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Case Report

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Parathyroid Tumor Resection in a Patient with Hypercalcemia Caused by a Parathyroid Tumor Complicated by Heart Failure, Renal Failure, and Other Conditions: A Case Report

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Abstract

Introduction: Hypercalcemia is most commonly caused by parathyroid tumors (PT). These rare neoplasms disrupt calcium-phosphorus metabolism and impair multiple organ functions, while surgical resection remains the standard treatment for parathyroid tumors. This case highlights management challenges in patients with complex comorbidities.

Case Report: A 61-year-old male presented with severe lumbosacral pain, limb pain, knee pain, polydipsia, polyuria, and constipation. Laboratory testing showed a serum calcium level of 4.27 mmol/L, consistent with hypercalcemic crisis complicated by heart failure and renal failure. Pathological examination of a thyroid biopsy confirmed a parathyroid adenoma in the right lower pole. Following preoperative correction of hypercalcemia and comprehensive evaluation, parathyroid tumor resection was performed. Postoperatively, the patient recovered well, with marked improvement in cardiac and renal function.

Conclusion: This case demonstrates that in patients with hypercalcemia due to parathyroid tumors and concurrent multi-organ dysfunction, timely surgical intervention after adequate preoperative management yields favorable outcomes. Surgery

effectively controls the primary disease and significantly reverses cardiac and renal impairment, highlighting its critical role in rescuing high-risk patients with multi-organ failure.

Keywords: case report, parathyroid tumors, hypercalcemia, hyperparathyroidism, surgery

1 Introduction

Hypercalcemia is a disorder of calcium metabolism; a serum calcium concentration of 2.75 mmol/L or higher is sufficient for diagnosis. The primary causes are primary hyperparathyroidism (PHPT) and malignant tumors; primary hyperparathyroidism most frequently results from parathyroid tumors [1]. The latest classification of parathyroid tumors includes parathyroid adenoma (PA), parathyroid carcinoma (PC), and atypical parathyroid tumor (APT)[2]. PA accounts for 80% to 85% of PHPT cases, while parathyroid cancer is rare[3]. Surgical resection is the traditional method for treating parathyroid adenomas. Patients who do not undergo surgery have a significantly higher mortality rate due to hypercalcemic crises and end-organ damage, whereas surgical treatment can significantly reduce the risk of death and improve long-term survival[4]. This case report describes the use of parathyroid tumor resection in a patient with hypercalcemia caused by a parathyroid tumor, accompanied by heart failure, renal failure, and multi-organ dysfunction; the follow-up evaluation results were favorable. This case report was prepared in accordance with the CARE guidelines (10).

2 Case Presentation:

A 61-year-old man was admitted to the Department of Endocrinology on 8 October 2025 for intermittent pain in the lumbosacral region and limbs that had persisted for over a year and had worsened in the past month. One year ago, the patient presented to our hospital's Gastroenterology Department with epigastric distension and pain. Laboratory tests revealed a calcium level of 2.85 mmol/L, and he was diagnosed with hypercalcemia; however, no specific treatment was administered. One month ago, the patient's symptoms worsened. He subsequently presented to our outpatient clinic for further systematic evaluation and treatment. Laboratory tests showed: Carbon dioxide 19.90 mmol/L, urea 21.65 mmol/L, creatinine 340 μmol/L, uric acid 569 μmol/L, glomerular filtration rate 15.97 mL/min/1.73 m^2, sodium 134.3 mmol/L, calcium 4.27 mmol/L, fasting blood glucose 5.69 mmol/L. The patient was subsequently admitted to the hospital via the outpatient clinic with a diagnosis of "hypercalcemia." Presenting symptoms at admission: severe pain in the lower back and limbs, knee pain, excessive thirst, polyuria, and constipation. Past medical history includes carotid artery plaque, chronic atrophic gastritis (C1) with erosions, reflux esophagitis (Grade B), fatty liver, cholecystitis, liver cysts, adrenal nodules (bilateral), simple renal cysts (bilateral), pulmonary nodules, multiple diverticula of the cecum, and right eye lens replacement surgery performed 3 years ago.The patient denies a history of blood transfusions. The patient denies a history of allergies to medications, foods, or pollen.

Personal history: Has smoked for 30 years but has been smoke-free for 7 years. Denies a history of alcohol consumption. Denies exposure to radioactive substances or chemical toxins. Denies a history of promiscuity.

