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Case series

Challenges in Parathyroidectomy in End-Stage Kidney Disease: Preoperative Preparation, Localisation, and Surgery. A Case Series and Evidence-Based Approach

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A B S T R A C T

Renal hyperparathyroidism is a frequent and serious complication of end-stage kidney disease (ESKD), contributing to vascular calcifications, bone pain, and cardiovascular morbidity. For patient's refractory to medical therapy, parathyroidectomy (PTX) offers definitive treatment, alleviating symptoms, improving quality of life, and potentially enhancing survival. However, PTX in ESKD presents distinct intra-operative and post-operative challenges. This study evaluated the peri-operative and clinical considerations of PTX in ESKD, with emphasis on operative planning, gland localisation, post-operative hypocalcaemia, and recurrence risk. A literature review and retrospective analysis were conducted on eight dialysis-dependent patients with renal hyperparathyroidism unresponsive to medical treatment, all assessed by a multidisciplinary team prior to surgery. Three patients developed complications due to persistently elevated parathyroid hormone (PTH) levels, while the remainder were discharged in stable condition. These findings underscore the need for meticulous patient selection, comprehensive pre-operative counselling, and multidisciplinary decision-making. Surgical indications should be guided by symptom burden, biochemical derangements, and persistently elevated PTH. Although comparative evidence between surgical and medical approaches remains limited, PTX is associated with survival benefits and cost-effectiveness. Persistent post-operative PTH elevation may be linked to increased mortality, highlighting the importance of long-term follow-up and structured post-operative management

Introduction

End-stage kidney disease (ESKD) is frequently complicated by disturbances in mineral metabolism, particularly leading to Renal hyperparathyroidism [1]. Among the potentially modifiable mineral disorders, such as hyperphosphatemia, hypercalcemia, and renal hyperparathyroidism in patients with end-stage renal disease, are independently associated with increased morbidity and mortality due to cardiovascular issues, infections, fractures, and hospitalisations related to vascular access[1]. Chronic kidney disease disrupts calcium and vitamin D metabolism, leading to the activation of the calcium-sensing receptor. This activation subsequently results in increased secretion and synthesis of parathyroid hormone, along with hyperplasia of the parathyroid gland. These alterations represent a physiological adaptation aimed at maintaining calcium homeostasis[2].

Conventional management utilising calcium and active vitamin D represents the first-line treatment for patients [3,4]. However, numerous individuals may develop resistance or intolerance to this pharmacologic approach[4]. Indications for parathyroidectomy include refractory pruritus, muscle weakness, bone pain, calciphylaxis, and adverse effects associated with cinacalcet[4,5].Performing parathyroidectomy in patients with end-stage renal disease (ESRD) poses distinct challenges, particularly related to the increased cardiovascular risks and metabolic complications [6,7]. Intraoperative difficulties are often compounded by the variable anatomical location of the parathyroid glands, which can hinder effective preoperative Localisation and complicate surgical planning.[6,7] . Moreover, there are currently no universally accepted, evidence-based guidelines outlining precise indications for parathyroidectomy in renal hyperparathyroidism. Most existing recommendations are based on observational data, as randomised controlled trials to date have largely focused on comparing surgical outcomes with those of medical therapy.

This case series analyse eight patients with end-stage kidney disease (ESKD) and renal hyperparathyroidism (SHPT) who underwent parathyroidectomy (PTX) following failure of medical management. We discuss the complexities associated with preoperative planning, surgical techniques, imaging limitations, and patient outcomes, with a focus on the challenges faced in clinical practice.

Methods

This retrospective case series was conducted between June 2023 to August 2024 at Tripoli Central Hospital, a tertiary care surgical and nephrology centre. The study included eight patients with end-stage kidney disease (ESKD) on dialysis who had refractory renal hyperparathyroidism, all patients were considered ineligible for renal transplantation. Each

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case was evaluated through joint discussions among nephrologists, endocrinologists, and surgeons. All patients received heparinised dialysis and underwent a preoperative airway assessment. Ultrasound (US) was the primary imaging modality used, a Sestamibi scan was performed in one case. All patients underwent a standard total parathyroidectomy. Outcome measures included biochemical responses (pre-operative and post-operative parathyroid hormone levels), postoperative complications, and clinical status at follow-up.

