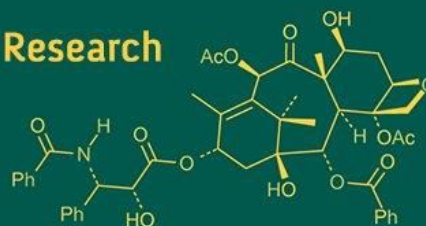


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Comparative evaluation of computed radiography and computed tomography for the diagnosis of thoraco-abdominal disorders in dogs

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Abstract

A total of four cases with an age range of 4-10 years old of various breeds of two male labradors, one female Golden Retriever, and one male Great Dane presented with a history and clinical signs of thoraco-abdominal disorders such as inappetence coughing, inappetence, respiratory distress, vomition, high temperature, tachycardia, cardiac murmurs, muffled lung sounds and distended abdomen presented to Veterinary hospital, Veterinary College, Hassan. Further, these pets were subjected to Computed Radiographic (CR) and Computed Tomographic (CT) evaluation. These modalities helped to diagnose the thoraco-abdominal disorders, such as dilated cardiomyopathy (DCM), pulmonary oedema and pleural effusion secondary to DCM and associated with gastric dilatation and volvulus (GDV) in a Grate Dane, soft tissue sarcoma at the axial region of the left forelimb and associated with hepatocellular carcinoma (HCC) in a Labrador, lymphoma (abdominal lymph nodal mass) also associated with ascites and pleural effusion secondary to cardiac insufficiency in a Golden Retriever, nasal adenocarcinoma associated with pulmonary metastasis and GIST in a labrador. However, radiography may be the first choice for diagnosing thoracoabdominal disorders as it is easily accessible and low-cost compared to CT. If the cases have ambiguity in diagnosis, they need to be subjected to CT for confirmative diagnosis. CT was a more useful modality, resulting in a high-detailed anatomical image with excellent soft tissue contrast of the thoraco-abdomen, facilitating the characterisation and localisation of the thoraco-abdominal lesions. The precision offered by both modalities facilitated the planning, surgical and medical management, and established the prognosis.

Keywords: Computed Radiography (CR), Computed Tomography (CT), Dilated cardiomyopathy (DCM), Gastric dilatation and volvulus (GDV), Hepatocellular Carcinoma (HCC), gastrointestinal stromal tumor

Introduction

Thoraco-abdominal disorders occur more commonly in dogs. The occurrence of dogs having thoraco-abdominal disorders was found to be age, breed and gender-related. Thoraco-abdominal disorders were more prevalent in male dogs than female dogs (Kouamo *et al.*, 2021; Rakha *et al.*, 2015) [10, 14]. Puppies have a weaker immune system than adult dogs; they are more susceptible to various disorders and infections and develop thoraco-abdominal disorders (Dodds, 2020) [6]. Thoraco-abdominal disorders were commonly observed in Great Danes, Cane Corso's, Rottweilers, Toy breeds, German shepherds and crossbreeds. (Kouamo *et al.*, 2021) [10]. An imaging modality is essential for the diagnosis of any thoraco-abdominal disorder. A thorough assessment of the patient's medical history and physical examination results is necessary to choose the appropriate imaging technique for a conclusive diagnosis. Diagnostic imaging is essential for the early evaluation of dogs exhibiting thoraco-abdominal symptoms. A quick and accurate diagnosis is crucial in directing the proper course of medical and/or surgical intervention. Survey radiography and abdominal ultrasonography are the two standard imaging modalities for evaluating dogs with thoraco-abdominal symptoms (Shanaman *et al.*, 2013) [15]. Radiography is the most common diagnostic technique for patients experiencing thoraco-abdominal symptoms. It is often recognised that radiography is helpful in the identification of some thoraco-abdominal disorders.

It is also a valuable tool for examining the presence of subtle abnormalities. When evaluating thoraco-abdominal disorders, contrast techniques may also be helpful. However, in Veterinary practice, survey radiography is still widely used and often the only method available for evaluating thoraco-abdominal patients due to its accessibility and lower cost (Shanaman, 2013) [15]. Though radiographic examination is a standard modality for diagnosing thoraco-abdominal disorders in dogs, it is not always sufficient for an accurate diagnosis because radiography is a two-dimensional imaging modality and has anatomical superimposition properties; therefore, a higher imaging modality is required to improve diagnosis. Imaging modalities such as radiography and ultrasonography cannot be sufficient to diagnose the conditions accurately. Hence, Computed Tomography (CT) is recommended in such situations (Armbrust *et al.*, 2012) [2]. Since CT has cross-sectional imaging properties, it is crucial in diagnosing thoracic-abdominal disorders in humans. In Veterinary practice, its prevalence is increasing in tandem with technological progress. Compared to standard radiography and ultrasound, CT is non-invasive, capable of cross-sectional imaging, lacks anatomical superimposition and has three-dimensional reconstruction imaging properties, which play a significant role in assessing a wide range of thoraco-abdominal disorders (Boztok Ozgemen and Bumin 2016) [5]. In recent years, several promising investigations in Veterinary practice have been undertaken to evaluate the trachea, oesophagus, heart, lungs, liver, spleen, kidney, pancreas, adrenal gland, genital and urinary system in small animals. Computer tomography (CT) generates detailed anatomical images with excellent contrast of soft tissues in the thoracic and abdomen. This phenomenon can be attributed to the enhanced differentiation among the three separate CT tissue densities within the thoracic and abdominal cavities. Mastery of the planimetric anatomy and its topography is essential for precisely interpreting and identifying CT images.

