MAYO CLINIC LABORATORIES

Test Definition: CHIMS

Chimerism Transplant Sorted Cells, Varies

Overview

Useful For

Determining the relative amounts of donor and recipient cells in a specimen in sorted cell fractions

An indicator of bone marrow transplant success

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
SORT1	Chimerism Cell Sort 1	No, (Bill Only)	No
SORT2	Chimerism Cell Sort 2	No, (Bill Only)	No

Testing Algorithm

Complete chimerism analysis requires 3 specimens, under 3 separate orders, for the 3 separate tests listed below. These specimens should be submitted when collected. An interpretive report will be provided once all specimens are received.

Pre-Transplant:
-CHRGB / Chimerism-Recipient Germline (Pretransplant), Varies
-CHIDB / Chimerism-Donor, Varies
-ADONO / Additional Chimerism Donor (Bill Only), if applicable

Post-Transplant:
-CHIMU / Chimerism Transplant No Cell Sort, Varies or CHIMS / Chimerism Transplant Sorted Cells, Varies

Billing occurs with the following tests:
Pre-transplant:
-CHRGB / Chimerism-Recipient Germline (Pretransplant), Varies
-ADONO / Additional Chimerism Donor (Bill Only), if applicable

Post-Transplant:
-CHIMU / Chimerism Transplant No Cell Sort, Varies
-CHIMS / Chimerism Transplant Sorted Cells, Varies
-SORT1 / Chimerism Cell Sort 1 (Bill Only)
-SORT2 / Chimerism Cell Sort 2 (Bill Only)

For more information see Chimerism-Recipient Germline Testing Algorithm

Special Instructions

- Chimerism Analysis Information
- Chimerism-Recipient Germline Testing Algorithm

Method Name

Polymerase Chain Reaction (PCR) Amplification/Capillary Electrophoresis

NY State Available

Yes

Specimen

Specimen Type

Varies

Ordering Guidance

This test is used to determine the relative amounts of donor and recipient cells in the recipient post-bone marrow transplant specimen. Sorted cell analysis permits more detailed evaluation of chimeric status in T-cell and myeloid cell fractions. For post-bone marrow transplant evaluation of the recipient specimen, see CHIMU / Chimerism Transplant No Cell Sort, Varies

Shipping Instructions

1. Specimen must arrive within 4 days of collection.

2. Collect and package specimen as close to shipping time as possible.

Necessary Information

Specimen Type is required, either as an answer to the Order Questions or on Chimerism Analysis Information (T594) if not ordering electronically. **Testing will be delayed if this information is not provided.**

Specimen Required

Submit only 1 of the following specimens:

Specimen Type: Whole blood
Container/Tube:
Preferred: Lavender top (EDTA)
Acceptable: Yellow top (ACD)
Specimen Volume: 4 mL
Collection Instructions:
1. Only 1 tube is required.
2. Invert several times to mix blood.
3. Label specimen as blood.
4. Send whole blood specimen in original tube. **Do not aliquot**.

Specimen Type: Bone marrow
Container/Tube:
Preferred: Lavender top (EDTA)
Acceptable: Yellow top (ACD)
Specimen Volume: 2 mL
Collection Instructions:

1. Invert several times to mix bone marrow.
2. Label specimen as bone marrow.
3. Send bone marrow specimen in original tube. **Do not aliquot.**

Forms

1. Chimerism Analysis Information Sheet (T594)
2. If not ordering electronically, complete, print, and send a Hematopathology/Cytogenetics Test Request (T726) with the specimen.

Specimen Minimum Volume

Whole blood: 3 mL
Bone marrow: See Specimen Required
Lesser volumes may be acceptable, depending on white cell count.
Call 800-533-1710 or 507-266-5700 with questions.

Reject Due To

Gross hemolysis	Reject
Moderately to severely clotted	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Ambient (preferred)	4 days	PURPLE OR PINK TOP/EDTA
	Refrigerated	4 days	PURPLE OR PINK TOP/EDTA

Clinical & Interpretive

Clinical Information

Patients who have had donor hematopoietic cells infused for the purpose of engraftment (ie, bone marrow transplant recipients) may have their blood or bone marrow monitored for an estimate of the percentage of donor and recipient cells present. This can be done by identifying unique features of the donor's and the recipient's DNA prior to transplantation and then examining the recipient's blood or bone marrow after the transplantation procedure has occurred. The presence of both donor and recipient cells (chimerism) and the percentage of donor cells are indicators of transplant success.

Short tandem repeat (STR) sequences are used as identity markers. STR are di-, tri-, or tetra-nucleotide repeat sequences interspersed throughout the genome at specific sites. There is variability in STR length among people and the STR lengths remain stable throughout life, making them useful as identity markers. Polymerase chain reaction is used to amplify selected STR regions from germline DNA of both donor and recipient. The lengths of the amplified fragment are evaluated for differences (informative markers). Following allogeneic hematopoietic cell infusion, the recipient blood or

bone marrow can be evaluated again for the informative STR regions to identify chimerism and estimate the proportions of donor and recipient cells in the specimen.

