Whole Exome Sequencing Analysis

Patient name	:	**Mr. XY**	**PIN**	:	**XXX**
Gender/ Age	:	**Male / 15 Years**	**Sample number**	:	**XXX**
Referring Clinician	:	**XXXX**	**Sample collection date**	:	**30-12-2024**
Hospital / Clinic	:	**XXXX**	**Sample receipt date**	:	**30-12-2024**
Specimen	:	**Peripheral Blood**	**Report date**	:	**06-05-2025**

Clinical history

Proband, Master. XY is presented with chief complaints of chronic mucocutaneous candidiasis with prolonged coughing, oral candidiasis (duration for about 10 years) and hypothyroidism. Proband, Master. XY has been evaluated for pathogenic variations.

Results

Likely pathogenic variant causative of the reported phenotype was identified

List of significant variant identified related to the phenotype:

Gene	Region	Variant*	Allele Status	Disease	Classification*	Inheritance pattern
STAT1 (-)	Exon 14	c.1170G>A **(p.Met390Ile)**	Heterozygous	Immunodeficiency 31C, chronic mucocutaneous candidiasis, autosomal dominant **(OMIM#614162)** Immunodeficiency 31A,	**Likely Pathogenic (PM1, PM2, PM5, PP2, PP3)**	Autosomal Dominant

				mycobacteriosis, autosomal dominant **(OMIM#614162)**		
				Immunodeficiency 31B, mycobacterial and viral infections, autosomal recessive **(OMIM#613796)**		Autosomal Recessive

*Genetic test results are based on the recommendation of American college of Medical Genetics [1].
No other variant that warrants to be reported for the given clinical indication was identified

CNV Findings

No significant Copy Number Variations (CNV) related to phenotype was detected.

Interpretation

***STAT1*: c.1170G>A**

Variant summary: A heterozygous missense variation in exon 14 of the *STAT1* gene (chr2:g.190986905C>T, NM_007315.4, Depth: 115x) that results in the amino acid substitution of Isoleucine for Methionine at codon 390 (p.Met390Ile) was detected.

Population frequency: This variant has not been reported in gnomAD database and 1000 genomes databases.

Clinical and Literature evidence: This variant has been classified as uncertain significance in ClinVar database [3]. This variant has been previously reported in a patient affected chronic mucocutaneous candidiasis in heterozygous state as a *de novo* variant [4].

***In-silico* prediction:** The *in-silico* predictions of the variant are damaging by SIFT, PolyPhen-2 (HumDiv) LRT and MutationTaster2. The reference codon is conserved across mammals in PhyloP and GERP++ tools.

OMIM phenotype: Immunodeficiency 31C, chronic mucocutaneous candidiasis, autosomal dominant (OMIM#614162) is caused by heterozygous gain-of-function mutation in the *STAT1* gene (OMIM*600555).

IMD31C is a disorder of immunologic dysregulation with highly variable manifestations resulting from autosomal dominant gain-of-function mutations in *STAT1* gene. Most patients present in infancy or early childhood with chronic mucocutaneous candidiasis (CMC). Other highly variable features include recurrent bacterial, viral, fungal, and mycoplasmal infections, disseminated dimorphic fungal infections, enteropathy with villous atrophy, and autoimmune disorders, such as hypothyroidism or diabetes mellitus. A subset of patients show apparently nonimmunologic features, including osteopenia, delayed puberty, and intracranial aneurysms.Immunodeficiency 31A, mycobacteriosis, autosomal dominant (OMIM#614892) is caused by heterozygous mutation in the *STAT1* gene (OMIM*600555). These diseases follow autosomal dominant pattern of inheritance [2]. Immunodeficiency 31B, mycobacterial and viral infections, autosomal recessive (OMIM#613796) is caused by homozygous mutation in the *STAT1* gene (OMIM*600555). This disease follows autosomal recessive pattern of inheritance [2].

Variant classification: Based on the evidence, this variant is classified as a likely pathogenic variant. **In this view, clinical correlation and familial segregation analysis are strongly recommended to establish the significance of the finding. If the results do not correlate, additional testing may be considered based on the phenotype observed.**

Recommendations

- Sequencing the variant(s) in the parents and the other affected and unaffected members of the family is recommended to confirm the significance.
- Alternative test is strongly recommended to rule out the deletion/duplication.
- Genetic counselling is advised.

