PHILIPS

Computed tomography

Case studies

The **clinical impact of calcium-suppressed images** generated from IQon Spectral CT

The Philips IQon Spectral CT delivers conventional and spectral clinical information in a single scan utilizing the IQon dual layer detectors. The IQon spectral detector simultaneously, both in time and space, distinguishes between X-ray photons of high and low energies necessary for generating spectral images. The scanner is capable of generating prospective and retrospective spectral image types reconstructed through advanced spectral algorithms. Spectral image data have the potential for additional clinical information to conventional CT imaging.

The Calcium Suppression (CaSupp) image is a newly introduced IQon HU-based spectral image type. In this image, voxels containing calcium are suppressed and replaced by virtual HU values as similar as possible to the expected HU without calcium contribution to the attenuation.

The following is a collection of case studies demonstrating the improved imaging capabilities of the IQon Spectral CT when using CaSupp images.

Visualizing **bone marrow in the presence of bone lesions** with calcium-suppressed CT images

Case study 1

Nuran Abdullayev MD, University Hospital Cologne, Uniklinik Köln; Zimam Romman, Gregor Pahn, Nadav Shapira, Galit Kafri, Philips Healthcare

Underlying bone marrow abnormalities in the presence of bone lesions can be masked in conventional CT imaging, making MRI the modality of choice as it is more accurate and sensitive in the diagnosis of bone lesions.[1,2] The Calcium Suppression (CaSupp) image may help the clinician in the visualization of bone marrow abnormalities that otherwise are obscured by bone while comparing to conventional CT imaging.

In this case review study, we are showing the clinical advantage of CaSupp in helping the clinician in visualization of bone marrow abnormality after bone suppression in the presence of spine bone lesions. Spectral images are compared to conventional CT as well as MRI images from Short Tau Inversion Recovery (STIR) sequence.

A 35-year-old male patient diagnosed with hemangio-pericytoma (HPC) and diffuse osteolytic-osteoblastic bone metastases underwent chemo and radiotherapy. Latest MRI showed bone marrow edema and metastasis at the level of T8. Decisive bone marrow involvement was not proven in the follow up CT performed five days before the MRI.

CT technical parameters
120 kV helical CT with slice thickness of 2 mm, pitch of 0.67, rotation time of 0.33 sec, filter B with standard resolution, and $CTDI_{vol}$ of 16.9 mGy.

Conclusion

Visualization of bone marrow is limited in conventional CT imaging and is favored by MRI due to its increased accuracy and sensitivity. The illustrated example showed that calcium-suppressed imaging using IQon Spectral CT provides additional information to the clinician that may help them in the visualization of bone marrow involvement when bone metastasis lesions are presented.

