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Head and Neck Imaging

CT of the Normal Temporal Bone: Comparison of Multi– and Single–Detector Row CT[1]

Lorenz Jäger, MD, Harald Bonell, MD, Martin Liebl, MD, Sudesh Srivastav, PhD, Viktor Arbusow, MD, Martin Hempel, MD and Maximilian Reiser, MD

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ABSTRACT

PURPOSE: To evaluate multi– and single–detector row computed tomographic (CT) depiction of anatomic landmarks of temporal bone.

MATERIALS AND METHODS: Institutional review board approval and written informed consent were obtained. In 50 temporal bones, transverse and coronal single–detector row CT images were compared with transverse and reformatted coronal multi–detector row CT images obtained of additional 50 temporal bones. Two radiologists evaluated images. Visibility of 50 landmarks was scored with a five-point quality rating scale. Fisher exact test, κ statistics, and Mann-Whitney *U* test were used to evaluate imaging technique and landmark visibility.

RESULTS: In delineating landmarks, total interobserver agreement was higher ($P < .001$) for transverse multi– than for single–detector row CT images. In 60% of landmarks, interobserver agreement was higher ($P < .001$) for transverse multi– than for single–detector row CT images. In 20% of landmarks, there was no difference, and in another 20% of landmarks, interobserver agreement was higher ($P < .01$) for single–detector row CT. Total interobserver agreement was higher ($P < .01$) for coronal multi–detector row reformations than for coronal single–detector row images. In 58% of landmarks, interobserver agreement was higher ($P < .001$) for coronal multi–detector row reformations than for coronal single–detector row images, while there was no difference in 8%. In 34% of landmarks, interobserver agreement was higher ($P < .001$) for coronal single–detector row images. Frequency of detected landmarks was higher for transverse (82%) and coronal (88%) multi–detector row images than for corresponding single–detector row images. In 72% of landmarks, transverse multi–detector row images were ($P < .05$) superior to corresponding transverse single–detector row images in landmark delineation. In 56% of landmarks, reformatted coronal multi–detector row images were ($P < .05$) superior to coronal single–detector row images in landmark delineation.

CONCLUSION: Multi–detector row CT images, including reformations, better delineate temporal bone anatomy than do single–detector row CT images.

INTRODUCTION

Computed tomography (CT) of the temporal bone with high spatial resolution is an established standard examination technique (1). Normal anatomy of the osseous structures of the middle ear, as well as normal anatomy and anatomic variations of the ossicular ligaments, has been studied with CT (2–5). CT has also been used to examine inner ear anatomy (6,7). The morphology of the posterior ampullary nerve and the accessory nerve of the posterior ampullary nerve has been described in anatomic studies (8–10), but so far, high-spatial-resolution CT and magnetic resonance imaging have not been able to delineate the bony canals of these structures or the nerves themselves. It is of great clinical interest to evaluate the anatomy of these structures, especially since there is no proved explanation for the heterogenity of the clinical findings in patients with vestibular neuritis (11). For example, a double innervation of the ampulla of the posterior semicircular canal may be the reason for the preservation of the functional ability of the posterior semicircular canal, while the function of the superior and horizontal semicircular canals, as well as the functional ability of the vestibule, is lost.

A recent major advance in CT technology, the introduction of multi–detector row helical CT, may provide a way to view these temporal bone structures. This new type of CT has a submillimeter spatial resolution, which is especially important in the z-axis. Besides providing additional information compared with single–detector row CT, multi–detector row CT may also improve the visibility of thin structures, such as the stapedial crura or the ossicular ligaments. Moreover, multi–detector row CT may also be beneficial in eliminating double examinations when transverse and coronal projections are necessary to assign a diagnosis, such as in patients with middle or inner ear tumors or inflammation and labyrinth fistulas. This is also extremely important to immobilized patients with head trauma or severe polytrauma, where coronal CT is not possible. Thus, it is clinically important to determine the value of reformatted coronal images from multi–detector row CT. The purpose of this study was to evaluate the depiction of anatomic landmarks of the temporal bone by using multi– and single–detector row CT.

