Journal of Clinical Anesthesia (2006) **18**, 286–292

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Journal of Clinical Anesthesia

Case report

Thyrotoxic periodic paralysis and anesthesia report of a case and literature review

Daniel A. Diedrich MD, Denise J. Wedel MD*

Department of Anesthesiology, Mayo Clinic College of Medicine, Rochester, MN 55905, USA

Received 18 January 2005; accepted 17 August 2005

Keywords:
Thyrotoxic periodic paralysis;
TPP;
Paralysis;
Anesthesia;
Hyperthyroidism;
Hypokalemia

Abstract Thyrotoxic periodic paralysis (TPP) is a disease characterized by recurrent episodes of paralysis and hypokalemia during a thyrotoxic state. The disease primarily affects people of Asian descent, but can affect other ethnic groups. In Asians, the symptoms of thyrotoxicosis are distinct and usually precede the first paralytic episode, whereas in non-Asian populations, paralysis is the presenting symptom. If TPP has not been diagnosed and the patient has a surgical procedure during general or regional anesthesia, symptoms of the disease may be confused with other adverse perioperative events such as delayed recovery from neuromuscular paralysis. No specific anesthetic regimen is superior. Current TTP treatment recommendations involve treating the underlying hyperthyroid state. Other modalities such as β-blockade and potassium replacement are also important in the acute paralytic state. Future diagnostic and treatment innovations may lie in the genetic and molecular understanding of this disease. We present a case of an Asian male with known TPP undergoing general anesthesia, a brief case series involving 5 patients, and a review of the literature.

1. Introduction

Thyrotoxic periodic paralysis (TPP) is a disease characterized by recurrent episodes of paralysis and hypokalemia in the setting of thyrotoxicosis. The disease primarily affects people of Asian descent, but can also affect other ethnic groups. In Asians, the symptoms of thyrotoxicosis are distinct and usually precede the first paralytic episode, whereas in non-Asian populations, paralysis is the presenting symptom. If TPP is undiagnosed and the patient has a surgical procedure during general or regional anesthesia, symptoms of the disease may be confused with other adverse perioperative events such as delayed recovery from neuromuscular paralysis. We present a case of an Asian man with known TPP undergoing general anesthesia, a brief case series, and a review of the literature.

2. Case report

A 32-year-old Vietnamese man presented to the emergency department with a history of several hours of profound weakness in his lower extremities after a sudden collapse as he was walking down a flight of stairs. He denied paresthesias but reported lower extremity myalgias intermittently over the last several weeks. The symptoms were sudden in onset with no precipitating event and resolved spontaneously within a

* Corresponding author.

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doi:10.1016/j.jclinane.2005.08.016

couple of hours. His medical history included a childhood head injury requiring surgery with no residual neurological deficits. There were no residual neurological deficits.

His physical examination was unremarkable. Laboratory testing revealed a creatinine kinase (CK) of 1123 U/L (normal 52-336 U/L) and serum potassium (K^+) of 3.0 mEq/L (normal 3.6-4.8 mEq/L). The final assessment was "functional weakness." At a neurological follow-up consultation 3 days later, there were no abnormal physical findings. Subsequent electromyography and brain magnetic resonance imaging were normal as were repeat CK and serum electrolytes.

A week later, he awoke suddenly with lower extremity paralysis, upper extremity weakness, and diffuse myalgias. In the emergency department, he reported that the frequency of these attacks had increased to twice per week. Physical examination revealed intact sensation and reflexes with pronounced weakness in the lower and mild in the upper extremities. His K^+ was 1.8 mEq/L and a thyroid-stimulating hormone (TSH) drawn the previous week was noted to be low (0.010 mIU/L, normal 0.30-5.0 mIU/L) with a high free thyroxin (3.1 ng/dL, normal 0.8-1.8 ng/dL). The diagnosis of TPP was made. The patient was administered oral potassium and his weakness spontaneously improved. He was dismissed home with oral potassium.

The patient denied personal or family history of thyroid disorders. On direct questioning by an endocrinologist, he reported a mild tremor, loose stools, and palpitations that coincided with the weakness over the previous 2 months. He denied temperature sensitivities or skin changes, but noted a 7-lb weight loss over the same period. On examination, the thyroid was estimated at 30 to 35 g; 24-hour radioactive iodine uptake was normal at 15% (normal 8%-29%). The diagnosis of Graves' disease was made. The patient was started on atenolol and scheduled for thyroidectomy.

On the day of surgery, a preoperative K^+ was 3.8 mEq/L. After intravenous placement, Ringer's lactate solution was administered and standard monitors were applied. The patient received 8 mg of dexamethasone for postoperative nausea and vomiting and one mg of midazolam before intravenous induction with 50 mg of lidocaine, 50 μg of fentanyl, 200 mg of propofol, and 6 mg of vecuronium. The trachea was intubated atraumatically, an arterial catheter was placed, and the patient was positioned for surgery. Anesthesia was maintained with isoflurane, nitrous oxide, vecuronium, and oxymorphone. An intraoperative K^+ was 4.3 mEq/L. The patient was stable throughout the procedure. At the conclusion, the muscle relaxant was reversed with neostigmine and glycopyrrolate and the trachea extubated. The postoperative course was unremarkable.

3. Case series

Perioperative problems with TPP are rare. To our knowledge, there is only one case report in the western literature of a paralytic attack occurring after general anesthesia in a patient with TPP [1]. To further clarify this condition, we performed an institutional review board–approved retrospective chart review of all patients with a diagnosis of TPP who underwent general or regional anesthesia at our institution from 1976 to 2002. The primary aim of this review was to determine the incidence of postoperative ventilatory failure, perioperative paralysis, thyroid storm, electrocardiographic (ECG) abnormalities, or other adverse events in this population. We found 6 general anesthetics involving 5 patients using multiple general anesthetic techniques; no perioperative complications were noted (Table 1).

4. Review of the literature

Thyrotoxic periodic paralysis has similar clinical findings to familial hypokalemic periodic paralysis (FHPP). The primary difference between the two disease states is the presence of a thyrotoxic state in TPP. This review will focus specifically on TPP.

4.1. Clinical presentation

Thyrotoxic periodic paralysis is characterized by recurrent episodes of weakness primarily of the lower extremities. Proximal muscle groups are affected more than distal ones [2]. The attacks typically occur acutely at night [3] and may be heralded by muscle cramps, aches, and rigidity [4];

Table 1 Patients with TPP undergoing anesthesia at the Mayo Clinic (1976-2002)

Patient	Age	Gender	Race	Surgical procedure	Type of anesthesia[a]	Perioperative complications[b]
1	34	M	C	Right inguinal hernia repair	GETA	None
2	50	M	C	Laparoscopic cholecystectomy	GETA	None
3	32	M	V	Total thyroidectomy	GETA	None
4	56	M	J	Mitral valve repair	GETA	None
5	43	F	F	Cholecystectomy/appendectomy	GETA	None
	58			Coronary artery bypass grafting	GETA	None

C indicates Caucasian; V, Vietnamese; J, Japanese; F, Filipino.

[a] GETA (general endotracheal anesthesia) with induction drug, paralytic, opioid, volatile, and all but two anesthetics (cardiac) received a reversal medication.

[b] Includes paralytic attack, perioperative ventilatory failure, thyroid storm, and ECG abnormalities from baseline.