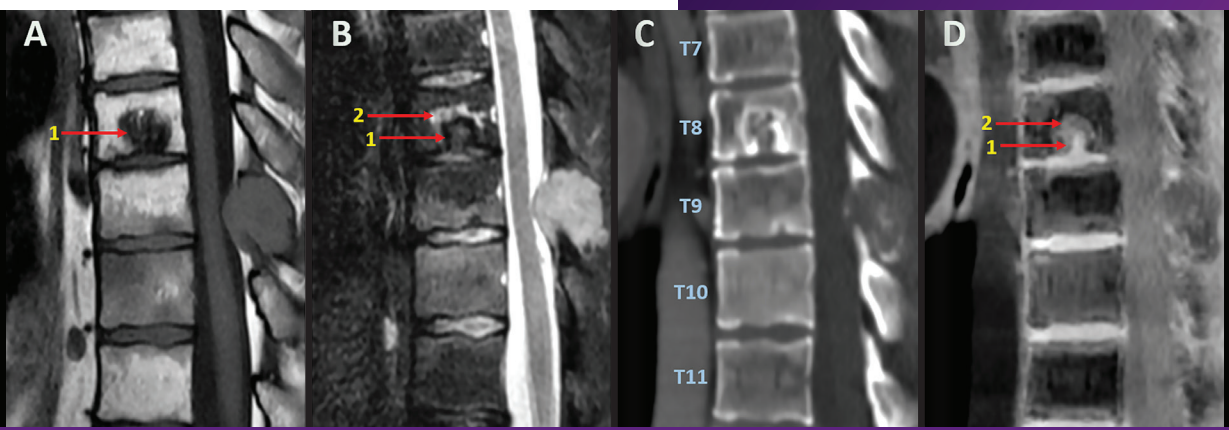


Figure A Sagittal (T1) MRI image shows T8 vertebral metastasis (arrow 1).
Figure B Sagittal (STIR) MRI image shows T8 vertebral metastasis (arrow 1) with bone marrow edema involvement (arrow 2).
Figure C Conventional CT image shows T8 bone abnormality without any additional information regarding bone marrow involvement.
Figure D CaSupp shows indication for bone lesion (arrow 1) with bone marrow involvement (arrow 2) correlated with the MRI image.

Images courtesy of University Hospital Cologne, Uniklinik Köln, Cologne, Germany.

Visualizing **bone marrow in the presence of bone fractures** with calcium-suppressed CT images

Case study 2

Victor Neuhaus MD, University Hospital Cologne, Uniklinik Köln; Zimam Romman, Gregor Pahn, Nadav Shapira, Galit Kafri, Philips Healthcare

Underlying bone marrow abnormalities in the presence of fractures can be masked in conventional CT imaging by the dense trabecular bone, making MRI the modality of choice to determine the age and etiology of vertebral fractures.[3,4] The Calcium Suppression (CaSupp) image may help the clinician in visualization of bone marrow abnormalities that otherwise are obscured by the dense trabecular bone while comparing to conventional CT imaging.

In this case review study, we are showing the clinical utility of CaSupp in helping the clinician with the visualization of bone marrow abnormality after bone suppression in lumbar vertebral fracture. Spectral images are compared to conventional CT as well as MRI images from T1-weighted and Short Tau Inversion Recovery (STIR) sequences.

A 74-year-old female patient arrived at the emergency room with low back pain following a minor fall. CT of the thoracic and lumbar spine was performed to rule out fractures. CT showed a compression fracture of the first lumbar vertebra. One day later, the patient was referred to MRI in order to determine fracture age and bone marrow involvement. MRI revealed bone marrow edema at the fracture level, suggesting an acute vertebral fracture.

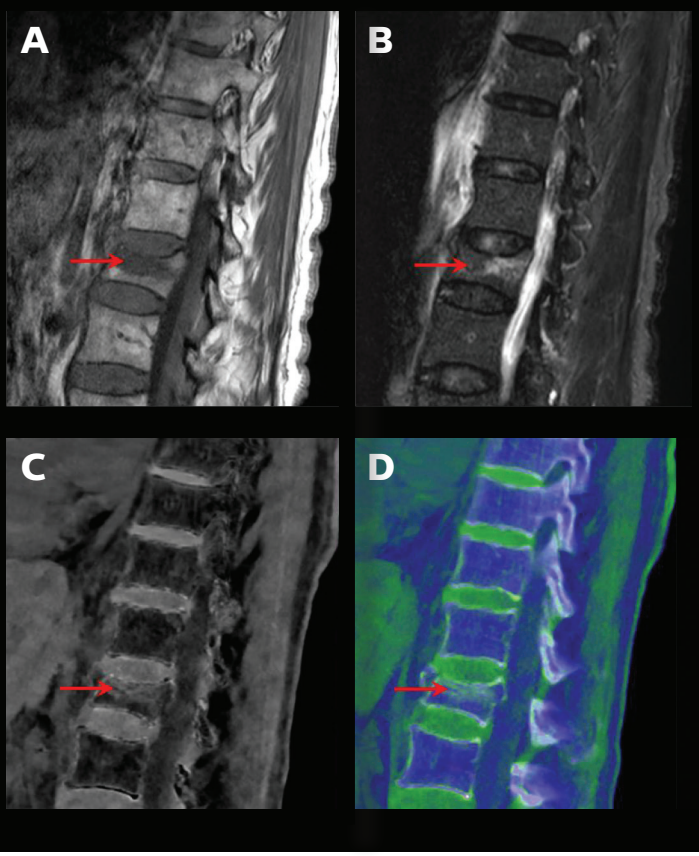
Figure A Sagittal (T1) MRI image shows a compression fracture at the body of L1, showing changes to the bone marrow (arrow).

