Introduction
Diagnostic imaging of the cervical spine has been normally done with medical CT (MDCT) and 2D native X-ray units. While medical CT produces high diagnostic yield, the drawback is relatively high X-ray dose. 2D skull imaging apparatus produces only one projection at a time, i.e., many exposures are needed to fulfill the diagnostic task. The recently introduced Cone Beam CT (CBCT) imaging technique can offer an alternative worth of considering for cervical spine imaging.

The described case study clearly shows the benefits of CBCT imaging in the cervical spine area. With SCANORA® 3D by SOREDEX the field-of-view (FOV) size can be optimally selected and freely located to the region of interest in the cervical spine area. The unit is designed so that the whole cervical spine from C1 to C7 can be imaged in one exposure program, the patient being in comfortable seated position on the integrated chair. The technical factors of the protocol were 90 kV, 13 mA, 6.6 s. The voxel size was 250 µm and the Dose Area Product 1000 mGy·cm².

The bony structures of the cervical spine appear clearly in the images. Also metallic parts show up clearly without producing too much artifacts. The CBCT imaging is very appropriate for imaging cervical spine area, because the bony structures are surrounded by soft tissues that do not harm 3D reconstruction. If the region of interest is surrounded by hard tissues, as is the case e.g. in temporal bone area, the reconstruction is more challenging.

Compared to MDCT, the CBCT method is a more cost-effective solution. Examinations are quick and more convenient for the patient in normal seated position. In vertebral imaging the patient’s head can be easily stabilized in different neck angulations for comparative studies.

Discussion of a sample patient case

Effects of Cone Beam Imaging on a Spondylodesis Procedure

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A middle-aged female patient complained severe radiating pain in both the upper extremities and severely reduced movements of the cervical spine. After undergoing a cervical spine MRI a diagnosis of severe cervical spine spondylosis involving C3-C7 area of cervical spine was made. Because the lesions were seen in a large area C3-C7, the neurosurgeon decided to operate the patient. He decided to make an anterior spondylosis decompression, because lesion of the discs was also seen. Spondylosis of the intervertebral disc spaces C3-C4, C4-C5 and C5-C6 was performed using Cornerstone (Medtronic) polyetheretherketone (PEEK) intervertebral space cages filled with autologous bone. The cages have both anteriorly and posteriorly placed radiopositive tantalum wires as metallic markers. In addition, the anterior part of the cervical spine was stabilized using a titanium alloy Venture (Medtronic) cervical plate fixed to the C3, C4, C5 and C6 vertebral bodies using titanium alloy screws symmetrically. Postoperatively we decided to judge the fixation of these implants using CBCT instead of MDCT of the cervical spine, because according to our experience the MDCT of this area is full of metallic artifacts. Axial, coronal and sagittal reformations of the operated cervical spine were made. Also the changes seen in the intervertebral areas were well defined. In addition, we made sagittal, coronal and axial 3D surface reconstructions showing the implants absolutely free of metallic artifacts. The residual spondylotic bone changes and the stenotic changes were well determined. There were minimal metallic artifacts to be seen. The metallic plate and screws were extremely well defined including the vertebral bodies, facet joints and the intervertebral foramina. Also the anterior and posterior metallic markers were well defined on CBCT. A MDCT of the cervical spine was not done, because a very good postoperative image of the cervical spine was defined.

The radiation dose of cervical spine imaging was calculated by a hospital physicist. In high resolution CBCT the efficient dose is approximately 260 µSv, with lower resolution 76 µSv. The dose is considerably lower than in MDCT. In 16 slices MDCT the calculated dose is approximately 1400 µSv, while in 64 slices MDCT with ASiR (Adaptive Statistical Iterative Reconstruction) it is 800 µSv. That is why we conclude that the average radiation dose of the patients imaged with CBCT is nearly one-third or even lower depending on the indication involved and the size of the patient.

Conclusion

We recommend that patients with metallic implants of the cervical spine can be imaged only with CBCT, because the quality of the postoperative images is optimal and the amount of radiation is one third of that used in MDCT of the cervical spine.
SOREDEX focuses on developing innovative imaging solutions that enhance diagnostic performance for healthcare professionals. SOREDEX medical imaging systems are developed in close co-operation with leading ENT and dentomaxillofacial specialists at universities and hospitals around the world. This gives us deep insight into the advanced clinical requirements of our systems. With assistance of global radiology partners, we diligently follow the latest treatment guidelines and industry best practices. From the founding of our company in 1977, the leading principle of our development work is the well-being of the patient. SOREDEX imaging systems are well known for cutting-edge technological solutions, high quality standards, ease of use and excellent clinical results. Our global distributor network is thoroughly trained and ready to give the best support and service for our systems. SOREDEX imaging systems are the point-of-care solution for faster, cost-efficient and patient-friendly diagnostic performance.

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