Results

The cohort of eight patients had a mean age of 43 years, with a male-to-female ratio of 5:3. One patient presented a challenging airway assessment preoperatively due to neck stiffness. All patients underwent a total parathyroidectomy. During the surgical procedure, four parathyroid glands were excised in three patients, while another three patients had three glands removed. One patient had two glands excised, and one patient had one gland removed. Regarding postoperative complications, there were no reported instances of intraoperative bleeding or injuries to the right recurrent laryngeal nerve. Three out of the eight patients experienced persistently elevated levels of parathyroid hormone, as detailed in Table 1. All patients were discharged in stable condition.

Table 1. Cases That Experienced Persistent High PTH

Case 1	Case 2	Case 3
• Preoperative PTH: 1305 pg./mL • Localisation: Sestamibi scan negative • Surgery: Standard total PTX • Number of parathyroid glands removed: One gland. • Postoperative PTH: 893 pg./mL • Outcome: Persistent elevation of PTH. • Challenge Highlighted: Imaging failure and difficult intraoperative Localisation. • Current Management Medical Management; Slightly improved	• **Preoperative PTH:** 2655 pg./mL • **Localisation**: Ultrasound only • **Surgery**: Standard total PTX • N**umber of parathyroid glands removed:** Three glands. • **Postoperative PTH:** 623 pg./mL • **Outcome**: Clinical improvement; discharged in good condition. • **Challenge Highlighted**: High PTH reduction despite surgery and requires follow-up. • **Current Management** Medical management is completely controlled clinically and laboratory	• **Preoperative PTH:** 4922 pg./mL • **Localisation**: Ultrasound • **Surgery**: Standard total PTX • **Number of parathyroid glands removed**: Three glands. • **Postoperative PTH**: 3704 pg./mL • **Outcome**: Follow-up missed • **Challenge Highlighted**: Very high baseline PTH and suboptimal response; poor continuity of care. • **Current Management** Follow up missed

Discussion

Parathyroidectomy is a crucial intervention for patients with end-stage kidney disease (ESKD) who suffer from severe renal hyperparathyroidism unresponsive to medical treatment. This case series highlights the various challenges associated with PTX, including preoperative preparation, gland localisation, and intraoperative management. These findings emphasise the complexity of surgical care in high-risk patient population.

Currently, there are no universally accepted, evidence-based guidelines for surgical intervention in renal hyperparathyroidism. Most recommendations are based on observational studies. Indications typically include parathyroid hormone (PTH) levels exceeding 800 pg/mL, accompanied by hypercalcemia or hyperphosphatemia despite medical management, as well as symptomatic cases presenting with pruritus, bone pain, or calciphylaxis [8, 9]. The decision to proceed with surgery should involve a multidisciplinary evaluation that takes into account the patient's cardiovascular status, candidacy for transplantation, bone mineral profile, and surgical risk [10, 11]. This approach was applied in our series as all patients' demonstrated refractory biochemical or clinical features.

PTX offers a rapid correction of electrolyte imbalances and is associated with improved survival rates, particularly in patients suffering from severe renal hyperparathyroidism. Calcimimetics, such as cinacalcet can provide benefits but are often inadequate in severe cases and have not consistently shown an improvement in quality of life. In the long term, surgical management may present a more cost-effective solution [12,13]. A Japanese prospective cohort study reported that the survival benefit of parathyroidectomy compared to cinacalcet is especially seen in patients with baseline intact PTH levels of 500 pg/mL or higher, as well as those with baseline serum calcium levels of 10.0 mg/dL or higher (both *P* for interaction < 0.001). The study concluded that PTX, in comparison to cinacalcet, is associated with a reduced risk of mortality, particularly among patients with severe SHPT[14].In a randomised controlled trial, the administration of cinacalcet, in conjunction with vitamin D and phosphate binders, demonstrated a reduction in the risk of cardiovascular morbidity and pathological fractures compared to a placebo. However, there was no significant reduction in mortality observed[15].

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Both subtotal and total parathyroidectomy with autograft have been shown to reduce long-term medication costs for patients with renal hyperparathyroidism [16]. The optimal extent of parathyroidectomy for renal hyperparathyroidism remains a subject of ongoing debate [17]. A meta-analysis suggests that subtotal parathyroidectomy (SPTX) and total parathyroidectomy with autograft (TPTX+AT) are equally effective in preventing recurrent HPT and improving outcomes in secondary HPT[18]. Therefore, the decision regarding the procedure can be entrusted to the surgeons. A nine-year analysis further supports the use of total parathyroidectomy alone, reporting low morbidity and mortality rates, favourable medium- to long-term outcomes, and a low recurrence rate. Meanwhile, other studies have not demonstrated significant benefits from auto transplantation or thymectomy, and there remains a lack of definitive evidence favouring any one specific surgical approach. [19].

