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# Visual Hallucinations in a Patient with Pons Ischemia and Bipolar Disorder Diagnosis-A Case Report with a Review of the Literature

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## Abstract

**Background:** Visual hallucinations are disturbances of perception present in various pathologies. Peduncular hallucinosis is complex visual hallucinations involving animals or often terrifying people that occur after pontine injuries. In this case report we present the clinical history of a middle-age man who reported peduncular hallucinosis due to mild but numerous ischemic lesions in the pontine region. This is a peculiar condition as the literature reports PH for much more severe injuries.

**Case presentation:** A 55-year-old Caucasian man with hypertension, dyslipidemia, carotid atheromatosis and a previous diagnosis of bipolar disorder was admitted to the psychiatry ward of the Sant'Andrea Hospital due to the appearance of a mixed mood state with psychomotor agitation, ideic acceleration, anguish, auditory hallucinations, severe anxiety, panic attacks, total insomnia, disturbances in concentration and suicidal ideation. During hospitalization, he had complex visual hallucinations. On MRI of the brain, there were numerous ischemic areas in the pontine paramedian ventral region. On audiometric examination, there was bilateral sensorineural hearing loss. The patient was discharged with Valproic Acid 1000 mg/day, Quetiapine 200 mg/day. After discharge he underwent a neuropsychological evaluation that showed a cognitive decline.

**Conclusion:** There are various cases in the literature of pontine ischemias that have given simple and complex, terrifying and beautiful visual hallucinations. Patients generally had a normal state of consciousness, no delusions, and had sleep disturbances. Lesions of the pons involving the dorsal raphe nucleus result in the loss of ascending serotonin inhibition to the dorsal lateral geniculate nucleus. Consequently, an over-excited geniculate can generate visual hallucinations at the cortical level. These ischemias in the paramedian ventral pontine region may have damaged the nucleus of the acoustic nerve causing a bilateral sensorineural hearing loss and the nuclei of the lenticular formation which, through the serotinenrgic and dopaminergic dysregulation, gave rise to visual hallucinations. These visual hallucinations can be considered PH. Considering the cognitive impairment, assessed through neuropsychological assessment, and the cardiometabolic risk factors, we can also affirm that the previous psychiatric diagnosis of bipolar disorder could have delayed the neurological diagnostic investigations.

**Keywords:** Pons ischemia • Visual hallucinations • Peduncular hallucinosis • Bipolar disorder • Bilateral sensorineural hearing loss • Cognitive impairment

## Introduction

Peduncular Hallucinosis (PH) is a form of complex visual hallucinations that include vivid, well-organized and non-stereotyped images of people or animals and have been reported in pontine lesions.

PH is associated with a range of different pathologies of the central nervous system, including vascular and infectious lesions of the midbrain, pons, and thalamus; local subarachnoid hemorrhage; compression by local and distal tumors; basilar migraines; basilar vascular hypoplasia and following regional surgical or angiographic interventions. The images are often bizarre, with decapitated human torsos or monstrous animals. Patients experience their hallucinations as genuine and are unable to discriminate their percepts from reality: in fact, by damage to the ascending reticular system and thalamocortical circuits, PH compromises cognitive functions which enable us to differentiate between illusionary percepts and reality, a reality monitoring system. Hallucinations occur throughout the day, with the patient retaining insight. Sleep disturbances are common due to the dysregulation of REM sleep mechanisms. Lhermitte was

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the first to describe PH in 1922. Brainstem lesions appear to affect the ascending cholinergic and serotonergic pathways. These brainstem abnormalities are often associated with sleep disturbances [1].

## Case Presentation

A 55-year-old caucasian man with hypertension (in therapy with cardioaspirin 100 mg/day, amlodipine 10 mg/day and perindopril-indapamide 10-2,5 mg/day), hypertriglyceridemia and hypercholesterolemia (in therapy with ezetimibe-simvastatin 10 mg/day) and carotid atheromatosis, arrived at the Emergency Department of the Sant'Andrea Hospital in Rome accompanied by his wife for the appearance of severe agitation. The patient underwent evaluation of vital signs, blood tests, toxicological examination, and electrocardiogram. These were good. The neurologist viewed an echo color doppler of the supra-aortic trunks done in September 2020, which showed a 30% plaque on the right and a 20% plaque on the left, and an MRI of the brain done in September 2020 that showed faded areoles of the periventricular white matter. In the previous years he also underwent different CT scans without contrast that shown asymmetry of the lateral ventricles with prevalence of the left one. The neurological exam was good and recommended a new brain MRI and a new visit to neurology clinics. During the psychiatric visit, the patient was hypervigilant, oriented in space and concerning people but slightly disoriented in time. He presented with severe anxiety with dyspnoea and the need to use oxygen therapy. He had ideic acceleration and strong emotional lability with sudden unmotivated crying and severe anguish [2].