Materials and Methods

Thoracic and/or abdominal radiographs were taken using X-ray machine, company: Allengers, model: Mars equipped with a computed radiographic system (CR12-X digitizer) working in conjunction with NX, Agfa health care's SE software for complete soft copy, single cassette feed, horizontal cassette insertion with the greyscale resolution of 20 bits/pixel auto ranging external power supply, input 100-240 V, 2A, 50/60 Hz. The study was conducted using a 35 X 43 cm (14 X 17 inch) cassette with a plate size of 35 X 43 cm and a DRYSTAR 5302 imager for hard copy. GE 32 slices CT machine was used for the study which had a multi-detector scanner capable of acquiring high-resolution images with a 1 mm slice thickness. Its advanced reconstruction algorithms allow multiplanar and 3D visualisation, which was essential for detecting subtle lesions. The CT system was calibrated daily through automated quality checks, verifying detector alignment and uniformity. The machine was subjected to periodic manual quality assurance tests by physicists to ensure optimal performance. DICOM-compliant software provided efficient image management, enabling precise manipulation and interpretation. Iohexol, an iodine-based contrast media, was administered intravenously at a dosage of 600 mg/kg to improve the accuracy of thoracic and abdominal CT scans.

Procedure for CR and CT imaging: The effective positioning was crucial for obtaining diagnostic images. For thoracic affections, dogs were positioned in the right lateral, left lateral and ventro-dorsal recumbency, ensuring the sternum was parallel to the table. For lateral views, the forelimbs were extended cranially, and the hind limbs were extended caudally to avoid superimposition. Ventro-dorsal views required similar limb extensions with the dog placed on its back. Thoraco-abdominal images were obtained from different views, such as right lateral, left lateral and ventro-dorsal. These views were crucial for fully exposing the abdominal cavity, focusing on extending the forelimbs cranially and the hind limbs caudally. To ensure stability, foam wedges were used as positioning aids, especially for anaesthetised dogs. The exposure settings for the images depended on the suspected condition and the patient's size. Generally, for thoracic images, a high kVp (90-100) and low mAs (3-6) were used to visualise lung structures with minimal motion artifacts. On the other hand, abdominal imaging requires a slightly lower kVp (70-80) and higher mAs (6-10) to enhance the contrast of soft tissues. Technique charts adjusted the settings based on the patient's size.

The dogs were ideally placed in ventral recumbency with their forelimbs positioned optimally cranially along the head during the acquisition of the thoracic CT scans. The thoracic CT picture was obtained by scanning from the thoracic inlet (at the C5/6 level) to the caudal tip of the lungs. The decent thoracic CT images were achieved using technical settings of 120 kV and 160-200 mA. The slice thickness was varied to a range of 1.25-3mm to provide a high spatial resolution picture for precise diagnosis. Medium frequency was used to create the spatial reconstruction algorithm for soft tissue (pre- and post-contrast). High-frequency bone scans (pre-contrast). Dogs were ideally positioned in a recumbent position to produce a nice abdomen CT image. The optimal position for the hind legs was stretched caudally. To prevent the hips from overextending, a rolled towel can be positioned beneath the pelvis. Additionally, this permits the bladder to naturally "hang" into the abdominal cavity, which is beneficial for assessing the trigonal region. Alternatively, the hind legs can be flexed into a "sphinx" position. CT scan of the abdomen extending from the tip of the diaphragm to the perianal region, achieved using technical settings of 160-200 mA at 120 kV. The 1.25 -3 mm slice thickness was modified for an appropriate diagnosis to get a spatial-resolution image.

Results and Discussion

Case-1: A seven-year-old male Grate Dane came with a history of heavy respiratory distress, discomfort, inappetence and inactiveness. On auscultation, cardiac murmurs with tachycardia were noticed. Intermittent coughing was also seen. On blood evaluation, the total leukocyte count was 36,000 cells/ cu mm, packed cell volume (PCV) was 48 per cent and neutrophils 85 per cent were characteristic.

CR Findings

On the right lateral, left lateral, and DV thorax radiographs revealed air bronchograms with the alveolar pattern highly appreciable, suggestive of mild pleural effusion (Plate 1 A white arrow). Pulmonary veins were enlarged (Plate 1 A yellow arrow). Perihilar opacities were seen in the upper

lung lobes, suggesting pulmonary oedema (Plate 1 A blue arrow). The gas-filled bowel loops (Plate 1 B). The fundus was displaced on the right side on the dorsal-ventro view (DV) and the pylorus was displaced dorsally on the lateral

radiograph, giving an appearance of a “double bubble” suggestive of gastric dilatation and volvulus (GDV) (Plate 1 B).

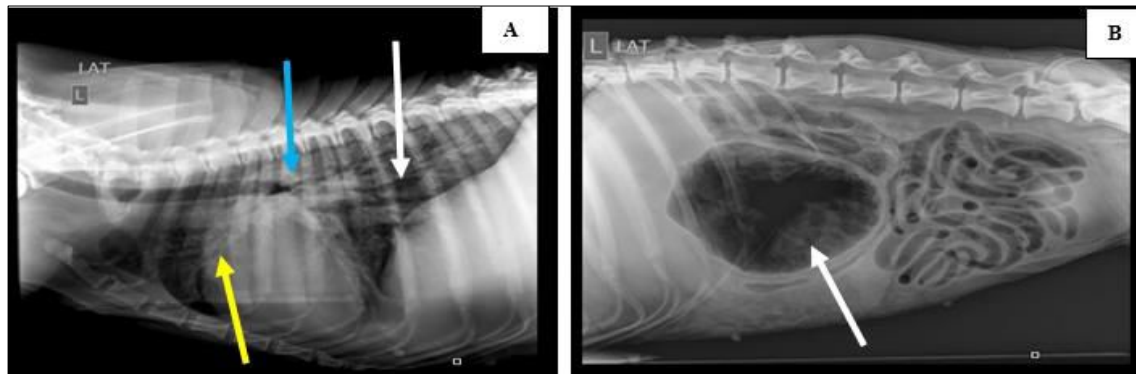


Plate 1: CR: A: Left lateral thoracic view, Air bronchograms were visible - the alveolar pattern was appreciable (white arrow). Pulmonary veins were enlarged. (yellow arrow). Perihilar opacities were seen in the upper lung lobes, suggestive of pulmonary oedema. (blue arrow). B: Left lateral abdomen - gas-filled stomach and bowel loops. and the pylorus was displaced dorsally

Impression: Pulmonary oedema, pleural effusion secondary to dilated cardiomyopathy, gastric dilatation and volvulus (GDV) and splenic torsion.

