

Table S1 Correlation analysis of clinicopathological factors and lymph node metastasis at level II

Variables	Level II		P value
	– (n=245), n (%)	+ (n=241), n (%)	
Gender			0.148
Female	158 (64.5)	140 (58.1)	
Male	87 (35.5)	101 (41.9)	
Tumor size (cm)			0.039
≤2	208 (84.9)	187 (77.6)	
>2	37 (15.1)	54 (22.4)	
Total tumor size (cm)			0.009
≤2	171 (69.8)	141 (58.5)	
>2	74 (30.2)	100 (41.5)	
Age (years)			0.554
<55	212 (86.5)	204 (84.6)	
≥55	33 (13.5)	37 (15.4)	
Location			<0.001
Upper	91 (37.1)	148 (61.4)	
Others	154 (62.9)	93 (38.6)	
Multifocality			0.046
Yes	93 (38.0)	113 (46.9)	
No	152 (62.0)	128 (53.1)	
Coexistent HT			0.302
Yes	86 (35.1)	74 (30.7)	
No	159 (64.9)	167 (69.3)	
Coexistent NG			0.833
Yes	62 (25.3)	59 (24.5)	
No	183 (74.7)	182 (75.5)	
Micro ETE			0.534
Yes	63 (25.7)	68 (28.2)	
No	182 (74.3)	173 (71.8)	
Gross ETE			0.210
Yes	10 (4.1)	16 (6.6)	
No	235 (95.9)	225 (93.4)	
Margin			0.674
Smooth	63 (25.7)	58 (24.1)	
Ill-defined	182 (74.3)	183 (75.9)	
Microcalcification			0.190
Yes	171 (69.8)	181 (75.1)	
No	74 (30.2)	60 (24.9)	
CLNM			0.026
Positive	182 (74.3)	199 (82.6)	
Negative	63 (25.7)	42 (17.4)	
Level III			0.450
Positive	164 (66.9)	169 (70.1)	
Negative	81 (33.1)	72 (29.9)	
Level IV			0.753
Positive	180 (73.5)	174 (72.2)	
Negative	65 (26.5)	67 (27.8)	
Level V			0.008
Positive	39 (15.9)	62 (25.7)	
Negative	206 (84.1)	179 (74.3)	
CLNM-ENE			0.007
Positive	17 (6.9)	35 (14.5)	
Negative	228 (93.1)	206 (85.5)	
Level III-ENE			0.025
Positive	10 (4.1)	22 (9.1)	
Negative	235 (95.9)	219 (90.9)	
Level IV-ENE			0.051
Positive	16 (6.5)	28 (11.6)	
Negative	229 (93.5)	213 (88.4)	
Level V-ENE			0.301
Positive	3 (1.2)	6 (2.5)	
Negative	242 (98.8)	235 (97.5)	
T stage			0.235
T1–2	170 (69.4)	155 (64.3)	
T3–4	75 (30.6)	86 (35.7)	

HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis; ENE, extranodal extension.

Table S2 Correlation analysis of clinicopathological factors and lymph node metastasis at level III

