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Case Study

A Case Series on Parathyroid Adenoma: A Medical Chameleon

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Abstract

Parathyroid adenoma (PA) is a part of spectrum of parathyroid disease which also includes parathyroid hyperplasia and parathyroid carcinoma. More than 80 percent cases of parathyroid disease manifest as PA. Most patients of PA remain asymptomatic and get diagnosed incidentally. The present case series consists of case 1 who had psychiatric manifestations; case 2 who was being investigated for nephrocalcinosis and case 3 who was assessed for the complaint of backache. It is important to appreciate from our case series that all cases were completely staggered in their presentations and got referred to Otolaryngologist from very different specialties. The authors have compared this medical entity to a chameleon encountered in clinical medicine because of its myriad presentations. A high degree of suspicion and good clinical acumen are, therefore, mandatory to clinch the diagnosis. Precise surgical technique ensures achievement of normal health which is also depicted in our case series. The instant case report discusses the symptoms, investigative techniques: biochemical and imaging, surgical procedure and prospective clinical course of 3 cases of PA.

Keywords: Parathormone; Hypercalcemia; Primary Hyperparathyroidism; Parathyroidectomy; Nephrocalcinosis

Introduction

Parathyroid adenomas (PAs) are heterogeneous group of tumors affecting (0.1-0.3%) of general population. In most scenarios, they are hyper-functional where the production of parathormone (PTH) is high. This condition is known as primary hyperparathyroidism (PHPT) which is the 3rd most common endocrine disease after Diabetes and thyroid disorders [1]. PHPT is the most common disease of parathyroid glands with a prevalence of 21 per 100,000 in general population per year. 80-90% of PHPT cases are the manifestation of PAs [2]. Raised PTH inhibits osteoblasts, stimulates osteoclasts, enhances calcium resorption in kidneys and gut, inhibits renal phosphate reabsorption. All thee effects compound into hypercalcemia which may manifest as nephrocalcinosis, osteoporosis-osteopenia, pancreatitis, depressive episodes or cognitive dysfunction. From historical perspective, these manifestations were correctly phrased as Psychic moans, abdominal groans, painful bones and renal stones [3]. Atypical and pronounced clinical

presentations of PA can, therefore cause delayed diagnosis and are causes of significant medical morbidity. The present case series is clinical analysis of 3 patients who had unique clinical features of a single medical entity and were managed successfully by a multidisciplinary team approach.

Clinical Data

Case 1

42 years old male, recently diagnosed with Primary hypertension, hypothyroidism was referred from a peripheral hospital for psychiatric evaluation. The bystander furnished history of abnormal behavior in the form of irrelevant talking and untoward behavior of 1 month duration. Patient's colleagues reported him to have sad moods, decreased interaction and speech along with reduced sleep. He was evaluated by a psychiatrist. Imaging of brain was essentially normal. Surprisingly, his hematological investigations showed hypercalcemia and raised PTH levels. Endocrinologist's referral was sought and clinical diagnosis of PHPT with hypothyroidism was made. Ultrasonography (USG) of neck showed an ill-defined, heterogenous, hypoechoic lesion of 6X12mm at the posterior aspect of right thyroid. Nuclear imaging (SPECT) showed a 7X10, non-tracer avid, soft tissue density nodular lesion suggestive of right PA. Patient was medically managed with hydration, tablet calcium and calcitonin and later underwent right inferior parathyroidectomy. PTH levels reached normalcy in the immediate postoperative period. Calcium levels got normalized gradually. Patient improved well with our management and became asymptomatic.

