

Supplementary table 1. Information of primers for *BRCA1*

Exons of <i>BRCA1</i>	Primers
ENSE00001871077	F:AAGGGGTTGGCAGCAATATG R:AGGCAGAGTGGATGGAGAAC
ENSE00003559512	F:TTGAACGAACTTGAGGCCTT R:TATGTCAGTCGGGTGTGGTG
ENSE00003510592	F:GGCTCTTAAGGGCAGTTGTG R:GCGATACAGCCCTACTTTACA
ENSE00003541068	F:CACTGCCATCACACGGTTTA R:GCTAAGACACCAACAATGTAAGT
ENSE00003531836	F:TGTTGGTGTCTTAGCTTTAGTGA R:CAATTTGGGGAGCCGAGGT
ENSE00003513709	F:TCCCAGCCCCAGACATTTTA R:CCAAAGCTGCCTACCACAAA
ENSE00003642045	F:TGCCACAGTAGATGCTCAGT R:GCACATACATCCCTGAACCT
ENSE00003587679	F:GCCCAGCAACCATTTCATTTC R:GGTTGTAAAGGTCCCAAATGG 1F:TGGTTGATTTCACCTCCAAG 1R:ACACAGGGGATCAGCATTCA 2F:ACTCATGCCAGCTCATTACAG 2R:CATGGCTTAAGTTGGGGAGG 3F:GCCATGCTCAGAGAATCCTAG 3R:ACTGCTGCTTATAGG TTCAGC 4F:TGGCAGTTCAAAAGACTCCTG 4R:CTTCTTGGCTCCAGTTGCAG
ENSE00003522602	5F:ACGAAAGCTGAACCTATAAGCAG 5R:AGTGCCATAATCAGTACCAGGT 6F:GCCAAGAAGAGTAACAAGCCA 6R:TGTTTCTTTAAGGACCCAGAGTG 7F:CACAGTCGGGAAACAAGCAT 7R:CGGCTAATTGTGCTCACTGT 8F:GGCAACGAACTGGACTCAT 8R:TGTGTATGGGTGAAAGGGCT 9F:TGGGAAGTAGTCATGCATCTCA 9R:TGTAAAATGTGCTCCCCAAAAG
ENSE00003547126	F:AAAGCAAATCCAGGTGTCCC R:GCAGTGTATGTGTAGGCTGTG
ENSE00003527960	F:AGGTGATTTCAATTCCTGTGCT R:ACATGAATGACTGCCTTGGG
ENSE00003791246	F:GTCTGTTGCATTGCTTGTGT R:AAGGGCTGCCTTGAAGAAGT
ENSE00003537850	F:GACTTCTAGGCTGTCTTGCG

	R:ACACCAAGACTCCCTCATCC
	1F:ACCAACACTGTATTCATGTACCC
ENSE00003497952	1R:AATTCTGGCTTCTCCCTGCT
	2F:GCCTCTTCTCTGATGACCCT
	2R:TGGCAGTACATTTGGAACCAG
ENSE00003492626	F:TTTAAATAGTTCCAGGACAC
	R:CTCCCAAAGTGCTGCGATTA
ENSE00003591784	F:GCCTCCCCTAGACTTCCAAAT
	R:GGTAACTCAGACTCAGCATCAG
ENSE00003672792	F:CCTCTGTCATTCTTCCTGTGC
	R:GTGGTGCATTGATGGAAGGA
ENSE00003458468	F:GCCTTAAATATGACGTGTCTGCT
	R:AAAATGAAGCGGCCCATCTC
ENSE00003477922	F:CTGGACATTGGACTGCTTGT
	R:GCTGTTTTGTTTGGAGAGTGG
ENSE00003628864	F:TCCTTTGGAGCAGAGAGACAG
	R:GCAGTTCTCAAATCCTTACCCA
ENSE00003687053	F:GGTGGTGGTACGTGTCTGTA
	R:AAATGTGCCAAGAACTGTGC
ENSE00001814242	F:ACTCATACAACCAGGACCCT
	R:ACCCTTGCATAGCCAGAAGT

Supplementary table 2. Information of primers for *BRCA2*

Exons of <i>BRCA2</i>	Primers
ENSE00001484009	F:AGCGCTTCTGAGTTTTACCTC R:AGCAACACTGTGACGTACTG
ENSE00003666217	F:GGGGTTTCAACGTGTTAGCA R:GCCCAGCATGACACAATTAATG
ENSE00003659301	F:CCCTATACATTCTCATTCCCAGT R:TGTAAGATCTTCTACCAGGCTCT
ENSE00003739878	F:AATACACGGTTTCCAGCAGC
ENSE00003747332	R:GATCCACCTCAGCTCCTAGAC
ENSE00003749714	F:GCGTTATACCTTTGCCCTGA R:ATGCTTGACACCACTGGACT
ENSE00003714754	F:ACCAAGCCATATCTTACCACCT R:ACAGAGAGACAGCAGAGTTTCA
ENSE00003731761	F:TGGACCTAGGTTGATTGCAG R:TGAGGCAGGATCGCTTGA 1F:AACAGGAGAAGGGGTGACTG 1R:GGTAGGCTAGAAATACGTGGC
ENSE00000939167	2F:GGCCTGTGAATGGTCTCAAC 2R:GCTTCAAACCTGGGCTGAACA 3F:TGCTCACAGAAGGAGGACTC 3R:ACCATGTTTGAGTGACCTGAT 1F:CCTGAGTAACTGGCACCACA 1R:TGTTGTACTGGGTGACATGC 2F:TCTGAAGAACCAACTTTGTCCT 2R:GGCAACAGCTCAACGTTTT 3F:CAGCACTCTTATTTTAACTC 3R:CATTTTGCTCTTCTTAATGT 4F:ACAAGCAACCCAAGTGTCAA 4R:TCAACAGGCCAGCAAACCTC 5F:ACCCCTCAGATGTTATTTTCCA 5R:TGAGAATTTCTACTGGCAGCAG
ENSE00000939168	6F:AAGTGGGGTTTAGGGGCTTT 6R:TCCCACCTTGCACTCTGAAAA 7F:GGCCAGTTTATGAAGGAGGG 7R:TGGCACCACAGTCTCAATAGA 8F:GGTTTTTCATACAGCTAGCGGG 8R:GCTGTTAGACATGCTACTGTTAC 9F:TCAGTCCCCTTATTCAGTCATTG 9R:CTGAATCATCCAATGCCTCGT 10F:TGTGACTAGCTCTTACCCTG 10R:TGTTCTGGAGTACGTATAGCAGT 11F:CAGCAAGTGGAATCTGTCCA 11R:AGCCTGTTCTTTTCCCAAAC

	12F: TGATAAGAGAAACCCAGAGCACT
	12R: TCCTCATTTTCGGGACATGTAA
	13F: TGGGAAAAGAACAGGCTTCAC
	13R: GCCTCCCGGAAACCAACT
ENSE00000939169	F: GCTTATCTGTGGTATCTGGTAGC
	R: ACTTTGAGAGGCAGGTGGAT
ENSE00000939171	F: TGAGCATCTGTTACATTCACTGA
	R: TTAAGTGAATTCGGAGCAATTTCC
ENSE00000939173	F: GCAAATGAGGGTCTGCAACA
	R: AGGGCTTTAAAATTACCACCACC
ENSE00000939174	F: CCACACCTGGCTACTTTTGT
	R: GCACAGATCACTTTAGCAGGA
ENSE00000939175	F: GGGGTGGAAAAGGTACAGCA
	R: TAAACCCCAGGACAAACAGC
ENSE00001394102	F: GGGGTCTCACTATGTTGCCT
	R: AGGGATGACAGGAGAACAGC
	1F: CTTGCTTCCCTCTTTCCCA
	1R: ACCAACTGTCAGTCTGCCAT
ENSE00000939177	2F: GGGATGACACAGCTGCAAAA
	2R: GAGAACAAGAGGGCAGCAAG
ENSE00000939178	F: TCTCTCTAGTTGCCTTTGTCCA
	R: TGGCTCAGCTACTTGAGAGG
ENSE00000939180	F: TCCACTAATCTCAGCCTCCC
	R: AGGTCCTAGTTCCAGGCATA
ENSE00003461148	F: CTTTAAATCTCCCTTCTTTG
	R: CTGGCACATCACTGAAAATC
ENSE00000939183	F: ACCACACCCTTAAGATGAGCT
	R: CTTTGTGGGCATTAGTAGTGGA
ENSE00000939185	F: CCACTACTAATGCCCACAAAGA
	R: CCACCTCAGAACAAGATGGC
ENSE00000939187	F: CACTTCTTCCATTGCATCTTTCT
	R: AGGATGTAACTTGTTACCCTTGA
ENSE00000939189	F: TGGAAAACCTGAGCTTTTCGC
	R: TCCTGAGGTTTCATGGGCAAT
ENSE00003560258	F: TCTCTGTTCCCTCTCCCTAT
	R: ACAGGAGCCACATAACAACC
	1F: GGGAGGGAGACTGTGTGTAA
	1R: CTGAACTGGTGGGAGCAGT
ENSE00001184789	2F: GAGTTGTGGCACCAAATACGA
	2R: CCGATACACAAACGCTGAGG

Supplementary Table 3. Distributions of selected variables in multi-cancer cases and cancer-free controls

Variables	Discovery Stage	Validation Stage		<i>P</i> value
	Breast Cancer	Breast Cancer		
	Case (N = 70)	Case (N = 3217)	Control (N = 2660)	
Gender				
Male	0(0%)	0(0%)	0(0%)	
Female	70(100%)	3217(100%)	2660(100%)	
Age, years (mean ±s.d.)^a	50.04±9.45	50.19±11.12	50.42±11.87	0.454
Age at menarche, years (mean ±s.d.)^b	14.57±1.55	14.74±1.86	15.86±2.08	<0.001
Age at natural menopause, years (mean ±s.d.)^d	49.05±4.75	49.05±4.41	48.94±4.37	0.543
Age at first live birth, years (mean ±s.d.)^c	26.58±3.29	25.58±3.28	24.38±3.30	<0.001
Menopausal status^e				<0.001
Premenopausal	30(42.86%)	1589(49.39%)	1359(51.10%)	
Natural menopausal	34(48.57%)	1341(41.68%)	1260(47.37%)	
Unnatural menopausal	6(8.57%)	150(4.66%)	18(0.7%)	
Estrogen receptor (ER)^f				
Positive	23(32.86%)	1718(53.40%)		
Negative	30(42.86%)	1134(35.25%)		
Progesterone receptor (PR)^f				
Positive	23(32.86%)	1594(49.55%)		
Negative	27(38.57%)	1247(38.76%)		
Human epidermal growth factor receptor-2 (HER2)^f				
Positive	9(12.86%)	280(8.70%)		
Negative	34(48.57%)	1109(34.47%)		

(Continued) Supplementary Table 3. Distributions of selected variables in multi-cancer cases and cancer-free controls