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Subjects and Imaging

This prospective study included 100 consecutive patients with clinical signs suspicious for various inner and middle ear abnormalities who were referred between October 1999 and June 2000 to our department for thin-section CT of the temporal bone. Patients with severe abnormalities, such as trauma, tumor, or inflammation leading to destruction of the skull base, or patients with electric devices at the skull base, such as cochlea implants, were excluded from the study. The study was approved by the institutional review board, and written informed patient consent was obtained.

Patients underwent either single– or multi–detector row CT. The first 50 consecutive patients who met the inclusion criteria (36 men and 14 women; mean age, 49.1 years ± 17.3) underwent single–detector row CT (Somatom Plus 4; Siemens Medical Systems, Erlangen, Germany). Scans were acquired in the helical mode, and transverse and coronal images were obtained. Scanning parameters were 120 kV, 180 mAs, 1-second rotation time, 1-mm section thickness, 1-mm collimation, 0.5 reconstruction increment, 1-mm table feed per rotation, 512 x 512 matrix, and 9-cm field of view.

The second group of 50 consecutive patients who met the inclusion cirteria (32 men and 18 women; mean age, 36.5 years ± 24.3) was examined with multi–detector row CT (Somatom Plus 4 Volume Zoom; Siemens Medical Systems). Transverse scans were acquired in the helical mode with 120 kV, 180 mAs, 1-second rotation time, 0.5-mm section thickness, 0.5-mm collimation with two detector rows, 0.2 reconstruction increment, 1-mm table feed and rotation, 512 x 512 matrix, and 9-cm field of view. Coronal reformatted multiplanar images were generated on the basis of the transverse images with 1-mm section thickness and an overlap of 0.5 mm.

Transverse scans were acquired parallel to the hard palate and inferior to the orbit (1). Therefore, the cornea was not in the primary x-ray beam of the CT scanner. The coronal scans were acquired perpendicular to the transverse images. The multiplanar coronal images were also reformatted perpendicular to the transverse images. All images were displayed at a window center of 800 HU and a window width of 4000 HU.

Image Evaluation

Temporal bones with any evidence of severe abnormalities were excluded from analysis of normal anatomy, but in these cases, the contralateral temporal bones were included for evaluation. Only one temporal bone in each patient was evaluated. For each imaging modality (single– or multi–detector row CT), 25 left and 25 right temporal bones were examined somewhat randomly by using a table of random numbers for patients without abnormalities.

Two radiologists prospectively evaluated the images. One specialized in head and neck radiology (L.J., observer one) and the other did not (H.B., observer two). To familiarize the two observers with the anatomic structures and the image evaluation procedure, training was performed with five examples, which were not included in the study. Evaluations were performed independently. The visibility of 50 anatomic landmarks was scored by using the following five-point quality rating: 1 = definitely not present, 2 = probably not present, 3 = uncertain, 4 = probably present, and 5 = definitely present.

Statistical Analysis

The Fisher exact test was used to determine the independence of observations within each imaging modality, between the imaging modalities, and between the two readers for all anatomic landmarks. *P* values less than .05 were regarded as indicating a statistically significant difference, signifying that the results of image evaluation were not independent from the observer and from the categories. By chance alone, two readers will agree from time to time, even if they both assign ratings randomly. κ statistics were calculated to determine how well the two readers agreed on each image. A κ value of 0.41 to 0.60 was regarded as good agreement, 0.61 to 0.80 indicated extremely good agreement, and 0.81 to 1.00 indicated nearly complete agreement. The study involved differences in agreement of at least 0.56 for two-tailed and 0.50 for one-tailed κ statistic testing with 80% power and a 5% level of significance. The standard error of agreement according to κ values varied between 0.06 and 0.075 with a mean κ value of 0.85.

