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# CMV Resistance Sequencing

TEST CODES: 33125, 33126, 30722

CPT CODE: 87910 (with Multiplier)

CATEGORY: Infectious Disease

## Reportable Mutations - UL54 (DNA Polymerase)[1]

| Viral Phenotype Confirmed by Marker Transfer[2] | | | | |
|---|---|---|---|---|
| **Mutation** | **Cidofovir** | **Foscarnet** | **Ganciclovir** | **REFERENCE** |
| S290R | S | R | S | 106 |
| D301N | R | S | R | 19,33,56 |
| E303D[4] | R | S | R | 93 |
| E303G[4] | R | S | R | 93 |
| N408D | R | S | R | 9,12,23,31,33,35,56,72 |
| N408K[4] | R | S | R | 13,74,93 |
| N408S | R | S | R | 84,88 |
| N408H | R | R | R | 123 |
| N410K | R | S | R | 19,23 |
| F412C | R | S | R | 9,20,23,33,35,65,72 |
| F412L | R | S | R | 74,111 |
| F412S | R | S | R | 25,74,111 |
| F412V | R | S | R | 9,23,72 |
| D413A | R | S | R | 69,73 |
| D413E | R | S | R | 19,23,31,33,52,56,69,72,73 |
| D413N | R | S | R | 89 |
| D413Y[4] | R | S | R | 93 |
| P488R | R | S | R | 79,111 |
| K493N | R | R | R | 118 |
| N495K | S | R | S | 73,76,106 |
| P497S | R | S | S | 118 |
| K500N | R | S | R | 79,11 |
| L501I | R | S | R | 2,9,12,23,33,64,72 |
| T503I | R | S | R | 12,19,33,35,72,73 |
| T503A | R | S | R | 123 |
| K513N | R | S | R | 23,33,35,56,72 |
| K513E | R | S | R | 9,23,33,34,35,72 |
| K513R | R | S | R | 35,72,89 |
| K513T | R | S | R | 118 |
| K513Q | R | S | R | 123 |
| D515E | S | S | R | 90 |
| D515Y | R | S | R | 91,121 |
| L516P | R | S | R | 120 |
| L516R | R | S | R | 19,33 |
| L516W | R | S | R | 92 |

[1] Most UL54 mutations also have UL97 mutations.
[2] R and S denote resistant and sensitive, respectively. ND indicates Not Determined.
[3] Low-grade or variable resistance.
[4] Also confers resistance to CMX001.

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## Reportable Mutations - UL54 (DNA Polymerase)[1]

| Viral Phenotype Confirmed by Marker Transfer[2] | | | | |
|---|---|---|---|---|
| **Mutation** | **Cidofovir** | **Foscarnet** | **Ganciclovir** | **REFERENCE** |
| I521T | R | S | R | 66,68,72 |
| P522A | R | S | R | 33,37,68,72 |
| P522S | R | S | R | 68,72 |
| P522T | R | S | R | 123 |
| del524 | R | S | R | 88 |
| V526L | R | S | R | 82 |
| C539G | R | S | R | 89 |
| C539R | R | S | R | 79,111 |
| D542E[4] | R | S | S | 81 |
| A543P | R | S | R | 108 |
| L545S | R | S | R | 9,12,33,72 |
| L545W | R | S | R | 74,111 |
| L545F | R | S | R | 123 |
| T552N | S | R | R | 79,106,111 |
| L565V | S | R | S | 118 |
| Q578H | R | R | R | 24,74,111 |
| Q578L | S | R | S | 83 |
| S585A | S | R | S | 79,111 |
| D588E | S | R | S | 9,12,23,35,72 |
| D588N | S | R | R | 12,23,27,33,74 |
| C590F | S | R | S | 123 |
| F595I | S | R | S | 79,111 |
| T700A | S | R | S | 5,9,18,33,47,72 |
| V715A | S | R | S | 92 |
| V715M | S | R | S | 5,9,18,25,33,37,47,72,92 |
| I726T | S | S | R | 83 |
| E756K | R or S[3] | R | R | 12,19,23,33,36,74, 82,110 |
| E756D | S | R | S | 12,19,31,33 |
| E756Q | S | R | S | 12,18,33,37 |
| L773V | R | R | R | 24,89 |
| L776M | S | R | R | 67,73 |
| V781I | S | R | R[3] | 9,23,74 |
| V787A | S | R | R | 91 |
| V787L | S | R | R | 18,37,48,73 |
| L802M | S | R | R or S[3] | 9,12,18,20,23,27,33,35,65,73 |
| K805Q | R | S | S | 9,18,28,35,72 |
| A809V | S | R | R | 18,25,28,33,47,72,106 |
| V812L[4] | R | R | R | 12,18,20,27,28,33,72,73,78,93 |
| T813S | R | R | R | 28,73 |
| T821I | S | R | R | 9,18,28,33,35,72,73 |
| V823A | R | S | R | 118 |
| P829S | S | S | R | 79,111 |

[1] Most UL54 mutations also have UL97 mutations.
[2] R and S denote resistant and sensitive, respectively. ND indicates Not Determined.
[3] Low-grade or variable resistance.
[4] Also confers resistance to CMX001.