Variables	Level III		P value
	– (n=153), n (%)	+ (n=333), n (%)	
Gender			0.298
Female	99 (64.7)	199 (59.8)	
Male	54 (35.3)	134 (40.2)	
Tumor size (cm)			0.361
≤2	128 (83.7)	267 (80.2)	
>2	25 (16.3)	66 (19.8)	
Total tumor size (cm)			0.113
≤2	106 (69.3)	206 (61.9)	
>2	47 (30.7)	127 (38.1)	
Age (years)			0.789
<55	130 (85.0)	286 (85.9)	
≥55	23 (15.0)	47 (14.1)	
Location			0.002
Upper	59 (38.6)	179 (53.8)	
Others	94 (61.4)	154 (46.2)	
Multifocality			0.534
Yes	68 (44.4)	138 (41.4)	
No	85 (55.6)	195 (58.6)	
Coexistent HT			0.735
Yes	52 (34.0)	108 (32.4)	
No	101 (66.0)	225 (67.6)	
Coexistent NG			0.838
Yes	39 (25.5)	82 (24.6)	
No	114 (74.5)	251 (75.4)	
Micro ETE			0.408
Yes	45 (29.4)	86 (25.8)	
No	108 (70.6)	247 (74.2)	
Gross ETE			0.343
Yes	6 (3.9)	20 (6.0)	
No	147 (96.1)	313 (94.0)	
Margin			0.250
Smooth	33 (21.6)	88 (26.4)	
Ill-defined	120 (78.4)	245 (73.6)	
Microcalcification			0.538
Yes	108 (70.6)	244 (73.3)	
No	45 (29.4)	89 (26.7)	
CLNM			<0.001
Positive	104 (68.0)	277 (83.2)	
Negative	49 (32.0)	56 (16.8)	
Level II			0.450
Positive	72 (47.1)	169 (50.8)	
Negative	81 (52.9)	164 (49.2)	
Level IV			0.150
Positive	118 (77.1)	236 (70.9)	
Negative	35 (22.9)	97 (29.1)	
Level V			0.163
Positive	26 (17.0)	75 (22.5)	
Negative	127 (83.0)	258 (77.5)	
CLNM-ENE			0.907
Positive	16 (10.5)	36 (10.8)	
Negative	137 (89.5)	297 (89.2)	
Level II-ENE			0.069
Positive	4 (2.6)	22 (6.6)	
Negative	149 (97.4)	311 (93.4)	
Level IV-ENE			0.772
Positive	13 (8.5)	31 (9.3)	
Negative	140 (91.5)	302 (90.7)	
Level V-ENE			0.904
Positive	3 (2.0)	6 (1.8)	
Negative	150 (98.0)	327 (98.2)	
T stage			0.785
T1–2	101 (66.0)	224 (67.3)	
T3–4	52 (34.0)	109 (32.7)	

HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis; ENE, extranodal extension.

Table S3 Correlation analysis of clinicopathological factors and lymph node metastasis at level IV

Variables	Level IV		P value
	– (n=132), n (%)	+ (n=354), n (%)	
Gender			0.824
Female	82 (62.1)	216 (61.0)	
Male	50 (37.9)	138 (39.0)	
Tumor size (cm)			0.331
≤2	111 (84.1)	284 (80.2)	
>2	21 (15.9)	70 (19.8)	
Total tumor size (cm)			0.488
≤2	88 (66.7)	224 (63.3)	
>2	44 (33.3)	130 (36.7)	
Age (years)			0.997
<55	113 (85.6)	303 (85.6)	
≥55	19 (14.4)	51 (14.4)	
Location			0.088
Upper	73 (55.3)	165 (46.6)	
Others	59 (44.7)	189 (53.4)	
Multifocality			0.829
Yes	57 (43.2)	149 (42.1)	
No	75 (56.8)	205 (57.9)	
Coexistent HT			0.906
Yes	44 (33.3)	116 (32.8)	
No	88 (66.7)	238 (67.2)	
Coexistent NG			0.660
Yes	31 (23.5)	90 (25.4)	
No	101 (76.5)	264 (74.6)	
Micro ETE			0.432
Yes	39 (29.5)	92 (26.0)	
No	93 (70.5)	262 (74.0)	
Gross ETE			0.350
Yes	5 (3.8)	21 (5.9)	
No	127 (96.2)	333 (94.1)	
Margin			0.460
Smooth	36 (27.3)	85 (24.0)	
Ill-defined	96 (72.7)	269 (76.0)	
Microcalcification			0.114
Yes	102 (77.3)	250 (70.6)	
No	30 (22.7)	104 (29.4)	
CLNM			0.019
Positive	94 (71.2)	287 (81.1)	
Negative	38 (28.8)	67 (18.9)	
Level II			0.753
Positive	67 (50.8)	174 (49.2)	
Negative	65 (49.2)	180 (50.8)	
Level III			0.150
Positive	97 (73.5)	236 (66.7)	
Negative	35 (26.5)	118 (33.3)	
Level V			0.519
Positive	30 (22.7)	71 (20.1)	
Negative	102 (77.3)	283 (79.9)	
CLNM-ENE			0.711
Positive	13 (9.8)	39 (11.0)	
Negative	119 (90.2)	315 (89.0)	
Level II-ENE			0.066
Positive	3 (2.3)	23 (6.5)	
Negative	129 (97.7)	331 (93.5)	
Level III-ENE			0.268
Positive	6 (4.5)	26 (7.3)	
Negative	126 (95.5)	328 (92.7)	
Level V-ENE			0.737
Positive	2 (1.5)	7 (2.0)	
Negative	130 (98.5)	347 (98.0)	
T stage			0.953
T1–2	88 (66.7)	237 (66.9)	
T3–4	44 (33.3)	117 (33.1)	

HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis; ENE, extranodal extension.

Table S4 Correlation analysis of clinicopathological factors and lymph node metastasis at level V

Variables	Level V		P value
	– (n=385), n (%)	+ (n=101), n (%)	
Gender			0.040
Female	245 (63.6)	53 (52.5)	
Male	140 (36.4)	48 (47.5)	
Tumor size (cm)			0.042
≤2	320 (83.1)	75 (74.3)	
>2	65 (16.9)	26 (25.7)	
Total tumor size (cm)			0.371
≤2	251 (65.2)	61 (60.4)	
>2	134 (34.8)	40 (39.6)	
Age (years)			0.644
<55	331 (86.0)	85 (84.2)	
≥55	54 (14.0)	16 (15.8)	
Location			0.056
Upper	180 (46.8)	58 (57.4)	
Others	205 (53.2)	43 (42.6)	
Multifocality			0.525
Yes	166 (43.1)	40 (39.6)	
No	219 (56.9)	61 (60.4)	
Coexistent HT			0.312
Yes	131 (34.0)	29 (28.7)	
No	254 (66.0)	72 (71.3)	
Coexistent NG			0.416
Yes	99 (25.7)	22 (21.8)	
No	286 (74.3)	79 (78.2)	
Micro ETE			0.341
Yes	100 (26.0)	31 (30.7)	
No	285 (74.0)	70 (69.3)	
Gross ETE			0.022
Yes	16 (4.2)	10 (9.9)	
No	369 (95.8)	91 (90.1)	
Margin			0.461
Smooth	93 (24.2)	28 (27.7)	
Ill-defined	292 (75.8)	73 (72.3)	
Microcalcification			0.970
Yes	279 (72.5)	73 (72.3)	
No	106 (27.5)	28 (27.7)	
CLNM			0.064
Positive	295 (76.6)	86 (85.1)	
Negative	90 (23.4)	15 (14.9)	
Level II			0.008
Positive	179 (46.5)	62 (61.4)	
Negative	206 (53.5)	39 (38.6)	
Level III			0.163
Positive	258 (67.0)	75 (74.3)	
Negative	127 (33.0)	26 (25.7)	
Level IV			0.519
Positive	283 (73.5)	71 (70.3)	
Negative	102 (26.5)	30 (29.7)	
CLNM-ENE			0.003
Positive	33 (8.6)	19 (18.8)	
Negative	352 (91.4)	82 (81.2)	
Level II-ENE			0.197
Positive	18 (4.7)	8 (7.9)	
Negative	367 (95.3)	93 (92.1)	
Level III-ENE			<0.001
Positive	18 (4.7)	14 (13.9)	
Negative	367 (95.3)	87 (86.1)	
Level IV-ENE			0.059
Positive	30 (7.8)	14 (13.9)	
Negative	355 (92.2)	87 (86.1)	
T stage			0.042
T1–2	266 (69.1)	59 (58.4)	
T3–4	119 (30.9)	42 (41.6)	

HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis; ENE, extranodal extension.