Family history: No history of hereditary diseases in the family.

Physical examination revealed a temperature of 36.3°C, pulse rate of 84 beats per minute, respiratory rate of 20 breaths per minute, and blood pressure of 151/99 mmHg. The patient was alert and of normal development, with no facial or eyelid edema and no jugular vein distension. Coarse breath sounds in both lungs, no dry or wet rales heard; heart rate 84 bpm, regular rhythm, no significant murmurs heard in any valvular auscultation areas; abdomen flat and soft, tenderness in the left lower quadrant (±), no significant tenderness, rebound tenderness, or masses noted in the rest of the abdomen; no hepatomegaly or splenomegaly palpable below the costal margin. No pitting edema in both lower extremities. Laboratory findings: white blood cell count 9.91 $\times$ 10^9/L, neutrophil count 8.14 $\times$ 10^9/L, neutrophil percentage 82.1%, red blood cell count 3.63 $\times$ 10^{12}/L, hemoglobin 91 g/L, hematocrit 31.3%, mean corpuscular hemoglobin 371 g/L; multiple complete blood counts revealed anemia. Alkaline phosphatase 134 U/L, albumin 39.1 g/L. Carbon dioxide 17.5 mmol/L, urea 18.7 mmol/L, creatinine 303 μmol/L, uric acid 469μmol/L, glomerular filtration rate 18.36 mL/min/1.73 m^2. Total cholesterol 2.63 mmol/L, HDL cholesterol 0.76 mmol/L, LDL cholesterol 1.42 mmol/L. Calcium 3.81 mmol/L. β2-microglobulin 6.1 μg/mL. Myoglobin 1012 ng/mL, creatine kinase isoenzyme 13.8 ng/mL, high-sensitivity troponin 64.6 pg/mL, B-type natriuretic peptide precursor (Pro-BNP) 3334pg/mL. Alpha-1 globulin 6.0%, C-reactive protein 28.02 mg/L, High-sensitivity C-reactive protein $>$ 10 mg/L, plasma D-dimer 1 mg/L, plasma fibrinogen 4.5 g/L. Parathyroid hormone 174 pmol/L, thyroxine 64.5 nmol/L. CYFRA 21-1 2.74 ng/mL. Cardiac ultrasound: Enlarged left atrium; widened ascending aorta; thickened interventricular septum; impaired left ventricular diastolic function, normal systolic function; mild aortic regurgitation; bradycardia (Fig 1). Ultrasound of the thyroid, parathyroid glands, abdomen, retroperitoneum, and urinary tract (male): Mixed-echo masses in the posterolateral regions of both thyroid lobes; origin from the parathyroid glands cannot be ruled out; mixed-echo nodule in the left thyroid lobe, TI-RADS category 3; liver cysts; bile stasis in the gallbladder, gallbladder wall crystals, and inflammatory changes in the gallbladder; diffuse lesions in both kidneys; bilateral renal cysts; benign prostatic hyperplasia (Fig 2). Radionuclide planar imaging (thyroid, parathyroid glands): Nodular shadow posterior to the lower pole of the right thyroid lobe with increased radionuclide uptake; consistent with a parathyroid adenoma. The pathological report of the biopsy of the right inferior parathyroid gland shows a parathyroid adenoma in the right inferior lobe, adherent to surrounding tissues; the possibility of an atypical parathyroid adenoma cannot be excluded (Fig 3).

Diagnosis: Western Medical Diagnosis: 1. Hypercalcemia 2. Heart and renal failure 3. Chronic atrophic gastritis (C1) with erosions 4. Reflux esophagitis (Grade B) 5. Fatty liver 6. Cholecystitis 7. Liver cyst 8. Adrenal nodules (bilateral) 9. Simple renal cysts (bilateral) 10. Carotid artery plaques (bilateral) 11. Pulmonary nodules 12. Multiple diverticula of the cecum.

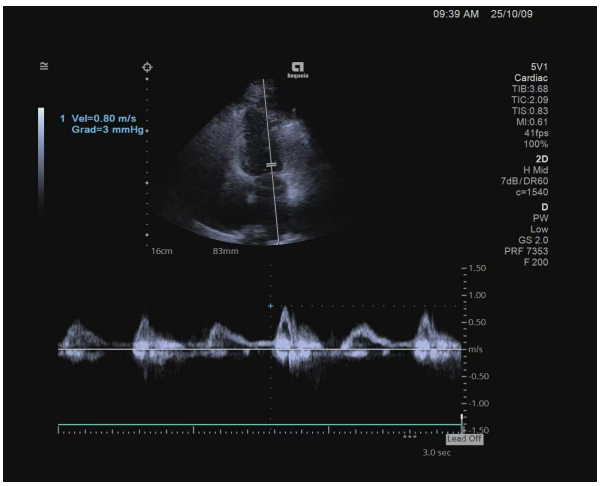


Fig. 1 Cardiac ultrasound.

