

Table S1. Clinicopathological features of sporadic childhood PTCs according to the oncogenes

	<i>BRAF</i> ^{V600E}	<i>RET/PTC1</i>	<i>RET/PTC3</i>	<i>ETV6ex4/NTRK3</i>	<i>TBL1XR1/RET</i> ¹	<i>TNIP1/RET</i> ¹	Any <i>RET/PTC</i>	Unknown
Number of patients	5 (14.7%)	4 (11.8%)	6 (17.6%)	6 (17.6%)	1 (2.9%)	1 (2.9%)	12 (35.3%)	11 (32.4%)
Age, mean ± SD, years	13.6 ± 1.2	11.7 ± 2.0	11.9 ± 3.2	12.6 ± 1.5	11.4	13.0	11.9 ± 2.4	12.2 ± 3.1
Sex, F/M (%F)	5/0 (100%)	3/1 (75%)	1/5 (16.7%)	5/1 (83.3%)	1/0 (100%)	1/0 (100%)	6/6 (50%)	6/5 (54.5%)
Tumors size, mean ± SD, mm	14.4 ± 3.4	21.3 ± 15.9	19.3 ± 10.1	12.8 ± 2.9	17	35	21.1 ± 11.7	15.7 ± 8.5
microcarcinoma	1 (20%)	0	1 (16.7%)	1 (16.7%)	0	0	1 (8.3%)	3 (27.3%)
11-20 mm	4 (80%)	3 (75%)	2 (33.3%)	5 (83.3%)	1 (100%)	0	6 (50.0%)	5 (45.5%)
≥ 21 mm	0	1 (25%)	3 (50.0%)	0	0	1 (100%)	5 (41.7%)	3 (27.3%)
pT category								
1	5 (100%)	3 (75%)	2 (33.3%)	6 (100%)	1 (100%)	0	6 (50%)	8 (72.7%)
2	0	0	1 (16.7%)	0	0	1 (100%)	2 (16.7%)	3 (27.3%)
3	0	1 (25%)	3 (50.0%)	0	0	0	4 (33.3%)	0
Lymph node metastasis	5 (100%)	4 (100%)	6 (100%)	3 (50%)	1 (100%)	1 (100%)	12 (100%)	6 (54.5%)
N1a	2 (40%)	1 (25%)	0	0	0	0	1 (8.3%)	1 (9.1%)
N1b	3 (60%)	3 (75%)	6 (100%)	3 (50%)	1 (100%)	1 (100%)	11 (91.7%)	5 (45.5%)
Distant metastasis	0	0	1 (16.7%)	0	0	0	1 (8.3%)	0
Multifocality	0	1 (25%)	2 (33.3%)	1 (16.7%)	0	1 (100%)	4 (33.3%)	1 (9.1%)
Intrathyroidal spread	4 (80%)	3 (75%)	6 (100%)	5 (83.3%)	1 (100%)	1 (100%)	11 (91.7%)	8 (72.7%)
Extrathyroidal extension	0	0	3 (50.0%)	0	0	0	3 (25.0%)	0
Vascular invasion	5 (100%)	4 (100%)	6 (100%)	6 (100%)	1 (100%)	1 (100%)	12 (100%)	10 (90.9%)
Tumor capsule	0	0	0	0	0	0	0	2 (18.2%)
Invasiveness score								
0	0	0	0	0	0	0	0	1 (9.1%)
1	0	0	0	1 (16.7%)	0	0	0	1 (9.1%)
2	1 (20%)	1 (25%)	0	2 (33.3%)	0	0	1 (8.3%)	4 (36.4%)
3	4 (80%)	2 (50%)	0	2 (33.3%)	1 (100%)	0	3 (25.0%)	4 (36.4%)
4 (max)	0	1 (25%)	6 (100%)	1 (16.7%)	0	1 (100%)	8 (66.7%)	1 (9.1%)
Clinical stage								
I	5 (100%)	4 (100%)	5 (83.3%)	6 (100%)	1 (100%)	1 (100%)	11 (91.7%)	1 (100%)
II	0	0	1 (16.7%)	0	0	0	1 (8.3%)	0
Dominant component								
papillary	5 (100%)	4 (100%)	1 (16.7%)	1 (16.7%)	0	1 (100%)	6 (50.0%)	4 (36.4%)
follicular	0	0	0	4 (66.7%)	0	0	0	6 (54.5%)
solid-trabecular	0	0	5 (83.3%)	1 (16.7%)	1 (100%)	0	6 (50.0%)	1 (9.1%)

¹ these fusion genes were discovered using RNA-seq as described in details in the corresponding subsection below

Table S2. Statistical assessment of clinicopathological features of sporadic childhood PTCs according to the oncogene¹

