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CASE REPORT

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Adrenal crisis precipitated by influenza A led to the diagnosis of Sheehan's syndrome 18 years after postpartum hemorrhage

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Abstract

Physicians must recognize and treat adrenal crisis that may occur with acute viral illnesses such as influenza in women with Sheehan's syndrome that has been undiagnosed and hence untreated, sometimes for many years, after postpartum hemorrhage.

KEYWORDS

adrenal crisis, case report, hypopituitarism, influenza virus infection, Sheehan's syndrome

1 | INTRODUCTION

Sheehan's syndrome is heterogeneous with respect to severity; some patients may live for many years without hormone replacement. Physicians should be aware that an acute viral illness may precipitate adrenal crisis in women with Sheehan's syndrome that may have been undiagnosed and hence untreated for many years after postpartum hemorrhage.

Sheehan's syndrome is caused by ischemic necrosis of the anterior pituitary gland following severe postpartum hemorrhage.[1] Patients with Sheehan's syndrome present with varying degrees of hypopituitarism and secondary adrenal insufficiency. Because endocrinologic abnormalities usually progress very slowly, diagnosis may be delayed due to the nonspecific nature of associated symptoms, such as fatigue, weight loss, nausea, fever, abdominal pain, and muscle pain.[2-5]

Recent advances in obstetric care have helped reduce the incidence of Sheehan's syndrome; however, the prevalence of this disorder remains poorly defined owing to the large number of undiagnosed patients.[6] According to the World Health Organization, approximately 100 000 women worldwide die annually due to Sheehan's syndrome; furthermore, more than three million women worldwide had Sheehan's syndrome in 1996.[7] This syndrome is often overlooked, even in developed countries,[8,9] resulting in lengthy delays[2-5,8-11] in the diagnosis of as much as 48 years.[11]

Adrenal crisis is a lethal medical emergency in the absence of prompt treatment.[12,13] Sheehan's syndrome is one cause of

secondary adrenal insufficiency.[12] However, Sheehan's syndrome is often undertreated, possibly owing to the low awareness of this syndrome among physicians.[9] We report a patient with previously undiagnosed and hence untreated Sheehan's syndrome who presented with adrenal crisis following infection with influenza A virus 18 years after severe postpartum hemorrhage.

2 | CASE PRESENTATION

A 50-year-old Japanese woman was admitted to another hospital with fever, cough, and altered consciousness. Her husband reported that she was well until one day prior to admission. Her medical history, reported by her former physician, included a transient episode of altered consciousness with fever occurring 2 years prior to admission and puerperal hemorrhage in her early thirties. The rapid influenza diagnostic test (immunoassay) using a nasal swab specimen identified the presence of influenza A. However, cerebrospinal fluid examination was unremarkable. Owing to progressive deterioration in consciousness, hypotension, and paroxysmal atrial flutter, the patient was tentatively diagnosed with influenza A, septic shock due to bacterial or viral meningoencephalitis, and acute myocarditis. She was treated with antibiotics and antiviral medications [meropenem (1.0 g/d) + vancomycin (1.0 g/d) + acyclovir (1500 mg/d) + peramivir (300 mg/d)] and noradrenaline infusion (0.3 μg/kg/min). However, she did not improve, so she was intubated and referred to the intensive care unit of our medical center after 12 hours.

Physical examination revealed that the patient was in acute distress with impaired consciousness (Glasgow Coma Scale: $E_1V_TM_2$). Her body mass index was 16.5 kg/m^2, body temperature 39.8°C, blood pressure 72/44 mm Hg (with noradrenaline infusion 0.3 μg/kg/min), heart rate 174 beats/min and irregular, respiratory rate 27 breaths/min, and percutaneous arterial blood oxygen saturation 100% (FiO_2 1.0). The quick Sequential Organ Failure Assessment (qSOFA) score[14] was 3. Eyebrows were thin and absent at both lateral ends. There were slight conjunctival pallor and no scleral icterus. The neck was supple with no signs of meningismus. Oral mucosa was moist. Both lungs were clear to auscultation, and cardiac examination was normal except for irregularly irregular tachycardia. Her skin was pale and dry. Axillae were normal except for the absence of axillary hair; nipples were light pink. External genitalia were normal, but pubic hair was sparse. Deep tendon reflexes were normal except for the Achilles that exhibited prolonged relaxation phase. Electrocardiography revealed tachycardia with low-voltage atrial flutter. Electrical direct current cardioversion (100 Joule) was performed soon after admission and restored cardiac sinus rhythm (heart rate 112 beats/min).

