Brief Communication

Slipped Capital Femoral Epiphysis in Primary Hyperparathyroidism - Case Report with Literature Review

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Abstract

Primary hyperparathyroidism is not common in children and adolescents. Association of slipped capital femoral epiphysis and hyperparathyroidism is rare. We report the case of a 15-year-old boy who presented with pain in both hips and limping. He was diagnosed to have bilateral slipped capital femoral epiphysis (SCFE) and underwent cancellous screw fixation of both hips. He had proximal myopathy and pain at multiple points over the chest. Examination revealed an emaciated patient with genu valgum, rachitic rosary, Harrison's sulcus, and bony tenderness over the ribs. Investigations showed PTH-dependent hypercalcemia with serum calcium levels reaching >17 mg/dL and electrocardiography showing QTc shortening. Imaging revealed parathyroid adenoma. The work up for multiple endocrine neoplasia syndromes (MEN) was negative. Serum calcium was controlled by medical management and patient underwent expedited surgery. Postoperatively serum calcium levels normalized and patient became better biochemically and clinically including resolution of skeletal changes on follow-up. Only 12 cases of SCFE associated with primary hyperparathyroidism have been reported worldwide till date including the current case. The literature has been reviewed and it indicates that SCFE is associated with late adolescent age and severe hyperparathyroidism (severe bone disease, higher parathormone, serum calcium, and alkaline phosphatase levels).

Keywords: Hypercalcemia, primary hyperparathyroidism, rachitic rosary, slipped capital femoral epiphysis, slipped capital femoral epiphysis

Introduction

Slipped capital femoral epiphysis also known as adolescent coxa vara is a common orthopedic condition among children and adolescents in which femoral head is displaced posteroinferiorly from femoral neck. Although most cases are idiopathic in origin it may be associated with endocrine disorders including obesity, hypothyroidism, growth hormone deficiency, or growth hormone treatment. The occurrence of hyperparathyroidism in patients with bilateral slipped capital femoral epiphysis is unusual.

Case Report

With proper consent, we report a case of a 15-year-old boy with normal developmental milestones, born to nonconsanguineous parents. Patient presented to the orthopedic outpatient department with limping and pain in both the hips for 1 year duration. He was diagnosed to have bilateral slipped capital femoral epiphysis based on radiological findings and was treated with bilateral cancellous screw fixation after preliminary examination and investigations to rule out a secondary cause for the same such as obesity, diabetes, thyroid disorders, growth hormone disorders, and kidney disease [Figure 1]. During postoperative follow-up, he continued to complain of pain in multiple bony points all over the body, especially over the ribs. In addition he had anorexia, generalized weakness, vomiting, and loss of weight for 3 months. Even after the surgery, patient had difficulty in supporting himself in the sitting or standing position due to proximal muscle weakness. Endocrinology referral was then sought in view of multiple systemic problems.

Physical examination revealed an alert but emaciated boy with body mass index (BMI) of 16.4 kg/m^2. Rachitic rosary

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and Harrison's sulcus were noted on the rib cage. Bony tenderness was elicitable on the ribs. His height was normal (height SDS = −0.58) and his bone age corresponded to a chronological age of 15 years. He was clinically euthyroid, testicular volume was 10 mL on each side with Tanner stage 5 pubic hair and a stretched penile length of 12 cm indicating a normal pubertal progression.

Investigations revealed liver, renal, and thyroid functions which were normal. Electrocardiogram showed QT interval shortening with a corrected QT (QTc) interval of 280 ms. Serum calcium level was 17.2 mg/dL (normal range, 8.7–10.3 mg/dL), and serum phosphorous was 2.8 mg/dL (normal range, 2.5–4.3 mg/dL), with a corresponding S.PTH value of 1,052 pg/ml (normal range, 8–51 pg/mL), and albumin level of 3.8 g/dL (normal range, 4–5 g/dL). In view of the PTH-dependent severe hypercalcemia parathyroid imaging in the form of ultrasound of neck, four-dimensional computed tomography (4D CT) of neck and ^{99}Tc Sestamibi scan were done. CT neck showed well defined moderately enhancing soft tissue density lesions in relation to inferior poles of both lobe of thyroid suggestive of parathyroid adenoma. SESTAMIBI scan showed MIBI avid hyper metabolic tissue corresponding to the right-sided lesion on 4D CT scan. Ultrasound also showed a lesion which corresponded to right inferior parathyroid adenoma.