Table S5 Correlation analysis of clinicopathological factors and ENE at level II

Variables	Level II-ENE		P value
	– (n=460), n (%)	+ (n=26), n (%)	
Gender			0.041
Female	287 (62.4)	11 (42.3)	
Male	173 (37.6)	15 (57.7)	
Tumor size (cm)			0.559
≤2	375 (81.5)	20 (76.9)	
>2	85 (18.5)	6 (23.1)	
Total tumor size (cm)			0.017
≤2	301 (65.4)	11 (42.3)	
>2	159 (34.6)	15 (57.7)	
Age (years)			0.195
<55	396 (86.1)	20 (76.9)	
≥55	64 (13.9)	6 (23.1)	
Location			0.361
Upper	223 (48.5)	15 (57.7)	
Others	237 (51.5)	11 (42.3)	
Multifocality			0.042
Yes	190 (41.3)	16 (61.5)	
No	270 (58.7)	10 (38.5)	
Coexistent HT			0.810
Yes	152 (33.0)	8 (30.8)	
No	308 (67.0)	18 (69.2)	
Coexistent NG			0.492
Yes	116 (25.2)	5 (19.2)	
No	344 (74.8)	21 (80.8)	
Micro ETE			0.997
Yes	124 (27.0)	7 (26.9)	
No	336 (73.0)	19 (73.1)	
Gross ETE			0.585
Yes	24 (5.2)	2 (7.7)	
No	436 (94.8)	24 (92.3)	
Margin			0.239
Smooth	112 (24.3)	9 (34.6)	
Ill-defined	348 (75.7)	17 (65.4)	
Microcalcification			0.084
Yes	337 (73.3)	15 (57.7)	
No	123 (26.7)	11 (42.3)	
CLNM			0.200
Positive	358 (77.8)	23 (88.5)	
Negative	102 (22.2)	3 (11.5)	
Level III			0.069
Positive	311 (67.6)	22 (84.6)	
Negative	149 (32.4)	4 (15.4)	
Level IV			0.066
Positive	331 (72.0)	23 (88.5)	
Negative	129 (28.0)	3 (11.5)	
Level V			0.197
Positive	93 (20.2)	8 (30.8)	
Negative	367 (79.8)	18 (69.2)	
CLNM-ENE			<0.001
Positive	41 (8.9)	11 (42.3)	
Negative	419 (91.1)	15 (57.7)	
Level III-ENE			<0.001
Positive	21 (4.6)	11 (42.3)	
Negative	439 (95.4)	15 (57.7)	
Level IV-ENE			<0.001
Positive	33 (7.2)	11 (42.3)	
Negative	427 (92.8)	15 (57.7)	
Level V-ENE			<0.001
Positive	6 (1.3)	3 (11.5)	
Negative	454 (98.7)	23 (88.5)	
T stage			0.553
T1–2	309 (67.2)	16 (61.5)	
T3–4	151 (32.8)	10 (38.5)	

ENE, extranodal extension; HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis.

Table S6 Correlation analysis of clinicopathological factors and ENE at level III

