Atrioventricular nodal dysfunction secondary to hyperparathyroidism

Athanasios Vosnakidis[1], Konstantinos Polymeropoulos[1], Paul Zarogoulidis[2], Ioannis Zarifis[1]

[1]Department of Cardiology, "George Papanikolaou" General Hospital, Thessaloniki, Greece; [2]Pulmonary Department, "George Papanikolaou" General Hospital, Aristotle University of Thessaloniki, Thessaloniki, Greece

ABSTRACT The relationship of hyperparathyroid—associated hypercalcemia with clinical significant bradyarrythmias still remains controversial. We present a 66-year-old patient with dizziness, headache and paroxysmal 2:1 atrioventricular block. A 24-hour Holter report revealed symptomatic intermittent 2nd degree (2:1) atrioventricular block with a mean heart rate of 46 bpm. A 2D echocardiogramm showed normal ejection fraction and there was no valve dysfunction or calcification. The biochemistry results showed elevated serum calcium level, low phosphate level, elevated serum parathyroid hormone level and normal serum levels of potassium, magnesium and sodium. The urine calcium excretion was 390 mg/24 h. A coronary angiography was performed and revealed no critical lesions. The patient continued to have symptoms despite of the treatment of hypercalcemia and a DDDR pacemaker was implanted. He had a Sestamibi-scan of the neck, that was suggestive of parathyroid adenoma, and parathyroidectomy was performed. The presuming mechanism is the degeneration of AV node due to calcium deposit.

KEY WORDS Atrioventricular nodal dysfunction; hyperparathyroidism (HPT); hypercalcemia

J Thorac Dis 2013;5(3):E90-E92. doi: 10.3978/j.issn.2072-1439.2013.05.06

Introduction

The relationship of hyperparathyroid—associated hypercalcemia with clinical significant bradyarrythmias still remains controversial and the possible pathophysiologic pathway has not been demonstrated. Most studies include a small number of subjects with conflicting results (1,2).

We present a patient who was referred to our centre due to atrioventricular (AV) nodal dysfunction in the setting of hypercalcemia secondary to hyperparathyroidism (HPT).

Case presentation

A 66-year-old male presented with a major complaint of dizziness and headache. He denied having chest pain, dyspnea or syncope. He also complained of palpitations for the past few days. He had a medical history of urinary bladder papilloma, nephrolithiasis and large intestine polyps. His familial medical history did not include any serious diseases.

On admission, his blood pressure was 125/75 mmHg and his heart rate 35 bpm. The physical examination revealed normal heart sounds and no murmurs. He received occasionally paracetamol for headache and he stated no use of lithium, digoxin, b-blockers or any other bradycardiac agent.

An electrocardiogram (ECG) showed sinus P waves and 2nd degree (2:1) AV block with QRS duration <120 msec and a rate of 35 bpm. A 24-hour Holter report revealed normal sinus rhythm and episodes of 2nd degree (2:1) AV block. Heart rate varied from 29 to 97 bpm (Mean HR 46 bpm). The chest X-ray and the cardiothoracic index were normal. A 2D echocardiogram demonstrated normal systolic function of the left ventricle. The size of the cardiac cavities and the wall thickness were normal and there was no valve dysfunction. Biochemistry showed elevated serum calcium level of 12.7 mg/dL (normal range, 8.5-10.5 mg/dL), low phosphate level of 1.5 mg/dL (normal range, 3.6-4.5 mg/dL), elevated serum parathyroid hormone (PTH) level of 706 pg/mL (normal range, 12-75 pg/mL) and normal serum levels of potassium, magnesium and sodium. The urine calcium excretion was 390 mg/24 h (normal range, 100-300 mg/24 h). The thyroid hormones (thyrotropin- TSH, free T3, free T4) and serum tumor antigens were normal. A coronary angiography was performed and revealed no critical lesions.

The patient constantly expressed symptomatic intermittent 2nd degree (2:1) AV block. An Electrophysiology Study was not performed as the patient fulfilled criteria for pacemaker

Corresponding to: Paul Zarogoulidis, M.D, PhD. "George Papanikolaou" General Hospital, Aristotle University of Thessaloniki, Thessaloniki, Greece. Email: pzarog@hotmail.com.

Submitted Mar 14, 2013. Accepted for publication, Apr 27, 2013.
Available at www.jthoracdis.com

ISSN: 2072-1439

implantation according to established ESC Guidelines (3). A DDDR pacemaker (incorporating algorithm of Managed Ventricular Pacing—MVP® Medtronic) was implanted 12 days after admission and the patient was discharged free of symptoms. On an outpatient basis, he had a neck Sestamibi-scan, that was suggestive of parathyroid adenoma, and parathyroidectomy was performed 6 weeks later. On routine follow-up in our clinic (after one and six months), the patient remained free of symptoms with serum calcium level within normal limits. Of note, the percentage of ventricular pacing was 23% at one month visit and less than 4% at six months visit, without any programmed alteration on pacing parameters.

Discussion

This case of AV nodal dysfunction due to hypercalcemia caused by primary hyperparathyroidism (PHPT) is a rare phenomenon. Calcium homeostasis is associated with PTH, an 84-amino acid protein, calcitonin and vitamin D levels. Whenever calcium concentration decreases, PTH is secreted by the chief cells in the parathyroid glands. PTH stimulates osteoclasts to increase bone resorption, the kidney to increase calcium resorption and renal production of 1,25-dihydroxyvitamin D and the intestine to increase absorption of calcium and phosphate (1). There are calcium-sensing receptors in the parathyroid glands, which detect serum calcium concentrations and create a negative feedback loop, resulting in decreased PTH production.

