



Parathyroidectomy for children with chronic renal failure and secondary hyperparathyroidism; what is the best technique?

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Abstract

Introduction: Reducing serum parathyroid hormone (PTH) level in patients with chronic renal failure can be achieved either by medical treatment or by parathyroidectomy. However, the long-term outcome of parathyroidectomy is better. More than one surgical technique can be done and there is no consensus about the best technique.

Objectives: In this study, we present our results in different techniques for parathyroidectomy for these children.

Patients and Methods: Six patients of both sexes with chronic renal failure and secondary hyperparathyroidism were collected from pediatric surgery department, Ain Shams University in the period between October 2014 and October 2015. All these patients underwent parathyroidectomy (Subtotal with preservation of half a gland in three patients, Subtotal with preservation of a whole gland in two patients and total with auto-transplantation in one patient). Patients were followed up for serum PTH and calcium levels to detect recurrence of hyperparathyroidism.

Results: Serum PTH and calcium levels dropped to normal levels after three months, in 3 of 6 patients (one with preservation of a gland, one with preservation of a whole gland and one with total parathyroidectomy and auto-transplantation). Two patients developed hypercalcemia and increased PTH level (one with preservation of half of a gland and the other with preservation of a whole gland). The sixth patient died one month postoperatively (the one with preservation of half of a gland).

Conclusion: There is no consensus upon the preferred surgical technique of parathyroidectomy in children with chronic renal failure and secondary hyperparathyroidism.

Keywords: Hyperparathyroidism, Parathyroidectomy, Subtotal, Autotransplantation, Parathyroid hormone, Calcium

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Introduction

Renal osteodystrophy is an important complication of secondary hyperparathyroidism. It results from disturbance in calcium-phosphate homeostasis and alteration in vitamin D and parathyroid hormone (PTH) metabolism (1). It leads to skeletal deformities and growth retardation. A broad spectrum of bone remodeling disorders can result, ranging from high-turnover lesions (osteitis fibrosa cystica) to low-turnover lesions (adynamic bone disease and osteomalacia) (2).

Lowering serum level of PTH is crucial to prevent this complication. Although medical treatment achieved some success in doing that, the long-term outcome of parathyroidectomy is better (3).

Objectives

More than one technique can be done for parathyroidectomy.

Total parathyroidectomy with or without auto-transplantation or subtotal parathyroidectomy can be performed. Although the safety and effectiveness of total parathyroidectomy with auto-transplantation have been extensively proven in adults, the evidence is scarce in children (4).

Patients and Methods

This study was carried out on six patients of both sexes (5 males and 1 female) who presented with chronic renal failure and secondary hyperparathyroidism and underwent parathyroidectomy, in pediatric surgery department, Ain Shams University in the period between October 2014 and October 2015. Patients' age ranged between 6 and 15 years.

All the patients underwent preoperative evaluation of serum PTH and serum calcium levels. Neck

■ Implication for health policy/practice/research/medical education

More than one technique can be employed for parathyroidectomy in children with chronic renal failure and secondary hyperparathyroidism. Choice of the surgical technique depends mainly on the surgeon's experience and comfort. Follow up of the postoperative serum levels of parathyroid hormone and calcium is important to document the success of the operation done.

ultrasonography was conducted to document hyperplasia of the parathyroid glands.

Subtotal parathyroidectomy with preservation of a whole gland was done in two patients. Subtotal parathyroidectomy with preservation of half a gland was done in three patients. Total parathyroidectomy with auto-transplantation of half a gland in the right sternocleidomastoid muscle was done in one patient.

Serum PTH and serum calcium levels were measured postoperatively after three months to detect recurrence of hyperparathyroidism.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. Before the study, written informed consent was obtained from all patients who participated in the study. All information about individuals was coded and kept confidential.

Results

Preoperative serum PTH levels ranged between 1300 and 1800 $\mu\text{g/mL}$ and preoperative serum calcium levels ranged between 7.5 and 9.1 mg/dL . The levels for each patient is shown in [Table 1](#).

