

Synthetic MRI on Hypoxic-Ischemic Brain Injury After Cardiac Arrest : A Case Report

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Introduction

Hypoxic-Ischemic Brain Injury (HIBI), a common complication among cardiac arrest patients, varies in clinical symptoms, severity, and prognosis. These depends on the period and extent of ischemia. Although conventional brain magnetic resonance imaging (MRI) and single photon emission computed tomography (SPECT) may be used to evaluate HIBI, it can be challenging to visualize and quantify the extent of brain injury. Synthetic brain MRI is a technique that synthesizes contrast-weighted images using quantitative relaxometry parameters measured from multi-contrast images. It can measure the amount of brain volume including myelin contents. In this study, we detected and quantified brain injuries using synthetic MRI.

Case Presentation

A 43-year-old female with a event of cardiac arrest successfully achieved a return of spontaneous circulation (ROSC) in approximately 7 minutes upon immediate cardiopulmonary resuscitation (CPR). The patient suffered another cardiac arrest within the next 30 minutes, in which spontaneous rhythm was returned after 2 minutes of resuscitation. In the following 2 days of hospitalization, the patient suffered 3 more cardiac arrests, all of which ROSC was achieved within 3 minutes.

Impairment in cognitive function was observed in the patient during hospitalization. Cognitive dysfunction was evaluated using the Mini-Mental State Exam (MMSE), a 30-point questionnaire in which the patient scored 19. A conventional brain MRI was performed. T2-weighted images and T2-weighted fluid-attenuated inversion recovery images showed high signal intensities in both anterior basal ganglia and subtle signal changes in both hippocampi. (Figure 1) A synthetic brain MRI was conducted to detect HIBI and quantify the contents of the brain.

