



## Clinical Corner

Roxanne Pickett-Hauber, Section Editor

# Tc SPECT Scan in a Patient with Occipital Lobe Infarction and Complex Visual Hallucinations

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Visual hallucinations have been reported in a variety of pathological states, including Charles Bonnet Syndrome (visual hallucinations of the blind), migraine headache, Lewy body dementia, Parkinson's disease, narcolepsy, delirium tremens, schizophrenia, use of hallucinogenic drugs, and peduncular hallucinosis (Manford & Andermann, 1998).

Peduncular hallucinosis (PH) is characterized by complex visual hallucinations (CVH); the images are detailed, colored, and animated. The content of the imagery is stereotyped, often limited to people or animals in miniature proportions (Danziger, Meary, & Mercier, 1997). Most cases of PH are caused by ischemic insults (Liedholm, Angergard, & de Flon, 1999); the imagery starts a few days after the stroke.

Other etiologic factors reported in the literature include neoplastic lesions (Miyazawa, Fukui, & Otani, 2001; Navdi & van Dellen, 1994) or surgical manipulation of the brainstem

(Kumar & Kaur, 2000; Quasho, Lunardi, & Mancinelli, 1998; Tasukamoto, Matsushima, & Fujiwara, 1993). Regardless of etiology, there is involvement of the deep gray matter, specifically, the brainstem or the thalami. Alterations in the sleep-wakefulness cycle also have been observed with PH, more so in patients with brainstem lesions. The hallucinations are present on and off during wakefulness and peak in the evening (Manford & Andermann, 1998). Patients are fully aware of the unreal nature of the visual imagery. In most cases, complete resolution of the hallucinations occurs in few days.

Peduncular hallucinations were described by Lhermitte (1922) in the beginning of the last century. He had observed frequent involvement of the midbrain, which led to selecting the term peduncular hallucinosis. This was a simple descriptive terminology implying the neuro-anatomical correlate for this condition. Typically, PH is associated with a normal visual cortex. On the other hand, similar clinical manifestations have been described, albeit rare, in patients with occipital lobe infarction.

The anatomical substrate for CVH is unknown. Manford and Andermann (1998) attribute the phenomenon to faulty cortical stimulation due to abnormal visual input or processing (the cortical release theory). They reviewed the occurrence of CVH in a number of conditions, including PH, epilepsy, narcolepsy-catalepsy syndrome, and others. These various pathologies all have in common some mechanism that could potentially

disrupt thalamocortical projections. Presumably, this results in a loss of inhibition at the levels of the visual association cortex and causes the hallucinations. Manford and Andermann postulated that the occurrence of strikingly similar hallucinations from these apparently diverse pathological conditions may be due to this abnormal cortical release phenomenon and the resulting loss of cortico-cortical inputs and effects on the reticular activating system.

The following case report describes a patient with occipital lobe infarction and CVH and provides radiographic evidence for the cortical release theory by reporting increased uptake in the right temporal lobe on the brain Tc SPECT (technetium single-photon emission computed tomography) scan.

### Case Report

This 84-year-old woman was admitted to the hospital due to congestive heart failure. She underwent surgery for aortic valve replacement and coronary bypass. She was in intermittent atrial fibrillation and was anticoagulated. On the seventh day after her operation, she reported complex visual hallucinations. She described seeing dwarfs on the left side of the room only. The images were colored, animated, and extremely realistic. The hallucinations were present on and off during waking hours. She found them entertaining and was fully aware of their unreal nature. Sleep disturbances were denied.

Neurology consultation was performed, and the examination demonstrated normal higher cortical function

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as well as normal ocular motility and pupillary reactions. A new left-sided hemianopia was documented. No sensory or motor deficits were found. There were no reflex asymmetries. A computed tomography (CT) scan of the brain showed a hemorrhagic stroke involving the right calcarine cortex (Fig 1). A Tc SPECT scan demonstrated decreased uptake in the right calcarine cortex. In addition, an area of increased uptake was demonstrated in the right temporal lobe (Fig 2). The hallucinations diminished rapidly and subsided in 72 hours.

### Discussion

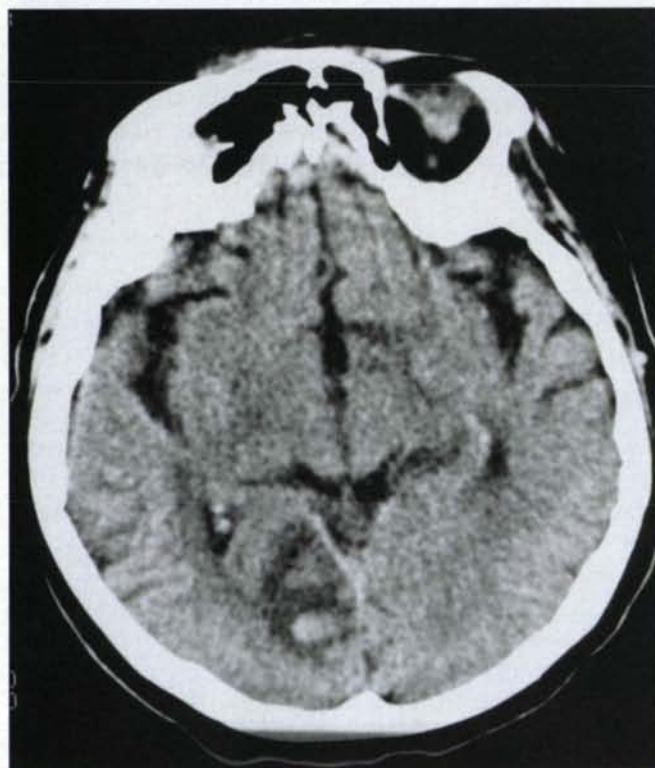
Tc-99m ethylcysteinate dimer (ECD) SPECT imaging is a form of functional imaging that has the potential to assist the clinician in localizing brain abnormalities associated with a variety of neurological disorders based on changes in cerebral blood flow. The brain uptake of Tc-99m ECD is proportional to