Figure B Sagittal (STIR) MRI image shows L1 bone marrow edema (arrow).

Figure C CaSupp shows indication for bone marrow involvement (arrow) correlated with the MRI images.

Figure D Image shows a fused image of CaSupp overlaying the conventional CT image, illustrating the bone marrow involvement in color.

CT technical parameters
120 kV helical CT with slice thickness of 0.8 mm, pitch of 1.17, rotation time of 0.4 sec, filter B with standard resolution, and $CTDI_{vol}$ of 13.5 mGy.



Conclusion

Visualization of bone marrow is limited in conventional CT imaging and MRI is the modality of choice for diagnosis of bone marrow edema. The illustrated example showed that calcium-suppressed imaging using IQon Spectral CT provides additional information to the clinician that may help in the visualization of bone marrow involvement when bone fractures are presented.

Images courtesy of University Hospital Cologne, Uniklinik Köln, Cologne, Germany.

Visualizing **intervertebral disc herniation** with calcium-suppressed CT images

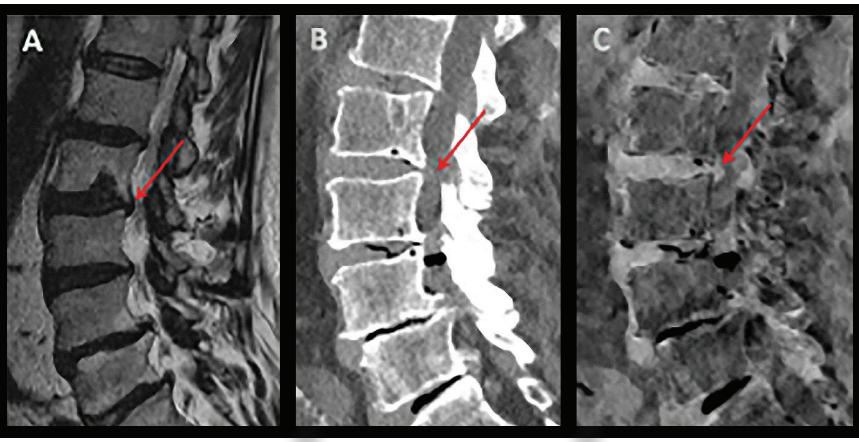


Figure A Sagittal (T2) MRI image shows L2-L3 disc herniation (arrow).

Figure B Sagittal conventional CT image indicates bone abnormality at the level of L2-L3 with limited information regarding disc herniation extent (arrow).

Figure C CaSupp reveals disc herniation (arrow) which can be correlated with the MRI image.

CT technical parameters
120 kV helical CT with slice thickness of 1 mm, pitch of 0.98, rotation time of 0.5 sec, filter B with standard resolution, and $CTDI_{vol}$ of 28.5 mGy.

Case study 3

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Visualization of intervertebral disc pathologies such as disc herniation is limited in conventional CT imaging, making MRI the modality of choice as it is more accurate and sensitive in the diagnosis of soft tissue differentiation.[5,6] Calcium Suppression (CaSupp) images may help a clinician to better visualize those pathologies by improving delineation to adjacent bony structures, such as neural foramen.

In this case review study, a clinical advantage of the CaSupp image type is demonstrated. Calcium suppression helped the clinician in improved visualization of intervertebral disc herniation. The spectral images were compared to their conventional CT counterparts. MRI images of same region are also included as reference.

A 75-year-old male patient with history of multiple intervertebral disc herniation lesions. The patient presented with acute low back pain and was referred to MRI. Among other findings, MRI showed disc herniation at the level of L2-L3. Eigthteen weeks later, CT was performed to plan surgery for decompression of multi-segmental spinal stenosis.

Conclusion

Visualization of intervertebral disc herniation is limited in conventional CT imaging and usually performed using MRI. The illustrated example shows that calcium-suppressed imaging using IQon Spectral CT provides additional information to the clinician that may help in better assessment of intervertebral disc herniation.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

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Images courtesy of University Hospital Cologne, Uniklinik Köln, Cologne, Germany.

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