Supplementary Material

Materials and Methods

Immunological and other laboratory analyses were done as routine tests in the institutional labs except otherwise indicated. In brief, for FACS analyses whole blood (50 µl) of patients and healthy controls was stained with optimal concentrations of the indicated directly conjugated monoclonal antibodies at room temperature for 20 minutes. Subsequently, red blood cells were removed with ADG-lysis solution (An der Grub, Vienna, Austria) and 1 x 10^4 cells in the lymphogate were acquired, gated on $CD19^+$ cells and further analyzed for IgD and CD27 expression as described before (see Refs. 16, 17 of the main document). CGH array analyses were done as described earlier (see Ref. 14 of the main document). For FISH analyses mix 7 and mix 14 of the Vysis ToTelVysion Multi-Color FISH Probe Kit (Abbott Diagnostics, Vienna, Austria) were used. Mix 7 of the kit contains probes TelVysion 7p SpectrumGreen, TelVysion 7q SpectrumOrange, TelVysion 14q SpectrumGreen and SpectrumOrange and LSI TCR 14q11.2 SpectrumAqua. Mix14 contains probes TelVysion 19p SpectrumGreen, TelVysion 19q SpectrumOrange and LSI 19p13 SpectrumAqua. Metaphase preparation was carried out by standard methods. Briefly, cells were cultured in LymphoGrow medium (CytoGen, Sinn, Germany) containing phytohaemagglutinin as mitogen. After fixation, metaphases were dropped onto slides and then dried at 60°C overnight. One slide was used for G-banding. For FISH analyses ToTelVysion probes were used after manufactures instruction, however, metaphase slides were hybridised without pretreatment.

Supplementary Table 1. Protein-encoding genes within the duplicated interval on 19p13 for patient 1 and 2 as indicated by array CGH analysis results annoted using Human Genome Build GRCh37/hg19.

Patient	Gene Name	Description
1	***OR4F17***	olfactory receptor
1	***PPAP2C***	phosphatidic acid phosphatase type 2C
1	***MIER2***	mesoderm induction early response 1
1+2	***THEG***	theg spermatid protein
1+2	***C2CD4C***	C2 calcium-dependent domain containing 4C
1+2	***SHC2***	SHC (Src homology 2 domain containing) transforming protein 2
1+2	***ODF3L2***	outer dense fiber of sperm tails 3-like 2
1+2	***MADCAM1***	mucosal vascular addressin cell adhesion molecule 1
1+2	***TPGS1***	tubulin polyglutamylase complex subunit 1
1+2	***CDC34***	cell division cycle 34
1+2	***GZMM***	granzyme M (lymphocyte met-ase 1)
1+2	***BSG***	basigin (Ok blood group)
1+2	***HCN2***	hyperpolarization activated cyclic nucleotide-gated potassium channel 2
1+2	***POLRMT***	polymerase (RNA) mitochondrial (DNA directed)
1+2	***FGF22***	fibroblast growth factor 22
1+2	***RNF126***	ring finger protein 126
1+2	***FSTL3***	follistatin-like 3 (secreted glycoprotein)
1+2	***PRSS57***	protease
1+2	***PALM***	paralemmin
1+2	***C19orf21***	chromosome 19 open reading frame 21
1+2	***PTBP1***	polypyrimidine tract binding protein 1
1+2	***LPPR3***	hsa-mir-3187
1+2	***AZU1***	azurocidin 1
1+2	***PRTN3***	proteinase 3
1+2	***ELANE***	elastase
1+2	***CFD***	complement factor D (adipsin)
1+2	***MED16***	mediator complex subunit 16
1+2	***R3HDM4***	R3H domain containing 4
1+2	***KISS1R***	KISS1 receptor
1+2	***ARID3A***	AT rich interactive domain 3A (BRIGHT-like)
1+2	***WDR18***	WD repeat domain 18
1+2	***AC004528.1***	Uncharacterized protein
1+2	***GRIN3B***	glutamate receptor
1+2	***TMEM259***	transmembrane protein 259
1+2	***CNN2***	calponin 2
1+2	***ABCA7***	ATP-binding cassette
1+2	***HMHA1***	histocompatibility (minor) HA-1
1+2	***POLR2E***	polymerase (RNA) II (DNA directed) polypeptide E
1+2	***GPX4***	glutathione peroxidase 4
1+2	***SBNO2***	strawberry notch homolog 2 (Drosophila)

