

A young girl with “bones, abdominal groans, thrones and psychic moans”

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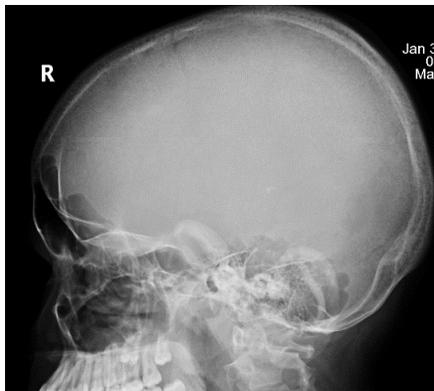
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A 17-year-old previously healthy school girl presented with, bilateral lower and upper limb pain and bowing of legs for 7 months. She also complained of constipation, polyuria and polydipsia. She had moderate depression with frequent school

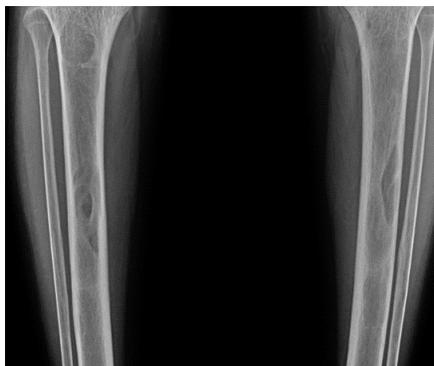
abstinence. There was no family history of a similar disorder. On examination, she had genu varus deformity of the knees. Her X-rays are shown below.



a)



b)



c)



d)

What is the radiological diagnosis?

Osteitis fibrosa cystica

Osteitis fibrosa cystica is the classic manifestation of hyperparathyroid bone disease. It is characterized clinically by bone pain and radiographically by salt and pepper" appearance of the skull (a), sub-periosteal bone resorption on the radial aspect of the middle phalanges (b), bone cysts, brown tumors of the long bones (c, d) and rugger jersey spine. Brown tumors arise from increased osteoclast activity and it has collections of osteoclasts intermixed with fibrous tissue and poorly mineralized woven bone. The brown colour occur due to hemosiderin deposition (1).

What is the clinical diagnosis?

Primary Hyperparathyroidism

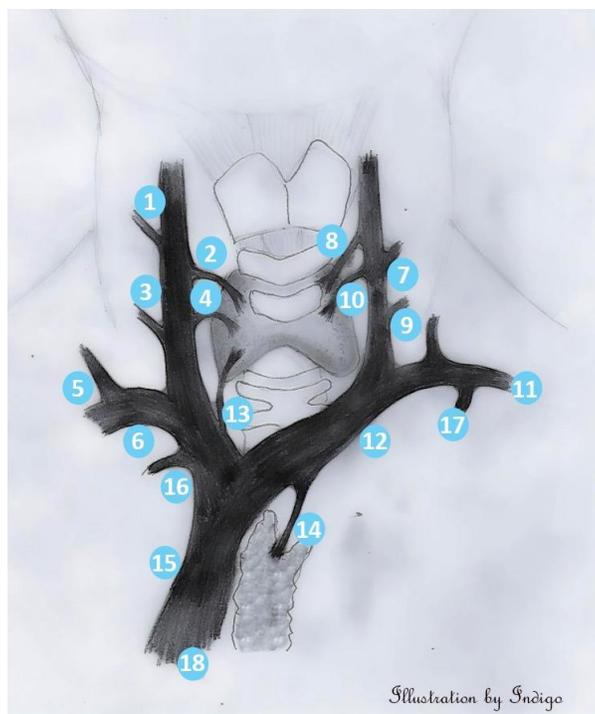
Primary hyperparathyroidism is a disorder characterized by excessive parathyroid hormone (PTH) secretion. Most are asymptomatic but some can have a variable presentation including nonspecific symptoms, skeletal and renal manifestations (1). Investigations typically reveal elevated PTH, high calcium, low phosphate and increased urinary calcium excretion. Radiological manifestations can be variable, but in severe cases, classical radiological features like osteitis fibrosa cystica can be seen.

What are the further investigations?

Following is a summary of the investigation results of the index patient.