He presented important suicidal ideation. During the visit, the patient talked to himself and had auditory hallucinations of an imperative nature that urged him to kill himself by defenestration. The patient said he had been suffering from insomnia for a few days. Therapy was set up with IV Lorazepam 4 mg and he was admitted to the psychiatry ward with a diagnosis of mixed mood. During the hospitalization, the patient's medical history was created and emerged a previous diagnosis of bipolar disorder in therapy with valproic acid chrono 600 mg/day, quetiapine 50 mg/day, escitalopram 10 mg/day, alprazolam 1 mg/day and clonazepam 1 mg/day. The patient was familiar with cerebrovascular and psychiatric pathologies. His father died of a cerebrovascular disease [3]. He lived with his mother who was suffering from generalized anxiety disorder and the mother's partner, an alcoholic, who mistreated the patient. The patient had a brother and two sisters. Both sisters had an unspecified mood disorder. The patient had a normal psychomotor development; he had a middle school diploma, undertook military service and, at the moment of the examination, was working as a dustman. He married at the age of 33 and had two children. During his youth he used cannabis and cocaine. The onset of the bipolar disease occurred at age 35 with a manic episode with psychotic symptoms. The patient presented a euphoric mood, increased energy, motor agitation, severe insomnia and persecutory and referential delusions.

The patient went to a psychiatrist and started benzodiazepine therapy for a short time. Over the next few years, the patient exhibited mildly severe depressive and manic episodes. At the age of 49, he went to a psychiatry clinic, on the advice of his wife, following the appearance of an irritable mood, auditory hallucinations of the imperative type, severe psychomotor agitation, severe anxiety, panic attacks, verbal aggression and insomnia. He began therapy with valproic acid and unspecified antipsychotics which he followed intermittently. The pathology then became more serious with the increase in intensity and frequency of depressive episodes and manic episodes. The patient went to the Emergency Department several times for anxious symptoms and the therapy was changed [4]. At the age of 53, the patient presented an agitated depressive episode and went to the psychiatry clinic of the Sant'Andrea Hospital in Rome. He started a therapy with lithium, Valproic Acid, Benzodiazepines and Escitalopram. In the past year, the patient presented with anguish, agitation, panic attacks, ideic acceleration, auditory hallucinations, memory disturbances, attention disorders, and suicidal ideation. The patient began hospitalization with Valproic Acid 1000 mg/day orally, Olanzapine 20 mg/day orally, Lorazepam 4 mg+ Chlorpromazine 50 mg. Olanzapine was discontinued after a few days due to cardiometabolic risk and replaced with Quetiapine 50 mg/day.

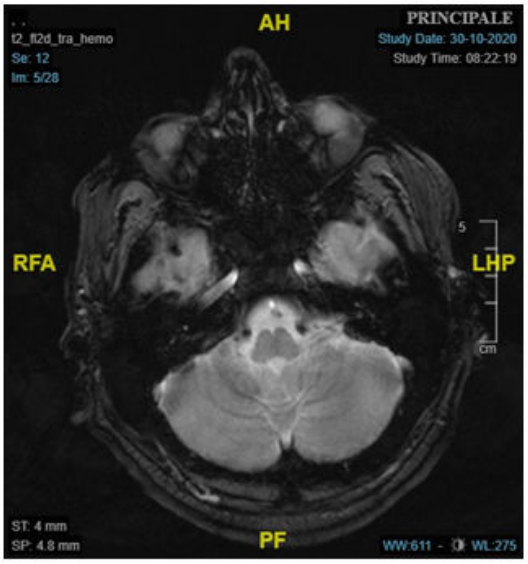


**Figure 1.** Hyperintensity areolas in the paramedian ventral pontine region, secondary to chronic ischemic cerebrovascular disease CSF spaces and the subtentorial ventricular system.

The patient underwent the following: blood chemistry tests, a brain MRI scan, a neurological consultation, an audiological examination. Blood chemistry tests showed only mild normocytic hypochromic anemia. During hospitalization, the patient presented a gradual improvement in agitation and anguish. Insomnia and auditory hallucinations persisted, which were imperative voices telling him to commit suicide. For this reason, Lurasidone was added which after a few days was suspended. While in hospital, he had complex visual hallucinations. The patient said he saw ants and other animals on the floor, pictures and images terrifying, like dragons, and of beautiful nature on the walls. At first, these manifestations were considered as psychiatric symptoms. He continued to have upper limb tremors, memory disturbances and attention disorders. For a suspicion of cognitive impairment he did an MRI of the brain. Brain magnetic resonance imaging showed hyperintensity areoles secondary to chronic ischemic cerebrovascular disease in the supratentorial white matter and especially in the paramedian ventral pontine region, increased periencephalic CSF spaces and the subtentorial ventricular system

