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Case Report

Pinealoma Masquerading as Post-Epidural Spinal Injection Dural Tear/Side Effect in a Patient with Chronic Back Pain

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Abstract

Introduction: Pineal gland neoplasms are uncommon, accounting for less than 1% of adult brain tumors. The variable morphology, radiological characteristics, and symptomatic manifestations further complicate the prompt diagnosis and management. Symptoms commonly arise from the tumor's mass effect with compression of surrounding structures (e.g., headaches, nausea, vomiting, blurry vision, vertigo, fatigue) and may further induce obstructive hydrocephalus and Parinaud's syndrome. However, with Non-Specific or atypical pinealoma presentation, overlapping medical history suggestive of alternative etiologies may obscure the underlying diagnosis and delay appropriate workup and treatment.

Case Presentation: We present a 41-year-old man with a history of chronic lower back pain and lumbar disc herniation presenting with worsening fatigue, cognitive lapses, and gait issues for three to four weeks, as well as nausea, vomiting, and blurry vision for the last three days. One month ago, the patient underwent bilateral L5-S1 transforaminal epidural steroid injection for lumbar radiculopathy and discogenic pain, which resolved the pain. Presentation appeared consistent with dural tear secondary to recent epidural injection. Brain imaging was obtained in the setting of altered mental status and neurologic symptoms. MRI showed a 17mm enhancing pineal mass with associated supratentorial obstructive hydrocephalus, with grade 1 papilledema found on ophthalmologic exam. CT chest/abdomen/pelvis was negative for primary lesions. Six days after initial presentation, the patient underwent an endoscopic third ventriculostomy for pineal tumor biopsy, and CSF collection for hydrocephalus treatment. The patient tolerated the procedure well without complications, was deemed medically and neurologically stable, and was discharged two days post-operatively. He continued to have lapses in judgment, fatigue, and double vision, and underwent a full craniotomy three weeks after discharge, which revealed a vermis lesion. Pathological report revealed a high-grade glioma.

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Conclusion: Unintentional dural tears occur in 1-3% of epidural spinal injections, commonly presenting as headaches, nausea, vomiting, and dizziness/ataxia. However, this case highlights the need for clinical suspicion of alternative causes for similar presentation and the utility of further workup.

Keywords: Pineal tumor; Epidural spinal injection; Dural tear.

Introduction

Pineal tumors, or pinealomas, are a relatively rare growth of the pineal gland region accounting for less than 1% of adult brain tumors [1]. Pineal tumors can affect all ages and pose intricate diagnostic and therapeutic challenges to healthcare practitioners due to the diverse histological types and varied clinical presentations [2,3,4]. That are classified, based on histopathologic etiology, into germ cell tumors, pineal parenchymal tumors, and tumors of the surrounding structures (e.g., gliomas from glial cells) [4]. Tumors are further classified by grade, with increasing tumor growth rate and invasive capacity with increasing grade [5].

The typical presentation of pineal tumors is characterized by symptoms arising from the tumor's mass effect with compression of surrounding structures; almost all pineal tumor patients develop triventricular, non-communicating obstructive hydrocephalus by the time of presentation due to the obstruction of the Sylvian aqueduct [6]. The resultant rise in intracranial pressure (ICP) manifests with the most common pinealoma symptoms of headaches, nausea, vomiting, which can be found in the majority of patients [7,8]. Additionally, patients can concomitantly display papilledema on fundoscopic exam, gait disturbances, ataxia, and urinary incontinence [4,8,9]. The neoplastic infiltration leading to these hydrocephalic symptoms may range from acute, subacute, to chronic onset, depending on the individual tumor characteristics [4].

However, the clinical picture of pineal tumors is not always confined solely to these typical features, and atypical presentations of pineal tumors present a more complex diagnostic scenario. Large pineal tumors may rarely present with severe motor deficits such as hemiparesis or hemisensory loss due to impingement of the corticospinal and corticopontine fibers [10,11]. Patients with elevated ICP can also infrequently develop cognitive deterioration such as recent and anterograde episodic memory disturbances involving both verbal and visual memory modalities [6,12]. Ophthalmologic manifestations are also seen less commonly, but primarily involve an upward gaze paresis-Parinaud's syndrome-caused by pressure on the dorsal midbrain [4,8]. Diplopia, oculomotor nerve palsies, pupillary dilation, nystagmus, and decreased visual acuity have also been described [4]. Compression or invasion of surrounding endocrine structures, including the hypothalamus and pituitary gland, can present as diabetes insipidus characterized by polyuria and polydipsia, precocious puberty, panhypopituitarism, hypogonadotropic hypogonadism, or adrenal insufficiency [4,13,14]. Endocrinologic disturbances may also present as fatigue, decreased libido, gynecomastia, or anorexia [15]. Additionally, disruption of melatonin synthesis by the pineal gland can lead to sleep and circadian rhythm disturbances and may

