Use of CBCT in the diagnosis of cervical spine spondylosis

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Introduction

Cone beam computed tomography (CBCT) has been conventionally used to diagnose diseases of the maxillofacial area for many decades. In the past few years sinonasal imaging with CBCT has become popular due to its low radiation dosage. The field of CBCT has received a great deal of R&D attention and consequently, technological progress has been fast and innovations frequent. As a result, the next appropriate area of CBCT imaging seems to be the area of cervical spine ranging from the level of occiput till the level of C7.

Due to the drastic increase of patients with cervical spondylosis and new operative techniques of spondylodesis the need for CT of the cervical spine has significantly increased. Compared to multidetector computed tomography (MDCT) of cervical spine the radiation dose of CBCT of cervical spine is considerably lower (i.e., comparable to AP and lateral views of cervical spine X-ray), but with much more detailed information of the spinal cavity and intervertebral foramina. The extent of false-positive diagnosis of intervertebral foraminal narrowing is dependent on the positioning of the patient in oblique views of the cervical spine. With CBCT of cervical spine this can be avoided.

Indications for a CBCT of the cervical spine are as follows:

- cervical spine spondylosis leading to spinal stenosis;
- facet joint arthrosis and associated dislocations;
- inter-vertebral foraminal stenosis;
- postoperative analysis of the anterior spondylodesis operations;
- traumatic fractures;
- bony tumours and associated destructions.

SCANORA 3D CBCT system

SCANORA 3D (SOREDEX, Finland) system is a cone beam CT imaging system that is intended for the head and neck area. The unit has been in use at Röntgentutka private clinic in Tampere, Finland, for several years mainly for maxillofacial and sinus diagnostics. Recently the system has been used also for upper cervical spine examinations and has been found extremely useful.

The fields-of-view (HxD) of the unit are 60 x 60 mm, 75 x 100 mm, 75 x 145 mm and 130 x 145 mm, and they are selectable according to the diagnostic task at hand. SCANORA 3D provides a seated patient platform and the region of interest can be freely located in the head and neck area thanks to motorized movements and laser lights. The voxel sizes for adjusting the spatial resolution are selectable in the range of 133-350 µm. The protocol can be optimized for each diagnostic task to produce proper image quality at minimum radiation dose.

The cervical spine can be scanned starting at level occiput till C7. The field of view is 130-145 mm. The voxel size is 0.3 mm, and the amount of radiation dose can be lower than recommended for example of that of the head and neck area. With CBCT this area can be well demonstrated depending on the patient anatomy: in severe obesity cases the level of C7/T1 could be difficult to demonstrate without technical innovations. At SCANORA 3D the patient is stable in anatomically optimal sitting position and the mandible is in a comfortable, optimal position resting on a plastic stand. In contrast, with MDCT scanning the patient is in a lying position, which changes the physiological position of the cervical spine.
Case presentation

Case 1

A middle-aged male patient was presented with symptoms of radiating pain in the left cervical region radiating towards left upper limb. In addition, he had movement restrictions of the neck on the left side. He had also noticed a bony lump in the left upper neck area. He consulted his neurosurgeon who referred the patient directly to CBCT of the cervical spine. On CBCT at level C3-C4 spondylotic hypertrophy of the left facet joint was found, which led to lateral stenosis of the intervertebral foramen in addition to a bony prominence on the left side (Fig. 1). Axial, coronal and sagittal slices in addition to surface reconstructions show the changes in details. The patient is now awaiting his surgery, i.e. facetectomy at level C3-C4 after an ENMG examination to rule out nerve degeneration.

Case 2

A middle-aged female patient was referred to CBCT of the cervical spine for restricted neck movements and mild radiating pain to both upper limbs. Also a history of giddiness was elucidated. Cervical spondylosis was suspected. On CBCT images, axial, coronal and sagittal slices in addition to surface reconstructions show mild arthrosis of the bilateral facet joints at upper cervical spine and posterolateral spondylosis at level C3-C6 (Fig. 2). Minimal narrowing of the bilateral intervertebral foramina may be noticed. The patient is currently undergoing medical treatment for spondylosis.

Case 3

A middle-aged female patient was referred to CBCT of the cervical spine for severe radiating pain of both upper limbs. A diagnosis of cervical spondylosis with inter-vertebral foraminal narrowing was suspected. On CBCT axial, coronal and sagittal images showed severe bilateral intervertebral stenosis at level C4-C5 (Fig. 3). The patient is awaiting an ENMG examination after which she will undergo a surgery.

Conclusion

At our clinic we have found the oblique views of plain radiographs not to be optimal enough to demonstrate the condition of intervertebral foramina. These radiographs are neither selective nor sensitive. In all cases of radicular pain of the upper limbs we recommend the simultaneous use of CBCT and MRI for pre-surgical evaluation.

CBCT with its low radiation dose is suitable for demonstration of cervical spondylosis and associated complications. Ventrolateral and posterolateral spondylosis leading to spinal and lateral stenosis may be well demonstrated during presurgical evaluation. Also rheumatic conditions of the upper cervical spine including atlantoaxial dislocation are well indicated by CBCT. Moreover, hair line fractures of the cervical spine and bony lytic tumors are well demonstrated by using CBCT. As a conclusion, we suggest that CBCT of the cervical spine should be routinely indicated for patients referred to surgical intervention.

References


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Röntgentutka Corporation is a renowned private imaging center located in Tampere, Finland. The clinic provides e.g. MRI, X-ray, ultrasound, CBCT, dental and mammography examinations performed by modern equipment with latest technological innovations and by experienced medical professionals.

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