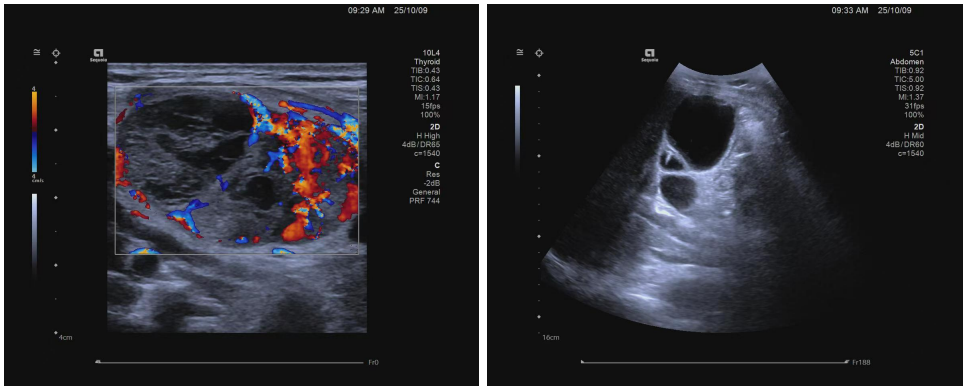


Fig. 2 Thyroid color Doppler ultrasound and Abdominal ultrasound.

In clinical practice, the differential diagnosis of hypercalcemia remains challenging for several reasons: symptoms in elderly patients and those with multi-organ failure are often nonspecific and easily masked by underlying conditions; renal insufficiency can interfere with parathyroid hormone levels, complicating the distinction between primary and secondary hyperparathyroidism; early-stage multiple myeloma may present initially with hypercalcemia alone, without typical bone pain; furthermore, concomitant medications such as diuretics and lithium may also interfere with serum calcium levels, complicating the determination of the underlying cause.

Treatment Plan: 1. Low-calcium diet; 2. Fluid replacement + diuretics: 0.9% sodium chloride injection for rapid volume expansion; furosemide 40 mg three times daily to promote urinary calcium excretion; 3. Rapid calcium reduction + symptomatic treatment: Salmon calcitonin 200 IU twice daily by intramuscular injection to rapidly inhibit osteoclasts, reduce bone calcium release, and promote urinary calcium excretion; sodium bicarbonate tablets 0.5 g three times daily to lower serum

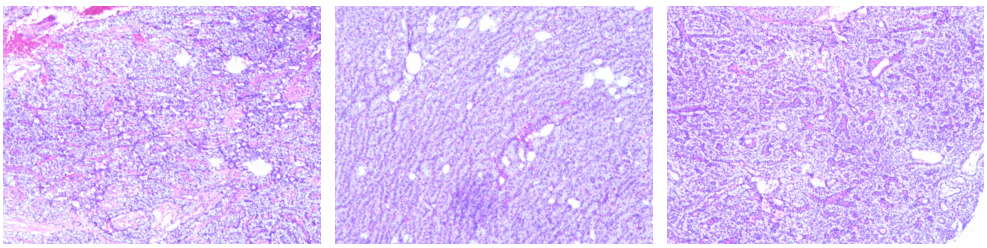


Fig. 3 Microscopic findings: The tumor tissue is arranged in nests and trabeculae; cells are cytoplasmic, eosinophilic or lightly stained; nuclei are round and uniform in size. Immunohistochemical results: A4: CgA(+), CK(+), Syn(-), CD56(-), CT(-), TTF-1(-), TG(-).

