



Parathyroid Hormone (PTH)

Monitoring a Critical Indicator of Renal Osteodystrophy

- Parathyroid hormone (PTH) is an 84-amino acid polypeptide that plays a critical role in maintaining homeostasis of serum ionized calcium.
- In dialysis patients, serum PTH levels are commonly elevated (secondary hyperparathyroidism) and may produce significant abnormalities of mineral metabolism and bone formation, resulting in increased morbidity.
- Assays that measure the intact PTH molecule are preferred for assessing PTH levels in ESRD.^{1,2,3}

Clinical Applications

Parathyroid hormone testing in dialysis patients may assist the clinician to:

- Assess the level of parathyroid gland function
- Diagnose and evaluate secondary hyperparathyroidism
- Evaluate patients for early signs of hyperparathyroidism and identify those who may benefit from therapeutic interventions
- Manage treatment for early secondary hyperparathyroidism before aggressive measures are needed, e.g. parathyroidectomy
- Distinguish between severe hyperparathyroidism (osteitis fibrosa) and low turnover (adynamic/aplastic) renal bone disease
- Monitor patient response to calcitriol therapy

Relevance in Dialysis Population

Increased parathyroid hormone secretion is a common consequence of end-stage renal disease, and plays a major role in the development of renal osteodystrophy. In various forms, renal osteodystrophy results in significant morbidity for this patient population.

Elevated PTH levels are often the first manifestation of abnormal bone mineral metabolism in patients with chronic renal failure.³

Preventive measures, including careful monitoring and management of PTH, phosphate, calcium and calcitriol levels, may arrest or delay the development of symptomatic bone disease, and avoid the need for surgical parathyroidectomy.

Parathyroid Hormone Biochemistry

Cells in the parathyroid glands secrete biologically active intact PTH and some PTH fragments. Once secreted, intact PTH is quickly metabolized by the liver and kidneys (half-life <10 minutes) into C-terminal and N-terminal fragments. In healthy individuals, intact PTH and its molecular fragments are cleared from the bloodstream by glomerular filtration.

Ionized calcium concentration in the extra-cellular fluid is the primary determinant of PTH secretion. A reduction in serum calcium levels stimulates PTH secretion, which in turn, releases calcium from bone stores into the bloodstream. These alterations in serum calcium, as well as changes in serum phosphorus and calcitriol concentrations, can activate a compensatory cycle that continues to elevate PTH and produce abnormal bone turnover and mineralization in ESRD patients.

Concentrations of PTH molecules and fragments in ESRD patients may reach levels many times greater

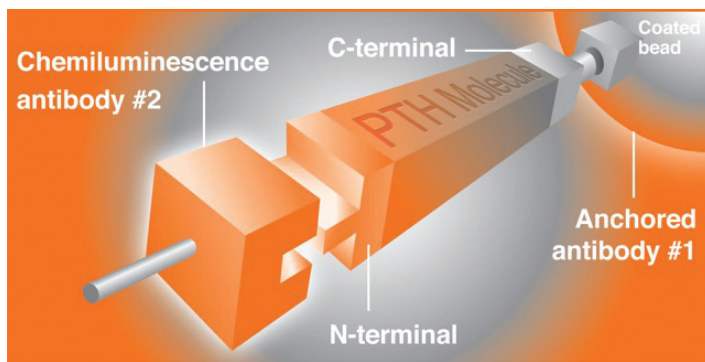
The availability of sensitive laboratory assays for the measurement of serum PTH improves clinicians' ability to detect and diagnose secondary hyperparathyroidism, identify patients at risk for renal osteodystrophy and effectively manage their therapy.

than normal, reflecting both increased secretion of intact PTH and fragments, as well as retention due to impaired renal function. Resistance to PTH may develop in uremia, and not all elevated hormone levels are associated with bone abnormalities.¹

Different assays may be used for PTH testing. The preferred assay for assessing PTH levels in ESRD patients measures the intact molecule.^{1,2,3}

- **Intact PTH assay.** Spectra’s intact PTH assay is a two-site sandwich immunoassay using direct chemiluminometric technology. The assay identifies two immunologic areas of the 84-amino acid PTH polypeptide, the amino acids 1-34, the biological active portion of the molecule, and the amino acid sequence 34-84 which is biologically inactive, but is used to positively identify the PTH molecule.

Intact PTH Immunochemiluminescence Assay (ICMA)



Double-antibody technology creates a molecule “sandwich” that catches only intact molecules.

The intact PTH ICMA provides an accurate assessment of current glandular activity. Results correlate well with intact PTH IRMA results,⁴ that have proved valuable for differentiation of various types of renal bone disease.⁵ High sensitivity makes intact PTH ICMA well-suited for detection of low PTH levels in uremic patients at risk for adynamic or aplastic bone disease. In addition, this assay can be useful for monitoring the response of PTH levels to calcitriol therapy,⁶ phosphate binding therapy and changes in dialysate calcium, as well as for detecting PTH suppression.

Clinical Intervention

The availability of sensitive laboratory assays for the measurement of serum PTH improves clinicians’ ability to detect and diagnose secondary hyperparathyroidism, identify patients at risk for renal osteodystrophy and effectively manage their therapy.

Clinical management of secondary hyperparathyroidism and renal osteodystrophy involves controlling levels of serum PTH, calcium, phosphorus and calcitriol. Dietary modifications, use of phosphate binders, the administration of Vitamin D analogues or intravenous calcitriol, and adjustment of the dialysate calcium concentration may be indicated.

Test Methodology

The test methodology for iPTH is immunochemiluminometric.

Reference Ranges

Gen. Pop. (pg/mL)	Exception	Critical
Intact PTH ICMA 14 – 72 pg/mL	None	None

Interpreting Results

- Because PTH assays from other vendors may use different methods, results may not be directly comparable. Refer to reference ranges.
- Intact PTH assay results can be acutely influenced by serum calcium changes during dialysis. Therefore, blood samples should be obtained predialysis.
- For a variety of reasons, changes in a patient’s PTH values over time may be more significant than absolute PTH test results on a single occasion.

Specimen Collection

One full Lavender Top Tube is required. Refer to the Spectra Directory of Services for more detailed information.

REFERENCES

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