Cryoablation of an adrenal metastasis under CT guidance

Michael Kostrzewa, MD; Florian Messmer, MD

Interventional Radiology, Kantonsspital Baden, Switzerland

History

An 85-year-old male patient, suffering from bronchial carcinoma, was diagnosed with a left adrenal mass. It was progressive in size, despite prior radiotherapy, therefore being highly suggestive of a metastasis. The patient was admitted for cryoablation.

Diagnosis and Intervention

The patient was placed in left lateral decubitus to prone position. The intervention was performed under general anesthesia.

The metastasis in the left adrenal gland, measuring approx. 5 cm in diameter, was seen in a biphasic (arterial and venous) contrast CT scan for planning, showing peripheral enhancement in the venous phase. The lesion was closely located between the upper pole of the left kidney and the abdominal aorta.

The access routes were planned using myNeedle Guide 3D. A total of six cryoprobes (Boston Scientific IceRod 1.5 CX 90°) were placed in the lesion using dorsal paravertebral or intercostal paths. Due to the lack of alternative access routes, three probes had to be placed using a transpulmonary approach. A 10-minute freeze cycle was carried out, followed by passive thawing for 9 minutes. Then another 10-minute freeze cycle was followed by an active thawing of 1 minute. The growth of the ice ball and the ablation zone were monitored at 8-minute intervals by CT scanning using i-spiral. Tract ablation was performed at the removal of the probes to prevent track seeding.

A biphasic (arterial and venous) control contrast CT scan was performed, showing a hypodense area in the ablation zone without contrast enhancement of the adrenal gland. No signs of post-interventional complications, especially neither bleeding nor pneumothorax, were seen.

The patient was dismissed from the hospital the day after the procedure. A follow-up CT, three months after the cryoablation, showed complete devascularization of the lesion with no signs of recurrence.

Comments

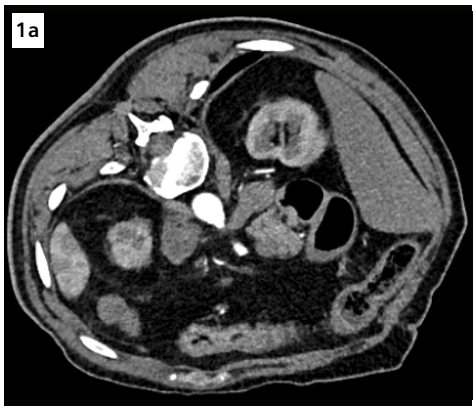
Cryoablation applies alternating cycles of freezing and thawing to cause mechanical stress on the cellular membranes from intracellular ice crystal formation and hypotonic cell disruption. Adrenal ablations are usually performed under CT guidance. The success of the procedure, as well as the prevention of nontarget thermal injury, highly rely on precise probe positioning, meticulous preprocedural planning and intraprocedural monitoring.

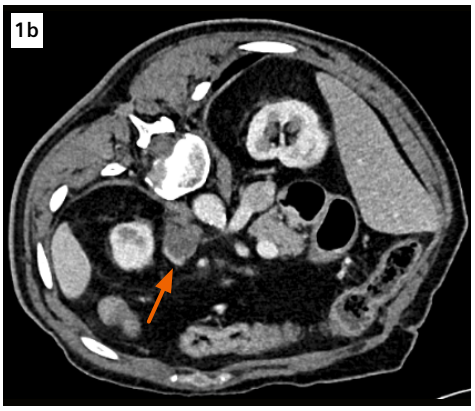
Studies have shown that cryoablation has a lower risk of a hypertensive crisis than microwave ablation. [1,2] During the cryoablation procedure, the ice ball growing, and thus the ablation area, can be clearly monitored on CT imaging. Potential damages to risk structures, such as vessels (a renal artery in this case) in the target area can be carefully avoided. The trajectories of six cryoprobes are planned on multiplanar reformats (MPRs) using myNeedle Guide 3D. This method is particularly helpful in planning a double angulated access path. The planned path is individually transferred by “one-click” to the laser guidance system, myNeedle Laser, integrated in both software and hardware of the CT scanner, SOMATOM X.ceed. Two of the four laser projectors installed on the gantry are utilized for visualizing the probe. Specifically, these two projectors are combined to visualize both the entry point and trajectory angle of the probe accurately. The selection criteria for these two adjacent laser projectors prioritize precision in entry point and trajectory angle visualization. During the probe placement, short sequential (i-sequence) or spiral (i-spiral) scans are performed to monitor the progress. With the help of the laser guidance system, the workflow of the probe positioning becomes more efficient, facilitating a successful placement of six cryoprobes in the tumor. ●