The frequency with which an anatomic landmark was identified was calculated for each observer, with an anatomic landmark considered to be present if it was scored with a 4 or 5 according to the quality rating scale. The observations within each imaging modality and between the imaging modalities and the two observers were independent for all anatomic landmarks according to the Fisher exact test, and the distribution of the unpaired data (single– and multi–detector row CT were performed in different patients) within a category (anatomic landmark) was continuous (one to five). Therefore, the Mann-Whitney *U* test was applied to compare all 1–5 ratings in the 50 subjects in the multi–detector row CT group with the ratings in the 50 subjects in the single–detector row CT group for each anatomic landmark and for each reader separately. To do this, a κ value for each rating of 1–5 was calculated. Then, the differences between κ values of multi– and single–detector row images for each anatomic landmark and for each reader were compared by using the Mann-Whitney *U* test. The level of significance was $P < .05$. All statistical tests were performed with Statistical Analysis Software version 8 (SAS Institute, Cary, NC).

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The κ values for visibility of anatomic landmarks revealed high interobserver agreement, independent of the imaging modality (multi– or single–detector row CT) or the image orientation (transverse or coronal) (Table 1). However, total interobserver agreement was significantly higher ($P < .001$) for multi–detector row images than for single–detector row images. In 60% (30 of 50) of the anatomic landmarks, interobserver agreement was significantly higher ($P < .001$) with the transverse multi–detector row images than with the single–detector row images (Table 1). In 20% (10 of 50) of the anatomic landmarks, there was no significant difference between the two imaging modalities, while 20% (10 of 50) of the anatomic landmarks showed significantly higher ($P < .01$) interobserver agreement for the transverse single–detector row CT images than for the transverse multi–detector row CT images.

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TABLE 1. κ Values for the Two Observers Who Evaluated CT Images

As for coronal single–detector row images and reformatted coronal multi–detector row images, the total agreement between both observers in the detection of anatomic landmarks was significantly higher ($P < .01$) for reformatted coronal multi–detector row CT images than for coronal single–

detector row CT images. In 58% (29 of 50) of the anatomic landmarks, interobserver agreement was significantly ($P < .001$) higher for the reformatted coronal multi–detector row images than for the coronal single–detector row images, while there was no difference in 8% (four of 50) and in 34% (17 of 50) of the anatomic landmarks.

Interobserver agreement was significantly higher ($P < .001$) for coronal single–detector row images (Table 1). In particular, agreement in the delineation of the facial nerve (fallopian) canal, the canal of the cochlear and saccular nerve, the superior portion of the vestibular nerve, and the ossicular chain was higher for the transverse and reformatted coronal multi–detector row CT images than for the corresponding single–detector row CT images (Figs 1–6). An equivalent result was found for the tympanic tegmen (Fig 3) and the round window (Fig 5) on the coronal multi–detector row images and for the osseous spiral lamina (Fig 7) on the transverse multi–detector row images. In contrast to these findings, interobserver agreement was higher for the transverse single–detector row CT images for the canal of the posterior ampullary nerve and the canal of the accessory nerve of the posterior ampullary nerve, the round window, and the cochlear aqueduct. Interobserver agreement in the delineation of anatomic landmarks was higher for coronal single–detector row images than for reformatted multi–detector row CT images with regard to the canal of the posterior ampullary nerve and the canal of the accessory nerve of the posterior ampullary nerve, the anterior crus of the stapes, the osseous spiral lamina, the cochlear aqueduct, and the lateral malleal ligament.

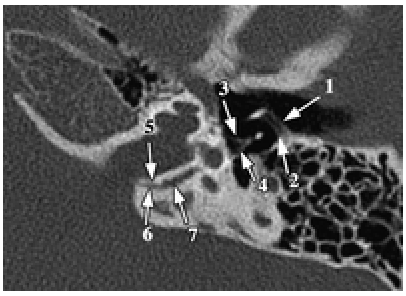

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Figure 1. Transverse multi-detector row CT scan of a normal left temporal bone. Tympanic membrane *(1)* runs laterally to the chorda tympani *(2)*. Anterior *(3)* and posterior *(4)* crura of the stapes are shown. Canal of the accessory nerve of the posterior ampullary nerve *(5)* emerges from the posterior wall of the internal auditory canal laterally and leads to the canal of the posterior ampullary nerve *(6)*. Within a distance of approximately 7 mm, both canals merge to one canal *(7)* leading directly to the posterior ampulla.

