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Review Article

The Effect of Diabetes Type 1 on Pituitary Apoplexy in Pediatric Patients

Dennis Adjepong,MD,MBA[1], Dennis Brako Sarpong, MD[2], Naa Oyoo Shidaa, MD[2] and Kwaku Amoateng[3]

[1]*Department of Neurological Surgery, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA*

[2]*Washington Adventist University, Takoma Park, USA*

[3]*University of Medicine & Pharmacy of Targus Mures, Transylvania, Romania*

Abstract

Pituitary Apoplexy (PA) often arises as a result of a bleeding tumor in the pituitary gland. Diabetes type 1 is among the significant risk factors of PA in children, young adults, and teens. The analysis proves that given the rare cases of symptoms accompanying pituitary apoplexy, it is usually challenging to diagnose it. However, it is characterized by severe sudden symptoms of altered mental status and headaches that raise intracranial pressure, whereby subsequent imaging proves the diagnosis. This review investigates the effect of diabetes type 1 on pituitary apoplexy in pediatric patients, identifying how the PA symptoms manifest, genetic factors, and the clinical presentation of the condition.

Keywords: Diabetes type 1; Pituitary apoplexy

Introduction

Pituitary apoplexy is considered a life-threatening condition, given the acute infarctions by pituitary glands [1]. Its major characteristics include nausea, headaches, vomiting, hypopituitarism, altered mental status, and visual impairment [2]. On the other hand, diabetes type I is associated with ketoacidosis, which is also an acute complication among patients with itself having its associated characteristics [3]. Clinicians consider pituitary apoplexy to be an endocrine emergency originating from poorly controlled glucose, with its causative factors unknown [4]. Type 1 diabetes has been considered to predispose PA due to its degenerative changes in the microvasculature glands [5]. Patients with type 1 diabetes may develop a complication referred to as Diabetes Ketoacidosis (DKA), which can be fatal if untreated [6]. DKA is associated with similar symptoms presented in patients with PA. For instance, a patient may exhibit alterations in the biochemical and mental status. Physicians may suggest DKA, but after diagnosis, the patient may be identified with PA [7]. PA may display intracranial disorders making it hard for diagnosis. PA is associated with low frequency and acute and dramatic presentations accompanied by non-specific symptoms making it hard for diagnosis [8].

***Corresponding author:** Dennis Adjepong, Department of Neurological Surgery, California Institute of Behavioral Neurosciences & Psychology, Fairfield, USA, Tel: +1 5712771998; E-mail: adjepongdennis1@gmail.com

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Methods

The research study reviewed multiple clinical features, biochemistry, predisposing factors, and clinical outcomes of patients across the United States presenting clinical diagnosis of type I diabetes and pituitary apoplexy between the years 2000 and 2020. Most of the studies had their patients presented with diabetes and sudden onset of visual disturbances, headache, and altered consciousness, including characteristics of subclinical pituitary apoplexy. Patients without diabetes were excluded from the study. All others included had pituitary hemorrhages on MRI, with historical evidence of necrosis or hemorrhage in their pituitary glands. The study also evaluated the diagnosis process of DKA with type I diabetes. After 24 hours, their metabolisms abnormalities were also recorded, with many patients having severe symptoms of headache and higher RBC counts.

Results

This study proved that in severe cases, PA patients experience vasospasm whereby their growth exceeds the arterial supply hence compressing the vascular structures, among other intrinsic factors including local inflammations. It is always worth mentioning prolactinomas and non-functioning adenomas, given their higher association with apoplexy compared to different types of tumors [9,10]. Over the years, diabetes has also been known to be a significant cause of pituitary apoplexy, given the degenerative changes in the microvasculature glands among patients diagnosed with pituitary apoplexy [11,12]. Regardless, research argues that diabetes ketoacidosis often precipitates with apoplectic episodes. The conditions are life-threatening, given its association with insulin resistance and the uncontrollable type I diabetes.

Pathophysiology of disease

Pituitary Apoplexy (PA) is a fatal disease caused by hemorrhage or acute ischemic infarction of the pituitary gland. PA is associated with type 1 diabetes. Type 1 diabetes is a rare condition and can occur at any stage [13-15]. However, it is mostly diagnosed in children, teenagers, and young adults. When one has this condition, the body has complications in producing insulin. This is a result of the stopping of the pancreas cells responsible for producing insulin. Type 1 diabetes may lead to kidney problems such as kidney failure. Diabetes Type 1 is rare in patients with Pituitary Apoplexy on the onset. Studies show

that less than 5% of these patients display symptoms of Diabetes Type 1 [16-18]. However, PA may be masked by the secondary failure of the adrenaline, a condition referred to as hypothyroidism. Diabetes Type 1 may be fatal to pediatric patients with PA.

