Genotypes of patients with factor XIII deficiency

Gene	Mutation	Location	Domain	Type	Genotype	Origin	Activity U/dL	Antigen U/dL	Expression	Comments	Reference
F13A	nt -7 del 20 bp and Ala394Val IVS4+2 ins T (Nagoya 1)	UTR Exon 9 IVS4	- Core	Splicing Missense Splicing	Comp het	Japan	<5	<5			1,2
F13A	IVS1-7 ins TT Arg326Gln*	Intron 1 Exon 8	- Core	Splicing Missense	Comp het	Netherlands	19	13		Undetectable in platelets	3
F13A	nt 7 del AG His64Tyr	Exon 2	Activation peptide b-sandwich	Frame shift Missense	Comp het	France	<1	<1			4
F13A	nt 27 del T*	Exon 2	Activation peptide	Frameshift	Hom	Sweden	<3	<5		Also found in a heterozygote from Denmark	5
F13A	nt 131 del AG	Exon 3	b-sandwich	Frameshift	Hom	Japan	<3	<5			6
F13A	Asn60Lys Tyr441stop	Exon 3 Exon 11	b-sandwich Core	Missense Nonsense	Comp het	Caucasian	<1	<5	Yes		7,8,9
F13A	Tyr69stop	Exon 3	b-sandwich	Nonsense	Hom	India					10
F13A	Arg77Cys*	Exon 3	b-sandwich	Missense	Hom	Switzerland	2.9	0.9	Yes	First family described in 1960	11
F13A	Arg77Cys*	Exon 3	b-sandwich	Missense	Hom	China	0				12
F13A	Arg77Cys* Arg174stop	Exon 3 Exon 4	b-sandwich b-sandwich	Missense Nonsense	Comp het	China					13
F13A	Arg77Cys* nt 499 del 14	Exon 3 Exon 4	b-sandwich b-sandwich	Missense Frameshift	Comp het	Poland	<1.5	<2			14

F13A	Arg77Cys* nt 607 del G	Exon 3 Exon 5	b-sandwich Core	Missense Splicing	Comp het	Switzerland	5.4	1.8		Measured under replacement therapy	11
F13A	Arg77His*	Exon 3	b-sandwich	Missense	Hom	Iran	<3	0			15
F13A	Arg77His* Undefined	Exon 3	b-sandwich	Missense	Comp het	Spanish	<1				4
F13A	Arg77His* Leu604Pro	Exon 3 Exon 13	b-sandwich Barrel 1	Missense Missense	Comp het	Belgium	5				4
F13A	Arg78Cys IVS5-1 G>C	Exon 3 Intron 5	b-sandwich	Missense Splicing	Comp het						16
F13A	nt 249 del 13	Exon 3	b-sandwich	Frameshift	Hom	Greece	<5				17
F13A	nt 254 ins T	Exon 3	b-sandwich	Frameshift	Hom	Algeria	<3				4
F13A	nt 291 del GG and nt 303 ins 6 bp IVS3+5 G>A	Exon 3 Intron 3	b-sandwich	Frameshift Splicing	Comp het						9
F13A	Glu102Lys	Exon 3	b-sandwich	Missense	Hom		13	34-41			18
F13A	nt 319 G>T*	Exon 3	b-sandwich	Splicing	Hom						9
F13A	nt 319 G>T* Undefined	Exon 3	b-sandwich	Splicing	Comp het	U.K					19
F13A	IVS3+4 A>T IVS5-1 G>A*	Intron 3 Intron 5		Splicing Splicing	Comp het	Netherlands	<1				4
F13A	IVS3+6 T>C Arg661stop*	Intron 3 Exon 14	- Barrel 2	Splicing Nonsense	Comp het	Finland	<1				20,21
F13A	IVS3-1 G>T	Intron 3		Splicing	Hom	UK	<1				9
F13A	nt 398 ins G Ser413Leu*	Exon 4 Exon 10	b-sandwich Core	Frameshift Missense	Comp het		<2				22
F13A	Met159Arg*	Exon 4	b-sandwich	Missense	Hom	Switzerland	1.3	<0.5	Yes		11
F13A	Met159Arg* Arg661stop*	Exon 4 Exon 14	b-sandwich Barrel 2	Missense Nonsense	Comp het	Switzerland	1.8	<0.5			11

