



ORIGINAL ARTICLE

Influence of dialysis modalities on patients undergoing parathyroidectomy for renal hyperparathyroidism



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Summary *Background/Introduction:* Dialysis modalities may influence parathyroid hormone (PTH) levels and renal osteodystrophy patterns. To date, no study has compared the effects of dialysis modality on surgical patients with renal hyperparathyroidism.

Purpose/Aim: This study evaluated the influence of different dialysis modalities on perioperative features among patients undergoing parathyroidectomy.

Methods: Overall, 386 patients who underwent initial parathyroidectomy for renal hyperparathyroidism were recruited. Biochemical data and relevant symptoms were compared between hemodialysis and peritoneal dialysis patients.

Results: Compared with the hemodialysis patients, the 40 (10%) peritoneal dialysis patients were younger ($p = 0.002$) and had a shorter duration of dialysis ($p < 0.001$). The peritoneal dialysis patients had lower hemoglobin ($p = 0.006$), albumin ($p = 0.040$), and intact PTH levels ($p = 0.039$) prior to surgery but had higher serum aluminum levels ($p = 0.039$). During follow-up, the peritoneal dialysis patients tended to have higher calcium–phosphorus product levels and more severe residual symptoms of bone pain ($p = 0.080$), mood swings ($p = 0.053$), and pruritus ($p = 0.094$).

Conclusion: Patients on different dialysis modalities had similar decreases in intact PTH and alkaline phosphatase levels after surgery. However, the peritoneal dialysis patients had higher postoperative calcium–phosphorus product levels and more severe residual symptoms.

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1. Introduction

Mineral dysfunction and hyperparathyroidism are common complications of end-stage renal disease (ESRD). The prevalence of renal hyperparathyroidism among dialysis populations ranges from 12% to 54%.¹ Elevated levels of parathyroid hormone (PTH) are associated with several inflammatory markers.² For patients with severe uncontrolled hyperparathyroidism, parathyroidectomy may improve overall survival,³ bone mineral density (BMD),⁴ and quality of life as well as alleviate symptoms⁵ and fracture nonunion.⁶ In the United States, the rate of parathyroidectomy declined between 1988 and 1998 but increased thereafter, despite advances in medical treatment.⁷

For patients requiring renal replacement therapy, no clear survival benefit exists for hemodialysis or peritoneal dialysis.⁸ Nonetheless, dialysis modalities significantly influence hemoglobin, ferritin, albumin, cholesterol, and PTH levels.⁹ Some studies have shown that the prevalence of adynamic bone disease is consistently higher in peritoneal dialysis patients than in hemodialysis patients.¹⁰ To our knowledge, no study has compared the effects of dialysis modality on surgical patients with renal hyperparathyroidism. This study evaluated the influence of different dialysis modalities on perioperative features among patients undergoing parathyroidectomy for renal hyperparathyroidism.

2. Methods

From January 2004 to December 2014, 389 consecutive ESRD patients underwent initial parathyroidectomy for renal hyperparathyroidism at a tertiary care center. Three patients younger than 20 years were excluded. Overall, 386 patients who had biochemically confirmed renal hyperparathyroidism comprised the study population. The indication for parathyroidectomy was severe hyperparathyroidism associated with hypercalcemia and/or hyperphosphatemia that was refractory to medical therapy.¹¹

Serum calcium, phosphate, total alkaline phosphatase, albumin, and intact PTH levels (1–84) were regularly monitored preoperatively and during follow-up.¹² Most referring dialysis centers examined electrolytes on a monthly basis and alkaline phosphatase and PTH levels at 3-month intervals. When the serum albumin level was <4.0 g/dL, serum calcium levels were corrected using the following formula:

$$\text{corrected calcium (mg/dL)} = \text{measured total calcium (mg/dL)} + 0.8 \times [4.0 - \text{serum albumin (g/dL)}]. \quad (1)$$

BMD at the lumbar spine and hip was measured using dual-energy X-ray absorptiometry. After August 2008, the serum aluminum level was determined preoperatively and/or within 1 week after surgery.¹³

All operations were performed or supervised by board-certified endocrine surgeons. Bilateral cervical exploration was followed by subtotal parathyroidectomy or total parathyroidectomy with or without autotransplantation¹⁴;

the decision was at the discretion of the operating surgeon. After parathyroidectomy, persistent disease was defined as any measurement of an intact PTH level >300 pg/mL in the postoperative 6 months. Recurrence was defined as any measurement of an intact PTH level >300 pg/mL beyond 6 months after surgery.¹¹

After August 2008, the Parathyroidectomy Assessment of Symptoms (PAS) questionnaire was used to assess relevant symptoms preoperatively and 6–12 months after the surgery. The PAS scoring system addresses 13 parameters: pain in the bones, feeling tired easily, mood swings, feeling “blue” or depressed, pain in the abdomen, feeling weak, feeling irritable, pain in the joints, being forgetful, difficulty getting out of a chair or car, headaches, itchy skin, and being thirsty.¹⁵ Each item was scored on a 100-point visual analog scale, and the PAS score was calculated as the sum of all 13 answers (range, 0–1300). The reliability and validity of the Taiwan Chinese-translated version were established in our previous study.⁵

Data were analyzed using STATA 12.0 (Stata Corp., College Station, TX, USA) and are reported as the mean \pm standard deviation. Natural log or square root transformations were performed when necessary to normalize skewed distributions. Categorical data were compared using Fisher’s exact test or the Chi-square test, as appropriate. A paired or unpaired Student *t* test was used to evaluate differences between groups. All statistical tests were two-sided, and statistical significance was determined as $p < 0.05$.

3. Results

Of the 386 patients, 346 (90%) were on regular hemodialysis and 40 (10%) were on regular peritoneal dialysis. The peritoneal dialysis patients were significantly younger and had a shorter duration of dialysis compared with the hemodialysis patients (Table 1). The mean duration of dialysis prior to surgery was 9.9 ± 4.9 years and 6.3 ± 3.9 years for the hemodialysis patients and peritoneal dialysis patients, respectively. The peritoneal dialysis patients had lower hemoglobin, albumin, and intact PTH levels compared with the hemodialysis patients. Prior to parathyroidectomy, no differences existed in serum calcium, phosphorus, and alkaline phosphatase levels between the groups. Serum aluminum levels were significantly higher among the peritoneal dialysis patients than among the hemodialysis patients (17.0 ± 11.1 $\mu\text{g/L}$ vs. 13.1 ± 6.7 $\mu\text{g/L}$, $p = 0.039$).

The majority of patients underwent total parathyroidectomy and autotransplantation (Table 2). Overall, 89 (26%) hemodialysis patients underwent concurrent thyroidectomy for benign goiter ($n = 73$), thyroiditis ($n = 3$), or papillary thyroid cancer ($n = 13$). Six peritoneal dialysis patients underwent concurrent thyroidectomy for benign goiter. The average postoperative hospital stay was 5.0 ± 3.6 days (range, 2–42 days). Both groups showed similar postoperative recovery. Persistent disease was observed in 46 (12%) patients. The dialysis modality did not influence the prevalence of persistent disease.

In both groups, serum calcium, phosphorus, alkaline phosphatase, and intact PTH levels decreased significantly

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