regional blood flow. Lorberboym, Lampl, Gilad, and Sadeh (2002) reported a limited case study of nine patients with visual hallucinations who were evaluated using Tc SPECT imaging. They found that seven of the nine had increased cerebral perfusion as seen on Tc SPECT scan in one or more regions of the brain. Follow-up imaging after 1 week in these patients showed significant or complete resolution of the perfusion changes noted on the initial scan. This correlated to a partial to complete resolution of the hallucinations. They concluded, and the current case study also suggests, that brain imaging using Tc SPECT may be useful in identifying brain-blood flow abnormalities associated with visual hallucinations in some subgroups of patients, including those with stroke.

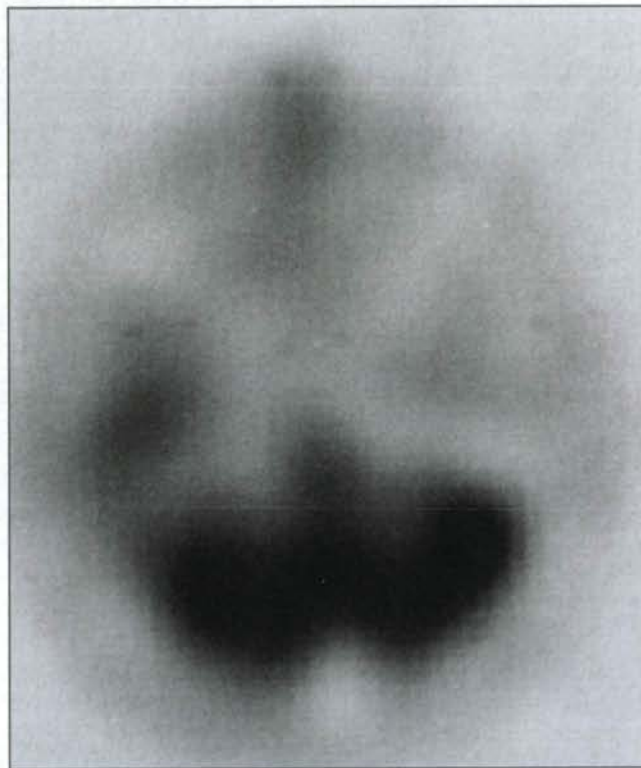
We have demonstrated abnormal activation of the right temporal lobe in this patient with CVH. This finding can be considered as supportive

evidence for the cortical release theory. The right temporal lobe is crucial for visual memory. We have acquired this knowledge by studying temporal lobe epilepsy (TLE; Barr, 1997), temporal lobectomy for TLE (Morris, Abrahams, & Polkey, 1995; Nunn, Polkey, & Morris, 1998), and Wada testing. Deficits in visual and spatial memory in patients with right mesiotemporal sclerosis are well documented (Gleissner, Helmstaedter, & Elger, 1998). We propose that activation of the right temporal lobe, as one of the areas closely involved with the visual memory, might be the responsible mechanism for CVH.

This patient reported experiencing visual hallucinations in the hemianopic field only. This phenomenon has rarely been reported in the literature (Manford & Andermann, 1998). The mechanism for laterality of the hallucinations remains unclear. Theoretically, this could be explained by the fact that the stroke



**Fig 1.** Head CT shows evidence of hemorrhagic stroke in the right calcarine cortex.



**Fig 2.** An area of increased uptake in the region of the right temporal lobe is demonstrated on Tc SPECT scan.

and subsequent metabolic changes in the temporal lobe involved the right side of the brain.

### Implications for Care

Important implications for nursing can be drawn from this case report. In elderly hospitalized patients, hallucinations and other visual disturbances are often attributed to hospital psychosis, dementia, drug reaction, or simple confusion without a full evaluation of organic factors. Further, restraints (physical or chemical) may be used based on an assumption that the hallucinating patient is likely to act upon the hallucinations, resulting in injury to herself or others.

When a patient reports hallucinations, it is incumbent upon the nurse to perform a detailed assessment, including a full physical and neurological assessment. A thorough neurological examination will elicit key findings that assist in the correct diagnosis of the problem and help guide appropriate nursing care.

The neurological assessment of this patient with complex visual hallucinations revealed normal higher cortical function and a new left-sided hemianopia. Another key parameter assessed was the patient's impression of, and response to, the hallucinations. The patient was aware of the unreal nature of the hallucinations, and she seemed unafraid and unlikely to respond inappropriately to them. When these findings were assessed in conjunction with the results of the CT and Tc SPECT scans, it became clear that there was

an organic, neurological basis to the problem of the complex visual hallucinations.

The nurse must accurately assess all reported symptoms and ensure that patient care is based on objective assessment findings, rather than on assumptions that might be biased due to the age of the patient or the unusual nature of the reported symptom. This case report highlights the need to suspect neurological disturbances as possible organic causes of hallucinations and to use all the tools of neurological assessment and neuroradiological imaging available to correctly diagnose the condition and appropriately manage the patient.

### Summary

We have described a patient with occipital lobe infarction and CVH in the hemianopic field. Increased uptake in the right temporal lobe was documented on the brain Tc SPECT scan. We propose that activation of this area might be the underlying mechanism for visual hallucinations. This case report is a clear example of the wide spectrum of the clinical manifestations in stroke victims. We also emphasize the importance of educating the medical staff about the organic basis for human behavior.

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