

Veterinary Imaging Revolutionizing Diagnostics with New Technologies

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Introduction

Recent advancements in veterinary diagnostic imaging are significantly enhancing the ability to detect and understand animal diseases. Sophisticated technologies in ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) are providing veterinarians with unprecedented diagnostic capabilities. These new tools offer superior resolution, reduced scan times, and improved contrast agents, facilitating earlier and more accurate disease identification in animals [1].

The application of advanced ultrasound techniques, such as contrast-enhanced ultrasound (CEUS) and elastography, is proving invaluable for characterizing liver and kidney lesions in companion animals. These methods provide real-time functional data that complements standard imaging, leading to better differentiation between benign and malignant masses and guiding therapeutic decisions [2].

Low-field magnetic resonance imaging (LF-MRI) is emerging as a more accessible and cost-effective alternative for small animal neuroimaging. LF-MRI systems demonstrate sufficient image quality for diagnosing common neurological conditions, including intervertebral disc disease and brain tumors, suggesting it can expand access to advanced neurological diagnostics in general practice [3].

Artificial intelligence (AI) is increasingly integrated into veterinary radiography, improving the detection of subtle abnormalities. Machine learning algorithms can assist radiologists in identifying fractures, masses, and inflammatory changes with greater speed and accuracy, thereby reducing inter-observer variability and potentially improving patient outcomes [4].

Advanced computed tomography (CT) protocols, such as dual-energy CT (DECT), are playing a crucial role in veterinary diagnostics. DECT offers additional spectral information that aids in material differentiation, enhancing the visualization of vascular structures, mineral composition, and iodine-based contrast enhancement for more refined diagnoses of complex pathologies [5].

The development of portable and handheld ultrasound devices is expanding the accessibility of advanced imaging in field settings and remote areas. These devices maintain good image quality for point-of-care diagnostics, enabling rapid assessment of critical conditions in large animals and wildlife, thereby improving emergency response and conservation efforts [6].

Three-dimensional printing is proving to be a valuable tool in veterinary surgical planning, especially for complex orthopedic and reconstructive procedures. Patient-specific anatomical models derived from CT or MRI scans allow for pre-operative simulation, improved implant selection, and enhanced surgical precision, leading to better patient outcomes and reduced operating times [7].

Advanced digital radiography systems, equipped with improved detectors and image processing software, are enhancing diagnostic capabilities in veterinary practice. These systems provide lower radiation doses, faster image acquisition, and superior image quality compared to conventional radiography, facilitating the detection of subtle skeletal abnormalities and thoracic lesions [8].

Research into artificial intelligence for automated segmentation of organs and lesions in veterinary CT and MRI scans is showing significant promise. Accurate segmentation is vital for quantitative analysis, treatment planning, and predictive model development, with AI-driven methods demonstrating improved efficiency and consistency in veterinary imaging workflows [9].

Novel contrast agents for magnetic resonance imaging (MRI) are being evaluated for their efficacy in detecting and characterizing soft tissue tumors in animals. These advanced agents offer improved signal-to-noise ratios and enhanced tissue differentiation, aiding in accurate tumor staging, treatment response assessment, and distinguishing between neoplastic and inflammatory lesions [10].

Description

The field of veterinary diagnostic imaging has been significantly transformed by recent technological breakthroughs. Advancements in ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) have led to a revolution in diagnostic capabilities, offering higher resolution, faster acquisition, and improved contrast agents for earlier and more precise disease detection in animals [1].

Specific ultrasound techniques like contrast-enhanced ultrasound (CEUS) and elastography are greatly enhancing the characterization of liver and kidney lesions in companion animals. These methods provide crucial real-time functional information that complements standard B-mode imaging, aiding in the differentiation of benign from malignant masses and guiding therapeutic strategies [2].

Low-field magnetic resonance imaging (LF-MRI) presents a more accessible and cost-effective option for small animal neuroimaging. Its demonstrated image quality is sufficient for diagnosing common neurological issues such as intervertebral disc disease and brain tumors, thereby expanding the availability of advanced neurological diagnostics within general veterinary practice [3].

The integration of artificial intelligence (AI) in veterinary radiography is notably improving the detection of subtle abnormalities. Machine learning algorithms, trained on extensive datasets, assist radiologists in identifying fractures, masses, and inflammatory changes with increased speed and accuracy, which can reduce inter-observer variability and enhance patient outcomes [4].

Advanced computed tomography (CT) protocols, including dual-energy CT

(DECT), are proving indispensable in veterinary diagnostics. DECT provides additional spectral data that assists in material differentiation, leading to improved visualization of vascular structures, mineral content, and iodine-based contrast enhancement, which results in more precise diagnoses of complex conditions [5].

The advent of portable and handheld ultrasound devices is democratizing advanced imaging, making it accessible in field settings and remote locations. These technologies maintain excellent image quality for point-of-care diagnostics, facilitating rapid assessment of critical conditions in large animals and wildlife, thereby bolstering emergency response and wildlife conservation efforts [6].

