

Bone scan: improved imaging technologies for the canine elbow

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Elbow lameness is a frequently encountered problem in dogs. Elbow lameness may be provoked by different pathologies such as coronoid process pathologies, flexor desmopathy, medial compartmental syndrome and arthrosis. In many cases a thorough clinical examination, including palpation, evaluation of pain elicited by flexion and extension of the elbow and intraarticular anaesthesia, may locate the problem in the elbow. First line imaging usually consists of radiography but may further include CT and/or MRI. However, this routine diagnostic imaging protocol may be inconclusive. Also, clinical findings may be difficult to interpret due to the temperament of the dog and/or lack of clear-cut signs. In these cases the classical bone scan will help to locate the origin of lameness to the elbow. Functional imaging, e.g. scintigraphy, will demonstrate alterations in bone remodelling at a very early stage, even before structural alterations are evident. In addition, if the origin of the problem cannot be located, the bone scan will provide an overview of the patients' joints and bones thus revealing lameness location in a highly sensitive way. The disadvantage is that the classical bone scan has prominent resolution limits, thereby precluding, particularly within the canine elbow joint, to locate the specific region of interest. Recently a semiquantification method was introduced as an option in cases where pathology is limited to the coronoid area. However, frequently pathology is not limited to this structure and this will interfere with this semiquantification method. Despite its high sensitivity, the classical bone scan suffers from low specificity and structural imaging is obligatory in most cases in order to define the type of pathology involved in the increased bone remodelling.

We investigated the use of a micro-SPECT system which not only provides a 3-dimensional overview of the joint but also increases resolution of the nuclear scan substantially, thus revealing specific regions of interest within the joint. The main limitation of most conventional micro-SPECT systems is that they are specifically built for use in small rodents and as such, have a limited gantry opening, precluding the use in dogs. We used the HiSPECT system which is a multi-pinhole collimated micro-SPECT system for use on conventional gamma camera systems and allows adaptation of the space between the camera heads for larger animals. Initially we explored the use of HiSPECT in normal dogs. Different areas that play an important role in elbow pathology could be recognized with the help of fusion with structural imaging modalities such as CT and MRI. In more recent work 69 elbows, including

normal elbows and elbows with varying pathologies were studied. High correlation was found with findings on CT and arthroscopy. In 90% of the cases with coronoid pathology, HiSPECT findings agreed with CT/arthroscopic findings. In the cases of flexor desmopathy (reflected as increased uptake in the medial epicondyle) agreement with CT (with contrast enhancement) was less than with arthroscopy. This probably is a reflection of the suboptimal capacity of CT (even with contrast enhancement) to demonstrate soft tissue lesions and, in this regard, MRI/ultrasound are superior. Also in a number of cases, HiSPECT revealed increased activity in regions not demonstrating structural abnormalities. It will be a matter of prospective studies to demonstrate whether structural normal regions with increased remodelling pose clinical problems and/or structural lesions in the long run. It is well known that the bone scan is highly sensitive and is used in this regard to demonstrate early bone remodelling in sports medicine (both for man as well as animals, e.g. horses) reflecting bone fatigue which precedes clinical symptoms. This high sensitivity combined with improved resolution makes it a possible tool for implementation in longitudinal studies, aiming at clarifying the pathogenesis of elbow joint disorders. A limitation of HiSPECT bone scanning is that its access is limited. However, recently resolution recovery software has been introduced for conventional SPECT bone scanning. This reconstruction software improves resolution and as a consequence, may be potentially a more accessible alternative for the HiSPECT system.

References

A multi-modality approach to bone imaging. Carrera,G.F, 1996, In "Skeletal Nuclear Medicine". Eds Collier,B.D.; Fogelman,I.; Rosenthal,L.; Missouri, Ch 5:73-84

Recognition of anatomical predilection sites in canine elbow pathology on bone scans using micro-single photon emission tomography

K. Peremans, S. Vermeire, A. Dobbeleir, I. Gielen, Y. Samoy, K. Piron, E. Vandermeulen, G. Slegers, B. De Spiegeleer, H. van Bree, K. Dik, 2011, Veterinary Journal, 188:64-72