Pathological Laughing in a Patient with a Pontine Tumor

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Abstract

An 18-year-old man presented with the complaints of occasional headache and limb weakness associated with slurring of speech and purposeless laughing. Magnetic resonance imaging showed a diffuse altered signal intensity area involving the pons with asymmetrical expansion. The patient underwent surgical resection. Histology revealed WHO grade IV glioblastoma.

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CONFLICT OF INTEREST

None of the authors have potential conflicts of interest to be disclosed.

RUNNING TITLE

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ABSTRACT

An 18-year-old man presented with the complaints of occasional headache and limb weakness associated with slurring of speech and purposeless laughing. Magnetic resonance imaging showed a diffuse altered signal intensity area involving the pons with asymmetrical expansion. The patient underwent surgical resection. Histology was suggestive of a WHO grade IV glioblastoma. Pathological laughing in a patient with a pontine lesion is a very rare presentation. Evidence for a mechanism of action underpinning how pontine lesions can cause such behavioral changes through the disruption of a network of cerebro-ponto-cerebellar pathways is discussed.

Keywords: Pathological laughing, Pons, tumor

Introduction

Pathological laughing and crying (PLC) can be described as uncontrollable episodes of laughing or crying that are triggered by a stimulus that would not normally cause either response.[1] Patients with a lesion

in the pons mainly present with features of motor deficits, and associated cranial nerve palsies. However, pathological laughter in a patient with a pontine lesion is a very rare presentation. The disruption of a network of cerebro-ponto-cerebellar pathways has been considered to be a possible mechanism for such behavior. We report a case of pathological laughing in a patient with pontine tumor.

Case report

An 18 year-old man presented with a headache for 1 month and limb weakness for 10 days. He also had slurring of speech and purposeless laughing while talking over the same duration. On examination, motor power in the lower limb was 4/5 in all limbs, with increased tone and exaggerated deep tendon reflexes. Ankle clonus was present. Hand grip was weak in both hands (Right > Left). A sensory exam appeared to be intact.

Magnetic resonance imaging (MRI) showed diffuse altered signal intensity area involving the pons with its asymetrical expansion predominantly on the left aspect measuring 29 x 32 x 39 mm (Figure 1A-1B). The lesion was causing dorsal displacement of the floor of the fourth ventricle, with compression of the middle cerebellar peduncle. This was towards the left side, was abutting both the basilar artery and its anterior displacement with normal flow voids. The post contrast image showed thick, irregular, and heterogeneous enhancement within the expanded pons (Figure 2 A-2B). Magnetic resonace spectroscopy showed a decrease in NAA and an elevated choline/ creatinine ratio. The patient was diagnosed with pontine tumor and underwent a left retrosigmoid craniectomy, and gross total excision of the tumor was achieved. Postoperative imaging showed complete resection of the tumor. Histopathological examination was suggestive of glioblastoma (Figure 3). A customized immunohistochemistry panel was advised, which revealed immunoreactive Olig-2, Ki-67,ATRX, P53 and H3K27M.

The patient's postoperative recovery was uneventful with mild hemiparesis and facial palsy. The patient was discharged on tenth postoperative day with satisfactory outcomes and a Karnofsky performance score (KPS) of 50%. Postoperatively, the patient was then scheduled for referral to a cancer center for further treatment. However, he unfortunately passed away in a local hospital while receiving treatment for pneumonia.

Discussion

Pathological laughing has been reported across literature in cases of tumor[1,2], infarction and abscess[3]. The exact mechanism is still poorly understood, with various pathological proposals. Oppenheim, Siemerling, and Wilson suggested that modulation is facilitated by direct corticobulbar pathways and in a liner top-down model.[4,5] They posited that PLC occurs when the voluntary control of the emotional expression fails due to bilateral lesions of the descending corticobulbar tracts. Parvizi et al, suggested that an intact relationship between the cerebral cortex and cerebellum is important for a normal regulation of emotional expression.[6] They propose therefore that problems with an exaggerated or contextually inappropriate emotional response result when the cerebellar modulation of these behaviors is impaired by a lowered emotional threshold, or by a incorrect, contextually inappropriate response. Wilson et al, suggested that a brainstem faciorespiratory center could act as a mechanism of this phenomenon.[5] This center was presumed to be under the control of higher centers, and pathological laughter was thought to ensue when they were incapable of exerting their inhibitory influence on the faciorespiratory center.

Structures such as the pre frontal cortex, anterior cingulated cortex, internal capsule, thalamus, subthalamic nucleus, basis pontis, and cerebellar white and gray matter have been implicated in PLC, as revealed by many studies. The basis pontis stands out as the only identified site where a discrete lesion can cause PLC.[7]

Functional imaging studies have proved helpful in discovering the neural correlates for both pathological and normal regulation of emotional expression.[8] They used three types of fMRI experiment tasks, including facial recognition,semantic decision, and motor function to establish the response to non-specific stimuli. The patient showed consistently abnormal pontine activation while performing all tasks before treatment, which was not present for any of the controls. However, the exaggerated pontine activation was normalized after patients were treated with paroxetine, terminating the laughing episodes. Thus, their study suggested

that serotonergic replacement decreases the aberrant activity in a circuit that involves the pons.