Methodology

DNA extracted from the blood was used to perform whole exome using whole exome capture kit. The targeted libraries were sequenced to a targeted depth of 80 to 100X using Genolab M sequencing platform. This kit has deep exonic coverage of all the coding regions including the difficult to cover regions. The sequences obtained are aligned to human reference genome (GRCh38.p13) using Sentieon aligner and analyzed using Sentieon for removing duplicates, recalibration and re-alignment of indels. Sentieon DNAscope has been used to call the variants. Detected variants were annotated and filtered using the VarSeq software with the workflow implementing the ACMG guidelines for variant classification. The variants were annotated using 1000 genomes (V2), gnomAD (v3.1,2.1.1), ClinVar, OMIM, dbSNP, NCBI RefSeq Genes. *In-silico* predictions of the variant was carried out using VS-SIFT, VS-PolyPhen2, PhyloP, GERP++, GeneSplicer, MaxEntScan, NNSplice, PWM Splice Predictor. Only non-synonymous and splice site variants found in the coding regions were used for clinical interpretation. Silent variations that do not

result in any change in amino acid in the coding region are not reported.

Sequence data attributes

Total reads generated	8.63 Gb
Data ≥ Q30	95.43%

Genetic test results are reported based on the recommendations of American College of Medical Genetics [1], as described below:

Classification	Interpretation
Pathogenic	A disease-causing variation in a gene which can explain the patients' symptoms has been detected. This usually means that a suspected disorder for which testing had been requested has been confirmed
Likely Pathogenic	A variant which is very likely to contribute to the development of disease however, the scientific evidence is currently insufficient to prove this conclusively. Additional evidence is expected to confirm this assertion of pathogenicity.
Variant of Uncertain Significance	A variant has been detected, but it is difficult to classify it as either pathogenic (disease causing) or benign (non- disease causing) based on current available scientific evidence. Further testing of the patient or family members as recommended by your clinician may be needed. It is probable that their significance can be assessed only with time, subject to availability of scientific evidence.

Disclaimer

- The classification of variants of unknown significance can change over time. Anderson Diagnostics and Labs cannot be held responsible for it.
- Intronic variants, UTR and Promoter region variants are not assessed using this assay.

- This assay has a sensitivity of 70-75% in detecting large deletions/duplications of more than 10 base pairs or copy number variations (CNV). However, it is important to note that any CNVs detected must be confirmed using an alternate method.
- Certain genes may not be covered completely, and few mutations could be missed. Variants not detected by this assay may impact the phenotype.
- The variations have not been validated by Sanger sequencing.
- The above findings and result interpretation was done based on the clinical indication provided at the time of reporting.
- It is also possible that a pathogenic variant is present in a gene that was not selected for analysis and/or interpretation in cases where insufficient phenotypic information is available.
- Genes with pseudogenes, paralog genes and genes with low complexity may have decreased sensitivity and specificity of variant detection and interpretation due to inability of the data and analysis tools to unambiguously determine the origin of the sequence data in such regions.
- Incidental or secondary findings that meet the ACMG guidelines can be given upon request [5].

References

1. Richards, S, et al. Standards and Guidelines for the Interpretation of Sequence Variants: A Joint Consensus Recommendation of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology. Genetics in medicine: official journal of the American College of Medical Genetics. 17.5 (2015): 405-424.
2. Amberger J, Bocchini CA, Scott AF, Hamosh A. McKusick's Online Mendelian Inheritance in Man (OMIM). Nucleic Acids Res. 2009 Jan;37(Database issue):D793-6. doi: 10.1093/nar/gkn665. Epub 2008 Oct 8.
3. https://www.ncbi.nlm.nih.gov/clinvar/variation/VCV002203237.2
4. Toubiana, Julie et al. “Heterozygous *STAT1* gain-of-function mutations underlie an unexpectedly broad clinical phenotype.” Blood vol. 127,25 (2016): 3154-64. doi:10.1182/blood-2015-11-679902
5. Miller, David T., et al. "ACMG SF v3. 1 list for reporting of secondary findings in clinical exome and genome sequencing: A policy statement of the American College of Medical Genetics and Genomics (ACMG)." Genetics in Medicine 24.7 (2022): 1407-1414.

This report has been reviewed and approved by:

Sivasankar.S, Ph.D Molecular Biologist	Muthukumaran. S, Ph.D Clinical Bioinformatician	Sachin. D.Honguntikar, Ph.D, Molecular Geneticist	Dr. G. Suriyakumar Director