The results of laboratory tests conducted upon admission are shown in Table 1. The most notable results were hormone levels that strongly suggested panhypopituitarism and secondary adrenal insufficiency (unfortunately, estradiol was not measured). Chest computed tomography (CT) revealed bilateral cingulate consolidation along the dorsal ribs, while both adrenal glands could not be visualized by abdominal contrast-enhanced CT. The Acute Physiology and Chronic Health Evaluation (APACHE) II score[15] was 25.

Based on the clinical findings and the test results, adrenal crisis was diagnosed, possibly precipitated by influenza A virus infection. Adrenal crisis has also been reported as one of the causes of myocardial dysfunction[16] but because influenza virus infection is also known to cause acute cardiac injury,[17] pneumonia,[18] and acute respiratory distress syndrome (ARDS),[19] we could not exclude septic shock. Intravenous injection of 100 mg hydrocortisone and intravenous drip infusion of 5% glucose with 200 mg hydrocortisone per 24 hours were started[13,20] as well as continuation of antibiotics and influenza antiviral medications [meropenem (1.0 g/d) + vancomycin (1.0 g/d) + levofloxacin (500 mg/d) + peramivir (300 mg/d)] along with noradrenaline and vasopressin. Following the commencement of hydrocortisone replacement therapy, we were able to discontinue vasopressin on day 2, noradrenaline on day 3, and antibiotics on day 5. Blood, urine, and cerebrospinal fluid cultures, including those at the previous hospital, were negative for any specific bacteria. She showed rapid improvement and was transferred to the general ward on day 5 for further evaluation.

On hospital day 6, she reported that she had experienced puerperal hemorrhage at the age of 32 years during the delivery of a full-term infant who did not survive. Subsequently, she was prescribed medications (details unknown) for one year because of amenorrhea. However, she discontinued this treatment because of her distrust of the medical profession due to grief over losing her baby. This was followed by a long history of infertility, amenorrhea, voice hoarseness, cold intolerance, fatigue, loss of appetite, and constipation. Prior to her pregnancy, menstrual cycles had been regular with no dysmenorrhea or menorrhagia. Therefore, we strongly suspected Sheehan's syndrome.

The results of hormone stimulation tests after recovery from shock are shown in Table 2. Plasma cortisol did not respond to the rapid adrenocorticotropic hormone (ACTH) test on day 8. The combined anterior pituitary stimulation test on day 9 using corticotrophin-releasing hormone (CRH), thyrotropin-releasing hormone (TRH), luteinizing hormone-releasing hormone (LH-RH), and growth hormone-releasing hormone (GH-RH) showed partial increases in thyroid-stimulating hormone (TSH), prolactin, luteinizing hormone (LH), and follicle-stimulating hormone (FSH) levels. However, there were no changes in free thyroxine (FT_4), growth hormone (GH), and IGF-1 levels.