CT findings: Upon CT, enlarged left ventricle with a size of 6.52 cm and left atrial thrombus was noticed (Plate 2 A). Superior mediastinal lymph node enlargement was seen. The peribronchovascular ground glass density in both the

lungs was appreciable. Perihilar opacities was seen in the upper lobes -likely of infective origin, causing pulmonary oedema (Plate 2 C). Moderate ascites was noted. Multiple splenic infarcts were characteristic (Plate 2 D). Mesenteric congestion -fat stranding was appreciable. Moderate bilateral pleural effusion was noted (Plate 2 A). Pulmonary artery size was increased (Plate 2 B). Dilated stomach with air filled was also appreciable.

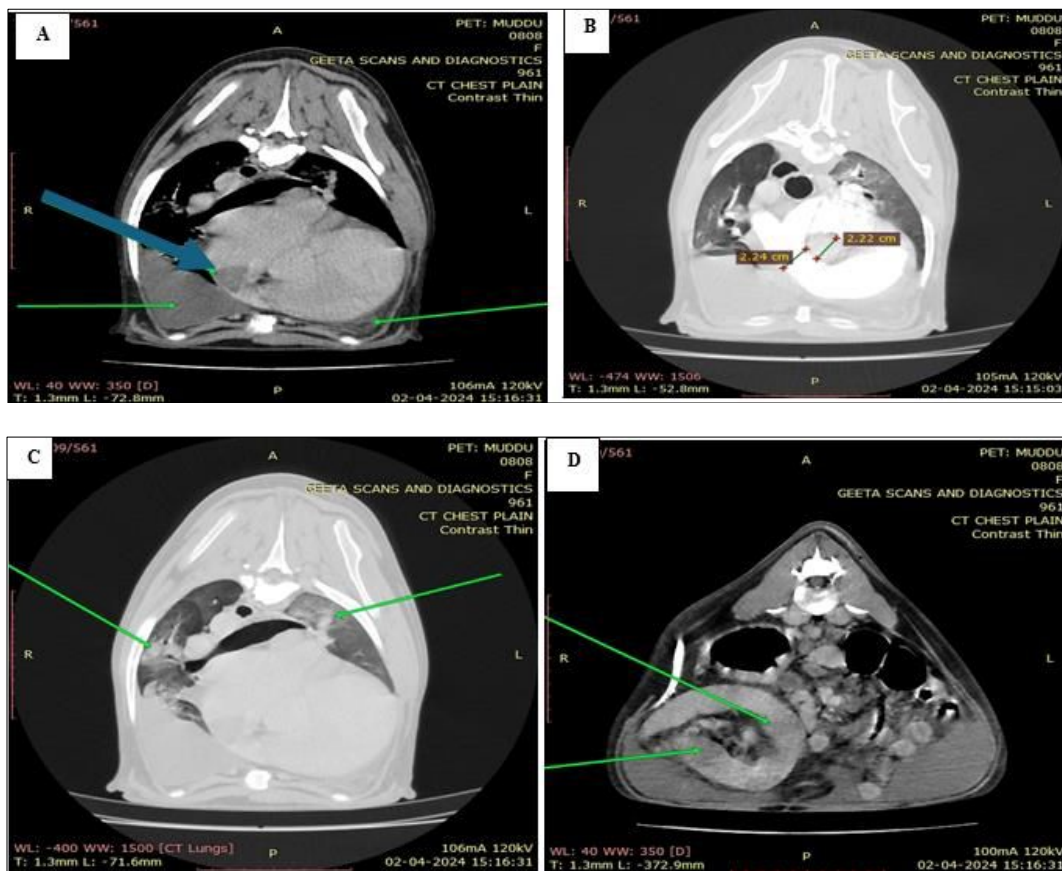


Plate 2: CT: A: Arrow showing bilateral pleural effusion (Green arrows) and left atrium thrombus (Blue arrow); B: Increased pulmonary artery size. C: Arrows showing perihilar opacities indicating pulmonary oedema; D: Markedly increased size of spleen—splenomegaly with infarcts in the spleen.

Impression: Pleural effusion secondary to dilated cardiomyopathy/GDV.

Comparison of CT and CR findings: Both modalities effectively diagnose these conditions, but CT seemed more effective than CR in diagnosing cardiac and vascular abnormalities.

Case-2: A nine-year-old male Labrador presented with history of swelling at the left axial region. The owner also complained about the pet's decreased body weight and appetite. On blood evaluation leucocytosis (42,000 cells/cu

mm), elevated ALT (118 IU/L) and hypoproteinaemia (4.6 g/dl) were characteristic.

CR findings

The right and left lateral and VD thoraco-abdominal radiographs revealed well-defined homogenous mass opacity in the left axial region of the chest wall without bony destruction or calcification (Plate 3 A). The right and left lateral thorax view revealed that the patchy interstitial pattern was appreciable (Plate 3 A). A soft tissue opacity mass was observed just dorsally to the liver and the mass was lifting the stomach more towards dorsally (Plate 3 B). Bowels were air-filled.

