

# Application of Tissue Aspirate Parathyroid Hormone Assay for Imaging Suspicious Neck Lesions in Patients with Complicated Recurrent Or Persistent Renal Hyperparathyroidism

## Supplementary Material

Table S1. Demographic data of patients receiving tissue aspirate PTH assays.

Ca se*	Gender (F:M=2 5:7)	Age (years)	Number of operations	Prior operation performed at our hospital (1) or another hospital (2)	Number of parathyroid glands removed during prior operation	Recurrent (R) or Persistent (P) (R:P=8:2 4)	Lesions underwent tissue aspiration (n=50)	Serum PTH (pg/mL)	Tissue aspirate PTH (pg/mL)	Parathyroid scintigraphy <sup>†</sup>	Parathyroid sonography <sup>†</sup>	Reoperative findings (parathyroid location)	Pre-re op PTH (pg/mL)	Post-re op PTH (pg/mL)
1	F	62	1	1	5	R	1	514.6 1	38.9	n	p	Intravagal	721.77	201.1
2	F	71	1	1	4	P	1	869.7	2150.9	n	p	RS	876.81	215.93
3	F	73	1	1	4	P	2	>2500	>2500 712	s	s	LS	803.2	302
4	M	46	2	1	6	P	2	624.4 1	6156.9 5914.6 5	p	p	intrathyroid RI	624.41	35.18
5	F	66	1	1	4	R	1	412.3 9	15,807	n	s	undescended	412.39	0.98
6	F	43	1	1	4	P	1	1348	558.53	p	p	RI	1551.4	0.91
7	F	44	1	1	4	P	1	1216	1550	n	s	undescended	954.62	26.14
8	F	60	1	1	3	R	2	428.2 7	4366 2.43	n	s	RI	852.45	90.39
9	M	65	1	1	3	R	1	1404	0.99	n	s	§	1404	52.15
10	F	56	1	1	4	P	1	635	4235.4	p	p	RS	768.92	144.62
11	F	57	1	1	1	R	2	544.7 4	44470 1520.2 2	s	p	RS RI	1987.6	60.85
12	F	53	1	1	4	P	1	832	4132	s	s	undescended	832	4.09
13	F	59	1	1	4	R	2	975.5 4	10,443.2 1.02	s	p	Lt carotid sheath	603.15	155.26
14	M	47	1	1	4	P	1	752.7	18.6	n	s	§	752.71	57.59
										p	s	§ intrathyroid		

15	F	63	2	1	5	R	1	632.6 2	519.2	n	s	‡		
16	M	46	2	1	5	P	1	442.1 6	444.87	s	p	LS	509.2	9.58
17	F	68	1	1	4	P	1	896.7	2591.2	p	s	intrathyroid	2114.2	124.34
18	F	53	1	1	3	P	1	314.6	5.22	n	s	§		
19-1	F	51	1	1	2	P	1	513.4 7	4967.6	s	s	intrathyroid	963.4	158.46
19-2	F	52	2	1	3	P	1	227.7 8	822.6	n	s	intrathyroid	789.15	53.88
20	F	51	1	1	4	P	1	524	2744.4	p	s	intrathyroid	936.05	25.85
21	F	63	1	1	4	P	1	297.3 4	2521.6	N	p	‡		
22	F	55	1	1	4	P	1	748.9 1	13,934	S	s	intrathyroid	1318.0 7	111.66
23	F	61	1	1	4	P	1	416.3 3	1388.1 6	S	s	intrathyroid	1218.2	27.16
24	F	59	1	2	4	P	2	1675	>2500 >2500	S S	s s	intrathyroid parathyromatosis	1079	55.7
25	F	54	4	2	4	R	1	1005	>2500	S	s	LS	1017.9 1	18.39
				2			4	32,986. 5		N	s	parathyromatosis	1377	351
26-1	F	54	3		5	P		1817. 8	27,318	N	s	parathyromatosis		
								24,278		N	s	parathyromatosis		
								5.14		N	s	§		
26-2	F	58	4	2	5 + Parathyromatosis	P	3	7.4		N	s	§		
								351	3.93	N	s	§		
								2.21		N	s	§		
27	F	67	1	2	3	P	1	1429. 2	3019.3	P	s	LI	769.12	24.03
28	F	51	2	2	Unknown	P	2	998.8 5	714.44	P	s	parathyromatosis	998.85	307.9
								315.17		P	s	parathyromatosis		
29	M	51	1	2	Unknown	P	2	1417. 77	11,296. 6	S	s	RS	1417.7 7	341.72
								28.62		N	s	§		
30	M	52	4	2	Unknown	P	2	739.5 8	3274	S	s	‡		
								1393		S	s	‡		
31	F	58	1	2	Unknown	P	1	214.7	2.35	P	s	§	1882.8	138.54

							8				
			2				3	>2500	S	s	parathyromatosis
32	M	55	2	Unknown	P	901	>2500	S	s	s	parathyromatosis
							>2500	S	s	s	parathyromatosis

\*Case 3, 4, 8, 11, 13, 24, 26, 28, 29, 30, 32 received multiple tissue aspirate PTH assays at the same time; Case 19, 26 received multiple tissue aspirate PTH assays at different times; Case 24~32 received prior operations at other hospitals; Case 32 received reoperation at other hospital. †Image study results: p=positive; s=suspicious; n=negative. ‡Assay-positive lesions without operation. §Assay-negative lesions: Case 14 false assay-negative lesion; Case 26-1, 29 received neck operations with assay-negative lesions explored; Case 8, 13 received neck operations without assay-negative lesions explored; Case 9, 31 received graft operations. Abbreviation: PTH, parathyroid hormone; RS, right superior; RI, right inferior; LS, left superior; LI, left inferior.

