Section: General Medicine

Case Report

ACUTE BASAL GANGLIA HEMORRHAGE AS THE INITIAL PRESENTATION OF EXTRA-ADRENAL PARAGANGLIOMA IN AN ADOLESCENT: A CASE REPORT

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ABSTRACT

Background: Intracerebral hemorrhage (ICH) in adolescents is uncommon and often indicates an underlying secondary etiology. Among these, catecholamine-secreting tumors such as paragangliomas are rare but potentially life-threatening causes of severe hypertension and vascular complications.

Case Presentation: We report the case of a 15-year-old male who presented with sudden onset left-sided hemiparesis and slurred speech. On admission, he was found to have severe hypertension (200/110 mmHg). Neuroimaging revealed a right basal ganglia hemorrhage. Further evaluation uncovered a history of episodic headache, palpitations, sweating, and abdominal pain suggestive of catecholamine excess. Abdominal imaging demonstrated a well-defined enhancing mass in the aortocaval region adjacent to the right adrenal gland. Biochemical analysis showed significantly elevated urinary metanephrine levels, confirming the diagnosis of an extra-adrenal paraganglioma.

Management and Outcome: The patient was managed conservatively for intracerebral hemorrhage with blood pressure control using intravenous labetalol and osmotherapy. Rehabilitation therapy was initiated, and the patient was subsequently referred for definitive surgical management of the tumor.

Conclusion: This case highlights the importance of considering paraganglioma as a rare but critical cause of hypertensive intracerebral hemorrhage in adolescents. Early recognition through clinical suspicion, biochemical testing, and imaging is essential to prevent morbidity and mortality.

Keywords: Intracerebral hemorrhage; basal ganglia; paraganglioma; adolescent hypertension; catecholamine excess; stroke in young.

INTRODUCTION

Intracerebral hemorrhage (ICH) is a relatively rare but serious neurological emergency in the pediatric and adolescent population, accounting for a small proportion of all stroke cases in this age group.[1] Unlike adults, where chronic hypertension is the predominant risk factor, ICH in younger individuals is more frequently associated with secondary causes such as vascular malformations, coagulation disorders, infections, neoplasms, and metabolic or endocrine abnormalities. Identifying the underlying etiology is crucial, as it significantly influences both acute management and long-term prognosis.[2]

Among endocrine causes, catecholamine-secreting tumors—including pheochromocytomas and paragangliomas—represent an uncommon but important subset.[3] Paragangliomas are extra-adrenal neuroendocrine tumors that arise from chromaffin cells of the sympathetic or parasympathetic nervous system. These tumors are capable of producing excessive catecholamines, leading to episodic or sustained hypertension.[4] Although rare, with an estimated incidence of 2–8 cases per million population annually, their clinical significance lies in their potential to cause severe cardiovascular and cerebrovascular complications.

The classical clinical presentation of catecholamine-secreting tumors includes the triad of episodic headache, palpitations, and diaphoresis. However, this triad is not always present, and symptoms may be intermittent, leading to delayed or missed diagnosis. In pediatric and adolescent patients, the diagnosis is particularly challenging due to the low index of suspicion and the nonspecific nature of symptoms.[5,6] Persistent or paroxysmal hypertension in this age group should always prompt evaluation for secondary causes, including endocrine tumors.

Excess catecholamines exert profound effects on the cardiovascular system, including vasoconstriction, tachycardia, and increased cardiac output. Sudden surges in blood pressure can result in endothelial damage and rupture of small penetrating arteries, particularly in regions such as the basal ganglia, thalamus, and brainstem.[7] Consequently, patients with undiagnosed catecholamine-secreting tumors are at increased risk of intracerebral hemorrhage, hypertensive encephalopathy, and other life-threatening complications.

Paragangliomas, especially those located in the aortocaval region, are even rarer compared to adrenal pheochromocytomas. Their extra-adrenal location can make detection more challenging, often requiring advanced imaging modalities such as contrast-enhanced computed tomography or magnetic resonance imaging. Biochemical confirmation is typically achieved through measurement of plasma or urinary metanephrines, which are highly sensitive markers of catecholamine excess.

The occurrence of intracerebral hemorrhage as the initial manifestation of paraganglioma is exceedingly rare, particularly in adolescents. Such presentations underscore the importance of maintaining a high index of suspicion in young patients presenting with hypertensive emergencies and neurological deficits. Early diagnosis not only facilitates appropriate acute management but also enables timely surgical intervention, which is potentially curative.[8]

In this report, we describe a rare case of a 15-year-old male presenting with acute basal ganglia hemorrhage secondary to hypertensive crisis caused by an extra-adrenal paraganglioma. This case highlights the diagnostic challenges and emphasizes the need for comprehensive evaluation of secondary hypertension in young patients presenting with stroke.