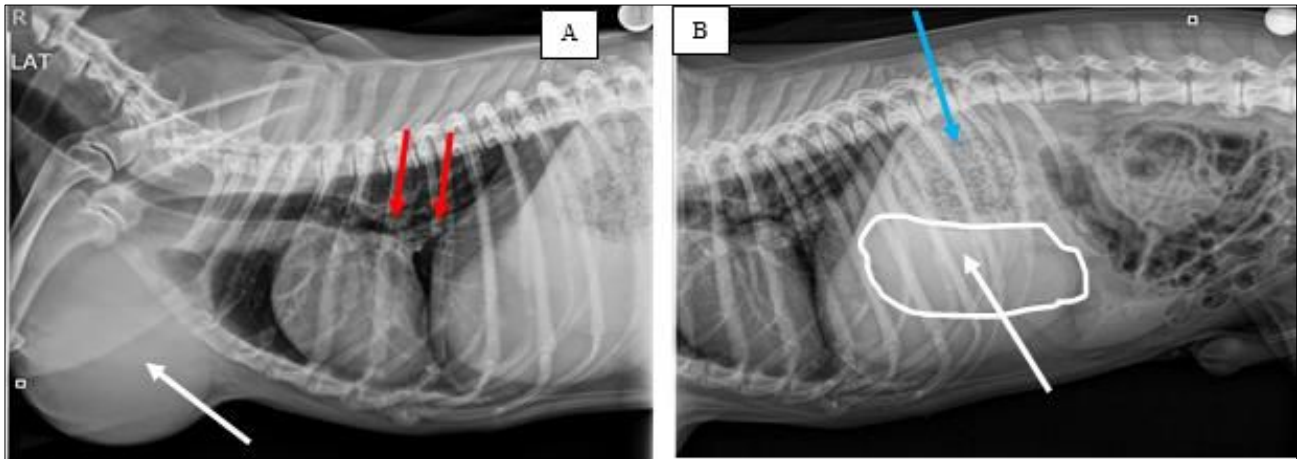


Plate 3: CR: A: Right lateral thorax -increased soft tissue opacified mass at the axial region of the left forelimb and the patchy interstitial pattern was appreciable (red arrows). B: Right lateral abdomen - a soft tissue opacity mass was observed just dorsally to the liver.

Impression: Tumor at the axial region of left forelimb and mass/lesion located dorsally to liver.

CT finding

A Heterogeneous soft tissue mass measuring 135 x 109 mm was seen in the left anterior chest wall extending into the left axillary and supraclavicular regions and tracking underneath the left pectoralis major muscle. (Plate 4 A). No adjacent bone erosion/intrathoracic extension was seen. An iso-dense lesion measuring 69 X 128 mm was seen in the left lobe of the liver with cystic areas within. The rest of the liver parenchyma appears to be a typical - metastatic lesion. (Plate 4 B). No lung lesions were seen.

Impression: Soft tissue sarcoma and hepatocellular carcinoma.

Case-3: A four-year-old female Golden retriever presented with a history of prolonged inappetence, a distended abdomen, a high temperature and respiratory distress was presented to the Veterinary Clinical Complex, Veterinary College, Hassan. The animal was dull and inactive. On blood evaluation, there was leukocytosis (43,000 cells/cu

mm) and elevated serum creatinine (2.5 mg/dl) was appreciable. Further, the pet was subjected to CR and CT evaluation.

CR findings

On right lateral, left lateral and VD abdominal radiograph revealed a large soft tissue opacity in the mid-ventral abdomen. (Plate. 5 A white mark B). The majority of the small intestine was displaced towards the right side. Kidneys appeared normal. The liver was well within the costal arch. The urinary bladder was normal. The pylorus and fundus were displaced dorsally on the lateral view. (Plate. 5 A blue arrow). Ventral lipping involving multiple thoracolumbar vertebrae (T12 - T13 and L2 - L7) suggestive of multifocal spondylosis deformans (Plate 5 B). Bridging of successive lumbar vertebrae from L2 - L7 with multifocal spondylosis deformans referred to as diffuse idiopathic skeletal hyperostosis (DISH) (Plate 5 B). On right lateral thoracic and VD thoracic radiography also revealed that ground glass opacity (alveolar pattern) within left cranial and caudal lung lobe with moderate cardiomegaly on observations.

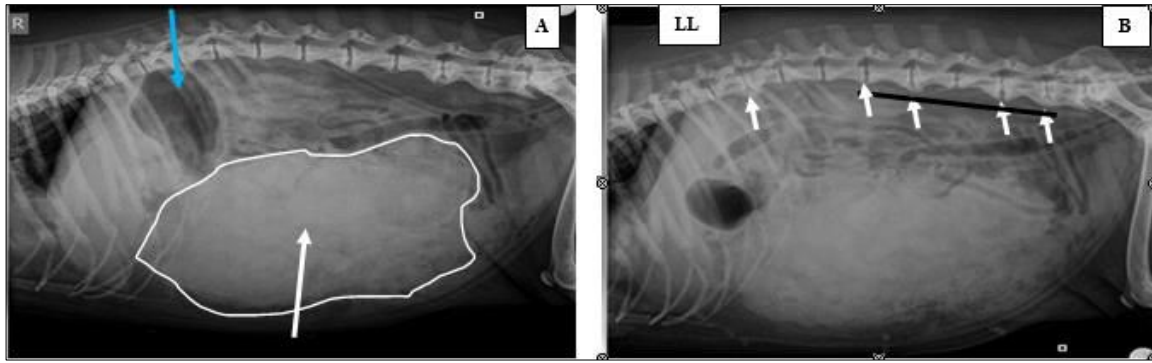


Plate 4: CR: A: Right lateral abdomen - the abdominal radiograph revealed a large soft tissue opacity in the mid-ventral abdomen. (white mark). The pylorus and fundus were displaced dorsally on the lateral view. (blue arrow). B: Left lateral abdomen - ventral lipping involving multiple thoracolumbar vertebrae (T12 - T13 and L2 - L7) suggested multifocal spondylosis deformans. Bridging of successive lumbar vertebrae from L2 - L7 with multifocal spondylosis deformans referred to as "DISH" (multiple white arrows with black line).

