Investigation of juxtacellar and cerebellopontine angle meningiomas and neurogenic tumours: two-phase helical CT

Abstract We performed two-phase helical CT in 31 patients with juxtasellar region and cerebellopontine angle tumours to evaluate its usefulness in differentiating meningiomas from neurogenic tumours. After the intravenous injection of 90 ml contrast medium at 3 ml/s, axial helical images were obtained with delays of 30 and 120 s. After the delayed axial images, we acquired coronal images. Changes in attenuation were assessed visually and quantitatively (by comparing the attenuation in Hounsfield units). There were 17 meningiomas and 14 neurogenic tumours, all pathologically proven. Two-phase helical CT showed a decrease in attenuation in 15 (88%) meningiomas and an increase in 14 (100%) neurogenic tumours from early to delayed axial images. Coronal images showed a decrease in attenuation in all 17 meningiomas and an increase in 13 (93%) of the neurogenic tumours. The mean HU and their ratios were significantly different between meningiomas and neurogenic tumours.

Keywords Computed tomography · Head and neck tumour · Meningioma · Neurogenic tumour

Introduction

Preoperative diagnosis of skull-base tumours may be difficult as they arise from various structures and often show similar radiological features [1]. Meningioma and neurogenic tumour are the most common tumours in the juxtacellar region and cerebellopontine angle [2, 3, 4, 5]. At surgery, the relationships of tumour and cranial neurovascular structures are much less predictable with meningioma than with neurogenic tumours [6]. Therefore, differentiating meningioma from neurogenic tumour can be important [2]. It may be difficult to differentiate meningioma from neurogenic tumour on CT or MRI because either may appear as a homogeneously enhancing mass [7]. Many well-defined differential criteria have been adopted [8, 9, 10, 11, 12].

J.W. Ryoo · D.G. Na · J.Y. Woo · K. Park · H.D. Kim · D.S. Choi · H.S. Byun
Department of Radiology, Samsung Medical Centre, Sungkyunkwan University School of Medicine, 50 Ilwon-Dong, Kangnam-Ku, Seoul 135-710, Korea
e-mail: dgna@smc.samsung.co.kr
Tel.: + 82-2-34100516
Fax: + 82-2-34100084

K. Park
Department of Neurosurgery, Samsung Medical Centre, Sungkyunkwan University School of Medicine, Seoul, Korea

H.D. Kim
Department of Radiology, Kangnam Sacred Heart Hospital, Seoul, Korea

D.S. Choi
Department of Radiology, Pohang Hospital, College of Medicine Dongguk University, Kyungsanbuk-Do, Korea

Received: 22 August 2000
Accepted: 13 October 2000
Table 1  Visual assessment of attenuation changes of juxtasellar and cerebellopontine angle tumours on two-phase helical CT images

<table>
<thead>
<tr>
<th>Histology</th>
<th>Change in attenuation</th>
<th>Delayed axial to coronal</th>
<th>Early axial to coronal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early to delayed axial</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease</td>
<td>No change</td>
<td>Increase</td>
</tr>
<tr>
<td>Meningioma (17)</td>
<td>15</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Neurogenic tumour (14)</td>
<td>14</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2  Hounsfield units (HU) and ratios (means ± SD) of meningiomas and neurogenic tumours at each phase

<table>
<thead>
<tr>
<th>Histology</th>
<th>Early axial</th>
<th>Delayed axial</th>
<th>Coronal</th>
<th>Ratio delayed/early axial</th>
<th>Coronal/early axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningioma</td>
<td>107.1 ± 37.5</td>
<td>86.0 ± 20.8</td>
<td>61.9 ± 12.2</td>
<td>0.84 ± 0.15</td>
<td>0.61 ± 0.15</td>
</tr>
<tr>
<td>Neurogenic tumour</td>
<td>53.9 ± 12.7</td>
<td>70.1 ± 15.1</td>
<td>75.6 ± 16.0</td>
<td>1.32 ± 0.17</td>
<td>1.44 ± 0.29</td>
</tr>
</tbody>
</table>

However, some tumours show similar radiological features and a definitive diagnosis may not be made prior to surgery [2, 7].

With helical CT, which provide more rapid imaging of a large volume, multiphase imaging without use of additional contrast medium is possible and has used for detection and characterisation of tumours [13, 14]. However, to our knowledge, there is no report on the use of helical CT for characterisation of juxtasellar and cerebellopontine angle tumours. This study was performed to evaluate the usefulness of two-phase helical CT in differentiating meningiomas from neurogenic tumours and to describe the enhancement characteristics of these tumours in the juxtasellar region and cerebellopontine angle.

Materials and methods

We studied 31 patients (16 men, 15 women, aged 19–70 years, mean 45 years), of whom 19 had juxtasellar and 12 had cerebellopontine angle tumours. The histological diagnosis was obtained by surgical resection in all patients.

Two-phase helical CT was performed. We injected 90 ml iopamidol 300 into an antecubital vein at 3 ml/s, using a power injector. Early and delayed axial images were then obtained with a delay of 30 and 120 s, respectively. Imaging was initiated at the level of the C2 vertebral body and continued towards the skull base with 5 mm collimation, 35 s acquisition time, and 5 mm/s table speed. From the volumetric data, contiguous axial images were reconstructed at 5 mm intervals, giving 35 sections at each phase. Coronal images were obtained 6.5–17 min (mean 10 min) after starting the injection of contrast medium.

Two radiologists, unaware of the histological findings, evaluated each image independently, and reached a consensus when there was any discrepancy. First, we visually assessed the enhancement pattern of the tumour. Changes in attenuation between early and delayed axial images, delayed axial and coronal images, and early axial and coronal images were analysed, and were categorised as “decrease,” “no change,” or “increase”. Obviously cystic or necrotic areas showing constant low attenuation in each phase were excluded. Visual assessment of images in each phase was carried out at the same window width (240 HU) and level (30 HU) in all patients.

Second, we measured attenuation coefficients, in Hounsfield units (HU) of the tumours in each phase, using regions of interest ROI). The latter was made as large as possible (24–60 mm²), and obvious cystic or necrotic areas were again excluded. The ratios of the HU between delayed and early axial images and between (delayed) coronal and early axial images were calculated. The Student’s t-test was used for the statistical analysis of differences in HU between meningiomas and neurogenic tumours. One-way ANOVA was used for the analysis of the change in HU in each tumour in each phase and P values less than 0.05 were considered significant.

Results

There were 13 juxtasellar and 4 cerebellopontine angle meningiomas, 5 juxtasellar and 8 cerebellopontine angle schwannomas and one juxtasellar ganglioneuroma.

The visual assessments are summarised in Table 1. Compared with early axial images, delayed axial images showed a decrease in attenuation in 15 meningiomas (88 %) (Figs. 1, 2) and an increase in two (12 %), while all neurogenic tumours showed an increase (Figs. 3, 4).

Coronal images, compared with delayed axial images, showed a decrease in all meningiomas (Fig. 1) and increased attenuation in nine (64 %) (Fig. 3), no change in four (29 %), and decreased attenuation in one of the 14 neurogenic tumours. Coronal images showed lower attenuation than early axial images in all meningiomas, but higher attenuation 13 (93 %) of the neurogenic tumours; the remaining neurogenic tumour was unchanged.