Eurasia Specialized Veterinary Publication

International Journal of Veterinary Research and Allied Science

ISSN:3062-357X

2025, Volume 5, Issue 2, Page No: 53-63

Available online at: www.esvpub.com/

Diagnostic Imaging Should Reduce Clinical Uncertainty Rather Than Merely Increase Abnormality Detection: A Veterinary Decision Framework for Incidental Findings, Discordant Modalities, Actionability, and Sequential Reassessment

Emma Wilson[1]*, Frederik De Jong[2], Lara Peters[2]

[1]Department of Veterinary Diagnostic Imaging and Clinical Decision-Making, Faculty of Veterinary Medicine, University of Edinburgh, Edinburgh, United Kingdom.
[2]Department of Veterinary Radiology and Imaging Interpretation, Faculty of Veterinary Medicine, Utrecht University, Utrecht, Netherlands.

***E-mail** ✉ emma.wilson@ed.ac.uk

ABSTRACT

Diagnostic imaging in veterinary medicine is commonly judged by its capacity to reveal abnormalities, yet abnormality detection is not equivalent to diagnostic utility. A conspicuous lesion may be incidental, artifactual, biologically nonspecific, or unrelated to the decision that prompted imaging, whereas clinically important disease may remain occult or only partially characterized. This article develops an original non-empirical framework in which imaging is evaluated by the extent to which it reduces decision-relevant uncertainty. The framework separates detection from diagnosis and actionability; requires an explicit clinical question and pre-imaging probability state; treats modality selection as a question of expected information gain rather than technological hierarchy; and distinguishes incidental abnormalities, modality discordance, and imaging–pathology discordance from definitive diagnostic conclusions. It further proposes that positive and negative findings can generate asymmetric errors of false escalation and false reassurance, and that sequential imaging should be triggered by a plausible opportunity to change interpretation or management rather than by elapsed time or persistent abnormality alone. Reporting and multidisciplinary interpretation are positioned as part of the diagnostic process because clinical context, reader agreement, operative findings, pathology, and temporal change may contribute nonredundant information. The framework is intended as a decision architecture rather than a validated score or universal rule. Its principal limitations are the heterogeneity of available veterinary evidence, dependence on disease- and modality-specific studies, and the need for prospective validation of reliability, decision impact, external transferability, and clinically meaningful reassessment strategies.

Keywords: Diagnostic imaging, Veterinary radiology, Incidental findings, Diagnostic uncertainty, Actionability, Sequential reassessment

Received: 09 July 2025
Revised: 04 September 2025
Accepted: 07 September 2025

How to Cite This Article: Wilson E, De Jong F, Peters L. Diagnostic Imaging Should Reduce Clinical Uncertainty Rather Than Merely Increase Abnormality Detection: A Veterinary Decision Framework for Incidental Findings, Discordant Modalities, Actionability, and Sequential Reassessment. Int J Vet Res Allied Sci. 2025;5(2):53-63.
https://doi.org/10.51847/ajFYX7K8yd

Introduction

Veterinary diagnostic imaging is often discussed as though greater sensitivity, finer anatomical resolution, or more detected abnormalities necessarily produce better diagnosis. The evidence is more complicated. In a necropsy-referenced audit, major discrepancies between antemortem imaging and postmortem findings arose from several sources, including interpretive error, microscopic disease, timing, modality limitations, and incomplete visibility; a radiographic artificial-intelligence system likewise showed that identifying some confirmed pulmonary lesions did not eliminate substantial false-negative performance, while abdominal computed tomography (CT) could

appear normal or nonspecific despite cytologically identified mast-cell-tumour metastasis [1–3]. These observations support a narrower proposition: an image contributes clinically when it changes what is reasonably believed, what remains uncertain, or what should be done next.

The inverse problem is equally important. Thoracic CT can reveal conspicuous soft-tissue gas in clinically asymptomatic dogs and cats without evidence that the gas itself represents active disease [4]. Accordingly, this article treats detection, diagnostic interpretation, biological relevance, and actionability as separable states. Imaging may therefore fail by overlooking relevant disease, by overinterpreting a visible abnormality, or by answering a technically interesting question that is not the patient's decisive clinical question. The article proposes an uncertainty-reduction architecture for judging whether imaging answers that question, modifies a defensible pre-imaging probability, resolves or exposes discordance, crosses a pathology or validation boundary, and justifies observation, intervention, additional testing, or reassessment. The framework is not a score and does not presume that more imaging is better; its purpose is to make image-based decisions explicit, conditional, and revisable.

Detection versus diagnostic utility

Detection answers a comparatively narrow question: is an imaging feature present and visible under the acquisition and interpretation conditions used? Diagnostic utility asks a different question: does that feature materially alter the probability, classification, urgency, or management relevance of the condition under consideration? The distinction matters because errors can occur even when the abnormality itself is correctly perceived. A visible lesion may be nonspecific, a negative study may be insensitive to microscopic or early disease, and a technically accurate observation may fail to answer the question that motivated the examination. The necropsy-referenced discrepancy data illustrate why “missed diagnosis” cannot be reduced to reader error alone [1].

