Proust and madeleine

Together in the thalamus?

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"Involuntary memories are mental states that once present in consciousness, return to it with apparent spontaneity and with no act of will; that is, they are reproduced involuntarily."[1] In his book, author Marcel Proust wrote about a vivid involuntary autobiographical memory (IAM) that was triggered by dipping a madeleine cookie into a cup of tea.[2] IAMs, also known as the "petit madeleine phenomenon," are an interesting cognitive phenomenon because they are conscious episodic memories but they are involuntarily retrieved based on associative processes.[3] They are common in both normal and pathologic states, occurring 3 times more frequently than voluntary memories.[3–5] They have been explored in the context of drug-induced states, posttraumatic stress disorder, and temporal lobe epilepsy.[2] We describe a patient with a hypertensive hemorrhagic stroke in the left posterior thalamus who subsequently experienced both multimodal synesthesia (stimulation in one sensory modality giving rise to an experience in a different modality) and IAMs.

Practical Implications

Patients with focal vascular thalamic lesions should be screened for unusual sensory phenomena such as synesthesia and involuntary autobiographical memories.

Case

The patient is a 45-year-old right-handed man with a history of hypertension. He has 18 years of education, is bilingual, and was employed as a registered nurse. He experienced a left posterothalamic hemorrhagic stroke with intraventricular blood extension and was later evaluated in our memory clinic, where he was found to have right hemiparesis, right hemisensory deficit (touch, pinprick, joint position, and vibration), right hemianopsia, and slurred speech with normal comprehension and prosody. Nine months after his stroke, the patient started experiencing multimodal synesthesia that have been described elsewhere.[5] Around the same time, the patient developed IAMs. These IAMs span from his first year of life to events that occurred in the past week. They could be triggered by sensory, tactile, olfactory, or gustatory stimuli. For example, the smell of fresh dough would trigger a rich memory of him walking barefoot on the cold granite floor in his grandmother's kitchen and grabbing his mother's index fingers as an infant would. He could recall details of this memory, including his grandmother's apron and the round feeling of the soles of his feet. He could also generalize his memories such that tasting apple pie would trigger memories of all pies he had ever tasted; they would be experienced in proper chronology and would rush into his mind like a "cascade." On some occasions, the patient does not require any sensory cues to trigger his IAMs; for example, he unexpectedly remembered a full detailed passage of his experience at the Montreal Expo as a 3-year-old. His memory for day-to-day events has become more accurate since his cerebrovascular insult. Although his motor deficits have become less pronounced, his synesthesia and IAMs (which he can voluntary suppress), occur daily.

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DISCUSSION

Autobiographical memory is a unique form of memory because it combines episodic and semantic memory; it recruits congruent as well as unique neural substrates to these memory forms.[6] It relies on a diffuse network, involving the medial and dorsolateral prefrontal cortex in self-referential processing, the hippocampus and retrosplenial cortex in recollection processing, the amygdala in emotional processing, the occipital and cuneus regions in visual imagery, and the ventral parietal cortex in top-down attention.[7] It also recruits the sensory regions and thalamus in relaying sensory information and detecting cues, which are highly connected with memory retrieval. Our patient represents a unique case because his lesion spared his medial temporal lobes, which are critical for memory; however, his infarct in the left pulvinar and posterior lateral nucleus is thought to derange his thalamocortical and thalamolimbic connections, thereby enabling cross-modal experiences. This case sheds light on the potential role of the posterior thalamus in IAMs. A previous case study on a patient with a thalamic stroke also described subsequent IAMs and argued that conscious access to autobiographical memory in IAMs may be facilitated by reciprocal connections between thalamic nuclei and temporal and frontal regions.[4] Independently, thalamic lesions contribute to the synesthetic experience[5] and, in the previous case and in our patient,[4,5] to the development of IAMs. Our patient presents a unique case in which both outcomes are experienced and the possible implications of cross-modal experiences on the development of IAMs through the common thalamic substrate can be discussed. The heightened sensory experience allows for unique sensory encoding of experiences as well as more substrates for cue recognition; this can broaden the opportunities for which engrams are viable. In a natural course, autobiographical memories can be retrieved through sensory cues, but as time passes, fewer cues are effective in stimulating this retrieval.[4] However, in synesthesia, unique opportunities present for cue recognition. Further research on capturing his IAM in a functional neuroimaging paradigm can elucidate the circuitry of IAM and its potential association with cross-modal experiences.

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