In view of primary hyperparathyroidism at a young age and bilateral adenomas, multiple endocrine neoplasia (MEN) types 1 and 2 were ruled out using serum prolactin, serum calcitonin, and 24-h urine estimation of metanephrine, normetanephrines, and vanilylmandellic acid, all which were within normal limits.

The shortened QT interval on ECG and raised serum calcium levels together with severe symptoms called for aggressive approach for reduction of serum calcium levels and an expedited surgical removal of parathyroid adenoma.

Patient was initially managed with aggressive fluid resuscitation and salmon calcitonin but later loop diuretics, intravenous corticosteroids, and cinacalcet were added for bringing down the serum calcium levels. Bisphosphonates were avoided in view of severe bone disease and increased risk of prolonged hypocalcemia in the postoperative period.

The patient underwent bilateral inferior parathyroidectomy and intraoperative palpation for enlargement of the other two parathyroid glands. Intraoperative PTH was done which showed significant fall of serum PTH (>50%) indicating a successful removal of the culprit gland. Postoperatively, serum calcium returned to normal range in 2 days. Although patient did not have symptoms of hypocalcemia, calcium and activated Vitamin D were supplemented for 1 month. Histopathology revealed a adenoma in the right inferior parathyroid gland; the other gland operated was found to be normal.

One year after the surgery the patient continues to be under regular follow-up. His gait improved by about one month postsurgery. Rachitic rosary disappeared and the degree of bowing of legs has reduced [Figure 2]. Patient is also maintaining normal serum calcium and phosphorus levels.

Discussion

This case illustrates the presentation of primary hyperparathyroidism in a teenage boy with severe life-threatening hypercalcemia, which initially presented as bilateral slipped capital femoral epiphysis. In total, 12 cases have been reported in the past where SCFE was associated with primary hyperparathyroidism. The cases have been reviewed in Table 1.

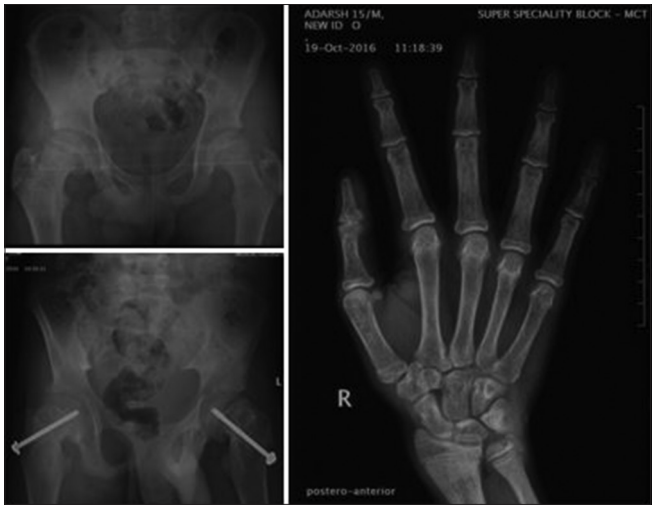

Figure 1: Radiograph showing SCFE before and after screw fixation and changes in hand bones

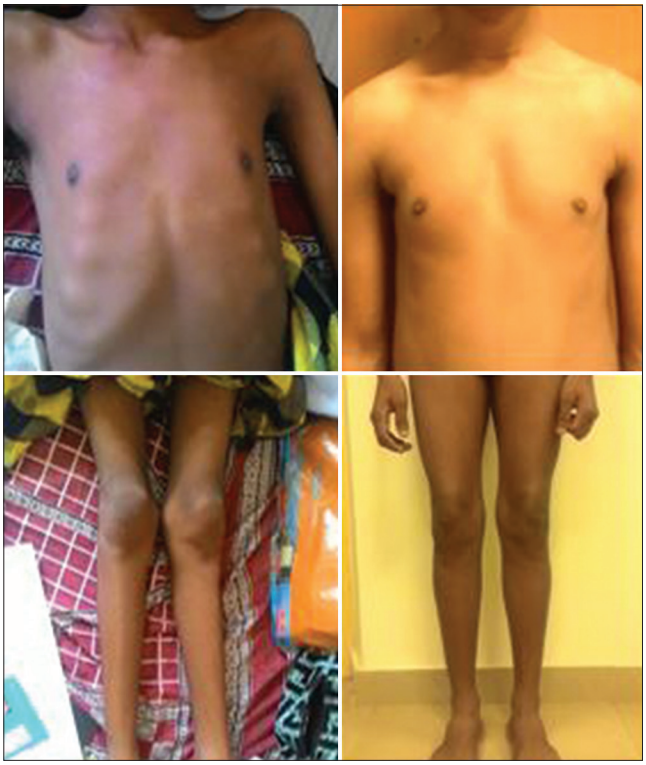

Figure 2: Rachitic rosary and genu valgum at presentation and after 1 year of surgical correction of primary hyperparathyroidism

