MAGNETIC RESONANCE IMAGING IN CANINE TUMORAL PATHOLOGY

Elefterescu\textsuperscript{1} H. L. Balan\textsuperscript{1} F. Grosu\textsuperscript{1} Angelica Mangrau\textsuperscript{2}

\textsuperscript{1}Faculty of Veterinary Medicine, Bucharest; \textsuperscript{2}Phoenix Diagnosis Clinic, Bucharest

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Abstract: In veterinary pathology tumors are very frequent and the general symptomatic chart of sick animals may very easily result in diagnosis errors and confusions. The Imagistic Research is a very important, essential tool in the diagnosis process, both in the pre-therapeutic stage for the early diagnosis of tumors and in the post-therapeutic stage for the detection of tumor recurrence. The magnetic resonance, not long ago adopted in the clinical use and particularly in the veterinary field, further to the higher tissue contrast it offers and to the possibility of obtaining three-dimensional sections, represents the most eligible method of diagnosis of tumors.

Its target is to detect, describe and stage the lesion in the tumoral pathology.

INTRODUCTION

Due to its higher tissue differentiation, the magnetic resonance allows a clear view of the anatomical details and the description of the various structures (muscles, tendons, ligaments, viscera).

The detection of the lesion depends on the investigation technique. A systematical examination of the concerned area supposes the acquisition of sections at various levels (coronal, axial and sagittal) and the use of a combination of sequences (T1, T2, sequences with fat suppression and T1 post-contrast iv sequences) (Fig. 1.A, B, C, D). The best plane for tumor view is chosen in accordance with tumor location so that it should provide information about tumor's relation to the adjacent structures. Practically, a correct and complete investigation protocol makes the non detection of the lesion almost impossible.

The use of additional sequences like STIR (short time inversion recovery) or GE (gradient-echo) sequences beside the conventional ones (T1 and T2) may reveal further information about the tumor. Thus, STIR sequences improve the contrast between the lesion and the adjacent structures, allowing the identification or (abnormal) tissues with an increased water content. The cancellation of the signal from the fat represents a further benefit of such sequences. The only difficulty in using the STIR sequences compared to the spin-echo sequences is represented by the lesion outsizing by the surrounding oedema (1). The gradient-echo sequences are rapid sequences allowing the shortening of the image acquisition time. Such sequences are sensitive for the detection of the haemosiderine (produced by haemoglobin deterioration). In the case of the RM examination of the upper abdomen, the in-phase and out-of-phase GE T1 sequences are useful for detecting the adipose content of some lesions.
RESULTS AND DISCUSSIONS

The analysis and comparison of the signal strength in the T1 and T2 sequences provide information concerning the various types of tumor constituents (water, fat, blood, fibrous tissue), thus enabling the lesion description (Table 1).

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<tr>
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<th>T1 Sequences</th>
<th>T2 Sequences</th>
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<tbody>
<tr>
<td>Water (necrosis)</td>
<td>hyposignal</td>
<td>hypersignal</td>
</tr>
<tr>
<td>Fat</td>
<td>hypersignal</td>
<td>intermediate signal</td>
</tr>
<tr>
<td>Blood (subacute haemorrhage)</td>
<td>hypersignal</td>
<td>hypersignal</td>
</tr>
<tr>
<td>Fibrous tissue</td>
<td>hyposignal</td>
<td>hyposignal</td>
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Most lesions have a non specific aspect characterized by T1 hyposignal and T2 hypersignal that makes the correct histological investigation, based only on the RM examination, possible in a small number of cases. However, there are situations in which the histopathological diagnosis may be easily stated, due to the characteristic aspect of the lesion (e.g., the lipoma, which returns an identical signal to that of the fat in all the sequences).

The administration of the contrast substance provides information about the tumor vascularization, knowing that nearly all the malignant tumors are hyper-vascularized (2). Also, the use of the intravenous contrast facilitates the identification of the intratumoral cystic or necrotic areas and helps to delimit the tumor from the adjacent oedema (3, 4). In the case of the recurrences, the dynamic sequences are used for differentiating the tumoral recurrences from the postoperative fibrotic alterations or from the post-irradiation alterations. Some of the lesions can be easily diagnosed only based on the vascular behaviour (for instance, the hepatic hemangioma shows a typical progressive, centripetal load). In respect of the benign or malign nature of the lesion, the signs indicating the malignancy are: the size of the lesion over 5 cm, the deep location (5, 6), the non homogeneous aspect of the tumor and the imprecise limits (7). In addition, the extension beyond the limits of an organ or the (extra-compartmental or extra-capsular) anatomic structure of a formation, the invasion of the adjacent osseous and vasculo-nervous structures suggest the malignant nature (8) of the lesion.

The biopsy followed by the histopathological examination represents the gold-standard method that can positively determine the benign or malign nature of a tumor, as well as the tumor type. The lesion staging, critical in the case of the tumors, supposes the specification of the tumor size, its location, its local extension in relation to the adjacent structures and planes, the determination of the invasion of the bone or articular structures, of the tumor relation to the adjacent vasculo-nervous packs, as well as the presence of remote metastases, all these having an influence on the prognosis and directing the subsequent therapy (Fig. 2).

For an increased accuracy of diagnosis, the RM examination should always be done before the tumor biopsy as the post-biopsy alterations (hemorrhage and oedema) may change the tumor aspect and cause diagnosis confusions.

The whole-body RM examination (RM examination of the whole body) (Fig. 3) which can be performed by the magnetic resonance equipment and last generation software allows
the staging of the patients with cancer (by detection of metastases), with a performance similar to that of the PET-CT.

Unlike the PET-CT which has several drawbacks (high cost, long time needed for examination, being invasive and irradiative, non specific and, in some types of tumors, useless), the whole-body RM examination is unquestionably useful in the tumoral staging. It provides the acquisition of information from the whole body in 20 minutes, with a highly accurate detection of the pathological alterations. The whole-body RM examination proves to be superior also to the scintigraphy examination in the detection of metastases (9, 10).

The shortcomings of this examination consist in the fact that some lesions have a non specific aspect (in such cases one more RM examination is necessary) and that it is useless in certain types of tumors (small lung tumors).

CONCLUSIONS

Due to the multitude of diagnosis benefits it offers, as well as due to its non invasive and non irradiative characteristic, the magnetic resonance is the most appropriate technique of diagnosis and staging in the tumoral pathology. The short time needed for determining a final diagnosis represents a major benefit, essential in the tumors case. The only shortcomings of the magnetic resonance are the long duration of the examination (at least 20 minutes), the necessity of anaesthetizing the animals (to avoid the moving artefacts occurrence), the high cost and the absolute contra-indications represented by the metallic foreign bodies presence, shortcomings that are overcome by this method's benefits.

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