

A case report of primary hyperparathyroidism in an adolescent during Ramadan fast

SAGE Open Medical Case Reports
Volume 12: 1–4
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DOI: 10.1177/2050313X241241439
journals.sagepub.com/home/sco



Ujunwa Justina Eze^{1,2}  and Sundus Elfadil²

Abstract

Primary hyperparathyroidism is rare in children and usually presents with nonspecific symptoms. Ramadan fasting has been reported to unmask the diagnosis of primary hyperparathyroidism. A 15-year-old boy presented to the clinic for an emergency department follow up visit. He had started Ramadan fasting a week before his presentation to the clinic. He reported unintentional weight loss, abdominal pain, constipation, frequent headaches, exercise intolerance, tiredness, and palpitations. Physical examination was unremarkable except that he looked tired. Investigations revealed elevated calcium and parathyroid hormone, hypophosphatemia, low vitamin D, and parathyroid adenoma. He underwent parathyroidectomy, leading to a decrease in parathyroid hormone levels. He did well postoperatively, and by his 11-month follow-up visit, his calcium was back to a normal level, he was energetic, and had gained weight. A high index of suspicion is required to diagnose primary hyperparathyroidism in young patients, especially young Ramadan-fasting patients, who mostly present with vague nonspecific symptoms.

Keywords

Primary hyperparathyroidism, hypophosphatemia, hypercalcemia, vitamin D, Ramadan fasting

Date received: 21 November 2023; accepted: 7 March 2024

Background

Primary hyperparathyroidism (PHPT) in the young population is uncommon and usually presents with ambiguous symptoms.¹ Healthcare providers, therefore, do not often suspect this disorder when patients present with some of these nonspecific symptoms. Unlike adults, the majority of children and adolescents with PHPT present with end-organ damage secondary to hypercalcemia at the time of diagnosis.^{1,2} There have been some reported cases of asymptomatic PHPT in young children where hypercalcemia was detected incidentally.³ Some environmental and lifestyle factors, including diet, smoking, exercise, alcohol, body mass index, and fasting, have been shown to change serum calcium and parathyroid hormone (PTH) levels.^{4–6} There have been conflicting reports on the effect of Ramadan fasting on serum calcium and PTH. Some studies show a significant increase in serum calcium and PTH, while others show a decrease or no significant changes.^{4,5} In as much as Ramadan fasting might benefit bone turnover,⁵ it could unmask previously undiagnosed hypercalcemia and PHPT by precipitating symptoms in previously asymptomatic patients. We herein report an adolescent boy with PHPT who presented with symptomatic hypercalcemia following Ramadan fasting.

Case presentation

A 15-year-old boy presented to our pediatric clinic for follow-up from the emergency department (ED) after diagnosis of acute bronchitis. He had started Ramadan fasting a week prior to the presentation. At the time of presentation, his respiratory symptoms had improved. However, he reports new unintentional weight loss that started before fasting (Figure 1). He also mentioned that following the commencement of fasting, he started having abdominal pain, constipation, frequent headache episodes, exercise intolerance, tiredness, and palpitations. On examination, he was alert but appeared tired. Other system examinations, as well as vital signs, were normal. A biochemical workup revealed markedly elevated calcium, hypophosphatemia, low vitamin D, and elevated

¹Family Medicine Residency Program, WellSpan Good Samaritan Hospital, Lebanon, PA, USA

²Pediatric Medicine Clinic, WellSpan Pediatric Medicine – Cornwall Road, Lebanon, PA, USA

Corresponding Author:

Ujunwa Justina Eze, Family Medicine Residency Program, WellSpan Good Samaritan Hospital, 252 S Fourth Street, Lebanon, PA 17042, USA.
Email: ueze@wellspan.org



