Case 9

Dual Energy for Ruling out Sinus Thrombosis or Cerebral Abscess From Acute Parenchymal Hemorrhage at Right Parietal Lobe

By Dominik Morhard, MD, Thorsten R. Johnson, MD, Prof. Maximilian F. Reiser, MD, and Christoph Becker, MD, PD, Department of Clinical Radiology, University Hospital of Munich-Großhadern, Munich, Germany

HISTORY

A 67-year-old male patient with known multiple myeloma, stadium 3, under anti-coagulatory therapy after aortic valve reconstruction, presented at the emergency room with a right sided visual field defect. Initial non-enhanced CT (NECT) showed an acute parenchymal hemorrhage at the left parietal lobe (Fig. 1).
To rule out sinus-thrombosis or cerebral abscesses, a Spiral Dual Energy CT (DECT) scan was performed after intravenous iodine contrast agent application. Material differentiation using the so called "Liver-VNC" algorithm and slightly modified default parameters (Fig. 2) resulted in a virtual non-enhanced / native (VN) and color-coded semi-quantitative iodine concentration (C) images[1]. Fused MPR images of VN and C images showed a solitary, pathological contrast enhancement in the centre of the hemorrhage (Fig. 3) that was masked by the surrounding hyper dense blood in the standard CT images without selective material differentiation. MRI, performed six hours later, showed a good correlation of the T1-weighted gadolinium-enhanced images to the DECT (Fig. 4).

DIAGNOSIS

A solitary spot of contrast enhancement in the centre of an acute parenchymal hemorrhage and ruled out sinus thrombosis guides the diagnosis to malignant tumor. Although intracerebral plasmacytoma is very rare, this is the most probable diagnosis[2]. Unfortunately the patient died on the second day after symptom onset. As there was no bioptical probe taken, a final histological diagnosis is missing.

COMMENTS

The "Liver VNC" algorithm, which was used for material differentiation in this case was optimized for parenchymal organs of the abdomen such as liver and kidneys. Specific modifications and filters on the algorithm for brain analysis and examinations with a radiation dose comparable to standard cranial CT scans (Note: CTDI of this examination: 29.0) may result in improved image quality. Possible future applications for DECT of the head could be routinely contrast-enhanced scanning with reconstruction of virtual non-enhanced images without a previous NECT – to rule out hemorrhage – resulting in a radiation dose reduced by half.

References
1 Johnson TR, Krauss B, Sedlmair M, Grasruck M, Bruder H, Morhard D, Fink C, Weckbach S, Lenhard M, Schmidt B, Flohr T, Reiser MF, Becker CR. Material differentiation by dual energy CT: initial experience. Eur Radiol. 2007 Jun;17(6):1510–7. Epub 2006 Dec 7.
2 Wavre A, Baur AS, Betz M, Mühlematter D, Jotterand M, Zaman K, Ketterer N. Case study of intracerebral plasmacytoma as an initial presentation of multiple myeloma. Neuro Oncol. 2007Jul; 9(3):370–2. Epub 2007 May 23.

EXAMINATION PROTOCOL

| Scanner	SOMATOM Definition
Scan area	Head
Scan length	180 mm
Scan time	23 s
Scan direction	cranio-caudal
Tube voltage A/B	140 kV / 80 kV
Tube curren A/B	84 eff. mAs / 357 eff. mAs
Rotation time	0.33 s
Slice collimation	0.6 mm
Slice width	1 mm
Pitch	0.8
Reconstruction increment	0.75 mm
$CTDI_{vol}$	29 mGy
Kernel	D31
Contrast	
Volume	95 ml
Flow rate	2.4 ml/s
Start delay	180 s
Postprocessing	Liver-VNC-algorithm on a syngo MMWP running the dual energy application, cross-sectional thick-MPR-Reformations (5 mm)

