

## Supplementary

Table S1. Variance Inflation Factor (VIF) for multicollinearity among predictors in the preoperative and the postoperative model

variable	vif
Tumor size	1.127481
Tumor shape	1.089634
LN calcification	1.01565
Multilevel involvement	1.228312
Level III involvement	1.180165

variable	vif
Pathologic tumor size (mm)	1.20939
Pathologic LN size (mm)	1.208269
Total number of harvested LNs	4.303605
Total number of metastatic LNs	9.416081
LN ratio	5.8115
Pathology	1.10641
Multifocality	1.079336
Extrathyroidal extension	1.086122
Extranodal extension	1.065918

Table S2. The correlation between the preoperative US features of the index tumor and LNs and pathologic features of LNs in N1b PTC. Cells highlighted in yellow indicate significant values ( $p < 0.05$ ).

Variables	Pathologic LN size (mm)		Total number of harvested LNs		Total number of metastatic LNs		LN ratio	
	r(95% CI) or median(IQR)	p-value	r(95% CI) or median(IQR)	p-value	r(95% CI) or median(IQR)	p-value	r(95% CI) or median(IQR)	p-value
Tumor size	0.184(0.092-0.273)	<.001	0.080(-0.007-0.165)	0.070	0.295(0.214-0.372)	<.001	0.308(0.227-0.383)	<.001
LN size	0.507(0.433-0.573)	<.001	0.090(0.003-0.174)	0.042	0.188(0.103-0.270)	<.001	0.164(0.079-0.247)	<.001
Tumor shape		0.846		0.393		0.361		0.544
Parallel	11.0(6.0-15.0)		43.0(34.0-56.0)		8.0(4.0-14.0)		0.2(0.1-0.3)	
Nonparallel	10.0(7.0-15.0)		43.0(33.0-53.0)		8.0(4.0-12.5)		0.2(0.1-0.3)	
Tumor composition		1.000		0.065		0.030		0.115
Solid	10.0(6.0-15.0)		43.0(34.0-55.0)		8.0(4.0-13.0)		0.2(0.1-0.3)	
<50% cystic	11.0(8.0-15.0)		47.5(36.0-63.0)		9.0(7.0-18.0)		0.3(0.2-0.3)	
>50% cystic	9.0(8.0-15.0)		68.0(49.0-90.0)		13.5(11.0-20.0)		0.3(0.2-0.3)	
Tumor echogenicity		0.320		0.209		0.296		0.269
Hyperechogenicity	.(.-.)		28.0(28.0-28.0)		14.0(14.0-14.0)		0.5(0.5-0.5)	
Isoechogenicity	13.0(11.0-15.0)		63.0(35.0-78.0)		12.0(5.0-28.0)		0.3(0.1-0.4)	
Hypoechoogenicity	10.0(7.0-15.0)		43.0(34.0-56.0)		8.0(4.0-13.0)		0.2(0.1-0.3)	
Marked hypoechoogenicity	10.0(5.0-15.0)		42.5(35.0-53.0)		8.0(5.0-13.0)		0.2(0.1-0.3)	

Tumor margin		0.592		0.642		0.622		0.705
Well	-		-		-		-	
Microlobulated	11.0(6.0-16.0)		42.5(34.0-53.0)		8.0(4.0-14.0)		0.2(0.1-0.3)	
Irregular	10.0(6.0-15.0)		43.0(34.0-55.0)		8.0(4.0-13.0)		0.2(0.1-0.3)	
Tumor calcification		0.059		0.178		<.001		<.001
No	9.0(6.0-13.0)		41.0(34.5-50.0)		7.0(4.0-10.5)		0.2(0.1-0.3)	
Macrocalcification	12.0(7.0-17.0)		41.0(30.0-57.0)		5.5(3.0-10.0)		0.2(0.1-0.2)	
Microcalcification	10.5(6.0-16.0)		44.0(34.0-57.0)		9.0(5.0-15.0)		0.2(0.1-0.3)	
Tumor location		0.163		0.133		0.321		0.855
Non-upper	11.0(7.0-16.0)		43.0(34.0-56.0)		8.0(4.0-14.0)		0.2(0.1-0.3)	
Upper	10.0(5.0-15.0)		43.0(33.0-51.0)		7.5(5.0-12.0)		0.2(0.1-0.3)	
LN cystic change		0.001		0.314		0.213		0.442
No	9.0(5.0-14.0)		43.0(33.0-55.0)		8.0(4.0-13.0)		0.2(0.1-0.3)	
Yes	12.0(7.0-17.0)		44.0(36.0-54.0)		8.0(5.0-15.0)		0.2(0.1-0.3)	
LN calcification		<.001		0.701		0.042		0.038
No	9.0(5.0-13.0)		42.0(35.0-53.0)		8.0(4.0-12.0)		0.2(0.1-0.3)	
Yes	12.0(8.0-18.0)		44.0(33.0-57.0)		8.0(5.0-15.0)		0.2(0.1-0.3)	
LN shape		<.001		0.275		0.744		0.158
Oval	10.0(5.0-14.0)		42.0(33.0-54.0)		8.0(4.0-13.0)		0.2(0.1-0.3)	

