Test Definition: PN23M

Streptococcus pneumoniae IgG Antibodies, 23 Serotypes, Serum

Overview

Useful For

Assessing the IgG antibody response to active immunization with nonconjugated, 23-valent pneumococcal vaccines

Assessing the IgG antibody response to active immunization with conjugated 13-valent, 15-valent and 20-valent pneumococcal vaccines

Determining the ability of an individual to produce an antibody response to polysaccharide antigens, as part of the evaluation for humoral or combined immunodeficiencies

Method Name

Bead-Based Multiplex Immunoassay

NY State Available

Yes

Specimen

Specimen Type

Serum

Ordering Guidance

This test is the preferred test for patients previously tested for *Streptococcus pneumoniae* serotypes (as part of follow up testing or part of pre/post vaccine assessment).

The preferred test for patients being evaluated for possible immunodeficiency or for assessment of pneumococcal vaccination response (initial evaluation) is PNTOR / *Streptococcus pneumoniae* IgG Antibodies, Total, with Reflex, Serum

The preferred test for patients previously tested for total *Streptococcus pneumoniae* antibodies (as part of follow up testing or part of pre/post vaccine assessment) is PNTO / *Streptococcus pneumoniae* IgG Antibodies, Total, Serum

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: 0.5 mL Serum
Collection Instructions: Centrifuge and aliquot serum into plastic vial

Forms

If not ordering electronically, complete, print, and send a General Test Request (T239) with the specimen.

Specimen Minimum Volume

Serum: 0.4 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	21 days	
	Frozen	21 days	

Clinical & Interpretive

Clinical Information

Streptococcus pneumoniae (S pneumoniae) is a gram-positive bacterium that causes a variety of infectious diseases in children and adults, including invasive disease (bacteriemia and meningitis) and infections of the respiratory tract (pneumonia and otitis media).(1) More than 90 serotypes of *S pneumoniae* have been identified, based on varying polysaccharides found in the bacterial cell wall. The serotypes responsible for disease vary with age and geographic location.

Bacterial polysaccharides induce a T-cell independent type II humoral immune response. In adults and older children, bacterial polysaccharides are effective in generating an immune response that results in production of IgG antibodies and generation of long-lived plasma cells and memory B cells.(2) *S pneumoniae* purified polysaccharide vaccines (PPSV) that contain a total of 23 serotypes (1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F) are available; these are referred to as PPSV23.(3) These 23 serotypes were included because, as a group, they account for approximately 90% of invasive pneumococcal infections. Antibody responses develop in approximately 75% to 85% of nonimmunocompromised adults and older children approximately 4 to 6 weeks following immunization with purified polysaccharide vaccines. A meta-analysis estimated an efficacy of 74% for prevention of invasive pneumococcal disease in adults vaccinated with PPSV23.(4) In contrast, immune responses to polysaccharide antigens in children younger than 2 years of age are generally weak.

Active immunization of children younger than 2 years requires vaccines prepared of polysaccharides conjugated to an immunogenic carrier protein (Corynebacterium diphtheria strain C7), which results in a T-cell dependent antibody response.(3) In children younger than 6 years, prior to the availability of routine *S pneumoniae* vaccination, 7 serotypes

(4, 6B, 9V, 18C, 19F, and 23F) accounted for 80% of invasive disease and up to 100% of all isolates that were found to be highly resistant to treatment with penicillin. The first pneumococcal conjugated vaccine (PCV) available for children younger than 2 years contained these 7 serotypes (PCV7). The vaccine was highly effective, with invasive disease in children younger than 5 years reduced from 99 to 21 cases per 100,000 population from 1998 to 2008.(5) In addition, it was demonstrated that after PCV7 became part of the routine vaccination schedule, only 2% of invasive disease was associated with any of the serotypes present in the vaccine. Instead, approximately 61% of the invasive disease was caused by an additional 6 serotypes (1, 3, 5, 6A, 7F, and 19A). This led to development of a 13-valent conjugated vaccine, known as PCV13. More recently, additional pneumococcal conjugate vaccines have been approved, specifically 15-valent (1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, 22F, 23F, 33F) and 20-valent (1, 3, 4, 5, 6A, 6B, 7F, 8, 9V, 10A, 11A, 12F, 14, 15B, 18C, 19A, 19F, 22F, 23F, and 33F) vaccines, known as PCV15 and PCV20, respectively.

Conjugated pneumococcal vaccination is included in the routine childhood schedule, with 4 doses of PCV13 or PCV15 administered at 2, 4, 6, and 12 to 15 months.(6) For adults younger than 65 years, a single dose of PCV20 or a single dose of PCV15 followed 1 year later with a single dose of PPSV23 is recommended.(7) This same pneumococcal vaccination strategy is recommended for adults 19 to 64 years of age with immunocompromising conditions, cochlear implants, cerebrospinal fluid leaks, or other chronic health conditions.

Patients with intrinsic defects in humoral immunity, such as common variable immunodeficiency, may have impaired antibody responses to pneumococcal vaccination.(8,9) Selective antibody deficiency is a recognized clinical entity in patients older than 2 years and is characterized by recurrent bacterial respiratory infections, absent or subnormal antibody response to a majority of polysaccharide antigens, and normal or increased immunoglobulin concentrations, including IgG subclasses, in the context of intact humoral response to protein antigens. In several other primary immunodeficiencies, including Wiskott-Aldrich syndrome, autoimmune lymphoproliferate syndrome, and DiGeorge syndrome, IgG subclass deficiencies may also result in impaired antibody responses to polysaccharide antigens.

