Change of Vital Signs and Adverse Reactions with Intravenous Nonionic Iodine Contrast Media Using Computed Tomography

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Abstract
The purpose of this study was to evaluate the change of vital signs and adverse reactions with intravenous nonionic iodine contrast media using computed tomography (CT). Seventy-six patients who received contrast enhanced CT with nonionic iodine were studied. Systolic and diastolic arterial blood pressure, pulse rate and arterial blood oxygen saturation were monitored. The mean values of change were $+0.36 \pm 6.18 \text{mmHg}$, $-0.24 \pm 6.36 \text{mmHg}$, $+4.95 \pm 6.63 \text{bpm}$ and $-0.17 \pm 1.22\%$, corresponding to systolic and diastolic arterial blood pressure, pulse rate and arterial blood oxygen saturation, respectively. Only one of 76 patients (1.3%) had nausea with rising of pulse rate and the infusion was stopped immediately. After that, pulse rate returned to nearly normal and nausea was disappeared. In conclusion, monitoring vital signs is very useful method for early detection of the accidental adverse reactions.

Introduction
Contrast-enhanced computed tomography (CT) is one of the most important procedures in the imaging of the oral and maxillofacial regions (1–4). However, it is well-known that intravascular administration of contrast medium may cause a severe, sometimes life-threatening adverse reaction (5–12). Death has been reported in cases of patients administered nonionic contrast media (5), although they have been shown to be significantly safer than conventional ionic agents (6). Therefore, emergency equipment must be available whenever an intravenous contrast agent is administered.

In our hospital, we routinely monitor the vital signs of the patients who received contrast-enhanced CT. That is systolic and diastolic arterial blood pressure, pulse rate and saturation of arterial blood oxygen. The purpose of this study was to evaluate the change of vital signs and adverse reactions with intravenous nonionic iodine contrast media using CT.

Materials and Methods
Seventy-six patients (52 males, 24 females; age 26 to 89 years, mean age 57.8 years) who received contrast-enhanced CT with nonionic iodine in our hospital from December 2002 to June 2005 were studied. One nonionic contrast media was used: Iohexol 300mgI/mL (Oumipaque 300 Syringe, Daiichi Pharmaceutical, Tokyo, Japan). Intravenous pretesting was routinely performed prior to the examination with 1 mL of contrast medium followed by close observation for at least 5 min. Contrast medium was administered as a bolus injection of 100 mL at a rate of 0.3–0.5 mL/s. Contrast medium was injected within 4–5 min with the use of a CT scanner (Vertex 3000, GE Yokokawa Medical Systems, Tokyo, Japan) and a power injector (Autoenhance A–25, Nemoto–Kyorindo, Tokyo, Japan).

Systolic and diastolic arterial blood pressure was monitored in all of the patients at 2–5 min intervals with an automated blood pressure monitor, and pulse rate and arterial oxygen saturation continuously with a pulse oximeter (DUXEO BX–10, Nihon Colin, Aichi, Japan). The results were recorded continuously. Monitoring and recording were started prior to pretesting and continued for at

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least 5 min after injection of contrast medium. All observable adverse reactions were recorded. This study was approved by the Ethics Committee of the University School of Dentistry (No. EC10-039).

Results

Change of vital signs in contrast-enhanced CT was shown in Table 1. The mean values of change were +0.36 ± 6.18 mmHg, −0.24 ± 6.36 mmHg, +4.95 ± 6.63 bpm and −0.17 ± 1.22%, corresponding to systolic and diastolic arterial blood pressure, pulse rate and arterial blood oxygen saturation, respectively. Only one of 76 patients (1.3%) had nausea with rising of pulse rate.

Case: A 44-year-old man with squamous cell carcinoma in buccal mucosa underwent contrast-enhanced CT in March 2003 as an outpatient. He had no past history and no history of allergy. Initial vital signs were 120 mmHg, 64 mmHg, 72 bpm and 96%, corresponding to systolic and diastolic arterial blood pressure, pulse rate and arterial blood oxygen saturation, respectively. No abnormal change was found on pretesting. However, after administration, change of vital signs were 136 mmHg (+16 mmHg), 80 mmHg (+16 mmHg), 120 bpm (+48 bpm) and 97% (+1%), corresponding to systolic and diastolic arterial blood pressure, pulse rate and arterial blood oxygen saturation, respectively. He had nausea with rising of pulse rate. The infusion was stopped immediately, and intravenous fluid (SOLITA-T No. 3, Ajinomoto, Tokyo, Japan) was administered. After that, pulse rate returned to nearly normal and nausea was disappeared.