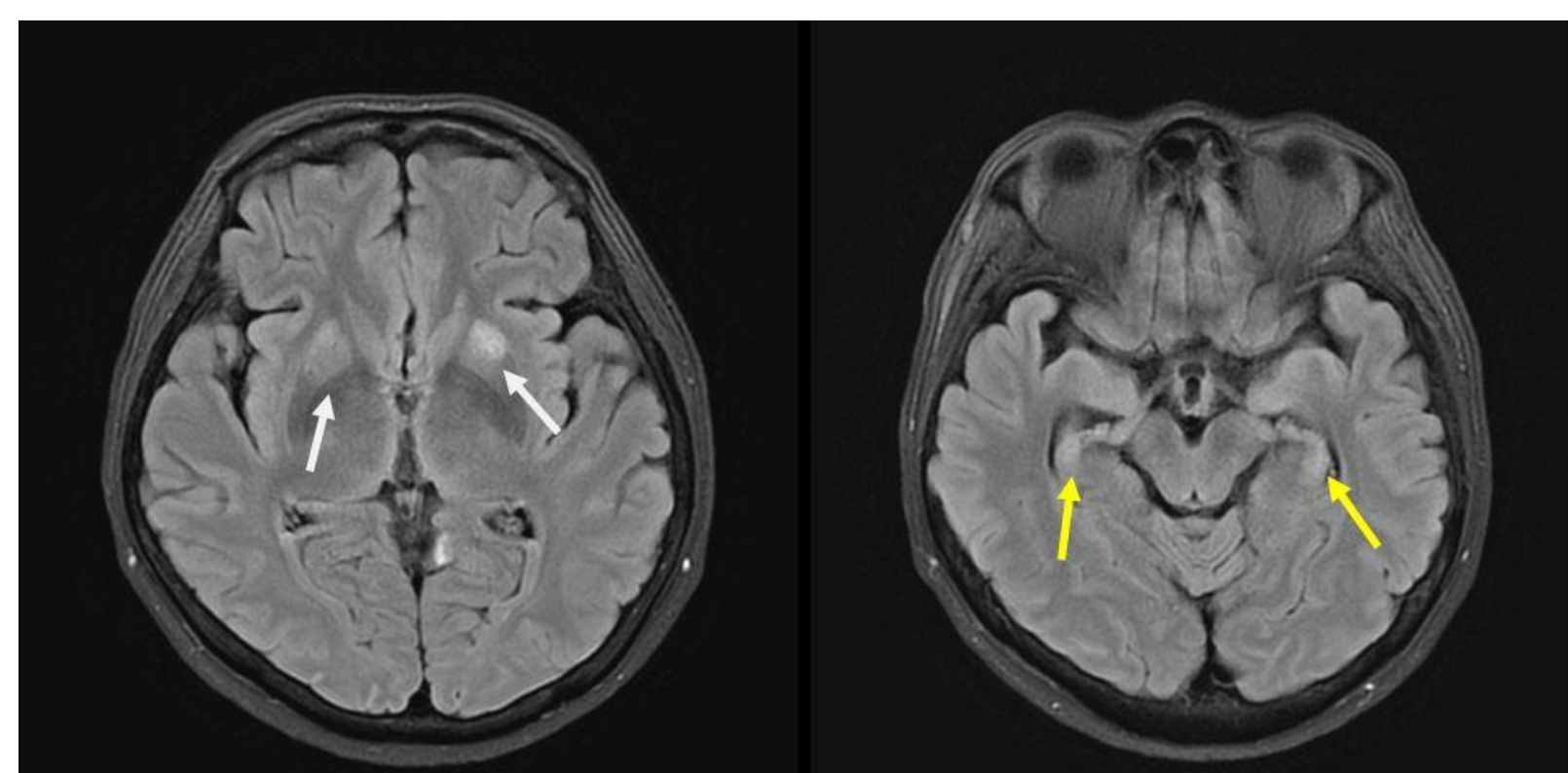


Figure 1. T2-weighted fluid attenuated inversion recovery image shows high signal intensity on both anterior basal ganglia (white arrow) and both hippocampi (yellow arrow).

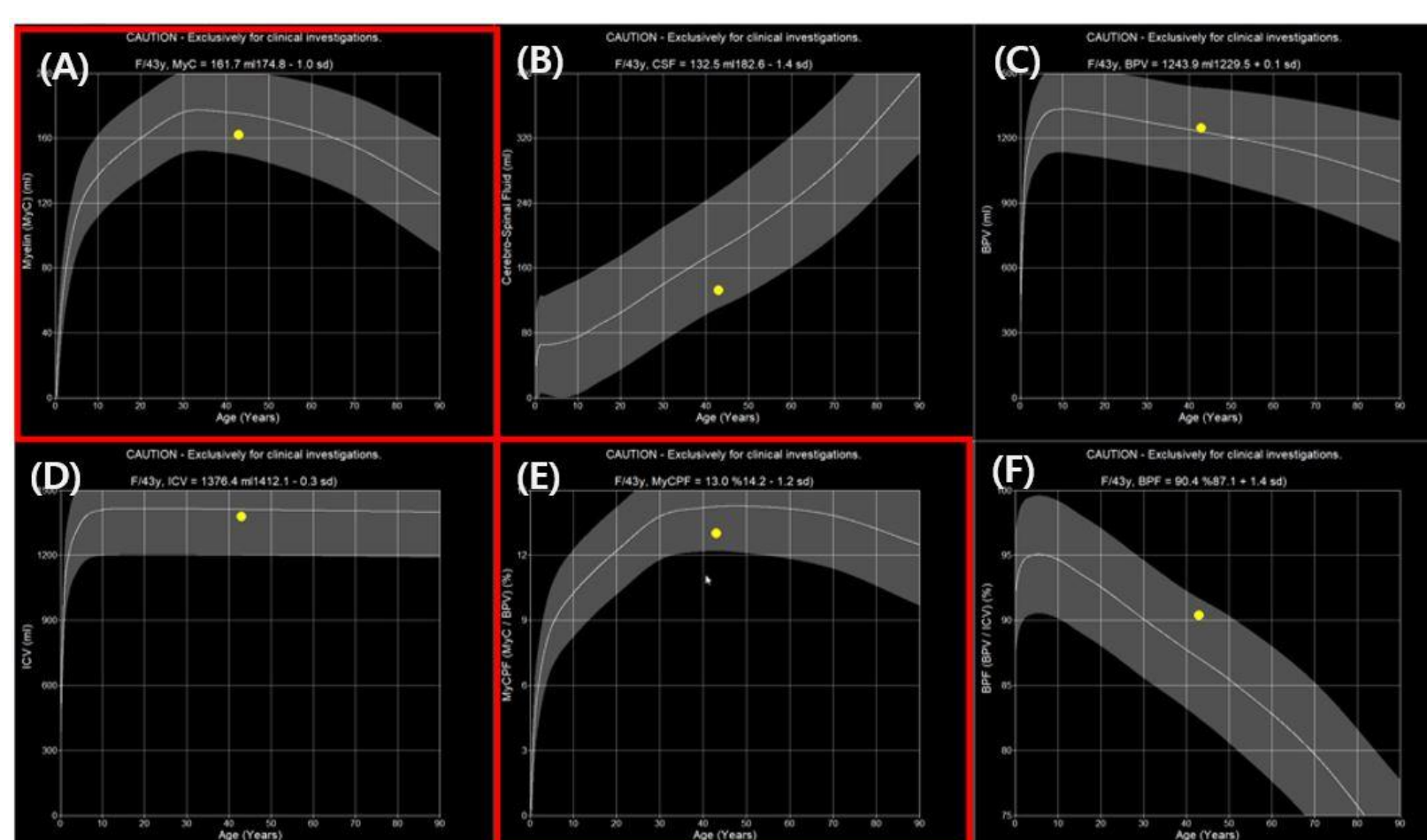


Figure 2. The amount of myelin contents and the ratio of parenchymal volume to myelin content were both found to be below the mean by -1 standard deviation or less. (Red box) (A; MyC, B; CSF, C; BPV, D; ICV, E; MyCPF, F; BPF)