	<i>BRAF</i> ^{V600E}	<i>RET/PTC1</i>	<i>RET/PTC3</i>	<i>ETV6ex4/NTRK3</i>	<i>TBLIXR1/RET</i>	<i>TNIP1/RET</i>	Any <i>RET/PTC</i>	Unknown
Number of patients (%)	5 (14.7%)	4 (11.8%)	6 (17.6%)	6 (17.6%)	1 (2.9%)	1 (2.9%)	12 (35.3%)	11 (32.4%)
Age at operation, years	0.196; 0.193	0.364; -0.131	0.775; -0.046	0.912; -0.020	0.588; -0.110	0.941; 0.022	0.292; -0.156	0.856; 0.029
Sex	0.137; 0.307	1.0; 0.079	0.014; 0.465	0.389; 0.180	1.0; 0.129	1.0; 0.129	0.265; 0.227	0.459; 0.147
Tumor size, mm	0.962; -0.011	0.630; 0.071	0.612; 0.077	0.364; 0.136	0.647; 0.090	0.176; 0.218	0.146; 0.218	0.490; -0.103
microcarcinoma	1.0; 0.026	1.0; 0.169	1.0; 0.012	1.0; 0.012	1.0; 0.081	1.0; 0.081	0.389; 0.180	0.363; 0.175
11-20 mm	0.379; 0.179	0.627; 0.120	0.202; 0.240	0.364; 0.231	1.0; 0.146	0.412; 0.208	0.487; 0.132	0.458; 0.188
≥ 21 mm	0.309; 0.230	1.0; 0.013	0.126; 0.289	0.297; 0.257	1.0; 0.097	0.235; 0.314	0.098; 0.316	1.0; 0.061
pT category	0.348; 0.249	0.511; 0.199	0.005; 0.560	0.269; 0.278	0.831; 0.104	0.050; 0.419	0.012; 0.508	0.160; 0.328
pT1	0.293; 0.249	1.0; 0.012	0.031; 0.422	0.162; 0.278	1.0; 0.104	0.265; 0.290	0.040; 0.394	1.0; 0.013
pT2 and pT3	0.293; 0.249	1.0; 0.012	0.031; 0.422	0.162; 0.278	1.0; 0.104	0.265; 0.290	0.040; 0.394	1.0; 0.013
Lymph node metastasis	0.309; 0.230	0.551; 0.203	0.297; 0.257	0.126; 0.289	1.0; 0.097	1.0; 0.097	0.030; 0.410	0.079; 0.357
N1a	0.094; 0.364	0.409; 0.150	1.0; 0.169	1.0; 0.169	1.0; 0.064	1.0; 0.064	1.0; 0.079	1.0; 0.057
N1b	1.0; 0.041	1.0; 0.079	0.069; 0.342	0.641; 0.142	1.0; 0.129	1.0; 0.129	0.024; 0.417	0.138; 0.279
Distant metastasis (M1)	1.0; 0.072	1.0; 0.064	0.176; 0.376	1.0; 0.081	1.0; 0.030	1.0; 0.030	0.353; 0.236	1.0; 0.120
Multifocality	0.559; 0.192	0.559; 0.070	0.281; 0.190	1.0; 0.012	1.0; 0.081	0.176; 0.376	0.154; 0.304	0.638; 0.155
Intrathyroidal spread	1.0; 0.026	0.559; 0.070	0.562; 0.214	1.0; 0.012	1.0; 0.081	1.0; 0.081	0.389; 0.180	0.363; 0.175
Extrathyroidal extension	1.0; 0.129	1.0; 0.114	0.003; 0.672	1.0; 0.144	1.0; 0.054	1.0; 0.054	0.037; 0.421	0.535; 0.215
Vascular invasion	1.0; 0.072	1.0; 0.064	1.0; 0.081	1.0; 0.081	1.0; 0.030	1.0; 0.030	1.0; 0.129	0.324; 0.252
Tumor capsule	1.0; 0.104	1.0; 0.091	1.0; 0.116	1.0; 0.116	1.0; 0.595	1.0; 0.044	0.529; 0.185	0.098; 0.361
Invasiveness score	0.322; 0.381	1.0; 0.133	0.001; 0.717	0.617; 0.266	1.0; 0.221	0.618; 0.270	0.008; 0.620	0.167; 0.413
0	1.0; 0.072	1.0; 0.064	1.0; 0.081	1.0; 0.081	1.0; 0.030	1.0; 0.030	1.0; 0.129	0.324; 0.252
1	1.0; 0.104	1.0; 0.091	1.0; 0.116	0.326; 0.212	1.0; 0.044	1.0; 0.044	0.529; 0.185	1.0; 0.094
2	1.0; 0.035	1.0; 0.013	0.297; 0.257	0.609; 0.107	1.0; 0.097	1.0; 0.097	0.210; 0.265	0.388; 0.209
3	0.059; 0.357	0.627; 0.088	0.062; 0.364	1.0; 0.047	0.382; 0.221	1.0; 0.137	0.292; 0.201	1.0; 0.027
4	0.291; 0.268	1.0; 0.035	<0.001; 0.717	0.644; 0.129	1.0; 0.112	0.294; 0.270	0.001; 0.604	0.113; 0.308
Dominant component	0.063; 0.440	0.125; 0.387	0.001; 0.656	0.077; 0.384	0.235; 0.314	1.0; 0.185	0.004; 0.569	0.087; 0.396
papillary	0.016; 0.440	0.039; 0.387	0.180; 0.282	0.180; 0.282	1.0; 0.164	0.471; 0.185	1.0; 0.044	0.477; 0.148
follicular	0.291; 0.268	0.296; 0.236	0.148; 0.081	0.048; 0.378	1.0; 0.112	1.0; 0.112	0.006; 0.477	0.045; 0.381
solid-trabecular	0.309; 0.230	0.551; 0.203	0.001; 0.653	1.0; 0.075	0.235; 0.314	1.0; 0.097	0.013; 0.461	0.227; 0.235
Oncocytic changes	1.0; 0.104	1.0; 0.091	1.0; 0.116	0.326; 0.212	1.0; 0.044	1.0; 0.044	0.529; 0.185	1.0; 0.094

¹ each cell contains two numbers: first is a p-value from the Mann-Whitney (age and tumor size) or Fisher exact test (all other categorical variables); the second is Kendall's tau-b rank correlation coefficient (age and tumor size) or Cramer's V effect size (all other categorical variables); the magnitude of the effect size: V~0.1 small, V~0.3 medium, V~0.5 large

Table S3. Frequency of the *BRAF*^{V600E} mutation in pediatric PTC of radiation and sporadic etiology in different countries

Country	Patients' age	N	<i>BRAF</i> ^{V600E}	%	Sampling	Reference ¹
<i>Radiation-related</i>						
Belarus	6-20	34	0	0	1991-1992	[1]
Belarus	16.0 ± 5.0	64	10	15.6	1995-1998	[2]
Belarus/Ukraine	12-31	21	2	9.5	1995-1998	[1]
Ukraine	13.8 (10.3-15.7)	27	1	3.5	1995-2001	[3]
Ukraine	14.3	15	0	0	1998-2000	[4]
Ukraine	17.7 (14-24)	33	8	24.2	NS (2016) ^{1,2}	[5]
Ukraine	18.0 (13 - 23)	26	2	7.7	1998-2007	[6]
Ukraine	27.1	62	9	14.5	1998-2007	[7]
Ukraine	15.9 (13-18)	16	2	12.5	1998-2004	[8]
Czech Republic	NS (6-20)	2	0	0	2003-2017	[9]
Canada	<18	2	0	0	NS (2018)	[10]
Colombia	11.8	1	0	0	2009-2018	[11]
Brazil	≤18	3	0	0	NS (2019)	[12]
USA	<10-23	8	0	0	2005-2016	[13]
<i>Sporadic</i>						
Belarus	12.4 (2-16)	34	5	14.7	2001-2007	Present study
Ukraine	11.9 (7.9-15.1)	8	0	0	1995-2001	[3]
Ukraine	15.6 (5-19)	27	7	25.9	1999-2009	[6]
Ukraine	16.3 (7-21)	32	6	18.8	NS (2016) ^{2,3}	[5]
Ukraine	15.4 (10-18)	32	10	31.3	1998-2004	[8]
Czech Republic	16.3 (11-19)	81	15	18.5	2003-2017	[9]
Serbia	8-18	8	1	12.5	1995-2008	[14]
France/Italy	8-19	28	3	10.7	2002-2010	[15]
Portugal/UK	≤18	17	1	5.9	NS, (1963-1992 UK)	[16]
Portugal	5-17	11	0	0	2002-2007	[17]
Turkey	16 (6-18)	50	15	30	1995-2015	[18]
Turkey	12.4 (1-17)	56	14	25	1983-2015	[19]
Saudi Arabia	≤18	84	9	10.7	1998-2015	[20]
Saudi Arabia	12-18	3	1	33.3	1987-2006	[21]
Saudi Arabia	17 (5-18)	48	9	18.8	2004-2019	[22]
India	≤20	98	14	14.3	2005-2018	[23]
China	3-13	48	17	35.4	1994-2014	[24]
China	<21	30	16	53.3	2015-2018	[25]
Japan	≤20	81	44	54.3	1991-2013	[26]
Japan	11.3 (< 15)	31	1	3.2	1962-1995	[4]
Japan	12.7 (9-14)	9	3	33.3	2013-2014	[27]