Case 2

29 years old male was admitted under medicine department with complaints of anorexia, weight loss and generalized bodyache of 2 months duration. Biochemical and hematological investigations revealed azotemia, hypercalcemia, hypophosphatemia, increased creatinine and anemia. Additional investigations to ascertain the cause of deranged parameters revealed high PTH (1281 pg/ml), Vitamin D (100 nmol/L). Raised PTH levels mandated further investigations to ascertain its cause. Ultrasonography of kidney and urinary bladder (USK-KUB) revealed features of bilateral early medical renal disease with prominent left renal pelvis harboring a 5.5 mm stone. Non contrast computed tomogram (NCCT) head showed features suggestive of hyperparathyroidism in bony calvarium. On magnetic resonance imaging (MRI) of neck, a well-defined lesion seen on postero-inferior aspect of thyroid gland. 99mTC sestamibi scan confirmed parathyroid adenoma at inferior pole of right lobe of thyroid gland. Patient was medically managed with calcitonin and later underwent right inferior parathyroidectomy. PTH levels reached within normal biological range immediately following surgery. Calcium levels gradually attained normalcy. All symptoms of the patient resolved completely with return of appetite and good weight gain subsequently.

Case 3

35 years male with primary hypertension reported to neurosurgeon for gradually progressive backache with no radiation to lower limbs. Patient denied any past trauma or sphincter disturbances. Patient's dual X-ray absorptiometry (DXA) scan suggested osteopenia. His 24 hours urinary calcium was normal. However, creatinine and phosphate were grossly reduced. An USG kidneys revealed bilaterally small kidneys with bilateral medullary nephrocalcinosis with left renal calculus. It was followed by USG neck that showed a well-defined, homogenous, hypoechoic lesion in left parathyroid region. CECT neck showed a heterogenously enhancing lesion related to lower lobe of left parathyroid gland. ^{99}mTc Sestamibi scan exhibited focal areas of increased tracer uptake inferior to lower pole of left thyroid lobe. A corroborative SPECT demonstrated a soft tissue lesion of approximately 12.7 mm X 11.2 mm inferior to lower pole of thyroid gland abutting trachea. With the clinical diagnosis of PA patient underwent left superior parathyroidectomy.

Discussion

Tumors originating from parathyroid exhibit heterogeneity and affect approximately 0.1-0.3% of the general population with excessive and uncontrolled PTH secretion (Primary hyperparathyroidism, PHPT) [1]. This spectrum encompasses PAs (single-85%, double-3%), parathyroid hyperplasia (10%) and parathyroid carcinoma (<1%). PHPT occurs mostly in sporadic form (90%) and can be familial too (10%) [4]. Amongst the familial cases, multiple endocrine neoplasia(MEN) type 1 (MEN1), MEN2A, MEN4 and hyperparathyroidism-jaw tumor syndrome (HPT-JT) are due to germline mutations and manifest as large number of endocrine and non-endocrine tumors [5]. PHPT is the most common cause of hypercalcemia in outpatient scenario and second most common cause of hypercalcemia after malignancy related hypercalcemia [6].

Parathyroid glands are the smallest endocrine glands (40-60 mg each). However, their dysfunction can cause havoc with PTH and calcium homeostasis thereby adversely affecting bone and kidneys respectively. The primary manifestation of PA is PHPT that results in chronic hypercalcemia. The most frequent result of chronic hypercalcemia is nephrocalcinosis and reduced bone mineral density [6]. PHPT was first described around 90 years ago as stones, bones