Variables	Level III-ENE		P value
	– (n=454), n (%)	+ (n=32), n (%)	
Gender			0.001
Female	287 (63.2)	11 (34.4)	
Male	167 (36.8)	21 (65.6)	
Tumor size (cm)			0.636
≤2	370 (81.5)	25 (78.1)	
>2	84 (18.5)	7 (21.9)	
Total tumor size (cm)			0.332
≤2	294 (64.8)	18 (56.3)	
>2	160 (35.2)	14 (43.7)	
Age (years)			0.077
<55	392 (86.3)	24 (75.0)	
≥55	62 (13.7)	8 (25.0)	
Location			0.394
Upper	220 (48.5)	18 (56.3)	
Others	234 (51.5)	14 (43.7)	
Multifocality			0.367
Yes	190 (41.9)	16 (50.0)	
No	264 (58.1)	16 (50.0)	
Coexistent HT			0.031
Yes	155 (34.1)	5 (15.6)	
No	299 (65.9)	27 (84.4)	
Coexistent NG			0.662
Yes	112 (24.7)	9 (28.1)	
No	342 (75.3)	23 (71.9)	
Micro ETE			0.797
Yes	123 (27.1)	8 (25.0)	
No	331 (72.9)	24 (75.0)	
Gross ETE			0.295
Yes	23 (5.1)	3 (9.4)	
No	431 (94.9)	29 (90.6)	
Margin			0.989
Smooth	113 (24.9)	8 (25.0)	
Ill-defined	341 (75.1)	24 (75.0)	
Microcalcification			0.194
Yes	332 (73.1)	20 (62.5)	
No	122 (26.9)	12 (37.5)	
CLNM			0.195
Positive	353 (77.8)	28 (87.5)	
Negative	101 (22.2)	4 (12.5)	
Level II			0.025
Positive	219 (48.2)	22 (68.8)	
Negative	235 (51.8)	10 (31.2)	
Level IV			0.268
Positive	328 (72.2)	26 (81.3)	
Negative	126 (27.8)	6 (18.8)	
Level V			<0.001
Positive	87 (19.2)	14 (43.7)	
Negative	367 (80.8)	18 (56.3)	
CLNM-ENE			<0.001
Positive	40 (8.8)	12 (37.5)	
Negative	414 (91.2)	20 (62.5)	
Level II-ENE			<0.001
Positive	15 (3.3)	11 (34.4)	
Negative	439 (96.7)	21 (65.6)	
Level IV-ENE			<0.001
Positive	26 (5.7)	18 (56.3)	
Negative	428 (94.3)	14 (43.7)	
Level V-ENE			<0.001
Positive	5 (1.1)	4 (12.5)	
Negative	449 (98.9)	28 (87.5)	
T stage			0.587
T1–2	305 (67.2)	20 (62.5)	
T3–4	149 (32.8)	12 (37.5)	

ENE, extranodal extension; HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis.

Table S7 Correlation analysis of clinicopathological factors and ENE at level IV

Variables	Level IV-ENE		P value
	– (n=442), n (%)	+ (n=44), n (%)	
Gender			0.023
Female	278 (62.9)	20 (45.5)	
Male	164 (37.1)	24 (54.5)	
Tumor size (cm)			0.758
≤2	360 (81.4)	35 (79.5)	
>2	82 (18.6)	9 (20.5)	
Total tumor size (cm)			0.935
≤2	284 (64.3)	28 (63.6)	
>2	158 (35.7)	16 (36.4)	
Age (years)			0.231
<55	381 (86.2)	35 (79.5)	
≥55	61 (13.8)	9 (20.5)	
Location			0.886
Upper	216 (48.9)	22 (50.0)	
Others	226 (51.1)	22 (50.0)	
Multifocality			0.911
Yes	187 (42.3)	19 (43.2)	
No	255 (57.7)	25 (56.8)	
Coexistent HT			0.131
Yes	150 (33.9)	10 (22.7)	
No	292 (66.1)	34 (77.3)	
Coexistent NG			0.266
Yes	107 (24.2)	14 (31.8)	
No	335 (75.8)	30 (68.2)	
Micro ETE			0.759
Yes	120 (27.1)	11 (25.0)	
No	322 (72.9)	33 (75.0)	
Gross ETE			0.010
Yes	20 (4.5)	6 (13.6)	
No	422 (95.5)	38 (86.4)	
Margin			0.28
Smooth	113 (25.6)	8 (18.2)	
Ill-defined	329 (74.4)	36 (81.8)	
Microcalcification			0.759
Yes	321 (72.6)	31 (70.5)	
No	121 (27.4)	13 (29.5)	
CLNM			0.563
Positive	345 (78.1)	36 (81.8)	
Negative	97 (21.9)	8 (18.2)	
Level II			0.051
Positive	213 (48.2)	28 (63.6)	
Negative	229 (51.8)	16 (36.4)	0.772
Level III			0.059
Positive	302 (68.3)	31 (70.5)	
Negative	140 (31.7)	13 (29.5)	
Level V			0.010
Positive	87 (19.7)	14 (31.8)	
Negative	355 (80.3)	30 (68.2)	
CLNM-ENE			<0.001
Positive	35 (7.9)	17 (38.6)	
Negative	407 (92.1)	27 (61.4)	
Level II-ENE			<0.001
Positive	15 (3.4)	11 (25.0)	
Negative	427 (96.6)	33 (75.0)	
Level III-ENE			<0.001
Positive	14 (3.2)	18 (40.9)	
Negative	428 (96.8)	26 (59.1)	
Level V-ENE			0.010
Positive	6 (1.4)	3 (6.8)	
Negative	436 (98.6)	41 (93.2)	
T stage			0.250
T1–2	299 (67.6)	26 (59.1)	
T3–4	143 (32.4)	18 (40.9)	

