

K-09

Anthropometric Renal Alterations in Supine and Prone Positions in Percutaneous Renal Cryoablation for Renal Cortical Neoplasms

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Introduction:

During percutaneous cryoablation for renal cortical neoplasms we noted clinically significant anatomic alterations in the position of the colon, lung and kidney compared to the (supine) preoperative CT. As such, we evaluated anatomic changes between supine and prone positions.

Material and Methods:

A total of 19 patients with solid renal cortical neoplasms were treated with percutaneous cryoablation. Each patient underwent an abdominal CT scan in the supine (pre-operative) and prone position (intra-operative). Data was collected on axial CT slides with adjustment to the tilt. Data points included anterior/posterior, medial/lateral, cranial/caudal movement of the kidney; as well, as kidney rotation relative to distinctive anatomic landmarks (posterior vertebral body, perpendicular bisector of vertebral body). Further measurements included the amount of kidney covered by liver/spleen/lung, tract length (distance of skin edge to mid part of tumor), amount of perirenal fat, distance of colon to kidney (hilar area) and finally anterior/posterior location of the colon compared to the kidney. Statistical analysis included a paired Wilcoxon Rank test with values < 0.05 seen as significant (SPSS Version 20).

Results:

Both kidneys are more anterior located in the prone position: 4.72 cm vs. 4.29 cm for left side and 4.41 cm vs. 4.06 cm for the right side ($p=0.02$ and $p=0.03$, respectively). In the prone position, the kidneys are more cranial compared to supine images: 80.4 mm vs. 60.8 mm [left kidney] and 87.2 mm vs. 57.4 mm [right kidney], ($p=0.002$ and $p<0.0001$, respectively). The prone position is also associated with a significant shorter skin edge to tumor distance: 6.34 cm vs. 7.18 cm ($p<0.0001$). Further, the position of the colon relative to the hilum of the kidney is closer in prone axial images: 1.02 cm vs. 1.32 cm [left] and 0.81 cm vs. 1.45 cm [right], [$p=0.04$ and $p=0.033$, respectively]. The colon is more posteriorly located in prone vs. supine position on both sides: 1.21 cm vs. 1.04 cm [left kidney] and 0.80 cm vs. 0.70 cm [right kidney], ($p=0.005$ and $p=0.005$, respectively).

Left kidney	A/P Movement [cm]	M/L Movement [cm]	Kidney Rotation [°]	Cranial/Caudal Movement[mm]	Tract Length [cm]
Prone	4.72	4.00	41.1	80.4	6.34
Supine	2.29	4.19	43.4	60.8	7.18
Wilcoxon Rank Test	0.02	0.122	0.573	0.002	<0.0001

Left kidney	Covered by Liver/Spleen [mm]	Covered by Lung [mm]	Perirenal Fat [cm]	Distance to Colon [cm]	A/P Movement Colon [cm]
Prone	39.2	14.2	1.04	1.02	1.94
Supine	35.3	8.05	1.21	1.32	3.26
Wilcoxon Rank Test	0.144	0.253	0.064	0.04	0.005

Right kidney	A/P Movement [cm]	M/L Movement [cm]	Kidney Rotation [°]	Cranial/Caudal Movement[mm]
Prone	4.41	4.24	42.9	87.2
Supine	4.06	4.15	44.7	57.4
Wilcoxon Rank Test	0.030	0.809	0.122	<0.0001

Right kidney	Covered by Liver/Spleen [mm]	Covered by Lung [mm]	Perirenal Fat [cm]	Distance to Colon [cm]	A/P Movement Colon [cm]
Prone	79.4	27.3	0.80	0.81	2.86
Supine	75.3	6.05	0.70	1.45	4.31
Wilcoxon Rank Test	0.266	0.001	0.103	0.033	0.005

Table 1: Anthropometric changes

Conclusion:

The prone position is associated with anthropometric changes including a more anterior, more cranial located kidney bilaterally, more coverage of the right upper pole by pleura, a shorter skin to tumor distance and a closer to the kidney and more posterior located colon. The prone position thus limits the window of access to the kidney for upper pole and more anterior tumors. These findings may help in treatment and positional planning for percutaneous renal ablation procedures.