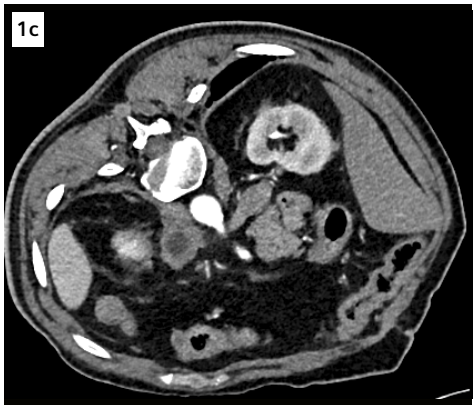
References

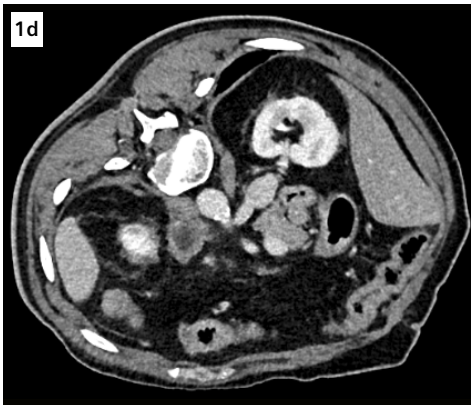
[1] Wei Zhang, et al. Computed tomography-guided cryoablation for adrenal metastases: local control and survival. Medicine (2018) 97:51(e13885)

[2] Claudio Pusceddu, et al. Evaluating the Effectiveness of CT Guided Cryoablation in Treating Adrenal Metastases: Insights from a Single-Center Study. Preprints.org. Posted: 24 January 2024. doi:10.20944/preprints202401.1762.v1