This article therefore proposes three linked but nonidentical states: detection, diagnostic interpretation, and decision utility. Movement from one state to the next requires additional justification. A detected feature must be interpreted in relation to anatomy, disease biology, technical limitations, prior information, and plausible alternatives; an interpretation becomes useful only when it reduces uncertainty that matters to a decision. This formulation also allows an imaging examination to be diagnostically useful despite residual uncertainty—for example, by excluding a management-relevant alternative or identifying the need for tissue sampling—while preventing an incidental abnormality from acquiring importance merely because it is conspicuous.

Clinical question formation before imaging

The diagnostic value of imaging begins before image acquisition. A request framed as “rule out thoracic disease” is less decision-specific than one that asks whether pulmonary metastasis is sufficiently plausible to change staging, treatment, or anaesthetic planning. Clinical information can materially affect interpretation: in a retrospective case-control study of canine thoracic radiographs, access to clinical history increased diagnostic accuracy among radiologists [5]. This does not establish that more contextual information is always beneficial; poorly framed or leading histories may also anchor interpretation. It does establish that the image is not interpreted in an informational vacuum.

Question formation should therefore identify the unresolved decision, the disease or structural alternatives that matter, and what imaging result would be capable of changing the next step. Reporting guidance from ACVR and ECVDI similarly emphasizes that veterinary imaging reports should support meaningful clinical communication rather than function as unstructured inventories of observations [6]. In the proposed architecture, the clinical question serves as an interpretive constraint: unexpected abnormalities remain reportable, but they should not displace the original decision problem without justification. A well-formed question also makes nonactionable imaging recognizable, because an examination may generate additional descriptive detail while leaving the decisive uncertainty unchanged.

Pre-imaging probability

Imaging findings have meaning relative to what was plausible before the examination. In this article, pre-imaging probability is not a mandated numerical Bayesian calculation. It is a structured clinical state derived from history, signalment, physical findings, disease prevalence within the presenting syndrome, previous tests, treatment exposure, and the consequences of missing or overcalling the suspected condition. The effect of clinical history

on radiographic interpretation demonstrates that contextual information can change how identical images are classified [5].

The proposed framework uses pre-imaging probability for two purposes. First, it prevents a positive finding from being interpreted as though it arose in a context-free population. A weakly specific abnormality may have very different meaning in a patient with strong concordant clinical evidence than in one imaged for an unrelated reason. Second, it prevents a negative examination from being treated as universal exclusion. When prior concern remains substantial and the modality is known to have limited sensitivity for the relevant disease scale or phenotype, residual uncertainty may remain clinically important. This approach deliberately avoids fixed thresholds because acceptable residual uncertainty depends on disease severity, invasiveness of confirmatory testing, anaesthetic or procedural burden, owner constraints, and whether an alternative action can safely preserve the option of reassessment.

Modality selection and expected information gain

A modality should be selected for the information required, not for its perceived technological rank. Comparative work illustrates that the same anatomical region can be represented differently depending on acquisition physics and the target task. In canine skull imaging, short- and ultra-short-echo-time magnetic resonance imaging (MRI) sequences improved osseous depiction relative to standard MRI and approached CT for selected measurements, but the study was conducted in healthy research dogs and does not establish universal interchangeability [7]. The relevant question is therefore not whether MRI is “better” than CT, but whether a particular protocol can answer the specific structural or decision problem with acceptable uncertainty.

The same logic applies to vascular imaging. Time-resolved contrast imaging, CT angiography, and noncontrast magnetic resonance angiography provide different temporal and structural information, so protocol choice changes what can be known rather than simply changing image quality [8]. Expected information gain is used here qualitatively: the preferred examination is the one most likely to resolve the decision-relevant uncertainty after considering prior information, target tissue, spatial and temporal requirements, radiation, anaesthesia or sedation, access, cost, and the possibility that another modality or tissue-based test will still be required. Greater technical complexity is not itself greater utility.

Incidental abnormalities

Incidental abnormalities expose the difference between detection and actionability most clearly. A six-year veterinary CT series documented incidental findings across routine examinations, demonstrating that unexpected abnormalities are a recurrent feature of cross-sectional imaging rather than an exceptional event. Studies of incidental pulmonary bullae further show why their clinical meaning cannot be inferred from visibility alone: reader agreement varied by morphological feature, and a later outcome-linked cohort found no subsequent clinical spontaneous pneumothorax among followed dogs with incidentally identified pulmonary bullae or blebs [9–11]. These findings do not establish that incidental pulmonary lesions are universally benign; they show that detection alone is insufficient grounds for escalation.

The proposed approach subjects an incidental finding to four questions: is it technically credible, biologically plausible, relevant to the patient's current problem or future risk, and capable of changing a justified action? The last question is deliberately separate from disease probability. A real abnormality may be nonactionable because intervention offers no demonstrated advantage, because confirmation would impose disproportionate burden, or because observation with defined reassessment criteria preserves safety. Conversely, an incidental finding may merit further investigation when its plausible consequences are substantial. The framework therefore rejects both automatic dismissal and automatic work-up.