free Ca^{2+} levels, promote urinary calcium excretion, and assist in calcium reduction; 4. Surgical Evaluation and Procedure: After assessing surgical risks and ruling out contraindications, the patient was transferred to the General Surgery Department for right parathyroid adenoma resection under general anesthesia. The procedure was uneventful, and anesthesia was well-tolerated. However, due to significant electrolyte fluctuations, poor cardiac and renal function, and difficulty in recovering from anesthesia, the patient was subsequently transferred to the Intensive Care Unit (ICU). Upon admission, immediate intensive care was initiated, including multi-parameter cardiac monitoring, endotracheal intubation, and mechanical ventilation; Continuous monitoring of oxygen saturation, fluid balance, and drainage output was performed, and relevant tests were completed. Treatment included appropriate analgesia, acid suppression and gastric protection, improvement of respiratory and circulatory function, blood pressure stabilization, maintenance of fluid, electrolyte, and acid-base balance, and nutritional support, along with other symptomatic supportive measures; pneumatic compression therapy was administered to the lower extremities to prevent VTE. After the patient regained consciousness and vital signs were largely stable, the patient was transferred back to the General Surgery Department for further treatment.

3 Conclusion:

The patient's clinical course spanned three months from October 8, 2025, to January 7, 2026, with regular follow-ups. In selecting the treatment plan, comprehensive consideration was given to the patient's primary hypercalcemia caused by a parathyroid tumor, along with multiple comorbidities such as heart and renal failure, as well as the patient's wishes. The patient is an elderly male with a serum calcium level of 4.27 mmol/L, indicating a hypercalcemic crisis. Upon admission, with a serum calcium level of 4.27 mmol/L, rapid volume expansion was immediately initiated using 0.9% sodium chloride injection. On the first day, 3500 mL was administered, and the serum calcium level was measured at 3.82 mmol/L. As the result was unsatisfactory, fluid administration was increased to 5000 mL the following day, with serum calcium rechecked at 3.6 mmol/L. On the third day, fluid administration was increased to 5500 mL, and serum calcium decreased to 2.99 mmol/L, though it still did not reach the target range. On the fourth day, fluid therapy continued at 5500 mL, and on the fifth day, serum calcium was measured at 2.9 mmol/L. Following a comprehensive

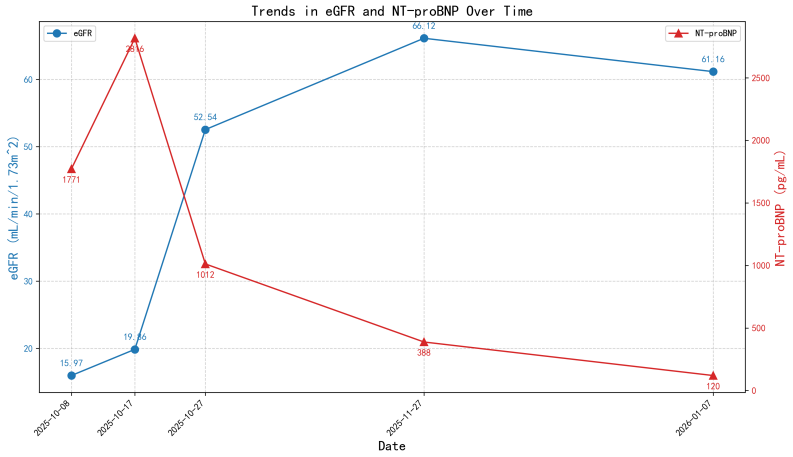


Fig. 4 Time-series trends of estimated glomerular filtration rate (eGFR) and N-terminal pro-brain natriuretic peptide (NT-proBNP) levels during the treatment period. The blue line (dots) represents the dynamic changes in eGFR, while the red line (triangles) shows the fluctuations in NT-proBNP levels.

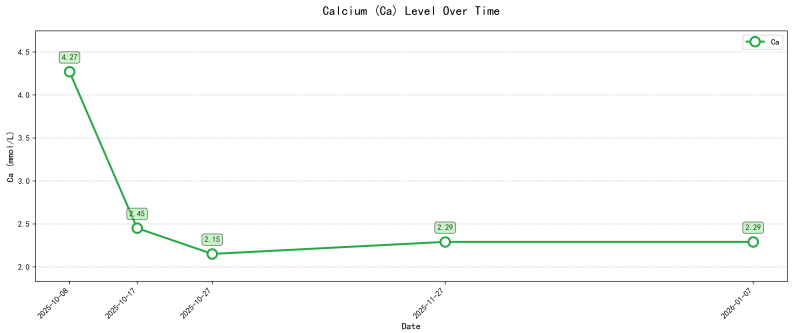


Fig. 5 Time-course changes in serum calcium (Ca) levels during treatment. The serum Ca level decreased from 4.27 mmol/L to the normal range (2.11 2.52 mmol/L) after intervention and remained stable thereafter, indicating effective control of hypercalcemia.