F13A	Tyr167Cys	Exon 4	b-sandwich	Missense	Het	Germany	57				23
F13A	Arg171stop* Undefined (Bristol)	Exon 4	b-sandwich	Nonsense	Comp het		<5				24
F13A	Arg171stop* Undefined	Exon 4	b-sandwich	Nonsense	Comp het	Spain	<1.5				4
F13A	Pro186Leu Arg260His*	Exon 4 Exon 6	Core Core	Missense Missense	Comp het	Italy	<3				25
F13A	nt 599 del AA	Exon 5	Core	Frameshift	Hom	China	0				12
F13A	nt 604 del A	Exon 5	Core	Frameshift	Hom	Iran	18	16		Measured under replacement therapy	15
F13A	Gly210Arg*	Exon 5	Core	Missense	Hom	India	9	10	Yes	Measured under replacement therapy	26,27
F13A	Gly210Arg* Lys257Glu	Exon 5 Exon 7	Core Core	Missense Missense	Comp het	Belgium	<1	<1			4
F13A	Gly215Arg IVS10+1 G>A	Exon 5 Intron 10	Core	Missense Splicing	Comp het	Serbia	5.7	2.2	Yes	Measured under replacement therapy	11
F13A	Del exon 5	Exon 5	Core	Frameshift	Hom	Japan	<10	<10			28
F13A	IVS5-1 G>A*	Intron 5		Splicing	Hom	Poland	<1.5	<2		Founder mutation	4
F13A	IVS5-1 G>A*	Intron 5		Splicing	Hom	Netherlands	<5	<5			29
F13A	IVS5-1 G>A*	Intron 5		Splicing	Hom	Czechoslovakia	0.5	0.1		Also found in homozygotes from Kosovo and Macedonia	11

F13A	IVS5-1 G>A* Gly420Ser*	Intron 5 Exon 10	- Core	Splicing Missense	Comp het	Netherlands		<1			4
F13A	IVS5-1 G>A* Asn541Lys*	Intron 5 Exon 12	- Barrel 1	Splicing Missense	Comp het	U.K		<5			30
F13A	IVS5-1 G>A* Arg661stop	Intron 5 Exon 14	- Barrel 2	Splicing Nonsense	Comp het	Poland	<1.5	<2			4
F13A	Leu235Arg	Exon 6	Core	Missense	Hom	Turkey		<5			31
F13A	nt 709 del G Trp691stop	Exon 6 Exon 15	Core Barrel 2	Frameshift Nonsense	Comp het	U.K					19
F13A	Met242Thr Arg661stop*	Exon 6 Exon 14	Core Barrel 2	Missense Nonsense	Comp het	Finland					21,32
F13A	Arg252Ile Arg326Gln*	Ex 6 Ex 8	Core Core	Missense Missense	Comp het	Germany	<2	<1	Yes		5,32
F13A	nt 765 insT	Exon 6	Core	Frameshift	Hom	Algeria	<1				33
F13A	Arg260Cys*	Exon 6	Core	Missense	Hom	Iran	8	3		Measured under replacement therapy	15
F13A	Arg260Cys*	Exon 6	Core	Missense	Hom	Poland	<1.5	<2			14
F13A	Arg260Cys* Trp375Cys	Exon 6 Exon 9	Core Core	Missense Missense	Comp het	Switzerland	8.4	11.9	Yes	Measured under replacement therapy	11
F13A	Arg260Cys* His716Arg*	Exon 6 Exon 15	Core Barrel 2	Missense Missense	Comp het	Switzerland	5.9	2.2	Yes	Measured under replacement therapy	11
F13A	Arg260Cys* Undefined (Nagoya 2)	Exon 6	Core	Missense	Comp het	Japan	<5				34
F13A	Arg260His*	Exon 6	Core	Missense	Hom	Syria			Yes		35
F13A	Arg260His*	Exon 6	Core	Missense	Hom	India					10