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# CMV Resistance Sequencing

## Reportable Mutations - UL54 (DNA Polymerase)[1]

| Viral Phenotype Confirmed by Marker Transfer[2] | | | | |
|---|---|---|---|---|
| **Mutation** | **Cidofovir** | **Foscarnet** | **Ganciclovir** | **REFERENCE** |
| A834P | R | R | R | 13,73 |
| T838A | S | R | S | 27,28,73 |
| G841A | R | R | R | 28,72,73 |
| G841S | S | R | R | 83 |
| V946L | S | R | S | 79,111 |
| E951D | S | R | R | 106 |
| L957F | ND | ND | R | 79,111 |
| del981 to 982 | R | R | R | 11,19,33,63,72,73,108 |
| A987G | R | S | R | 1,9,22,23,25,43,72 |
| A987V | S | R | S | 118 |
| E989D | S | R | R | 118 |
| N495K+Q783R | S | R | R | 106 |

## Reportable Mutations - UL54 (DNA Polymerase)[1]

| Viral Phenotype found in Clinical Isolates (Unconfirmed by Marker Transfer)[2] | | | | |
|---|---|---|---|---|
| **Mutation** | **Cidofovir** | **Foscarnet** | **Ganciclovir** | **REFERENCE** |
| M393R | R | R | R | 20,72 |
| M393K | R | R | R | 20,72 |
| T419M | S | R | S | 24 |
| L501F | R | S | R | 23,25,31,56,72 |
| Y(I)722V | R | S | R | 35,72 |
| H729Y | S | R | S | 115 |
| Y751H | R | S | R | 35,72 |
| V787I | S | R | S | 33 |

[1] Most UL54 mutations also have UL97 mutations.
[2] R and S denote resistant and sensitive, respectively. ND indicates Not Determined.
[3] Low-grade or variable resistance.
[4] Also confers resistance to CMX001.

## Reportable Mutations - UL56 (Terminase)

| Viral Phenotype Confirmed by Marker Transfer[1] | | |
|---|---|---|
| **Mutation** | **Letermovir** | **REFERENCE** |
| S229F | R | 104 |
| V231A | R | 102 |
| V231L | R | 98,102,104,108 |
| N232Y | R | 105 |
| V236A | R | 108 |
| V236L | R | 102 |
| V236M | R | 97,98,104,110 |
| E237D | R | 102,105 |
| E237G | R | 122 |
| L241P | R | 98,102,103,104 |
| T244K | R | 102 |
| L254F | R | 104 |
| L257F | R | 104 |
| L257I | R | 102,104 |
| K258E | R | 105 |
| F261L | R | 102,104,105 |
| Y321C | R | 102 |
| C325F | R | 102 |
| C325W | R | 108 |
| C325R | R | 102 |
| C325Y | R | 98,102 |
| M329T | R | 102,105 |
| A365S | R | 108 |
| N368D | R | 104 |
| R369G | R | 98 |
| R369M | R | 98,104 |
| R369S | R | 98,103 |
| R369T | R | 122 |
| E237D, T244K, F261L | R | 102 |
| V236L, L257I | R | 102 |
| V236M, L257I, M329T | R | 102 |
| S229F, L254F, L257I | R | 104 |

[1] R denotes resistance.