Variables	Validation Stage								
	Cervical Cancer		P value	Hepatocellular Carcinoma		P value	Colorectal Cancer		P value
	Case(N=1133)	Controls(N=1098)		Case(N=2044)	Controls ^g (n=1116)		Cases ^h (N=1116)	Controls ^g (N=1116)	
Gender ^a									
Male	0(0%)	0(0%)		1731(84.69%)	918(82.26%)		662(59.32%)	918(82.26%)	
Female	1133(100%)	1098(100%)		313(15.31%)	198(17.74%)		433(38.80%)	198(17.74%)	
Age, years (mean ±s.d.) ^a	53.80±12.59	52.70±11.88	0.053	52.48 ±10.57	52.91 ±11.33	0.295	60.37 ±12.33	52.91 ±11.33	<0.001
Age at menarche, years (mean ±s.d.) ^b	15.51±1.95	16.09±1.93	<0.001						
Age at natural menopause, years (mean ±s.d.) ^c	48.47 ±4.76	49.11 ±4.26	0.010						
Age at first live birth, years (mean ±s.d.) ^d									
Menopausal status									
Premenopausal									
Natural menopausal									
Unnatural menopausal									
Estrogen receptor (ER)									
Positive									
Negative									
Progesterone receptor (PR)									
Positive									
Negative									

^a Age information was available in 70 breast cancer cases in Discover stage, 3215 breast cancer cases and 2660 controls in Validation stage.
^b Age at menarche information was available in 67 breast cancer cases in Discover stage, 3040 breast cancer cases and 2649 controls in Validation stage.
^c Age at natural menopause age information was available in 40 breast cancer cases in Discover stage, 983 breast cancer cases and 1129 controls in Validation stage.
^d Age at first live birth information was available in 64 breast cancer cases in Discover stage ,1812 breast cancer cases and 2236 controls in Validation stage.
^e Menopause information was available in 70 breast cancer cases in Discover stage, 3080 breast cancer cases and 2637 controls in Validation stage.
^f ER, PR and HER2 status information were available in 53, 50, and 43 breast cancer cases in Discover stage, 2852, 2841 and 1389 breast cancer cases in Validation stage, respectively.
^g Hepatocellular carcinoma and colorectal cancer shared the cancer-free control samples.
^h Gender information was available in 1095 colorectal cancers.

Supplementary Table 4. 48 variants obtained from *BRCA1/2* scanning in 70 familial breast cancer cases

Gene	Location(hg19)	Variant type	Nucleotide change	MAF (1000 Genomes Project)	Classification of ENIGMA ^a
<i>BRCA1</i>	chr17:41209081-41209081	synonymous	c.5560C>A	NA	Class 3
<i>BRCA1</i>	chr17:41215910-41215910	frameshift	c.5133del	NA	Class 3
<i>BRCA1</i>	chr17:41223094-41223094	missense	c.4837A>G	0.3558	Class 1
<i>BRCA1</i>	chr17:41223130-41223130	nonsense	c.4801A>T	NA	Class 5
<i>BRCA1</i>	chr17:41228529-41228529	missense	c.4460A>G	NA	Class 3
<i>BRCA1</i>	chr17:41234470-41234470	synonymous	c.4803T>C	0.371	Class 3
<i>BRCA1</i>	chr17:41244000-41244000	missense	c.3548A>G	0.371	Class 1
<i>BRCA1</i>	chr17:41244100-41244100	missense	c.3448C>T	0.004	Class 3
<i>BRCA1</i>	chr17:41244291-41244291	nonsense	c.3257del	NA	Class 5
<i>BRCA1</i>	chr17:41244435-41244435	missense	c.3113A>G	0.371	Class 1
<i>BRCA1</i>	chr17:41244936-41244936	missense	c.2612C>A	0.371	Class 3
<i>BRCA1</i>	chr17:41244982-41244982	missense	c.2566T>C	0.014	Class 1
<i>BRCA1</i>	chr17:41245237-41245237	synonymous	c.2311T>C	0.3353	Class 1
<i>BRCA1</i>	chr17:41245466-41245466	synonymous	c.2082C>T	0.3365	Class 1
<i>BRCA1</i>	chr17:41245587-41245587	frameshift	c.1961del	NA	Class 5
<i>BRCA1</i>	chr17:41245847-41245848	frameshift	c.1700dup	NA	Class 5
<i>BRCA1</i>	chr17:41246724-41246724	missense	c.824G>A	NA	Class 3
<i>BRCA1</i>	chr17:41246753-41246753	synonymous	c.795T>C	0.001	Class 1
<i>BRCA1</i>	chr17:41256140-41256140	missense	c.440del	NA	Class 3
<i>BRCA1</i>	chr17:41258487-41258487	synonymous	c.198T>C	NA	Class 2
<i>BRCA1</i>	chr17:41267763-41267763	synonymous	c.114G>A	0.0126	Class 1
<i>BRCA2</i>	chr13:32899249-32899249	missense	c.353G>A	NA	Class 3
<i>BRCA2</i>	chr13:32906480-32906480	missense	c.865A>C	0.0737	Class 1
<i>BRCA2</i>	chr13:32906729-32906729	missense	c.1114A>C	0.2494	Class 1
<i>BRCA2</i>	chr13:32906980-32906980	synonymous	c.1365A>G	0.0737	Class 1
<i>BRCA2</i>	chr13:32910452-32910452	missense	c.1960G>A	NA	Class 3
<i>BRCA2</i>	chr13:32910721-32910721	synonymous	c.2229T>C	0.095	Class 1
<i>BRCA2</i>	chr13:32910963-32910963	nonsense	c.2471T>G	NA	Class 5
<i>BRCA2</i>	chr13:32911463-32911463	missense	c.2971A>G	0.097	Class 1
<i>BRCA2</i>	chr13:32911516-32911516	synonymous	c.3257C>T	NA	Class 3
<i>BRCA2</i>	chr13:32911757-32911757	nonsense	c.3265C>T	NA	Class 5
<i>BRCA2</i>	chr13:32911888-32911888	synonymous	c.3396A>C	0.368	Class 1
<i>BRCA2</i>	chr13:32912299-32912299	synonymous	c.3807T>C	0.173	Class 1
<i>BRCA2</i>	chr13:32912699-32912699	missense	c.4207A>G	NA	Class 3
<i>BRCA2</i>	chr13:32912799-32912799	missense	c.4307T>C	NA	Class 3
<i>BRCA2</i>	chr13:32913055-32913055	synonymous	c.4563A>G	NA	Class 1
<i>BRCA2</i>	chr13:32913070-32913070	synonymous	c.4578A>C	0.001	Class 2
<i>BRCA2</i>	chr13:32914173-32914174	nonsense	c.5681dup	NA	Class 5
<i>BRCA2</i>	chr13:32915005-32915005	synonymous	c.6513G>C	NA	Class 1
<i>BRCA2</i>	chr13:32929083-32929083	missense	c.7093C>A	NA	Class 3
<i>BRCA2</i>	chr13:32929140-32929140	nonsense	c.7149T>A	NA	Class 3
<i>BRCA2</i>	chr13:32929232-32929232	synonymous	c.7242A>G	0.369	Class 1
<i>BRCA2</i>	chr13:32929399-32929400	frameshift	c.7409dup	NA	Class 5
<i>BRCA2</i>	chr13:32930651-32930651	missense	c.7522G>A	NA	Class 3
<i>BRCA2</i>	chr13:32937526-32937526	missense	c.8187G>T	0.012	Class 1
<i>BRCA2</i>	chr13:32930598-32930598	missense	c.7469T>C	0.003	Class 1
<i>BRCA2</i>	chr13:32972388-32972388	synonymous	c.9738C>A	NA	Class 2
<i>BRCA2</i>	chr13:32972884-32972884	missense	c.10234A>G	0.021	Class 1

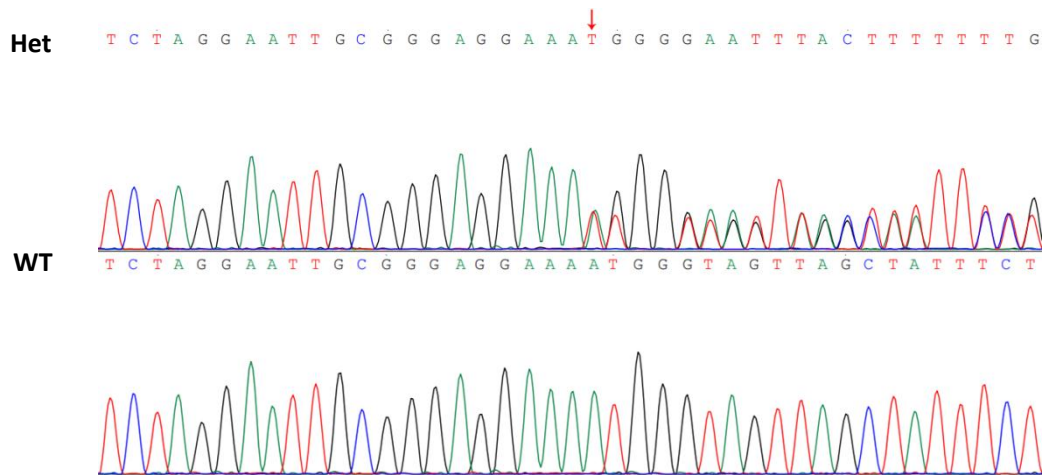
^a The ENIGMA classification was ascertained from BRCA exchange.

Supplementary Table 5. No recurrent BRCA1/2 germline variants in Validation stages

Gene	Nucleotide change	Validation stage							
		Breast Cancer		Cervical Cancer		Hepatocellular Carcinoma		Colorectal Cancer	
		Cases	Controls	Cases	Controls	Cases	Controls*	Cases	Controls*
		(N = 3217)	(N = 2660)	(N = 1133)	(N = 1098)	(N=2044)	(N=1116)	(N = 1116)	(N=1116)
<i>BRCA1</i>	c.5133delA	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA1</i>	c.4460A>G	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA1</i>	c.3448C>T	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA1</i>	c.1961del	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA1</i>	c.1700dup	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA1</i>	c.824G>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.353G>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.1960G>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.2471T>G	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.3265C>T	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.4207A>G	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.5681dup	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.7093C>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.7149T>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116
<i>BRCA2</i>	c.7522G>A	0/3217	0/2660	0/1133	0/1098	0/2044	0/1116	0/1116	0/1116