Impression: Soft tissue mass likely originating from spleen/mesentery. GIT involvement cannot be ruled out. Less likely to be ovarian in origin. Bilateral moderate pleural effusion with mild cardiomegaly. Multifocal thoraco-lumbar spondylosis deformans.

CT findings

Upon CT the loss of the soft tissue plane was noticed in the mid-abdomen. Multiple lobulated heterogenous mass within the abdomen was seen (Plate 6 A). The mass seemed to be

separated one. The mass appears like lymph node origin based on its structural resemblance. Significant fat stranding within the surrounding mesentery suggests -Infectious spreading. Ventral lipping involving multiple thoracolumbar vertebrae suggestive of multifocal spondylosis deformans was also noticed. The axial cuts of CT revealed a moderate bilateral alveolar pattern with subsegmental atelectasis and mild cardiomegaly was appreciable on observations (Plate 6 B).

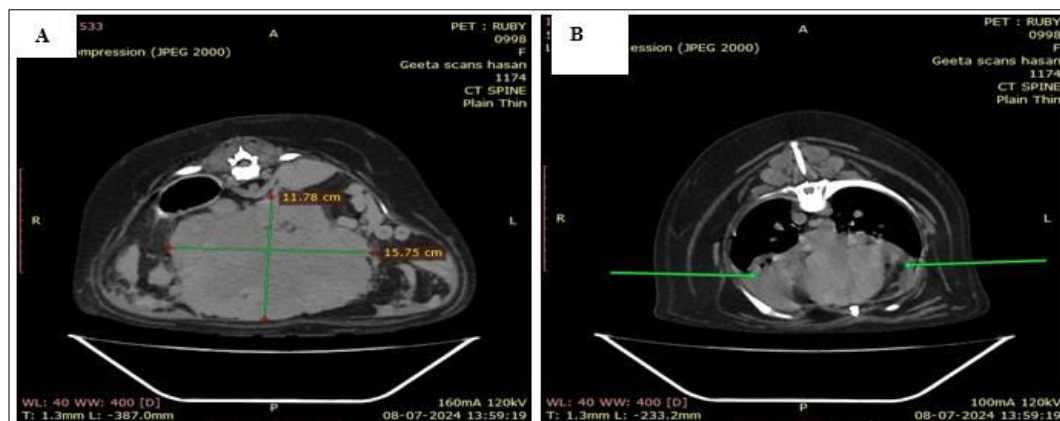


Plate 5: CT: A: A heterogenous lobulated mass measuring 118 X 157 mm. B: On axial CT view revealed bilateral moderate pleural effusion with subsegmental atelectasis.

Impression: CT findings were suggestive of lymphoma, bilateral moderate pleural effusion with mild cardiomegaly and multifocal thoraco-lumbar spondylosis.

Comparison of CR and CT findings: Both modalities effectively diagnose this condition, but CT is most likely suitable for identifying the exact origin of the mass/tumor.

Case-4: A 10-year-old male labrador had a history of epistaxis from the left nasal tract. The owner complained about gradually reducing the pet's body weight and appetite. The eye conjunctival mucous membrane (cmm) was pale pink. On blood evaluation, haemoglobin (9.5 g/dl), leukocytosis (34,930 cells /cu mm) and thrombocytopenia (22,000 cells /cu mm) were characteristic. Further, the pet was subjected to CR and CT evaluation.

CR findings

CR findings of the skull

The right lateral skull revealed soft tissue opacification was noted in the nasal and ethmoid regions. The frontal sinus looks normal with air-filled (Plate 7 A)

CR thorax and abdomen

The right lateral left lateral and VD abdominal radiography revealed increased soft tissue opacification in the mid-abdomen, a suspicious mass. Soft tissue opacified mass was pushing the bowels dorsally. Markedly increased size of the spleen was also noticed. The liver was well within the costal arch. The right lateral thoracic radiography revealed minute interstitial nodular lesions in lung lobes suggestive of Pulmonary metastasis (Plate 7 B).