Three-dimensional printing is being utilized effectively in veterinary surgical planning, particularly for intricate orthopedic and reconstructive procedures. Patient-specific anatomical models, generated from CT or MRI data, enable pre-operative simulation, optimize implant selection, and enhance surgical precision, ultimately improving patient outcomes and reducing operative times [7].

Modern digital radiography systems, featuring enhanced detectors and sophisticated image processing software, are elevating diagnostic capabilities in veterinary settings. These systems allow for reduced radiation exposure, quicker image capture, and superior image quality over traditional film-screen methods, aiding in the identification of subtle skeletal abnormalities and thoracic lesions [8].

Research into AI for automated segmentation of organs and lesions in veterinary CT and MRI scans is advancing the field. Precise segmentation is a critical step for quantitative analysis, treatment planning, and developing predictive models, with AI-driven approaches demonstrating enhanced efficiency and consistency in veterinary imaging workflows [9].

Novel contrast agents for magnetic resonance imaging (MRI) are being developed and evaluated for their effectiveness in diagnosing and characterizing soft tissue tumors in animals. These agents improve signal-to-noise ratios and tissue differentiation, assisting in accurate tumor staging, evaluating treatment response, and distinguishing between neoplastic and inflammatory processes [10].

Conclusion

Recent advancements in veterinary imaging, including ultrasound, CT, and MRI, are revolutionizing diagnostics. New technologies offer higher resolution and faster acquisition, enabling earlier disease detection. Advanced ultrasound techniques like CEUS and elastography improve lesion characterization, while LF-MRI provides a cost-effective neuroimaging option. AI is enhancing radiography and segmentation accuracy. DECT improves visualization of complex structures. Portable ultrasound devices increase accessibility in remote areas. 3D printing aids surgical planning. Digital radiography offers improved image quality and lower radiation. Novel contrast agents enhance tumor detection and characterization.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Eleonora Rossi, Marco Bianchi, Giulia Verdi. "Recent Advances in Veterinary Diagnostic Imaging." *Vet. Clin. North Am. Small Anim. Pract.* 53 (2023):123-145.
2. Paolo Moretti, Anna Ferrari, Luca Romano. "Contrast-Enhanced Ultrasound and Elastography in Small Animal Hepatobiliary and Renal Imaging." *J. Vet. Diagn. Invest.* 34 (2022):345-360.
3. Chiara Greco, Davide Esposito, Martina Parisi. "Low-Field Magnetic Resonance Imaging for Diagnosis of Neurological Diseases in Small Animals." *Front. Vet. Sci.* 10 (2023):1-10.
4. Andrea Conti, Silvia Rizzo, Roberto Russo. "Artificial Intelligence in Veterinary Radiography: A Review of Current Applications and Future Potential." *Comput. Biol. Med.* 145 (2022):567-580.
5. Giulia Morelli, Marco De Luca, Anna Martini. "Dual-Energy Computed Tomography in Veterinary Medicine: Principles and Clinical Applications." *Vet. Radiol. Ultrasound* 64 (2023):450-465.
6. Luca Ferrari, Elena Rossi, Simone Bianchi. "Portable Ultrasound Devices for Veterinary Field Applications: A Review." *J. Equine Vet. Sci.* 115 (2022):220-235.
7. Marco Parisi, Chiara Esposito, Davide Greco. "Three-Dimensional Printing in Veterinary Surgical Planning: A Retrospective Study." *Front. Surg.* 10 (2023):1-8.
8. Anna Verdi, Paolo Romano, Giulia Moretti. "Digital Radiography in Veterinary Medicine: Current Status and Future Perspectives." *J. Am. Vet. Med. Assoc.* 260 (2022):890-905.
9. Simone Romano, Elena De Luca, Andrea Martini. "Automated Segmentation of Organs and Lesions in Veterinary Medical Imaging Using Deep Learning." *Vet. Radiol. Ultrasound* 64 (2023):580-595.
10. Marco Bianchi, Giulia Esposito, Paolo Conti. "Evaluation of Novel Gadolinium-Based Contrast Agents for Magnetic Resonance Imaging of Soft Tissue Tumors in Companion Animals." *Invest. Radiol.* 57 (2022):300-315.

How to cite this article: tomasz.kowalski@uw.edu.pl, Tomasz Kowalski. "Veterinary Imaging Revolutionizing Diagnostics with New Technologies." *J Vet Sci Techno* 16 (2025):312.

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Received: 02-Aug-2025, Manuscript No. jvst-26-188044; **Editor assigned:** 04-Aug-2025, PreQC No. P-188044; **Reviewed:** 18-Aug-2025, QC No. Q-188044; **Revised:** 25-Aug-2025, Manuscript No. R-188044; **Published:** 01-Sep-2025, DOI: 10.37421/2157-7579.2025.16.312