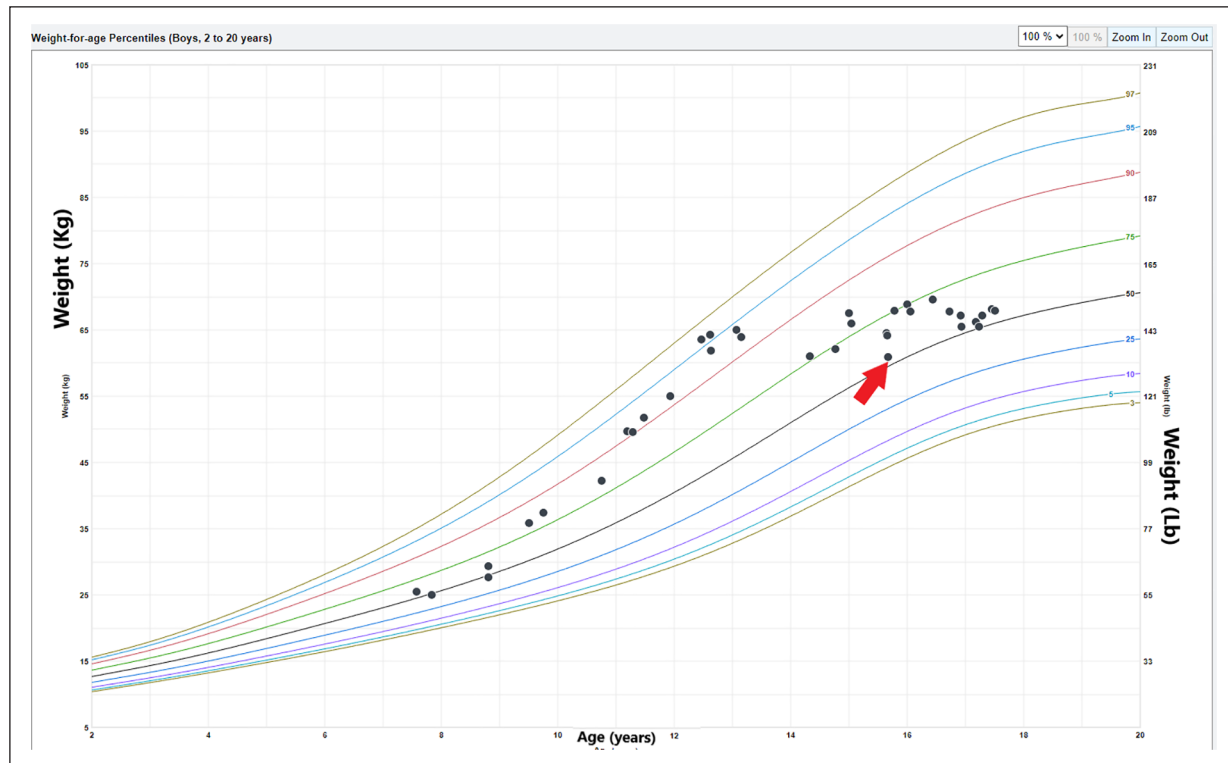


Figure 1. Patient's weights. The red arrow shows the weight of the patient at the time of diagnosis. Please note the downward trend of the patient's weight compared to earlier office visits.

Table 1. Preoperative and postoperative biochemical values of calcium and parathyroid hormone levels.

Parameters	Preoperative	Postoperative
Calcium	14.5 mg/dl	9.5 mg/dl
Parathyroid hormone	225 pg/mL	47 pg/mL

PTH. When contacted to discuss the result of laboratory work, parent reported patient was having weakness and bone pain; hence, he was advised to present to the ED to manage symptomatic hypercalcemia.

He had elevated blood pressure, elevated thyroid stimulating hormone, elevated total and ionized calcium, and low phosphate at the ED. This raised concerns for PHPT, leading to further workup. A head and neck ultrasound showed a parathyroid adenoma in the left tracheoesophageal groove measuring $0.8 \times 0.4 \times 1.9$ cm (Antero-posterior by width length). Endocrinology and endocrine surgery were consulted. The patient was started on IV fluid and IV Lasix pending surgery. He was subsequently transferred to a different facility that offers pediatric surgery services where he underwent parathyroidectomy, leading to a decrease in PTH from 225 pg/mL to 47 pg/mL intraoperatively (as shown in Table 1). He was discharged the same day and had an uncomplicated postoperative course.

After surgery, he was started on calcium and calcitriol to avoid postoperative hypocalcemia and for his low vitamin

D. His calcium, PTH, phosphate, magnesium, and vitamin D were followed up weekly. He had some symptomatic hypocalcemia, including a tingling sensation of the fingers. Subsequently, this improved, and the calcium and vitamin D supplements were gradually tapered down and successfully discontinued. The patient did well postoperatively, and by his 11-month follow-up visit, his calcium was still normal, and the patient had gotten his energy back and gained weight.

