



Multiple Pituitary Hormone Deficiency Due to Gunshot Injury in a 6-Year-Old Girl

Hüseyin Demirbilek¹, Mehmet Nuri Özbek¹, Rıza Taner Baran¹, Ahmet Baran²

¹Diyarbakır Children's State Hospital, Pediatric Endocrinology, Diyarbakır, Turkey

²Diyarbakır Children's State Hospital, Radiology, Diyarbakır, Turkey

Introduction

Gunshot injuries (GSI) to the cranial area have an extremely high mortality rate ranging from 51% to 84% (1,2,3,4,5). The most important prognostic factors affecting mortality rate are the course of the bullet and the Glasgow Coma Scale (GCS) score at the time of initial evaluation (6). Respiratory and circulatory status at presentation, the diameter and reactivity of the pupils, and the presence or absence of coagulopathy constitute the other prognostic factors. Intraventricular haemorrhage suggests a poor prognosis. The most important cause of death is hernia associated with an increased intracranial pressure (1,7,8). On the other hand, post-traumatic complications in individuals who survive GSI constitute a considerable health problem. Pituitary hormone deficiency after GSI to the cranial area has been reported in a limited number of cases, mainly in adults (8,9,10,11,12). Herein, we present a 6-year-old girl who suffered a GSI and is living with a bullet in the posterior sellar region which causes multiple pituitary hormone deficiency.

ABSTRACT

Gunshot injuries (GSI) of the cranial area have an extremely high mortality rate. Herein, we present a girl who has been living with a bullet in the posterior sellar region. A 6-year-old girl was admitted with complaints of headache, polyuria and polydypsia, which started after a GSI. At the time of admission the patient's anthropometric, physical and neurological examinations were normal. Urine output was 5.5 L/m²/24h. A water deprivation test suggested central diabetes insipidus, which responded to treatment. Evaluation of other pituitary hormones revealed central hypothyroidism and growth hormone deficiency. Pituitary hormone deficiency must be kept in mind in patients injured by a gunshot to the sellar/parasellar region.

Key words: Gunshot injury, hypopituitarism

Conflict of interest: None declared

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Case Report

A 6-year-old girl was admitted to our clinic with complaints of headache, polyuria, and polydypsia. The patient was reported to be healthy until 5 months ago, when she suffered a head injury with an unknown foreign object while playing in the garden. Radiological examination revealed a bullet in her skull thought to be a GSI (Figure 1). Since the bullet was adjacent to vital regions of the brain, she was deemed inoperable, and was left to live with a bullet in her brain. Her complaints, mainly consisting of headache, polyuria and polydypsia, started at that time. Her family history was unremarkable. At the time of

Address for Correspondence

Hüseyin Demirbilek MD, Diyarbakır Children's State Hospital, Pediatric Endocrinology, Diyarbakır, Turkey
Phone: +90 412 223 64 28 E-mail: dr_huseyin@hotmail.com

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admission, her height was 113.5 cm (25th-50th percentile) and weight was 21 kg (50th percentile). Other physical findings were normal.

Urine density at presentation was 1001. Urine output was 4.5 L/24h (5.5 L/m²/24h). A water deprivation test showed failure to concentrate urine (Table 1). After a test dose of nasal desmopressin (5µg), urine output decreased and urine osmolarity increased. She was diagnosed as a case of central diabetes insipidus. The complaints resolved with a single 5µg daily maintenance dose of intranasal desmopressin acetate.

At follow-up, hormonal evaluation revealed central hypothyroidism (Table 2). A euthyroid state was achieved using Na-L-thyroxine therapy. Baseline morning cortisol was 7.7 µg/dL and low-dose adrenocorticotrophic hormone (ACTH) test showed normal adrenal function (Table 2). A very low growth rate (0.2 cm/6 months), detected at follow-up,

suggested growth hormone (GH) deficiency. GH response to L-dopa and clonidine stimulation tests was inadequate, and recombinant human GH therapy was started. With this treatment, except for a slight headache, the patient has no complaints and appears healthy.

Discussion

GSI to the cranial region, which are commonly caused by celebratory gun shooting, have a very high mortality rate. Although this injury often results in death, in some cases the injured person can survive. In this case, the localization of the bullet plays a considerable role in the prediction of the prognosis and post-injury complications. A bullet located in non-vital regions of the brain can be removed successfully by surgery. However, in cases with bullet settled in vital areas, to avoid further damage from surgery, the bullet may be left in the cranium. In this instance, according to the location of the bullet, various complications such as headache, visual disorders, and infection may be inevitable. Post-traumatic hypopituitarism has been reported in patients suffering from traumatic brain injury (13,14,15,16). While it is extremely rare in the paediatric age group, multiple pituitary hormone deficiency due to cranial gunshot injury has been reported (8,9,10,11,12). Central diabetes insipidus is the mostly commonly reported neuroendocrine dysfunction of traumatic brain injury. Other and less frequent outcomes of



Figure 1. Bullet located in the posterior wall of the sella

	Baseline	After water deprivation	After desmopressin
Urine density	1005	1005	1025
Urine osmolarity (mOsmol/L)	150	150	750
Serum osmolarity (mOsmol/L)	293.2	305.2	274.1
Na (mEq/L)	141	147	131
Glucose (mg/dL)	87	80	78
Urea N (mg/dL)	18	19	22

	Blood levels
Free T4	7.16 pmol/L
TSH	3.95 µIU/mL
Morning cortisol	7.7 µg/dL
Peak cortisol in low-dose ACTH test	20.7 µg/dL
IGF-1	120 ng/mL
IGFBP-3	2810 ng/mL
Peak GH in clonidin stimulation test	0.3 ng/dL
Peak GH in L-dopa stimulation test	0.5 ng/dL
FSH	0.3 IU/L
LH	<0.1 IU/L
Estradiol	4.0 pg/mL
Prolactin	32.2 ng/mL

T4: thyroxine, TSH: thyroid stimulating hormone, ACTH: adrenocorticotrophic hormone, IGF-1: insulin-like growth factor-1, IGFBP-3: IGF binding protein-3, GH: growth hormone, FSH: follicle-stimulating hormone, LH: luteinizing hormone

traumatic brain injury are GH, thyroid stimulating hormone, ACTH, follicle-stimulating hormone, and luteinizing hormone deficiencies (12,17).

