

## Prolonged Hungry Bone Syndrome in a 10-year-old Child with Parathyroid Adenoma

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We report a case of primary hyperparathyroidism associated with prolonged hungry syndrome (HBS) after parathyroid adenomectomy in a 10-year-old girl. Bone mineral density (BMD) revealed severe loss of cancellous BMD. Overt bone disease, high alkaline phosphatase, decreased cancellous BMD and a large adenoma can be used as preoperative predictive risk factors of HBS in children.

**Key words:** Hungry Bone Syndrome, Hypocalcaemia, Primary hyperparathyroidism.

Primary hyperparathyroidism (PHPT) is characterized by an increased osteoclastic bone resorption, leading to osteopenia. Parathyroid resection is the treatment of choice for patients with declining cortical bone density, nephrolithiasis, and severe hypercalcemia(1). One of the common complications of parathyroid surgery is the development of hypocalcemia. The incidence of postoperative hypocalcemia varies, due to possible surgical removal of all parathyroid tissue and long-term hypercalcemic suppression of nonadenomatous parathyroid glands(1,2). Alternatively, hypocalcemia may be due to “hungry bone” syndrome (HBS), which is caused by massive calcium deposition in the bone after surgical treatment for PHPT(1). We report prolonged hungry bone syndrome in a 10-year-old child with a parathyroid adenoma.

### CASE REPORT

A previously healthy ten-year-old girl was admitted with a six-month history of intermittent abdominal pain and easy fatigability. A detailed family history ruled out the possibility of various forms of familial

hyperparathyroidism. On physical examination, there was a genu valgum deformity and a palpable nodule in the inferior-left lobe of thyroid gland, which was soft and smooth surfaced. Her height was 145.8 cm (50th percentile), weight 32.7 kg (between 10-25th percentile), arm-span 139 cm, and blood pressure 110/68 mmHg. Biochemical investigations are shown in **Table I**. Elevated serum calcium levels, decreased serum phosphate concentrations, together with increased parathyroid hormone (PTH) level confirmed the diagnosis of primary hyperparathyroidism (PHPT). Ultrasound demonstrated a large nodule adjacent to the inferior pole of the left lobe of the thyroid gland. Technetium-99m Sestaimibi scan gave images which were consistent with a left-sided parathyroid adenoma (**Fig. 1**). Roentgenogram of the long bones of lower extremity revealed demineralization and cystic lesions (**Fig. 2**). Bone mineral density (Lunar DPX-L) at the lumbar spine was 0.5 g/cm<sup>2</sup> and Z score -2.8. On neck exploration, a well defined mass in the left lobe of thyroid, 29 x 22 mm in size, weighing 4.2 grams was excised. Light microscopic examination of the mass revealed a parathyroid adenoma. On the first postoperative day, the serum calcium level fell

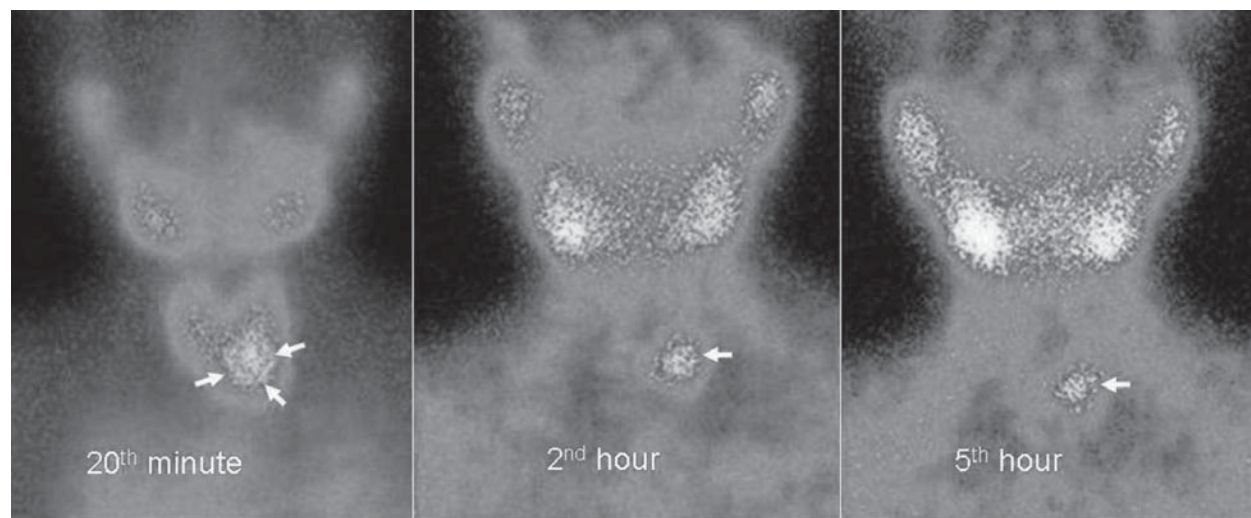


FIG. 1. The images of Technetium-99m Sestaimibi scan are consistent with a left-sided parathyroid adenoma (arrows).

