

Evaluation of acute infarct and leukoariosis with diffusion MRI

Published on 22.03.2001

DOI: 10.1594/EURORAD/CASE.651

ISSN: 1563-4086

Section: Neuroradiology

Imaging Technique: MR-Functional imaging

Case Type: Clinical Cases

Authors: R. N. Sener

Patient: 72 years, male

Clinical History:

Right-sided weakness, hemisensory loss, and homonymous hemianopia

Imaging Findings:

The patient presented with a transient ischemic attack. Six days later he developed right-sided weakness, hemisensory loss, and homonymous hemianopia. Echo-planar diffusion MRI was performed using the 'trace' technique (TR=5700, TE=139 msec), providing images with diffusion sensitivity values (b values) of 0.50 sec/mm², 500 sec/mm², and 1000 sec/mm². Also, automated apparent diffusion coefficient (ADC) maps were provided by this sequence.

Discussion:

In ischemia cytotoxic edema develops in the involved region. Cytotoxic edema is associated with restriction of the mobility of water molecules, therefore high signal is observed on true diffusion images (i.e. b=1000 sec/mm² images), and low signal is seen on corresponding ADC maps with low ADC values. On the other hand, leukoariosis (white matter hyperintensities) is commonly seen in the periventricular regions of elderly, and on ADC maps of diffusion MRI these have high signal, while they may not be apparent on true diffusion (b=1000 sec/mm²) images. Both, acute infarction and leukoariosis have high signal on T2-weighted images, however, their discrimination is possible using the b=500 sec/mm², and b=1000 sec/mm² images, and ADC maps.

Differential Diagnosis List: Acute infarct and leukoariosis

Final Diagnosis: Acute infarct and leukoariosis

References:

Castillo M, Mukherji SK, Isaacs D, Smith JK. Cerebral infarctions: evaluation with single-axis versus trace diffusion-weighted MR imaging.

AJR Am J Roentgenol. 2000 Mar;174(3):853-7. (PMID: [10701638](#))

Roh JK, Kang DW, Lee SH, Yoon BW, Chang KH. Significance of acute multiple brain infarction on diffusion-weighted imaging.

Stroke. 2000 Mar;31(3):688-94. (PMID: [10700505](#))

Yamada H, Ezuka I, Ikegami Y, Suda T, Kakinuma K, Kanazawa T, Higuchi S. Diffusion-weighted echo planar imaging of acute brain infarction: a preliminary report.

Neurol Med Chir (Tokyo). 1999 Dec;39(13):913-21. (PMID: [10658452](#))

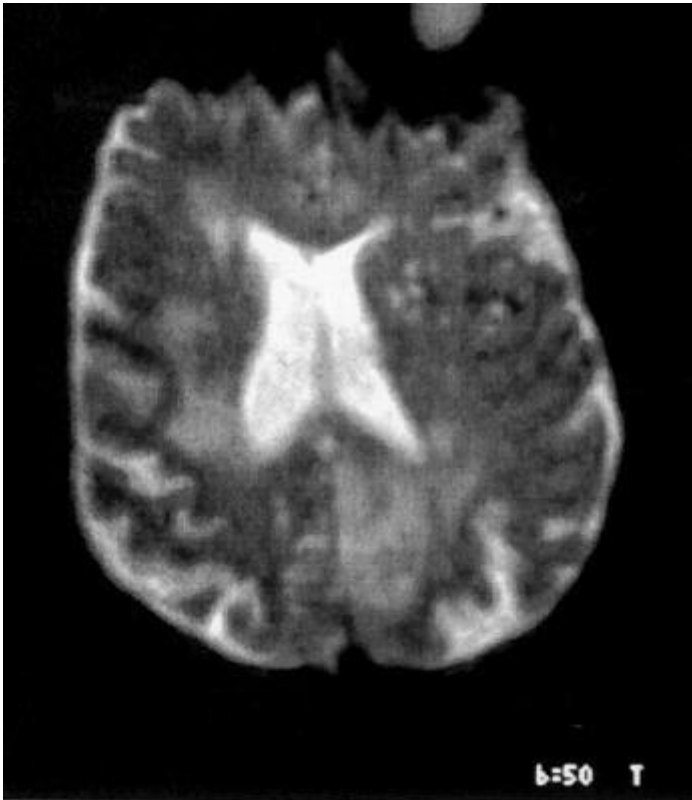
Altieri M, Metz RJ, Muller C, Maeder P, Meuli R, Bogousslavsky J. Multiple brain infarcts: clinical and neuroimaging patterns using diffusion-weighted magnetic resonance. Eur Neurol. 1999;42(2):76-82. (PMID: [10473978](#))