TABLE 1 Laboratory test results at admission

	Data	Reference range		Data	Reference range
Complete Blood Count			Chemistry		
White cells	4.2	3.9-9.3 × 10^6/L	Total protein	3.9	6.6-8.1 g/dL
Neutrophils	68	40%-70%	Albumin	2.2	4.1-5.1 g/dL
Lymphocytes	28	22%-44%	Total bilirubin	0.6	0.4-1.5 mg/dL
Monocytes	4	4%-11%	Direct bilirubin	0.35	0.05-0.23 mg/dL
Eosinophils	0	0%-7%	AST	57	0-55 U/L
Red cells	2.5	3.5-5.0 × 10^9/L	ALT	14	0-44 U/L
Hemoglobin	72	125-170 g/L	LD	227	124-222 U/L
Hematocrit	22	33%-45%	Creatine kinase	2,142	45-163 U/L
Platelets	9.4	150-450 × 10^6/L	ALP	109	106-322 U/L
Urinalysis and Sediments			C-reactive protein	8.37	0.00-0.14 mg/dL
Gravity	1.032	1.005-1.025	Urea nitrogen	17	8-20 mg/dL
pH	7.5	5-7.5	Creatinine	1.44	0.46-0.79 mg/dL
Protein	1+	Negative	Sodium	135	138-145 mmol/L
Red blood cells	many/HPF	Negative	Potassium	3.9	3.6-4.8 mmol/L
White blood cells	10-19/HPF	Negative	Chloride	112	100-110 mmol/L
Blood gas analysis (F_iO_2 1.0)			Random plasma glucose	65	70-109 mg/dL
pH	7.39	7.35-7.45	PT-INR	1.74	0.9-1.2
$PaCO_2$	31.8	30.5-45.0 mm Hg	APTT	77.4	28.5-40.9 s
PaO_2	350.6	85.0-105.0 mm Hg	Brain natriuretic peptide	713	80-130 pg/mL
HCO_3^-	18.9	21.0-28.0 mmol/L	Highly sensitive troponin I	9574.7	<26.2 pg/mL
Base excess	−5.3	−6	Procalcitonin	>10	<0.05 ng/mL
A-aDO_2	322.7	<15.0 mm Hg	Rapid influenza diagnostic test	A (+) B (−)	A (−) B (−)
Hormone levels					
FT_3	1.93	1.71-3.71 pg/mL	GH	0.03	0.010-3.607 ng/mL
FT_4	0.26	0.70-1.48 ng/dL	IGF-1	<4	78-213 ng/mL
TSH	0.794	0.35-4.94 μIU/mL	ACTH	2.9	7.4-55.7 pg/mL
Prolactin	1.22	3.12-15.39 ng/mL	ADH	0.7	<2.8 pg/mL
FSH	0.78	2.0-8.3 mIU/mL	Cortisol	≤0.9	6.24-18.0 μg/dL
LH	0.11	0.79-5.72 mIU/mL			

Abbreviations: A-aDO_2, alveolar arterial difference of oxygen; ACTH, adrenocorticotropic hormone; ADH, antidiuretic hormone; ALP, alkaline phosphatase; ALT, alanine aminotransferase; APTT, activated partial thromboplastin time; AST, aspartate aminotransferase; FSH, follicle-stimulating hormone; FT_3, free triiodothyronine; FT_4, free thyroxine; GH, growth hormone; HPF, high-power field; IGF-1, insulin-like growth factor 1; LD, lactate dehydrogenase; LH, luteinizing hormone; PT-INR, international normalized ratio of prothrombin time; TSH, thyroid-stimulating hormone.

ACTH remained responsive to CRH. Antithyroid autoantibodies, including antithyroid peroxidase antibody and anti-thyroglobulin antibody, were negative. The hormonal profile and brain magnetic resonance imaging (MRI) findings (Figure 1A-C) (empty sella; low T1 signal in anterior pituitary; high T2 homogenous signal; ring enhancement with enhanced MRI) were consistent with panhypopituitarism and Sheehan's syndrome.

Her recovery from altered consciousness, hypotension, and respiratory distress after hydrocortisone replacement therapy was consistent with adrenal crisis and negated the possibility of septic shock due to meningoencephalitis. We therefore diagnosed adrenal crisis caused by influenza A virus infection in a woman with untreated Sheehan's syndrome.

We began replacement therapy with hydrocortisone (40 mg in the morning and 20 mg in the evening) and levothyroxine (25 μg/d), and her symptoms, including cold intolerance, fatigue, and loss of appetite, subsided. She and her husband were educated about the regular use of hydrocortisone and the sick day rule,[12,13] wherein she was advised to take two to three times the usual dose of hydrocortisone during sickness or when under physical stress. In addition, annual vaccination against seasonal influenza was recommended[21] and she was advised to carry a medical alert card.[12,13] It should be noted

TABLE 2 Hormone stimulation tests

Time	Minute	0	30	60	90	120
Rapid ACTH test (250 μg, IV) on day 8						
Cortisol	μg/dL	≤0.9	≤0.9	≤0.9	≤0.9	≤0.9
CRH test (100 μg, IV) on day 9						
ACTH	pg/mL	6.7	11.1	20.1	5.8	11.2
TRH test (500 μg, IV) on day 9						
TSH	μIU/mL	1.547	4.057	4.235	4.127	3.689
FT_4	ng/dL	0.22	0.24	0.22	0.22	0.22
Prolactin	ng/mL	2.27	4.12	3.58	3.42	3.15
LH-RH test (100 μg, IV) on day 9						
LH	mIU/mL	0.67	2.12	2.49	2.59	2.55
FSH	mIU/mL	1.95	2.67	2.94	3.33	3.31
GRH test (1 μg/kg, IV) on day 9						
GH	ng/mL	0.03	0.03	0.03	0.03	0.03
IGF-1	ng/mL	<4	<4	<4	<4	<4