Anatomical abnormality versus clinically relevant disease

Imaging depicts structure, signal, attenuation, echogenicity, enhancement, motion, and related surrogates; disease is a biological state inferred from those observations in context. The distinction becomes important when apparently normal morphology coexists with disease or when an abnormal appearance has multiple pathological, physiological, technical, or procedural explanations. In dogs with mast cell tumours, abdominal CT appearances of the liver and spleen were nonspecific and could fail to reveal cytologically identified metastatic involvement [3]. In the opposite direction, clinically asymptomatic thoracic CT examinations may contain conspicuous soft-tissue gas without evidence that the finding represents active gas-producing disease [4].

Clinically relevant disease adds a further condition: the biological abnormality must matter to prognosis, welfare, treatment, procedural planning, surveillance, or another defined decision. This article therefore avoids treating "abnormal," "diseased," and "actionable" as synonyms. An imaging feature can be abnormal yet not establish disease, pathological yet currently nonactionable, or apparently normal while clinically important disease remains unresolved. The appropriate response depends on the clinical question, confidence in the observation, plausible alternative explanations, scale of disease detectable by the chosen modality, and whether independent confirmation would change management rather than merely increase diagnostic detail.

Discordance between imaging modalities

When two modalities disagree, the disagreement should be treated as information about measurement rather than as an immediate contest for which test is correct. In dogs and cats with pathologically confirmed focal renal lesions, CT detected lesions in all affected kidneys whereas ultrasonography detected fewer and sometimes underestimated lesion number, demonstrating modality-dependent visibility for this specific lesion set [12]. The result supports greater CT sensitivity in that context, not a general hierarchy in which CT supersedes ultrasonography for all renal questions.

Discordance can also arise because modalities sample different properties of the same disease. In pleural and peritoneal carcinomatosis and sarcomatosis, CT and ultrasonographic appearances overlapped enough that imaging alone could not reliably provide definitive biological classification [13]. Conversely, a modality may substitute for another only for a narrowly validated task: a presurgical study comparing a single high-field MRI sequence with radiographic measurements and operative findings in canine tibial plateau levelling osteotomy planning tested substitution at the level of that specific decision [14]. The proposed framework therefore asks whether discordance reflects sensitivity, tissue contrast, field of view, timing, operator dependence, protocol, or genuinely conflicting biological interpretations. Resolution may require reinterpretation, targeted repeat imaging, a complementary modality, pathology, surgery, or acceptance of residual uncertainty.

Imaging–pathology discordance

Pathology is often treated as the point at which imaging uncertainty disappears, yet the relationship is more nuanced. Imaging characterizes spatial phenotype; cytology and histopathology interrogate cellular or tissue biology, usually from sampled regions. In feline injection-site sarcoma, CT angiography and MRI features did not reliably predict tumour type or grade, even when imaging depicted projections or other apparently aggressive characteristics [15]. Earlier CT–cytology evidence similarly showed that apparently normal organs could contain metastatic disease [3]. Multimodality evidence also demonstrated that different biological diagnoses can share overlapping imaging appearances [13].

The framework therefore places an explicit biological-inference boundary between image phenotype and pathological identity. Crossing that boundary requires an independent reference when biological classification would alter treatment, prognosis, surgical margins, or surveillance. Pathology is not assumed to be infallible: sampling error, intralesional heterogeneity, targeting, and temporal separation can also produce discordance. The practical response is not to privilege imaging or pathology reflexively, but to ask which uncertainty each method addresses, whether the sampled tissue corresponds to the imaged target, and whether resolving the discrepancy would change action. Where it would not, residual discordance may be documented rather than pursued indefinitely.

False reassurance and false escalation

Imaging can misdirect decisions in opposite directions. False reassurance occurs when a negative, subtle, or apparently benign study is interpreted as stronger exclusion than the modality and disease state justify. False escalation occurs when a conspicuous feature is promoted too rapidly from observation to disease identity or intervention. The latter can arise from technical phenomena: hypoattenuating ocular lenses on CT were shown to occur in clinically and pathologically normal lenses and to vary with reconstruction conditions, demonstrating how image processing can create a disease-like appearance [16].

False reassurance is equally important because high specificity in some imaging signs can coexist with limited sensitivity. In dogs with abdominal masses, certain CT signs of severe adhesions were specific but insufficiently sensitive for their absence to exclude adhesions [17]. A negative study can therefore reduce uncertainty without reducing it to zero. The proposed adjudication rule is asymmetric: positive findings require scrutiny for specificity,

biological plausibility, and actionability, whereas negative findings require scrutiny for sensitivity, disease scale, and residual risk. Patient status, procedural risk, owner constraints, and availability of a safer confirmatory route modify what residual uncertainty is acceptable.

Table 1 contrasts the two error pathways directly because a negative study and a conspicuous finding require different technical, biological, and actionability checks.