1+2	***STK11***	serine/threonine kinase 11
1+2	***C19orf26***	chromosome 19 open reading frame 26
1+2	***ATP5D***	ATP synthase
1+2	***MIDN***	midnolin
1+2	***CIRBP***	cold inducible RNA binding protein
1+2	***C19orf24***	chromosome 19 open reading frame 24
1+2	***MUM1***	melanoma associated antigen (mutated) 1
1+2	***EFNA2***	ephrin-A2
1+2	***NDUFS7***	NADH dehydrogenase (ubiquinone) Fe-S protein 7
1+2	***GAMT***	guanidinoacetate N-methyltransferase
1+2	***DAZAP1***	DAZ associated protein 1
1+2	***RPS15***	ribosomal protein S15
1+2	***AC027307.3***	Uncharacterized protein
1+2	***APC2***	adenomatosis polyposis coli 2
1+2	***C19orf25***	chromosome 19 open reading frame 25
1+2	***PCSK4***	proprotein convertase subtilisin/kexin type 4
1+2	***REEP6***	receptor accessory protein 6
1+2	***ADAMTSL5***	ADAMTS-like 5
1+2	***PLK5***	polo-like kinase 5
1+2	***MEX3D***	mex-3 homolog D (C. elegans)
1+2	***MBD3***	methyl-CpG binding domain protein 3
1+2	***UQCR11***	cytochrome b-c1 complex subunit 10
1+2	***TCF3***	transcription factor 3
1+2	***ONECUT3***	one cut homeobox 3
1+2	***ATP8B3***	ATPase
1+2	***REXO1***	REX1
1+2	***KLF16***	Kruppel-like factor 16
1+2	***ABHD17A***	abhydrolase domain containing 17A
1+2	***SCAMP4***	secretory carrier membrane protein 4
1+2	***ADAT3***	adenosine deaminase
1+2	***CSNK1G2***	casein kinase 1
1+2	***BTBD2***	BTB (POZ) domain containing 2
1+2	***MKNK2***	MAP kinase interacting serine/threonine kinase 2
1+2	***MOB3A***	MOB kinase activator 3A
1+2	***IZUMO4***	IZUMO family member 4
1+2	***AP3D1***	adaptor-related protein complex 3
1+2	***DOT1L***	DOT1-like
1+2	***PLEKHJ1***	pleckstrin homology domain containing
1+2	***SF3A2***	splicing factor 3a
1+2	***AMH***	anti-Mullerian hormone
1+2	***JSRP1***	junctional sarcoplasmic reticulum protein 1
1+2	***OAZ1***	ornithine decarboxylase antizyme 1
1+2	***C19orf35***	chromosome 19 open reading frame 35
1+2	***LINGO3***	leucine rich repeat and Ig domain containing 3
1+2	***LSM7***	LSM7 homolog
1+2	***TMPRSS9***	transmembrane protease
1+2	***TIMM13***	translocase of inner mitochondrial membrane 13 homolog (yeast)

1+2	***LMNB2***	lamin B2
1+2	***GADD45B***	growth arrest and DNA-damage-inducible
1+2	***GNG7***	guanine nucleotide binding protein (G protein)
1+2	***DIRAS1***	DIRAS family
1+2	***AC006538.4***	Uncharacterized protein
1+2	***SLC39A3***	solute carrier family 39 (zinc transporter)
1+2	***SGTA***	small glutamine-rich tetratricopeptide repeat (TPR)-containing
1+2	***THOP1***	thimet oligopeptidase 1
1+2	***ZNF554***	zinc finger protein 554
1+2	***ZNF555***	zinc finger protein 555
1+2	***ZNF556***	zinc finger protein 556
1+2	***ZNF57***	zinc finger protein 57
1+2	***ZNF77***	zinc finger protein 77
1+2	***TLE6***	transducin-like enhancer of split 6 (E(sp1) homolog
1+2	***TLE2***	transducin-like enhancer of split 2 (E(sp1) homolog
1+2	***AES***	amino-terminal enhancer of split
1+2	***GNA11***	guanine nucleotide binding protein (G protein)
1+2	***GNA15***	guanine nucleotide binding protein (G protein)
1+2	***S1PR4***	sphingosine-1-phosphate receptor 4
1+2	***NCLN***	nicalin
1+2	***CELF5***	CUGBP
1+2	***NFIC***	nuclear factor I/C (CCAAT-binding transcription factor)
1+2	***C19orf77***	chromosome 19 open reading frame 77
1+2	***DOHH***	deoxyhypusine hydroxylase/monooxygenase
1+2	***FZR1***	fizzy/cell division cycle 20 related 1 (Drosophila)
1+2	***MFSD12***	major facilitator superfamily domain containing 12
1+2	***C19orf71***	chromosome 19 open reading frame 71
1+2	***HMG20B***	high mobility group 20B
1+2	***GIPC3***	GIPC PDZ domain containing family
1+2	***TBXA2R***	thromboxane A2 receptor
1+2	***CACTIN***	cactin
1+2	***PIP5K1C***	phosphatidylinositol-4-phosphate 5-kinase
1+2	***TJP3***	tight junction protein 3
1+2	***APBA3***	amyloid beta (A4) precursor protein-binding
1+2	***MRPL54***	mitochondrial ribosomal protein L54
1+2	***RAX2***	retina and anterior neural fold homeobox 2
1+2	***MATK***	megakaryocyte-associated tyrosine kinase
1+2	***ZFR2***	zinc finger RNA binding protein 2
1+2	***ATCAY***	ataxia
1+2	***NMRK2***	nicotinamide riboside kinase 2
1+2	***DAPK3***	death-associated protein kinase 3
1+2	***EEF2***	eukaryotic translation elongation factor 2
1+2	***PIAS4***	protein inhibitor of activated STAT
1+2	***ZBTB7A***	zinc finger and BTB domain containing 7A
1+2	***MAP2K2***	mitogen-activated protein kinase kinase 2
1+2	***CREB3L3***	cAMP responsive element binding protein 3-like 3
1+2	***SIRT6***	sirtuin 6