VNC = Virtual Non-Contrast, MPR = Multiplanar Reformation
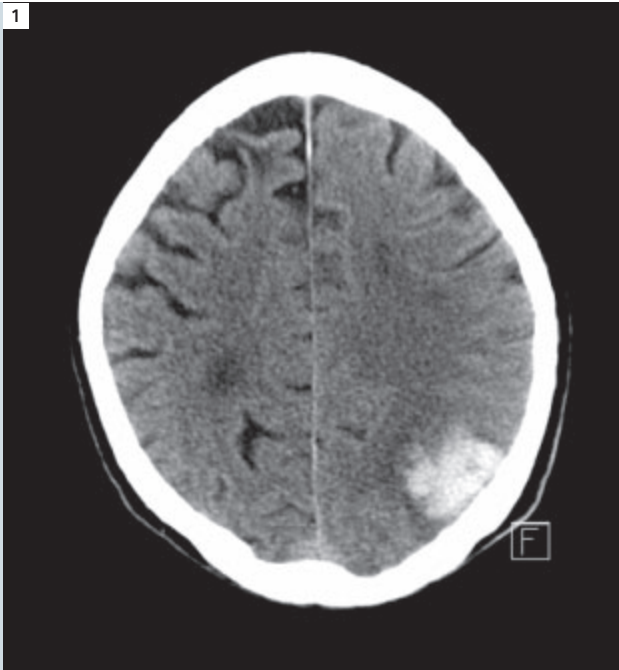
1 NECT showing an acute parenchymal hemorrhage in the left parietal lobe.
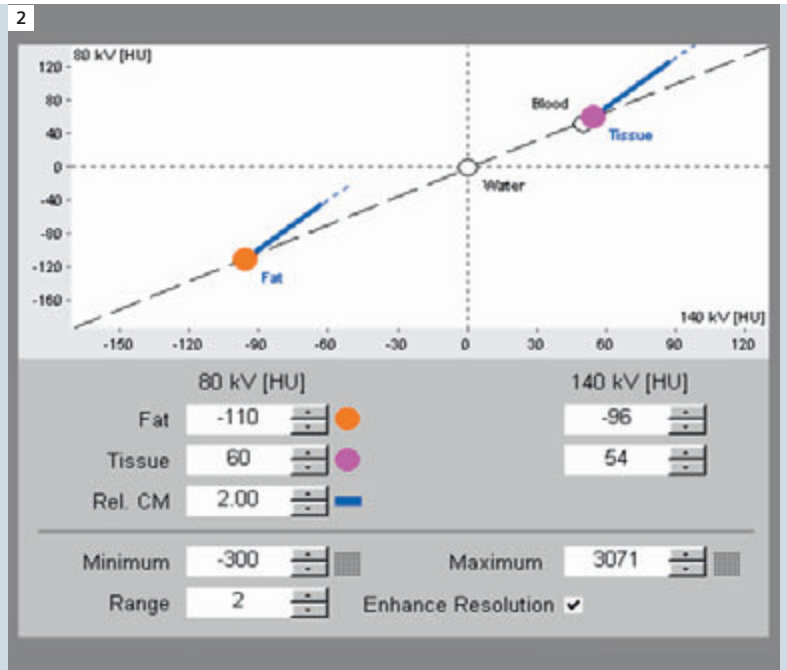
2 Settings for material differentiation by Spiral Dual Energy using the "Liver VNC" algorithm.
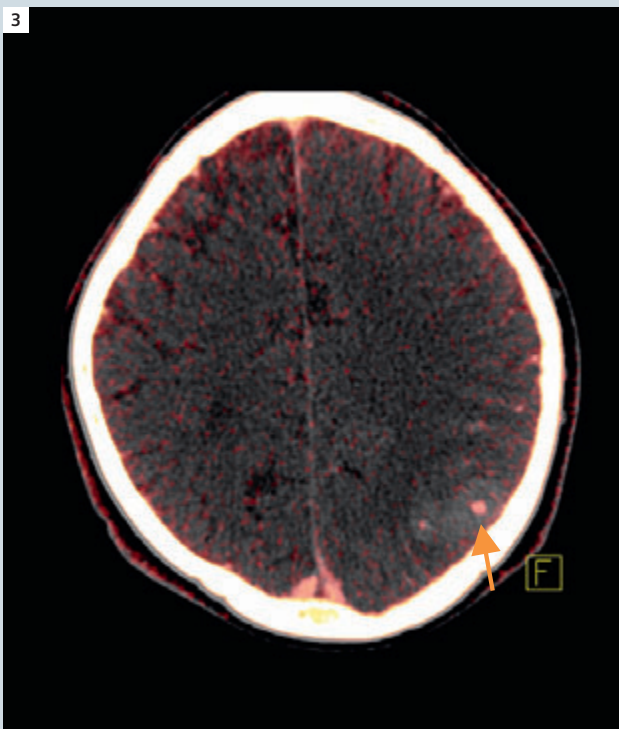
3 Fused MPR images of "virtual non-enhanced" and iodine images shows a solitary, pathological contrast enhancement in the centre of the hemorrhage (arrow).
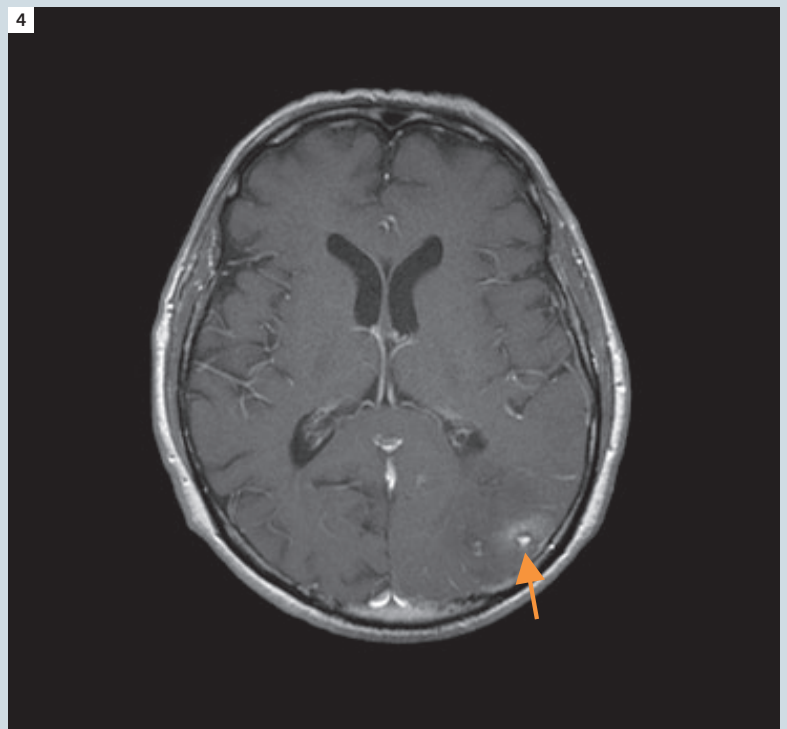
4 MRI, performed six hours after the DECT, shows a good correlation of the T1-weighted gadolinium-enhanced images to the DECT (arrow).