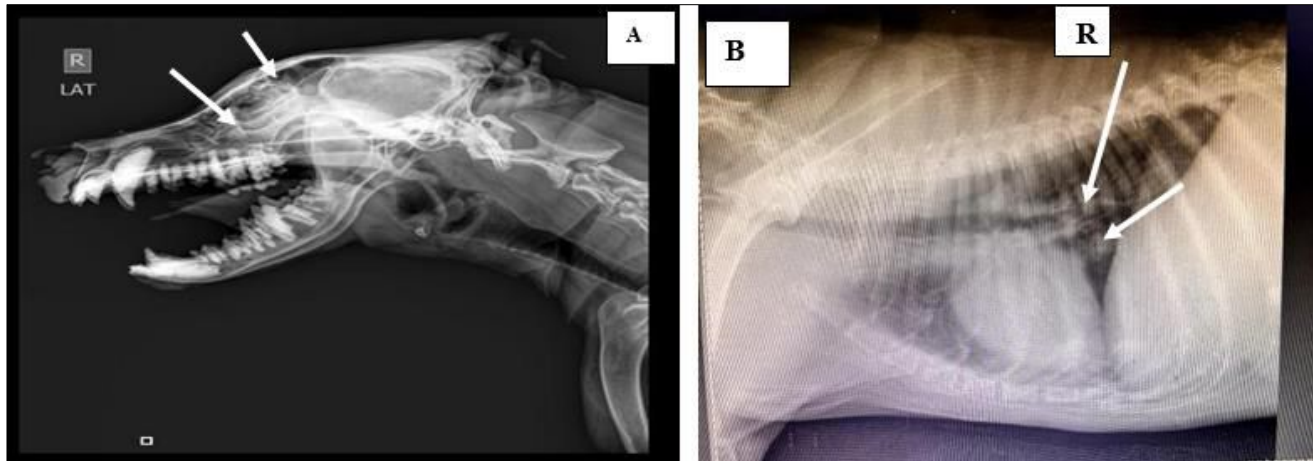


Plate 6: CR: A: Right lateral skull-soft tissue opacification was noted in the nasal and ethmoid regions. The frontal sinus looks normal with air-filled. B: Left lateral thorax, minute interstitial nodular lesions were seen in lung lobes suggestive of pulmonary metastasis.

Impression- Sinusitis/Nasal tumor and abdominal mass associated with pulmonary metastasis.

CT findings

CT skull findings

A multiseptated cystic lesion was seen in the left nasal cavity measuring 32 x 28 mm with erosion of the adjacent portion of the nasal septum medially, hard palate on the inferior aspect and the ethmoid trabeculae on the superior aspect causing nasal cavity obstruction on the left side (Plate 8 A and B). Soft tissue opacification was noted in the left nasal and ethmoid sinuses, but the right frontal and ethmoid sinuses appear normal. (Plate 8 A and B). 3D view showing left nasal and ethmoid bone osteolysis (Plate 8 C).

Impression: Sinusitis/Nasal adenocarcinoma

CT Findings of the thorax and abdomen

Upon CT, the gallbladder was distended with few radio-opaque intraluminal calculi, the largest measuring up to 8.83

mm, with average wall thickness and no features to suggest cholecystitis (Plate 8 D). A solid cystic lesion measuring 67.9mm X 79.7mm was seen in the mesentery in the right hypochondrium and lumbar region. It had a solid component on the superior aspect and a cystic component on the inferior aspect (Plate 8 E). Markedly increased size of spleen measuring 145 mm (Plate 8 E). Prominent surrounding mesenteric vessels were noted. The lesion had appeared to be about the anterior wall of the duodenum. The right kidney was displaced inferiorly and medially by the mass lesion. No abnormal calcification was seen within the lesion, suggesting that neoplastic aetiology, such as gastrointestinal stromal tumor/lymphoma, can be considered. The pancreatic parenchyma was not delineated - diffuse fatty replacement of the pancreatic parenchyma was noted. The rest of the abdominal structures appeared normal. A few atypical hyperdense nodular lesions within the lung lobes suggested pulmonary metastasis.

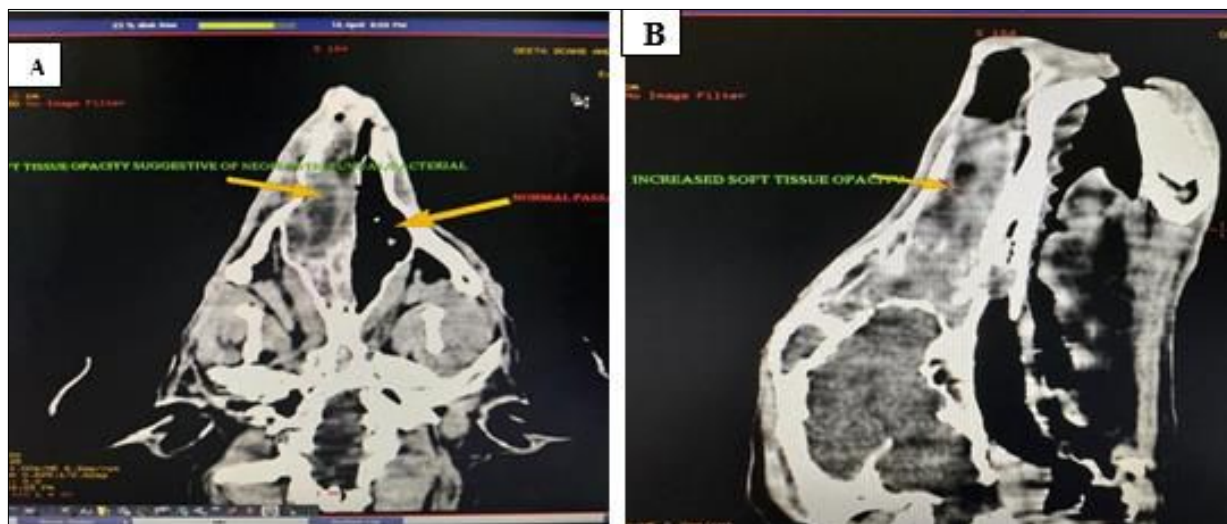


Plate 7a: CT: A: Sagittal view - soft tissue opacification in the left nasal tract. B: Coronal View -soft tissue opacification left nasal and ethmoid bones