Brazil	≤18	35	3	8.6	NS (2017)	[28]
Brazil	≤18	77	12	15.6	NS (2019)	[12]
Colombia	11.8	15	1	6.3	2009-2018	[11]
USA	17.5 (10-21)	20	0	0	NS (2005)	[29]
USA	15 (10-17)	20	4	20	1985-2004	[30]
USA	≤21	11	2	18.2	2007-2011	[31]
USA	12-16	5	2	40	2009-2012	[32]
USA	10-19	27	10	37	2009-2014	[33]
USA	14 (12-17)	13	4	30.8	2008-2012	[34]
USA	13.7 (2-18)	19	7	36.8	1999-2012	[35]
USA	14.7 (7.9-18.4)	34	9	26.5	2001-2013	[36]
USA	0-15	9	5	55.6	1973-2005	[37]
USA	15 (4-18)	62	12	19.4	1989-2012	[38]
USA	12-22	8	2	25	NS (2017)	[39]
USA	<17	8	0	0	NS (2017)	[40]
USA	0-21	50	24	48.0	2003-2015	[41]
USA	<10-23	31	6	19.4	2005-2016	[13]
USA	14 (6-18)	63	12	19.0	1989-2012	[42]
Canada	14.4 (10-17)	28	5	17.9	NS (2018)	[10]

3 ¹ NS, not specified (year of publication); ² estimated period 1999-2009

Table S4. Frequency and prevalence of *RET/PTC1* and *RET/PTC3* rearrangements in pediatric PTC of radiation and sporadic etiology in different countries

Country	Patients' age	N	<i>RET/PTC1</i> (%)	<i>RET/PTC3</i> (%)	Sampling	Reference
<i>Radiation-related</i>						
Belarus	8-19	12	2 (16.7)	6 (50)	1993-1995	[43]
Belarus	15-18	38	6 (15.8)	22 (57.9)	1991-1992	[44]
Belarus	8-15	51	12 (23.5)	12 (23.5)	1993-1997	[45]
Belarus, Ukraine	< 15	61	13 (21.3)	3 (4.9)	1990-1994	[46]
Belarus, Ukraine	< 15	45	7 (15.6)	12 (26.7)	1995-1996	[46]
Belarus	12.9 (11-17)	32	9 (28.1)	1 (3.1)	1996	[47,48]
Belarus	6-18	39	9 (23.1)	11 (28.8)	1995-1997	[49]
Ukraine	6-18	28	5 (17.9)	12 (42.9)	1995-1997	[49]
Belarus	≤14	99	19 (19.2)	26 (26.3)	1993-1998	[50]
Belarus	12.0 (10-17)	25	5 (20.0)	8 (32.0)	NS (2001) ¹	[51]
Ukraine	12-31	21	2 (9.5)	6 (28.6)	1995-1998	[1]
Ukraine	11-18	8	1 (12.5)	3 (37.5)	NS (2005)	[52]
Ukraine	18.0 (13-23)	26	4 (15.4)	7 (26.9)	1998-2007	[6]
Ukraine	20.1-23.6 (20-29)	62	14 (22.6)	8 (12.9)	1998-2007	[7]
Ukraine	15.9 (13-18)	16	2 (12.5)	4 (25.0)	1998-2004	[8]
Czech Republic	NS (6-20)	2	0	0	2003-2017	[9]
Canada	<18	2	0	0	NS (2018)	
<i>Sporadic</i>						
Belarus	12.4 (2-16)	34	4 (11.8)	6 (17.6)	2001-2007	Present study
Ukraine	15.6 (5-19)	27	5 (18.5)	2 (7.4)	1999-2009	[6]
Ukraine	15.4 (10-18)	32	5 (15.6)	1 (3.1%)	1998-2004	[8]
Czech Republic	NS (6-20)	81	12 (14.8)	6 (7.4)	2003-2017	[9]
Serbia	8-18	8	5 (62.5)	0	1992-2008	[14]
France	9-15	4	0	1 (25.0)	NS (1997)	[53]
Italy	16 (8-18)	25	5 (20)	4 (16.0)	NS (2001)	[51]
Italy/France	8-19	28	2 (7.1)	6 (21.4)	2002-2010	[15]
Italy	9-16	4	0 (0)	1 (25.0)	NS (2002)	[54]
Italy	<19	9	3 (33.3)	1 (11.1)	NS (1996)	[55]
Saudi Arabia	12-18	3	0	0	1987-2006	[21]
Saudi Arabia	17 (5-18)	48	9 (18.8)	4 (8.3)	2004-2019	[22]
China	≤20	6	3 (50)		2005-2006	[56]
China/HK	12	1	0	1 (100)	NS (2002)	[57]
Japan	11-19	31	10 (32.3)	4 (12.9)	NS (2005)	[58]
Japan	12.8 (9-14)	10	2 (20)	1 (10.0)	1980-1995	[59]
Japan	12.7 (9-14)	9	3 (33.3)	0	2013-2014	[27]

Brazil	≤18	35	6 (17.1)	6 (17.1)	NS (2017)	[28]
USA	9	1	1 (100)	0	NS (2004)	[60]
USA	18 (6-21)	33	8 (24.2)	2 (6.1)	NS (2002)	[61]
USA	15-18	23	8 (34.8)	3 (13.0)	since 1974	[44]
USA	≤21	11	3 (27.3)	0	2007-2011	[31]
USA	NS	5	1 (20.0)	0	2009-2012	[32]
USA	14 (12-17)	13	1 (7.7)	1 (7.7)	2008-2012	[34]
USA	14.7 (7.9-18.4)	34	5 (14.7)	1 (2.9)	2001-2013	[36]
USA	15 (4-18)	62	10 (16.1)	2 (3.2)	1989-2012	[38]
USA	12-22	8	1 (12.5)	0	NS (2017)	[39]
USA	17.5 (11-21)	12	5 (41.7)	2 (16.7)	NS (2005)	[29]
USA	14 (6-18)	63	5 (7.9)	4 (6.3)	1989-2012	[42]
Canada	14.0 (10-17)	28	3 (10.7)	4 (14.3)	NS (2018)	[10]

¹ NS (2001), not specified (year of publication)

Table S5. Frequency and prevalence of *ETV6/NTRK3* and *AKAP9/BRAF* rearrangements, and of point mutations in the *RAS* family genes in pediatric PTC of radiation and sporadic etiology in different countries