Discussion

There are reasonable explanations for the low suspicion of PHPT in children and adolescents. First, they are very rare in these populations, with an estimated incidence of 1/300,000 compared to 28/100,000 in adults.¹ Second, when they occur in this population, they present with nonspecific symptoms ranging from subtle gastrointestinal symptoms like nausea and vomiting to even more severe features like heart block and bone fracture. Our patient presented with some of these vague symptoms: abdominal pain, constipation, unintentional weight loss, palpitation, and headache. Most of these symptoms are secondary to hypercalcemia which is known to affect cell signaling which can have detrimental effects on different organs and systems in the body including gastrointestinal, neurologic, and cardiovascular systems.⁷ It is important to mention that, unlike adults, the majority of children

and adolescents at the time of diagnosis are symptomatic and usually present with end-organ damage.¹

The estimated incidence of PHPT in pediatric patients is 1 per 200–300,000 and its prevalence is 2–5 in 100,000.^{8,9} It has a higher predominance in adolescents, but its incidence is still much lower in this population than in adults where it has been estimated at 1:500–2000.¹⁰ In older children and adolescents, PHPT is most often caused by isolated sporadic parathyroid adenomas (80%–92%).¹¹ The remaining are due to multiglandular parathyroid hyperplasia observed in familial endocrine neoplastic syndromes, in which cases a family history of endocrine tumors with an autosomal dominant pattern of inheritance often exists.

During Ramadan, Muslims abstain from food and drink from dawn to sunset. They have an early morning meal before dawn and afterward do not eat or drink anything until after sunset. There have been conflicting reports on the effect of Ramadan fasting on serum calcium and PTH. Some studies show a significant increase in serum calcium and PTH, while others show a decrease or no significant change.^{4,5} A study to compare the levels of plasma calcium, PTH, and calcitonin during Ramadan fasting and non-fasting days in healthy individuals at 4.00 a.m., 9.00 a.m., 4.00 p.m., and 9.00 p.m. in nine healthy subjects showed that there was a significant increase in plasma PTH during fasting at 9.00 a.m.⁴ A similar study in Saudi Arabia showed “there was a substantial decrease in the evening mean level of circulating intact PTH during Ramadan compared with the morning mean level ($p=0.001$) and compared with the evening mean values during Shaban – a non-fasting month ($p=0.029$).”⁵ This study also showed that during Shaban, three subjects had slightly elevated intact PTH concentrations in the morning or the evening sample, and two had more than double the top normal range in the morning and evening. During Ramadan, however, a slight elevation was noted for four subjects in the morning samples and one subject in the evening sample. Only one subject with more than double the top normal range values during Shaban continued to have an elevated level during Ramadan.

The effect of Ramadan fasting on PTH and calcium has been explained to be due to the impact of sleep disturbance and fasting on PTH secretion and calcium metabolism. PTH has been shown to follow a diurnal pattern by various studies.^{12–14} During Ramadan, sleeping hours, between 11.00 p.m. and 8.00 a.m., are frequently interrupted by the fasting hours and associated prayers. In one of the studies conducted to investigate the circadian rhythm of PTH, a circadian rhythm during daytime was found for intact PTH in healthy men and women with a nadir at 0930h and a peak in the afternoon.¹⁵ Another study showed that patients with obstructive sleep apnea had significantly higher serum levels of PTH (5.93 ± 1.82 pmol/L) compared to controls (3.13 ± 0.97 pmol/L), $p < 0.001$.¹⁶ Among the various environmental and lifestyle factors known to affect PTH secretion, diet is one of them.⁶ Fasting could lead to a reduction in

calcium, which can increase PTH concentration; in the same vein, a heavy meal following evening prayer after breaking the day’s fasting can lead to an increase in post-absorptive calcium concentration, which can reduce PTH. This was also observed in the Saudi Arabia study where food (including dairy products) was ingested 2–3 h before taking the evening sample; hence, the lower intact PTH mean concentration corresponded with an increased post-absorptive calcium concentration and a decreased phosphate concentration with increased carbohydrate metabolism both acting to repress PTH secretion.⁵

In as much as the majority of children and adolescents are symptomatic by the time of diagnosis, a significant number of them, with a range of 14%–25%, are diagnosed incidentally by routine blood chemistry.⁷ We could create an assumption that our patient had undiagnosed asymptomatic or subclinical hyperparathyroidism, which was aggravated by the effect of Ramadan fasting on calcium and PTH. This is supported by the history of unintentional weight loss before fasting; again, weight loss is a nonspecific symptom that can easily be attributed to more benign causes in a seemingly healthy adolescent. Similarly, the onset of more symptoms shortly after the commencement of Ramadan fasting supports this assumption. PHPT is a disorder that can successfully be treated with parathyroidectomy. Our patient was successfully managed with parathyroidectomy and did well on follow-up without having to stay on long-term calcium or vitamin D supplementation. At the same time, PHPT, if not caught early, can cause lots of end-organ damage, including debilitating skeletal disorders. This is even more pertinent when dealing with the pediatric population, as most tend to have progressed to end-organ damage by the time of diagnosis. Hence, providers should have a high index of suspicion when children and adolescents present with these vague symptoms, especially during the fasting state.