Abbreviations: ACTH, adrenocorticotropic hormone; CRH, corticotrophin-releasing hormone; FSH, follicle-stimulating hormone; FT_4, free thyroxine; GH, growth hormone; GRH, growth hormone-releasing hormone; IGF-1, insulin-like growth factor 1; IV, intravenous injection; LH, luteinizing hormone; LH-RH, luteinizing hormone-releasing hormone; TRH, thyrotropin-releasing hormone; TSH, thyroid-stimulating hormone.

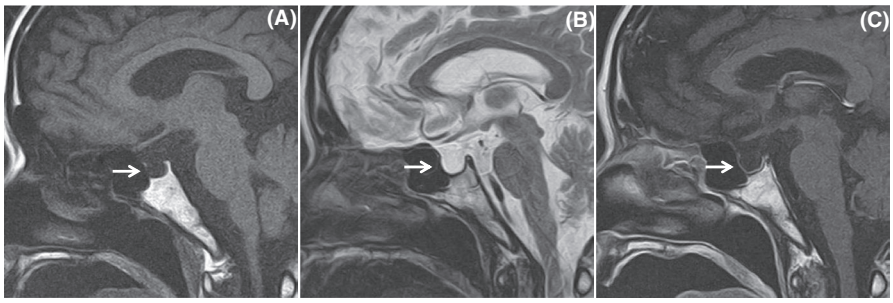

FIGURE 1 Magnetic resonance imaging of the pituitary gland (sagittal section); arrows indicate the sella turcica. A, T1-weighted image showing a low homogenous signal in the sella turcica. B, T2-weighted image showing a highly homogenous signal in the sella turcica. C, Gadolinium-enhanced image showing peripheral enhancement of the pituitary gland. These findings are diagnostic of an empty sella

that the emergency hydrocortisone self-injection kit[12,13,22] is not available in the Japanese healthcare system. The patient was discharged on day 21 with prescriptions of hydrocortisone (20 mg in the morning and 10 mg in the evening) and levothyroxine (50 μg/d). She has continued to do well 6 months after discharge.

3 | DISCUSSION

This report describes a patient with unsuspected Sheehan's syndrome in whom influenza A virus infection precipitated adrenal crisis and highlighted four important clinical issues. First, some patients with Sheehan's syndrome may live without hormone replacement therapy for a long period of time. This is probably related to the severity and the rate of progression of hypopituitarism. Second, influenza virus infection is a potential trigger for adrenal crisis in patients with untreated Sheehan's syndrome. Third, in a clinical scenario like the one presented by our patient, it is important that the past medical history is thoroughly obtained in order to identify women who may be at risk of having Sheehan's syndrome. Lastly, if Sheehan's syndrome is suspected, perform appropriate diagnostic testing and immediately begin glucocorticoid treatment even before the test results are known.

Cortisol is an essential hormone that is released during physical or emotional stress.[23] However, our patient was able to live for more than 18 years without any hormone replacement since Sheehan's syndrome had not been suspected even though she had experienced massive hemorrhage during pregnancy at 32 years of age. Patients with Sheehan's syndrome may present with variable clinical and pathological features at diagnosis.[1-11,24] In a previous study, 55% of patients exhibited panhypopituitarism, whereas 45% exhibited partial

hypopituitarism.[2] Depending on the extent of tissue damage,[1] therefore, patients with Sheehan's syndrome may present either an acute or chronic course, and hypopituitarism may be either complete or partial.[7] This is probably because the hormones of the anterior pituitary gland are primarily affected in the following sequence when the pituitary is damaged GH first, followed by PRL, FSH, LH, ACTH, and the end TSH.[25] Consequently, patients with Sheehan's syndrome who have partial hypopituitarism may be able to live for variable periods of time without hormone replacement therapy,[8] because hormone deficiency, particularly hypoadrenalism, is incomplete.[26] Furthermore, the production of mineralocorticoids is usually preserved in secondary adrenal insufficiency.[26] The duration between the occurrence of postpartum hemorrhage and diagnosis of Sheehan's syndrome in our patient may seem unusually long, but other cases with equal or even longer delays have been reported, up to 48 years in one report. [2-5,8-11] Thus, some patients with Sheehan's syndrome may live for many years without hormone replacement therapy.