assessment, surgical treatment was performed to address the underlying condition. Concurrently, calcitonin and sodium bicarbonate tablets were administered to lower serum calcium levels. After 10 days, serum calcium decreased from 4.27 mmol/L to 2.45 mmol/L (Fig 5). The patient presented with mild anemia and was treated with 300 mg/day of iron polysaccharide complex plus 10 mg of folic acid tablets three times daily. After two months, the patient's hemoglobin level rose from 91 g/L to 114 g/L. After 3 months, the patient's blood CO_2 level rose from 17.5 mmol/L to 22.9 mmol/L, reaching the normal range, and serum creatinine decreased from 303 μmol/L to 112 μmol/L, and the glomerular filtration rate (eGFR) increased from 16.32 mL/min/1.73 m^2 to 61.16 mL/min/1.73 m^2, improving from severe renal impairment preoperatively to mild renal impairment (Fig 4). Myoglobin decreased from 1012 ng/mL to 52.8 ng/mL; creatine kinase isoenzymes decreased from 13.8 ng/mL to 1.77 ng/mL;

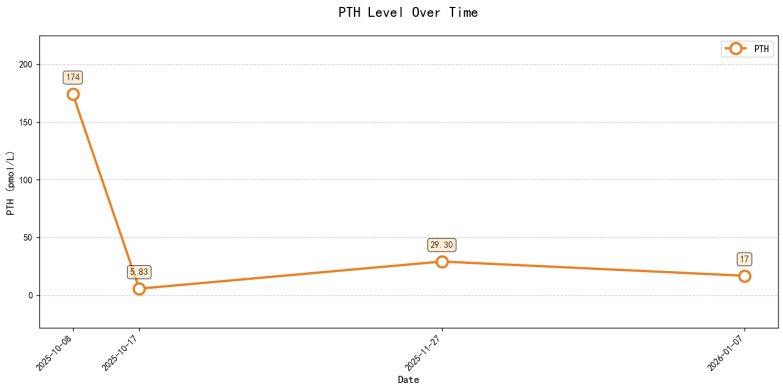


Fig. 6 Parathyroid hormone (PTH) levels were monitored throughout the course of treatment. The initial value was significantly elevated at 174 pmol/L but decreased markedly to 5.83 pmol/L following active intervention. Post-discharge follow-up tests showed that PTH levels remained within the normal reference range, indicating that the hyperparathyroidism was well controlled.

high-sensitivity troponin decreased from 64.6 pg/mL to 12.7 pg/mL; B-type natriuretic peptide (BNP) levels decreased from 3334pg/mL to 120pg/mL. The patient's condition improved from preoperative acute myocardial injury complicated by acute heart failure to myocardial recovery, with cardiac function largely returning to normal (Fig 4). Postoperatively, the patient's parathyroid hormone (PTH) levels decreased from 174 pmol/L to 17 pmol/L (Fig 6). The parathyroid adenoma was successfully resected, and the patient achieved biochemical cure.The patient demonstrated good compliance with all interventions and tolerated both surgery and medication well.No adverse events were observed during treatment.

During follow-up visits, serum calcium levels gradually returned to normal, and the anemia improved. Following treatment of the underlying condition, heart failure and renal failure showed significant improvement. After discharge, the patient was prescribed 2.2 g of Bailing tablets three times daily for maintenance therapy.

4 Discussion:

Hypercalcemia is a common electrolyte disorder in clinical practice [5], affecting approximately 1% of the global population [6]. The symptoms and signs of hypercalcemia depend on the severity of the condition and the rate at which serum calcium levels rise [7]. Mild hypercalcemia is defined as total calcium levels of 2.65–2.99 mmol/L; moderate hypercalcemia as 3.0–3.49 mmol/L; and severe hypercalcemia or hypercalcemic crisis as total calcium $\geq$ 3.5 mmol/L (emergency) [8]. Mild hypercalcemia is generally asymptomatic, whereas moderate-to-severe hypercalcemia with a rapid rise in serum calcium levels can lead to anorexia, nausea, vomiting, constipation, abdominal pain, drowsiness, confusion, coma, anxiety, depression, arrhythmias, and acute kidney injury (AKI), among other manifestations symptoms [9]. Approximately 90% of patients with hypercalcemia have primary hyperparathyroidism or a malignant tumor [10]. The vast majority of cases of hyperparathyroidism are caused by