We did not have the means to perform pituitary or cranial MR imaging in our patient, thus, we were not able to completely rule out other causes of hypopituitarism. However, evidence such as the patient being healthy until suffering the cranial injury and the onset of the symptoms following the injury strongly suggest that the multiple pituitary hormone deficiency was caused by GSI. Moreover, at the time of admission, the patient's height was between the 25th and 50th percentiles for age and sex, but during follow-up, growth velocity was found to be extremely low, and a sharp decline was observed in the growth curve. The inadequate GH response to the GH stimulation test performed with L-dopa and clonidine also supported the presence of an acquired pituitary dysfunction.

Since the patient was pre-pubertal, we could not evaluate her gonadotropins and gonadal functions. Although her ACTH level was within the normal range, the risk of development of ACTH and gonadotropin deficiency may exist and the hormonal profile needs to be monitored at regular intervals.

In conclusion, the findings of this patient demonstrate that GSI can cause multiple pituitary hormone deficiency. Although it is extremely rare, pituitary hormone deficiency must be kept in mind in patients presenting with GSIs and living with a bullet in their brain, especially in the sellar/parasellar regions.

References

1. Gonul E, Erdogan E, Izci Y, Baysefer A, Seber N. Craniocerebral Gunshot Wounds: Analysis of 288 Cases, A Clinical Review. *Turk Neurosurg* 1999;9:1-7.
2. Kim TW, Lee JK, Moon KS, Kwak HJ, Joo SP, Kim JH, Kim SH. Penetrating gunshot injuries to the brain. *J Trauma* 2007;62:1446-1451.
3. Martins RS, Siqueira MG, Santos MT, Zanon-Collange N, Moraes OJ. Prognostic factors and treatment of penetrating gunshot wounds to the head. *Surg Neurol* 2003;60:98-104.
4. Ordog GJ, Dornhoffer P, Ackroyd G, Wasserberger J, Bishop M, Shoemaker W, Balasubramaniam S. Spent bullets and their injuries: The result of firing weapon into the sky. *J Trauma* 1994;37:1003-1006.
5. Ozdemir M, Unlu A. Gunshot injuries due to celebratory gun shootings. *Turk Neurosurg* 2009;19:73-76.
6. Selden BS, Goodman JM, Cordell W, Rodman GH Jr, Schnitzer PG. Outcome of self-inflicted gunshot wounds of the brain. *Ann Emerg Med* 1988;17:247-253.
7. Suddaby L, Weir B, Forsyth C. The management of 22 caliber gunshot wounds of the brain: A review of 49 cases. *Can J Neurol Sci* 1987;14:268-272.
8. Alaca R, Yilmaz B, Gunduz S. Anterior hypopituitarism with unusual delayed onset of diabetes insipidus after penetrating head injury. *Am J Phys Med Rehabil* 2002;81:788-791.
9. D'Angelica M, Barba CA, Morgan AS, Dobkin ED, Pepe JL. Hypopituitarism secondary to transfacial gunshot wound. *J Trauma* 1995;39:768-771.
10. Lo Iudice G, D'Alessandro B, Esposito V, Federico P, Mignini R, Rispoli C. Hypopituitarism following a direct bullet injury to the pituitary. A case report. *Minerva Endocrinol* 1989;14:251-254.
11. Trujillo-Juarez D, Culler FL, Ganelin RS, Jones KL. Traumatic hypopituitarism due to gunshot wound. *West J Med* 1987;147:591-593.
12. Salti IS, Haddad FS, Amiri ZN, Khalil AA, Akar AA. Bullet injury to the pituitary gland: a rare cause of panhypopituitarism. *J Neurol Neurosurg Psychiatry* 1979;42:955-959.
13. Zaben M, El Ghouli W, Belli A. Post-traumatic head injury pituitary dysfunction. *Disabil Rehabil* 2013;35:522-525. Epub 2012 Jul 10.
14. Kozłowski Moreau O, Yollin E, Merlen E, Daveluy W, Rousseaux M. Lasting pituitary hormone deficiency after traumatic brain injury. *J Neurotrauma* 2012;29:81-89.
15. Abadi MR, Ghodsi M, Merazin M, Roozbeh H. Pituitary function impairment after moderate traumatic brain injury. *Acta Med Iran* 2011;49:438-441.
16. Norwood KW, Deboer MD, Gurka MJ, Kuperminc MN, Rogol AD, Blackman JA, Wamstad JB, Buck ML, Patrick PD. Traumatic brain injury in children and adolescents: surveillance for pituitary dysfunction. *Clin Pediatr (Phila)* 2010;49:1044-1049. Epub 2010 Aug 19.
17. Barreca T, Perria C, Sannia A, Magnani G, Rolandi E. Evaluation of anterior pituitary function in patients with posttraumatic diabetes insipidus. *J Clin Endocrinol Metab* 1980;51:1279-1282.