Jazz, Guitar, and Neurosurgery: The Pat Martino Case Report

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Key words
- Amnesia
- Amygdala
- Auditory-motor interrelations
- Brain
- Brain plasticity
- Cerebral arteriovenous malformation
- Epilepsy
- Hippocampus
- Memory
- Music
- Neurologic deficit
- Neuropsychologic assessment
- Neuroscience
- Temporal lobe

Abbreviations and Acronyms
AVM: Arteriovenous malformation
MRI: Magnetic resonance imaging
SD: Standard deviation

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OBJECTIVE: **We present the case of a professional jazz guitarist with temporal lobe epilepsy secondary to an arteriovenous cerebral malformation.**

CASE DESCRIPTION: **The patient underwent a left temporal lobectomy in 1980. After surgery, he presented with severe retrograde amnesia and complete loss of musical interest and capabilities. The patient's musical abilities recovered over time, and he regained his previous virtuoso status. In 2007, his medical history, neuropsychologic functions, and structural magnetic resonance imaging study were examined and revealed a remarkable degree of recovery of memory and musical abilities in the context of extensive temporal lobe resection. The neuropsychologic findings and neuroanatomic features of the magnetic resonance imaging study were analyzed to try to understand the high degree of recovery of both long-term memory and musical processing abilities in this musician.**

CONCLUSIONS: **This case reveals the possibility of an unusual degree of cerebral plasticity and reorganization. Additionally, it emphasizes the question of musical virtuosity. This report shows that the musical capabilities of professional musicians, in specific cases, can completely recover even when much of the left temporal lobe has been removed.**

> "I feel dropped cold, empty, neutral, cleansed… naked."
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> "And slowly but surely, piece by piece, interrelationships began to revive themselves."
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> —P.M., 1944

INTRODUCTION

Music is studied by a specific field of neuroscience, and musicians traditionally have been studied as an amalgamated group. Overall, in terms of neuroscience, musical activities of musicians are considered equal in terms of memory as well as perceptive, cognitive and motor functions. Also, there has been great interest in neurologic disabilities of musicians acquired before the era of brain function imaging methods (8). Neuroscientists have suggested that musicians with enhanced motor skills possess greater capacity for plasticity because of enriched interhemispheric connections (11) and structural asymmetry of relevant brain areas (12).

P.A. (P.M. stage name) was born in Philadelphia in 1944 and was first exposed to jazz by his father, who sang and played guitar in local clubs. Having studied briefly with Eddie Lang, a famous jazz guitarist of the time, P.M. started playing guitar when he was 12 years old. He left school at that age to pursue a music career (Azzara P: Personal communication, October 2009–2010). Before his 18th birthday, he became an icon in the jazz scene, signed as a leading artist for Prestige Records at age 20. His key albums during this period included "Strings!," "Desperado," "El Hombre," and "Baiyina," one of the first successful jazz ventures in psychedelic music.

This professional guitarist underwent surgery to treat an intracerebral hemorrhage resulting from a cerebral arteriovenous malformation (AVM), requiring a wide left temporal lobectomy. Before surgery, P.M. had a history of epilepsy associated with manic depression but no abnormalities in his musical capabilities. After surgery, he had an almost complete memory loss, showing the expected effect of an extensive injury to the left temporal lobe. He completely lost his musical capabilities including theory, technique, and skills (Azzara P: Personal communication, October 2009–2010). We present a case report detailing the exceptional history of this musician, who ultimately regained completely his previous virtuoso status. In addition, we present the neuropsychologic tests and magnetic resonance imaging (MRI) findings.

CASE REPORT

In 1976, a 32-year-old, Italian-American professional guitarist (P.M.) began experiencing holocranial headaches that gradually increased in frequency and intensity. The

headaches were associated with simple partial seizures evolving to a complex type. Partial seizures were characterized by autonomic manifestations including pallor, redness of the skin, tachycardia, epigastric discomfort, and occasional vomiting. He also experienced psychic crises characterized as delusions and olfactory hallucinations, distortion of time, emotional expressions, and behavioral disorders. These latter manifestations occurred often during 1977 (Knox I [producer and director of the documentary *Martino Unstrung*]: Personal communication, August 2009–2010). The psychic crises increased in frequency and intensity, with behavioral changes, sometimes totally chaotic, with manic depressive crisis, and long bouts of an absorbed state of complete disconnection with the environment. Complex partial seizures occurred occasionally followed by motor involvement and oroalimentary manifestations, lasting generally >1 minute. The patient usually recovered with a confusional state, gradually returning to normal condition. During this period, he traveled professionally between New York City and Philadelphia. By this time, he had published 15 jazz music albums, the last in 1977, called, ironically, "Exit." In addition, he presented with prolonged states of mania and depression and at least a couple of suicide attempts, which led to frequent patient admission in psychiatric wards, prolonged drug treatment, and sporadic electroconvulsive therapy (Azzara P: Personal communication, October 2009–2010).