F13A	Arg260His*	Exon 6	Core	Missense	Hom	Iran	<3	<1			15
F13A	Arg260Leu	Exon 6	Core	Missense	Hom	Israeli Arab	4	<5	Yes	Measured under replacement therapy	26,27
F13A	Gly262Glu Val316Phe*	Exon 6 Exon 7	Core Core	Missense Missense	Comp het	Dutch	<1	<12.5			36
F13A	Ser263Phe IVS14-1 G>A	Exon 6 Intron 14	Core	Missense Splicing	Comp het	India					10
F13A	Tyr283Cys Undefined	Exon 7	Core	Missense	Comp het	Italy	<2	<5	Yes		37,38
F13A	Pro289Arg	Exon 7	Core	Missense	Het	Germany	46				23
F13A	nt 869 ins C*	Exon 7	Core	Frameshift	Hom	Tunis	4				26
F13A	nt 869 ins C*	Exon 7	Core	Frameshift	Hom	Tunis	<1	<1		Founder mutation	39
F13A	nt 869 ins C*	Exon 7	Core	Frameshift	Hom	Tunis	<1				40
F13A	nt 874 ins G	Exon 7	Core	Frameshift	Hom	India					10
F13A	Ser295Arg*	Ex on 7	Core	Missense	Hom	Pakistan				Found in several unrelated families	4,19,41
F13A	Val316Phe* Arg326Gln*	Exon 7 Exon 8	Core Core	Missense Missense	Comp het	Netherlands	<1				3
F13A	Ala318Val nt 1652 del 10 bp	Exon 7 Exon 12	Core Barrel 1	Missense Frameshift	Comp het	Athiopian Jewish	2	2	Yes		26,27
F13A	IVS7+1 G>A and nt 1111 T>G	Intron 7 Exon 8	 Core	Splicing	Hom		<1				42
F13A	Arg326stop*	Exon 8	Core	Nonsense	Hom	Pakistan					19
F13A	Arg326stop*	Exon 8	Core	Nonsense	Hom	Italy	<3				25
F13A	Arg326Gln*	Exon 8	Core	Missense	Hom	Germany	<2	<1	Yes		4,5,32
F13A	Arg326Gln*	Exon 8	Core	Missense	Hom	Pakistan					43
F13A	Arg326Gln*	Exon 8	Core	Missense	Comp het	Netherlands	<1				3

	Undefined										
F13A	nt 1033 del AAT	Exon 8	Core	Del Asn 344	Hom	Thailand	5		Yes		44
F13A	Leu354Pro*	Exon 8	Core	Missense	Hom	Pakistan	<5			Additional homozygote from India	26,45
F13A	Ala378Pro Gly420Ser*	Exon 9 Exon 10	Core Core	Missense Missense	Comp het	Poland	<1.5	<2			4
F13A	Arg382Ser	Exon 9	Core	Missense	Hom	Iran	6	5		Measured under replacement therapy	15
F13A	Gly390stop	Exon 9	Core	Nonsense	Het	Germany	49				23
F13A	Thr398Asn	Exon 9	Core	Missense	Hom	India	1.6	1.3	Yes		26,27
F13A	Gln400stop	Exon 9	Core	Nonsense	Hom	Turkey	<1				46
F13A	nt 1202 ins C*	Exon 9	Core	Frameshift	Hom	Turkey				Additional homozygote from Greece	47,48
F13A	Arg408Gln	Exon 10	Core	Missense	Hom	Tunis	<1				40
F13A	Arg408Gln Big del exons 4-11	Exon 10 Exon 4-11	Core	Missense Big deletion	Comp het	UK	<1	<1			9,49
F13A	Ser413Leu*	Exon 10	Core	Missense	Hom	India					10
F13A	Ser413Trp	Exon 10	Core	Missense	Hom	China	0	0	Yes		12,50
F13A	Val414Phe*	Exon 10	Core	Missense	Hom	Malaysia-India	6	6		Measured under replacement therapy	51
F13A	Val414Phe*	Exon 10	Core	Missense	Hom	India			Yes		10,46
F13A	Gly420Ser*	Exon 10	Core	Missense	Hom	Thailand					52
F13A	Exon 10 del 33 bp	Exon 10	Core	Frameshift	Hom						53
F13A	Thr449Ile	Exon 11	Core	Missense	Het		48				54
F13A	nt 1392 del AATT*	Exon 11	Core	Frameshift	Comp het	France	<1				46