Various reports suggested that tricyclic antidepressants such as amitriptyline and nortriptyline and selective serotonin reuptake inhibitors (SSRIs) are effective in treating PLC.[9,10] Abnormal fMRI results disappearing with clinical improvement after treatment with paroxetine also suggested some SSRI efficacy in PLC.[8]

Pathological laughing was the only feature shown by the case reported. The patient's postoperative recovery was uneventful with mild hemiparesis and facial palsy. He had no purposeless laughing after the surgery. The patient was discharged with satisfactory outcome with a KPS of 50%. Postoperatively, the patient was scheduled for referral to a cancer center for further treatment. However, he suffered from pneumonia and passed away in another local hospital during the pneumonia treatment process.

Conclusion

We have presented a very rare case of pathological laughing in a patient with a pontine tumor. Patients with the features of PLC are often underestimated. Therefore, these symptoms may serve as an early indicator for disease progression. An understanding of the mechanisms underlying these behavioral changes may help in providing both clinical and psycho-social care.

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CONFLICTS OF INTEREST

None of the authors have potential conflicts of interest to be disclosed.

AUTHOR CONTRIBUTIONS

Gopi Nepal was involved in the original draft, conceptualization, review, and editing. Pritam Gurung involved in the review, editing, and supervision. Anik Jha was involved in the review, and editing. Durga Khadka and Resha Shrestha established the diagnosis and treated the patient. Basant Pant involved in supervision.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval of the case report is not needed by the local ethical guideline. Written informed consent was obtained from the patient to include the clinical details.

KEY CLINICAL MESSAGE

Pathological laughing in a patient with a pontine lesion is a very rare presentation. Patients with the features of PLC are often underestimated. Therefore, these symptoms may serve as an early indicator for disease progression.

References

1. Cantu RC, Drew JH. Pathological laughing and crying associated with a tumor ventral to the pons. Case report. *J Neurosurg* . 1966. doi:10.3171/jns.1966.24.6.1024

2. Hargrave DR, Mabbott DJ, Bouffet E. Pathological laughter and behavioural change in childhood pontine glioma. *J Neurooncol* . 2006. doi:10.1007/s11060-005-9034-8

3. Elyas AE, Bulters DO, Sparrow OC. Pathological laughter and crying in patients with pontine lesions: Case report. *J Neurosurg Pediatr* . 2011. doi:10.3171/2011.8.PEDS11265

4. Text-Book of Nervous Diseases for Physicians and Students. By Professor H. Oppenheim, of Berlin. Authorised translation by Alexander Bruce, M.D., F.R.C.P.E., LL.D. Fifth enlarged and improved edition. Edinburgh, 1911. 432 illustrations and 8 plates. Pric. *J Ment Sci* . 1911. doi:10.1192/bjp.57.237.376

5. Wilson SAK. Some Problems in Neurology: Pathological laughing and crying. *Psychopathol J Neurol* . 1924.

6. Parvizi J, Anderson SW, Martin CO, Damasio H, Damasio AR. Pathological laughter and crying: A link to the cerebellum.*Brain* . 2001. doi:10.1093/brain/124.9.1708

7. Parvizi J, Coburn KL, Shillcutt SD, Coffey CE, Lauterbach EC, Mendez MF. Neuroanatomy of pathological laughing and crying: A report of the american neuropsychiatric association committee on research. *J Neuropsychiatry Clin Neurosci* . 2009. doi:10.1176/jnp.2009.21.1.75

8. Kosaka H, Omata N, Omori M, et al. Abnormal pontine activation in pathological laughing as shown by functional magnetic resonance imaging.*J Neurol Neurosurg Psychiatry* . 2006. doi:10.1136/jnnp.2005.073288

9. Schiffer RB, Herndon RM, Rudick RA. Treatment of Pathologic Laughing and Weeping with Amitriptyline. *N Engl J Med* . 1985. doi:10.1056/nejm198506063122303

10. Burns A, Russell E, Stratton-Powell H, Tyrell P, O'Neill P, Baldwin R. Sertraline in stroke-associated lability of mood. *Int J Geriatr Psychiatry* . 1999. doi:10.1002/(SICI)1099-1166(199908)14:8<681::AID-GPS49>3.0.CO;2-Z

Figure legend

Figure 1

Magnetic resonance imaging (T1 axial and saggital) shows diffuse altered signal intensity area involving the pons with its asymetrical expansion predominantly on the left aspect measuring 29 x 32 x 39 mm. The lesion is causing dorsal displacement of floor of the fourth ventricle with compression of the middle cerebeller peduncle more on the left side, and is abutting the basilar artery and its anterior displacement with normal flow voids.

Figure 2

Magnetic resonance imaging contrast (T1 axial and coronal) shows thick irregular and heterogeneous enhancement with in the expanded pons.

Figure 3

Histopathological examination showing increased cellularity and the cells are arranged in diffuse pattern in a fibrillary background. The cells are moderate to markedly pleomorphic and hyperchromatic with abundant eosinophilic cytoplasm. The nuclei are round, oval and elongated. Microvascular proliferation, few gemistocytes, necrosis in a tiny focal area and hemorrhage are also seen. (Magnification 10 X)