Case 7
Metal Artifact Reduction by Energetic Extrapolation in Single Source Dual Energy CT[1]

By Felix G. Meinel, MD, and PD Thorsten R. C. Johnson, MD

Institute for Clinical Radiology, Ludwig-Maximilians-University Hospital Munich, Germany

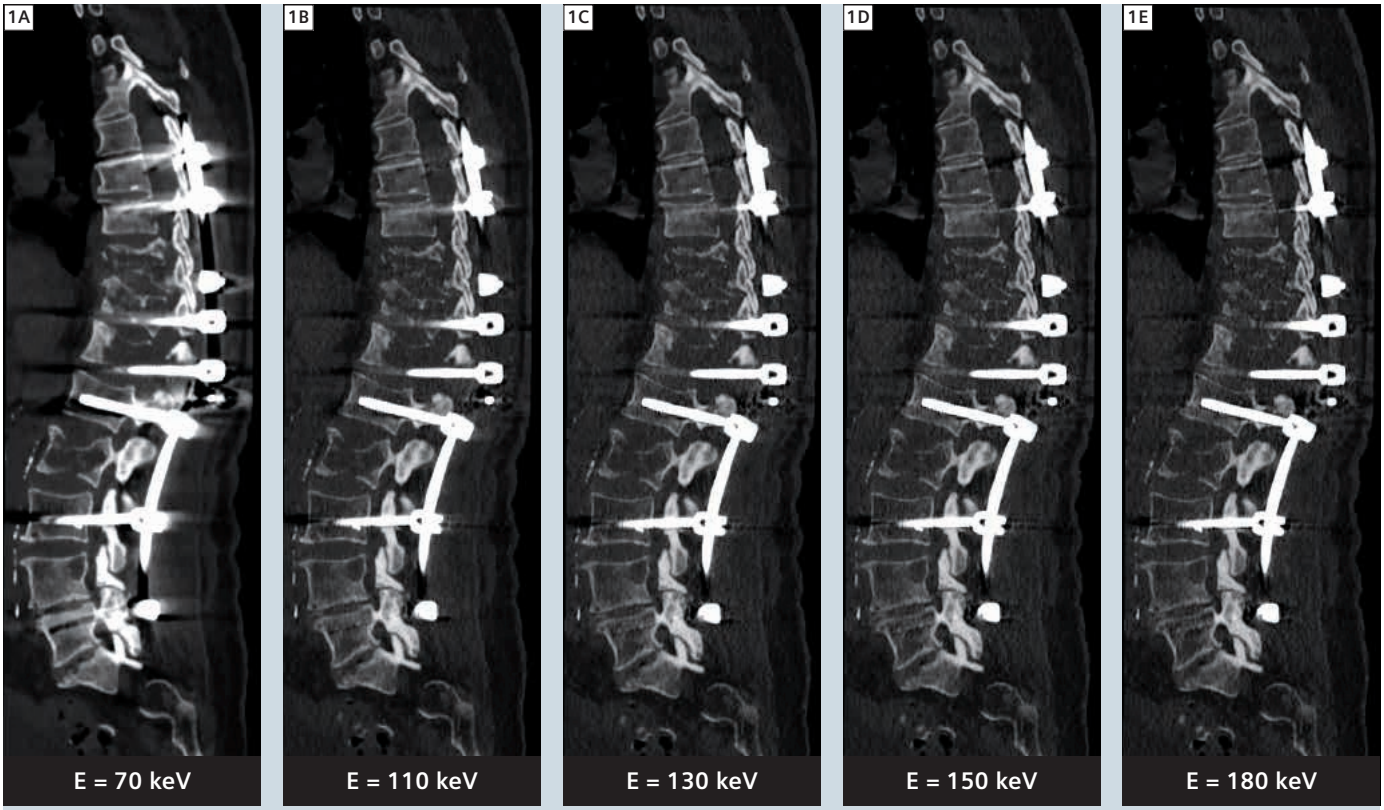
HISTORY

A 77-year-old female patient with multiple vertebral metastases from a renal cell carcinoma, which had been stabilized with several spinal fusion operations, presented herself to the emergency room complaining of weakness in her left leg. A CT examination was performed to assess the degree of osteolytic destruction, the integrity and position of the osteosynthetic material and to rule out an infiltration or compression of the spinal canal and the neuroforamina by metastases or hematoma.