Burdette JH, Elster AD, Ricci PE. Acute cerebral infarction: quantification of spin-density and T2 shine-through phenomena on diffusion-weighted MR images.

Radiology. 1999 Aug;212(2):333-9. (PMID: [10429687](#))

Figure 1

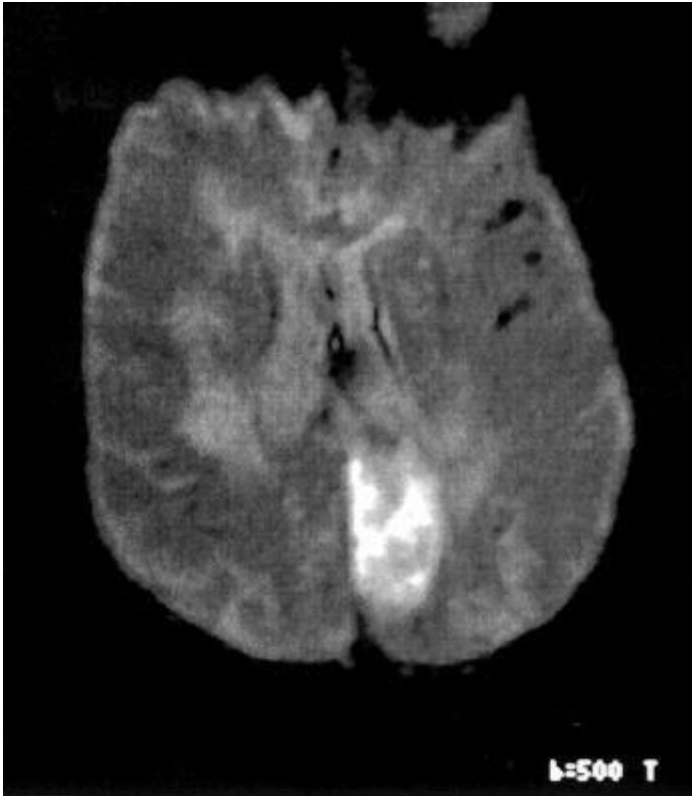
a



Description: b=50 sec/mm² image, which actually is a T2-weighted image, reveals high signal changes in the left occipital region, and in the right periventricular region. Their signals are similar.

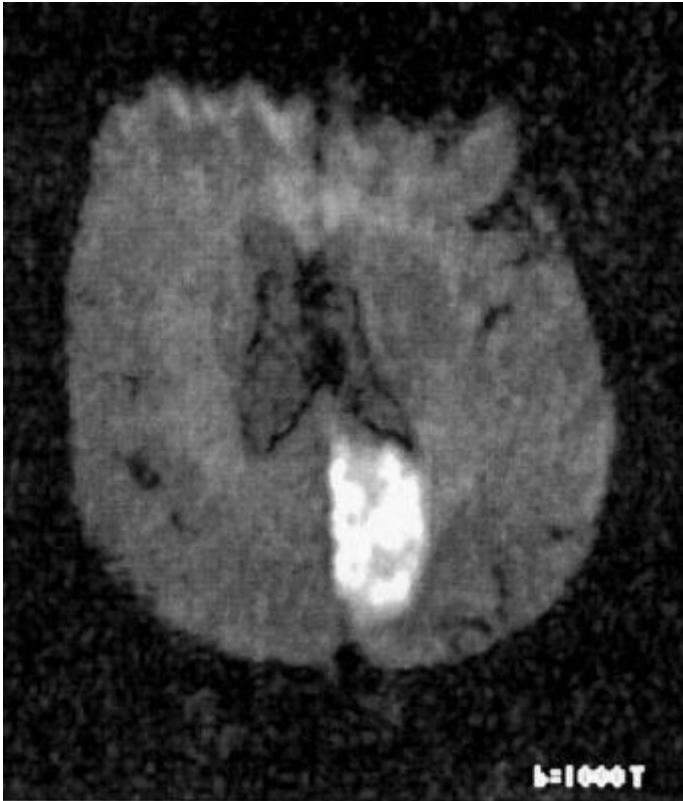
Origin:

b



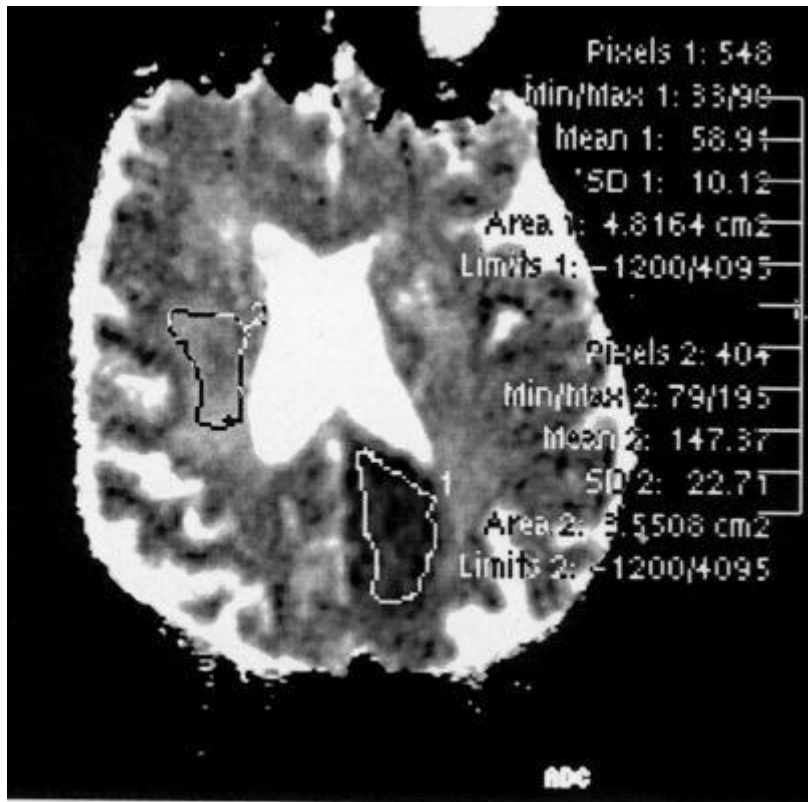
Description: b=500 sec/mm² image, which contains T2-weighted data called T2 shine-through, reveals the infarcted zone with higher signal than periventricular leukoariosis. See the true diffusion (b=1000 sec/mm²) image (1c), and ADC map (1d). **Origin:**

c



Description: b=1000 sec/mm² image, which is heavily diffusion-weighted, shows the infarcted region with very high signal (cytotoxic edema). Note that periventricular changes related with leukoaraiosis are not seen on this image. See ADC map (1d). **Origin:**

d



Description: ADC (apparent diffusion coefficient) map reveals the infarcted zone with low signal and an ADC value of $0.58 \times 10^{-3} \text{mm}^2/\text{sec}$. (ADC values lower than $0.60 \times 10^{-3} \text{mm}^2/\text{sec}$, and as low as $0.10 \times 10^{-3} \text{mm}^2/\text{sec}$ can be noted in cytotoxic edema). Note that the ADC value of periventricular leukoaraiosis is $1.47 \times 10^{-3} \text{mm}^2/\text{sec}$, a value similar to that of vasogenic edema. **Origin:**