CASE REPORT

A 15-year-old male presented to the emergency of Department of Medicine, Baba Raghav Das Medical College, Gorakhpur, Uttar Pradesh with complaints of sudden onset weakness involving the left side of the body and slurring of speech for one day. The symptoms were abrupt in onset, non-progressive, and not associated with any preceding trauma, seizures, loss of consciousness, or visual disturbances. There was no history suggestive of prior neurological deficits or similar episodes in the past.

On detailed history, the patient reported intermittent episodes of headache and palpitations over the preceding few months. These episodes were paroxysmal in nature and were often accompanied by excessive sweating and vague abdominal pain. However, these symptoms had not been previously evaluated and were not associated with any documented diagnosis. There was no history of chronic illnesses such as diabetes mellitus, hypertension, tuberculosis, or any known cardiac or renal disease. There was also no significant family history of hypertension, endocrine disorders, or cerebrovascular events.

On examination at presentation, the patient was conscious, alert, and oriented to time, place, and person. His general condition was stable, but vital parameters revealed markedly elevated blood pressure of 200/110 mmHg and a pulse rate of 106 beats per minute, which was regular in rhythm. Oxygen saturation was maintained at 99% on room air, and random blood glucose levels were within normal limits.

Neurological examination revealed left-sided hemiparesis with motor strength graded as 2/5 in the left upper limb and 3/5 in the left lower limb, while the right-sided limbs had normal power (5/5). Deep tendon reflexes were exaggerated on the affected side, and plantar response was extensor on the left and flexor on the right. Higher mental functions were intact, and cranial nerve examination did not reveal any abnormalities. There were no signs of meningeal irritation such as neck rigidity or positive Kernig's sign.

Systemic examination, including cardiovascular, respiratory, and abdominal systems, was unremarkable. Cardiovascular examination revealed normal heart sounds without murmurs or gallops. Respiratory examination showed bilaterally normal vesicular breath sounds, and abdominal examination revealed a soft, non-tender abdomen with no palpable organomegaly.

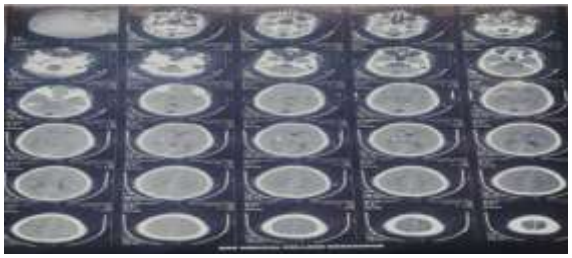

Figure 1: NCCT BRAIN showed "Axial sections of non-contrast computed tomography scan of brain shows a hyperdense focus of bleed attenuation in right lentiform nucleus. Surrounding hypodense rim is seen representing edema. Right basal ganglia hemorrhage".

Given the acute neurological presentation, an urgent non-contrast computed tomography (NCCT) scan of the brain was performed, which demonstrated a hyperdense lesion in the right lentiform nucleus with surrounding hypodense edema, consistent with an acute intracerebral hemorrhage involving the right

basal ganglia. There was no evidence of midline shift or intraventricular extension. [Figure 1]

Baseline laboratory investigations revealed hemoglobin of 12.8 g/dL, total leukocyte count of 15,600 cells/mm³, and platelet count of 214,000 cells/mm³. Renal function tests, including blood urea and serum creatinine, were within normal limits. Liver function tests showed mildly elevated transaminases, while serum electrolytes and arterial blood gas analysis were within normal ranges. Viral markers were negative, and urine routine examination did not reveal any abnormalities. [Table 1]

Table 1: Baseline Laboratory Parameters at Presentation

Parameter	Value	Reference Range	Interpretation
Potassium (K^+)	3.7 mEq/L	3.5 – 5.0 mEq/L	Normal
Sodium (Na^+)	137 mmol/L	135 – 145 mmol/L	Normal
Arterial pH	7.41	7.35 – 7.45	Normal
Hemoglobin (Hb)	12.8 g/dL	12 – 16 g/dL	Normal
Total Leukocyte Count (TLC)	15,600 cells/mm³	4,000 – 11,000 cells/mm³	Elevated (Leukocytosis)
Platelet Count (PLC)	214,000 cells/mm³	150,000 – 400,000 cells/mm³	Normal
Serum Bilirubin Total (SBT)	0.70 mg/dL	0.3 – 1.2 mg/dL	Normal
Serum Bilirubin Direct (SBD)	0.27 mg/dL	0.1 – 0.4 mg/dL	Normal
SGOT (AST)	73 U/L	< 40 U/L	Elevated
SGPT (ALT)	69 U/L	< 40 U/L	Elevated
Alkaline Phosphatase (ALP)	251 U/L	44 – 147 U/L	Elevated
Serum Urea	42 mg/dL	15 – 40 mg/dL	Mildly Elevated
Serum Creatinine	0.96 mg/dL	0.6 – 1.2 mg/dL	Normal
Viral Markers	Negative	Negative	Normal
Urine Routine/Microscopy	Within Normal Limits	Normal	Normal

In view of severe hypertension in a young patient without prior history, further evaluation for secondary causes was undertaken. Ultrasonography of the abdomen revealed a well-defined round to oval hyperechoic lesion measuring approximately 56 × 32 mm in the epigastric region, exhibiting mild internal vascularity. To rule out renovascular causes of hypertension, Doppler evaluation of the renal arteries was performed, which showed normal flow patterns with no evidence of stenosis.