	Case 1	Case 2	Case 3
Age/Gender	42/Male	29/Male	35/Male
Comorbidities	Hypothyroidism	Nil	Primary hypertension, PIVD
Presenting complaints	Abnormal untoward behavior X 1 month Irrelevant talking	Anorexia, recurrent vomiting, significant weight loss and generalized bodyache X 1 month	Gradually progressive backache X 1 month
Initially evaluated by	Psychiatrist and Endocronologist	Medical specialist and Endocrinologist	Nephrologist and Endocrinologist
Clinical examination	Sad mood, spoke very little.	Pallor, BMI-17.04 Kg/m2	Within normal limits
Hematocrit and Biochemistry	CBC: normal S. Ca2+ 11.3 Free T3/T4/TSH: 3.93/1.20/16.74, iPTH-197.4 pg/ml Urine toxicology screen- Negative	CBC: Hb-10gm%, TLC (12,380/mm3) S. Urea/Creatinine- 55/3.5 S. Ca2+-14mg/dL, S. PO4-5.6mg/dL, S. albumin-5.3 gm% PTH-1281pg/ml, Vit D- 100nmol	CBC: normal 24 Hour urinary Ca2+/ Creatinine/ PO4: 13.8/28.3/19.2mg/dL, Prolactin -24.75ng/ml, IGF-104 ng/ml, T3/T4/TSH: Normal range iPTH: 226.3
Radiology	NCCT/CE-MRI brain: Normal SPECT Scan: Right inferior PA	USG-KUB: Bilateral medullary nephrocalcinosis (Figure 2a) CT head: Bilateral calvareal lesions suggestive of PA CE-MRI neck: 24X23X28 mm well defined lesion postero-inferior to right lobe of thyroid (Figure 2b, blue arrow)	USG KUB: Bilateral small kidneys with medullary nephrocalcinosis USG NECK: Well defines hypoechoic (8.5X12X17mm) lesion in left parathyroid gland. CECT-NECK: heterogenously enhancing lesion at lower lobe of left parathyroid gland
Special investigations to prove the diagnosis	99mTc parathyroid scan- 7X10 mm, non-tracer avid soft tissue density nodular lesion posterior to upper pole of (R) thyroid lobe. DXA: Osteopenia with osteosporosis (Figure 1a)	99mTc parathyroid scan- PA at inferior pole of right thyroid lobe	99mTc parathyroid scan- focal areas of increased tracer uptake inferior to lower pole of left thyroid lobe with progressive accumulation over delayed images. (Figure 3a & 3b) SPECT: Soft tisse lesion ~12.7X11.2 mm inferior to lower pole of left thyroid lobe abutting trachea
Diagnosis	PA with PHPT and hypothyroidism	PA with PHPT, hypercalcemia induced AKI	PA with PHPT, nephrocalcinosis
Medical management	Hydration, Thyroxine, Cinacelcet, Sodium valproate	Hydration, antibiotics, antiemetics, Calcitonin, Cinalcet	Hydration, Calcitonin, Cinacalcet,
Surgical management	Right superior parathyroidectomy under GA (Figure 1b, blue arrow)	Right inferior parathyroidectomy under GA (Figure 2c, yellow arrow)	Left superior parathyroidectomy under GA (Figure 3c)
Perioperative complication	Nil	Nil	Nil
Final HPR of excised specimen	Consistent with PA	Consistent with PA	Consistent with PA (Figure 3d)
Follow up	S. Ca2+ and PTH normalized on post-operative evening with complete resolution of neuro-psychiatric symptoms over 2 days.	S. Ca2+ and PTH normalized on post-operative evening. Appetite returned over 3-4 days and patient gained weight over 3 months post surgery	S. Ca2+ and PTH normalized on post-operative day 1. Backache recovered within a week.

Table 1: Results of case series.

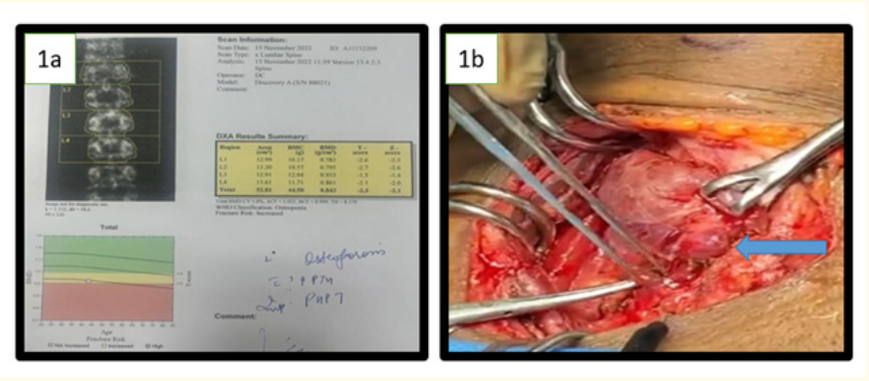

Figure 1a: DXA scan showing osteoporosis.

Figure 1b: Intraoperative picture showing right superior parathyroid adenoma (blue arrow) being removed under GA.