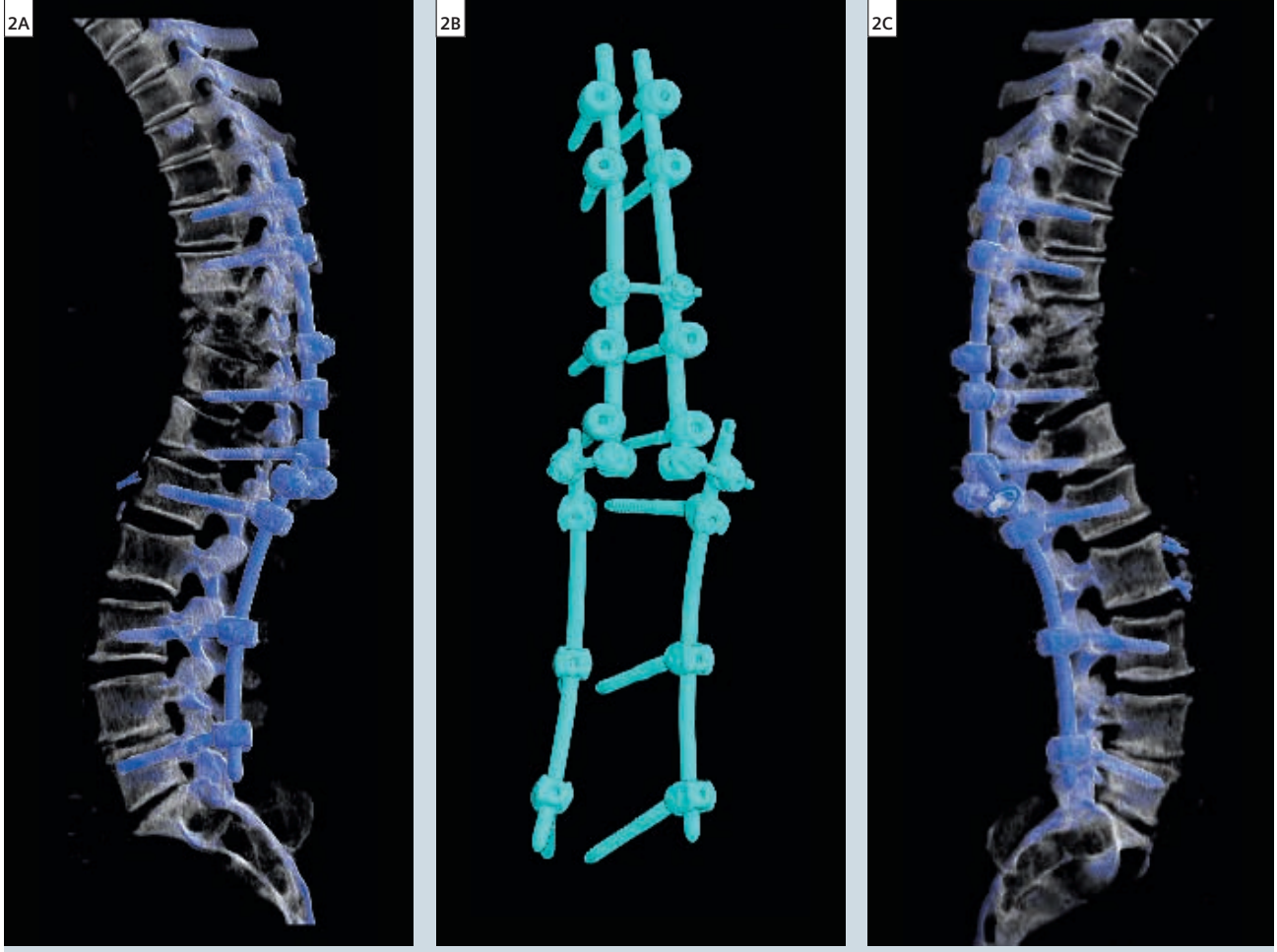
DIAGNOSIS

The CT scan showed a complete collapse of the 9th and 10th thoracic vertebrae (Fig. 1). Advanced osteolytic metastases were also noted in the 11th and 12th thoracic and in the 2nd and 4th lumbar vertebrae (Fig. 1). The osteosynthetic material itself was intact. However, the

[1] Under FDA review. Not available for sale in the U.S.



1 Sagittal MPR images at extrapolated photon energies of 70, 110, 130, 150 and 180 keV show a marked reduction in metal artifacts with increased extrapolated photon energy.



2 The effective reduction of metal artifacts at high extrapolated photon energies allows for highly accurate volume rendering technique (VRT) images.

screws had broken through the base plates of the 11th and 12th thoracic vertebral bodies (Fig. 2). There was no evidence of a hematoma or metastatic mass in the spinal canal or in the neuroforamina.

COMMENTS

Appearing as bright and dark streaks originating from the metallic implants, metal artifacts can greatly hamper accurate CT interpretation, including the diagnosis of fractures, implant loosening, or to rule out inflammation or hematoma in the surrounding soft tissue. These artifacts can be effectively reduced in Dual Energy CT by generating images extrapolated to higher photon energies. These extrapolated photon energies, with the highest diagnostic quality, usually fall in the range of 100-130 keV. This technique can be applied for the examination of metallic implants of various types and alloys and their surrounding tissues. Pathologies of the spine can be extremely challenging to assess in patients after spinal fusion surgery, due to substantial metal artifacts in both CT and MRI scans. Energetic extrapolation effectively reduces metal artifacts in Dual Energy CT and allows for an accurate assessment of the spine, the spinal canal and the neuroforamina in such patients.

EXAMINATION PROTOCOL

Scanner	*SOMATOM Definition Edge*		
Scan Mode	*Single Source Dual Energy*	***DLP***	*482 mGy cm / 629 mGy cm*
Scan area	*Spine*	***Effective dose***	*7.2 mSv / 9.4 mSv*
Scan length	*415 mm*	***Rotation time***	*0.5 s*
Scan direction	*Cranio-caudal*	***Pitch***	*0.5 / 1.2*
Scan time	*11 s*	***Slice collimation***	*128 x 0.6 mm*
Tube voltage	*80 kV / 140 kV*	***Slice width***	*1 mm*
Tube current	*600 mAs / 142 mAs*	***Reconstruction increment***	*1 mm*
Dose modulation	*CARE Dose4D*	***Reconstruction kernel***	*Q40f*
$CTDI_{vol}$	*11 mGy / 14 mGy*		