Table 1: Previous case reports of SCFE in patients with hyperparathyroidism

Author/year	Age/ sex	S.Ca (mg/dl)	iPTH (pg/ ml)	SCFE B/L or u/l	ALP	Histopathology	Notable clinical findings/management
Chiroff *et al*., 1974[1]	11/M	4.0*		B/L		Single adenoma	Height 5th centile, B/l genu valgum, sinus arrhythmia on ECG, cupped and frayed epiphyses on X rays
Bone *et al*., 1985[2]	13/F	6.0 *	451	B/L	866	Single adenoma	Spontaneous resolution of SCFE after parathyroidectomy
Kinoshita *et al*., 1995[3]	16/M	11.5	340	B/L	6900	Single adenoma	SCFE and Parathyroid adenoma treated surgically at a simultaneous surgery
Yang *et al*., 1997[4]	13/M			B/L		Adenoma	SCFE and Parathyroid adenoma surgeries done 3 weeks apart. Patient asymptomatic at one year follow-up
Quadan *et al*., 2003[5]	13/F	15.6			1780	Adenoma	Severe hypercalcemia treated preoperatively with IV pamidronate
Khiari K *et al*., 2003[6]	16/M	12.42		B/L		Single adenoma	Resolution of SCFE after parathyroid surgery
Madeira *et al*., 2005[7]	18/M	13.6	1524	B/L	3449		SCFE managed conservatively
Alghamdiel *et al*., 2016[8]	13/F	11.62	2253	B/L	2008	Adenoma	SCFE and parathyroid adenoma surgeries done a week apart
El Scheich *et al*., 2012[9]	15/M	3.52*	172	B/L	1186	Single adenoma	SCFE and parathyroid adenoma surgeries done 3 weeks apart
Bhadada *et al*.[10]	12/F	10.4	1523	B/L	22	Single adenoma	Parathyroid and SCFE surgeries done 3 months apart
Tai-Seung Kim *et al*., 2009[11]	14/M	11.8	1299	B/L	1450	Single adenoma	SCFE and Parathyroid adenoma treated surgically at a simultaneous surgery
Pitukcheewanont *et al*.[12]	14/F	13.4	1013	R U/L		Parathyroid carcinoma	SCFE and parathyroid surgeries done separately

iPTH: Intact PTH, S. Ca: S. calcium, SCFE: Slipped capital femoral epiphysis, ALP: S. alkaline phosphatase, U/L: Unilateral, B/L: Bilateral. *Ionized calcium

From our case and the literature reviewed above, we found that almost all the cases were reported in the later adolescence with a mean age of diagnosis of 14.3 (± 1.95) years, which when compared with a recent community-based data on slipped capital femoral epiphysis (due to all causes) was significantly higher i.e. 11.6 years for girls and 12.9 years for boys.[13] The study by Herngern *et al*.[13] done by collecting data from the Swedish national registry got information about 379 cases of SCFE of which 34 had a comorbidity associated including endocrine diseases (9 patients), but none of them were having primary hyperparathyroidism. Out of the 10 patients 7 were males. The duration of symptoms before presentation was long except in one case. The patients were having more severe bone disease by the time SCFE was diagnosed. Hypercalcemia was undoubted and severe in most cases and serum parathyroid hormone levels were more than 1,000 pg/mL. Serum alkaline phosphatase levels were also very high. The above biochemical findings indicate that more severe the biochemical abnormalities, higher is the risk for SCFE, and correspondingly the bone disease appears more severe at presentation. The pathogenesis may involve adolescent growth spurt leading to proliferation in the epiphyseal cartilages in the setting of failure to mineralize due to the biochemical milieu which is unfavorable for retention of calcium in bone and mineralizing cartilage. Recent evidence suggests presence of PTH receptors in the growth plates[14] and it is hypothesized that it is involved in the degradation of matrix proteins and epiphyseal fusion.[15] An excess of parathyroid hormone may cause abnormalities in the matrix proteins together with difficulty in mineralization of this defective matrix. The rapid rise in the body weight associated with puberty may lead to shear stress[16] on the cartilage and finally slippage of capital femoral epiphysis. Similar pathogenesis may involve SCFE which occurs in patients with chronic kidney disease.