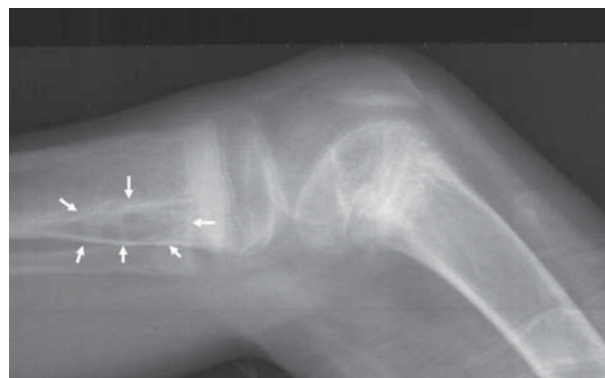


FIG. 2 Cystic lesion (white arrows) and subperiosteal resorption in the proximal metaphysis of the right tibia, and osteosclerosis in the distal metaphysis of the right femur.

suddenly to 7.0 mg/dL. Despite intravenous intermittent calcium supplementation, the serum calcium further fell to less than 7.0 mg/dL and urinary calcium/creatinine ratio was consistently less than 0.05. Continuous intravenous calcium supplementation was given for four weeks and stopped when serum phosphorus and alkaline phosphatase levels returned to normal limits. Two months after the operation, she had no symptoms and the BMD at the lumbar spine increased to 0.6 g/cm<sup>2</sup> (Z score -2.05). Eight month after surgery, the serum prolactin and calcitonin level was measured to rule out MEN 1 and MEN 2 syndromes and the results were in normal range (6.9 ng/mL and 1.2 pg/mL, respectively).

TABLE I BIOCHEMICAL CHARACTERISTICS OF PATIENT WITH PRIMARY HYPERPARATHYROIDISM

	Parathyroid surgery		Reference range
	Before	after 2 mo	
S. total calcium, mg/dL	12.8	8.9	8.9-10.1
S. inorganic phosphate, mg/dL	2.1	4.6	3.5-4.7
S. alkaline phosphatase, IU/L	1710	433	130-560
S. I-PTH, pg/mL (ICMA)	1027	47	9-65
S. calcitriol, pg/mL	>150	54	30-65
Blood urea nitrogen, mg/dL	12	14	5-18
S. 25 [OH] vitamin D, (ng/mL)	32	NM	34-56
1,25[OH] vitamin D, (ng/mL)	>150	NM	30-65
Spot urine Ca/Cr	0.36	0.08	<0.2

*I-PTH*, intact parathyroid hormone; *ICMA*, immunochemiluminescent assay; *NM*, not measured; 1,25 [OH]<sub>2</sub>D<sub>3</sub>, 1,25-dihydroxycholecalciferol; *S. Serum*; *Ca/Cr*, calcium/creatinine ratio

## DISCUSSION

Hungry bone syndrome is considered to be present if serum calcium levels are below 8.5 mg/dL and if serum phosphate levels are normal or below 3 mg/dL on the third day after parathyroidectomy(1). The predominant feature of the present case is the marked and a longstanding postoperative HBS. It can be explained by long period of hypercalcemia secondary to parathyroid adenoma resulted atrophy of the other healthy parathyroid glands. One previous report

demonstrated HBS persisting for 27 weeks post surgery in a case of hyperparathyroidism(3). A long time is needed by the atrophied parathyroid glands to respond rDA hypocalcaemic stimulus. Smith, *et al.*(4) recommended that preoperative treatment with calcitriol for 5-10 days may prevent HBS in the postparathyroidectomy state(4). In primary hyperparathyroidism, 25-hydroxy vitamin D concentration tends to be low normal, while 1,25-dihydroxy vitamin D tends to be high normal(5). In the present case, calcitriol level was extremely high, and there was no indication of treatment with calcitriol. Bisphosphonates have a negative effect on bone remodeling and some authors recommended their use to prevent HBS in patients with PHPT(6,7). Hungry bone syndrome secondary to PHPT is transient. In this period, calcium supplementation is preferred over bisphosphonate treatment in children.

Brasier, *et al.*(1) followed 198 adult patients after surgery for PHPT and studied the risk factors for development of HBS(1). They found a positive correlation with ageing, larger adenoma size, increased serum alkaline phosphatase levels, and elevated blood urea nitrogen levels. There has been no report on predictive risk factors for HBS in children with PHPT. Because bone metabolism is more active in children than adult patients, HBS is more severe and frequent in young patients with PHPT(5,8). Although most patients with primary hyperparathyroidism demonstrate preserved vertebral BMD, which mainly reflects cancellous bone, our case showed a significant loss of vertebral bone density. There are a few reports on severe affected lumbar spine bone densitometry in adults with PHPT, but no report in children with PHPT is available(9). This finding may indicate that severely affected lumbar spine BMD at the diagnosis of PHPT may be used as one of the additional preoperative predictors of HBS in children. The presentation of PHPT in children is different from PHPT in adults, in whom the disease is usually less severe(10).

We found a reversible cancellous BMD loss in our child with PHPT. Overt bone disease, raised alkaline phosphatase, decreased cancellous BMD and a large parathyroid adenoma may be used as preoperative predictive risk factors of HBS in pediatric patients with PHPT.

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