	Undefined										
F13A	nt 1392 del AATT*	Exon 11	Core	Frameshift	Hom						55
F13A	nt 1392 del AATT*	Exon 11	Core	Frameshift	Hom	Italy	<3				25
F13A	nt 1405 del CAAA	Exon 11	Core	Frameshift	Hom	Turkey					47
F13A	IVS11+1 G>T	Intron 11		Splicing	Hom	Indian Jewish	2.5	5		Measured under replacement therapy	26
F13A	nt 1475 del GA	Exon 12	Core	Frameshift	Hom					Also VWD	56
F13A	Leu498Pro Arg661stop*	Exon 12 Exon 14	Core Barrel 2	Missense Nonsense	Comp het	Sweden	<2	<1	Yes		5,32
F13A	Gly501Arg	Exon 12	Core	Missense	Het				Yes		7,8
F13A	Arg540Gln	Exon 12	Barrel 1	Missense	Het	Germany	50				23
F13A	Asn541Lys*	Exon 12	Barrel 1	Missense	Hom	Turkey					47
F13A	nt1643 ins A	Exon 12	Barrel 1	Splicing	Hom	India					10
F13A	Gly562Arg	Exon 12	Barrel 1	Missense					Yes		55
F13A	Gly592Ser*	Exon 13	Barrel 1	Missense	Het	Germany	61				23
F13A	Arg611His*	Exon 13	Barrel 1	Missense	Het	Germany	49				23
F13A	nt 1981 del C	Exon 14	Barrel 2	Frameshift	Hom	Iran	<3	<1			15
F13A	Leu660Pro*	Exon 14	Barrel 2	Missense	Hom	Israeli Arabs	<1	<5		Founder mutation	57
F13A	Arg661stop*	Exon 14	Barrel 2	Nonsense	Hom	Finland	<1		Yes		5,21,32
F13A	Arg661stop*	Exon 14	Barrel 2	Nonsense	Hom	India	6	2			26
F13A	Trp664stop	Exon 14	Barrel 2	Nonsense	Hom	Germany	<5				23
F13A	nt 2002 del CT	Exon 14	Barrel 2	Frameshift	Hom	Italy	<3				25
F13A	Leu667Pro (Calgary)	Exon 14	Barrel 2	Missense	Hom	Canada	1	<6			58
F13A	Asp668Gly*	Exon 14	Barrel 2	Missense	Het	Germany	23-40				23
F13A	nt 2026 ins AAGA	Exon 14	Barrel 2	frameshift	Hom		<5	60			59
F13A	nt 2035 del AAG	Exon 14	Barrel 2	Del Lys 678	Hom		<2	<5			31

F13A	nt 2045 G>A* Published as Arg681His	Exon 14	Barrel 2	Splicing	Hom	UK	<1				9,60
F13A	nt 2045 G>A*	Exon 14	Barrel 2	Splicing	Hom	Pakistan				Founder mutation Additional homozygotes from India.	26,43
F13A	IVS14-2 A>G	Intron 14		Splicing	Hom	France	<1.5	<2			4
F13A	Arg703Trp His716Arg*	Exon 15 Exon 15	Barrel 2 Barrel 2	Missense Missense	Comp het	China	<5	<1			61
F13A	Arg703Gln Undefined	Exon 15	Barrel 2	Missense	Comp het	Hungary	<1	<1			4
F13A	Ser708Asn	Exon 15	Barrel 2	Missense	Hom	Italy	<3				25
F13A	Del exon 15	Exon 15		Big deletion	Hom	Poland	<1.5	<2			14
F13B	IVS1-2 del A*	Intron 1		Splicing	Hom	Japan		<10		Founder mutation	62
F13B	IVS1-2 del A* Cys430Phe	Intron 1 Exon 8	Sushi 7	Splicing Missense	Comp het	Japan		<5	Yes		63,64,65
F13B	IVS1-2 del A* nt 1498 del G	Intron 1 Exon 9	Sushi 8	Splicing Frameshift	Comp het	Japan		<10	Yes		62
F13B	Cys5Arg	Exon 2	Sushi 1		Het			32			66
F13B	IVS2-1 G>C	Intron 2		Splicing	Het	Mozambique	53†				66
F13B	nt 299 ins AAC*	Exon 3	Sushi 2	Frameshift	Hom	Italy		<5		Founder mutation	67,68
F13B	Ile81Asn*	Exon 3	Sushi 2	Missense	Het	Germany		60			65
F13B	Leu116Phe	Exon 3	Sushi 2	Missense	Het	Germany		64			66
F13B	IVS3 -1 G>C	Intron 3		Splicing	Het	Germany		32			66
F13B	nt 471 del ATT	Exon 4	Sushi 3	Deletion	Het	Germany	53†				66
F13B	Val217Ile	Exon 5	Sushi 4	Missense	Het	Germany	50†				66
F13B	Cys316Phe*	Exon 7	Sushi 6	Missense	Het	Germany	30†				66

