Test Definition: TCD4

CD4 Count for Immune Monitoring, Blood

Overview

Useful For

Serial monitoring of CD4 T cell count in patients who are HIV-positive

Follow-up and diagnostic evaluation of primary cellular immunodeficiencies, including severe combined immunodeficiency

T-cell immune monitoring following immunosuppressive therapy for transplantation, autoimmunity, and other immunological conditions where such treatment is utilized

Assessment of T-cell immune reconstitution post hematopoietic cell transplantation

Early screening of gross quantitative anomalies in T cells in infection or malignancies

This assay **should not be used** for diagnosing T-lymphocytic malignancies or evaluation of T-cell lymphocytosis of unknown etiology.

Method Name

Flow Cytometry

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Ordering Guidance

For diagnosing T-lymphocytic malignancies or evaluation of T-cell lymphocytosis of unknown etiology, order LCMS / Leukemia/Lymphoma Immunophenotyping, Flow Cytometry, Varies, which includes a hematopathology review.

Shipping Instructions

It is recommended that specimens arrive within 24 hours of collection. Collect and package specimen as close to shipping time as possible.

Necessary Information

Date of collection is required.

Specimen Required

Container/Tube: Lavender top (EDTA)

Specimen Volume: 3 mL
Collection Instructions: Send whole blood specimen in original tube. **Do not aliquot.**
Additional Information: For serial monitoring, it is recommended that specimen collection be performed at the same time of day.

Forms
If not ordering electronically, complete, print, and send a Kidney Transplant Test Request with the specimen.

Specimen Minimum Volume
1 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Ambient	72 hours	PURPLE OR PINK TOP/EDTA

Clinical & Interpretive

Clinical Information
Lymphocytes in peripheral blood (circulation) are heterogeneous and can be broadly classified into T cells, B cells, and natural killer cells. There are various subsets of each of these individual populations with specific cell-surface markers and function. This assay provides absolute (cells/mcL) and relative (%) quantitation for total T cells and CD4+ and CD8+ T-cell subsets, in addition to a total lymphocyte count (CD45+).

Each of these lymphocyte subpopulations have distinct effector and regulatory functions and are maintained in homeostasis under normal physiological conditions. Each of these lymphocyte subsets can be identified by a combination of 1 or more cell surface markers. The CD3 antigen is a pan-T-cell marker, and T cells can be further divided into 2 broad categories based on the expression of CD4 or CD8 coreceptors.

The absolute counts of lymphocyte subsets are known to be influenced by a variety of biological factors including hormones, the environment, and temperature. The studies on diurnal (circadian) variation in lymphocyte counts have demonstrated progressive increase in CD4 T-cell count throughout the day, while CD8 T cells increase between 8:30 a.m. and noon with no change between noon and afternoon.(1) Circadian variations in circulating T-cell counts have been shown to be negatively correlated with plasma cortisol concentration.(2-4) In fact, cortisol and catecholamine concentrations control distribution and, therefore, numbers of naive versus effector CD4 and CD8 T cells.(2) It is generally accepted that lower CD4 T-cell counts are seen in the morning compared to the evening(5) and during summer compared to winter.(6) These data therefore indicate that timing and consistency in timing of blood collection is critical when serially monitoring patients for lymphocyte subsets.

Abnormalities in the number and percent of CD3, CD4, and CD8 T cells have been described in a number of different disease conditions. In patients who are infected with HIV, the CD4 count is measured for AIDS diagnosis and for initiation of antiviral therapy. The progressive loss of CD4 T lymphocytes in patients infected with HIV is associated with increased infections and complications. The US Public Health Service has recommended that all patients who are HIV-positive be tested every 3 to 6 months for the level of CD4 T lymphocytes.

Basic T-cell subset quantitation is also very useful in the evaluation of patients of all ages with primary cellular immunodeficiencies, including follow-up for newborn screening for severe combined immunodeficiency and immune monitoring following immunosuppressive therapy for transplantation, autoimmunity, or any other relevant clinical condition where immunomodulatory treatment is used, and the T-cell compartment is specifically affected.

It is also helpful as a preliminary screening assay for gross quantitative anomalies in T cells, whether related to malignancies or infection.

Reference Values

The appropriate age-related reference values will be provided on the report.

Interpretation

HIV treatment guidelines from the US Department of Health and Human Services and the International Antiviral Society USA Panel recommend antiviral treatment in all patients with HIV infection, regardless of CD4 T-cell count.(7,8) Additionally, antibiotic prophylaxis for *Pneumocystis jiroveci* infection is recommended for patients with CD4 counts below 200 cells/mcL. For other opportunistic infections, see the recommendations from the Centers for Disease Control and Prevention, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America.(9)

Cautions

T-cell counts should be appropriately interpreted in context of the clinical presentation and other immunological parameters and relevant laboratory test results.

For serial monitoring of T-cell numbers, it is recommended that the patient be evaluated at the same time of the day to account for diurnal variation.

For follow-up of infants identified by newborn screening for severe combined immunodeficiency (SCID) and severe T-cell lymphopenia, SCID should be considered as a potential diagnosis in infants with fewer than 300 autologous CD3 T cells/mcL. Infants with 300 to 1500 autologous CD3 T cells/mcL may have leaky SCID, Omenn syndrome, or variant SCID, depending on other clinical and molecular features.

In infants identified by newborn screening for SCID, T-cell lymphopenia is defined as having up to 1500 autologous CD3T cells/mcL.