Subsequently, a contrast-enhanced CT aortogram was performed, which demonstrated a well-defined hypodense lesion in the aortocaval region abutting the body of the right adrenal gland. The lesion exhibited intense enhancement in the arterial phase with washout in the delayed phase and contained non-enhancing areas suggestive of necrosis. These imaging features raised strong suspicion for an extra-adrenal catecholamine-secreting tumor, most likely a paraganglioma. [Figure 2]

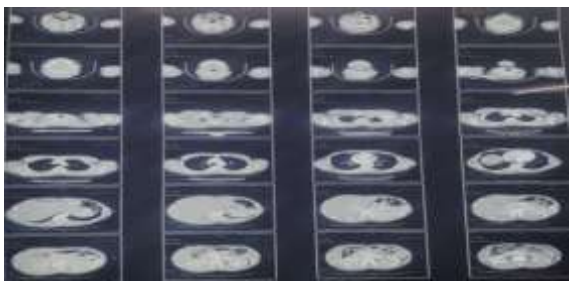

Figure 2: CT aortogram showing aortocaval mass.

To confirm the diagnosis, biochemical evaluation was carried out, which revealed significantly elevated urinary metanephrine levels, with a metanephrine-to-creatinine ratio of 515 µg/g creatinine. This finding established the presence of catecholamine excess and supported the diagnosis of paraganglioma as the underlying cause of hypertensive crisis.

The patient was managed conservatively for intracerebral hemorrhage in the acute phase. Blood pressure was controlled using intravenous labetalol infusion, with careful monitoring to avoid rapid fluctuations. Osmotherapy with intravenous mannitol was administered for three days to reduce intracranial pressure and cerebral edema. Supportive care, including fluid management and neurological monitoring, was provided in a high-dependency setting.

As the patient's condition stabilized, physiotherapy was initiated to improve motor function and facilitate neurological recovery. For long-term blood pressure control, the patient was transitioned to oral antihypertensive therapy, including a combination of angiotensin-converting enzyme inhibitors and calcium channel blockers.

After stabilization of neurological status and blood pressure, the patient was referred to the urology department for further evaluation and definitive management of the paraganglioma, including surgical planning after appropriate preoperative preparation.

This case illustrates a rare presentation of extra-adrenal paraganglioma manifesting as hypertensive intracerebral hemorrhage in an adolescent, emphasizing the importance of considering secondary causes of hypertension in young patients presenting with acute neurological deficits.

DISCUSSION

Intracerebral hemorrhage (ICH) in the pediatric and adolescent population is an uncommon but serious neurological emergency, accounting for approximately 2–5% of all stroke cases in this age

group. Unlike in adults, where chronic hypertension is the predominant cause, ICH in younger individuals is more frequently associated with secondary etiologies such as vascular malformations, hematological disorders, infections, trauma, and, less commonly, endocrine abnormalities. The present case highlights a rare but clinically significant cause of ICH in adolescents—catecholamine excess due to extra-adrenal paraganglioma.

Paragangliomas are rare neuroendocrine tumors arising from extra-adrenal chromaffin tissue of the autonomic nervous system. They are closely related to pheochromocytomas but differ in anatomical location, occurring outside the adrenal medulla, commonly in the abdomen along the sympathetic chain. The annual incidence of pheochromocytomas and paragangliomas combined is estimated to be 2–8 cases per million population, with a smaller proportion occurring in the pediatric age group.[1,2]

The pathophysiological basis of intracerebral hemorrhage in catecholamine-secreting tumors is multifactorial. The basal ganglia, thalamus, and brainstem are particularly susceptible due to their rich vascular supply and the presence of small perforating arteries that are vulnerable to hypertensive damage.[3,4] In the present case, the hemorrhage localized to the right basal ganglia is consistent with the typical distribution of hypertensive intracerebral bleeds.

Although hypertension is a well-established risk factor for ICH, its occurrence in adolescents should always prompt evaluation for secondary causes. In this case, the markedly elevated blood pressure (200/110 mmHg) in a previously normotensive adolescent, combined with a history of episodic headache, palpitations, and diaphoresis, raised suspicion for catecholamine excess. This classical triad, although characteristic of pheochromocytoma and paraganglioma, is present in less than 50% of cases, contributing to delays in diagnosis.[5] Notably, the patient in this case had experienced these symptoms for several months prior to presentation, underscoring the importance of early recognition and evaluation of paroxysmal sympathetic symptoms.