Discussion

The adverse reactions to contrast media for intravascular use have been reported by many researchers (5-12). Katayama et al (5) reported in their large-scale study that the prevalence of all adverse reactions to nonionic contrast media was 3.13% and of severe reactions 0.04%. Yuasa et al (11) showed that the overall incidence of adverse reactions to contrast media was 2.1%. Kurabayashi et al (12) reported that the overall prevalence was 3.7%, and the most common symptom was nausea followed by pharyngeal discomfort. Our results indicated only one of 76 patients (1.3%) had nausea with rising of pulse rate. The value in our study was not dissimilar.

Katayama et al (5) showed that patients at risk, such as history of adverse drug reactions, asthma and cardiac disease, must be identified before the contrast-enhanced CT, and all possible measures must be taken to deal effectively with spontaneous anaphylactic reactions. Mikkonen et al (10) indicated that the risk factors for late reactions were allergy, medicine allergy, previous adverse reaction to contrast medium and other diseases including diabetes mellitus, heart-, liver- and kidney diseases. We have obtained informed consent prior to the intravenous administration of contrast material. Although contrast materials are safe and widely used, adverse reactions can occur. Cautious administration of contrast material is required in patients with prior reactions, allergies or renal dysfunction.

Kurabayashi et al (12) reported that they routinely monitored and recorded vital signs of the patients during the examination and found hypotensive and hypertensive reactions. They emphasized the importance of routine monitoring of vital signs during radiography with intravenous contrast media, and it is not only simple and noninvasive, but also useful for early detection of any acute adverse reactions. In our hospital, we routinely monitor the vital signs of the patients who received contrast-enhanced CT, that is systolic and diastolic arterial blood pressure, pulse rate and saturation of arterial blood oxygen. Careful observation is needed of patients with such minor symptoms as nausea and vomiting because they may be the first signs of severe or life-threatening reactions (13). In this study, one patient had nausea with rising of pulse rate and the infusion was stopped immediately. After that, pulse rate returned to nearly normal and nausea was disappeared. Prompt initiation of therapy by the radiologist, followed by help from an advanced cardiovascular life support team is necessary when severe adverse reactions occur. The author consider the importance of informed consent, clear indications for the use of contrast material, preparation for severe adverse reactions and collaboration with an advanced cardiovascular life support team of the hospital.

In our hospital from April 2006, CT imagings are performed with a 64 multi-detector row CT (MDCT).

### Table 1. Change of vital signs in contrast-enhanced CT

<table>
<thead>
<tr>
<th>Vital signs</th>
<th>Mean ± SD (Range)</th>
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</thead>
<tbody>
<tr>
<td>Systolic arterial blood pressure (mmHg)</td>
<td>+0.36 ± 6.18 (-11~+20)</td>
</tr>
<tr>
<td>Diastolic arterial blood pressure (mmHg)</td>
<td>−0.24 ± 6.36 (-15~+16)</td>
</tr>
<tr>
<td>Pulse rate (bpm)</td>
<td>+4.95 ± 6.63 (-9~+48)</td>
</tr>
<tr>
<td>Arterial blood oxygen saturation (%)</td>
<td>−0.17 ± 1.22 (-4~+2)</td>
</tr>
</tbody>
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SD: standard deviation
system (Aquilion 64, Toshiba Medical Systems, Tokyo, Japan). Wienbeck et al. (14) reported the frequency and type of intravenous injection site complications associated with high-flow power injection of nonionic contrast medium in MDCT. We consider that the further study of adverse reactions with intravenous nonionic iodine contrast media using MDCT is necessary to compare MDCT with CT.

In conclusion, monitoring vital signs is very useful method for early detection of the accidental adverse reactions.

References