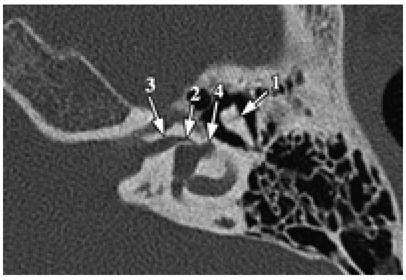

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Figure 2. Transverse multi-detector row CT scan of a normal left temporal bone. A normal incudomallear articulation *(1)* is shown. Canal of the lateral ampullary nerve *(2)* runs from the canal of the superior division of the vestibular nerve *(3)* to the lateral ampulla *(4)*.

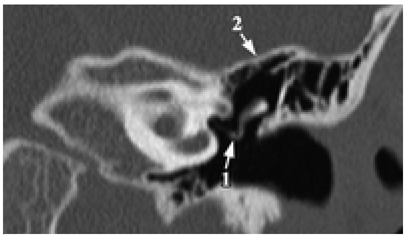

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Figure 3. Coronal images reformatted from transverse multi-detector row CT images of a normal left temporal bone. Incudostapedial articulation *(1)* is shown. Tegmen tympani *(2)* can be delineated.

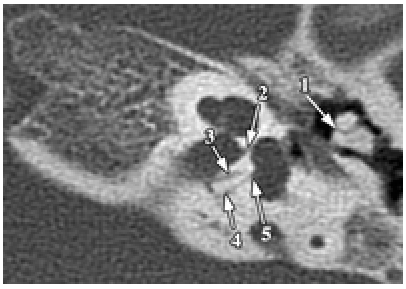

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Figure 4. Transverse multi-detector row CT scan of a normal left temporal bone. A normal incudomallear articulation *(1)* is shown. The saccular nerve, a branch of the inferior division of the vestibular nerve runs in its own canal *(2)* from the fundus of the internal auditory canal to the vestibule. The canal of the accessory nerve of the posterior ampullary nerve *(3)* and canal of the posterior ampullary nerve *(4)* emerge from the posterior wall of the internal auditory canal. Both run separately to the posterior ampulla *(5)*.

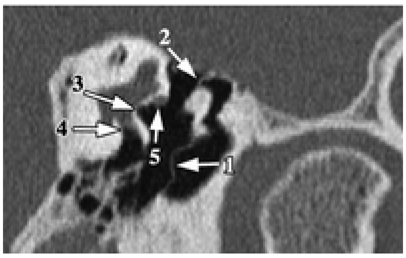

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Figure 5. Coronal images reformatted from transverse multi-detector row CT images of a left temporal bone with dehiscence of the facial nerve canal. Tympanic membrane *(1)* is located between the tympanic cavity and the external auditory canal. Superior malleal ligament *(2)* runs from the malleus head to the tegmen tympani. Oval window *(3)* is located cranially to the round window *(4)*. A lack of complete cortical canal (dehiscence) of the S2 segment of the facial nerve canal *(5)* is detected near the oval window.

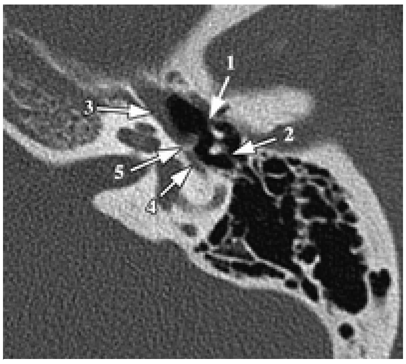

Figure 6. Transverse multi-detector row CT scan of a normal left temporal bone. The anterior malleal ligament *(1)* and the posterior incudal ligament *(2)* are shown, as well as the tensor tympani muscle *(3)*, the S2 segment of the facial nerve *(4)*, and the cochleariform process *(5)*.