This assay **should not be used** for diagnosing T-lymphocytic malignancies or evaluation of T-cell lymphocytosis of unknown etiology, though the latter may be identified through this assay in a screening assessment. In such cases, LCMS / Leukemia/Lymphoma Immunophenotyping, Flow Cytometry, Varies will be recommended, which includes a hematopathology review.

Also, when diagnostically assessing lymphocyte subsets (quantitatively) in any of the above clinical contexts, it may be more useful to order the T-cell, B-cell, and natural killer (NK)-cell quantitation assay rather than the T-cell subset quantitation alone, as it excludes B-and NK-cell counts.

Clinical Reference

1. Carmichael KF, Abayomi A. Analysis of diurnal variation of lymphocyte subsets in healthy subjects and its implication in HIV monitoring and treatment. 15th Intl Conference on AIDS, Bangkok, Thailand, 2004, Abstract B11052
2. Dimitrov S, Benedict C, Heutling D, Westermann J, Born J, Lange T. Cortisol and epinephrine control opposing circadian rhythms in T-cell subsets. Blood. 2009;113(21):5134-5143
3. Dimitrov S, Lange T, Nohroudi K, Born J. Number and function of circulating antigen presenting cells regulated by sleep. Sleep. 2007;30(4):401-411
4. Kronfol Z, Nair M, Zhang Q, Hill EE, Brown MB. Circadian immune measures in healthy volunteers: relationship to hypothalamic-pituitary-adrenal axis hormones and sympathetic neurotransmitters. Psychosom Med. 1997;59(1):42-50
5. Malone JL, Simms TE, Gray GC, Wagner KF, Burge JR, Burke DS. Sources of variability in repeated T-helper lymphocyte counts from HIV 1-infected patients: total lymphocyte count fluctuations and diurnal cycle are important. J Acquir Immune Defic Syndr. 1990;3(2):144-151
6. Paglieroni TG, Holland PV. Circannual variation in lymphocyte subsets, revisited. Transfusion. 1994;34(6):512-516
7. Panel on Antiretroviral Guidelines for Adults and Adolescents: Guidelines for the use of antiretroviral agents in adults and adolescents living with HIV. Department of Health and Human Services; Updated January 20, 2022. Accessed April 4, 2022. Available at https://clinicalinfo.hiv.gov/sites/default/files/guidelines/documents/guidelines-adult-adolescent-arv.pdf
8. Thompson MA, Horberg MA, Agwu AL, et al. Primary Care Guidance for Persons With Human Immunodeficiency Virus: 2020 Update by the HIV Medicine Association of the Infectious Diseases Society of America. Clin Infect Dis. 2021;73(11):e3572-e3605. doi:10.1093/cid/ciaa1391
9. Panel on Opportunistic Infections in Adults and Adolescents with HIV. Guidelines for the prevention and treatment of opportunistic infections in adults and adolescents with HIV: recommendations from the Centers for Disease Control and Prevention, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America. Department of Health and Human Services; Updated July 14, 2025. Accessed August 27, 2025. Available at https://clinicalinfo.hiv.gov/en/guidelines/hiv-clinical-guidelines-adult-and-adolescent-opportunistic-infections/whats-new
10. Schmid I, Krall WJ, Uittenbogaart CH, Braun J, Giorgi JV. Dead cell discrimination with 7-amino-actinomycin D in combination with dual color immunofluorescence in single laser flow cytometry. Cytometry. 1992;13(2):204-208. doi:10.1002/cyto.990130216

Performance

Method Description

The T cell surface marker assay uses monoclonal antibodies to identify the various membrane antigens, and flow cytometry to enumerate the number of cells expressing these differentiation antigens. CD14 is used to exclude monocytes, thereby improving accuracy and enhancing the purity of the lymphocyte population. The results are reported as the percent of lymphocytes that are total T cells (CD3+), CD3+CD4+ T cells, and CD3+CD8+ T cells, along with the absolute number of each cell type per microliter of blood. The assay is a 5-color, no-wash procedure and the absolute counts are calculated from internal bead standards. The total CD45+ lymphocyte count (reported as thousand

cells per microliter) and the CD4:CD8 ratio are also reported. 7-AAD is used to assess the percentage of viable cells for both the leukocyte and the lymphocyte populations, reported as % Sample Viability and % Lymphocyte Viability, respectively.(Hoffman RA, Kung PC, Hansen WP, Goldstein G. Simple and rapid measurement of human T lymphocytes and their subclasses in peripheral blood. Proc Natl Acad Sci USA. 1980;77[8]:4914-4917; Mandy FF, Nicholson JK, McDougal JS. CDC. Guidelines for performing single-platform absolute CD4+ T-cell determinations with CD45 gating for persons infected with human immunodeficiency virus. Centers for Disease Control and Prevention. MMWR Recomm Rep. 2003;52[RR-2]:1-13)

PDF Report
No

Day(s) Performed
Monday through Sunday

Report Available
1 to 2 days

Specimen Retention Time
4 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 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
86359-T cells, total count
86360-Absolute CD4/CD8 count with ratio

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
TCD4	CD4 T-Cell Count	80721-4

Result ID	Test Result Name	Result LOINC® Value
3322	CD3 (T Cells)	8122-4

3319	% CD4 (T Cells)	8123-2
3325	CD4 (T Cells)	24467-3
3326	CD8 (T Cells)	14135-8
3327	4/8 Ratio	54218-3
3321	CD45 Total Lymph Count	27071-0
3316	% CD3 (T Cells)	8124-0
3320	% CD8 (T Cells)	8101-8
CMTTC	Comment	69052-9
622952	% Sample Viability	33193-4
622953	% Lymphocyte Viability	33193-4