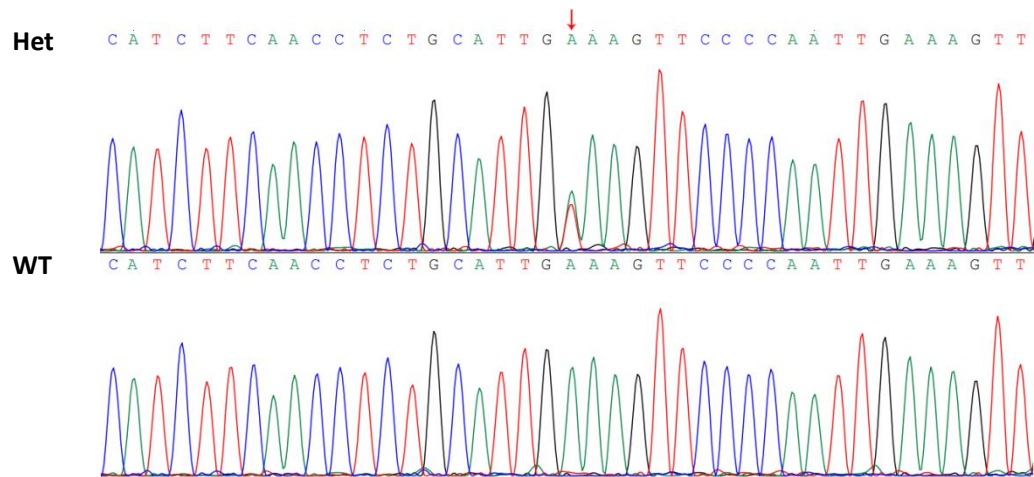
***BRCA1* c.5133delA**

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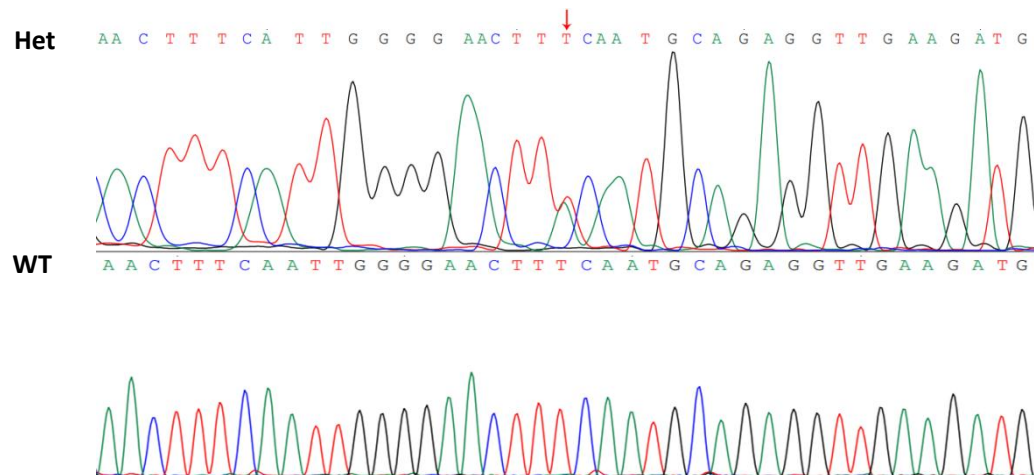


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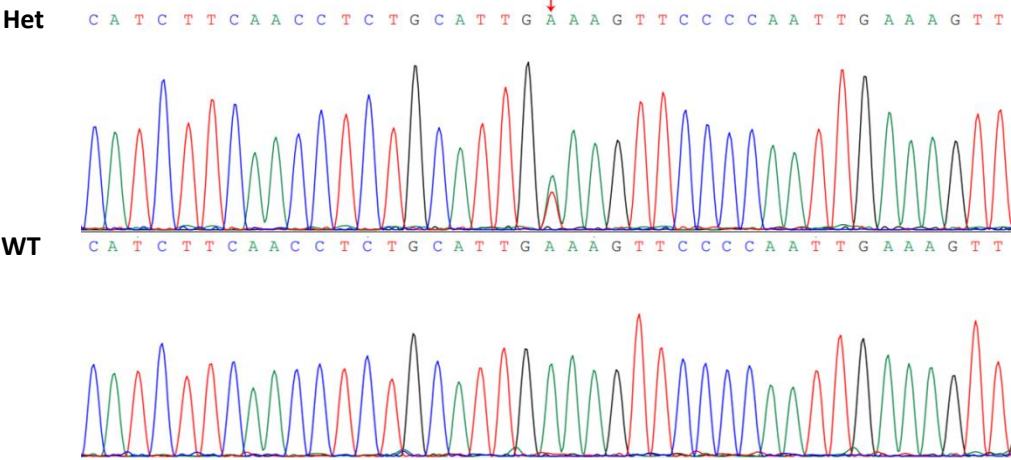
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Case.71

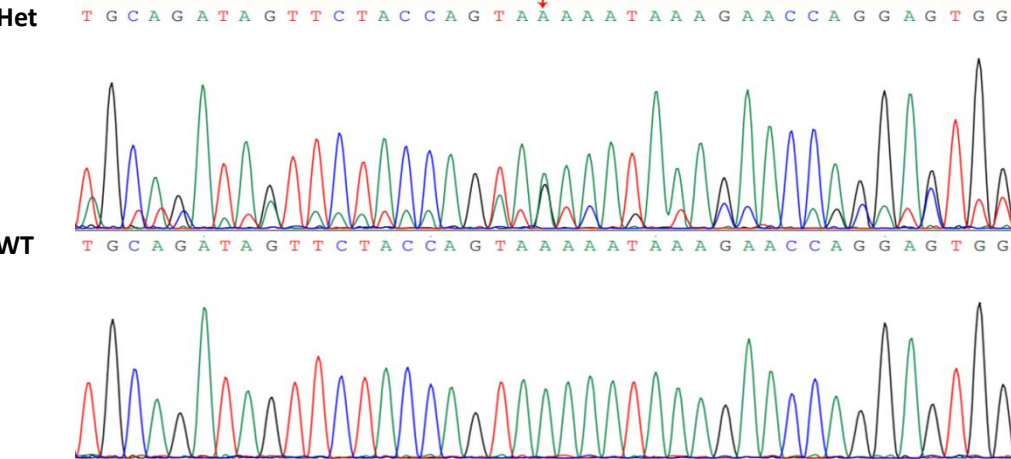


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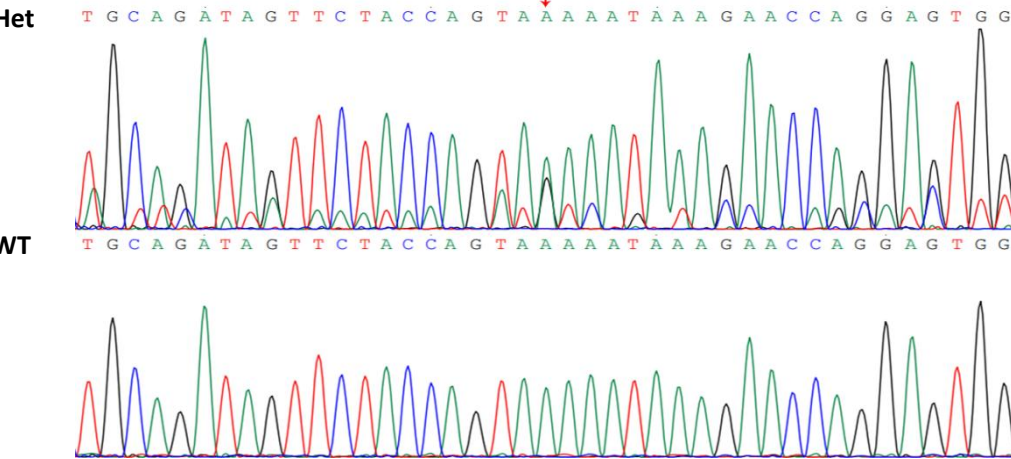


BRCA1 c.4460A>G

Case.21

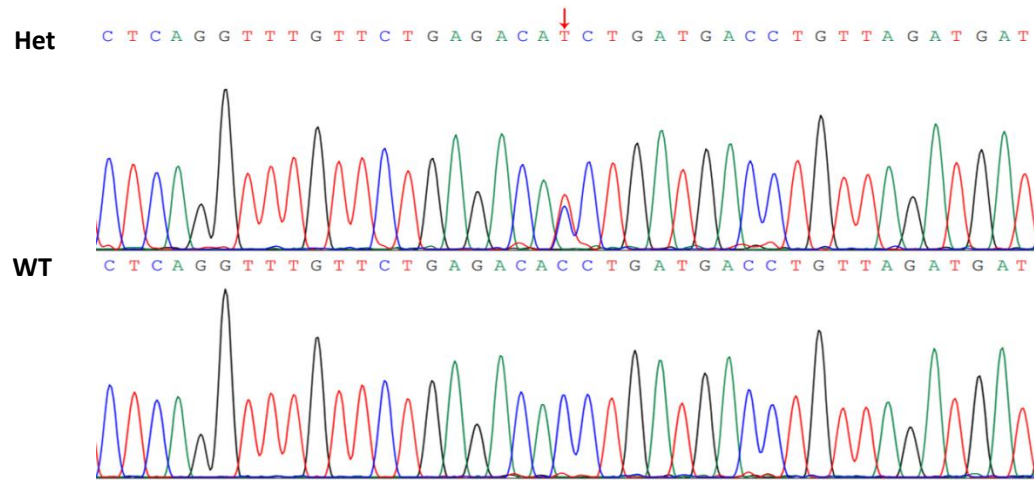


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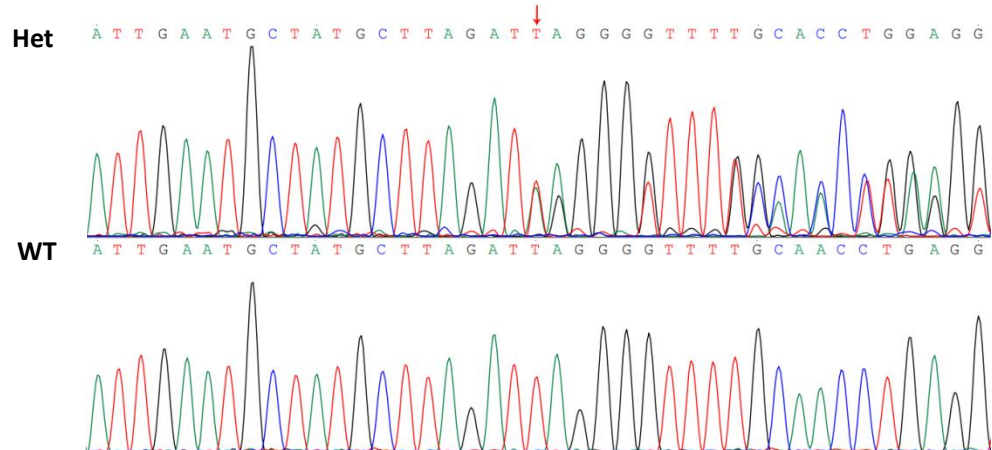
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1-14-12