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Figure 7. Transverse multi-detector row CT scan of a normal right temporal bone. Tympanic membrane *(1)* shows a funnel-shaped appearance. Osseous spiral lamina of the cochlea *(2)* runs within the cochlea as a hyperdense structure.

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On the basis of the quality rankings for indication of detected anatomic landmarks (rankings of 4 or 5), the frequency of detected anatomic landmarks was higher for transverse multi–detector row images (for both observers, 82%, 41 of 50; and observer 2, 84%, 42 of 50) and coronal multi–detector row CT images (observer 1, 88%, 44 of 50; and observer 2, 90%, 45 of 50) than for single–detector row images (Table 2). This was particularly true for the ligaments of the ossicles (Figs 5, 6, 8, 9), the facial nerve canal (Figs 5, 6, 10), the canal of the posterior ampullary nerve (Figs 1, 4), the canal of the accessory nerve of the posterior ampullary nerve (Figs 1, 3), the stapes (Fig 1), the round window (Fig 5), and the cochlear and vestibular aqueduct.

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TABLE 2. Frequency of Detected Anatomic Landmarks on Transverse and Coronal CT Images according to Absolute Observer Decision

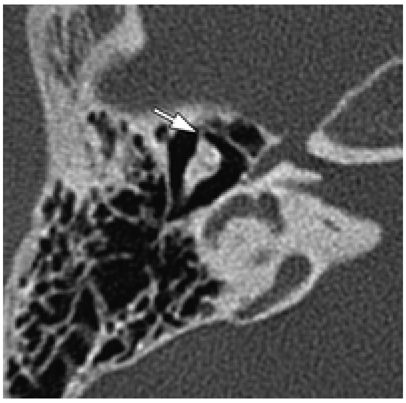

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Figure 8. Transverse multi-detector row CT scan of a normal right temporal bone. Anterior malleal ligament (arrow) is shown.

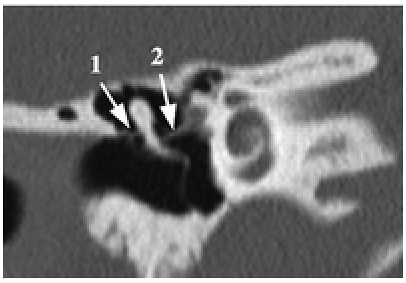

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Figure 9. Coronal images reformatted from transverse multi-detector row CT images of a normal right temporal bone. Lateral malleal ligament *(1)* is shown, as well as tensor tympani tendon *(2)*.

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Figure 10. Transverse multi-detector row CT scan of a left temporal bone with variation of the facial nerve canal. Canal of the greater superficial petrosal nerve *(1)* emerges in the proximal S1 segment of the facial nerve canal *(2)*.

The canal of the accessory nerve of the posterior ampullary nerve was identified on the transverse multi–detector row CT images in nine cases, regardless of the observer. In all nine cases, the canal of the accessory nerve of the posterior ampullary nerve emerged from the posterior wall of the internal auditory canal approximately 2 mm medially or laterally to the canal of the posterior ampullary nerve. In two of these cases, the canal of the accessory nerve of the posterior ampullary nerve was delineated from the posterior wall of the internal auditory canal to the posterior ampulla (Fig 4). In the remaining seven cases, the canal of the accessory nerve of the posterior ampullary nerve joined the canal of the posterior ampullary nerve within the first 8 mm after emerging from the posterior wall of the internal auditory canal (Fig 1).

In one of 50 subjects, both observers could identify the canal of the accessory nerve of the posterior ampullary nerve on transverse single–detector row CT images; however, on the five-point quality rating scale, it was judged with a rating of 4. On coronal single–detector row images, the accessory nerve of the posterior ampullary nerve was not detected in any subjects. In one subject, the canal of the greater superficial petrosal nerve ran separately and anteriorly to the labyrinthine segment (S1) of the facial nerve canal (Fig 10), and in another subject, a doubling of the S2 segment of the facial nerve canal was found. In the first subject, no other malformation of the temporal bone was seen; in the second subject, however, an enlarged vestibular aqueduct and an enlarged endolymphatic sac were detected.