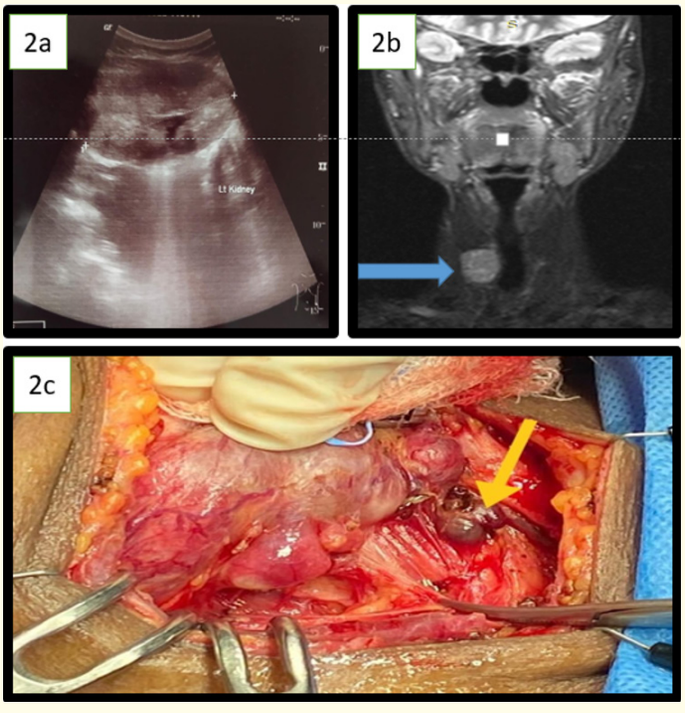

Figure 2a: USG KUB demonstrating bilateral medullary nephrocalcinosis.

Figure 2b: CE-MRI neck demonstrating a 24X23X28 mm well defined lesion postero-inferior to right lobe of thyroid (blue arrow).

Figure 2c: Intraoperative picture showing right inferior parathyroid PA (yellow arrow) being removed under GA.

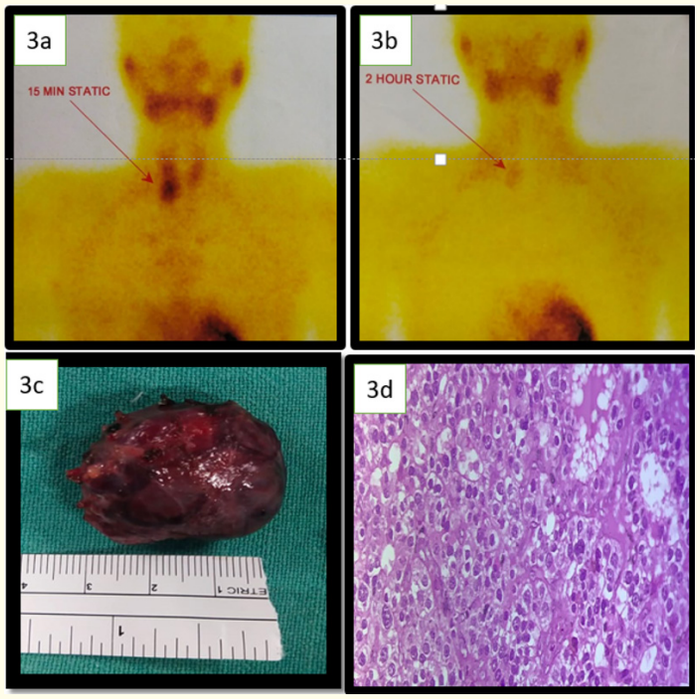

Figure 3a & 3b: 99mTc parathyroid scan demonstrating focal areas of increased tracer uptake inferior to lower pole of left thyroid lobe with progressive accumulation over delayed images taken at 15 minutes and 2 hours respectively.

Figure 3c: Specimen of Parathyroid adenoma delivered out.