Country	Patients' age	N	Positive	%	Sampling	Reference
<i>ETV6/NTRK3</i>						
<i>Radiation-related</i>						
Ukraine	18.0 (5-19)	26	2	7.7	1998-2007	[6]
Ukraine	22.7 (14-32)	62	9	14.5	1998-2008	[62]
Ukraine	15.9 (13-18)	16	1	6.3	1998-2004	[8]
<i>Sporadic</i>						
Belarus	12.4 (2-16)	34	6	17.6	2001-2007	Present study
Ukraine	15.6 (5-19)	27	2	7.4	1999-2009	[6]
Ukraine	15.4 (10-18)	32	2	6.3	1998-2004	[8]
Saudi Arabia	17 (5-18)	48	4	8.3	2004-2019	[22]
Japan	12.7 (9-14)	9	1	11.9	2013-2014	[27]
Brazil	≤18	35	3	8.6	NS (2017) ¹	[28]
USA	13 (8-17)	18	3	16.7	2002-2014	[63]
USA	15 (6-18)	27	5	18.5	2009-2015	[64]
USA	<10-23	25	2	8.0	2005-2016	[13]
USA	14 (6-18)	63	2	3.2	1989-2012	[42]
<i>AKAP9/BRAF</i>						
<i>Radiation-related</i>						
Belarus	11.4 ± 3.6	28	3	10.7	1991-1992	[2]
Belarus	16.0 ± 5.0	64	0	0	1995-1998	[2]
Ukraine	18.0 (5-19)	26	1	3.8	1998-2007	[6]
Ukraine	15.9 (13-18)	16	0	0	1998-2004	[8]
<i>Sporadic</i>						
Belarus	12.4 (2-16)	34	0	0	2001-2007	Present study
Ukraine	15.6 (5-19)	27	0	0	1999-2009	[6]
Ukraine	15.4 (10-18)	32	0	0	1998-2004	[8]
Japan	12.7 (9-14)	9	0	0	2013-2014	[27]
<i>RAS</i>						
<i>Radiation-related</i>						
Belarus	5-19	33	0	0	1991-1992	[65]
Belarus	NS, "children"	34	0	0	1992	[66]
Ukraine	14.3	15	0	0	1998-2000	[4]
Ukraine	18.0 (5-19)	26	0	0	1998-2007	[6]
Ukraine	20-29	62	5	8.0	1998-2008	[62]

Ukraine	15.9 (13-18)	16	0	0	1998-2004	[8]
Czech Republic	NS (6-20)	2	1	50.0	NS (2003-2017) ²	[9]
<i>Sporadic</i>						
Belarus	12.4 (2-16)	34	0	0	2001-2007	Present study
Ukraine	15.6 (5-19)	27	2	7.4	1999-2009	[6]
Ukraine	15.4 (10-18)	32	1	3.1	1998-2004	[8]
Czech Republic	NS (6-20)	81	1	1.2	NS (2003-2017)	[9]
The Netherlands	12.8 (9-16)	8	0	0	NS (2001)	[67]
Italy/France	8-19	28	1	3.6	2002-2010	[15]
Saudi Arabia	≤18	79	2	2.5	1998-2015	[20]
Saudi Arabia	17 (5-18)	48	2	4.2	2004-2019	[22]
Japan	11.3	31	0	0	1962-1995	[4]
Japan	12.7 (9-14)	9	0	0	2013-2014	[27]
USA	17 (6-21)	31	2	6.5	NS (1999)	[68]
USA	11-21	11	0	0	NS (2005)	[29]
USA	15 (4-18)	62	4	6.5	NS (2018)	[38]
USA	12-22	8	2	25.0	NS (2017)	[39]
USA	14.7 (7-18)	34	1	2.9	2001-2013	[36]
USA	12-16	5	1	20.0	2009-2012	[32]
USA	14 (6-18)	63	4	6.4	1989-2012	[42]

¹ NS (2017), not specified (year of publication); ² years of sampling in the study;

Table S6. Primer and probe sequences for detections of oncogenes

2

Gene	Primer Sequence, 5'-3'	Annealing temperature (°C)	Amplicon size (bp)	Reference	Southern blotting probe sequence, 5'-3'
<i>BRAF (ex15)</i>	ACATACTTATTGACTCTAAGAGGAAAGATGAA GATTTTGTGAATACTGGGAACATGA	60	401	[27]	
<i>H-RAS (codons 12, 13)</i>	AGCAGGGCCCTCCTTGGCAG CAGCCAGCCCTATCCTGGCTG	65	261	[27]	
<i>H-RAS (codon 61)</i>	CAGGGAGAGGCTGGCTGTGTG CCACCTGTGCGGCGTGGGCT	65	298	[27]	
<i>K-RAS (codons 12, 13)</i>	GGTACTGGTGGAGTATTTGATAGT CTCATGAAAATGGTCAGAGAAACCT	60	290	[27]	
<i>K-RAS (codon 61)</i>	GGTGCACCTGTAATAATCCAGACTG CTATAATTACTCCTTAATGTCAGCTT	60	268	[27]	
<i>N-RAS (codons 12, 13)</i>	CACACTAGGGTTTTTCATTTCATTG GGTAAAGATGATCCGACAAGTGAGCG	63	283	[27]	
<i>N-RAS (codon 61)</i>	TTGAACTTCCCTCCCTCCCTGC AGCTCTATCTTCCCTAGTGTGGTAA	65	316	[27]	
<i>RET/PTC1</i>	GCCTGGAGGAGCTCACCAA CTCTGCCTTTCAGATGGAA	56	252	[27]	GCGTTACCATCGAGGATCCAAA
<i>RET/PTC3</i>	ACCTGCCAGTGGTTATCAAGCT TTCGCCTTCTCCTAGAGTTTTTCC	59	154	[27]	AGAACAGTCAGGAGGATCCAAA
<i>AKAP9/BRAF</i>	AGCAAGAACAGTTGATTTTGGGA GCAGACAAACCTGTGGTTGA	56	181	[2]	AAACTTCAGAAAGAACTCAATGTACTT
<i>ETV6(ex4)/NTRK3</i>	CATTCTTCCACCCTGGAAAC TCCTCACCCTGATGACAGC	55	97	[62]	AACCATGAAGAAGGTCCCGT
<i>ETV6(ex5)/NTRK3</i>	AAGCCCATCAACCTCTCTCA TCCTCACCCTGATGACAGC	60	139	[62]	AGAATAGCAGGTCCCGTGGC
<i>TBL1XR1/RET</i>	AAGATGTTCCAAGCAACAAGGATGTCACA CCAAGTTCTTCCGAGGGAAT	62	243	Present study	AGTAGACAAGGAGGATCCAAA
<i>TNIP1/RET</i>	TCCAAGATTGAAATGGAGGAGACC TTCGCCTTCTCCTAGAGTTTTTCC	58	216	Present study	GCTCAACAAGGAGGATCCAA