A dehiscence of the superior semicircular canal (Fig 11) was found in five of 50 patients (10%) with multi–detector row CT but was seen in only one of 50 patients (2%) with single–detector row CT (Table 2). Dehiscence of the S2 segment of the facial nerve canal was detected in 30 (60%) patients on coronal multi–detector row images but was seen in only 11 (22%) patients on coronal single–detector row CT images (Table 3).

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Figure 11a. (a) Coronal image reformatted from transverse multi-detector row CT images of a left temporal bone shows a dehiscence of the superior semicircular canal (arrow). **(b)** Coronal image parallel to the axis of the superior semicircular canal reformatted from transverse multi-detector row CT images, as in **a**. A dehiscence of the superior semicircular canal (arrow) is detected.

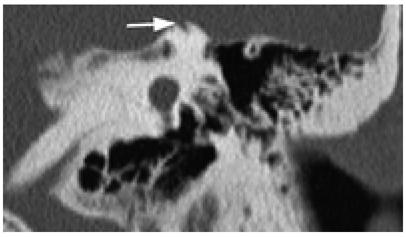

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Figure 11b. (a) Coronal image reformatted from transverse multi-detector row CT images of a left temporal bone shows a dehiscence of the superior semicircular canal (arrow). **(b)** Coronal image parallel to the axis of the superior semicircular canal reformatted from transverse multi-detector row CT images, as in **a**. A dehiscence of the superior semicircular canal (arrow) is detected.

View this	TABLE 3. Comparison of Visibility of Anatomic Landmarks between

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Single- and Multi-Detector Row CT

On the basis of the anatomic quality rating scale, the comparison of transverse single–detector row CT images with transverse multi–detector row CT images was performed for each anatomic landmark separately. By using a $P < .05$ level of significance, 33 of 50 anatomic landmarks (66%) were delineated as significantly superior on multi–detector row CT images, and in 17 of 50 anatomic landmarks (34%), there was no significant difference (Table 3) between multi– and single–detector row images. Comparison of the detection of anatomic landmarks showed that in 27 of 50 patients (54%), the reformatted coronal multi–detector row CT images were significantly ($P < .05$) superior to the coronal single–detector row CT images. For the remaining 23 (46%) anatomic landmarks, there was no significant difference between the coronal single–detector row CT images and the reformatted coronal multi–detector row CT images.

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DISCUSSION

Single–detector row CT with high spatial resolution is a well-established imaging technique for examination of temporal bone abnormalities. To get diagnostic-quality images in two different planes with single–detector row CT, however, a second coronal acquisition must be performed in addition to the transverse acquisition, which is highly dependent on the patient's mobility. The development of multi–detector row CT offers the potential to overcome this obstacle because reformatted coronal images have sufficient quality. The high image quality is a result of the thinner section thickness (0.5 mm instead of 1 mm in single–detector row CT) and the smaller reconstruction increment. The aim of this study was to evaluate image quality with respect to the detection of subtle anatomic landmarks on transverse images by using single– and multi–detector row CT techniques and to compare the visibility of anatomic landmarks on coronal single–detector row CT images with reformatted coronal multi–detector row CT images.

Our results show that there is high interobserver agreement between transverse single– and multi–detector row CT images. However, agreement between both observers was higher for the transverse multi–detector row CT images than for the transverse single–detector row CT images. A similar result was obtained for reformatted coronal multi–detector row images and for coronal single–detector row images, but again, interobserver agreement was higher for multi–detector row CT.

For multi–detector row CT, low κ values were observed only with anatomic landmarks that were seen in only a few patients within a single rating group, such as the stapedius tendon, the canal of the posterior ampullary nerve, or the canal of the accessory nerve of the posterior ampullary nerve. These findings suggest that detection of temporal bone anatomy is less dependent on the experience of the radiologist with multi–detector row CT than with single–detector row CT. Given the fact that anatomic orientation and identification are the bases for locating abnormalities, diagnosis of temporal bone abnormalities is better achieved with multi–detector row CT.

