CASE REPORT

Imaging features of primary hyperparathyroidism

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SUMMARY

Hyperparathyroidism can be primary, secondary or tertiary depending on its aetiology. Parathyroid adenoma accounts for 80% of cases of primary hyperparathyroidism. We report a case of a 41-year-old female patient presented with severe osteoporosis and pathological fracture of right acetabulum and left intertrochanteric region. The patient had diffuse osteoporosis and multiple well-defined lytic lesions. A diagnosis of hyperparathyroidism apart from multiple myeloma and metastasis was made based on the findings of diffuse osteoporotic changes with multiple lytic lesions. A skeletal survey was performed in view of the pathological fracture of the femur; findings of the skeletal survey favoured the diagnosis of hyperparathyroidism. An ultrasound of the neck was performed to look for the cause and a parathyroid adenoma was picked up in the inferior aspect of the left lobe of the thyroid gland. CT of the neck was also performed for preoperative localisation of the lesion. Based on these findings diagnosis of primary hyperparathyroidism due to parathyroid adenoma was made. The patient underwent parathyroidectomy and perioperative and histopathological findings confirmed the preoperative diagnosis.

BACKGROUND

In patients presenting with pathological fracture associated with multiple osteolytic lesions, the differential of hyperparathyroidism should be kept in mind apart from metastasis or multiple myeloma (MM) since it is treatable and simple investigations

such as plain radiograph and ultrasound can help determine the cause and aids in better management of such treatable cases.

CASE PRESENTATION

A 41-year-old female patient presented with a history of trivial trauma followed by pain in the left hip and difficulty in walking. She had history of fatigue and pain in both thighs along with painful movements of both the hip joints for more than a year prior to the injury. No other significant history was present.

INVESTIGATIONS

Plain radiographs of the pelvis and both hip joints revealed diffuse osteoporosis and multiple well-defined lytic lesions (asterix in [figure 1A](#)) involving the pelvic bones and fracture of the right acetabulum and left intertrochanteric region. CT pelvis revealed generalised osteopenia with multiple diffusely scattered lytic lesions of various shapes and sizes (black arrows in [figure 1B](#)). The lesions were causing cortical expansion and endosteal scalloping suggestive of brown's tumour (white arrow in [figure 1B](#)).

The patient was subjected to plain radiograph of the hand which showed acro-osteolysis (black arrow in [figure 2A,B](#)) of distal phalanges and subperiosteal bone resorption involving the lateral aspect of the middle phalanges of the index, middle and ring fingers with cortical tunnelling (block arrows in [figure 2C](#)). Calcification of

Figure 1 (A) X-ray of the pelvis anteroposterior view showing generalised osteopenia with protrusioacetabuli on the right side and multiple diffusely scattered lytic lesions (asterix) of varying size and shape in pelvis. (B) CT of the pelvis showing generalised osteopenia with multiple diffusely scattered lytic lesions of various shapes and sizes (black arrow). There is cortical expansion and endosteal scalloping (white arrow).

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Figure 2 X-ray of the hand anteroposterior view showing acro-osteolysis of distal phalanges (black arrow in A and B) and subperiosteal bone resorption (black arrows in C) involving the lateral aspect of the middle phalanges of the index, middle and ring fingers with cortical tunnelling. Calcification of tri-radiate cartilage and metacarpophalangeal cartilage (white arrows in A are also seen). (D) X-ray of the skull lateral view showing areas of decreased radio-opacity intermingled with sclerotic radio-opaque areas, resulting in a classic appearance called 'pepper pot appearance' of the skull with granular texture and multiple lytic lesions (white arrow).

tri-radiate cartilage and metacarpophalangeal cartilage were also seen (white arrows in [figure 2A](#)).

Plain radiograph of the skull revealed areas of decreased radio-opacity intermingled with sclerotic radio-opaque areas, resulting in a classic appearance called 'pepper pot appearance' of the skull with granular texture and multiple lytic lesions (white arrows in [figure 1D](#)).

On ultrasound of the abdomen, the pancreas was diffusely atrophic with dilation of main pancreatic duct (white arrow in [figure 3A](#)) and specks of echogenicity in the parenchyma (black arrow in [figure 3A](#)) suggestive of calcification features were typical of chronic pancreatitis and both kidneys had increased cortical echogenicity with specks of echogenicity which were suggestive of medullary nephrocalcinosis involving both the kidneys. Features were highly suggestive of hyperparathyroidism.