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# CMV Resistance Sequencing

## Reportable Mutations - UL97 (Phosphotransferase)

| Viral Phenotype Confirmed by Marker Transfer[1] | | | |
|---|---|---|---|
| **Mutation** | **Maribavir** | **Ganciclovir** | **REFERENCE** |
| F342S | ND | R | 94,95,96 |
| F342Y | R | R | 112,114 |
| V356G | ND | R | 95,96 |
| K359E | ND | R | 112,114 |
| K359Q | ND | R | 112,114 |
| K359N | ND | R | 114,116 |
| E362D | ND | R | 116 |
| L405P | ND | R | 75 |
| T409M | R | ND | 114,119 |
| H411L | R | ND | 117,118 |
| H411N | R | ND | 117 |
| H411Y | R | ND | 114,117 |
| M460I | ND | R | 3,5,6,7,8,10,12,23,25,33,109 |
| M460T | ND | R | 75,109 |
| M460V | ND | R | 6,7,8,10,11,17,24,33,43,50,109 |
| V466G | R | R | 73,77,96 |
| C480F | R | R | 112,118 |
| C518Y | ND | R | 84,85 |
| H520Q | ND | R | 6,7,10,25,33,43,109 |
| P521L | R | R | 96,112 |
| del590 to 593 | ND | R | 12,72 |
| del591 to 594 | ND | R | 8,10,33,34,35,72,107 |
| del591 to 607 | ND | R | 51,72 |
| A591V | ND | R | 107 |
| C592G | ND | R[2] | 6,8,10,11,20,23,27,33,51,106,107,109,114 |
| A594E | ND | R | 73,75 |
| A594G | ND | R | 84,86 |
| A594P | ND | R | 6,25,59,72 |
| A594T | ND | R | 10,25,33,36,50,51,54,92 |
| A594V | ND | R | 5,6,8,10,11,17,25,27,33,50,107,109,113 |
| A594S | ND | R | 113 |
| L595F | ND | R | 10,33,41,72 |
| L595S | ND | R | 5,6,8,10,11,12,17,23,25,33,109 |
| L595W | ND | R | 6,10,25,33,51,72 |
| del595 | ND | R | 4,10,17,72,107 |
| del595 to 603 | ND | R | 14,33,48,72,107 |
| del596 | ND | R | 107 |
| E596G | ND | R | 10,20,33,35,36,51,72 |
| E596Y | ND | R | 90 |
| E596Q | - | R | 123 |
| del597 to 599 | ND | R | 92,107 |

[1] R denotes resistance. ND indicates Not Determined.
[2] Alone confers modest resistance. When found in conjunction with UL54 del 981 to 982, there is a much higher level of resistance.

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# CMV Resistance Sequencing

## Reportable Mutations - UL97 (Phosphotransferase)

| Viral Phenotype Confirmed by Marker Transfer[1] | | | |
|---|---|---|---|
| **Mutation** | **Maribavir** | **Ganciclovir** | **REFERENCE** |
| del597 to 598 | ND | R | 107 |
| G598S | ND | R | 33,58,72 |
| del599 | ND | R | 107 |
| k599T | ND | R | 60,72 |
| del600 | ND | R | 10,33,36,51,72,107 |
| del600-601 | ND | R | 107 |
| del601 | ND | R | 107 |
| del601-602 | ND | R | 107 |
| del601 to 603 | ND | R | 69,107 |
| C603R | ND | R | 73,77,109 |
| C603W | ND | R | 6,8,10,20,23,25,33,35,72,109 |
| C607F | ND | R | 8,50,51,72 |
| C607Y | ND | R | 10,25,33,34,35,39,51,72 |
| I610T | ND | R | 90 |
| A613V | ND | R | 84,87 |

[1] R denotes resistance. ND indicates Not Determined.

[2] Alone confers modest resistance. When found in conjunction with UL54 del 981 to 982, there is a much higher level of resistance.

## Reportable Mutations - UL97 (Phosphotransferase)

| Viral Phenotype found in Clinical Isolates (Unconfirmed by Marker Transfer)[1] | | | |
|---|---|---|---|
| **Mutation** | **Maribavir** | **Ganciclovir** | **REFERENCE** |
| M460L | ND | R | 49,72 |
| A590T | ND | R | 10,49,72 |
| del590 to 600 | ND | R | 17,72 |
| del590 to 603 | ND | R | 56,72 |
| A591D | ND | R | 10,49,72 |
| C592F | ND | R | 72 |
| del594 to 601 | ND | R | unpublished clinical isolate |
| L595T | ND | R | 10,35,72 |
| N597I | ND | R | 10,49,72 |
| del597 to 603 | ND | R | 25 |
| G598V | ND | R | 10,49,72 |
| K599M | ND | R | 10,49,72 |
| C603Y | ND | R | 6,10,49,72 |
| A606D | ND | R | 10,49,72 |

[1] R denotes resistance. ND indicates Not Determined.
[2] Alone confers modest resistance. When found in conjunction with UL54 del 981 to 982, there is a much higher level of resistance.
For the most up to date list of assays, please visit our website at www.Eurofins-Viracor.com. This test was developed and its performance characteristics determined by Eurofins Viracor. It has not been cleared or approved by the U.S. Food and Drug Administration.

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# CMV Resistance Sequencing References


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