MAYO CLINIC LABORATORIES

Test Definition: PSAFT

Prostate-Specific Antigen (PSA), Total and Free, Serum

Overview

Useful For

As an aid in distinguishing prostate cancer from benign prostatic conditions in men aged 50 years and older with total PSA between 4.0 and 10.0 ng/mL with digital rectal examination findings that are not suspicious for cancer

Testing Algorithm

Total prostate-specific antigen (PSA) and free PSA are performed and reported on every specimen.

If the initial total PSA concentration is between 4.0 and 10.0 ng/mL, then the percentage of free PSA will be calculated and reported.

Highlights

In individuals with a total prostate-specific antigen (PSA) concentration between 4.0 and 10.0 ng/mL, free PSA:total PSA ratio could help determine the relative risk of prostate cancer. The lower the free PSA:total PSA ratio, the higher the risk of prostate cancer.

Method Name

Electrochemiluminescent Immunoassay (ECLIA)

NY State Available

Yes

Specimen

Specimen Type

Serum

Ordering Guidance

This test may be ordered for patients undergoing evaluation of suspicion of prostate cancer, or for assessing the risk of prostate cancer in patients with borderline or moderately increased total prostate-specific antigen (4.0-10.0 ng/mL).

Necessary Information

Include patient's age.

Specimen Required

Supplies: Sarstedt Aliquot Tube 5 mL (T914)
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial

Specimen Volume: 1 mL serum
Collection Instructions: Within 3 hours of collection, centrifuge and aliquot serum into a plastic vial.

Forms

If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-General Request (T239)
-Oncology Test Request (T729)

Specimen Minimum Volume

Serum: 0.75 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Frozen (preferred)	90 days	
	Refrigerated	72 hours	

Clinical & Interpretive

Clinical Information

Prostate-specific antigen (PSA) is a glycoprotein produced by the prostate gland, the lining of the urethra, and the bulbourethral gland. Normally, very little PSA is secreted in the blood. Increases in glandular size and tissue damage caused by benign prostatic hypertrophy, prostatitis, or prostate cancer may increase circulating PSA levels.

PSA exists in serum in multiple forms: complexed to alpha-1-anti-chymotrypsin (PSA-ACT complex), unbound (free PSA), and enveloped by alpha-2-macroglobulin (not detected by immunoassays).

Higher total PSA levels and lower percentages of free PSA are associated with higher risks of prostate cancer.

Most prostate cancers are slow growing, so the utility of prostate cancer screening is marginal in most men with a life expectancy of less than 10 years.

Reference Values

Total prostate-specific antigen (PSA)
Males:

<40 years: < or =2.0 ng/mL
40-49 years: < or =2.5 ng/mL
50-59 years: < or =3.5 ng/mL
60-69 years: < or =4.5 ng/mL
70-79 years: < or =6.5 ng/mL
> or =80 years: < or =7.2 ng/mL

Females: Not applicable

Free PSA:Total PSA
Males:
When total PSA concentration is in the range of 4.0-10.0 ng/mL:

Probability of cancer			
Free PSA/total PSA ratio	50-59 years	60-69 years	> or =70 years
< or =0.10	49%	58%	65%
0.11-0.18	27%	34%	41%
0.19-0.25	18%	24%	30%
>0.25	9%	12%	16%

Females: Not applicable

Interpretation

When total prostate-specific antigen (PSA) concentration is below 2.0 ng/mL, the probability of prostate cancer in asymptomatic men is low, further testing and free PSA may provide little additional information. When total PSA concentration is above 10.0 ng/mL, the probability of cancer is high and prostate biopsy is generally recommended.

The total PSA range of 4.0 to 10.0 ng/mL has been described as a diagnostic "gray zone," in which the free PSA:total PSA ratio helps to determine the relative risk of prostate cancer (see table). Therefore, some urologists recommend using the free PSA:total ratio to help select which men should undergo biopsy. However, even a negative result of prostate biopsy does not rule out prostate cancer. Up to 20% of men with negative biopsy results have subsequently been found to have cancer.

Based on free PSA:total PSA ratio: the percentage of probability of finding prostate cancer on a needle biopsy by age in years:

Free PSA:total PSA ratio	50-59 years	60-69 years	70 years and older
< or =0.10	49%	58%	65%
0.11-0.18	27%	34%	41%
0.19-0.25	18%	24%	30%
>0.25	9%	12%	16%

Cautions

Normal results do not eliminate the possibility of prostate cancer.

Values obtained with different assay methods or kits may be different and cannot be used interchangeably.

Tumor markers are not specific for malignancy. Test results cannot be interpreted as absolute evidence for the presence or absence of malignant disease.

Specimens collected from patients undergoing prostate manipulation, especially needle biopsy and transurethral resection, may show erroneously high prostate-specific antigen (PSA) results. Care should be taken that specimens are obtained before these procedures are performed.

Prostate cancer patients receiving treatment with anti-androgens and luteinizing hormone-releasing factor agonists may exhibit markedly decreased levels of PSA. Also, men treated for benign prostatic hyperplasia with inhibitors of 5-alpha-reductase (finasteride) may demonstrate a significant reduction in PSA levels compared to values before treatment. Care should be taken in interpreting values for these individuals.