Table 1: Summary of Investigations

Investigation	Result	Reference range
Serum Calcium	2.72 mmol/L	2-1-2.5
Serum Phosphate	0.5 mmol/L	0.8-1.5
Serum Creatinine	40 µmol/L	60-120
Alkaline Phosphatase	1662 U/L	47-119
25 Hydroxy Vitamin D Levels	12.71 ng/ml	30-100
Serum PTH Levels	1462.2 pg/ml	18.4-80.1
Serum PTH Levels after vitamin D correction	> 1900 pg/ml	18.4-80.1
Urinary Calcium/Creatinine Ratio before vitamin D correction	0.22 mol/mol	0.1-0.4
Distal Forearm Bone Mineral Density	0.238 g/cm ²	
Ultrasound Scan Neck	Hypo-echoic solitary left thyroid nodule	
CECT neck and Chest	Nodule in the left thyroid lobe	
Parathyroid Venous Sampling	Refer image f	



f)

Parathyroid venous sampling (pg/ml)			
Sample ID	Vein	PTH level (pg/ml)	Central/Peripheral ratio
1	Right upper internal jugular vein	1657	0.96
2	Right superior thyroid vein	1332	0.77
3	Right lower internal jugular vein	1748	1.01
4	Right middle thyroid vein	1834	1.06
5	Right sub-clavian vein	1811	1.05
6	Right innominate vein	1794	1.04
7	left upper internal jugular vein	1618	0.94
8	Left superior thyroid vein	Not cannulated	Not cannulated
9	Left lower internal jugular vein	2926	1.70
10	Left middle thyroid vein	Not cannulated	Not cannulated
11	Left sub-clavian vein	1495	0.87
12	Left innominate vein	2088	1.21
13	Main inferior thyroid vein	7994	4.6
14	Thymic vein	Not cannulated	Not cannulated
15	Superior vena cava	2194	1.27
16	Azygous vein	Not cannulated	Not cannulated
17	Left superior intercostal vein	Not cannulated	Not cannulated
18	Right atrium	1718	1.00

Peripheral PTH levels : 1718 pg/ml

What is the management?

For symptomatic patients and asymptomatic patients with primary hyperparathyroidism who meets the specific criteria should undergo surgery as the definitive management⁽²⁾. Surgery is facilitated by preoperative localization of the underlying causative pathological gland using ultrasonography, technetium-99m–labeled sestamibi, high resolution CT, four-dimensional CT and intraoperative PTH measurement in the modern era⁽³⁾. Though our patient had a possible lesion on the left side, parathyroid venous sampling revealed inconclusive results. The left sided parathyroid veins were poorly cannulated and inferior parathyroid venous drainage revealed elevated parathyroid hormone levels which was most suggestive of multi-gland disease.

The indexed patient underwent bilateral neck exploration with three and half gland removal with half gland re-implantation in the left sternocleidomastoid muscle. Her intraoperative PTH measurement revealed 50% reduction from the pre-operative value (pre-op- 1925 pg/ml, 15 min after gland removal 625 pg/ml). Histology revealed three and half parathyroid glands with chief cell hyperplasia. Nevertheless, her post-operative serum calcium and parathyroid hormones were persistently

elevated (1363.7 pg/ml) and she is awaiting further evaluation and management.

Parathyroid venous sampling is an invasive method to determine the location of the hyper-functioning parathyroid tissue when the noninvasive imaging techniques are rendered inconclusive such as incompatible functional and anatomical imaging or inability to accurately localize the lesion⁽⁴⁾. Though high success rates can be obtained if precisely performed, several technical difficulties and pitfalls may act as confounders⁽⁵⁾. The index patient had multi-gland disease as demonstrated by the venous sampling and underwent four gland exploration with three and half gland removal. Despite the meticulously performed surgery she continued to have very high PTH levels which necessitated further intervention.

Intraoperative PTH measurement is considered as a highly sensitive and a specific method in predicting operative success with postoperative achievement of normo-calcaemia⁽⁶⁾. Technical errors in handling the samples, multiglandular disease and parathyroid carcinoma are some of the causative factors documented in the literature that may result in falsely positive results with > 50 % drop in the intra-operative PTH assay⁽⁷⁾. The patient on discussion also had a false positive result on the intra-operative PTH assay culminating in unsuccessful surgery.

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