3

References

1. Nikiforova, M.N.; Ciampi, R.; Salvatore, G.; Santoro, M.; Gandhi, M.; Knauf, J.A.; Thomas, G.A.; Jeremiah, S.; Bogdanova, T.I.; Tronko, M.D., et al. Low prevalence of BRAF mutations in radiation-induced thyroid tumors in contrast to sporadic papillary carcinomas. *Cancer Lett* **2004**, *209*, 1-6, doi:10.1016/j.canlet.2003.12.004.
2. Ciampi, R.; Knauf, J.A.; Kerler, R.; Gandhi, M.; Zhu, Z.; Nikiforova, M.N.; Rabes, H.M.; Fagin, J.A.; Nikiforov, Y.E. Oncogenic AKAP9-BRAF fusion is a novel mechanism of MAPK pathway activation in thyroid cancer. *J Clin Invest* **2005**, *115*, 94-101, doi:10.1172/JCI23237.
3. Powell, N.; Jeremiah, S.; Morishita, M.; Dudley, E.; Bethel, J.; Bogdanova, T.; Tronko, M.; Thomas, G. Frequency of BRAF T1796A mutation in papillary thyroid carcinoma relates to age of patient at diagnosis and not to radiation exposure. *J Pathol* **2005**, *205*, 558-564, doi:10.1002/path.1736.
4. Kumagai, A.; Namba, H.; Saenko, V.A.; Ashizawa, K.; Ohtsuru, A.; Ito, M.; Ishikawa, N.; Sugino, K.; Ito, K.; Jeremiah, S., et al. Low frequency of BRAFT1796A mutations in childhood thyroid carcinomas. *J Clin Endocrinol Metab* **2004**, *89*, 4280-4284, doi:10.1210/jc.2004-0172.
5. Handkiewicz-Junak, D.; Swierniak, M.; Rusinek, D.; Oczko-Wojciechowska, M.; Dom, G.; Maenhaut, C.; Unger, K.; Detours, V.; Bogdanova, T.; Thomas, G., et al. Gene signature of the post-Chernobyl papillary thyroid cancer. *Eur J Nucl Med Mol Imaging* **2016**, *43*, 1267-1277, doi:10.1007/s00259-015-3303-3.
6. Ricarte-Filho, J.C.; Li, S.; Garcia-Rendueles, M.E.; Montero-Conde, C.; Voza, F.; Knauf, J.A.; Heguy, A.; Viale, A.; Bogdanova, T.; Thomas, G.A., et al. Identification of kinase fusion oncogenes in post-Chernobyl radiation-induced thyroid cancers. *J Clin Invest* **2013**, *123*, 4935-4944, doi:10.1172/JCI69766.
7. Leeman-Neill, R.J.; Brenner, A.V.; Little, M.P.; Bogdanova, T.I.; Hatch, M.; Zurnadzy, L.Y.; Mabuchi, K.; Tronko, M.D.; Nikiforov, Y.E. RET/PTC and PAX8/PPARGgamma chromosomal rearrangements in post-Chernobyl thyroid cancer and their association with iodine-131 radiation dose and other characteristics. *Cancer* **2013**, *119*, 1792-1799, doi:10.1002/cncr.27893.
8. Morton, L.M.; Karyadi, D.M.; Stewart, C.; Bogdanova, T.I.; Dawson, E.T.; Steinberg, M.K.; Dai, J.; Hartley, S.W.; Schonfeld, S.J.; Sampson, J.N., et al. Radiation-related genomic profile of papillary thyroid carcinoma after the Chernobyl accident. *Science* **2021**, *372*, doi:10.1126/science.abg2538.
9. Pekova, B.; Dvorakova, S.; Sykorova, V.; Vacinova, G.; Vaclavikova, E.; Moravcova, J.; Kutra, R.; Vlcek, P.; Sykorova, P.; Kodetova, D., et al. Somatic genetic alterations in a large cohort of pediatric thyroid nodules. *Endocr Connect* **2019**, *8*, 796-805, doi:10.1530/EC-19-0069.
10. Wasserman, J.D.; Sabbaghian, N.; Fahiminiya, S.; Chami, R.; Mete, O.; Acker, M.;

- Wu, M.K.; Shlien, A.; de Kock, L.; Foulkes, W.D. DICER1 Mutations Are Frequent in Adolescent-Onset Papillary Thyroid Carcinoma. *J Clin Endocrinol Metab* **2018**, *103*, 2009-2015, doi:10.1210/jc.2017-02698.
11. Castro, P.; Patino, E.; Fierro, F.; Rojas, C.; Buitrago, G.; Olaya, N. Clinical characteristics, surgical approach, BRAFV600E mutation and sodium iodine symporter expression in pediatric patients with thyroid carcinoma. *Journal of Pediatric Endocrinology and Metabolism* **2020**, DOI: 10.1515/jpem-2020-0201, in press, doi:10.1515/jpem-2020-0201.
 12. Sisdelli, L.; Cordioli, M.; Vaisman, F.; Moraes, L.; Colozza-Gama, G.A.; Alves, P.A.G., Jr.; Araujo, M.L., Jr.; Alves, M.T.S.; Monte, O.; Longui, C.A., et al. AGK-BRAF is associated with distant metastasis and younger age in pediatric papillary thyroid carcinoma. *Pediatr Blood Cancer* **2019**, *66*, e27707, doi:10.1002/pbc.27707.
 13. Potter, S.L.; Reuther, J.; Chandramohan, R.; Gandhi, I.; Hollingsworth, F.; Sayeed, H.; Voicu, H.; Kakkar, N.; Bakshi, K.S.; Sarabia, S.F., et al. Integrated DNA and RNA sequencing reveals targetable alterations in metastatic pediatric papillary thyroid carcinoma. *Pediatr Blood Cancer* **2020**, 10.1002/pbc.28741, e28741, doi:10.1002/pbc.28741.
 14. Stanojevic, B.; Dzodic, R.; Saenko, V.; Milovanovic, Z.; Pupic, G.; Zivkovic, O.; Markovic, I.; Djuriscic, I.; Buta, M.; Dimitrijevic, B., et al. Mutational and clinico-pathological analysis of papillary thyroid carcinoma in Serbia. *Endocr J* **2011**, *58*, 381-393.
 15. Sassolas, G.; Hafdi-Nejjari, Z.; Ferraro, A.; Decaussin-Petrucci, M.; Rousset, B.; Borson-Chazot, F.; Borbone, E.; Berger, N.; Fusco, A. Oncogenic alterations in papillary thyroid cancers of young patients. *Thyroid* **2012**, *22*, 17-26, doi:10.1089/thy.2011.0215.
 16. Lima, J.; Trovisco, V.; Soares, P.; Maximo, V.; Magalhaes, J.; Salvatore, G.; Santoro, M.; Bogdanova, T.; Tronko, M.; Abrosimov, A., et al. BRAF mutations are not a major event in post-Chernobyl childhood thyroid carcinomas. *J Clin Endocrinol Metab* **2004**, *89*, 4267-4271, doi:10.1210/jc.2003-032224.
 17. Espadinha, C.; Santos, J.R.; Sobrinho, L.G.; Bugalho, M.J. Expression of iodine metabolism genes in human thyroid tissues: evidence for age and BRAFV600E mutation dependency. *Clin Endocrinol (Oxf)* **2009**, *70*, 629-635, doi:10.1111/j.1365-2265.2008.03376.x.
 18. Onder, S.; Ozturk Sari, S.; Yegen, G.; Sormaz, I.C.; Yilmaz, I.; Poyrazoglu, S.; Sanli, Y.; Giles Senyurek, Y.; Kapran, Y.; Mete, O. Classic Architecture with Multicentricity and Local Recurrence, and Absence of TERT Promoter Mutations are Correlates of BRAF (V600E) Harboring Pediatric Papillary Thyroid Carcinomas. *Endocr Pathol* **2016**, *27*, 153-161, doi:10.1007/s12022-016-9420-0.
 19. Poyrazoglu, S.; Bundak, R.; Bas, F.; Yegen, G.; Sanli, Y.; Darendeliler, F.