Table 1. Opposite imaging failure pathways: false reassurance after a negative study versus false escalation after a visible abnormality

Comparison dimension	False reassurance pathway	False escalation pathway
Typical initiating result	Negative, subtle, or apparently benign examination	Conspicuous, repeated, or technically persuasive abnormality
Core category error	Absence of a visible feature is treated as exclusion of disease	Visibility is promoted to disease identity or treatment indication
Technical question	Was the modality sensitive to the relevant disease scale, phenotype, protocol, and timing?	Could acquisition, reconstruction, or interpretation have created or amplified the appearance?
Biological question	How much disease probability remains after the negative study?	Is the feature specific, clinically relevant, and linked to the patient's actual problem?
Actionability question	Would residual risk change sampling, operative preparation, monitoring, or follow-up?	Would confirmation or intervention improve the decision enough to justify its burden?
Corrective response	Preserve residual uncertainty; use complementary evidence or reassess when stakes warrant	Review technique and corroborate biology only when classification would change management

Actionability of imaging findings

An actionable finding is not merely one that is abnormal or diagnostically interesting. It is one that justifiably changes a next step: treatment, surgery, sampling, monitoring, further imaging, watchful waiting, or a decision to stop investigating. Long-term follow-up of incidentally identified pulmonary bullae and blebs illustrates why actionability must remain separate from visibility: their presence did not, in that cohort, support prophylactic lung resection solely because they had been detected [11]. Conversely, a negative CT assessment may leave enough residual uncertainty to affect operative preparation when tested signs are insensitive [17].

The framework proposes three conditions for actionability. First, the finding must be credible under the acquisition and interpretation conditions. Second, its biological or functional meaning must be sufficiently plausible for the decision at hand. Third, acting on it must offer a reasonable informational or clinical advantage over not acting, considering procedural burden, anaesthetic exposure, cost, access, welfare, and the possibility of later reassessment. These conditions are noncompensatory: a highly conspicuous abnormality does not become actionable if biological meaning is indeterminate, and a biologically plausible diagnosis does not mandate intervention when confirmation would not change management. Actionability is therefore a decision property of a finding-in-context, not an intrinsic property of the image.

A proposed uncertainty-reduction framework

The central proposal is to judge imaging by its effect on decision-relevant uncertainty across four linked domains: the clinical question and pre-imaging state; expected information from the selected modality; credibility and biological interpretation of the observed result; and the action or reassessment that follows. Evidence from pathology-referenced splenic MRI, triple-phase hepatic CT, and surgically referenced CT arthrography shows how imaging can be evaluated against independent biological or operative targets without implying that any one modality yields certainty across indications [18–20]. These studies support the need for reference-aware interpretation; the architecture that integrates them is proposed here.

The framework uses a central adjudication boundary. A finding may pass from detection to decision only when it remains credible after technical review, changes a relevant disease interpretation, and has a defensible consequence. Incidental abnormalities can therefore remain outside the action pathway; discordant modalities can return the case to question refinement; and suspected biological identity can cross to tissue confirmation when that distinction changes management. Constraints such as anaesthetic risk, access, caregiver resources, and time do not redefine disease probability but can alter the feasible decision.

Decisions remain revisable rather than terminal. New clinical information, pathology, treatment response, or temporal change may reopen an earlier state. The figure below compresses these conditional relationships while distinguishing evidence-supported inputs from the proposed adjudication logic **(Figure 1)**.