Serum biotin concentrations up to 1200 ng/mL do not interfere with this assay. Concentrations up to 1200 ng/mL may be present in specimens collected from patients taking extremely high doses of biotin up to 300 mg per day.(1) In a study among 54 healthy volunteers, supplementation with 20 mg/day biotin resulted in a maximum serum biotin concentration of 355 ng/mL 1-hour post-dose.(2)

In rare cases, some individuals can develop antibodies to mouse or other animal antibodies (often referred to as human anti-mouse antibodies [HAMA] or heterophile antibodies), which may cause interference in some immunoassays. The presence of antibodies to streptavidin or ruthenium can also rarely occur and may interfere in this assay. Caution should be used in interpretation of results, and the laboratory should be alerted if the result does not correlate with the clinical presentation.

Clinical Reference

1. Saint Paul LP, Debruyne D, Bernard D, Mock DM, Defer GL. Pharmacokinetics and pharmacodynamics of MD1003 (high-dose biotin) in the treatment of progressive multiple sclerosis. Expert Opin Drug Metab Toxicol. 2016;12(3):327-344. doi:10.1517/17425255.2016.1136288
2. Grimsey P, Frey N, Bendig G, et al. Population pharmacokinetics of exogenous biotin and the relationship between biotin serum levels and in vitro immunoassay interference. Int J Pharmacokinet. 2017;2(4):247-256. doi:10.4155/ipk-2017-00131
3. Catalona WJ, Smith DS, Wolfert RL, et al. Evaluation of percentage of free serum prostate-specific antigen to improve specificity of prostate cancer screening. JAMA. 1995:274(15);214-1220
4. Oesterling JE, Jacobsen SJ, Klee GG, et al. Free, complexed and total serum prostate specific antigen: the establishment of appropriate reference ranges for their concentrations and ratios. J Urol. 1995;154(3):1090-1095. doi:10.1016/s0022-5347(01)66984-2
5. Duffy MJ. Biomarkers for prostate cancer: prostate-specific antigen and beyond. Clin Chem Lab Med. 2020;58(3):326-339. doi:10.1515/cclm-2019-0693
6. Catalona WJ. Prostate cancer screening. Med Clin North Am. 2018102(2):199-214. doi:10.1016/j.mcna.2017.11.001
7. Ilic D, Djulbegovic M, Jung JH, et al. Prostate cancer screening with prostate-specific antigen (PSA) test: a systematic review and meta-analysis. BMJ. 2018;362:k3519. doi:10.1136/bmj.k3519

Performance

Method Description

Total prostate-specific antigen:
The Roche Elecsys total PSA (prostate-specific antigen) assay is a sandwich electrochemiluminescent immunoassay that employs a biotinylated monoclonal PSA-specific antibody and a monoclonal PSA-specific antibody labeled with ruthenium complex. PSA in the specimen reacts with both the biotinylated monoclonal PSA-specific antibody (mouse) and the monoclonal PSA-specific antibody (mouse) labeled with a ruthenium, forming a sandwich complex. Streptavidin-coated microparticles are added, and the mixture aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell. Application of voltage to the electrode induces the chemiluminescent emission, which is then measured against a calibration curve to determine the amount of PSA in the patient specimen. This method has been standardized against the Reference Standard/WHO 96/670.(Package insert: Elecsys total PSA., Roche Diagnostics; V 3.0, 07/2024)

Free PSA:
The Roche Elecsys free PSA assay is a sandwich electrochemiluminescent immunoassay that employs a biotinylated monoclonal PSA-specific antibody and a monoclonal PSA-specific antibody labeled with ruthenium complex. Free PSA in the specimen reacts with both the biotinylated monoclonal PSA-specific antibody (mouse) and the monoclonal PSA-specific antibody (mouse) labeled with a ruthenium, forming a sandwich complex. Streptavidin-coated microparticles are added, and the mixture aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell. Application of voltage to the electrode induces the chemiluminescent emission, which is then measured against a calibration curve to determine the amount of free PSA in the patient specimen. This method has been standardized against the Reference Standard/WHO 96/668.(Package insert: Elecsys Free PSA reagent, Roche Diagnostics; V 2.0, 09/2024)

Free PSA:total PSA ratio:
The free PSA concentration is divided by the total PSA to derive the free:total ratio. The PSA, total and free test provides a free PSA measurement on every specimen, however, because very high or low total PSA measurements are predictive in themselves, a ratio is provided only when the total PSA is in the range of 4.0 to 10.0 ng/mL.

PDF Report

No

Day(s) Performed

Monday through Saturday

Report Available

1 to 3 days

Specimen Retention Time

14 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

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

84153
84154

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
PSAFT	PSA Total and Free, S	53764-7

Result ID	Test Result Name	Result LOINC® Value
TPSA	Total PSA	83112-3
FPSA	Free PSA	83113-1
PSA_R	Free PSA/PSA Ratio	12841-3