Several studies have documented cerebrovascular complications associated with catecholamine-secreting tumors, including ischemic stroke, intracerebral hemorrhage, subarachnoid hemorrhage, and posterior reversible encephalopathy syndrome (PRES). Among these, intracerebral hemorrhage is relatively rare but carries a high risk of morbidity and mortality. A systematic review by Lenders et al. reported that cerebrovascular events occur in approximately 3–5% of patients with pheochromocytoma/paraganglioma, with hemorrhagic stroke being less common than ischemic events.[1] However, in pediatric populations, hemorrhagic presentations may be more prominent due to sudden and severe hypertensive episodes.

The diagnostic approach to suspected paraganglioma involves both biochemical and imaging modalities. Measurement of plasma free metanephrines or urinary fractionated metanephrines is considered the gold standard for biochemical diagnosis due to their high sensitivity. In the present case, the markedly elevated urinary metanephrine-to-creatinine ratio confirmed catecholamine excess. Imaging studies, including contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI), are essential for tumor localization. The CT aortogram findings of a well-defined, enhancing lesion in the aortocaval region with arterial phase enhancement and delayed washout are characteristic of paraganglioma.[6]

Extra-adrenal paragangliomas, particularly those located in the aortocaval region, are less common than adrenal pheochromocytomas and may present with more aggressive behavior, including a higher risk of malignancy and recurrence. Their anatomical location can pose challenges in surgical management due to proximity to major vascular structures. Early identification is therefore critical to facilitate timely intervention and reduce complications.[7]

A review of the literature reveals that cases of intracerebral hemorrhage as the initial presentation of paraganglioma in adolescents are exceedingly rare. Most reported cases involve adults, with only a few pediatric cases documented. For instance, a case reported by Kim et al. described a young patient with pheochromocytoma presenting with intracranial hemorrhage secondary to hypertensive crisis.[8] Similarly, other reports have highlighted the association between undiagnosed catecholamine-secreting tumors and catastrophic cerebrovascular events. Compared to these reports, the present case is notable for the extra-adrenal location of the tumor and the young age of the patient, adding to the limited body of literature on this subject.

The management of such cases requires a multidisciplinary approach involving neurologists, endocrinologists, radiologists, and surgeons. The initial priority is stabilization of the patient, including control of blood pressure and management of intracranial pressure. In this case, intravenous labetalol was used effectively to control hypertension, while mannitol was administered to reduce cerebral edema. It is important to avoid rapid fluctuations in blood pressure, as both severe hypertension and hypotension can worsen cerebral injury.

Definitive treatment of paraganglioma involves surgical resection, which is potentially curative. However, preoperative preparation is crucial to prevent intraoperative hypertensive crises. This typically includes alpha-adrenergic blockade followed by beta-blockade, along with adequate volume expansion. Although the patient in this case was referred for surgical management after stabilization, the importance of appropriate preoperative optimization cannot be overstated.[1,9]

Another important consideration is the potential genetic basis of paragangliomas, particularly in younger patients. Up to 30–40% of cases are associated with germline mutations in genes such as

SDHB, SDHD, VHL, RET, and NF1. Therefore, genetic counseling and testing should be considered, especially in pediatric and adolescent patients, to identify hereditary syndromes and guide long-term follow-up.[10]

The present case also highlights the importance of recognizing early warning signs of catecholamine excess. The patient had recurrent episodes of headache, palpitations, and sweating, which were not investigated prior to the acute event. Early identification and evaluation of these symptoms could potentially have prevented the occurrence of intracerebral hemorrhage. This underscores the need for increased awareness among clinicians regarding the presentation of paraganglioma, particularly in young patients with unexplained hypertension.

From a prognostic perspective, outcomes in intracerebral hemorrhage depend on several factors, including the size and location of the hemorrhage, the level of consciousness at presentation, and the timeliness of intervention. In this case, early diagnosis and prompt management resulted in stabilization of the patient and initiation of rehabilitation, which is expected to improve functional outcomes.

CONCLUSION

This case emphasizes the importance of considering secondary causes of hypertension in adolescents presenting with intracerebral hemorrhage. Paraganglioma, although rare, should be included in the differential diagnosis, particularly in the presence of episodic symptoms suggestive of catecholamine excess. Early diagnosis through a combination of clinical suspicion, biochemical testing, and imaging can facilitate timely management and prevent life-threatening complications. This case adds to the limited literature on paraganglioma presenting as intracerebral hemorrhage in adolescents and highlights the need for heightened clinical vigilance in similar scenarios.

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