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even be implicated in psychiatric disturbances such mood disorders and schizophrenia [16]. Rarely, pineal tumors can present with symptoms of intratumoral, subarachnoid or intraventricular hemorrhage, or pineal apoplexy, though the etiology of bleeding has remained unclear [17-20]. The unique anatomical location of the pineal gland portends a remarkable range of clinical symptoms stemming from even minor tumor growth, infiltration, and impingement. Early diagnosis of pineal tumors is of paramount importance, in order to initiate appropriate treatment modalities (e.g., surgical resection, radiation therapy, or chemotherapy). Thus, clinicians must be aware of the varied presentation and initial warning signs pineal tumors can present with and be wary of clinical situations where these often-nonspecific presentations may masquerade as other diagnoses. We present the case of a patient with chronic back pain presenting with suspected post-epidural spinal injection dural tear incidentally found to have a pineal tumor.

Case report

We present a 41-year-old man with a history of chronic lower back pain and lumbar disc herniation presenting with worsening fatigue, cognitive lapses, and gait issues for three to four weeks, as well as nausea, vomiting, and blurry vision for the last three days. One month ago, the patient underwent bilateral L5-S1 transforaminal epidural steroid injection for lumbar radiculopathy and discogenic pain, which resolved the pain. Presentation appeared consistent with Dural tear secondary to recent epidural injection. Vitals were within normal limits, and blood work was notable for an elevated white blood cell count (16.5), glucose (156), BUN (30), and creatinine (1.4). Brain imaging was obtained in the setting of altered mental status and neurologic symptoms. MRI showed a 17mm enhancing pineal mass with associated supratentorial obstructive hydrocephalus, with grade 1 papilledema found on ophthalmologic exam. CT chest/abdomen/pelvis was negative for primary lesions. Six days after initial presentation, the patient underwent an endoscopic third ventriculostomy for pineal tumor biopsy, and CSF collection for hydrocephalus treatment. The patient tolerated the procedure well without complications, was deemed medically and neurologically stable, and was discharged two days post-operatively. He continued to have lapses in judgment, fatigue, and double vision, and underwent a full craniotomy three weeks after discharge, which revealed a vermis lesion concerning for metastasis of his primary pineal cancer. Pathological report revealed a high-grade glioma.

Discussion

Lumbosacral radicular pain is one of the most common causes of back pain in adults, with a One-Year prevalence estimated from 3% to 14% [21,22]. Therapeutic epidural steroid injections (ESIs) have become the most popular non-Surgical treatment option for patients suffering from lumbosacral radicular pain [23]. Particulate and non-particulate corticosteroid injections aim to provide relief from pain and discomfort via stimulating an anti-inflammatory process, inhibiting the expression of pro-inflammatory cytokines around the affected nerves in the epidural

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space [24]. Notably, while ESI use has been demonstrated to be more effective in lumbosacral radicular pain control and functional improvement than conservative treatments in the short and intermediate-term, effects are not clearly maintained in the long-term [25]. It is crucial to consider the potential side effects and complications associated with ESI in weighing its risks and benefits. Complications are typically minor, most commonly consisting of nonspecific headache, dural puncture and post-dural puncture headache, irregular periods, thoracic pain, rash, sinusitis, hypotension, nausea and tinnitus [23,26]. Up to 10% of patients receiving ESI may have suppression of morning cortisol levels, which could possibly contribute to systemic effects including Cushing syndrome, osteoporosis, and hyperglycemia that persist for weeks post-injection [26-28].

A Cochrane review of 2470 patient cases by Oliveira et al. reported no major or minor events during short-term follow-up after ESIs or placebo injections, though noted that most trials provide limited evidence of minor adverse events to support drawing conclusions regarding safety [23]. Major adverse effects are rare, but can include severe infection (e.g., epidural abscess, discitis, osteomyelitis, meningitis) occuring in up to 0.1% of spinal injections [29]. Epidural hematomas are observed in fewer than 1 in 150,000 cases, and permanent neurological damage (e.g., foot drop) has only been reported in case reports [29]. Post-dural puncture effects manifest from a leak of cerebrospinal fluid (CSF) at the puncture site that causes traction on the meninges and subsequent vasodilation of cerebral vasculature, with a lowering of intracranial pressures [30,31]. Incidence estimates vary between 2% to 40% of lumbar puncture procedures and are dependent on size of needle and patient risk factors [32]. Presentation involves a bilateral frontal or occipital headache aggravated in the upright position, nausea, neck pain, dizziness/ataxia, tinnitus, hearing loss, and visual changes [32]. Lowered intracranial pressure can further lead to photophobia and altered mental status [31]. Though approximately 90% of post-dural headaches occur within 72 hours of the dural puncture and resolve within a week, some studies suggest an increased risk of longer-term, persistent headaches lasting over 6 weeks [33-36].

