on various animal species, including avian, reptiles, and rabbits; however, CT scans for large animals have not yet been performed. This limitation may arise from the current CT device and the area designated for its operation is not suitable for larger species, such as cattle and horses. Acquiring a compatible tomography device for large animals, which possess significant economic value, and conducting proper area planning during installation will facilitate the performance of CT scans on these animals and increase the number of large animals undergoing such procedures. By considering the aforementioned recommendations, the prevalence of CT scans for large animals can be enhanced in our country, thereby contributing positively to the economy.

The data analyzed in this study indicates a lack of tomographic imaging for dogs younger than nine months (Table 2). In small breed dogs (0-10 kg) aged 19-108 months, the cranial and abdominal regions were the most frequently imaged, possibly reflecting a higher incidence of conditions in these areas. Middle-aged male dogs (11-25 kg) exhibited a considerable number of scans, particularly in the thoracic region, which might suggest a greater occurrence of respiratory or cardiovascular issues. For large breed dogs (26kg and above), the scans were distributed across multiple regions, especially the abdominal and lumbar areas, potentially highlighting the complexity of health issues that arise with aging in these breeds. The relatively high number of scans in older dogs (109+ months) underscores the importance of routine imaging to monitor age-related health conditions (Table 2). Overall, these findings suggest that tomographic imaging in dogs could benefit from a tailored approach based on breed, age, and sex to enhance early detection and treatment outcomes. Special attention may be needed for the cranial, thoracic, and lumbar regions, particularly in older and larger dogs.

In the present study, similar to dogs, there was a lack of tomographic imaging in cats aged between 0-6 months, and none was performed in males (Table 3). Among male cats aged 7-35 months, the cranial and abdominal regions were most imaged, possibly reflecting a greater prevalence of health problems in these regions and the need for more focused diagnostic approaches for cats in this age group. Female cats aged 36-83 months had a significant number of scans, particularly in the abdominal region, and this finding may emphasize the importance of regular health monitoring in this age group of cats. Older cats (84+ months) had a moderate imaging frequency, especially in the abdominal and thoracic regions (Table 3). The findings of the present study highlight the role of age and sex in influencing veterinary imaging practices in cats and support the need for specific diagnostic strategies to improve feline health outcomes. Miniter et al. (2019) reported 130 abdominal CT scans (75 for canines and 22 for felines) over a two-year period. In this study, 93 abdominal CT scans were identified within one year (60 dogs and 33 cats). The number of CT scans performed within one year in this study suggests a need for CT imaging in the patients presenting to our hospital.

The findings also suggest the potential necessity of tomographic imaging for animals besides companion animal species (Table 4). The variability in imaging requirements among avian and reptilian species may indicate that imaging protocols could benefit from customization to address the specific diagnostic needs of each species.

Conclusion

The present study demonstrates a lack of tomographic imaging in very young animals, particularly in male dogs

and cats aged between 0-6 months. In contrast, older animals exhibit increased imaging frequencies across various regions, suggesting a potential need for diagnostic approaches for certain diseases. The findings highlight the importance of considering species, age, and sex to optimize health outcomes in different animal populations. This study aims to raise awareness of the increasing use of CT in veterinary medicine and to assess the frequency of CT usage between 2023 and 2024. Summarizing the trends in CT scans for patients admitted to our hospital during this period may provide valuable insights for veterinarians, animals, and their owners.

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Conflict of interest

The authors declared that there is no conflict of interest.

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