The localisation of the parathyroid gland prior to surgery exhibits significant variability in the reported sensitivity and specificity of Sestamibi scanning for renal hyperparathyroidism. A systematic review and meta-analysis revealed that Sestamibi has insufficient diagnostic accuracy, with a pooled sensitivity of 58% and a specificity of 93%. Therefore, it should not be considered a first-line imaging method for the pre-surgical detection of hyperplastic parathyroid glands [20]. Furthermore, a retrospective cohort study demonstrated that the majority of ectopic glands were successfully identified during surgery without the necessity for a preoperative Sestamibi scan [21]. For initial parathyroidectomy (PTx) in SHPT, a combination of computed tomography (CT), ultrasound (US), and MIBI scans is recommended, while CT and MIBI scans are valuable imaging modalities for subsequent PTx procedures [8,22]. Combined SPECT/CT provides greater sensitivity (66%–88%) than Sestamibi alone in identifying parathyroid glands in SHPT; however, it still encounters challenges in detecting ectopic glands, which may prolong the duration of surgery [8,22]. Many surgeons prefer a focused neck ultrasound, as this procedure is both efficient and straightforward to perform in an office setting [8,22].

Persistent elevated parathyroid hormone (PTH) levels following parathyroidectomy (PTx) in patients with end-stage renal disease (ESRD) represent a clinically significant concern [8,11]. This condition often indicates incomplete resection, the presence of supernumerary or ectopic glands, parathyromatosis, or autonomous graft function in cases of auto transplantation. However, existing guidelines for managing persistent or recurrent renal hyperparathyroidism (SHPT) are currently insufficient [8,11].

The KDOQI guidelines recommend the use of imaging modalities—such as ultrasound, sestamibi scans, and CT or MRI—to localise residual parathyroid tissue prior to re-exploration. Management strategies for recurrent or persistent hyperparathyroidism following parathyroidectomy (PTx) are similar to those used in secondary hyperparathyroidism (SHPT) before surgery, and may include both medical and surgical approaches[11]. A study conducted by Zitt et al., based on data from the pan-European observational study ECHO, revealed that cinacalcet achieved KDOQI treatment targets in approximately 20% of patients with recurrent or persistent hyperparathyroidism after PTx, a rate comparable to that in patients with SHPT who had no prior history of PTx [23]. It is crucial to note that persistent PTH levels do not always necessitate reoperation unless accompanied by hypercalcemia, hyperphosphatemia, or clinical symptoms [23]. The primary objective of management is to control symptoms and normalise calcium and phosphate balance, rather than solely to return PTH levels to the reference range in ESRD. According to the KDIGO 2017 guidelines, the target PTH level in ESRD is 2–9 times the upper limit of normal, typically around 150–600 pg/mL [11,24,25].

In the short term, parathyroidectomy (PTX) poses a significant risk regarding morbidity and mortality. According to data from the US Renal Data System (USRDS) for the years 2007-2009 revealed a 30-day postoperative mortality rate of 2.1% following PTX [26]. A comprehensive review by Komaba et al. highlighted the consistent survival advantage associated with PTX, as evidenced by studies conducted across various regions worldwide [14]. Furthermore, patients with parathyroid hormone (PTH) levels exceeding 600 pg/mL exhibited higher mortality rates compared to those with lower levels following the procedure [27].

This study has several limitations, including a small sample size, it's single-centre focus, and lack of long-term follow-up data on recurrence. However, it provides valuable insights for surgical teams managing parathyroid disease in dialysis-dependent patients. Future research should aim to develop standardised protocols for preoperative optimisation and imaging, validating emerging intraoperative tools, and establishing registries to monitor long-term outcomes. Additionally, prospective trials are needed to compare subtotal and total parathyroidectomy regarding recurrence rates, quality of life, and complication profiles.

Conclusion

Parathyroidectomy is a vital therapeutic intervention for managing renal hyperparathyroidism in patients with end-stage kidney disease (ESKD) when medical therapy is no longer effective. However, the procedure is accompanied by various challenges. The analysis highlights the importance of accurate preoperative localisation, the potential risk of persistent disease, and the need for ongoing multidisciplinary care and long-term follow-up. To improve patient outcomes, it is essential to adopt advanced imaging techniques, conduct regular postoperative monitoring, and develop individualised treatment plans.

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Conflicts of Interest

The authors declare no conflicts of interest.

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