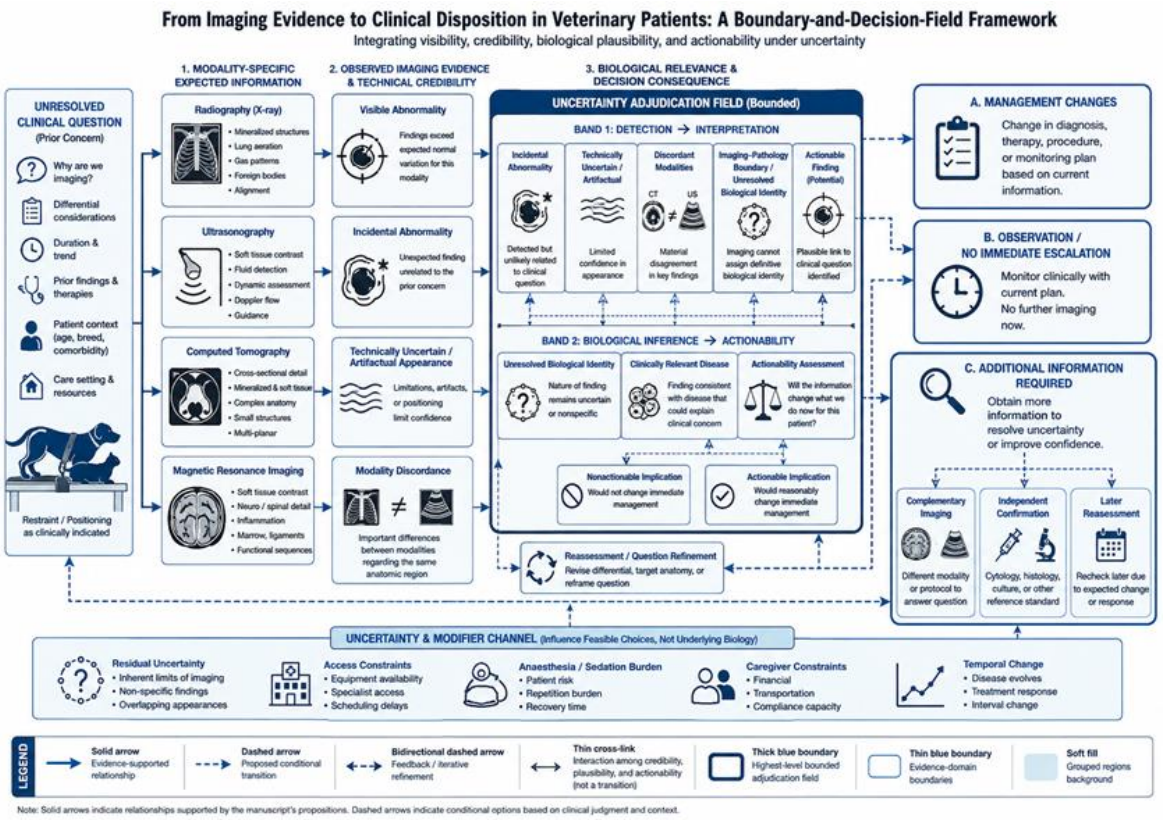

Figure 1. Adjudicating incidental, discordant, and actionable imaging evidence across the veterinary uncertainty boundary

Clinical question, modality-specific information, observed evidence, and biological/action relevance feed a central adjudication boundary. Solid arrows denote evidence-supported relationships; dashed arrows denote proposed conditional transitions; bidirectional connectors indicate reinterpretation or reassessment. Findings may remain nonactionable, change management, or return for complementary imaging or independent confirmation. The architecture is proposed, not validated.

Left-to-right veterinary decision field. Parallel lanes for clinical context, modality information, imaging credibility, and biological relevance converge on boundaries separating detection, interpretation, and actionability. Incidental findings, modality discordance, technical uncertainty, and pathology confirmation remain distinct. Conditional branches lead to observation, management change, further testing, or feedback reassessment.

Sequential imaging and reassessment

Time can alter both disease and the value of previously acquired information. In dogs with relapsing meningoencephalomyelitis of unknown origin, repeat MRI demonstrated that lesion distribution could differ materially from that seen at initial diagnosis, supporting reassessment when the clinical state itself changes [21]. Serial fluorodeoxyglucose PET/CT has also been explored prospectively in canine osteosarcoma as a quantitative response measure, but the small pilot design does not establish validated prognostic or treatment-response performance [22].

The opposite result is equally informative. In a prospective longitudinal study of dogs with acute pancreatitis, repeat CT angiography three to five days after admission produced little additional imaging information when clinical deterioration was absent [23]. Sequential imaging should therefore not be a default consequence of time passing. The proposed trigger is whether a plausible change in anatomy, disease activity, treatment response, or decision context could make new imaging alter action. Reassessment may also consist of reinterpreting existing images after pathology or clinical evolution rather than reacquiring them.

The temporal architecture below separates triggers for new information from conditions in which uncertainty is stable enough to observe, while preserving a feedback route when the patient's trajectory changes **(Figure 2)**.

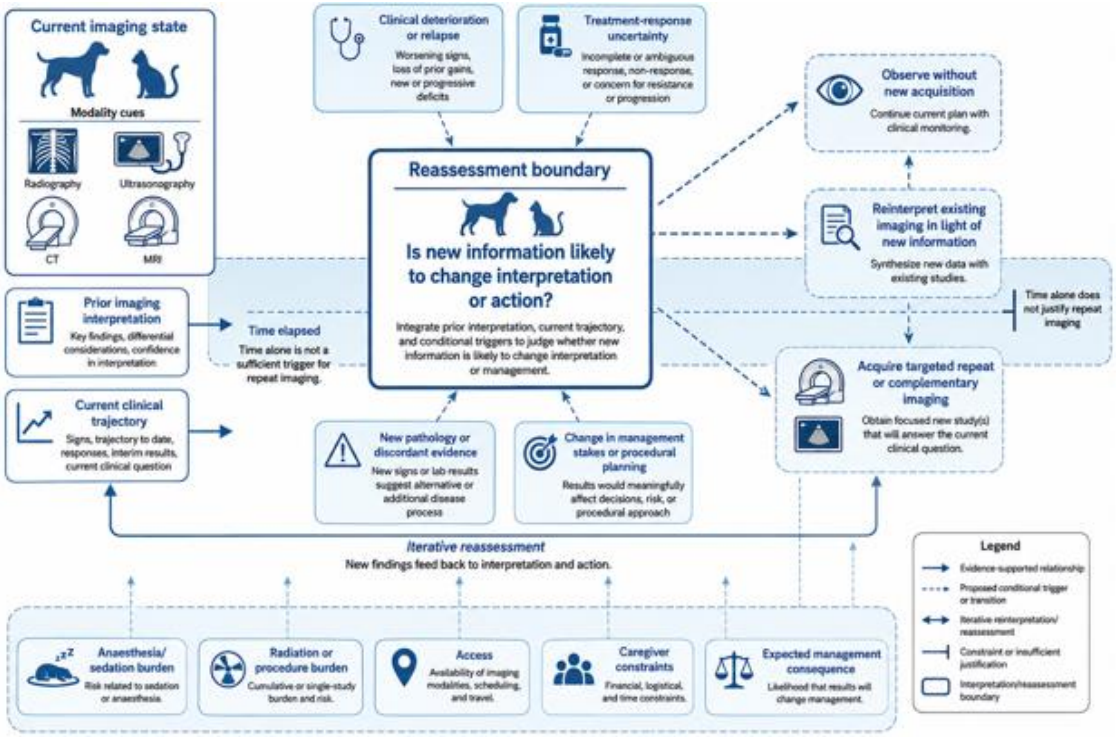

Figure 2. When another image is informative: temporal triggers, stable uncertainty, and reassessment exit paths

Sequential imaging is organized around change in decision-relevant uncertainty rather than fixed intervals. Solid paths represent supported temporal observations; dashed paths represent proposed triggers. Stable clinical and decision states can lead to observation, whereas relapse, response questions, discordant evidence, or changed management stakes can reopen imaging.