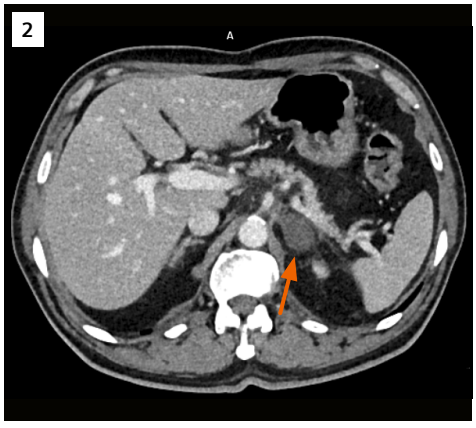






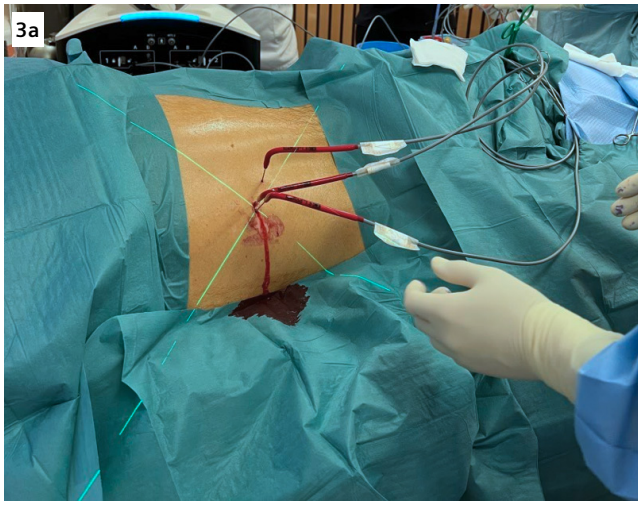


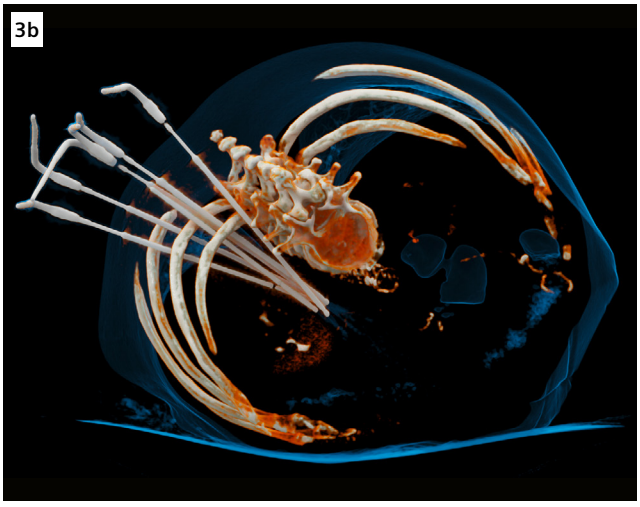
1 Axial images (2 mm) prior to the cryoablation (Fig. 1a, arterial phase and 1b, venous phase) show a metastatic lesion in the left adrenal gland, measuring approx. 5 cm in diameter, with peripheral enhancement (arrow), closely located between the upper pole of the left kidney and the abdominal aorta. After the cryoablation (Fig. 1c, arterial phase and 1d, venous phase), a hypodense area in the ablation zone without contrast enhancement is shown.



2 An axial image from a follow-up contrast CT scan, 3 months after the cryoablation procedure, showed complete devascularization of the lesion (arrow) with no signs of recurrence.

3 A photo (Fig. 3a) shows two fan beam laser projectors that best visualize the geometry of the needle path are combined to project the entry point and the angulation of the path. A cinematic volume rendered image (Fig. 3b) shows the position of the 6 cryoprobes in three dimensions.





Examination Protocol

Scanner	**SOMATOM X.ceed**	
Scan area	Mid abdomen	Mid abdomen
Scan mode	Spiral mode (planning) Arterial/venous	Spiral mode (control) Arterial/venous
Scan length	212 / 216 mm	156 / 150 mm
Scan direction	Cranio-caudal	Cranio-caudal
Scan time	3.3 / 3.6 s	2.4 / 2.3 s
Tube voltage	100 kV	100 kV
Effective mAs	91 / 107 mAs	93 / 110 mAs
Dose modulation	CARE Dose4D	CARE Dose4D
$CTDI_{vol}$	4.8 / 5.6 mGy	4.8 / 5.7 mGy
DLP	114 / 141 mGy*cm	88 / 102 mGy*cm
Rotation time	0.5 s	0.5 s
Pitch	0.8	0.8
Slice collimation	128 × 0.6 mm	128 × 0.6 mm
Slice width	2 mm	2 mm
Reconstruction increment	2 mm	2 mm
Reconstruction kernel	Br40	Br40

Contrast	**370 mg/mL**	**370 mg/mL**
Volume	90 mL + 30 mL saline	90 mL + 30 mL saline
Flow rate	4 mL/s	4 mL/s
Start delay	1, Arterial phase: Bolus tracking triggered at 100 HU in the abdominal aorta + 3 s 2, Venous phase: 70 s	1, Arterial phase: Bolus tracking triggered at 100 HU in the abdominal aorta + 3 s 2, Venous phase: 70 s

The statements by Siemens Healthineers' customers described herein are based on results that were achieved in the customer's unique setting. Because there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT and/or automation adoption) there can be no guarantee that other customers will achieve the same results.

The products/features (mentioned herein) are not commercially available in all countries. Their future availability cannot be guaranteed.