F13B	nt 1158 ins ACTT	Exon 7	Sushi 6	Frameshift	Hom	India		<1			66
F13B	Val401Glu	Exon 8	Sushi 7	Missense	Het	Germany	45†				66
F13B	Pro428Ser	Exon 8	Sushi 7	Missense	Het	Germany	46†				66
F13B	Nt1959 ins T	Exon 12	Sushi 12	Frameshift	Het	Germany	52†				66

Nucleotide numbers of *F13A* are based on the Genebank file NM_000129 using the A (nucleotide 102) of the ATG initiator methionine as +1.
Nucleotide numbers of *F13B* subunit are based on the Genebank file NM_001994 using the A (nucleotide 36) of the ATG initiator methionine as +1.
Amino acid numbers of *F13A* are based on the initiator methionine as O and its succeeding serine as +1 (this is due to wrong numbering cited in most papers.)

* A mutation that was identified in more than 1 family.

Matching genotypes to phenotypes was kindly communicated by the authors.

† Subunit A activity

Mutations causing Factor XIII A deficiency according to their types

Promoter	Missense			Nonsense	Splice	Deletion/Insertion		Big deletion
nt -7 del 20	N60K	G262E	G420S*	Y69X	IVS1-7 ins TT	nt 7 del AG	nt 1111 T>G	Exon 5
	H64Y	S263F	T449I	R171X*	nt 319 G>T*	nt 27 del T*	exon 10 del 33	Exons 4-11
	R77C*	Y283C	L498P	R174X	IVS3+4 A>T	nt 131 del AG	nt 1392 del AATT*	Exon 15
	R77H*	P289R	G501R	R326X*	IVS3+5 G>A	nt 249 del 13	nt 1405 del CAAA	
	R78C	S295R*	A540Q	G390X	IVS3+6 T>C	nt 254 ins T	nt 1475 del GA	
	E102K	V316F*	N541K*	Q400X	IVS3-1G>T	nt 291 del GG	nt 1643 ins A	
	M159R*	A318V	G562R	Y441X	IVS4+2 ins T	nt 303 ins 6 bp	nt 1652 del 10 bp	
	Y167C	R326Q*	G592S*	R661X	IVS5-1 G>A*	nt 398 ins G	nt 1981 del C	
	P186L	L354P*	R611H*	W664X	IVS5-1 G>C	nt 499 del 14	nt 2002 del CT	
	G210R	W375C	D668G	W691X	IVS7+1 G>A	nt 599 del AA	nt 2026 ins AAGA	
	G215R	A378P	L604P		IVS10+ G>A	nt 604 del A	nt 2035 del AAG	
	L235R	R382S	L660P*		IVS11 +1 G>T	nt 607 del G		
	M242T	A394V	L667P		nt 2045 G>A*	nt 709 del G		
	R252I	T398N	R703W		IVS14-1 G>A	nt 765 ins T		
	K257E	R408Q*	R703Q		IVS14-2 A>G	nt 869 ins C*		
	R260H*	S413L*	S708N			nt 874 ins G		
	R260C*	S413W	H716R*			nt 1033 del AAT		
	R260L	V414F*				nt 1201 ins C*		

* Mutations that were identified in more than one family

Mutations causing Factor XIII B deficiency according to their types

Missense	Splice	Deletion/Insertion
C5R	IVS2-1 G>C	nt 299 ins AAC*
I81N*	IVS1-2 del A*	nt 471 del ATT
L116F	IVS3-1 G>C	nt 1155-58 dup ACTT
V217I		nt 1498 del G
C316F*		nt 1959 ins T
V401E		
P428S		
C430F		

* Mutations that were identified in more than one family

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