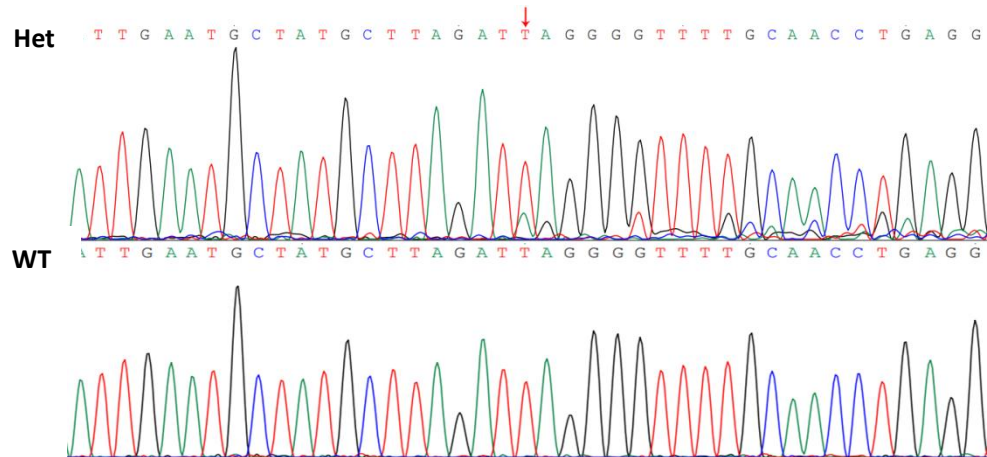


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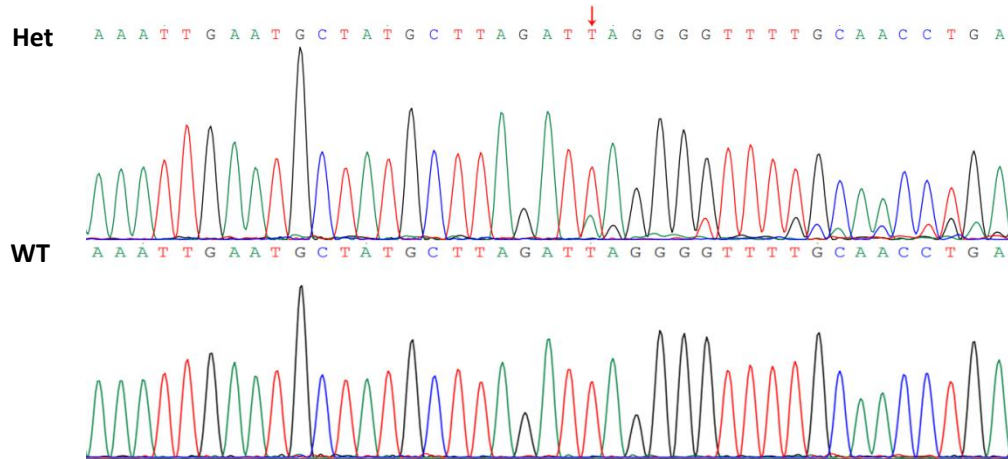
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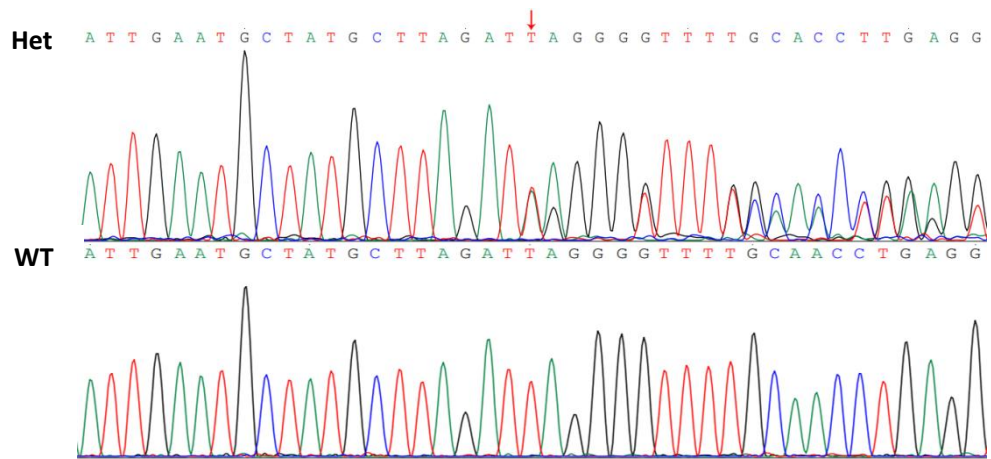
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Case.73

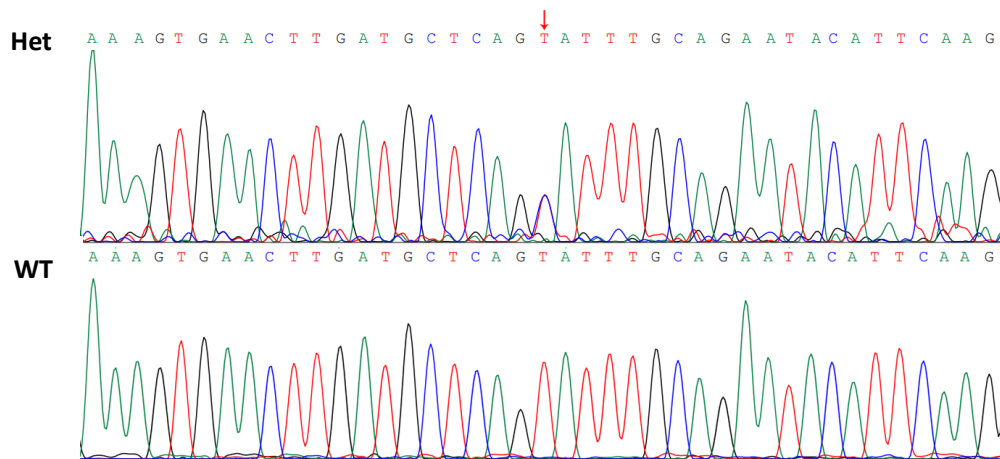


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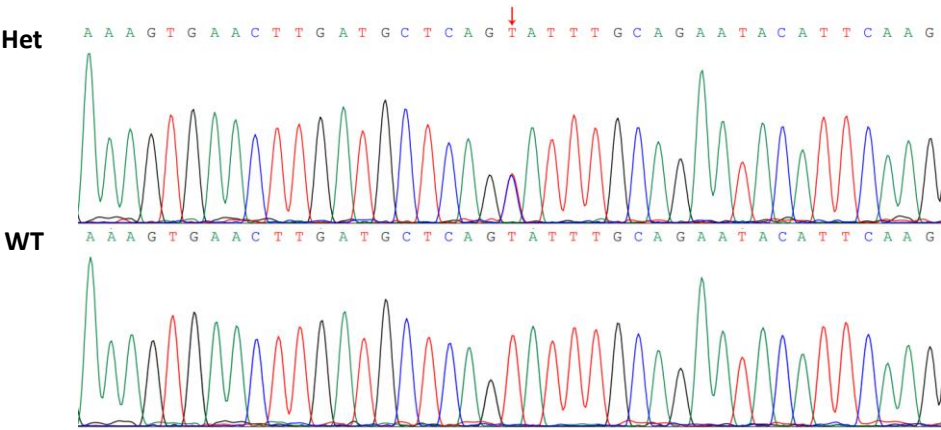


BRCA1 c.256T>C

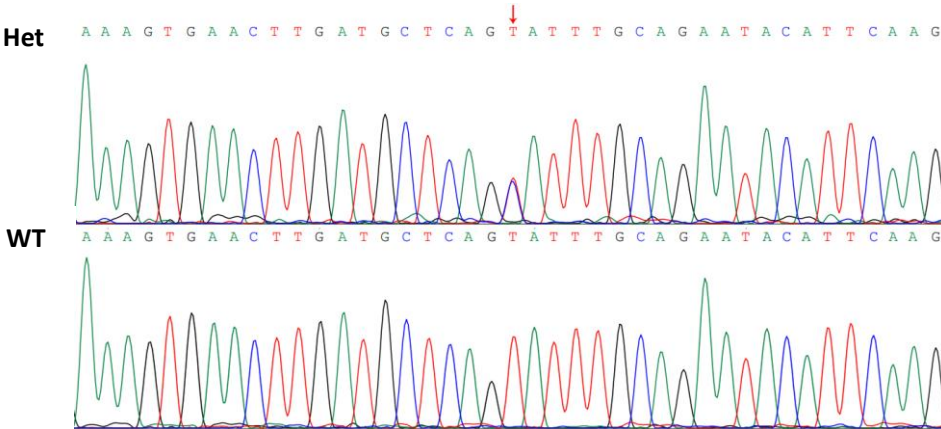
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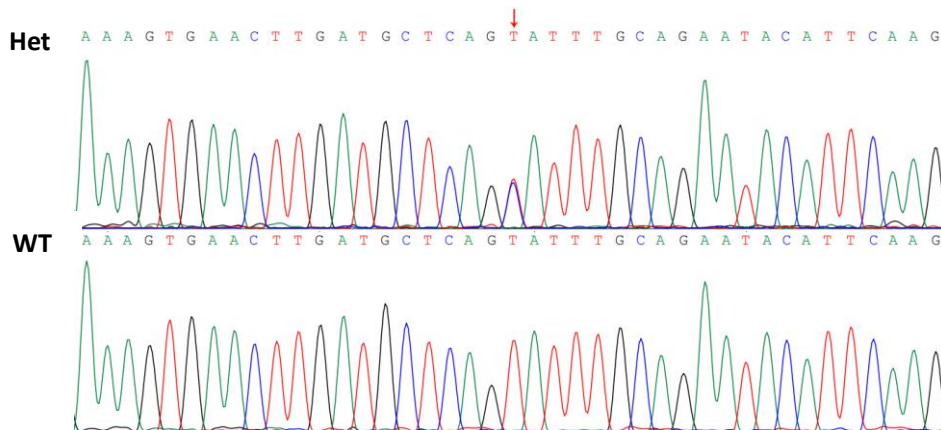
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Case.63

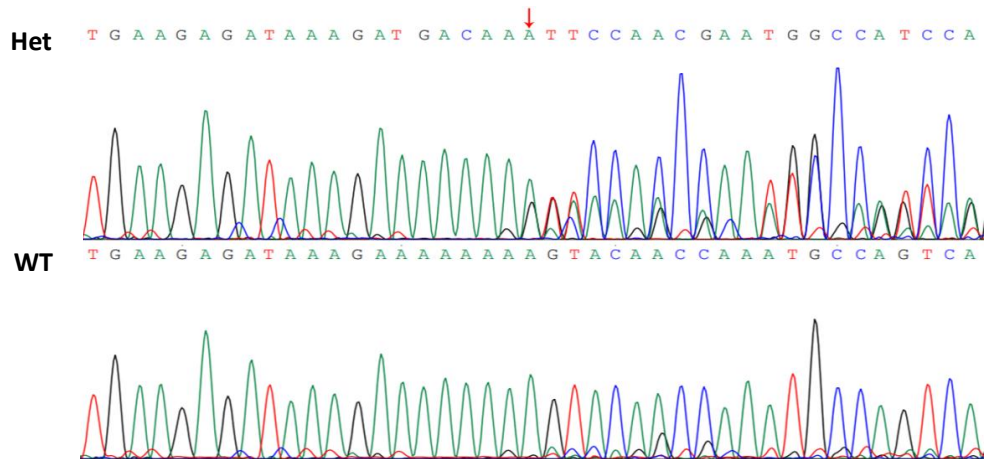


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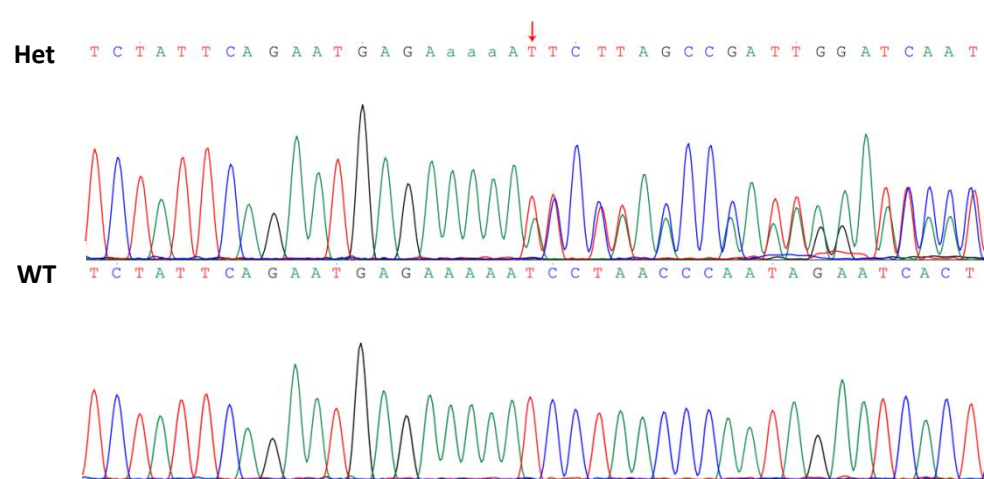
***BRCA1* c.1961delA**