(Figure 1). Considering the visual hallucinatory symptomatology with extremely vivid character, the MRI findings and the patient's cardiovascular risk, the diagnosis of Peduncular Hallucinosis was hypothesized. He later did neurological counseling [5].During the examination there was a bilateral postural tremor in the upper limbs, asymmetrical in prevalence to the right and a slight widening of the support base in maintaining an upright position and walking as an initial impairment of the cerebellum function. The neurologist recommended neuropsychological tests. The patient had had tinnitus and hearing loss for some months. In fact, during the visits the doctors had to repeat the questions asked several times. The patient underwent audiometric and impedance tests. There was moderate-severe bilateral sensorineural hearing loss, and bilateral tympanogram type A. Hearing aids were recommended. In the last days of hospitalization, the patient began to have more insight into his psychiatric disorder despite reconstructing his past events in an elementary way. Emotional lability, agitation and auditory despair disappeared. Complex visual hallucinations, insomnia, tremor in the upper limbs, and memory disturbances and attention persisted. The patient was discharged with Quetiapine 200 mg/day, Valproic Acid 1000 mg/day and was given an appointment in the psychiatry clinic of the Sant'Andrea Hospital. About a month after discharge, the patient underwent a neuropsychological evaluation that showed a cognitive profile characterized by: Executive-frontal deficits; short and long term visuo-spatial memory deficits; deficit of recognition of targets previously learned within a list composed of distractors; slight difficulty in short-term memory and delayed recall of auditory-verbal material and mild constructive apraxia. In fact, he scored below the normality cut off on the following tests: Rey Auditory Verbal Learning.

## Discussion and Conclusion

The pons is the central part of the brain stem. It is formed by an anterior or basilar part and a posterior or tegmental part. The pons has the nuclei of the following cranial nerves: fifth or trigeminal nerve, sixth or abducens nerve, seventh or facial nerve, eighth or auditory nerve. The pons also has the core of the trapezoid body, the superior olive core, the basilar core of the pons, the cores of the reticular pons formation, and the locus coeruleus. The loss of brainstem control of the cortex is crucial for subcortical hallucinations and cognitive defects. Excitatory, cholinergic projections arise from pontine tegmentum and inhibitory, serotonergic projections arise from the dorsal raphe nuclei. Both these projections influence the dorsal Lateral Geniculate Nucleus (LGN) of the thalamus that gives projections to visual cortical regions. Brainstem lesions may affect the inhibitory serotonergic inputs and overexcite the dorsal LGN leading to complex visual hallucinations. Nevertheless, the dorsal raphe nuclei is also implicated in sleep-wake cycle and regulation of REM and NON-REM sleep, so that the visual experiences of PH are similar to those of REM sleep. In the literature there are various cases of patients with visual hallucinations due to pontine lesions. In this report, a review of the literature was also conducted. The studies were identified through research in electronic database, carried out using the following string "peduncular hallucinosis". The research was completed on March 23, 2021, producing 93 results on PubMed. Of these, 36 were discarded since the abstract or the article were not available or unrelated to the subject of the present study. The final total database was restricted to 57 articles.

It has been noted that the majority of cases of PH reported in the literature are related to brainstem tumors in pediatric age, while in adults ischemic lesions, stroke, hemorrage, surgical trauma, metastatic lesions at the level of the brainstem or posterior compression by tumor masses present in neighboring sites as well as by edema are important. Only one case has been traced to the presence of an area of gliosis in the left cerebral peduncle. There are no guidelines on the treatment of peduncular hallucinations. Various studies have found psychotropic drugs, such as atypical antipsychotics, selective serotonin reuptake inhibitors, and anticonvulsants to be effective. Atypical antipsychotics, which modulate serotonin activity and dopamine antagonism, are likely to have a beneficial role in these patients. Clozapine is effective. Quetiapine is more widely used than clozapine, but there is less evidence of efficacy: Pimavanserin, an antipsychotic with potent reverse agonist activity at the 5HT2A receptor, has emerged as a potential new therapy. Our patient presented various ischemias in the paramedian ventral pontine region. These ischemias may have damaged the acoustic nerve's nucleus, causing a bilateral sensorineural hearing loss, and the nuclei of the lenticular formation which, through the serotoninergic and dopaminergic dysregulation, gave rise to visual hallucinations, that can be considered peduncular hallucinosis. Furthermore, considering the cardiometabolic risk factors and the cognitive impairment, assessed through neuropsychological assessment, we can affirm that the diagnosis of bipolar disorder that the patient received at the age of 35- could have delayed the neurological diagnostic investigations and have led to consider psychiatric a symptomatology that was instead expression of an initial process of cognitive impairment.

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