Horizontal veterinary reassessment field with prior imaging and current clinical trajectory feeding a central boundary. Separate triggers include deterioration or relapse, treatment-response uncertainty, new discordant evidence, and changed management stakes. Outcomes are observation, reinterpretation of existing studies, or targeted new imaging, with feedback to the clinical-question and action states.

Reporting implications

If imaging is intended to reduce uncertainty, a report should make the remaining uncertainty visible. Consensus guidance on veterinary imaging-report foundations supports clinically meaningful communication rather than simple enumeration of findings [6]. Within the proposed framework, reporting should distinguish at least four layers: what was observed, how confidently it is interpreted, which biologically relevant alternatives remain, and whether the result changes or fails to change the clinical decision.

This distinction is especially important for incidental abnormalities and discordant studies. A report that labels an unexpected feature without discussing likely relevance may encourage escalation merely because an abnormality has been named. Conversely, categorical language after a low-sensitivity examination may create false reassurance. Calibrated wording can indicate when an interpretation is strongly supported, when technical or biological alternatives remain plausible, and when another test would be useful only if a specified clinical distinction would alter management.

Recommendations should therefore be conditional rather than reflexive. “Consider CT” is less informative than explaining which unresolved question CT could answer and how that answer might change the next step. Equally, the radiologist should be able to state that additional imaging is unlikely to resolve the clinically decisive uncertainty. Such reporting turns uncertainty from an implicit weakness into an explicit component of diagnostic reasoning.

Multidisciplinary interpretation

Imaging interpretation may be distributed across clinicians, radiologists, surgeons, pathologists, and remote reporting systems, each of whom observes a different part of the diagnostic problem. ACVR and ECVDI teleradiology guidance emphasizes communication, information access, technical quality, and professional responsibility as components of safe remote interpretation [24]. These requirements matter because a technically adequate image can still be clinically misused if the question, patient state, or downstream decision is not communicated.

Agreement between readers is also not identical to correctness against an external reference. In cats with primary nonhematopoietic hepatic masses, CT localization showed useful intra- and interobserver agreement but was not perfectly concordant with surgical localization [25]. Likewise, confirmed nasal foreign bodies were not always directly visible on CT even though secondary abnormalities were common [26]. The causal interpretation therefore may depend on integrating image pattern, endoscopic or surgical findings, pathology, and clinical chronology.

The framework proposes multidisciplinary reconciliation when different sources answer nonredundant questions, particularly before high-stakes surgery, irreversible treatment, or dismissal of persistent clinical suspicion. Consensus should not be manufactured: disagreement should remain visible when evidence remains genuinely discordant. The aim is not a committee decision for every image, but targeted integration when crossing from observation to biological identity or consequential action.

Failure modes

The framework can fail if its distinctions are treated as procedural boxes rather than safeguards against overconfidence. One failure mode is question-free imaging: a technically excellent examination may enlarge the list of abnormalities while leaving the original decision unresolved. A second is incidentaloma capture, in which visibility itself becomes the reason for intervention. A third is negative-test closure, exemplified by situations in which insensitive signs are treated as exclusion despite residual risk [17].

Other failures arise from misplaced agreement. Repeating a modality with the same limitations can reproduce the same uncertainty, while concordant modalities may simply share a nonspecific phenotype. Biological overreach occurs when imaging language crosses into histological identity without an appropriate reference; technical overreach occurs when reconstruction or acquisition artifacts are interpreted biologically. Sequential overuse occurs when elapsed time becomes a substitute for a clinical trigger, despite evidence that repeat imaging can provide little incremental information in some stable contexts [23].

The proposed architecture also cannot neutralize access, cost, anaesthesia, caregiver capacity, or specialist availability. These constraints can make the theoretically most informative test infeasible. The correct response is to document the residual uncertainty and choose the safest defensible alternative, not to convert a constrained decision into false diagnostic certainty. Failure-mode monitoring should therefore accompany any future implementation study.

Validation priorities

Validation should begin by separating measurement reliability from diagnostic validity and clinical utility. CT prostate-volume measurement in dogs has been studied for intra- and interobserver reliability, protocol robustness, and agreement with an independent physical reference, illustrating that these properties can and should be tested separately [27]. Radiographic elbow-incongruity grading likewise demonstrated substantial repeatability under defined breed and reader conditions, but repeatability alone cannot establish that a measurement corresponds to clinically important disease [28].