Hypercalcemia leads to varying symptoms from multiple systems, including nephrolithiasis, anorexia, nausea, altered mental status. PHPT is the most common cause of hypercalcemia (0.2% in patients more than 60 years of age). The diagnosis is based on elevated serum calcium and intact parathyroid hormone levels with increased 24 h urine calcium concentration. Parathyroid adenomas are the most common cause of PHPT (85%) and are usually benign.

PHPT is related to several implications from the cardiovascular system, including myocardial interstitium, the conducting system and calcific deposits in the valve cusps and annuli (2). A recent study showed that PTH is an independent risk factor for mortality and cardiovascular events in patients undergoing coronary angiography (4). Moreover, severe hypercalcemia is associated with valvular and myocardial calcification, whereas modest hypercalceamia does not seem to provoke calcification. Left ventricular hypertrophy (LVH) seems to be related to PTH levels independently of hypertension and it may regress after parathyroidectomy (5). Left ventricular ejection fraction (LVEF) does not seem to be compromised in patients with PTPH (6).

Serum calcium levels correlate positively with T wave duration and negatively with QT and QTc interval (2). The duration of plateau of the action potential of cardiac fibers is shortened by high serum calcium concentration (2). There is lack of evidence whether hypercalceamia is related to clinical important conduction disturbances. Rosenqvist *et al.* (7) demonstrated that modest hypercalceamia is not correlated to increased prevalence of ventricular or supraventricular arrythmias or high-grade atrioventricular block. On the contrary, in the study of Shah *et al.* (8), it was suggested that PHPT could cause sinus node dysfunction. Other studies found that concomitant use of digitalis or lithium and hypercalceamia may lead to severe bradycardia (9). Another study showed severe bradycardia on a patient with breast cancer and acute hypercalceamia due to bone metastases (10).

Bradycardia may be due to a variety of intrinsic and extrinsic influences on the heart including idiopathic degeneration, ischemic heart disease, infiltrative and infectious diseases, hereditary syndromes, negatively chronotropic drugs, electrolyte disturbances and metabolic disorders (11). A suspected mechanism of AV block in our patient with PHPT is calcification and therefore dysfunction of AV node due to high levels of serum calcium. This hypothesis is supported by the fact that bradycardia in the elderly is caused by the degeneration and calcification of the sinus node (2). It is to emphasize the reduced percentage of ventricular pacing in our patient after parathyroidectomy. A plausible explanation is that AV conduction was restored postoperatively, leading to diminished requirements for ventricular pacing. Consequently, it seems justifiable to include calcium level measurement in the routine investigation of patients with symptomatic bradycardia.

In conclusion, we presented a rare case of AV node dysfunction in a patient with PHPT. The presuming mechanism is the degeneration of AV node due to calcium deposit; however, there is lack of strong evidence in the current literature. This emphasizes the necessity of more research to clarify relationship between hypercalceamia and symptomatic bradycardia.

Acknowledgements

Disclosure: The authors declare no conflict of interest.

References

1. Ariyan CE, Sosa JA. Assessment and management of patients with abnormal calcium. Crit Care Med 2004;32:S146-54.
2. Seely EW, Williams GH. The heart in endocrine disorders. In: Braunwald. eds. Heart Disease (6th Edition). Philadelphia: WB Saunders. 2001:2166.
3. Vardas PE, Auricchio A, Blanc JJ, et al. Guidelines for cardiac pacing and cardiac resynchronization therapy: The Task Force for Cardiac Pacing and Cardiac Resynchronization Therapy of the European Society of Cardiology. Developed in collaboration with the European Heart Rhythm Association. Eur Heart J 2007;28:2256-95.
4. Pilz S, Tomaschitz A, Drechsler C, et al. Parathyroid hormone level is

associated with mortality and cardiovascular events in patients undergoing coronary angiography. Eur Heart J 2010;31:1591-8.
5. Birgander M, Bondeson A, Bondeson L, et al. Relationship between mild primary hyperparathyroidism and left ventricular structure and diastolic performance. Endocrinologist 2009;19:187-91.
6. Farahnak P, Ring M, Caidahl K, et al. Cardiac function in mild primary hyperparathyroidism and the outcome after parathyroidectomy. Eur J Endocrinol 2010;163:461-7.
7. Rosenqvist M, Nordenström J, Andersson M, et al. Cardiac conduction in patients with hypercalcaemia due to primary hyperparathyroidism. Clin Endocrinol (Oxf) 1992;37:29-33.
8. Shah AP, Lopez A, Wachsner RY, et al. Sinus node dysfunction secondary to hyperparathyroidism. J Cardiovasc Pharmacol Ther 2004;9:145-7.
9. Wolf ME, Ranade V, Molnar J, et al. Hypercalcemia, arrhythmia, and mood stabilizers. J Clin Psychopharmacol 2000;20:260-4.
10. Badertscher E, Warnica JW, Ernst DS. Acute hypercalcemia and severe bradycardia in a patient with breast cancer. CMAJ 1993;148:1506-8.
11. Vardas PE, Mavrakis HE, Toff WD. Bradycardia. In: Camm AJ, Lüscher TF, Serruys PW. The ESC Textbook of Cardiovascular Medicine (2nd edition). Oxford: Oxford University, 2009:987.

Cite this article as: Vosnakidis A, Polymeropoulos K, Zarogoulidis P, Zarifis I. Atrioventricular nodal dysfunction secondary to hyperparathyroidism. J Thorac Dis 2013;5(3):E90-E92. doi: 10.3978/j.issn.2072-1439.2013.05.06