Case.67



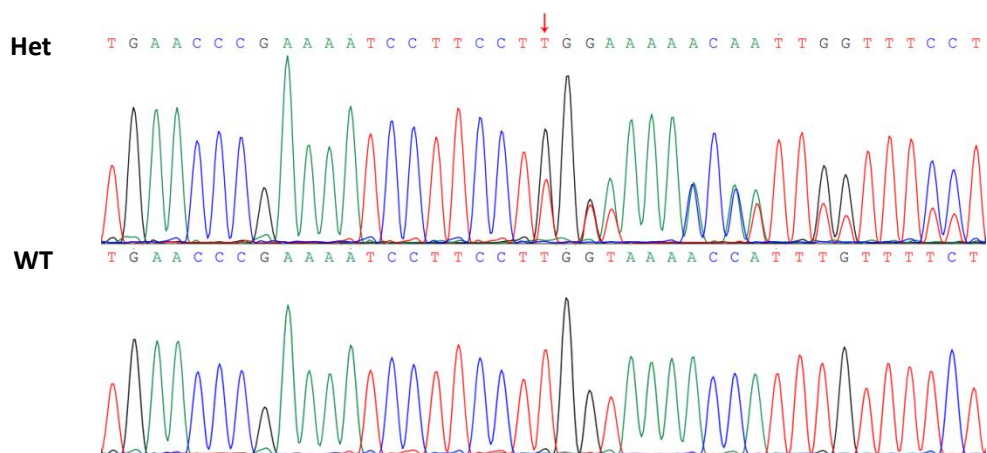
***BRCA1* c.1700_1701insA**

Case.40

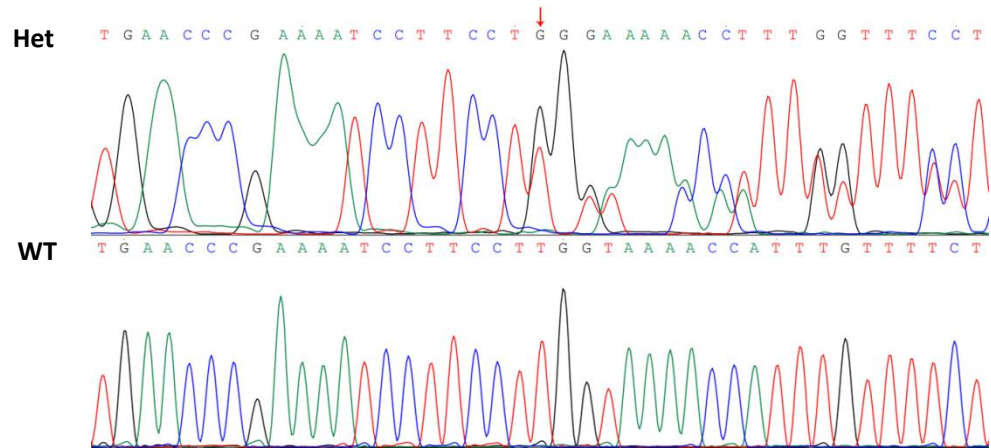


***BRCA1* c.440delT**

Case.50

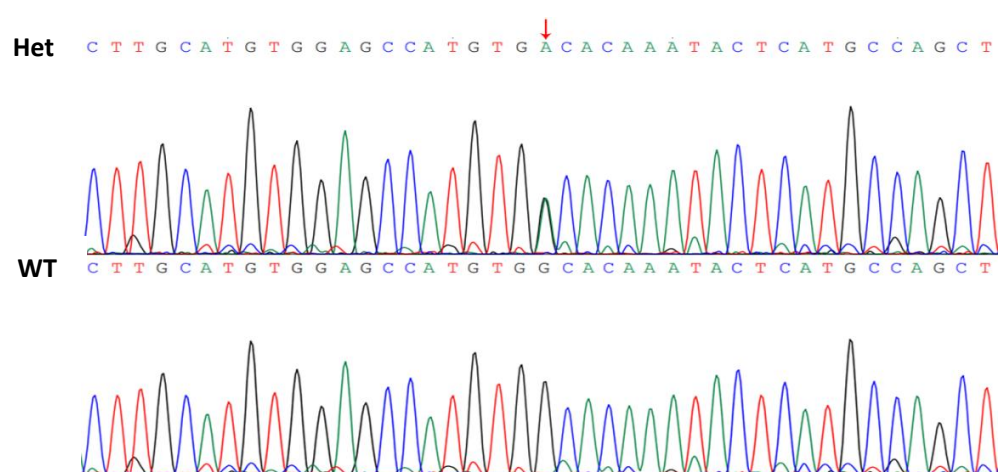


Case.75

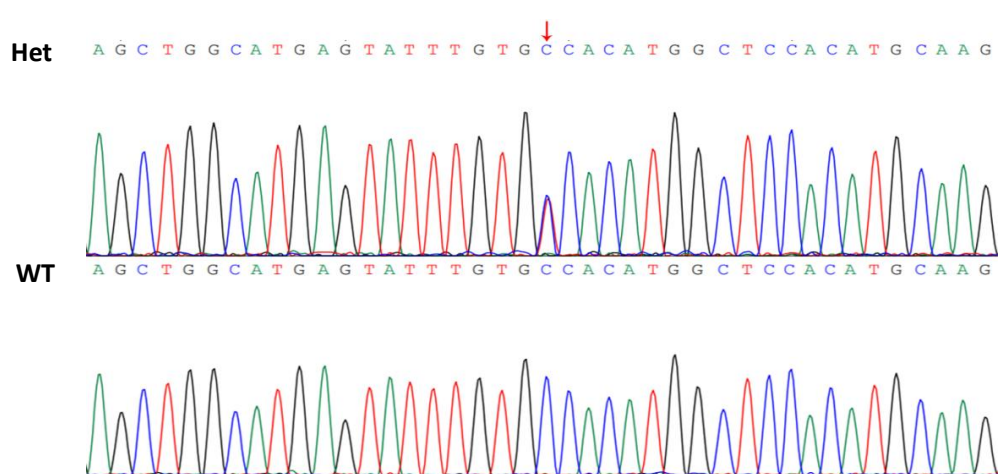


BRCA1 c.824G>A

Case.4

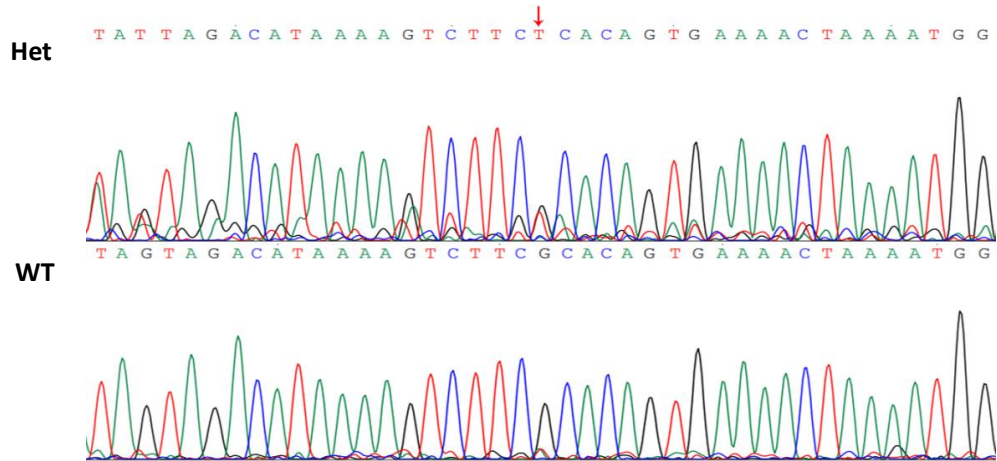


Case.70



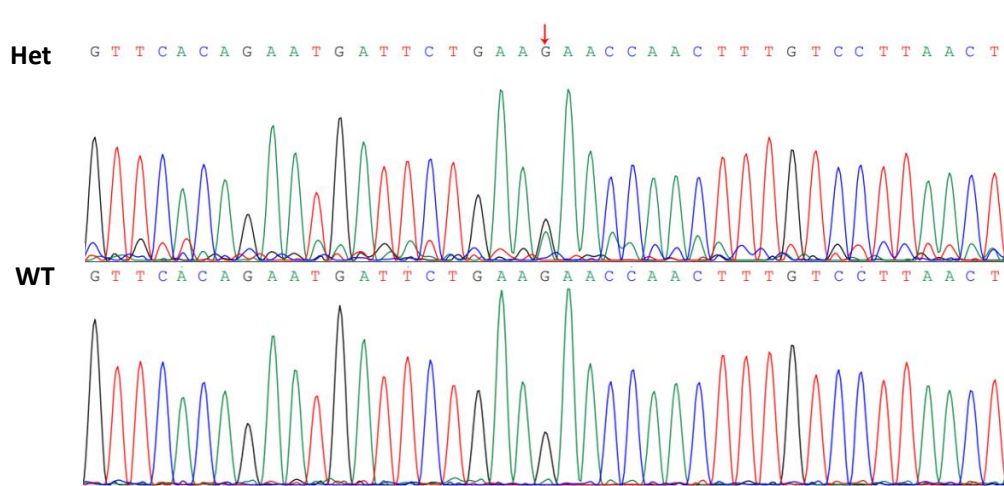
BRCA2 c.353G>A

Case.37



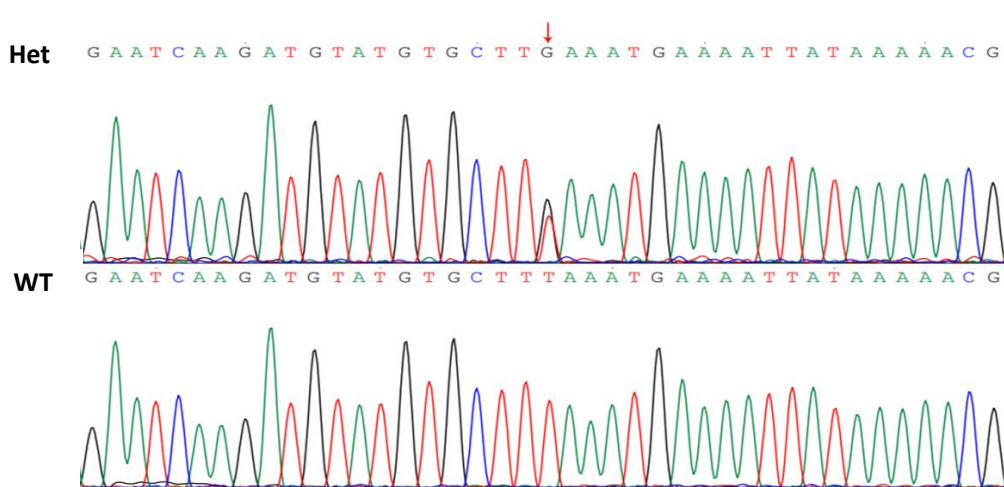
BRCA2 c.1960G>A

Case.25



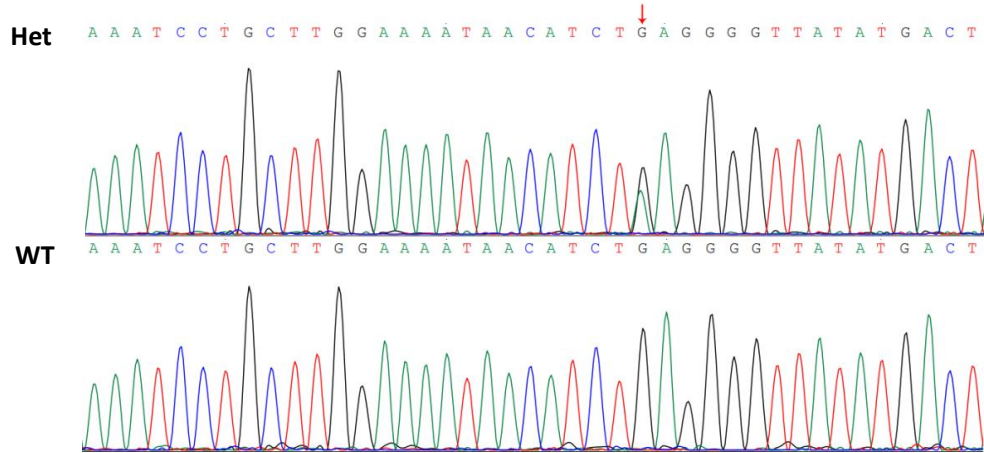
BRCA2 c.2471T>G

Case.10



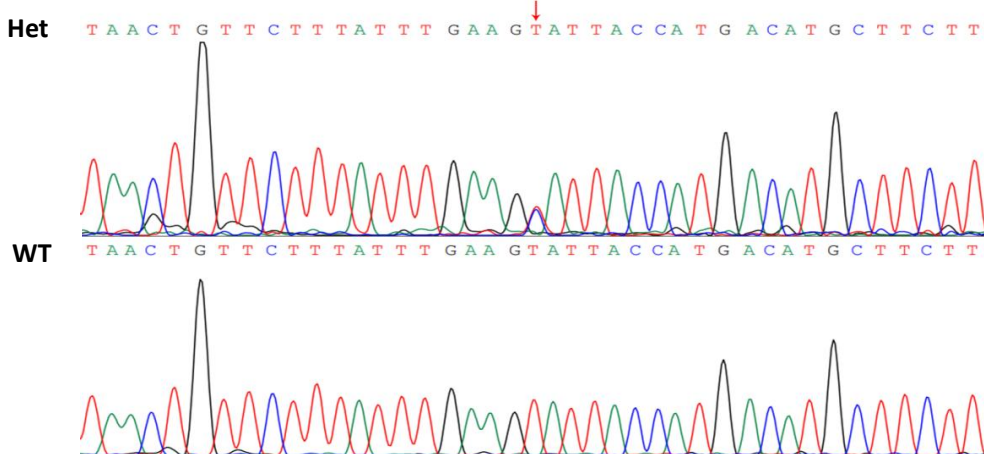
BRCA2 c.3265C>T

Case.57



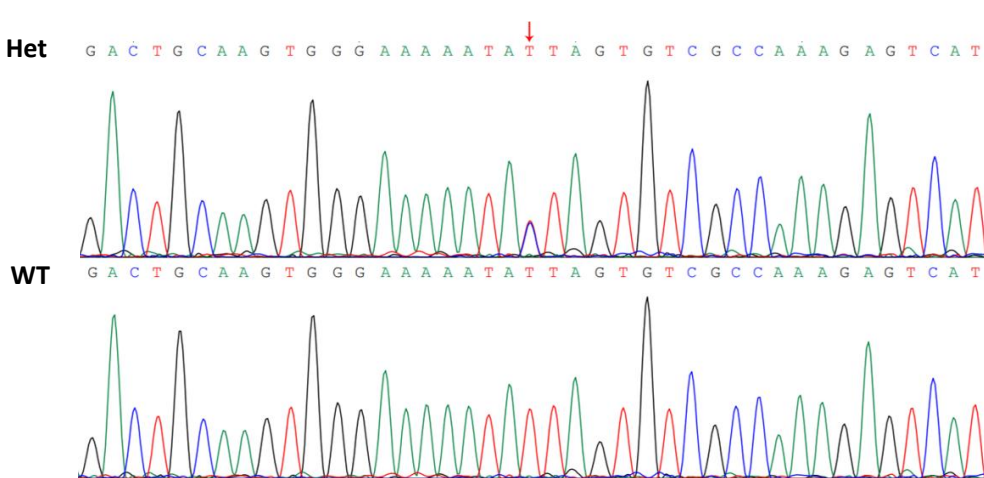
BRCA2 c.4207A>G

Case.35

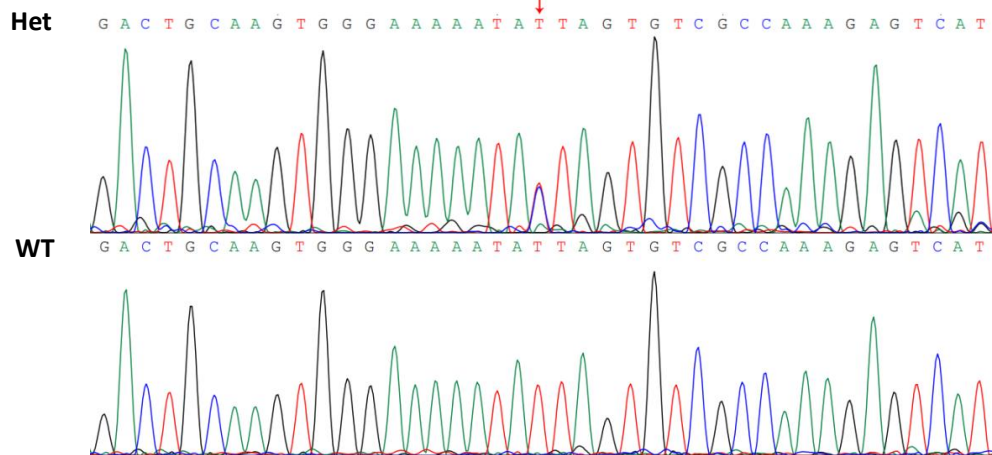


BRCA2 c.4307T>C

Case.64

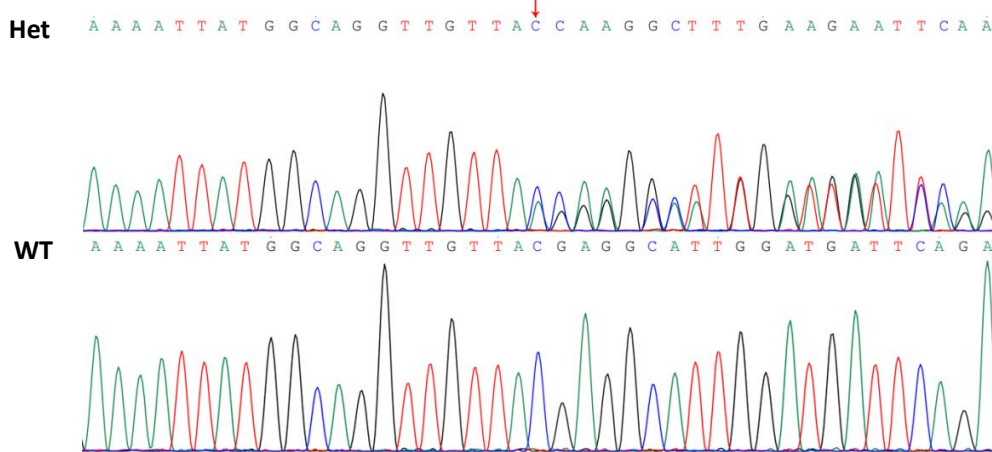