1+2	***ANKRD24***	ankyrin repeat domain 24
1+2	***EBI3***	Epstein-Barr virus induced 3
1+2	***CCDC94***	coiled-coil domain containing 94
1+2	***SHD***	Src homology 2 domain containing transforming protein D
1+2	***TMIGD2***	transmembrane and immunoglobulin domain containing 2
1+2	***FSD1***	fibronectin type III and SPRY domain containing 1
1+2	***STAP2***	signal transducing adaptor family member 2
1+2	***MPND***	MPN domain containing
1+2	***SH3GL1***	SH3-domain GRB2-like 1
1+2	***CHAF1A***	chromatin assembly factor 1
1+2	***UBXN6***	UBX domain protein 6
1+2	***HDGFRP2***	Hepatoma-derived growth factor-related protein 2
1+2	***PLIN4***	perilipin 4
1+2	***PLIN5***	perilipin 5
1+2	***CTB-50L17.14***	Uncharacterized protein
1+2	***LRG1***	leucine-rich alpha-2-glycoprotein 1
1+2	***SEMA6B***	sema domain
1+2	***TNFAIP8L1***	tumor necrosis factor
1+2	***C19orf10***	chromosome 19 open reading frame 10
1+2	***DPP9***	dipeptidyl-peptidase 9
1+2	***FEM1A***	fem-1 homolog a (C. elegans)
1+2	***TICAM1***	toll-like receptor adaptor molecule 1
1+2	***PLIN3***	perilipin 3
1+2	***ARRDC5***	arrestin domain containing 5
1+2	***KDM4B***	lysine (K)-specific demethylase 4B
1+2	***PTPRS***	protein tyrosine phosphatase
1+2	***ZNRF4***	zinc and ring finger 4
1+2	***SAFB2***	scaffold attachment factor B2
1+2	***SAFB***	scaffold attachment factor B
1+2	***RPL36***	ribosomal protein L36
1+2	***C19orf70***	chromosome 19 open reading frame 70
1+2	***HSD11B1L***	hydroxysteroid (11-beta) dehydrogenase 1-like
1+2	***LONP1***	lon peptidase 1
1+2	***CATSPERD***	catsper channel auxiliary subunit delta
1+2	***PRR22***	proline rich 22
1+2	***CTB-54O9.9***	Uncharacterized protein
1+2	***DUS3L***	dihydrouridine synthase 3-like (S. cerevisiae)
1+2	***NRTN***	neurturin
1+2	***FUT6***	fucosyltransferase 6 (alpha (1
1+2	***FUT3***	fucosyltransferase 3 (galactoside 3(4)-L-fucosyltransferase
1+2	***FUT5***	fucosyltransferase 5 (alpha (1
1+2	***AC024592.12***	Uncharacterized protein
1+2	***NDUFA11***	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex
1+2	***AC104532.2***	Uncharacterized protein
1+2	***VMAC***	vimentin-type intermediate filament associated coiled-coil protein
1+2	***CAPS***	calcyphosine