Biochemistry of disease

Most of the biochemical characteristics of the disease were in line with type I diabetes, including the altered mental status of individuals that had been completely resolved during metabolic treatments. Diagnosis of pituitary apoplexy is considered not valid until headaches prompted additional testing [19,20]. Again, aligned symptoms with the diseases included visual abnormalities, persistent headaches, vomiting, and nausea. Serum cortisol was evident in the quarter of the population [21,22]. Gonadotrophin deficiency was apparent in almost half of patients, with thyrotropin deficiency and low serum prolactin in the above quarters of the people.

Genetics of disease

Diabetes type 1 is considered highly inheritable and susceptible. In this case, patients are more likely to suffer from the disease if they have a family member with type 1 diabetes. In either case, parents and siblings who have developed cases of type 1 diabetes have higher chances of hereditary affecting other individuals in the family. Only in rare instances does genetics affect pituitary apoplexy [23]. However, with diabetes, individuals whose either parent or sibling present with such diagnoses make them at higher risk of PA.

Scientific Analysis

Diabetes Type 1 causes an increase in the levels of glucose in the blood. An increase in the glucose levels causes the growth of larger pituitary tumors, referred to as macro-adenomas. Diabetes Type 1 happens when the pituitary gland and the hypothalamus, fail to produce enough vasopressin or the Anti-Diuretic Hormone (ADH). This hormone is responsible for maintaining the water balance in the body. If one has type 1 diabetes, the body may fail to balance the fluid levels [24,25]. Constant thirst is the most common symptom when these glands fail to produce vasopressin. Damage to the hypothalamus and pituitary gland from a tumor or surgery or illness may increase the chances of type 1 diabetes. This may, in turn, affect the usual production, storage, and release of ADH [26]. If the kidneys fail to hold water, the body may get thirsty, triggering one to be thirsty. Clinical presentation of PA is accompanied by severe headache, diplopia, visual impairment, and vomiting. However, subclinical tumor bleeding may be identified by imaging exams [27]. Almost 50% of patients with PA had previously been diagnosed with pituitary adenoma. An adenoma may lead to apoplexy due to compression of vascular structures as a result of resistance of arterial blood supply. However, prolactinomas and non-functioning adenomas may also increase the risk of apoplexy. This condition may, therefore, stimulate numerous neurological complications and diseases.

The clinical analysis of the disease

The typical clinical features of PA are the occurrence of headache in the retro-orbital location. The headaches are severe, and sudden can lead to the emergence of other symptoms. The potential factors leading to the problem is due to Dura-mater compression, meningeal irritation, or sellar walls enlargement [28]. Clinically, PA also results in endocrine dysfunction, with most patients presenting with adrenocorticotrophic hormone deficiency and hypo-secretion. Clinical research shows that there is a high occurrence of pediatric invasive PA is high. Research shows that the use of MRI and CT is crucial in diagnosing PA. The primary intervention on patients with hemodynamic instability is the administration of hydrocortisone and intravenous fluid [29-31]. Due to the increase in cases of children and adolescents at the risk of pituitary apoplexy, clinicians must show awareness while treating pituitary adenomas.

The Unanswered Questions

Further research is needed to investigate the precise physiopathology of pituitary apoplexy. Researchers should also focus on confirming how systemic hypertension, which results in increased blood flow, is associated with both PA and diabetes type 1.

Conclusion

This research shows that pituitary apoplexy is a rare disease that is associated with diabetes type 1 in pediatric patients. Increased blood flow and imbalance stimulation of the pituitary gland impacts the pituitary adenoma level, which, as a result, increases complications among PA pediatric patients. PA is commonly caused when the benign tumor of the pituitary bleeds. These tumors are rarely diagnosed. When these tumors enlarge, the pituitary may be damaged. Enlargement of these tumors may either flow into the pituitary or block the supply of blood. Diabetes may increase the chance of occurrence of PA in individuals without an enlarged cyst. However, the study indicates that although PA can occur spontaneously with type 1 diabetes, there are various underlying risk factors linked to the condition.

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