Reference Values
An interpretive report will be provided.

Interpretation
An interpretive report will be provided, which includes whether chimerism is detected and, if detected, the approximate percentage of donor and recipient cells. Sorted cell analysis permits more detailed evaluation of chimeric status in T-cell and myeloid cell fractions, which can be helpful in clinical management.

It is most useful to observe a trend in chimerism levels. Clinically critical results should be confirmed with 1 or more subsequent specimens.

Cautions
Sensitivity varies with the proportions of donor and recipient cells in the specimen. For this reason, results are reported as approximate and rounded to the nearest 5% or 10%, depending on the calculated percentage of donor cells. For example, if the percent donor is 10% or less, it is reported as 5% donor cells. If the percent donor cells are 90% or more, it is reported as 95% donor cells. In rare cases (eg, matched related stem cell transplants), short tandem repeat patterns may be identical (ie, noninformative) and chimeric status cannot be determined with this test.

Clinical Reference
1. Antin JH, Childs R, Filipovich AH, et al. Establishment of complete and mixed donor chimerism after allogeneic lymphohematopoietic transplantation: recommendations from a workshop at the 2001 Tandem Meetings of the International Bone Marrow Transplant Registry and the American Society of Blood and Marrow Transplantation. Biol Blood Marrow Transplant. 2001;7(9):473-485
2. Tang X, Alatrash G, Ning J, et al. Increasing chimerism after allogeneic stem cell transplantation is associated with longer survival time. Biol Blood Marrow Transplant. 2014;20(8):1139-1144. doi:10.1016/j.bbmt.2014.04.003
3. Ludeman MJ, Zhong C, Mulero JJ, et al. Developmental validation of GlobalFiler PCR amplification kit: a 6-dye multiplex assay designed for amplification of casework samples. Int J Legal Med. 2018;132(6):1555-1573. doi:10.1007/s00414-018-1817-5
4. Tyler J, Kumer L, Fisher C, Casey H, Shike H. Personalized chimerism test that uses selection of short tandem repeat or quantitative PCR depending on patient's chimerism status. J Mol Diagn. 2019;21(3):483-490. doi:10.1016/j.jmoldx.2019.01.007
5. Lion T, Watzinger F, Preuner S, et al. The EuroChimerism concept for a standardized approach to chimerism analysis after allogeneic stem cell transplantation. Leukemia. 2012;26(8):1821-1828. doi:10.1038/leu.2012.66

Performance

Method Description
Genomic DNA is extracted using an automated extraction platform and is then used in a commercial GlobalFiler polymerase chain reaction (PCR) Amplification Kit, following the manufacturer's instructions. Briefly, 20 different short tandem repeat (STR) marker regions are amplified in single multiplex PCR using primers labeled with fluorescent tags. The products are analyzed for size and amount using capillary electrophoresis. For the initial sample on any patient, the

test is performed on 3 separate DNA samples: donor germline DNA, recipient germline DNA, and recipient posttransplant sample for chimerism determination. The STR profile of the germline samples is used to identify markers that can distinguish between the donor and recipient. Based on these profiles, the percentage of donor and recipient DNA is then determined in the posttransplant sample using the assumptions and calculations outlined in Thiede C et al. Subsequent samples for chimerism evaluation do not need to be accompanied by samples for donor and recipient germline evaluation, as the profiles from the initial testing are kept on file for comparison.

The sensitivity of this analysis is approximately 5% in a post-transplant specimen (donor and recipient DNA mixed chimerism).(Thiede C, Florek M, Bornhauser M, et al. Rapid quantification of mixed chimerism using multiplex amplification of short tandem repeat markers and fluorescence detection. Bone Marrow Transplant. 1999;23[10]:1055-1060; package insert: GlobalFiler PCR Amplification Kit. ThermoFisher Scientific; 08/21/2019)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
4 to 8 days following receipt of Pre and Donor Specimens

Specimen Retention Time
Whole blood/Bone marrow: 2 weeks; Extracted DNA: 3 months

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

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
81268-Chimerism (engraftment) analysis, post hematopoietic stem cell transplantation specimen, includes comparison to previously performed baseline analyses; with cell selection (eg, CD3, CD33), each cell type (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value

CHIMS	Chimerism Transplant Sorted Cells	34574-4

Result ID	Test Result Name	Result LOINC® Value
MP025	Specimen Type	31208-2
CHIS	Final Diagnosis	34574-4
622002	Donor 1 ID	44780-5
622001	Donor 1 T-cell (%)	In Process
622004	Donor 1 M-cell (%)	In Process
622006	Donor 2 ID	In Process
622533	Donor 2 T-cell (%)	In Process
622534	Donor 2 M-cell (%)	In Process
622003	Recipient T-cell (%)	In Process
622005	Recipient M-cell (%)	In Process