- Clinicopathological Characteristics of Papillary Thyroid Cancer in Children with Emphasis on Pubertal Status and Association with BRAF(V600E) Mutation. *J Clin Res Pediatr Endocrinol* **2017**, *9*, 185-193, doi:10.4274/jcrpe.3873.
20. Alzahrani, A.S.; Murugan, A.K.; Qasem, E.; Alswailem, M.; Al-Hindi, H.; Shi, Y. Single Point Mutations in Pediatric Differentiated Thyroid Cancer. *Thyroid* **2017**, *27*, 189-196, doi:10.1089/thy.2016.0339.
 21. Zou, M.; Baitei, E.Y.; Alzahrani, A.S.; BinHumaid, F.S.; Alkhafaji, D.; Al-Rijjal, R.A.; Meyer, B.F.; Shi, Y. Concomitant RAS, RET/PTC, or BRAF mutations in advanced stage of papillary thyroid carcinoma. *Thyroid* **2014**, *24*, 1256-1266, doi:10.1089/thy.2013.0610.
 22. Alzahrani, A.S.; Alswailem, M.; Alswailem, A.A.; Al-Hindi, H.; Goljan, E.; Alsudairy, N.; Abouelhoda, M. Genetic Alterations in Pediatric Thyroid Cancer Using a Comprehensive Childhood Cancer Gene Panel. *J Clin Endocrinol Metab* **2020**, *105*, doi:10.1210/clinem/dgaa389.
 23. Chakraborty, D., Shaky, S., Ballal, S., Agarwal, S., Bal, C. BRAF V600E and TERT promoter mutations in paediatric and young adult papillary thyroid cancer and clinicopathological correlation. *Journal of Pediatric Endocrinology and Metabolism* **2020**, *in press*, doi:https://doi.org/10.1515/jpem-2020-0174.
 24. Geng, J.; Wang, H.; Liu, Y.; Tai, J.; Jin, Y.; Zhang, J.; He, L.; Fu, L.; Qin, H.; Song, Y., et al. Correlation between BRAF (V600E) mutation and clinicopathological features in pediatric papillary thyroid carcinoma. *Sci China Life Sci* **2017**, *60*, 729-738, doi:10.1007/s11427-017-9083-8.
 25. Huang, M.; Yan, C.; Wei, H.; Lv, Y.; Ling, R. Clinicopathological characteristics and prognosis of thyroid cancer in northwest China: A population-based retrospective study of 2490 patients. *Thorac Cancer* **2018**, *9*, 1453-1460, doi:10.1111/1759-7714.12858.
 26. Oishi, N.; Kondo, T.; Nakazawa, T.; Mochizuki, K.; Inoue, T.; Kasai, K.; Tahara, I.; Yabuta, T.; Hirokawa, M.; Miyauchi, A., et al. Frequent BRAF (V600E) and Absence of TERT Promoter Mutations Characterize Sporadic Pediatric Papillary Thyroid Carcinomas in Japan. *Endocr Pathol* **2017**, *28*, 103-111, doi:10.1007/s12022-017-9470-y.
 27. Mitsutake, N.; Fukushima, T.; Matsuse, M.; Rogounovitch, T.; Saenko, V.; Uchino, S.; Ito, M.; Suzuki, K.; Suzuki, S.; Yamashita, S. BRAF(V600E) mutation is highly prevalent in thyroid carcinomas in the young population in Fukushima: a different oncogenic profile from Chernobyl. *Sci Rep* **2015**, *5*, 16976, doi:10.1038/srep16976.
 28. Cordioli, M.I.; Moraes, L.; Bastos, A.U.; Besson, P.; Alves, M.T.; Delcelo, R.; Monte, O.; Longui, C.; Cury, A.N.; Cerutti, J.M. Fusion Oncogenes Are the Main Genetic Events Found in Sporadic Papillary Thyroid Carcinomas from Children. *Thyroid* **2017**, *27*, 182-188, doi:10.1089/thy.2016.0387.

29. Penko, K.; Livezey, J.; Fenton, C.; Patel, A.; Nicholson, D.; Flora, M.; Oakley, K.; Tuttle, R.M.; Francis, G. BRAF mutations are uncommon in papillary thyroid cancer of young patients. *Thyroid* **2005**, *15*, 320-325, doi:10.1089/thy.2005.15.320.
30. Rosenbaum, E.; Hosler, G.; Zahurak, M.; Cohen, Y.; Sidransky, D.; Westra, W.H. Mutational activation of BRAF is not a major event in sporadic childhood papillary thyroid carcinoma. *Mod Pathol* **2005**, *18*, 898-902, doi:10.1038/modpathol.3800252.
31. Monaco, S.E.; Pantanowitz, L.; Khalbuss, W.E.; Benkovich, V.A.; Ozolek, J.; Nikiforova, M.N.; Simons, J.P.; Nikiforov, Y.E. Cytomorphological and molecular genetic findings in pediatric thyroid fine-needle aspiration. *Cancer Cytopathol* **2012**, *120*, 342-350, doi:10.1002/cncy.21199.
32. Buryk, M.A.; Monaco, S.E.; Witchel, S.F.; Mehta, D.K.; Gurtunca, N.; Nikiforov, Y.E.; Simons, J.P. Preoperative cytology with molecular analysis to help guide surgery for pediatric thyroid nodules. *Int J Pediatr Otorhinolaryngol* **2013**, *77*, 1697-1700, doi:10.1016/j.ijporl.2013.07.029.
33. Ballester, L.Y.; Sarabia, S.F.; Sayeed, H.; Patel, N.; Baalwa, J.; Athanassaki, I.; Hernandez, J.A.; Fang, E.; Quintanilla, N.M.; Roy, A., et al. Integrating Molecular Testing in the Diagnosis and Management of Children with Thyroid Lesions. *Pediatr Dev Pathol* **2016**, *19*, 94-100, doi:10.2350/15-05-1638-OA.1.
34. Gertz, R.J.; Nikiforov, Y.; Rehrauer, W.; McDaniel, L.; Lloyd, R.V. Mutation in BRAF and Other Members of the MAPK Pathway in Papillary Thyroid Carcinoma in the Pediatric Population. *Arch Pathol Lab Med* **2016**, *140*, 134-139, doi:10.5858/arpa.2014-0612-OA.
35. Givens, D.J.; Buchmann, L.O.; Agarwal, A.M.; Grimmer, J.F.; Hunt, J.P. BRAF V600E does not predict aggressive features of pediatric papillary thyroid carcinoma. *Laryngoscope* **2014**, *124*, E389-393, doi:10.1002/lary.24668.
36. Nikita, M.E.; Jiang, W.; Cheng, S.M.; Hantash, F.M.; McPhaul, M.J.; Newbury, R.O.; Phillips, S.A.; Reitz, R.E.; Waldman, F.M.; Newfield, R.S. Mutational Analysis in Pediatric Thyroid Cancer and Correlations with Age, Ethnicity, and Clinical Presentation. *Thyroid* **2016**, *26*, 227-234, doi:10.1089/thy.2015.0401.
37. Henke, L.E.; Perkins, S.M.; Pfeifer, J.D.; Ma, C.; Chen, Y.; DeWees, T.; Grigsby, P.W. BRAF V600E mutational status in pediatric thyroid cancer. *Pediatr Blood Cancer* **2014**, *61*, 1168-1172, doi:10.1002/pbc.24935.
38. Mostoufi-Moab, S.; Labourier, E.; Sullivan, L.; LiVolsi, V.; Li, Y.; Xiao, R.; Beaudenon-Huibregtse, S.; Kazahaya, K.; Adzick, N.S.; Baloch, Z., et al. Molecular Testing for Oncogenic Gene Alterations in Pediatric Thyroid Lesions. *Thyroid* **2018**, *28*, 60-67, doi:10.1089/thy.2017.0059.
39. Shifrin, A.L.; Fischer, M.; Paul, T.; Erler, B.; Gheysens, K.; Baodhankar, P.; Song-Yang, J.W.; Taylor, S.; Timmaraju, V.A.; Topilow, A., et al. Mutational analysis of metastatic lymph nodes from papillary thyroid carcinoma in adult and pediatric