There are many requirements for imaging techniques in the diagnosis of even small pathologic changes that cause conductive or sensorineural hearing loss or vertigo. For this reason, it is of interest to know whether additional information is gained with acquisition of transverse multi–detector row CT images with high spatial resolution in comparison to an equivalent single–detector row CT protocol. It is also important to know whether reformatted coronal multi–detector row CT images are as good as conventional coronal single–detector row CT images in the detection of middle- and inner-ear anatomy. Our study showed that more anatomic landmarks were detected on the transverse and reformatted coronal multi–detector row CT images than on the transverse and coronal single–detector row CT images.

The delineation of the ossicular ligaments was particularly better on the transverse and coronal multi–detector row images than on single–detector row images. The low visibility rate of the ossicular ligaments associated with our single–detector row technique in comparison to a previous report (3) may be explained by the relatively short rotation time used in our study, which was approximately 40% shorter than the rotation time reported in a previous study (3). When using multi–detector row CT with a short scanner rotation time, however, the visibility of the ossicular ligaments was even higher than that found by others when using a single–detector row CT technique with a relatively long rotation time of 2 seconds (3).

The tegmen tympani, a thin bony boundary between the tympanic cavity and the middle cranial fossa, is commonly involved when cholesteatomas, tumors, or fractures are present and shows dehiscence in 20% of these cases. For these reasons, it is crucial to be able to delineate this approximately 1-mm-thick bony structure (12). As our results have shown, the reformatted coronal multi–detector row CT images were slightly superior to the coronal single–detector row CT images in the delineation of this subtle anatomic landmark. However, the difference was not significant.

In the temporal bone, the facial nerve canal is divided into three segments after emerging from the internal auditory canal (13): the labyrinthine segment (S1), the tympanic segment (S2), and the mastoid segment (S3). The course of the facial nerve through the temporal bone is frequently anomalous (12,14,15). The absence of a complete cortical canal around the nerve, also known as facial nerve canal dehiscence, is typically located around the oval window in the middle two-thirds of the tympanic segment (4,15–17). The incidence of facial nerve canal dehiscence varies between 25% and 74% (4,15–17). Since the facial nerve is accessed easily for mesotympanic abnormalities, such as cholesteatoma, tumor, or inflammation, precise delineation of the facial nerve canal is mandatory before ear surgery to reduce the risk of iatrogenic facial nerve lesions. To meet these clinical requirements, high imaging standards are needed, which are fulfilled to a higher degree by the transverse and reformatted coronal multi–detector row CT images than by the single–detector row CT images. The rate of facial nerve canal dehiscence detection was approximately 60% with multi–detector row CT, within the range of published anatomic studies (4,15–17).

Superior semicircular canal dehiscence may cause severe clinical problems for affected patients, such as rotatory and vestibular vertigo as a result of coughing, straining, or loud noise (18). Plugging or covering the affected superior semicircular canal is a surgical therapy option. Therefore, CT images with high spatial resolution, not only in the x- and y-axes but also in the z-axis, are needed to detect this small dehiscence and thinning of the bony covering of the superior semicircular canal to the middle cranial fossa. A histopathologic study of 1000 temporal bones yielded a frequency of 0.5% of dehiscence and a frequency of 1.4% of severe bone thinning (bone thickness of only 0.1 mm or less) of the superior semicircular canal (18). In contrast to these findings, in our study, a dehiscence of the superior semicircular canal was found on the coronal single–detector row CT images in one patient (2%) and on the reformatted coronal multi–detector row CT images in five patients (10%). It should be kept in mind, however, that because the total number of examined temporal bones in the current study was rather small compared with that in published histopathologic studies, our percentages are somewhat inflated when considering the raw numbers.

Small ossifications of the basal turn of the cochlea, which may be found after labyrinthitis or in cases of otosclerosis, cause a bony obliteration of the lumen. It is important to detect these bony changes before cochlear implant surgery to circumvent these problems. To examine the detectability of such small cochlear ossifications in normal ears, we have chosen the osseous spiral lamina, which has a thickness of approximately 1 mm close to the modiolus (19), as an anatomic landmark to be identified with single– and multi–detector row CT.