Case.79



BRCA2 c.5681dupA

Case.61



BRCA2 c.7093C>A

Case.26



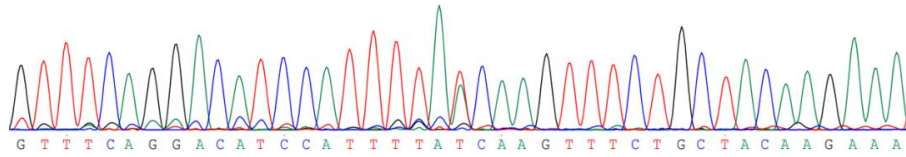
BRCA2 c.7149T>A

Case.69

Het

G T T T C A G G A C A T C C A T T T T A T C A A G T T T C T G C T A C A A G A A A

WT



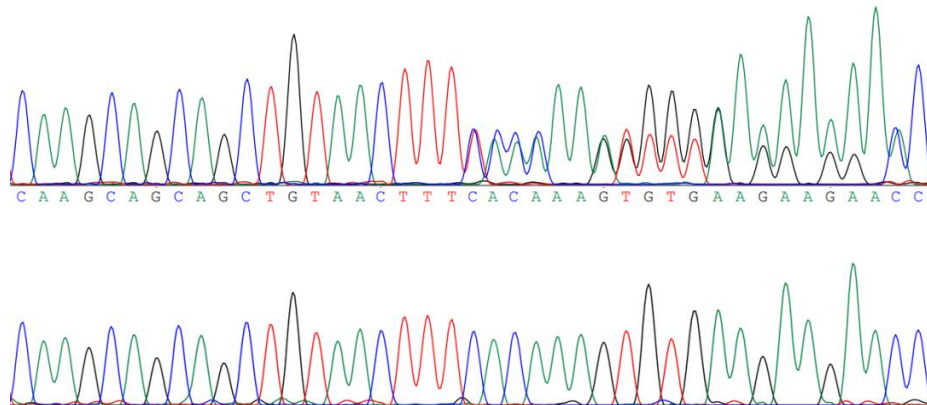
BRCA2 c.7409dupT

Case.18

Het

C A A G C A G C A G C T G T A A C T T T T C A C A A A T G G G A A A A A A C

WT

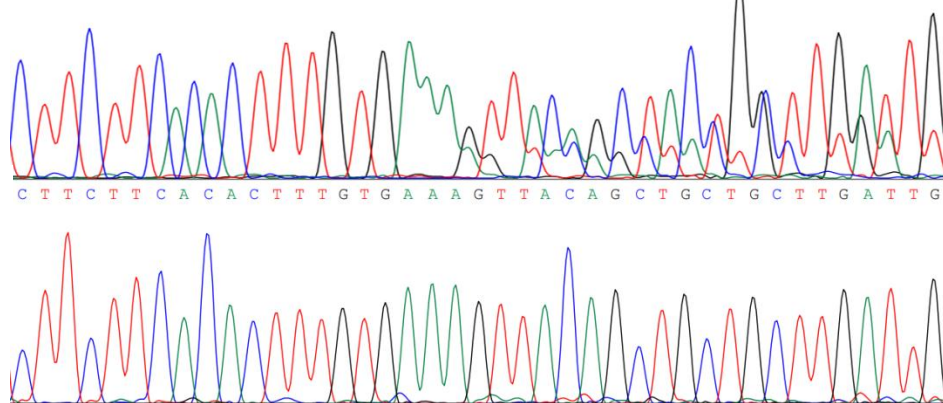


Case.76

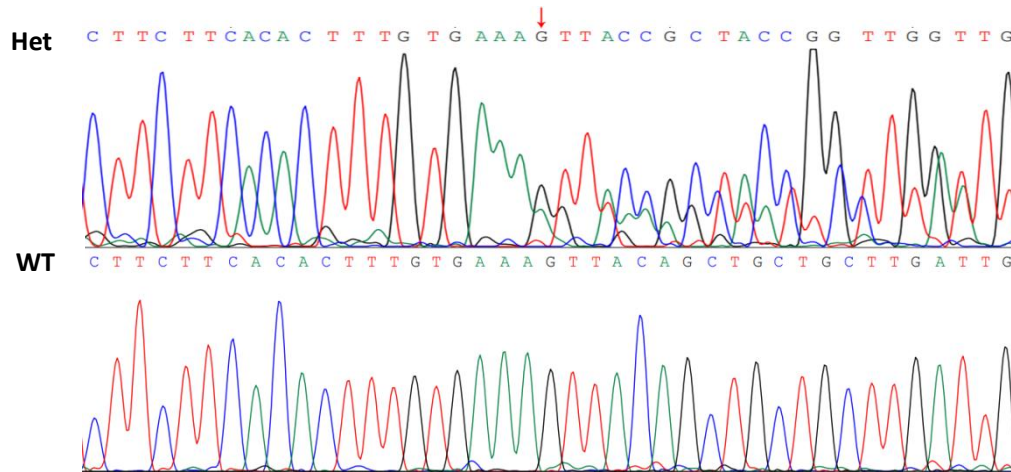
Het

C T T C T T C A C A C T T T G T G A A A G T T A C A G C C A C C G C T T G G T T T

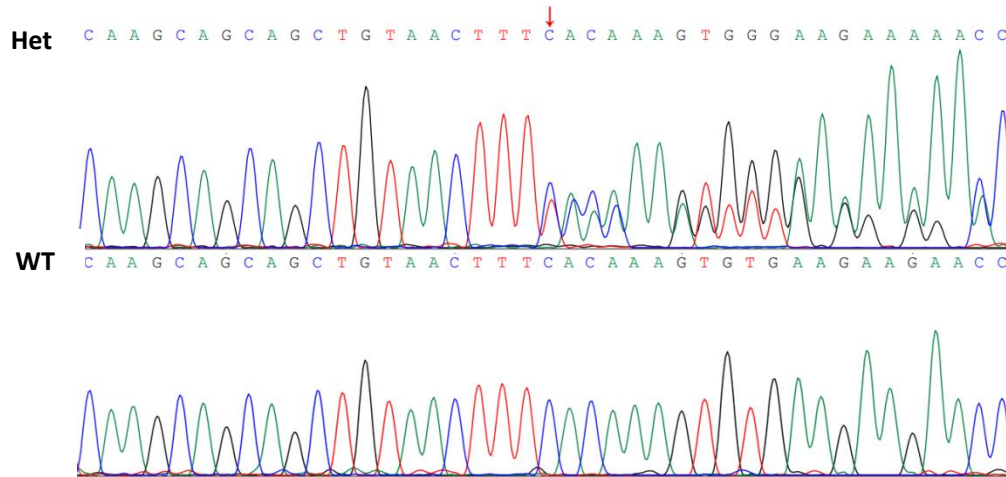
WT



Case.77

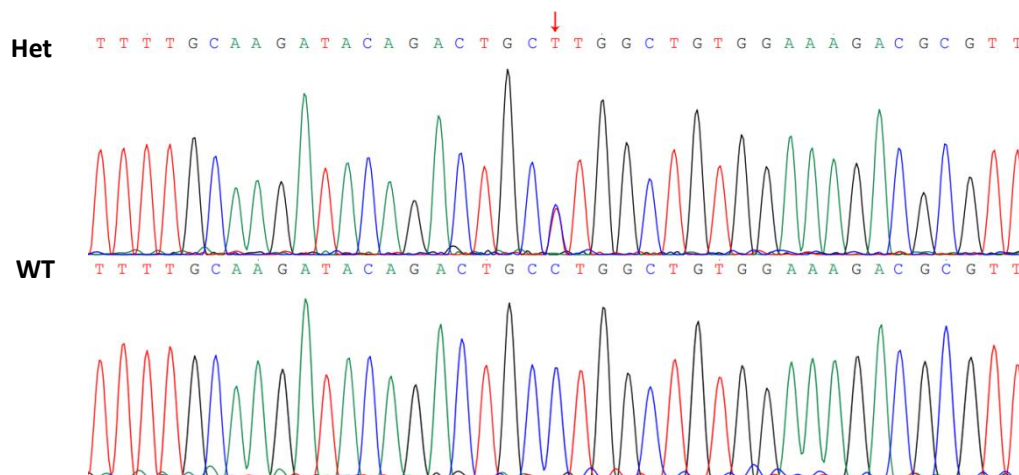


Case.80



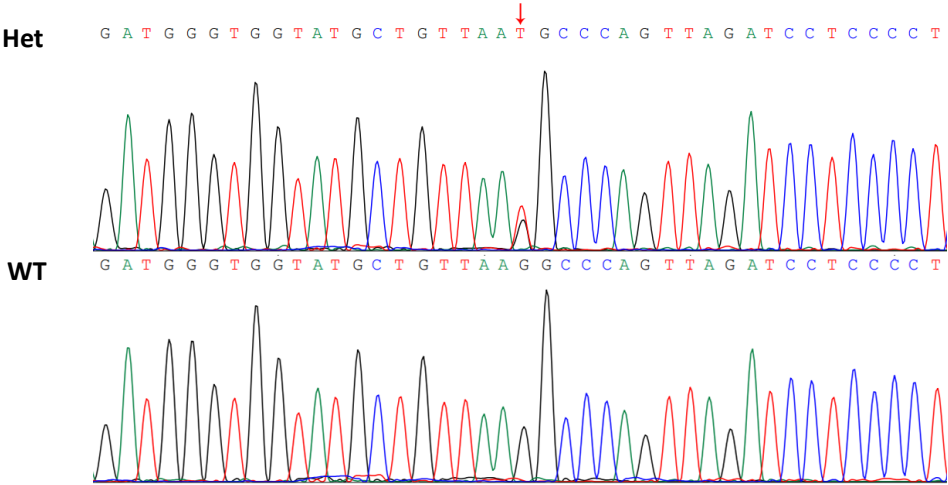
BRCA2 c.7522G>A

Case.3

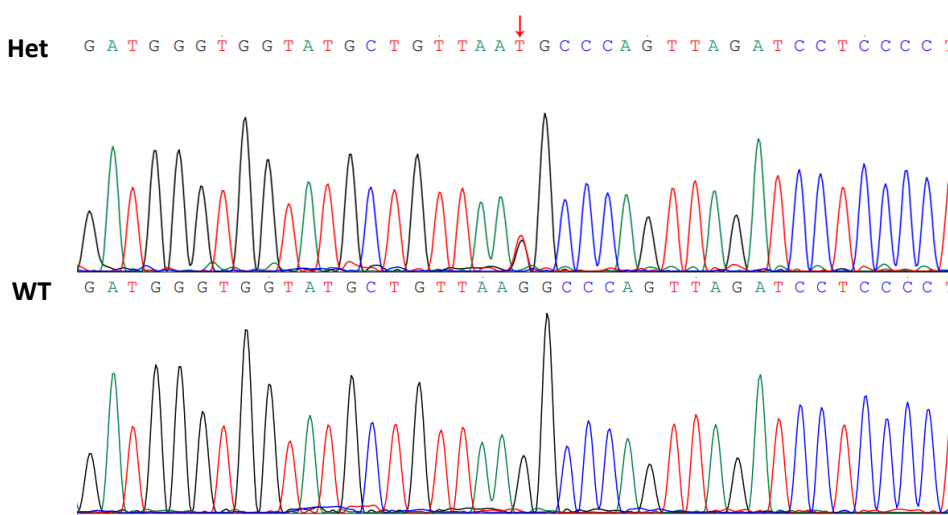


BRCA2 c.8414G>T