Round/irregular	11.5(7.0-18.0)		44.0(35.0-55.0)		8.0(5.0-13.0)		0.2(0.1-0.3)	
LN echogenicity		<.001		0.004		0.010		0.199
Hypo-/isoechogenicity	7.0(4.0-11.0)		41.0(33.0-49.0)		7.0(4.0-12.0)		0.2(0.1-0.3)	
Hyperechogenicity	13.0(8.0-18.0)		45.0(35.0-58.0)		8.0(5.0-14.0)		0.2(0.1-0.3)	
LN hilum		<.001		0.317		0.011		0.010
No	5.0(3.0-9.0)		40.0(33.0-48.0)		6.0(4.0-10.0)		0.1(0.1-0.2)	
Yes	11.0(7.0-16.0)		43.0(34.0-55.0)		8.0(5.0-13.0)		0.2(0.1-0.3)	
Multilevel involvement		<.001		<.001		<.001		<.001
No	8.0(5.0-12.0)		40.0(31.0-49.0)		5.0(3.0-8.5)		0.1(0.1-0.2)	
Yes	12.0(8.0-17.0)		45.0(36.0-58.0)		10.0(6.0-15.0)		0.2(0.2-0.3)	
Level III involvement		<.001		0.004		<.001		0.004
No	9.0(5.0-13.0)		41.0(32.0-49.0)		7.0(4.0-11.0)		0.2(0.1-0.3)	
Yes	11.0(7.0-17.0)		44.0(35.0-58.0)		8.0(5.0-14.0)		0.2(0.1-0.3)	

Variables	Extranodal extension			
	No (n=207)	Yes (n=264)	None (n=46)	p-value
	median(IQR) or N%	median(IQR) or N%	median(IQR) or N%	
Tumor size	14.0(10.0-20.0)	15.0(10.0-22.0)	13.5(8.0-20.0)	0.148
LN size	12.0(9.0-16.0)	12.0(9.0-17.0)	10.5(8.0-15.0)	0.341
Tumor shape				0.699
Parallel	105(50.72)	142(53.79)	26(56.52)	
Nonparallel	102(49.28)	122(46.21)	20(43.48)	
Tumor composition				0.214
Solid	198(95.65)	255(96.59)	42(91.30)	
<50% cystic	6(2.90)	8(3.03)	4(8.70)	
>50% cystic	3(1.45)	1(0.38)	0(0.00)	
Tumor echogenicity				0.235
Hyperechogenicity	0(0.00)	1(0.38)	0(0.00)	
Isoechogenicity	3(1.45)	8(3.03)	0(0.00)	
Hypoechogenicity	126(60.87)	133(50.38)	26(56.52)	
Marked hypoechogenicity	78(37.68)	122(46.21)	20(43.48)	
Tumor margin				0.004
Well	-	-	-	
Microlobulated	23(11.11)	41(15.53)	14(30.43)	
Irregular	184(88.89)	223(84.47)	32(69.57)	
Tumor calcification				0.065
No	57(27.54)	62(23.48)	17(36.96)	
Macrocalcification	14(6.76)	34(12.88)	6(13.04)	
Microcalcification	136(65.70)	168(63.64)	23(50.00)	
Tumor location				0.390
Non-upper	136(65.70)	180(68.18)	35(76.09)	
Upper	71(34.30)	84(31.82)	11(23.91)	
LN cystic change				0.165
No	159(76.81)	182(68.94)	33(71.74)	
Yes	48(23.19)	82(31.06)	13(28.26)	
LN calcification				0.393
No	124(59.90)	147(55.68)	30(65.22)	
Yes	83(40.10)	117(44.32)	16(34.78)	
LN shape				0.129
Oval	138(66.67)	152(57.58)	29(63.04)	
Round/irregular	69(33.33)	112(42.42)	17(36.96)	

LN echogenicity				<.001
Hypo-/isoechogenicity	94(45.41)	84(31.82)	26(56.52)	
Hyperechogenicity	113(54.59)	180(68.18)	20(43.48)	
LN hilum				0.102
No	25(12.08)	24(9.09)	9(19.57)	
Yes	182(87.92)	240(90.91)	37(80.43)	
Multilevel involvement				0.001
No	97(46.86)	84(31.82)	23(50.00)	
Yes	110(53.14)	180(68.18)	23(50.00)	
Level III involvement				0.146
No	88(42.51)	92(34.85)	21(45.65)	
Yes	119(57.49)	172(65.15)	25(54.35)	

Values are expressed as the median (IQR) or number (%) LN, lymph node; LN ratio, total number of metastatic LNs/total number of harvested LNs.