We believe that the bilaterally atrophic adrenal glands of our patient may still have been partially functioning before hospitalization, and the influenza virus infection then precipitated adrenal crisis. In 1959, Skanse and Mioerner reported a series of 10 fatal cases of influenza with adrenocortical insufficiency; they advised both influenza vaccination and adequate hormone replacement therapy for patients with adrenal insufficiency.[21] One of their patients had Sheehan's syndrome. In 2018, Notter reported that influenza virus infection was one of the most frequent precipitating factors for adrenal crisis in Switzerland.[27]

Finally, what is a practical approach to early identification of Sheehan's syndrome? Foremost in a clinical scenario like the one presented by our patient is the importance of a thorough past medical history such as history of failure to lactate and to resume menses after childbirth order to identify women who may be at risk of having Sheehan's syndrome.[28,29] If Sheehan's syndrome is suspected, perform appropriate diagnostic testing and immediately begin glucocorticoid treatment even before the test results are known.

4 | CONCLUSION

Sheehan's syndrome is a heterogeneous disorder with respect to severity, and some patients may live many years without hormone replacement until adrenal crisis is precipitated by an acute illness. In women with a history of puerperal hemorrhage, failure to lactate, and amenorrhea, Sheehan's syndrome accompanied by adrenal crisis should be considered when they develop a relatively sudden onset of altered sensorium, hypotension, fever, and hypoglycemia with an acute viral illness such as influenza A even if many years have passed following puerperal hemorrhage. Unless diagnosed by measuring hormone levels (pituitary, thyroid, and adrenal) and treated, unsuspected Sheehan's syndrome in the setting of an acute illness may result in rapid clinical deterioration and death. Appropriate hormone replacement therapy, especially administration of hydrocortisone, is critical. The possibility of unsuspected Sheehan's syndrome and acute adrenal crisis may be important to keep in mind with women patients during the current COVID-19 pandemic.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

AUTHOR CONTRIBUTIONS

JT, KY, and IK: managed the patient. AI: supervised the medical team of this patient. HY and MY: performed and estimated the hormone stimulation test. KY: followed up the patient. JT: drafted the manuscript. HS: substantially contributed to the conceptualization and design of the manuscript and edited the manuscript. HY, TF, and WYF: edited and supervised the manuscript. HS and WYF: revised the manuscript. All authors reviewed and approved the final version of the manuscript.

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REFERENCES

1. Sheehan HL. Post-partum necrosis of the anterior pituitary. *Trans Edinburgh Obstet Soc*. 1938;58:13-28.
2. Dökmetaş HS, Kilicli F, Korkmaz S, et al. Characteristic features of 20 patients with Sheehan's syndrome. *Gynecol Endocrinol*. 2006;22:279-283.