ENE, extranodal extension; HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis.

Table S8 Correlation analysis of clinicopathological factors and ENE at level V

Variables	Level V-ENE		P value
	– (n=477), n (%)	+ (n=9), n (%)	
Gender			0.082
Female	295 (61.8)	3 (33.3)	
Male	182 (38.2)	6 (66.7)	
Tumor size (cm)			0.004
≤2	391 (82.0)	4 (44.4)	
>2	86 (18.0)	5 (55.6)	
Total tumor size (cm)			0.008
≤2	310 (65.0)	2 (22.2)	
>2	167 (35.0)	7 (77.8)	
Age (years)			0.500
<55	409 (85.7)	7 (77.8)	
≥55	68 (14.3)	2 (22.2)	
Location			0.784
Upper	234 (49.1)	4 (44.4)	
Others	243 (50.9)	5 (55.6)	
Multifocality			0.137
Yes	200 (41.9)	6 (66.7)	
No	277 (58.1)	3 (33.3)	
Coexistent HT			0.160
Yes	159 (33.3)	1 (11.1)	
No	318 (66.7)	8 (88.9)	
Coexistent NG			0.851
Yes	119 (24.9)	2 (22.2)	
No	358 (75.1)	7 (77.8)	
Micro ETE			0.747
Yes	129 (27.0)	2 (22.2)	
No	348 (73.0)	7 (77.8)	
Gross ETE			0.023
Yes	24 (5.0)	2 (22.2)	
No	453 (95.0)	7 (77.8)	
Margin			0.851
Smooth	119 (24.9)	2 (22.2)	
Ill-defined	358 (75.1)	7 (77.8)	
Microcalcification			0.696
Yes	346 (72.5)	6 (66.7)	
No	131 (27.5)	3 (33.3)	
CLNM			0.964
Positive	374 (78.4)	7 (77.8)	
Negative	103 (21.6)	2 (22.2)	
Level II			0.301
Positive	235 (49.3)	6 (66.7)	
Negative	242 (50.7)	3 (33.3)	
Level III			0.904
Positive	327 (68.6)	6 (66.7)	
Negative	150 (31.4)	3 (33.3)	
Level IV			0.737
Positive	347 (72.7)	7 (77.8)	
Negative	130 (27.3)	2 (22.2)	
CLNM-ENE			0.027
Positive	49 (10.3)	3 (33.3)	
Negative	428 (89.7)	6 (66.7)	
Level II-ENE			<0.001
Positive	23 (4.8)	3 (33.3)	
Negative	454 (95.2)	6 (66.7)	
Level III-ENE			<0.001
Positive	28 (5.9)	4 (44.4)	
Negative	449 (94.1)	5 (55.6)	
Level IV-ENE			0.010
Positive	41 (8.6)	3 (33.3)	
Negative	436 (91.4)	6 (66.7)	
T stage			0.467
T1–2	320 (67.1)	5 (55.6)	
T3–4	157 (32.9)	4 (44.4)	

ENE, extranodal extension; HT, Hashimoto's thyroiditis; NG, nodular goiter; ETE, extrathyroidal extension; CLNM, central lymph node metastasis.