By using multi–detector row CT, both transverse and reformatted coronal images were significantly superior to the transverse and coronal single–detector row CT images in the delineation of the osseous spiral lamina. This finding supports the use of multi–detector row CT images, even if they are reformatted, to detect small ossifications of the cochlea.

The vestibular nerve is divided into a superior and an inferior division. The superior division innervates with afferent fibers, the crista of the anterior and lateral ampullae, and the utricle and small portion of the macula sacculi (8,11). The inferior division is divided into the saccular nerve, supplying the main portion of the macula sacculi, and the posterior ampullary nerve (singular nerve) (9,11,20), innervating the posterior ampulla (8,9,11,20).

Imaging of the bony canals of the superior and inferior division of the vestibular nerve is possible with single–detector row CT with high spatial resolution. On single–detector row CT images, the canal of the saccular nerve is detected as a lucency originating at the fundus of the internal auditory canal and running to the vestibule (8,11). However, the canal of the posterior ampullary nerve and the canal of the accessory nerve of the posterior ampullary nerve have not yet been imaged with single–detector row CT reliably, to our knowledge. Both nerves are separated from the inferior division of the vestibular nerve in the fundus of the internal auditory canal and course from the posterior wall of the internal auditory canal to the posterior ampulla (8). Anatomic studies have yielded diverging results.

The incidence of a canal of the accessory nerve of the posterior ampullary nerve varies between 5.6% and 100% (8–10). Because these data vary tremendously, we used this very subtle anatomic landmark to test the spatial resolution of single– and multi–detector row CT images. The transverse and reformatted coronal multi–detector row CT images were significantly superior in the delineation of the canal of the posterior ampullary nerve. Because the total number of imaged canals of the accessory nerve of the posterior ampullary nerve was small, however, the difference between multi– and single–detector row CT was not significant. Nevertheless, in 18% of the temporal bones examined with multi–detector row CT, a canal for the accessory nerve of the posterior ampullary nerve was found, which may explain the preservation of the functional ability of the posterior semicircular canal in some patients with vestibular neuritis, while the function of the superior and horizontal semicircular canal, as well as the functional ability of the vestibule, is lost.

To conclude, the superior performance of multi–detector row CT in the delineation of anatomic landmarks on conventional and reformatted images, the smaller dependency on the observer skills in image evaluation, and the higher certainty in the delineation of anatomic landmarks in comparison to single–detector row CT supports the use of multi–detector row CT in the diagnosis of temporal bone abnormalities.

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FOOTNOTES

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Author contributions: Guarantors of integrity of entire study, L.J., S.S., M.R.; study concepts, V.A., L.J., H.B., S.S.,; study design, L.J., H.B., S.S.; literature research, V.A., M.L.; clinical and experimental studies, M.L., M.H.; data acquisition, M.L., M.H.; data analysis/interpretation, L.J., H.B., S.S.; statistical analysis, S.S.; manuscript preparation, L.J., S.S., M.R.; manuscript definition of intellectual content, V.A., L.J., S.S.; manuscript editing and revision/review, L.J., S.S.; manuscript final version approval, L.J.

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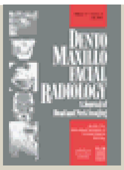

DENTOMAXILLOFACIAL RADIOLOGY ▸HOME

K Hashimoto, S Kawashima, S Kameoka, Y Akiyama, T Honjoya, K Ejima, and K Sawada

Comparison of image validity between cone beam computed tomography for dental use and multidetector row helical computed tomography

Dentomaxillofac. Radiol., December 1, 2007; 36(8): 465 - 471.

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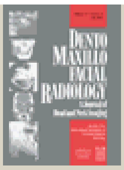

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Large scan field, high spatial resolution flat-panel detector based volumetric CT of the whole human skull base and for maxillofacial imaging

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