Neck ultrasound revealed an oval-shaped homogenous hypoechoic soft tissue lesion in the inferolateral aspect of the left thyroid gland (asterix in [figure 3B](#)) with a vascular arc-like pattern (asterix in [figure 3C](#)) on colour Doppler which is typical for parathyroid adenoma. CT of the neck showed an oval hypodense lesion in the posterior aspect of the left lobe of the thyroid gland which had intense homogenous enhancement on postcontrast study (asterix in [figure 4A](#)).

Laboratory findings showed elevated serum calcium (22 mg/dL) and parathyroid hormone (PTH) level (1500 pg/mL) and low

inorganic phosphorus (1.4 mg/dL). Protein electrophoresis for M band was negative.

DIFFERENTIAL DIAGNOSIS

On the basis of these findings of multiple diffuse lytic lesions of varying sizes hyperparathyroidism was kept as the primary diagnosis and differentials of MM or bony secondaries were also considered. Presence of diffuse osteoporosis with presence of typical features of hyperparathyroidism supports the diagnosis. Osteolytic lesions in MM have a punched out appearance and are of uniform size.

Hyperparathyroidism can be due to primary, secondary or tertiary causes. The renal parameters in this patient were normal. Joint cartilage calcification is a common finding in primary hyperparathyroidism¹ whereas soft tissue calcification and periostitis are findings which are more commonly seen in secondary hyperparathyroidism. Osteosclerosis is also more commonly described in secondary than in primary hyperparathyroidism.^{2,3} Involvement of the spine creates a striped appearance such as the 'rugger jersey' appearance due to alternating bands of sclerosis and lucency.⁴

Among the causes of primary hyperparathyroidism, parathyroid hyperplasia usually causes involvement of all four glands asymmetrically, whereas in case of multiple adenomas two or possibly three glands are involved. Parathyroid carcinoma is a

Figure 3 (A) Ultrasound of the pancreas showing atrophic pancreas with a calcific foci at the head region (black arrow) and dilated main pancreatic duct (white arrow). (B and C) Ultrasound of the neck: oval-shaped homogenous hypoechoic soft tissue lesion in the inferolateral aspect of the left thyroid gland (asterisk in B) with a vascular arc-like pattern on colour Doppler (asterisk in C) which is typical for parathyroid adenoma.

very rare cause of primary hyperparathyroidism. As both carcinomas and atypical adenomas can have increased cellular atypia with increased cellular activity, differentiation between two entities is difficult. Parathyroid carcinoma usually have high serum calcium level (>14 mg/dL) and at the time of surgery if a hard gland with fibrotic capsule is noted, a parathyroid carcinoma can be possible so an en bloc resection with preservation of tumour capsule to prevent seeding is performed. But in case of an invasive and metastatic disease such attempts are limited. Patients with carcinoma have poorer prognosis due to distant tumour metastasis or ongoing hyperparathyroidism and its complications.⁵

TREATMENT

The patient underwent surgery; a left lower parathyroidectomy with partial left lobe thyroidectomy was performed. Histopathological examination of the specimen confirmed the diagnosis of a parathyroid adenoma.

OUTCOME AND FOLLOW-UP

Postsurgical phase was uneventful. Serum calcium levels were reduced and hence the patient was given low-dose calcium supplementation.

DISCUSSION

Calcium homeostasis is maintained in the body by the parathyroid gland via the PTH. PTH raises calcium level by acting on the renal tubular system causing absorption of calcium and decreases the phosphate levels by decreasing its tubular resorption and it also stimulates the osteoclastic cells causing increase in calcium levels. In primary hyperparathyroidism, PTH levels are elevated resulting in increased bone resorption and increased calcium levels. In 80–90% cases it is caused by a single parathyroid adenoma, 10–20% cases by multiple gland enlargements and in less than 1% by carcinoma.^{6–8} There is a wide variety of clinical findings but typical features include 'painful bones, renal stones, abdominal groans and psychic moans'.