After parathyroidectomy, postoperative serum PTH levels ranged between 40 and 730 $\mu\text{g/mL}$ and postoperative serum calcium levels ranged between 8 and 10.4 mg/dL .

The levels for each patient is shown in [Table 2](#).

[Tables 1](#) and [2](#) show serum PTH and calcium levels dropped to normal levels in 3 of 6 patients (one with preservation of a whole gland, one with preservation of half of a gland and one with total parathyroidectomy and auto-transplantation). Two patients developed hypocalcemia and increased PTH level (one with preservation of a whole gland and the other with preservation of half a gland). The remaining patient died one month postoperatively (with preservation of half a gland).

Discussion

Secondary hyperparathyroidism is a common, important and treatable complication of chronic renal failure. Its exact pathogenesis is unknown, but hyperphosphatemia, hypocalcemia, decreased level of 1,25-dihydroxyvitamin D3, decreased expression of calcium and vitamin D receptors and PTH resistance may play a role. Longstanding secondary hyperparathyroidism results in osteitis fibrosa cystica (a high turnover bone lesion) and increases the risk for bone pain and fracture (5-7).

Medical treatment has been tried to treat this complication. Treatment with calcium and vitamin D have been associated with hypercalcemia and hyperphosphatemia. The administration of calcimimetics as cinacalcet has been associated with some success. Cinacalcet targets the calcium sensing receptors and decreases PTH level without increasing calcium or phosphorus levels (8). However, some patients are non-responsive or intolerant to the pharmacological treatment (9).

Surgical treatment remains the treatment of choice with better long-term outcome. Some studies implied that parathyroidectomy is indicated in severe cases of hyperparathyroidism that are not controlled by the medical treatment (serum PTH > 600 $\mu\text{g/mL}$ and serum calcium >10 mg/dL) (10,11). The outcome of parathyroidectomy depends on a large extent on the experience of the

Table 1. Preoperative serum PTH and calcium levels

Patient	Preoperative serum PTH levels ($\mu\text{g/mL}$)	Preoperative serum calcium levels (mg/dL)
Subtotal PXT and preserved half a gland	1300	7.5
Subtotal PXT and preserved half a gland	1800	7.9
Subtotal PXT and preserved half a gland	1472	7.6
Subtotal PXT and preserved a whole gland	1637	7.6
Subtotal PXT and preserved a whole gland	1800	9.1
Total PXT and autotransplantation	1800	8.2

Table 2. Postoperative serum PTH and calcium levels

Patient	Postoperative serum PTH levels ($\mu\text{g/mL}$)	Postoperative serum calcium levels (mg/dL)
Subtotal PXT and preserved half a gland	40	10.2
Subtotal PXT and preserved half a gland	665	8
Subtotal PXT and preserved half a gland	Died 1 month postoperatively	Died 1 month postoperatively
Subtotal PXT and preserved a whole gland	55	9.8
Subtotal PXT and preserved a whole gland	730	8.4
Total PXT and autotransplantation	43	10.4

operating surgeon (12). Total parathyroidectomy and auto-transplantation gained wide acceptance but the evidence for its safety and effectiveness in children is scarce (4,13,14).

Follow up after parathyroidectomy is essential as the sudden drop in PTH level may lead to hypocalcemia manifesting as tetany. The cause of this hypocalcemia is the enhanced calcium uptake by the demineralized bone (hungry bone syndrome). Another cause for this hypocalcemia is the loss of the effect of PTH on the renal tubular reabsorption of calcium (15).

Conclusion

More than one technique has been employed for parathyroidectomy in children with chronic renal failure and secondary hyperparathyroidism. Choice of the surgical technique depends mainly on the surgeon's experience and comfort. Follow up of the postoperative serum levels of PTH and calcium is important to document the success of the operation done.

Authors' contribution

In this study, ME as corresponding author and supervisor conducted the study. OE, ME and HS an advisor contributed to the design. MA analyzed the results and interpreted data. ME wrote the manuscript. ME, AA and MA collected the data.

Conflicts of interest

The authors declare that they have no conflict of interest.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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