

## Overview

### Useful For

Monitoring and assessing effectiveness of antiresorptive therapy in patients treated for osteopenia, osteoporosis, Paget's disease, or other disorders in which osteocalcin levels are elevated

As an adjunct in the diagnosis of medical conditions associated with increased bone turnover, including Paget disease, cancer accompanied by bone metastases, primary hyperparathyroidism, and renal osteodystrophy

This test is **not useful for** the diagnosis of osteoporosis.

### Method Name

Electrochemiluminescence Immunoassay (ECLIA)

### NY State Available

Yes

## Specimen

### Specimen Type

Serum

### Specimen Required

1. Fasting (12 hours)

2. **For 12 hours before specimen collection do not** take multivitamins or dietary supplements containing biotin (vitamin B7), which is commonly found in hair, skin, and nail supplements and multivitamins.

**Supplies:** Aliquot Tube, 5 mL (T465)

### Collection Container/Tube:

**Preferred:** Serum gel

**Acceptable:** Red top

**Submission Container/Tube:** Plastic vial

**Specimen Volume:** 1 mL

**Collection Instructions:** Centrifuge and aliquot serum into plastic vial.

### Reject Due To

Gross hemolysis    Reject

Gross lipemia      OK

### Specimen Minimum Volume

0.75 mL

### Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	14 days	
	Frozen	90 days	

	Ambient		
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## Clinical & Interpretive

### Clinical Information

Osteocalcin, the most important noncollagen protein in bone matrix, accounts for approximately 1% of the total protein in human bone. It is a 49-amino acid protein with a molecular weight of approximately 5800 Da. Osteocalcin contains up to 3 gamma-carboxyglutamic acid residues as a result of posttranslational, vitamin K-dependent enzymatic carboxylation. Its production is dependent upon vitamin K and is stimulated by 1,25 dihydroxy vitamin D.

Osteocalcin is produced by osteoblasts and is widely accepted as a marker of bone osteoblastic activity. Osteocalcin, incorporated into the bone matrix, is released into the circulation from the matrix during bone resorption and, hence, is considered a marker of bone turnover rather than a specific marker of bone formation. Osteocalcin levels are increased in metabolic bone diseases with increased bone or osteoid formation including osteoporosis, osteomalacia, rickets, hyperparathyroidism, renal osteodystrophy, thyrotoxicosis, and in individuals with fractures, acromegaly, and bone metastasis. By means of osteocalcin measurements, it is possible to monitor therapy with antiresorptive agents (bisphosphonates or hormone replacement therapy [HRT]) in, for example, patients with osteoporosis or hypercalcemia.(1) Decrease in osteocalcin is also observed in some disorders (eg, hypoparathyroidism, hypothyroidism, and growth hormone deficiency).

Immunochemical and chromatographic studies have demonstrated considerable heterogeneity for concentrations of circulating osteocalcin in normal individuals and in patients with osteoporosis, chronic renal failure, and Paget disease. Both intact osteocalcin (amino acids 1-49) and the large N-terminal/midregion (N-MID) fragment (amino acids 1-43) are present in blood. Intact osteocalcin is unstable due to protease cleavage between amino acids 43 and 44. The N-MID fragment, resulting from cleavage, is considerably more stable. This assay detects both the stable N-MID fragment and intact osteocalcin.

### Reference Values

#### Males

<5 years: 19-75 ng/mL

5-9 years: 21-108 ng/mL

10-15 years: 19-159 ng/mL

16-17 years: 12-114 ng/mL

> or =18 years: 9-42 ng/mL

#### Females

<5 years: 14-126 ng/mL

5-9 years: 16-152 ng/mL

10-15 years: 15-151 ng/mL

16-17 years: 9-70 ng/mL

> or =18 years: 9-42 ng/mL

### Interpretation

Elevated levels of osteocalcin indicate increased bone turnover.

In patients taking antiresorptive agents (bisphosphonates or hormone replacement therapy: HRT), a decrease of 20% or less from baseline osteocalcin level (ie, prior to the start of therapy) after 3 to 6 months of therapy suggests effective response to treatment.(2)

Patients with diseases such as hyperparathyroidism, which can be cured, should have a return of osteocalcin levels to

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the reference range within 3 to 6 months after complete cure.(3)

**Cautions**

Measurements of bone turnover markers are not useful for the diagnosis of osteoporosis, which should be made on the basis of bone density or clinical history of low-trauma fracture.

Osteocalcin is cleared by the kidneys; therefore, elevations may be observed in patients with impaired kidney function without increased bone turnover.

Serum osteocalcin may not reflect bone formation in patients treated with the hormone 1,25-dihydroxy vitamin D or those with abnormalities in that hormone since osteocalcin is regulated by 1,25-dihydroxy vitamin D.

As with all tests containing monoclonal mouse antibodies, erroneous findings may be obtained from specimens taken from patients who have been treated with monoclonal mouse antibodies or have received them for diagnostic purposes. In rare cases, interference due to extremely high titers of antibodies to ruthenium or streptavidin can occur.

**Clinical Reference**

1. Chen JT, Hosoda K, Hasumi K, Ogata E, Shiraki M: Serum N-terminal osteocalcin is a good indicator for estimating responders to hormone replacement therapy in postmenopausal women. *J Bone Miner Res.* 1996 Nov;11(11):1784-1792
2. Delmas PD, Eastell R, Garnero P, Seibel MJ, Stepan J, Committee of Scientific Advisors of the International Osteoporosis Foundation: The use of biochemical markers of bone turnover in osteoporosis. *Committee of Scientific Advisors of the International Osteoporosis Foundation. Osteoporos Int.* 2000;11(6):S2-S17
3. Harris SS, Soteriades E, Dawson-Hughes B, Framingham Heart Study, Boston Low-Income Elderly Osteoporosis Study: Secondary hyperparathyroidism and bone turnover in elderly blacks and whites. *J Clin Endocrinol Metab.* 2001 Aug;86(8):3801-3804
4. Fraser W: Bone and mineral metabolism. In: Rifai N, Horvath AR, Wittwer CT, eds. *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics.* 6th ed. Elsevier; 2018:1422-1491

**Performance****Method Description**

The Roche Osteocalcin assay is a 2-site immunometric (sandwich) assay using electrochemiluminescence detection. Patient specimen, biotinylated monoclonal N-MID osteocalcin-specific antibody, and monoclonal N-MID osteocalcin-specific antibody labeled with ruthenium react to form a complex. Streptavidin-coated microparticles act as the solid phase to which the complex binds. Voltage is applied to the electrode inducing a chemiluminescent emission from the ruthenium, which is then measured against a calibration curve to determine the amount of osteocalcin in the patient specimen.(Package insert: Elecsys N-MID Osteocalcin. Roche Diagnostics; V 1.0 English 01/2020)

**PDF Report**

No

**Specimen Retention Time**

3 months

**Performing Laboratory Location**

Rochester

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**Fees & Codes****Test Classification**

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

**CPT Code Information**

83937