The proposed framework requires validation at several additional levels. First, observers should reproducibly classify the clinical question, residual uncertainty, discordance type, actionability state, and reassessment trigger. Second, those classifications should be tested against relevant pathology, operative findings, longitudinal outcomes, or other independent references where appropriate. Third, decision pathways should be externally evaluated across species, diseases, scanners, practice settings, and levels of expertise. A retrospective study of 555 dogs with thoracolumbar myelopathy showed that the need for imaging beyond initial CT can itself be investigated as a clinical decision outcome [29]; analogous prospective work could test whether framework-guided escalation identifies unresolved cases without promoting unnecessary imaging.

Ultimately, prospective multicentre studies should compare framework-guided and usual decision processes for diagnostic resolution, additional testing, procedural burden, delay, and downstream management. Until such work exists, the framework should be treated as a structured hypothesis for decision making, not a validated clinical algorithm.

Conclusion

Veterinary diagnostic imaging has greatest clinical value when it changes a defensible interpretation or action rather than merely enlarging the inventory of abnormalities. The framework developed here separates detection, biological inference, and actionability; treats pre-imaging probability and question formulation as prerequisites to interpretation; and makes incidental findings, discordant modalities, pathology boundaries, and temporal reassessment explicit decision states. It also recognizes two opposing hazards: false reassurance from overinterpreting negative imaging and false escalation from overinterpreting conspicuous but nonspecific or technical findings.

The proposed architecture is deliberately revisable. Observation, additional imaging, tissue confirmation, intervention, and reassessment are conditional outcomes rather than compulsory steps. Its application must remain sensitive to species, disease phenotype, modality performance, patient status, procedural burden, caregiver constraints, and access. The framework therefore offers a structured way to expose where uncertainty remains and why a next step is justified, while requiring prospective testing before claims of improved diagnostic or clinical outcomes can be made.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Cohen J, Fischetti AJ, Daverio H. Veterinary radiologic error rate as determined by necropsy. Vet Radiol Ultrasound. 2023;64(4):573-84. doi:10.1111/vru.13259
2. Pomerantz LK, Solano M, Kalosa-Kenyon E. Performance of a commercially available artificial intelligence software for the detection of confirmed pulmonary nodules and masses in canine thoracic radiography. Vet Radiol Ultrasound. 2023;64(5):881-9. doi:10.1111/vru.13287
3. Hughes JR, Szladovits B, Drees R. Abdominal CT evaluation of the liver and spleen for staging mast cell tumors in dogs yields nonspecific results. Vet Radiol Ultrasound. 2019;60(3):306-15. doi:10.1111/vru.12717
4. Goins M, Puggioni A, Hoey S. Incidental findings of soft tissue gas in canine and feline thoracic computed tomographic examinations. Vet Radiol Ultrasound. 2024;65(1):4-9. doi:10.1111/vru.13314
5. Bergamaschi NA, Huber L, Ludewig E, Böhler A, Gumpenberger M, Hittmair KM, et al. Association between clinical history in the radiographic request and diagnostic accuracy of thorax radiographs in dogs: A retrospective case-control study. J Vet Intern Med. 2023;37(6):2453-9. doi:10.1111/jvim.16899
6. Scrivani PV, Watson E, Joostens Z, Yanchik A, Specchi S, Skogmo HK. American College of Veterinary Radiology and European College of Veterinary Diagnostic Imaging consensus statement on imaging report foundations. Vet Radiol Ultrasound. 2025;66(1):e13471. doi:10.1111/vru.13471
7. Cicci MC, Keenihan EK, Bailey K, Graham L, Sommer S, Cohen EB. Short/ultra-short TE MRI sequences comparable to CT and superior to standard MRI sequences for canine skull imaging. Vet Radiol Ultrasound. 2025;66(3):e70035. doi:10.1111/vru.70035
8. Woo H, Lee S, Hong S, Kwon N, Namgoong M, Wang S, et al. Time-resolved imaging of contrast kinetics for canine hindlimb angiography: A comparison with CT angiography and noncontrast magnetic resonance angiography. Vet Radiol Ultrasound. 2025;66(3):e70025. doi:10.1111/vru.70025