1+2	***RANBP3***	RAN binding protein 3
1+2	***RFX2***	regulatory factor X
1+2	***ACSBG2***	acyl-CoA synthetase bubblegum family member 2
1+2	***MLLT1***	myeloid/lymphoid or mixed-lineage leukemia (trithorax homolog
1+2	***ACER1***	alkaline ceramidase 1
1+2	***CLPP***	ClpP caseinolytic peptidase
1+2	***ALKBH7***	alkB
1+2	***PSPN***	persephin
1+2	***GTF2F1***	general transcription factor IIF
1+2	***KHSRP***	KH-type splicing regulatory protein
1+2	***SLC25A41***	solute carrier family 25
1+2	***SLC25A23***	solute carrier family 25 (mitochondrial carrier
1+2	***CRB3***	crumbs homolog 3 (Drosophila)
1+2	***DENND1C***	DENN/MADD domain containing 1C
1+2	***TUBB4A***	tubulin
1+2	***TNFSF9***	tumor necrosis factor (ligand) superfamily
1+2	***CD70***	CD70 molecule
1+2	***TNFSF14***	tumor necrosis factor (ligand) superfamily
1+2	***C3***	complement component 3
1+2	***GPR108***	G protein-coupled receptor 108
1+2	***TRIP10***	thyroid hormone receptor interactor 10
1+2	***SH2D3A***	SH2 domain containing 3A
1+2	***VAV1***	vav 1 guanine nucleotide exchange factor
1	***EMR1***	egf-like module containing
1	***AC025278.1***	Uncharacterized protein
1	***MBD3L5***	methyl-CpG binding domain protein 3-like 5
1	***MBD3L4***	methyl-CpG binding domain protein 3-like 4
1	***MBD3L2***	methyl-CpG binding domain protein 3-like 2
1	***MBD3L3***	methyl-CpG binding domain protein 3-like 3
1	***ZNF557***	zinc finger protein 557
1	***INSR***	insulin receptor

Supplementary Table 2. Protein-encoding genes within the deleted interval on 16p13 of patient 2 as indicated by array CGH analysis results annoted using Human Genome Build GRCh37/hg19.

Patient	Gene Name	Description
2	***RHBDF1***	rhomboid 5 homolog 1 (Drosophila)
2	***MPG***	N-methylpurine-DNA glycosylase
2	***NPRL3***	nitrogen permease regulator-like 3 (S. cerevisiae)
2	***HBZ***	hemoglobin, zeta
2	***HBM***	hemoglobin, mu
2	***HBA2***	hemoglobin, alpha 2
2	***HBA1***	hemoglobin, alpha 1
2	***HBQ1***	hemoglobin, theta 1
2	***LUC7L***	LUC7-like (S. cerevisiae)
2	***ITFG3***	integrin alpha FG-GAP repeat containing 3
2	***RGS11***	regulator of G-protein signaling 11
2	***ARHGDIG***	Rho GDP dissociation inhibitor (GDI) gamma
2	***PDIA2***	protein disulfide isomerase family A, member 2
2	***AXIN1***	axin 1
2	***MRPL28***	mitochondrial ribosomal protein L28
2	***TMEM8A***	transmembrane protein 8A
2	***NME4***	NME/NM23 nucleoside diphosphate kinase 4
2	***DECR2***	2,4-dienoyl CoA reductase 2, peroxisomal
2	***RAB11FIP3***	RAB11 family interacting protein 3 (class II)
2	***SOLH***	small optic lobes homolog (Drosophila)
2	***C16orf11***	chromosome 16 open reading frame 11
2	***PIGQ***	phosphatidylinositol glycan anchor biosynthesis, class Q
2	***NHLRC4***	NHL repeat containing 4
2	***RAB40C***	RAB40C, member RAS oncogene family
2	***WFIKKN1***	WAP, follistatin/kazal, immunoglobulin, kunitz and netrin domain containing 1
2	***C16orf13***	chromosome 16 open reading frame 13
2	***FAM195A***	family with sequence similarity 195, member A
2	***WDR90***	WD repeat domain 90
2	***RHOT2***	ras homolog family member T2
2	***RHBDL1***	rhomboid, veinlet-like 1 (Drosophila)
2	***STUB1***	STIP1 homology and U-box containing protein 1, E3 ubiquitin protein ligase
2	***JMJD8***	jumonji domain containing 8
2	***WDR24***	WD repeat domain 24
2	***FBXL16***	F-box and leucine-rich repeat protein 16
2	***METRN***	meteorin, glial cell differentiation regulator
2	***FAM173A***	family with sequence similarity 173, member A
2	***CCDC78***	coiled-coil domain containing 78
2	***HAGHL***	hydroxyacylglutathione hydrolase-like
2	***NARFL***	nuclear prelamin A recognition factor-like

2	***MSLN***	mesothelin
2	***MSLNL***	mesothelin-like
2	***RPUSD1***	RNA pseudouridylate synthase domain containing 1
2	***CHTF18***	CTF18, chromosome transmission fidelity factor 18 homolog (S. cerevisiae)
2	***GNG13***	guanine nucleotide binding protein (G protein), gamma 13
2	***PRR25***	proline rich 25