parathyroid tumors, the most common of which are parathyroid adenomas. Parathyroid adenomas are benign tumors arising from the parathyroid parenchymal cells; they can occur at any age, with the peak incidence occurring between 50 and 60 years of age [11]. Studies have shown that patients with primary hyperparathyroidism caused by parathyroid adenomas present with severe hypercalcemia, often accompanied by and potentially affecting multiple organs such as the heart and kidneys. Significantly elevated serum calcium levels and markedly increased parathyroid hormone levels are independent risk factors for cardiac dysfunction, progressive renal impairment, and even progression to end-stage renal disease. The patient in this case was an elderly male with hypercalcemia caused by a parathyroid adenoma, accompanied by heart failure and renal failure. His serum calcium level was $\geq$ 3.5 mmol/L, accompanied by elevated serum PTH. In this patient, PTH levels rose to approximately 25 times the upper limit of normal. Regarding diagnosis and differential diagnosis, PHPT is one of the major causes of hypercalcemic crisis and multi-organ dysfunction. Differential diagnosis requires systematic exclusion of secondary causes, including vitamin D overdose or toxicity; malignancy-related hypercalcemia; granulomatous diseases; familial hypocalciuric hypercalcemia; and drug-related factors such as a history of long-term use of thiazide diuretics or lithium [12]. Combined testing of serum PTH, serum calcium, serum phosphorus, and urinary calcium not only aids in confirming the diagnosis of PHPT but also helps assess disease severity and predict the prognosis of organ damage. Although hypercalcemic crises caused by PHPT are relatively rare, they can rapidly affect multiple organ systems once they occur. The literature reports two cases of severe hypercalcemia caused by parathyroid adenomas (with serum calcium levels of 5.14 mmol/L and 5.04 mmol/L, respectively), both of which presented with ventricular arrhythmias [13]. Typical histopathological features of parathyroid adenomas include tumor cells exhibiting a chief cell or eosinophilic morphology, surrounded by a complete capsule, with a "peripheral band" formed by compressed normal parathyroid tissue visible around the tumor; immunohistochemical staining reveals strong positive expression of PTH in the cytoplasm of tumor cells, which serves as definitive evidence of the tumor's parathyroid origin [14]. For atypical parathyroid tumors, care must be taken to distinguish them from parathyroid carcinoma, which are characterized by capsular invasion, vascular invasion, or infiltration of surrounding tissues [15, 16]. Studies have shown that measuring PTH not only helps confirm the diagnosis of parathyroid tumors [17], but also assesses the severity of hypercalcemia and the extent of multiorgan involvement. Case reports indicate that as PTH levels rise, hypercalcemia worsens, potentially leading to metastatic calcification in multiple organs, including the lungs, pancreas, and bladder [18]. This patient presented with significantly elevated PTH levels and serum calcium concentrations far exceeding the normal range, accompanied by heart failure (NT-proBNP 3334 pg/mL) and abnormal indicators of renal failure (elevated serum creatinine and blood urea nitrogen, glomerular filtration rate ¡20 mL/min/1.73 m^2). Ultrasound has a detection rate of 96% for intraglandular adenomas, while MIBI has a detection rate of 97% for ectopic adenomas; the combination of multimodal imaging can significantly improve localization accuracy [19]. The detection rate of parathyroid lesions using MIBI SPECT/CT (86.4%) is higher than that of ultrasound (65.9%); therefore, the combination of the two is the preferred

strategy for preoperative localization [20]. Early diagnosis and active management of the underlying condition are crucial for improving the prognosis of hypercalcemia, particularly in cases of multisystem involvement complicated by heart failure and renal insufficiency, where a multidisciplinary approach is necessary to develop individualized treatment plans to reduce perioperative risks [21]. The patient in this case was diagnosed with a parathyroid adenoma and had already developed hypercalcemia, heart failure, and renal failure.