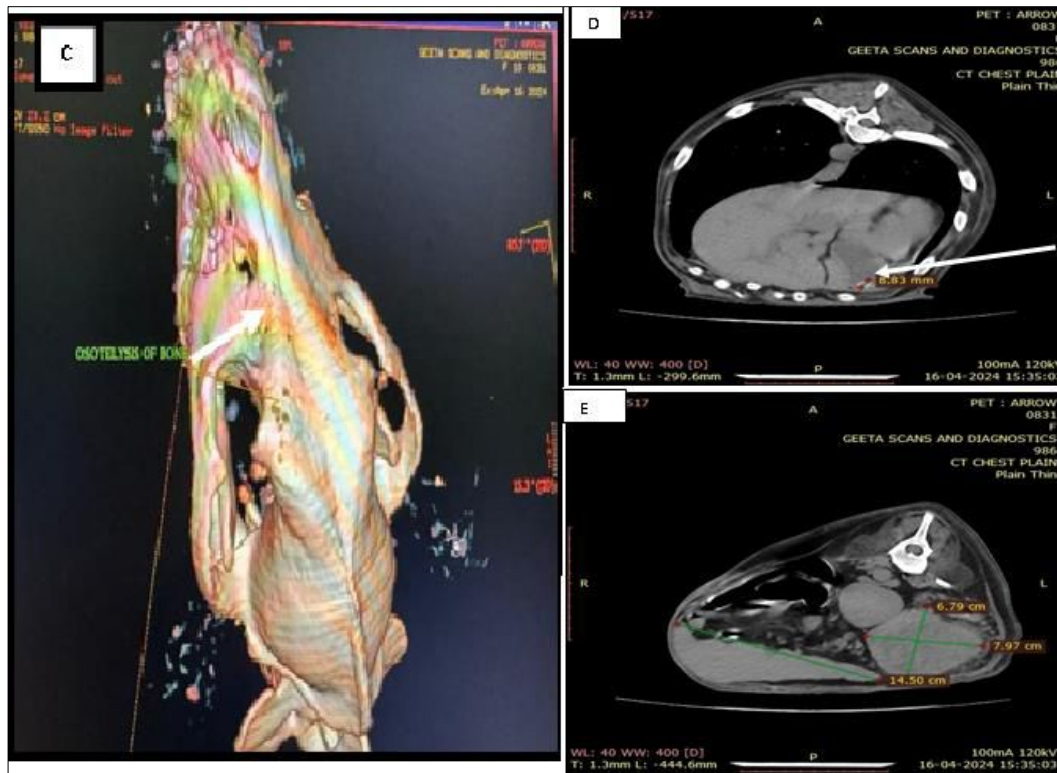


Plate 7b: CT: C: 3D osteolysis of nasal bones D: Choleliths measuring -8.83 mm (biggest one). E: Heterogenous solid cystic mass measuring 67.9mm X 79.7 mm and splenomegaly measuring -145mm

Impression-Gastrointestinal stromal tumor/ Lymphoma and pulmonary metastasis.

Comparison of CR and CT findings: Both modalities were useful in diagnosing such conditions. However, 3D CT has precisely diagnosed the condition with the extent of osteolysis of nasal and ethmoid bones. CT (axial, sagittal, coronal) soft tissue window view helped to assess the origin of the tumour and the lung window assisted in accurately diagnosing minute hyperdense nodules within the lung lobes.

Discussion

Case:1. A Great Dane, age seven, arrived with a history of severe respiratory distress, discomfort, inactivity, and inappetence. Tachycardia and heart murmurs were detected during auscultation. Coughing was also observed intermittently. Following more CR and CT testing, the pet was found to have a number of conditions, including splenomegaly, gastric dilatation and volvulus (GDV), pulmonary oedema and pleural effusion due to DCM, and dilated cardiomyopathy (DCM). Although both techniques were more successful in diagnosing the condition, CT was superior in identifying pulmonary oedema, multiple splenic infarcts, enlarged left ventricle, arterial thrombus, moderate pleural effusion, and moderate ascites due to the contrast organs' ability to enhance and distinguish cardiac chambers and cross-sectional imaging properties. CT is more sensitive and specific than CR when it comes to detecting and characterizing abnormalities of the heart, stomach, and spleen. The distinctive presentation of dorso-cranial displacement of the pylorus, along with distension of the gastric fundus and compartmentalization of gas, is well depicted by the right lateral abdominal radiograph. The diagnosis of GDV can occasionally be made more difficult by the presence of fluid or 360° rotation. It might be

required to evaluate ventro-dorsal and contralateral abdominal radiographs in such circumstances. The notion of a long picture collection time has limited the widespread use of CT scanners as a major diagnostic tool, despite the fact that they offer adequate spatial and contrast resolution to diagnose and characterize a variety of pericardial, myocardial, and valvular heart disorders. It was believed that the inability of CT scanners to remove picture artifacts caused by the complex contractile motion of the beating heart—the main source of hazy cardiac image formation—was due to their inadequate temporal resolution (Boxt, L.M *et al.*, 2003) [4].

Case 2: The left axial region of a male Labrador, age nine, had previously experienced edema. The pet's decreased appetite and body weight were further grievances raised by the owner. After undergoing additional CR and CT evaluation, the pet was found to have a soft tissue sarcoma at the left axial region mass, which was linked to hepatocellular carcinoma. With a soft tissue mass that was predictable in the axial region and another soft tissue opacified mass that was directly next to and dorsal to the liver, CR assisted in making an early diagnosis. But according to CT, this was a 135 x 109 mm heterogeneous soft tissue mass lesion in the left anterior chest wall that extended into the left axillary and supraclavicular areas and traced beneath the left pectoralis major muscle. Because CT has better imaging capabilities than computed radiography, it can diagnose hepatocellular carcinoma and soft tissue sarcoma in the left forelimb more precisely and reliably (Jeong *et al.*, 2024) [9]. Cross-sectional imaging, high resolution, contrast enhancement, and a thorough evaluation of the tumor's involvement and extent are all included. CR only provides a limited amount of information about tumor invasion and may not accurately reflect the impact of the condition.

The purpose of the study was to evaluate how well triple-phase helical CT could differentiate between various kinds of hepatic masses in dogs. Both the arterial and portal venous phases of the CT scan showed a steady decline in enhancement. Additionally, the study's findings showed that, before surgery, triple-phase CT is a useful technique for differentiating between hepatocellular carcinoma, nodular hyperplasia, and hepatic metastatic tumors in dogs (Kutara *et al.*, 2014)^[12].