In 1980, P.M. settled in Los Angeles, where he had a generalized tonic-clonic seizure that led to hospital admission. He underwent a cerebral computed tomography scan, the first in his life, was given a diagnosis of a complex AVM located in the medial and basal left temporal lobe with an associated hemorrhage. Physicians advised immediate surgery because of the life-threatening nature of the condition. However, the patient left the hospital and traveled to his hometown of Philadelphia to undergo surgery. During the first surgical procedure, an intralesional hematoma was evacuated; in the second procedure, performed after cerebral angiography, a left temporal AVM was completely resected by the senior author (F.S.). The left temporal lobe resection included approximately 70% of the temporal lobe. After a postoperative period without incident, the patient was discharged home. When discharged, he showed apparently no aphasia, but he had a profound retrograde amnesia, which included his own person, his environment, and familiar people (Knox I [producer and director of the documentary *Martino Unstrung*]: Personal communication, August 2009–2010). He also had complete loss of his musical capabilities. The rest of the physical and neurologic examination was apparently normal.

Aided by his father, P.M. was gradually introduced back into his past, with the help of photos; encounters with friends, including other musicians; and, mainly, listening to his own records (1) (Knox I [producer and director of the documentary *Martino Unstrung*]: Personal communication, August 2009–2010). The patient credited a computer with helping to revitalize his musical interest: a small Apple Macintosh with a tiny screen and a 127K system with a music program. Although the patient had not studied music formally, he recovered musical writing with pencil and musical stanzas in song sheets, transcribing 516 scale studies of Japanese, Hungarian, Chinese, and some Byzantine scales. In this way, he was deeply involved with different musical cultures (10). He returned progressively, although slowly and with difficulty, to playing the guitar—this time as if it were a toy, "to escape the situation, and to please my father" (5). The process of memory retrieval took him about 2 years. Although he never lost the dexterity to do things with his hands, the necessary skill to play guitar again to his previous musical level was brought back over years (Knox I [producer and director of the documentary *Martino Unstrung*]: Personal communication, August 2009–2010). In 1987, he recorded a jazz album called, logically, "The Return." This experience signified a return to his professional life, which remains constant to the present time except for an interruption of about 2 years for the death of his parents. P.M. is a renowned jazz musician, working continuously, with multiple awards, a busy professional schedule, and >33 music albums recorded. He still resides in his native Philadelphia.

MRI Findings

Measurements performed on cerebral MRI of 5 normal subjects were used as control. Damage to the left temporal lobe was extensive, and it appeared that the void had been filled with cerebrospinal fluid. The lesion included the whole of the temporal pole area and extended underneath and lateral to the hippocampus and amygdala. The damage to inferior temporal cortex extended more posteriorly than damage to the superior temporal cortex. In the inferior temporal lobe, the very posterior portion of the temporal fusiform gyrus looked to be intact (Figure 1). The superior temporal cortex appeared to exist from the position of the anterior end of the amygdala. Volume measurements of the hippocampi indicated that the right hippocampus was relatively large and that the left hippocampus was smaller and below the range of the control subjects. However projection sites of the left hippocampus (left fornix, mammillary bodies, and thalamus) appeared healthy and indicated that the left hippocampus was well functioning. Left and right amygdalae were the same size and appeared normal (Figure 2). However, volume measurements indicated that they were small and were outside the range of the control subjects (Table 1). Volumetric measurements indicated that the perirhinal cortex was normal on the right but abnormally small on the left (2 standard deviations [SDs] below that of the controls and outside the control range). The entorhinal cortex was normal on the right but abnormally small on the left (2 SDs below that of the controls and outside the control range). The parahippocampal cortex was normal on the right but below the range of the controls on the left. Volume measurements indicated a marked reduction in the volume of the left temporal lobe. The

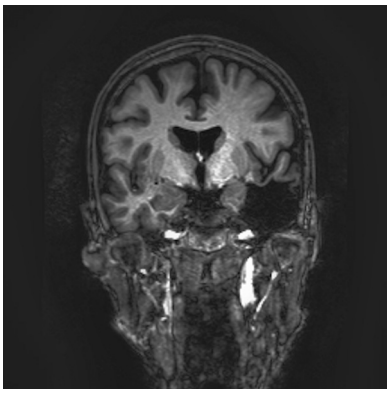

Figure 1. Coronal T1-weighted magnetic resonance imaging shows in the inferior temporal lobe that the very posterior portion of the temporal fusiform gyrus may be intact. The superior temporal cortex appears to exist from the position of the anterior end of the amygdala. The left hippocampus appeared healthy indicating that it was well functioning.