9. Caspanello T, Masucci M, Iannelli D, Iannelli NM, De Majo M. Prevalence and features of incidental findings in veterinary computed tomography: A single-center six-years' experience. Animals (Basel). 2023;13(4):591. doi:10.3390/ani13040591
10. Kim WS, Ward MP, Huynh E, Griffin L, Heo J, Vinayak A. Thoracic CT incidental pulmonary bullae in dogs: Characterization, interobserver variability, and general anesthesia risks. Vet Radiol Ultrasound. 2023;64(3):402-10. doi:10.1111/vru.13216
11. Healy D, Ballarini L, Agthe P, Cantatore M, Moores AL. Significance of incidentally identified bullae and blebs on thoracic computed tomography and prevalence of subsequent pneumothorax in dogs. Vet Surg. 2025;54(1):52-8. doi:10.1111/vsu.14144
12. Rossi F, Gianni B, Marconato L, Sabattini S, Caleri E, Mattolini M, et al. Comparison of sonographic and CT findings for the identification of renal nodules in dogs and cats. Vet Radiol Ultrasound. 2023;64(3):439-47. doi:10.1111/vru.13219
13. Weston PJ, Baines SJ, Finotello R, Mortier JR. Clinical, CT, and ultrasonographic features of canine and feline pleural and peritoneal carcinomatosis and sarcomatosis. Vet Radiol Ultrasound. 2021;62(3):331-41. doi:10.1111/vru.12951
14. Mattei C, Pratesi A, Bernardini M, Specchi S. May a single presurgical high-field MRI sequence replace standard radiographs for TPLO surgical planning in dogs? Vet Radiol Ultrasound. 2025;66(1):e70005. doi:10.1111/vru.70005
15. Fleming K, Nemanic S, Löhr CV, Terry J, Milovancev M. CT angiography and MRI imaging features do not predict the tumor type and grade of feline injection site sarcoma. Vet Radiol Ultrasound. 2019;60(6):668-79. doi:10.1111/vru.12807
16. Pemberton S, Odom TF, Dittmer KE, Kopke MA, Marshall JC, Poirier VJ, et al. The hypoattenuating ocular lens on CT is not always due to cataract formation. Vet Radiol Ultrasound. 2020;61(2):147-56. doi:10.1111/vru.12828
17. O'Mara LA, Fischetti AJ, Spector DI, Weltman JG. Accuracy of computed tomographic signs for the detection of severe adhesions in dogs with abdominal masses. Vet Radiol Ultrasound. 2025;66(4):e70058. doi:10.1111/vru.70058
18. Lux CN, Sula MJM, Sun X, Hecht S. Gadoxetate disodium (Gd-EOB-DTPA) contrast-enhanced magnetic resonance imaging for differentiation between benign and malignant splenic lesions in dogs. Vet Radiol Ultrasound. 2024;65(5):556-66. doi:10.1111/vru.13397
19. Einwaller J, Wennemuth J. Diagnostic utility of triple-phase CT: Differentiating benign liver lesions from hepatocellular carcinoma in dogs. Vet Radiol Ultrasound. 2025;66(4):e70060. doi:10.1111/vru.70060
20. Knudsen L, Østergaard E, Jensen JJ, Miles JE, Buelund LE. Diagnosis of medial meniscal lesions in the canine stifle using multidetector computed tomographic positive-contrast arthrography. Vet Surg. 2024;53(1):75-83. doi:10.1111/vsu.13982
21. Soulé C, Blond L, Cavalerie R, Piazza S, Baudin-Tréhiou C. Evolution of brain magnetic resonance imaging lesions in dogs treated for meningoencephalomyelitis of unknown origin between initial diagnosis and relapse. J Vet Intern Med. 2025;39(3):e70086. doi:10.1111/jvim.70086
22. Martin TW, Griffin L. Prospective pilot study utilizing changes in quantitative values obtained on serial fluorine-18 fluorodeoxyglucose positron emission tomography-computed tomography in dogs with appendicular osteosarcoma before and after stereotactic body radiation therapy and carboplatin chemotherapy to assess for prediction of survival and therapeutic effectiveness. Vet Radiol Ultrasound. 2024;65(4):408-16. doi:10.1111/vru.13361
23. French JM, Twedt DC, Rao S, Marolf AJ. CT angiographic changes in dogs with acute pancreatitis: A prospective longitudinal study. Vet Radiol Ultrasound. 2020;61(1):33-9. doi:10.1111/vru.12816
24. Ziemer LS, De Haan CE, Cardwell AL, Gambino JM, McLear RC, Silverman S, et al. ACVR and ECVDI consensus statement for teleradiology. Vet Radiol Ultrasound. 2024;65(3):288-93. doi:10.1111/vru.13353
25. Bentley C, Fouriez-Lablée V, Rossanese M. Intra- and interobserver agreement in computed tomography localization of primary nonhematopoietic hepatic masses and comparison with surgical and histopathological outcomes in 21 cats. Vet Radiol Ultrasound. 2024;65(5):469-76. doi:10.1111/vru.13376
26. Moreno-Aguado B, Carrera I, Holdsworth A, Agthe P, Maddox TW, Trevail T. CT findings in 20 dogs and six cats with confirmed nasal foreign bodies. Vet Radiol Ultrasound. 2020;61(4):417-26. doi:10.1111/vru.12832

27. Salonen HM, Åhlberg TM, Laitinen-Vapaavuori OM, Mölsä SH. CT measurement of prostate volume using OsiriX® viewer is reliable, repeatable, and not dependent on observer, CT protocol, or contrast enhancement in dogs. Vet Radiol Ultrasound. 2022;63(6):729-38. doi:10.1111/vru.13125
28. Pulkkinen HSM, Reunanen VLJ, Hyytiäinen HK, Junnila JJT, Laitinen-Vapaavuori OM, Lappalainen AK. The intra- and intertester repeatability of radiographic elbow incongruity grading is high in chondrodystrophic dog breeds. Vet Radiol Ultrasound. 2020;61(3):329-35. doi:10.1111/vru.12853
29. Emery L, Hecht S, Sun X. Investigation of parameters predicting the need for diagnostic imaging beyond computed tomography in the evaluation of dogs with thoracolumbar myelopathy: Retrospective evaluation of 555 dogs. Vet Radiol Ultrasound. 2018;59(2):147-54. doi:10.1111/vru.12576