Case 3: Four-year-old Golden Retriever with a history of persistent appetite loss, abdominal swelling, high body temperature, and respiratory distress. The pet underwent CR and CT for additional assessment. With the aid of CR, ventral lipping of the thoraco-lumbar vertebrae and a soft tissue opacified mass at the mid-ventral abdomen were found. Nevertheless, CR was unable to identify the source of the soft tissue mass in the mid-ventral abdomen. The many lobulated heterogeneous mass in the abdomen, which most likely originated from a lymph nodal mass, was nevertheless identified with the aid of CT. This feature of CT is mostly due to its cross-sectional imaging capability, which provides slice-by-slice visual ability and guarantees the precise origin of the mass. It was an excellent CT imaging characteristic that aided in precisely identifying the size, shape, density, and contour of the suspicious lesion. Although there is no age, sex, or breed predisposition to gastrointestinal lymphoma, the most frequently reported breeds are boxers and sharpei. Usually of T-cell origin, the disease can manifest as a single lesion, multifocal, or widespread. In contrast, the Golden Retriever dog was the subject of the current investigation. Dogs with multicentric canine lymphoma (cL) may have abnormalities on their thoracic and abdominal radiographs, although these results are typically nonspecific and merely suggest cL as a possible differential diagnosis (Ballegeer *et al.*, 2013)^[3].

Case 4: The diagnosis of pulmonary metastases related to nasal adenocarcinoma and connected with the gastrointestinal stromal tumor was made for a 10-year-old male Labrador who had unilateral (left nasal tract) epistaxis. A small nodular interstitial pattern in the lung lobes that suggested pulmonary metastasis and soft tissue opacification in the nasal and ethmoid regions were identified by CR as the first indications of the nasal condition. Additionally, there was soft tissue opacification in the mid-ventral abdomen, which is likely indicative of a growth or tumor. However, a 32 x 28 mm multiseptated cystic lesion in the left nasal cavity was very precisely identified by CT. It was accompanied by medial erosion of the nasal septum, hard palate on the inferior aspect, and ethmoid trabeculae on the superior aspect, which resulted in obstruction of the left nasal cavity. CT revealed a solid cystic lesion in the mesentery of the right hypochondrium and lumbar area, measuring 67.9 mm by 79.7 mm. Its superior aspect has a solid component, whereas its inferior aspect has a cystic component. The most common tumor form in the nasal area is adenocarcinoma. Osteolysis alterations in the nasal, ethmoid, and frontal bones were more clearly visible with axial slices and a 3D CT scan (Kromhout *et al.*, 2011)^[11]. According to Agut *et al.* (2015)^[1], a male Dalmatian dog who had never been injured or exposed to toxins before developed acute respiratory insufficiency. Pneumothorax, diffuse unstructured interstitial pattern, and

pneumomediastinum were observed on chest radiography. A classic symptom of pulmonary interstitial emphysema, the computed tomography showed a "ring" sign surrounding the bronchi and pulmonary arteries. Inflammation, fibrosis, or the accumulation of fluid exudate or cells in the interstitial space are common causes of an interstitial lung pattern (Hecht, 2020)^[7].

Thoracic radiographs displaying one or more soft tissue nodules or masses of varying sizes within the pulmonary parenchyma were indicative of the structured interstitial pattern, which was a clear and distinct pulmonary pattern. These characteristics are frequently seen in cases of primary lung cancer, lung metastases, abscesses, and related conditions. They can be either poorly or clearly defined (Thrall, 2018)^[16]. Rahil (2023)^[13] noted that although no cardiac silhouette was seen, the lateral and DV of the thorax in a small number of dogs on CR showed notable solitary pulmonary nodules in the lung parenchyma. The bilateral lung parenchyma showed several soft tissue cannon ball-like lesions on CT scans. The parenchyma of the lungs appeared normal. Similar to this, the pet in this study also had gastrointestinal stromal tumor/lymphoma and nasal adenocarcinoma at the same time, albeit a small number of hyperdense nodular lesions in the lungs were distinctive and suggestive of pulmonary metastasis. The radiographic examination is capable of accurately diagnosing severe diseases and may be the primary imaging method for lung ailments. However, compared to radiography, CT scans generate cross-sectional pictures and are more effective in diagnosing pulmonary conditions such as pleural effusion, pneumothorax, and lung metastases (Boztok Ozgermen and Bumin, 2016)^[5]. The capacity of CT to recognize gastrointestinal segments and analyze the gastrointestinal tract's width and wall thickness makes it useful for studying the gastrointestinal tract (Hoey *et al.*, 2013)^[8].

Conclusion

This study provided concrete evidence of common thoraco-abdominal diseases in dogs. CT was found to be more conclusive than CR in the following areas: pleural effusions, pulmonary metastasis, cardiac disorders, oesophageal disorders, soft tissue tumors, hepatic disorders, lymphomas, gastrointestinal stromal tumors, and neoplastic diseases. CT scans provide cross-sectional images that reveal more about the body's internal structures than traditional radiography, which only creates two-dimensional (2D) images of the body. Anatomical structures that overlap or superimpose, making it difficult to view crucial details in X-ray pictures, are reduced by this characteristic. CT scans can be completed much more quickly than traditional X-rays. The time needed for image gathering is greatly reduced by the use of advanced technologies in CT equipment, providing considerable benefits in emergency scenarios. In summary, compared to conventional radiography, computed tomography has a number of advantages. Among these benefits include improved image quality, the ability to produce three-dimensional reconstructions, faster scanning rates, increased sensitivity in detecting abnormalities, and broad diagnostic capabilities. Its widespread use in modern medical diagnostics is a result of the above listed factors.

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