Any of the four parathyroid glands can have adenoma causing its asymmetrical enlargement. The uniform hypercellularity of the gland with little fat content is responsible for the hypoechoic appearance of the gland in ultrasonogram. The vascular arc which envelops 90–270° of the gland can be appreciated on colour flow, spectral and power Doppler sonography. This vascular flow pattern may increase the sensitivity of initial detection of parathyroid adenomas and it can also aid in confirmation of diagnosis and distinguishing it from lymphadenopathy by the presence of the central hilar flow pattern which is typical in case of lymph nodes.⁵

The most common imaging finding in case of primary hyperparathyroidism is of generalised osteopenia. In advanced stage of bony involvement, there is subperiosteal resorption of bones of hand and feet which primarily involve the lateral aspect of second and third middle phalanges. Terminal tuft of phalanges can also undergo resorption producing acro-osteolysis. Intracortical tunneling, endosteal and trabecular bone resorption can also be present. Subperiosteal resorption of bones can occur at multiple sites such as sacroiliac, acromioclavicular, sternoclavicular and temporomandibular joints, the symphysis pubis and the patella.

Osteoclastomas (also known as brown tumour) are expansile lesions which are eccentrically located and resulting from aggregation of osteoclasts and fibrous tissue.

For preoperative location of parathyroid adenomas sonography and ^{99m}Tc-sestamibi scintigraphy are the most dominant imaging techniques. A large number of studies done to compare the sensitivities and specificities for solitary adenoma detection has shown similar findings. Preoperative localisation improved accuracy of both the studies.^{9 10} MRI and contrast-enhanced CT are also effective to locate parathyroid adenomas but in the setting of ectopic often mediastinal location of the glands, it might be ineffective. If findings of ^{99m}Tc-sestamibi scintigraphy are not similar, cross-sectional imaging can be used.

Figure 4 (A and B) CT of the neck showing an intensely enhancing oval hypodense lesion in the posterior aspect of the left thyroid gland. The lesion is showing intense homogenous enhancement (asterix in (A)). Sagittal reformatted image showing lesion in the posteroinferior aspect of the left lobe of the thyroid (asterix in B).

Learning points

- ▶ When a patient presents with pathological fracture and multiple lytic lesions, one of the differentials has to be hyperparathyroidism.
- ▶ Appreciation of features such as diffuse osteoporosis and evaluation of skull and hand X-rays for characteristic features of hyperparathyroidism will clinch the diagnosis.
- ▶ Preoperative localisation of adenomas must be carried out for assistance in minimal invasive surgery thereby reducing postoperative morbidity and mortality.

Contributors TL participated in collection of the data and investigation studies, reviewed scientific literature and drafting of manuscript. RS participated in the acquisition and interpretation of radiological data. Supervised the article design and critically evaluated and finalised the article. SVC and AEJ participated in the acquisition and interpretation of the radiological data and critically evaluated the article.

Competing interests None.

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REFERENCES

- 1 Dodds WJ, Steinbach HL. Primary hyperparathyroidism and articular cartilage calcification. *Am J Roentgenol Radium Ther Nucl Med* 1968;104:884–92.
- 2 Edeiken J, Dalinka M, Karasick D. Metabolic and dystrophic bone disease. In: Edeiken J, ed. *Edeiken's Roentgen diagnosis of diseases of bone*. 4th edn. vol. 2. Baltimore: Williams and Wilkins, 1990:1150–78.
- 3 Genant HK, Baron JM, Straus FH, et al. Osteosclerosis in primary hyperparathyroidism. *Am J Med* 1975;59:104–13.
- 4 Lenchik L, Mitchell K. Hyperparathyroidism and renal osteodystrophy. In: El-Khoury G, ed. *Essentials of musculoskeletal imaging*. Philadelphia, PA: Churchill Livingstone, 2003:295–301.
- 5 Rumack C, Wilson S, Charboneau J. *Diagnostic ultrasound*. St. Louis: Elsevier Mosby, 2005.
- 6 Thompson NW, Eckhauser FE, Harness JK. The anatomy of primary hyperparathyroidism. *Surgery* 1982;92:814–21.
- 7 Van Heerden JA, Beahrs OH, Woolner LB. The pathology and surgical management of primary hyperparathyroidism. *Surg Clin North Am* 1977;57:557–63.
- 8 Wang CA. Surgery of the parathyroid glands. *Adv Surg* 1966;5:109–27.
- 9 Scheiner JD, Dupuy DE, Monchik JM, et al. Pre-operative localization of parathyroid adenomas: a comparison of power and colour Doppler ultrasonography with nuclear medicine scintigraphy. *Clin Radiol* 2001;56:984–8.
- 10 Purcell GP, Dirbas FM, Jeffrey RB, et al. Parathyroid localization with high-resolution ultrasound and technetium Tc 99m sestamibi. *Arch Surg* 1999;134:824–30.

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