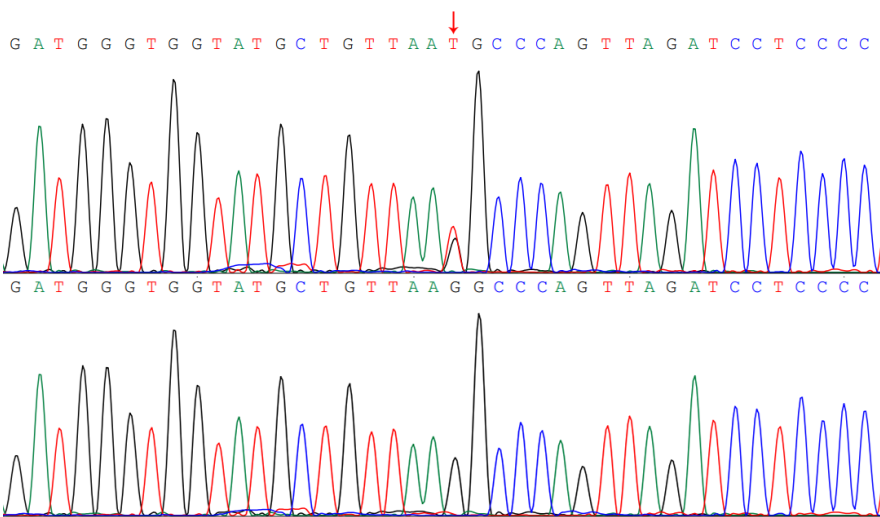
Case.36



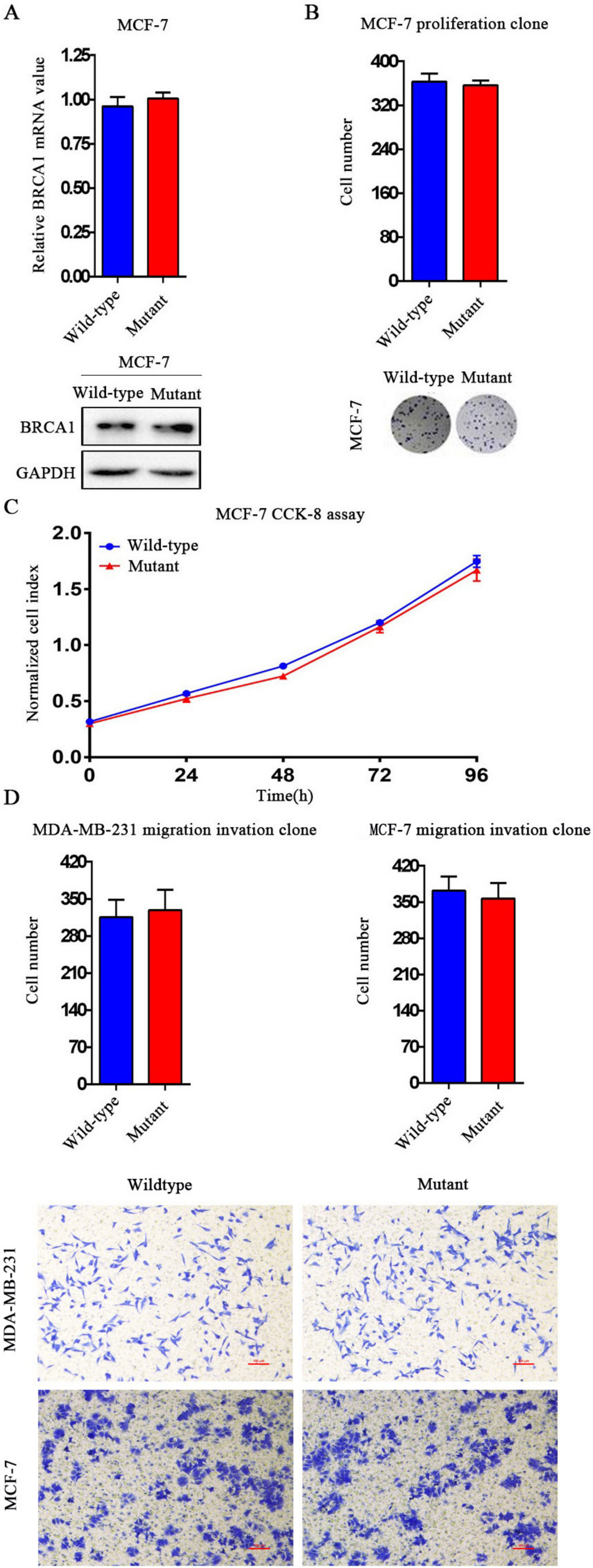
Case.43



Case.49

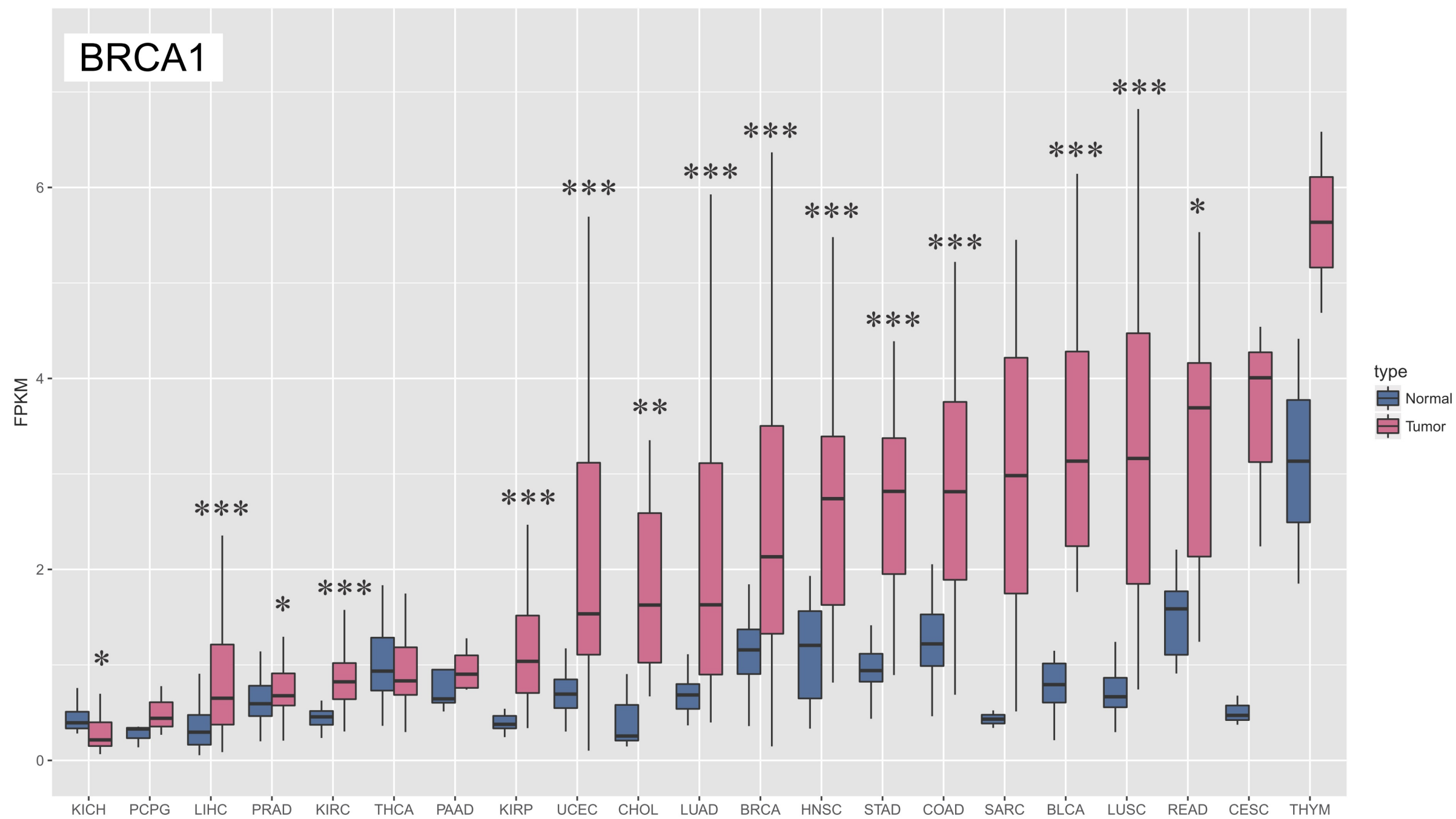


Supplementary Figure 2

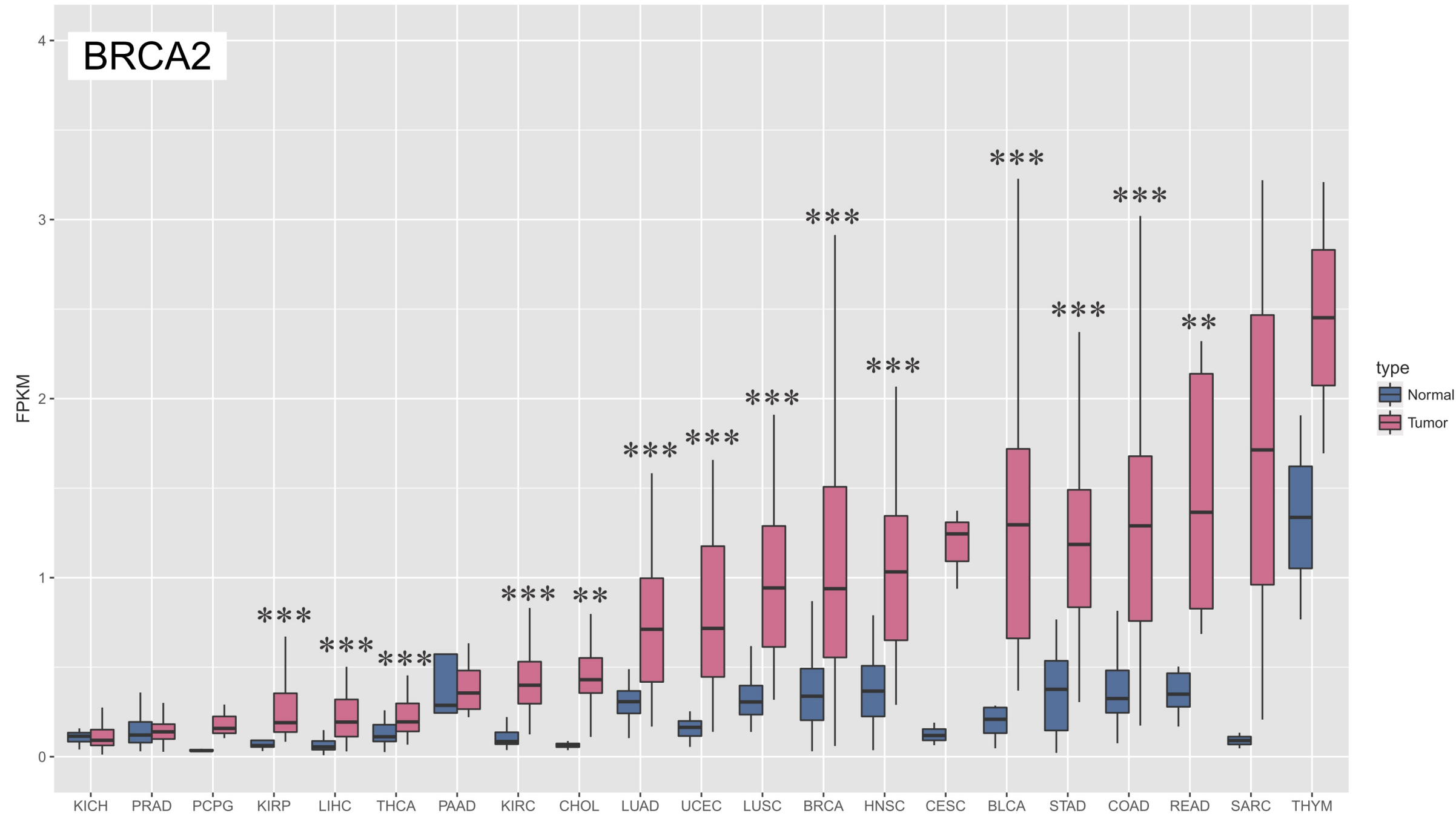


Supplementary Figure 3

A



B



Supplementary Table 1. Information of primers for *BRCA1*.

Supplementary Table 2. Information of primers for *BRCA2*.

Supplementary Table 3. Distributions of selected variables in multi-cancer cases and cancer-free controls.

Supplementary Table 4. 48 variants obtained from *BRCA1/2* scanning in 70 familial breast cancer cases.

Supplementary Table 5. No recurrent *BRCA1/2* germline variants in validation stages.

Supplementary Figure 1. Sequence results of 20 detected variants in 31 cases in *BRCA1* and *BRCA2*.

Supplementary Figure 2. (A) The mRNA level of MCF-7 transfected with different plasmids showed no significant difference in different groups ($P > 0.05$). Western blot analysis showed that the *BRCA1* proteins translated by *BRCA1* c.3257del were not truncated in MCF-7 cells. (B) The colony formation efficiency of MCF-7 transfected with *BRCA1* c.3257del was not increased ($P > 0.05$). (C) *BRCA1* c.3257del-overexpressing MCF-7 cell proliferation efficiency was not increased as measured by the CCK-8 assay in vitro ($P > 0.05$). (D) Both MDA-MB-231 and MCF-7 cell migration were measured by transwell assay, and no significant difference in cell migration was detected ($P > 0.05$).

Supplementary Figure 3. *BRCA1* and *BRCA2* expression data from TCGA in multiple tumors compared with paired normal tissues.