This case employed a multidisciplinary, intensive management approach: Regarding the emergency management of a hypercalcemic crisis, initial treatment typically emphasizes the use of intravenous 0.9% sodium chloride solution to correct dehydration and increase glomerular filtration rate, combined with loop diuretics such as furosemide to promote urinary calcium excretion. This constitutes the standard emergency treatment protocol recognized by both domestic and international consensus [22]. On this basis, the addition of salmon calcitonin can rapidly inhibit osteoclast activity and reduce the release of bone calcium, typically taking effect within 48 hours. It serves as an emergency treatment for moderate-to-severe hypercalcemia, thereby creating conditions for subsequent surgery [23]. Once the hypercalcemic crisis has been initially controlled, a multidisciplinary evaluation should be conducted to determine the location of the adenoma and proceed with surgical resection. Precise preoperative localization is crucial for ectopic or complex adenomas; minimally invasive resection via video-assisted thoracoscopic surgery (VATS) can be performed to reduce complications. For patients who cannot undergo immediate surgery due to severe comorbidities, cinacalcet, as a calcium-sensitizing agent, can effectively lower serum calcium and parathyroid hormone levels, thereby creating the conditions and timing for surgery. This strategy is recommended in both domestic and international guidelines [24]. The patient underwent successful resection of a right parathyroid adenoma. Postoperatively, PTH levels dropped to 17 pmol/L, and serum calcium levels gradually returned to normal. Of particular note is the marked improvement in the patient's heart failure and renal failure. Following discharge, the patient was prescribed Bailing Tablets for maintenance therapy. Bailing Tablets are a preparation made from fermented Cordyceps sinensis fungal powder (Cs-4) and are widely used in the treatment of chronic kidney disease (CKD) and renal insufficiency. The main limitations of this case report include: the lack of a control group in this single-case report limits the generalizability of the conclusions; and the short follow-up period results in a lack of long-term prognostic data.

Surgical removal of the adenoma is the only curative treatment. However, for elderly patients or those with high-risk comorbidities such as heart failure or renal failure, a multidisciplinary team should comprehensively weigh the surgical risks and benefits and formulate a personalized perioperative management strategy. In the management of patients with multiorgan-involved parathyroid adenomas, controlling hypercalcemia—especially in those with concomitant heart failure and renal insufficiency—poses substantial clinical challenges. During diagnosis, imaging should be performed in patients with primary hyperparathyroidism for precise lesion localization. Additionally, a comprehensive panel of laboratory tests—including serum parathyroid hormone, serum calcium, serum creatinine, and 24-hour urinary calcium

excretion—should be obtained whenever possible. These results aid in establishing the diagnosis, assessing disease severity, and guiding the determination of optimal surgical timing. In traditional treatment, managing a hypercalcemic crisis requires immediate intervention. Intravenous infusion of 0.9% sodium chloride solution is administered to rapidly increase blood volume, combined with diuretics such as furosemide to promote calcium excretion in urine, while salmon calcitonin helps reduce the release of calcium from bones into the bloodstream. However, if the patient has already developed heart failure, cardiac function must be carefully assessed before rapid fluid administration to prevent exacerbating acute heart failure. Additionally, for patients with renal insufficiency, the dose of furosemide must be adjusted; while calcitonin has minimal impact on renal function, electrolyte imbalances must still be monitored. Surgical removal of the adenoma is the only curative treatment [25]. However, for elderly patients with high-risk conditions such as heart failure or renal failure, the risks and benefits of surgery must be comprehensively assessed through a multidisciplinary approach [26]. Develop a perioperative management plan tailored to the individual patient's circumstances. For patients who cannot undergo immediate surgery due to severe complications, cinacalcet may be used to lower serum calcium and PTH levels in preparation for subsequent surgery. Therefore, in the management of patients with parathyroid adenomas and multisystem involvement, it is essential to review current treatment approaches, prioritize the patient's specific circumstances when formulating a treatment plan, and select an appropriate treatment strategy based on factors such as cardiac function, renal function staging, surgical risk, and drug tolerance.

List of Abbreviations

PHPT: primary hyperparathyroidism
PTH: parathyroid hormone
MIBI: Methoxyisobutyl Isonitrile

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Ethical approval and Consent to Participate

This case report was conducted in accordance with the Declaration of Helsinki. Ethical approval for the publication of this case report was obtained from the Institutional Ethics Review Committee of the Affiliated Hospital of Shaanxi University of Chinese Medicine, in accordance with local regulations (Approval number: SZFYIEC-YJ-KYBC-2026NO.[01]). Written informed consent for participation and publication was obtained from the patient.

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Declaration of competing interest

The author declares that he has no competing interests.

Author contributions

Conceptualization, literature review, case management, data collection, manuscript writing, and final approval of the version to be submitted.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article.

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CARE Guidelines

This case report has been reported in line with the CARE guidelines.

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