- patients. *Surgery* **2017**, *161*, 176-187, doi:10.1016/j.surg.2016.10.002.
40. Vanden Borre, P.; Schrock, A.B.; Anderson, P.M.; Morris, J.C., 3rd; Heilmann, A.M.; Holmes, O.; Wang, K.; Johnson, A.; Waguespack, S.G.; Ou, S.I., et al. Pediatric, Adolescent, and Young Adult Thyroid Carcinoma Harbors Frequent and Diverse Targetable Genomic Alterations, Including Kinase Fusions. *Oncologist* **2017**, *22*, 255-263, doi:10.1634/theoncologist.2016-0279.
 41. Hardee, S.; Prasad, M.L.; Hui, P.; Dinanuer, C.A.; Morotti, R.A. Pathologic Characteristics, Natural History, and Prognostic Implications of BRAF(V600E) Mutation in Pediatric Papillary Thyroid Carcinoma. *Pediatr Dev Pathol* **2017**, *20*, 206-212, doi:10.1177/1093526616689628.
 42. Franco, A.T.; Labourier, E.; Ablordeppey, K.K.; Surrey, L.F.; Mostoufi-Moab, S.; Isaza, A.; Adzick, N.S.; Kazahaya, K.; Kumar, G.; Bauer, A.J. miRNA expression can classify pediatric thyroid lesions and increases the diagnostic yield of mutation testing. *Pediatr Blood Cancer* **2020**, *67*, e28276, doi:10.1002/pbc.28276.
 43. Klugbauer, S.; Lengfelder, E.; Demidchik, E.P.; Rabes, H.M. High prevalence of RET rearrangement in thyroid tumors of children from Belarus after the Chernobyl reactor accident. *Oncogene* **1995**, *11*, 2459-2467.
 44. Nikiforov, Y.E.; Rowland, J.M.; Bove, K.E.; Monforte-Munoz, H.; Fagin, J.A. Distinct pattern of ret oncogene rearrangements in morphological variants of radiation-induced and sporadic thyroid papillary carcinomas in children. *Cancer Res* **1997**, *57*, 1690-1694.
 45. Smida, J.; Salassidis, K.; Hieber, L.; Zitzelsberger, H.; Kellerer, A.M.; Demidchik, E.P.; Negele, T.; Spelsberg, F.; Lengfelder, E.; Werner, M., et al. Distinct frequency of ret rearrangements in papillary thyroid carcinomas of children and adults from Belarus. *Int J Cancer* **1999**, *80*, 32-38, doi:10.1002/(sici)1097-0215(19990105)80:1<32::aid-ijc7>3.0.co;2-l.
 46. Santoro, M.; Thomas, G.A.; Vecchio, G.; Williams, G.H.; Fusco, A.; Chiappetta, G.; Pozcharskaya, V.; Bogdanova, T.I.; Demidchik, E.P.; Cherstvoy, E.D., et al. Gene rearrangement and Chernobyl related thyroid cancers. *Br J Cancer* **2000**, *82*, 315-322, doi:10.1054/bjoc.1999.0921.
 47. Pisarchik, A.V.; Ermak, G.; Fomicheva, V.; Kartel, N.A.; Figge, J. The ret/PTC1 rearrangement is a common feature of Chernobyl-associated papillary thyroid carcinomas from Belarus. *Thyroid* **1998**, *8*, 133-139, doi:10.1089/thy.1998.8.133.
 48. Pisarchik, A.V.; Ermak, G.; Demidchik, E.P.; Mikhalevich, L.S.; Kartel, N.A.; Figge, J. Low prevalence of the ret/PTC3r1 rearrangement in a series of papillary thyroid carcinomas presenting in Belarus ten years post-Chernobyl. *Thyroid* **1998**, *8*, 1003-1008, doi:10.1089/thy.1998.8.1003.
 49. Thomas, G.A.; Bunnell, H.; Cook, H.A.; Williams, E.D.; Nerovnya, A.; Cherstvoy, E.D.; Tronko, N.D.; Bogdanova, T.I.; Chiappetta, G.; Viglietto, G., et al. High