Recommendation

Due to limited studies on the effect of Ramadan fasting on PTH secretion and calcium metabolism, this area should be studied further. Future studies should also focus on other factors that might unmask symptoms of hyperparathyroidism due to parathyroid adenoma among pediatric patients.

Conclusion

Although PHPT is extremely rare in young patients and tends to present with nonspecific symptoms at the time of diagnosis, there should be a high index of suspicion in Ramadan fasting patients with these vague symptoms as fasting together with sleep disturbance has been identified to unmask the symptoms and diagnosis of PHPT.

Acknowledgements

Not applicable.

Authors' contributions

UJE analyzed and interpreted the patient data and drafted and edited the manuscript. SE conceptualized the study, reviewed the manuscript and provided critical input. All authors have read and approved the final version of the manuscript and have agreed to publish it.

Availability of data and material

Data sharing is not applicable to this article, as no datasets were generated or analyzed during the current study.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

ORCID iD

Ujunwa Justina Eze  <https://orcid.org/0000-0003-3699-4548>

References

- Gafar SMA, Fadlbari GF, Abdalla AT, et al. Pitfalls in the diagnosis of primary hyperparathyroidism in a sudanese adolescent boy; a case disguised as rickets. *BMC Endocr Disord* 2022; 22: 322.
- Roizen J and Levine MA. Primary hyperparathyroidism in children and adolescents. *J Chin Med Assoc* 2012; 75: 425–434.
- Tosur M, Patel KN, Swischuk LE, et al. Incidental hypercalcemia caused by primary hyperparathyroidism with rapid progression to renal complications in a child. *Clin Pediatr (Phila)* 2018; 57(1): 117–120.
- Bakir SM, Al-Attas MSMT, Kordy A, et al. The effect of ramadan fast on the diurnal change of total calcium, parathyroid hormone and calcitonin. *Med J Cairo Univ* 1994; 62(2): 485–491.
- Bahijri SM, Ajabnoor GM, Borai A, et al. Effect of Ramadan fasting in Saudi Arabia on serum bone profile and immunoglobulins. *Ther Adv Endocrinol Metab* 2015; 6(5): 223–232.
- Leko MB, Pleić N, Gunjača I, et al. Environmental factors that affect parathyroid hormone and calcitonin levels. *Int J Mol Sci* 2022; 23: 44.
- Mancilla EE, Windle ML, Chrousos GP, et al. Pediatric hyperparathyroidism clinical presentation: history, physical examination. *Medscape*. <https://emedicine.medscape.com/article/921453-clinical?form=fpf> (2022, accessed 7 December 2022).
- Mallet E and Working Group on Calcium Metabolism. Primary hyperparathyroidism in neonates and childhood. The French experience (1984–2004). *Horm Res* 2008; 69(3): 180–188.
- Lawson ML, Miller SF, Ellis G, et al. Primary hyperparathyroidism in a paediatric hospital. *QJM* 1996; 89(12): 921–932.
- Nicholson KJ, McCoy KL, Witchel SF, et al. Comparative characteristics of primary hyperparathyroidism in pediatric and young adult patients. *Surgery* 2016; 160(4): 1008–1016.
- Ruda JM, Hollenbeak CS and Stack BC Jr. A systematic review of the diagnosis and treatment of primary hyperparathyroidism from 1995 to 2003. *Otolaryngol Head Neck Surg* 2005; 132(3): 359–372.
- Jubrz W, Canterbury JM, Reiss E, et al. Circadian rhythm in serum parathyroid hormone concentration in human subjects: correlation with serum calcium, phosphate, albumin, and growth hormone levels. *J Clin Invest* 1972; 51(8): 2040–2046.
- Logue F, Fraser W, O'Reilly D, et al. The circadian rhythm of intact parathyroid hormone (1–84) and cyclic adenosine monophosphate in normal men. *J Endocrinol* 1989; 121: R1–R3.
- Fuleihan GE-H, Klerman EB, Brown EN, et al. The parathyroid hormone circadian rhythm is truly endogenous—a general clinical research center study. *J Clin Endocrinol Metab* 1997; 82(1): 281–286.
- Herfarth K, Schmidt-Gayk H, Graf S, et al. Circadian rhythm and pulsatility of parathyroid hormone secretion in man. *Clin Endocrinol (Oxf)* 1992; 37(6): 511–519.
- Krasimirova D, Bilyukov R, Pencheva V, et al. Parathyroid hormone and vitamin D levels in obstructive sleep apnea. *Eur Respir J* 2017; 50(61): PA2335.