3. Kumar N, Singh P, Kumar J, et al. Recurrent hypoglycaemia: a delayed presentation of Sheehan syndrome. *BMJ Case Rep*. 2014;2014:bcr2013200991.
4. Gokalp D, Alpagat G, Tuzcu A, et al. Four decades without diagnosis: Sheehan's syndrome, a retrospective analysis. *Gynecol Endocrinol*. 2016;32:904-907.
5. Diri H, Tanriverdi F, Karaca Z, et al. Extensive investigation of 114 patients with Sheehan's syndrome: a continuing disorder. *Eur J Endocrinol*. 2014;171:311-318.
6. Shivaprasad C. Sheehan's syndrome: Newer advances. *Indian J Endocrinol Metab*. 2011;15(Suppl 3):S203-S207.
7. Diri H, Karaca Z, Tanriverdi F, et al. Sheehan's syndrome: new insights into an old disease. *Endocrine*. 2016;51:22-31.
8. Ramiandrasoa C, Castinetti F, Raingeard I, et al. Delayed diagnosis of Sheehan's syndrome in a developed country: a retrospective cohort study. *Eur J Endocrinol*. 2013;169:431-438.
9. Jose M, Amir S, Desai R. Chronic Sheehan's syndrome - a differential to be considered in clinical practice in women with a history of postpartum Hemorrhage. *Cureus*. 2019;11:e6290.
10. Otsuka F, Kageyama J, Ogura T, et al. Sheehan's syndrome of more than 30 years' duration: an endocrine and MRI study of 6 cases. *Endocr J*. 1998;45:451-458.
11. Ishikawa K, Sohmiya M, Furuya H, et al. A case of Sheehan's syndrome associated with severe anemia and empty sella proved 48 years after postpartum hemorrhage. *Endocr J*. 1995;42:803-809.
12. Puar THK, Stikkelbroeck NMML, Smans LCCJ, et al. Adrenal crisis: still a deadly event in the 21st century. *Am J Med*. 2016;129:339.e1-e9.
13. Arlt W, Society for Endocrinology Clinical Committee. Society for endocrinology endocrine emergency guidance: Emergency management of acute adrenal insufficiency (adrenal crisis) in adult patients. *Endocr Connect*. 2016;5:G1-G3.
14. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA*. 2016;315:801-810.
15. Wagner DP, Draper EA. Acute physiology and chronic health evaluation (APACHE II) and Medicare reimbursement. *Health Care Financ*. 1984; Suppl(Suppl):91-105.
16. Sherlock M, Gittoes NJ, Arlt W. Adrenal crisis causing critical illness related reversible myocardial dysfunction. *Clin Endocrinol (Oxf)*. 2008;68:667-669.
17. Harris JE, Shah PJ, Korimilli V, et al. Frequency of troponin elevations in patients with influenza infection during the 2017–2018 influenza season. *Int J Cardiol Hear Vasc*. 2019;22:145-147.
18. Daoud A, Laktineh A, Macrander C, et al. Pulmonary complications of influenza infection: a targeted narrative review. *Postgrad Med*. 2019;131:299-308.
19. Duggal A, Pinto R, Rubenfeld G, et al. Global variability in reported mortality for critical illness during the 2009–10 influenza a(h1n1) pandemic: a systematic review and meta-regression to guide reporting of outcomes during disease outbreaks. *PLoS One*. 2016;11:e0155044.
20. Yanase T, Tajima T, Katabami T, et al. Diagnosis and treatment of adrenal insufficiency including adrenal crisis: a Japan Endocrine Society clinical practice guideline [Opinion]. *Endocr J*. 2016;63:765-784.
21. Skanse B, Mioerner G. Asian influenza with adrenocortical insufficiency. *Lancet*. 1959;273(7083):1121-1122.
22. Hahner S, Spinnler C, Fassnacht M, et al. High incidence of adrenal crisis in educated patients with chronic adrenal insufficiency: a prospective study. *J Clin Endocrinol Metab*. 2015;100:407-416.
23. Papadimitriou A, Priftis KN. Regulation of the hypothalamic-pituitary-adrenal axis. *NeuroImmunoModulation*. 2009;16:265-271.
24. Sert M, Tetiker T, Kirim S, et al. Clinical report of 28 patients with Sheehan's syndrome. *Endocr J*. 2003;50:297-301.
25. Schury MP, Adigun R. Sheehan Syndrome, 2019. https://www.ncbi.nlm.nih.gov/books/NBK459166/. Accessed February 2, 2020.
26. Alexandraki KI, Grossman A. Adrenal insufficiency. In: Feingold K, Anawalt B, Boyce A, et al., *Endotext. South Dartmaouth (MA): MDText. com, Inc 2018. [Internet]*. South Dartmaouth, MA: MDText. com. https://www.ncbi.nlm.nih.gov/books/NBK279122/. Accessed October 13, 2019.
27. Notter A, Jenni S, Christ E. Evaluation of the frequency of adrenal crises and preventive measures in patients with primary and secondary adrenal insufficiency in Switzerland. *Swiss Med Wkly*. 2018;148:w14586.
28. Furnica RM, Gadisseux P, Fernandez C, et al. Early diagnosis of Sheehan's syndrome. *Anaesth Crit Care Pain Med*. 2015;34:61-63.
29. Pekic S, Popovic V. Diagnosis of endocrine disease: expanding the cause of hypopituitarism. *Eur J Endocrinol*. 2017;176:R269-R282.

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