- prevalence of RET/PTC rearrangements in Ukrainian and Belarussian post-Chernobyl thyroid papillary carcinomas: a strong correlation between RET/PTC3 and the solid-follicular variant. *J Clin Endocrinol Metab* **1999**, *84*, 4232-4238, doi:10.1210/jcem.84.11.6129.
50. Rabes, H.M.; Demidchik, E.P.; Sidorow, J.D.; Lengfelder, E.; Beimfohr, C.; Hoelzel, D.; Klugbauer, S. Pattern of radiation-induced RET and NTRK1 rearrangements in 191 post-chernobyl papillary thyroid carcinomas: biological, phenotypic, and clinical implications. *Clin Cancer Res* **2000**, *6*, 1093-1103.
 51. Elisei, R.; Romei, C.; Vorontsova, T.; Cosci, B.; Veremeychik, V.; Kuchinskaya, E.; Basolo, F.; Demidchik, E.P.; Miccoli, P.; Pinchera, A., et al. RET/PTC rearrangements in thyroid nodules: studies in irradiated and not irradiated, malignant and benign thyroid lesions in children and adults. *J Clin Endocrinol Metab* **2001**, *86*, 3211-3216, doi:10.1210/jcem.86.7.7678.
 52. Detours, V.; Wattel, S.; Venet, D.; Hutsebaut, N.; Bogdanova, T.; Tronko, M.D.; Dumont, J.E.; Franc, B.; Thomas, G.; Maenhaut, C. Absence of a specific radiation signature in post-Chernobyl thyroid cancers. *Br J Cancer* **2005**, *92*, 1545-1552, doi:10.1038/sj.bjc.6602521.
 53. Bounacer, A.; Wicker, R.; Caillou, B.; Cailleux, A.F.; Sarasin, A.; Schlumberger, M.; Suarez, H.G. High prevalence of activating ret proto-oncogene rearrangements, in thyroid tumors from patients who had received external radiation. *Oncogene* **1997**, *15*, 1263-1273, doi:10.1038/sj.onc.1200206.
 54. Basolo, F.; Giannini, R.; Monaco, C.; Melillo, R.M.; Carlomagno, F.; Pancrazi, M.; Salvatore, G.; Chiappetta, G.; Pacini, F.; Elisei, R., et al. Potent mitogenicity of the RET/PTC3 oncogene correlates with its prevalence in tall-cell variant of papillary thyroid carcinoma. *Am J Pathol* **2002**, *160*, 247-254, doi:10.1016/S0002-9440(10)64368-4.
 55. Bongarzone, I.; Fugazzola, L.; Vigneri, P.; Mariani, L.; Mondellini, P.; Pacini, F.; Basolo, F.; Pinchera, A.; Pilotti, S.; Pierotti, M.A. Age-related activation of the tyrosine kinase receptor protooncogenes RET and NTRK1 in papillary thyroid carcinoma. *J Clin Endocrinol Metab* **1996**, *81*, 2006-2009, doi:10.1210/jcem.81.5.8626874.
 56. Wang, Y.L.; Zhang, R.M.; Luo, Z.W.; Wu, Y.; Du, X.; Wang, Z.Y.; Zhu, Y.X.; Li, D.S.; Ji, Q.H. High frequency of level II-V lymph node involvement in RET/PTC positive papillary thyroid carcinoma. *Eur J Surg Oncol* **2008**, *34*, 77-81, doi:10.1016/j.ejso.2007.08.012.
 57. Lam, K.Y.; Lo, C.Y.; Leung, P.S. High prevalence of RET proto-oncogene activation (RET/PTC) in papillary thyroid carcinomas. *Eur J Endocrinol* **2002**, *147*, 741-745.
 58. Nakazawa, T.; Kondo, T.; Kobayashi, Y.; Takamura, N.; Murata, S.; Kameyama, K.; Muramatsu, A.; Ito, K.; Kobayashi, M.; Katoh, R. RET gene rearrangements

- (RET/PTC1 and RET/PTC3) in papillary thyroid carcinomas from an iodine-rich country (Japan). *Cancer* **2005**, *104*, 943-951, doi:10.1002/cncr.21270.
59. Motomura, T.; Nikiforov, Y.E.; Namba, H.; Ashizawa, K.; Nagataki, S.; Yamashita, S.; Fagin, J.A. ret rearrangements in Japanese pediatric and adult papillary thyroid cancers. *Thyroid* **1998**, *8*, 485-489, doi:10.1089/thy.1998.8.485.
 60. Rhoden, K.J.; Johnson, C.; Brandao, G.; Howe, J.G.; Smith, B.R.; Tallini, G. Real-time quantitative RT-PCR identifies distinct c-RET, RET/PTC1 and RET/PTC3 expression patterns in papillary thyroid carcinoma. *Lab Invest* **2004**, *84*, 1557-1570, doi:10.1038/labinvest.3700198.
 61. Fenton, C.L.; Lukes, Y.; Nicholson, D.; Dinauer, C.A.; Francis, G.L.; Tuttle, R.M. The ret/PTC mutations are common in sporadic papillary thyroid carcinoma of children and young adults. *J Clin Endocrinol Metab* **2000**, *85*, 1170-1175, doi:10.1210/jcem.85.3.6472.
 62. Leeman-Neill, R.J.; Kelly, L.M.; Liu, P.; Brenner, A.V.; Little, M.P.; Bogdanova, T.I.; Evdokimova, V.N.; Hatch, M.; Zurnadzy, L.Y.; Nikiforova, M.N., et al. ETV6-NTRK3 is a common chromosomal rearrangement in radiation-associated thyroid cancer. *Cancer* **2014**, *120*, 799-807, doi:10.1002/cncr.28484.
 63. Picarsic, J.L.; Buryk, M.A.; Ozolek, J.; Ranganathan, S.; Monaco, S.E.; Simons, J.P.; Witchel, S.F.; Gurtunca, N.; Joyce, J.; Zhong, S., et al. Molecular Characterization of Sporadic Pediatric Thyroid Carcinoma with the DNA/RNA ThyroSeq v2 Next-Generation Sequencing Assay. *Pediatr Dev Pathol* **2016**, *19*, 115-122, doi:10.2350/15-07-1667-OA.1.
 64. Prasad, M.L.; Vyas, M.; Horne, M.J.; Virk, R.K.; Morotti, R.; Liu, Z.; Tallini, G.; Nikiforova, M.N.; Christison-Lagay, E.R.; Udelsman, R., et al. NTRK fusion oncogenes in pediatric papillary thyroid carcinoma in northeast United States. *Cancer* **2016**, *122*, 1097-1107, doi:10.1002/cncr.29887.
 65. Nikiforov, Y.E.; Nikiforova, M.N.; Gnepp, D.R.; Fagin, J.A. Prevalence of mutations of ras and p53 in benign and malignant thyroid tumors from children exposed to radiation after the Chernobyl nuclear accident. *Oncogene* **1996**, *13*, 687-693.
 66. Suchy, B.; Waldmann, V.; Klugbauer, S.; Rabes, H.M. Absence of RAS and p53 mutations in thyroid carcinomas of children after Chernobyl in contrast to adult thyroid tumours. *Br J Cancer* **1998**, *77*, 952-955, doi:10.1038/bjc.1998.157.
 67. Pauws, E.; Tummers, R.F.; Ris-Stalpers, C.; de Vijlder, J.J.; Voute, T. Absence of activating mutations in ras and gsp oncogenes in a cohort of nine patients with sporadic pediatric thyroid tumors. *Med Pediatr Oncol* **2001**, *36*, 630-634, doi:10.1002/mpo.1140.
 68. Fenton, C.; Anderson, J.; Lukes, Y.; Dinauer, C.A.; Tuttle, R.M.; Francis, G.L. Ras mutations are uncommon in sporadic thyroid cancer in children and young adults. *J Endocrinol Invest* **1999**, *22*, 781-789, doi:10.1007/BF03343644.