Results

Brain parenchymal volume (BPV), intracranial volume (ICV), cerebrospinal fluid (CSF), and myelin contents (MyC) were measured using synthetic MRI images and reference values of the same age group were used for comparison. The results of BPV, ICV, CSF and MyC were 1243.9ml, 1376.4ml, 132.4ml, and 161.7ml, respectively. When compared to the standard deviation(sd), BPV was above average at 0.1 sd; however, MyC and MyCPF(MyC/BPV) were all below average at -1.0 sd and -1.2 sd. (Figure 2) Notably, segmental images confirmed myelin loss in both basal ganglia and hippocampi. (Figure 3)

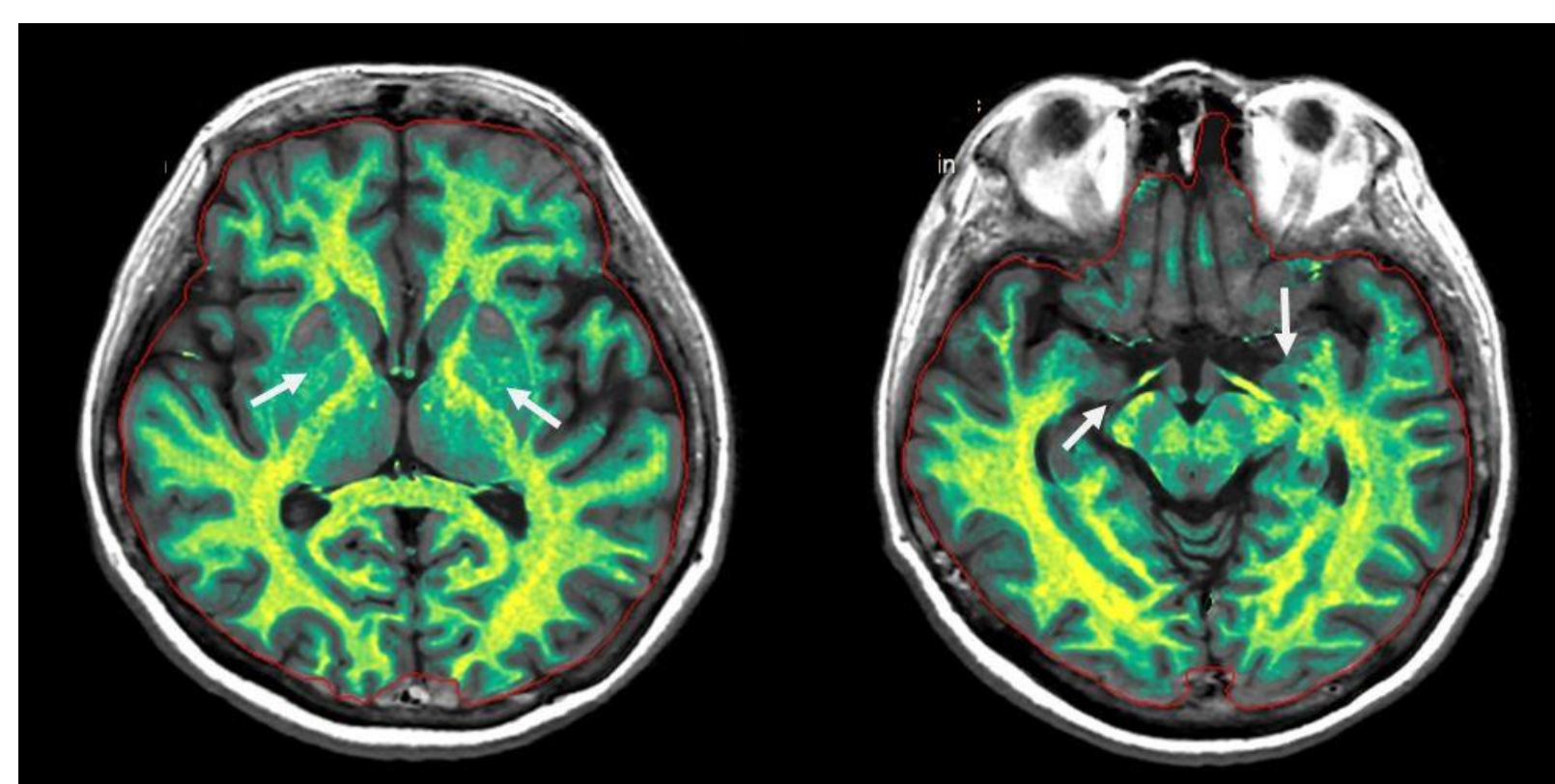


Figure 3. Segmental images of synthetic MRI show myelin loss on both anterior basal ganglia and hippocampi (white arrows).

Conclusion

Synthetic MRI is a useful technique in evaluating HIBI. In particular, although more research is needed, quantifying the amount of myelin contents may be useful in assessing the prognosis and severity of HIBI.