Conclusion

Primary hyperparathyroidism needs active consideration in the differential diagnosis of slipped capital femoral epiphysis especially when the presentation is in later part of adolescence and when there are clinical features to suggest bone disease. Pathogenesis may be related to higher levels of serum calcium and parathyroid hormone.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Chiroff RT, Sears KA, Slaughter WH 3rd. Slipped capital femoral epiphyses and parathyroid adenoma. J Bone Joint Surg Am

1974;56:1063-7.
2. Bone LB, Roach JW, Ward WT, Worthen HG. Slipped capital femoral epiphysis associated with hyperparathyroidism. J Pediatr Orthop 1985;5:589-92.
3. Kinoshita J, Kaneda K, Matsuno T, Hosokawa Y, Nagashio R. Slipped capital femoral epiphysis associated with hyperparathyroidism. A case report. Int Orthop 1995;19:245-7.
4. Yang WE, Shih CH, Wang KC, Jeng LB. Slipped capital femoral epiphyses in a patient with primary hyperparathyroidism. J Formos Med Assoc 1997;96:549-52.
5. Qadan L, Al-Quaimi M, Ahmad A. Slipped capital femoral epiphysis associated with primary hyperparathyroidism and severe hypercalcemia. Clin Pediatr (Phila) 2003;42:439-41.
6. Khiari K, Cherif L, Ben Abdallah N, Maazoun I, Hadj Ali I, Bentaarit C, *et al.* Slipped capital femoral epiphysis associated with hyperparathyroidism: A case report. Ann Med Interne (Paris) 2003;154:544-6.
7. Madeira IR, Machado M, Maya MC, Sztajnbok FR, Bordallo MA. Primary hyperparathyroidism associated to slipped capital femoral epiphysis in a teenager. Arq Bras Endocrinol Metabol 2005;49:314-8.
8. Alghamdi AA, Ahmad MM, Almalki MH. Slipped capital femoral epiphysis and primary hyperparathyroidism: A case report. Clin Med Insights Endocrinol Diabetes 2016;9:73-6.
9. El Scheich T, Marquard J, Westhoff B, Krauspe R, Schneider A, Cupisti K, *et al.* Approach to the management of slipped capital femoral epiphysis and primary hyperparathyroidism. J Pediatr Endocrinol Metab 2012;25:407-12.
10. Bhadada SK, Menon AS, Bhansali A, Das S, Gill SS, Behera A. An unusual cause of limping in primary hyperparathyroidism. Endocrinologist 2009;19:122-3.
11. Kim T-S, Choi W-S. Bilateral slipped capital femoral epiphysis due to primary hyperparathyroidism. J Korean Orthop Assoc 2009;44:565-9.
12. Serrano-Gonzalez M, Shay S, Austin J, Maceri DR, Pitukcheewanont P. A germline mutation of *HRPT2/CDC73* (70 G>T) in an adolescent female with parathyroid carcinoma. J Pediatr Endocrinol Metab 2016;29:1005-12.
13. Herngren B, Stenmarker **V**avruch L, Hagglund GM. Slipped capital femoral epiphysis: A population-based study. BMC Musculoskeletal Disorders BMC series –2017.
14. Crabb ID, O'Keefe RJ, Puzas JE, Rosier RN. Differential effects of parathyroid hormone on chick growth plate and articular chondrocytes. Calcif Tissue Int 1992;50:61-6.
15. Kawashima-Ohya Y, Satakeda H, Kuruta Y, Kawamoto T, Yan W, Akagawa Y, *et al.* Effects of parathyroid hormone (PTH) and PTH-related peptide on expression of matrix metalloproteinase-2, -3, and -9 in growth plate chondrocyte cultures. Endocrinology 1998;139:2120-7.
16. Papavasiliou KA, Kapetanos GA, Kirkos JM, Beslikas TA, Dimitriadou AS, Papavasiliou VA, *et al.* The pathogenetic influence of I-parathyroid hormone on slipped capital femoral epiphysis. J Musculoskelet Neuronal Interact 2003;3:2517.