Figure 3d: Microphotograph of specimen (400X) was consistent with parathyroid adenoma. Tumor was composed of uniform polygonal cells with round nucleus and salt and pepper chromatin. Tumor was arranged in trabecular and nested pattern with vascular stroma. Mitosis and necrosis were not seen.

and groans because historically in its severe form it would manifest from urolithiasis, osteopenia and disorders of the gastrointestinal system. However, in modern times due to incremental health coverage and screening, PAs get discovered fortuitously upon evaluation of an incidental mild hypercalcemia in an otherwise asymptomatic patient [7]. In our case series, one patient who was under evaluation for depression was found to have PA. Case 2 had presented with anorexia, recurrent vomiting, significant weight loss and generalized body ache which upon evaluation was found to be causation of nephrocalcinosis and led to the discovery of PA. Case 3 came to light while undergoing investigations for gradually progressive backache. Some lesser seen and consequently forgotten complications of PHPT include cardiovascular disease, osteitis fibrosa cystica (frequently misdiagnosed as bony metastases) and multiple pancreatic calcifications [8]. Table number 1 collates all the salient features and details of our patients for facilitating an easy contrast.

In any suspected case of parathyroid disorder, ultrasound (USG) of the neck is the most commonly requested primary investigation. It helps to detect the enlarged parathyroid gland and also reveals its precise location in relation to the thyroid. Co-existing nodular thyroid, obese patient, deep seated and ectopic adenomas result in poor visualization [9]. USG is non-invasive with no radiation exposure and is superior to other imaging modalities in locating the adenoma precisely. Hence, it becomes the first choice of imaging worldwide. Limitations of sonography are many like dependence upon technician's expertise, difficult localization if small in size or retropharyngeal/retro-esophageal in location or ectopic PA in the mediastinum [10]. Other imaging modality that can be employed is ^{99m}Tc-sestamibi scintigraphy that helps in locating PA especially if it co-exists with a nodular thyroid or at an ectopic locus. It is less prone to operator's limitations but it is found wanting while quadrant prediction [9]. Benign/malignant thyroid nodules, thyroid inflammation and cervical lymph nodes may also produce false

positive results upon scintigraphy. False negatives are seen with PAs weighing less than 0.6-0.8 grams [10]. USG and scintigraphy have similar individual sensitivity (~88%). However, combined together it is enhanced to 95% [9]. Hybrid imaging using single photon-emission computed tomography (SPECT) that uniquely amalgamates anatomical (CT) and scintigraphic data should facilitate accurate localization of exact tracer activity zone resulting as enhanced surgical success for both non-ectopic and ectopic PAs. However, available studies show equivocal results. CT and magnetic resonance imaging (MRI) are less frequently used. They are indicated in case of inconclusive prior imaging, contradictory findings or suspected ectopic adenoma. A negative imaging does not preclude a patient from neck exploration [9,10].

The only definitive treatment for all symptomatic patients with PA with has worldwide acceptance is its excision surgically. Additionally, it must also be offered to all asymptomatic patients younger than 50 years of age, showing significant hypercalcemia or developing renal complications seen upon imaging or developing signs of osteoporosis. As most patients with PHPT have a solitary adenoma, all such patients are candidates for unilateral minimally invasive focused parathyroidectomy after ensuring its precise location prior to surgery. This ensures acceptable cure rates, good cosmesis, reduced complication rates, shorter operative time, short hospital stay and cost-effectiveness [10].

Conclusion

Presentation of PA can be myriad and outward physical signs of PA may not be overt. The resultant hypercalcemia caused by PA is a common incidental discovery and the diseased gland is seldom palpable making the diagnosis difficult. Presentation of patients is extremely variable with completely contrasting symptoms. Since the disease poses a great diagnostic dilemma, it is essential for the treating team to possess high degree of suspicion and sharp clinical acumen to spot the pathology. Essential diagnostic parameters include serum Calcium and PTH. These upon combination with radio-imaging and functional imaging (Nuclear imaging) clinch the diagnosis. The importance of a multidisciplinary team approach in ensuring a timely and successful treatment with minimal long term morbidity cannot be emphasized enough. Parathyroidectomy is universally accepted to be curative provided it is performed explicitly and poses no danger to Recurrent Laryngeal Nerve. Accurate surgical intervention promises cure rates as high as 94-99%.

Conflicts of Interest

None.

Consent

Written informed consent was taken from all three patients to publish their photographs and medical data for the purpose of publication in medical journal.

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