Reference Values

Results are reported in mcg/mL

Serotype	Normal value
1 (1)	> or =1.0
2 (2)	> or =1.0
3 (3)	> or =1.0
4 (4)	> or =1.0
5 (5)	> or =1.0
8 (8)	> or =1.0
9N (9)	> or =1.0
12F (12)	> or =1.0
14 (14)	> or =1.0
17F (17)	> or =1.0
19F (19)	> or =1.0
20 (20)	> or =1.0
22F (22)	> or =1.0
23F (23)	> or =1.0
6B (26)	> or =1.0

10A (34)	> or =1.0
11A (43)	> or =1.0
7F (51)	> or =1.0
15B (54)	> or =1.0
18C (56)	> or =1.0
19A (57)	> or =1.0
9V (68)	> or =1.0
33F (70)	> or =1.0

Interpretation

As a general guideline, nonimmunocompromised adults develop IgG antibodies approximately 4 to 6 weeks following nonconjugated vaccination.

Either of the following conditions is consistent with a normal response to *Streptococcus pneumonia* vaccination:
1. When comparing pre- and post-vaccination samples, antibody concentrations increased by at least 2-fold for
a. >50% of serotypes in children <6 years
b. >70% of serotypes for individuals >6 years

2. In either a pre- or post-vaccination sample, antibody concentrations >/= 1.0 mcg/mL for
a. >50% of serotypes for children <6 years
b. >70% of serotypes for individuals >6 years

Cautions

The humoral immune response to *Streptococcal pneumoniae* vaccination is affected by multiple factors, including age, immune status, vaccination history, prior infections, and carrier status.

Protective concentrations of IgG antibodies, or those required to prevent infection from *S pneumoniae*, have not been defined for any serotype.

Quantitation of the IgG antibody response to pneumococcal serotypes does not provide any information on the functional capacity of the serotype-specific antibodies generated (opsonization efficiency).

IgG antibodies specific for the 23 serotypes included in PPSV23 are measured in this test; except for serotype 6A, IgG antibodies specific for all the serotypes in PCV13, PCV15, and PCV20 are measured in this test.

Clinical Reference

1. Weisberg SS. Pneumococcus. Dis Mon. 2007;53(10):495-502
2. Grabenstein JD and Manoff SB. Pneumococcal polysaccharide 23-valent vaccine: long-term persistence of circulating antibody and immunogenicity and safety after revaccination in adults. Vaccine. 2012;30(30):4435-4444
3. Musher DM, Anderson R, Feldman C. The remarkable history of pneumococcal vaccination: an ongoing challenge. Pneumonia. 2022;14(1):5
4. Moberley S, Holden J, Tatham DP, Andrews RM. Vaccines for preventing pneumococcal infection in adults. Cochrane Database Syst Rev. 2013;2013(1):CD000422
5. Paradiso PR. Advances in pneumococcal disease prevention: 13-valent pneumococcal conjugate vaccine for infants

and children. Clin Infect Dis. 2011;52(10):1241-1247
6. Kobayashi M, Farrar JL, Gierke R, et al. Use of 15-valent pneumococcal conjugate vaccine and 20-valent pneumococcal conjugate vaccine among U.S. adults: updated recommendations of the Advisory Committee on Immunization Practices – United States, 2022. MMWR Morb Mortal Wkly Rep. 2022;71(4):109-117
7. Kobayashi M, Farrar JL, Gierke R, et al. Use of 15-valent pneumococcal conjugate vaccine among U.S. children: updated recommendations of the Advisory Committee on Immunization Practices – United States, 2022. MMWR Morb Mortal Wkly Rep. 2022;71(37):1174-1181
8. Bonilla RA, Khan DA, Ballas ZK, et al. Practice parameter for the diagnosis and management of primary immunodeficiency. J Allergy Clin Immunol. 2015;136(5):1186-1205
9. Orange JS, Ballow M, Stiehm ER, et al. Use and interpretation of diagnostic vaccination in primary immunodeficiency: a working group report of the Basic and Clinical Immunology Interest Section of the American Academy of Allergy, Asthma and Immunology. J Allergy Clin Immunol. 2012;130(3 Suppl):S1-S24

Performance

Method Description
Testing for IgG antibodies to *Streptococcus pneumoniae* serotypes is performed using a laboratory-developed immunoassay.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
4 to 6 days

Specimen Retention Time
3 months

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.

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Streptococcus pneumoniae IgG Antibodies, 23 Serotypes, Serum

Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

86581

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
PN23M	S. pneumoniae IgG Ab,23 serotypes,S	42366-5

Result ID	Test Result Name	Result LOINC® Value
620316	Serotype 1 (1)	85954-6
620317	Serotype 2 (2)	86039-5
620318	Serotype 3 (3)	86080-9
620319	Serotype 4 (4)	86107-0
620320	Serotype 5 (5)	86130-2
620321	Serotype 8 (8)	86147-6
620322	Serotype 9N (9)	86169-0
620323	Serotype 12F (12)	85977-7
620324	Serotype 14 (14)	85991-8
620325	Serotype 17F (17)	86009-8
620326	Serotype 19F (19)	86024-7
620327	Serotype 20 (20)	86045-2
620328	Serotype 22F (22)	86052-8
620329	Serotype 23F (23)	86064-3
620330	Serotype 6B (26)	27118-9
620331	Serotype 10A (34)	86098-1
620332	Serotype 11A (43)	86122-9
620333	Serotype 7F (51)	25296-5
620334	Serotype 15B (54)	40973-0
620335	Serotype 18C (56)	27395-3
620336	Serotype 19A (57)	40974-8
620337	Serotype 9V (68)	30153-1
620338	Serotype 33F (70)	40969-8
620404	Interpretation	69048-7