Hyperacute bilateral thalamic infarction not presented on initial diffusion weighted magnetic resonance imaging

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In patients with hyperacute infarctions, there are situations in which initial diffusion-weighted magnetic resonance imaging (DW MRI) fails to explain the patient's neurological status. In the present case, the patient visited the emergency room about 15 minutes after the onset of symptoms and his initial neurological status was not explained by DW MRI. We injected intravenous tissue plasminogen activator on the basis of non-enhanced brain computed tomography. However, the degrees of neurological improvement were insignificant and follow up DW MRI showed multiple acute infarctions in the pons, midbrain, and bilateral thalamus. A rare case of acute bilateral thalamic infarction, this article summarizes initial management and clinical outcome.

Magnetic resonance imaging (MRI) is the best way to detect early signs of cerebral ischaemia and intracranial haemorrhage . Rapid MRI sequences reduce the length of the investigation, giving valuable information with an acceptable time in terms of patient care. For this reason, MRI is increasingly used to select candidates for thrombolysis. After a few minutes, acute arterial ischaemic stroke (AIS) appears as hyperintense on diffusion-weighted imaging (DWI), with a corresponding reduction of the apparent diffusion coefficient (ADC). However, DWI may also be negative at the very beginning of an ischaemic stroke, as it requires several tens of minutes for the cytotoxic oedema to return hyperintensity.

If AIS represents the most common cause of new sudden neurological deficit, other diseases mimicking ischaemic strokes represent up to one-third of cases and are termed ‘stroke mimics’. It is important to promptly identify these differential diagnoses to avoid inappropriate urgent treatment, but also to prevent inadequate long-term prevention treatment. Though computed tomography (CT) scanning is the standard technique in many stroke centres around the world and has demonstrated its effectiveness in the decision-making process for the treatment of AIS, MRI with DWI has a better sensitivity to depict small acute ischaemic cerebral lesions, but also offers the possibility, at the same time, to identify differential diagnoses to stroke in case of a sudden neurological deficit.

The surgical and experimental protocols were approved by the institutional animal care and use committee of Korea Animal Medical Science Institute (IACUC No. 12-KE-011). Fourteen healthy male beagle dogs (mean body weight, 9 kg; weight range, 7–10 kg; mean age, 9 months; age range, 8–10 months) were used in the study. All dogs yielded normal physiological examination, complete blood count, serum chemistry, and neurological examination results, and they had no history of neurological disorder. The dogs were fasted for 12 h before undergoing general anesthesia. Thiopental sodium (20 mg/kg intravenous, Pentothal Sodium; JW Pharmaceutical, Korea) was used for anesthesia induction; isoflurane (Terrel Solution; Kyongbo Pharmaceutical, Korea) was administered for maintenance.

Canine middle cerebral artery (MCA) occlusion models were induced by using allogeneic blood clots. Anesthetized dogs were positioned in dorsal recumbency on a surgical table. Hair was shaved from the left ventral neck, and povidone-iodine and alcohol were applied for disinfection. The common carotid artery was exposed via skin incision.

Based on the MRI results, the infarcts were classified according to location (unilateral or bilateral, anatomical location, and suspected arterial territory involved), distribution (focal or multifocal), border (ill-defined or clear margin), and serial signal intensity change in the infarct. In addition, changes in lateral ventricular size over time were assessed. The changes in lateral ventricular shape were evaluated and determined to be generalized or focal changes. For the lateral ventricular size analysis, dogs were divided into two groups based on lesion location and then further subdivided into two subgroups each based on lesion side as follows: Group 1a, dogs with unilateral cerebrocortical lesions; Group 1b, dogs with bilateral cerebrocortical lesions; Group 2a, dogs having unilateral lesions without cerebrocortical lesions; and Group 2b, dogs having bilateral lesions without cerebrocortical lesions. The lateral ventricular size was measured as the lateral ventricle height/brain height ratio at the level of the interventricular foramen on transverse T1W images, as described previously . By using IBM SPSS Statistics software (ver. 22.0; IBM, USA), the Mann-Whitney U test was implemented to analyze changes in the lateral ventricular size relative to the cerebral lesion side between 3 and 35 days and between 8 and 35 days post-occlusion. A p value < 0.05 was considered to indicate statistical significance.

In this study, there was variety in the distribution of infarcts,

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and that variation in the distribution of infarcts might be attributable to the cerebral vascular anatomy. The MCA derives from the internal carotid artery near the origin of the caudal communicating artery and divides into the cortical and central branches . The central branch forms striate vessels that supply blood to the caudate nucleus, internal capsule, and putamen, whereas the caudal communicating artery divides into perforating arteries that supply blood to the thalamus . In addition, anastomoses between the internal carotid artery and the MCA are relatively abundant in dogs . In these anatomical structures, clots from the internal carotid artery might follow the blood flow and thus block the striate or perforating artery. Other possibilities include the presence of small-sized or fragmented allogenic blood clots , unskilled injection velocity, or increased pressure due to blood clots. Despite a clot injection site in the left internal carotid artery, bilateral lesion induction may also result from small-sized or fragmented allogenic blood clots. Such clots could block not only the left cerebral artery but also the right cerebral artery since the clots follow blood flow.

In conclusion, MRI was useful for ischemic brain infarct phase diagnosis. T2W and FLAIR were useful for detecting early stage (3 h to 3 days) brain infarct. T1W and DWI provided supplemental information for detecting neuronal necrosis and time-related brain infarct changes. In addition, cerebral lobe infarct might result in lateral ventricular dilatation.

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