Table S2. Comparison of tissue aspirate PTH assays results using different criteria.

Case	Study protocol (dilution volume)	Our study (6mL saline)	Frasoldati et al. <sup>19</sup> (1mL saline)	Stephen et al. <sup>18</sup> (5mL saline)	Master et al. <sup>21</sup> (1mL saline)	Abdelghani et al. <sup>16</sup> (2mL saline)
	Positive assay	> serum PTH/30, pg/mL (B*30 > A)	> 101 pg/mL (B*6 > 101)	> normal serum PTH, pg/mL (B*6/5 > 40 (65))	> normal serum PTH, pg/mL (B*6 > 40 (65))	> serum PTH, pg/mL (B*3 > A)
1	<b>Corrected tissue aspirate PTH, pg/mL</b>	1167.0	233.4	46.7 <sup>+</sup>	233.4	116.7 <sup>+</sup>
2		64,527.0	12,905.4	2581.1	12,905.4	6452.7
3		75,000.0	15,000.0	3000.0	15,000.0	7500.0
		21,360.0	4272.0	854.4	4272.0	2136.0 <sup>+</sup>
4		184,707.0	36,941.4	7388.3	36,941.4	18,470.7
		177,439.5	35,487.9	7097.6	35,487.9	17,744.0
5		474,210.0	94,842.0	18,968.4	94,842.0	47,421.0
6		16,755.9	3351.2	670.2	3351.2	1675.6
7		46,500.0	9300.0	1860.0	9300.0	4650.0
8		130,980.0	26,196.0	5239.2	26,196.0	13,098.0
		72.9 <sup>*</sup>	14.6 <sup>*</sup>	2.9 <sup>*</sup>	14.6 <sup>*</sup>	7.3 <sup>*</sup>
9		29.7 <sup>*</sup>	5.9 <sup>*</sup>	1.2 <sup>*</sup>	5.9 <sup>*</sup>	3.0 <sup>*</sup>
10		127,062.0	25,412.4	5082.5	25,412.4	12,706.2
11		1,334,100.0	266,820.0	53,364.0	266,820.0	133,410.0
		45,606.6	9121.3	1824.3	9121.3	4560.7
12		123,960.0	24,792.0	4958.4	24,792.0	12,396.0
		313,296.0	62,659.2	12,531.8	62,659.2	31,329.6
13		30.6 <sup>*</sup>	6.1 <sup>*</sup>	1.2 <sup>*</sup>	6.1 <sup>*</sup>	3.1 <sup>*</sup>
14		558.0 <sup>+</sup>	111.6	22.3 <sup>+</sup>	111.6	55.8 <sup>+</sup>
15		15,576.0	3115.2	623.0	3115.2	1557.6
16		13,346.1	2669.2	533.8	2669.2	1334.6
17		77,736.0	15,547.2	3109.4	15,547.2	7773.6
18		156.6 <sup>*</sup>	31.3 <sup>*</sup>	6.3 <sup>*</sup>	31.3 <sup>*</sup>	15.7 <sup>*</sup>
19-1		149,028.0	29,805.6	5961.1	29,805.6	14,902.8
19-2		24,678.0	4935.6	987.1	4935.6	2467.8
20		82,332.0	16,466.4	3293.3	16,466.4	8233.2
21	75,648.0	15,129.6	3025.9	15,129.6	7564.8	
22	418,020.0	83,604.0	16,720.8	83,604.0	41,802.0	
23	41,644.8	8329.0	1665.8	8329.0	4164.5	
24	75,000.0	15,000.0	3000.0	15,000.0	7500.0	
	75,000.0	15,000.0	3000.0	15,000.0	7500.0	
25	75,000.0	15,000.0	3000.0	15,000.0	7500.0	
	989,595.0	197,919.0	39,583.8	197,919.0	98,959.5	
26-1	819,540.0	163,908.0	32,781.6	163,908.0	81,954.0	
	728,340.0	145,668.0	29,133.6	145,668.0	72,834.0	

	154.2*	30.8*	6.2*	30.8*	15.4*
	222.0*	44.4*	8.9*	44.4*	22.2*
26-2	117.9*	23.6*	4.7*	23.6*	11.8*
	66.3*	13.3*	2.7*	13.3*	6.6*
27	90,579.0	18,115.8	3623.2	18,115.8	9057.9
28	21,433.2	4286.6	857.3	4286.6	2143.3
	9455.1	1891.0	378.2	1891.0	945.5 <sup>+</sup>
29	338,898.0	67,779.6	13555.9	67,779.6	33,889.8
	858.6*	171.7 <sup>#</sup>	34.3*	171.7 <sup>#</sup>	85.9*
30	98220.0	19,644.0	3928.8	19,644.0	9822.0
	41790.0	8358.0	1671.6	8358.0	4179.0
31	70.5*	14.1*	2.8*	14.1*	7.1*
	75,000.0	15,000.0	3000.0	15,000.0	7500.0
32	75,000.0	15,000.0	3000.0	15,000.0	7500.0
	75,000.0	15,000.0	3000.0	15,000.0	7500.0

\*Assay-negative result (according to the individual criteria). <sup>+</sup>False assay-negative result (according to the individual criteria). <sup>#</sup>False assay-positive result (according to the individual criteria). A, Serum PTH (pg/mL) in Supplementary Table S1; B, Tissue aspirate PTH (pg/mL) in Supplementary Table S1. Abbreviation: PTH, parathyroid hormone.



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