The patient's chief complaint upon presentation one month after ESI; however, his fatigue, cognitive lapses, ataxia, nausea and visual changes initially pointed his clinical picture towards a post-dural puncture picture considering his recent treatment. A diagnostic challenge arose as post-dural puncture symptoms may mimic other, distinct pathophysiologic processes, even-paradoxically-intracranial hypertension. Mechanisms which might result in a similar array of symptoms include meningitis (if associated with fever), pachymeningeal inflammation-can be idiopathic or secondary to human T-cell leukemia, fungal infection, tuberculosis, sarcoidosis, etc.), collagen vascular disorders, and brain growths including pineal gland enlargement, meningiomas, or a plaque lymphoma [37]. Both intracranial hypertension and hypotension can result with headaches,

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nausea and vomiting, and visual disturbances [38]. Brain imaging was obtained for the patient due to heightened clinical suspicion regarding the duration of his symptoms, uncharacteristic cognitive lapses, and acuity of symptom progression within the last three days. A pineal glioma and vermis lesion were ultimately identified, resultant of prompt neurosurgical intervention and continued management.

Neuroimaging plays the pivotal role in diagnostic work-up of pineal masses and suspected malignancy [5]. Diagnosis remains challenging given the aforementioned variety of symptoms and common overlap with alternative diagnoses. Laboratory serum or cerebrospinal fluid tumor markers may play an increasingly important role, but a high clinical suspicion-especially in the presence of symptoms associated with obstructive hydrocephalus-is required to pursue such testing and imaging [5]. Pathological analysis of this patient's primary tumor revealed a high-grade glioma, with an additional vermis lesion subsequently discovered on further imaging. Gliomas are tumors arising from glial cells of the brain and spinal cord that display a wide distribution of possible anatomical locations, though most frequently developing in the frontal and temporal lobes of the cortex [39]. Beyond the most common initial presentation of headaches-a product of tumor growth mass effect-multiple case reports have reported anecdotal evidence of gliomas presenting with a diverse array of nondescript symptoms as witnessed in this case's patient, in whom at least two sites of malignancy were identified though additional lesions may be discovered in future workup [40]. A 67-year-old man presented with 2 months of vertigo and hearing disturbances, and radiological imaging revealed a temporal glioblastoma [41]. A 35-year-old woman with balance disorders was revealed to be caused by a low-grade brainstem glioma [42].

In a pediatric case, a 6-year-old girl presented with paroxysmal headaches, nausea, vomiting and vertigo for 6 months, preceding the more acute onset of paroxysmal neurological abnormalities with normal interictal examination, similarly diagnosed with a brainstem glioma [43]. A 13-year-old boy was diagnosed with depression following three weeks of reduced speech, hypersomnia, and psychomotor retardation preceded by three months of headache, found to have bilateral, convergence-retraction vertical nystagmus, and further worked up to reveal a large pineal gland germinoma [44]. In these cases, a detailed history of illness with emphasis on symptom timeline and a comprehensive neurological exam revealed crucial information prompting neuroimaging and subsequent tumor diagnosis and treatment. Surgical resection of any mass in the pineal region poses a complex anatomical challenge; surgical resection of these tumors has historically been associated with high postoperative recurrence and mortality [45,46]. With continuous exploration and advancement in the field of neurosurgery, the effect of pineal tumor treatment has greatly improved, with reduced mortality and recurrence rates associated with the development of microscopy and concurrent treatment with radiotherapy [47]. However, treatment remains challenging and controversial, with no consensus to date on

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the efficacy and safety of different treatment options further limited by the rare nature of these cases [46].

In 2023, Hu et al proposed a treatment strategy following the radiographic discovery of a pineal tumor, stratified by tumor type, serum markers, extent of growth, and patient age [46]. Following these guidelines, the 41-year-old patient with a malignant glioma should undergo surgical resection, radiotherapy, and chemotherapy. In a patient presenting post-ESI with nondescript neurological symptoms concerning for an adverse event from injection, given the lack of specificity in clinical presentation across a wide range of potentially serious conditions, high clinical suspicion for differential etiologies is imperative for the effective workup and management of uncommon diagnoses as seen in this case.

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