

# The Incidence of Adverse Reaction to Contrast Media in Computed Tomography Scan

Chand RB, Maharjan S, Pant DK and Paudel S.

Department of Radiology, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal

**Corresponding author:** Mr. Ram Bahadur Chand, Associate Professor, Department of Radiology, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal;

**Email:** rbchand2003@yahoo.co.in

## Abstract

**Introduction:** Iodinated contrast media is the most commonly used drug in diagnostic radiology. In the United States alone, more than 50 million Computed Tomography (CT) studies are performed annually and about 50% of CT studies use intravenous iodinated contrast media. The adverse reactions to intravenous iodinated contrast media range from a mild inconvenience, such as itching associated with hives to a life-threatening emergency. The aim of the study was to determine the incidence of adverse reactions to intravenous non-ionic iodinated contrast media in contrast enhanced CT examinations.

**Methods:** This quantitative, exploratory-descriptive cross-sectional study was carried out in Department of Radiology and Imaging of Tribhuvan University Teaching Hospital (TUTH), Maharajgunj, Kathmandu. All the patients undergoing contrast enhanced computed tomographic examinations from 29th Jestha, 2068 to 30th Asar, 2068 (12th June 2011 and 14th July 2011) were documented for the incidence of adverse reactions. Contrast reactions were categorized as mild, moderate, or severe according to American College of Radiology Guidelines. Descriptive statistics were calculated using SPSS software.

**Results:** A total 423 cases were undergone CT scan using non-ionic low-osmolar contrast media. Out of 423 cases, 17(4.01%) adverse reactions were type I (mild). Not a single case of type II (moderate) reaction and type III (severe) reaction was observed. Type I reactions were mainly characterized by nausea, vomiting, headache, dizziness and rashes. Intensity of all events was light, with signs and symptoms receding spontaneously.

**Conclusion:** Adverse reactions to intravenous administration of a non-ionic contrast media are fewer and mostly mild reactions. Thus the use of non-ionic low-osmolar contrast media is an appropriate strategy for minimizing adverse reactions.

**Keywords:** contrast media, adverse reactions, intravenous, CT-scan

## Introduction

Since their advent in the 1950s, radiologic contrast media have revolutionized diagnostic imaging. Although the diagnostic value of contrast media is enormous, other less desirable side effects also occur (Freed et al)<sup>1</sup>. Adverse reactions to iodinated contrast medium happen, relatively frequently in daily work at imaging units, and their occurrence can range from light forms to life-threatening events. International studies indicate that these events occur in between 0.2 and 12.7% of contrast injections,

depending on the type and characteristics of the radiopaque substance that is used (Katayama et al, 1990)<sup>2</sup>. Iodinated contrast media is the most commonly used drug in diagnostic radiology. In the United States alone, more than 50 million CT studies are performed annually and about 50% of CT studies use intravenous iodinated contrast media (Namasivayam, 2006)<sup>3</sup>. The adverse reactions to intravenous iodinated contrast media range from a mild inconvenience, such as itching associated with hives to a

life-threatening emergency. Renal toxicity is a well known adverse reaction associated with the use of intravenous contrast material. Other forms of adverse reactions include delayed allergic reactions, anaphylactic reactions, and local tissue damage (Maddox, 2002)<sup>4</sup>. Typical reactions to contrast media include nausea and/or vomiting, scattered to extensive urticaria, bronchospastic reaction, hypotension (isolated) with compensating tachycardia, anaphylactoid reaction, vagal reaction, cardiovascular collapse, convulsion and seizure (Bush et al, 1991)<sup>5</sup>. In this study we have classified adverse reactions on the basis of American College of Radiology (ACR, 2010)<sup>6</sup>.

There are no national publications in Nepalese Radiology Services regarding the adverse effects of iodinated contrast media. Hence, this research aimed to find out about the incidence of adverse reactions presented by patients undergoing contrast enhanced computed tomographic examinations with intravenous iodinated non-ionic contrast, at the Tribhuvan University Teaching Hospital, (TUTH), Kathmandu. A further goal was to identify the frequency of these events and establish a parallel with results from international references. This knowledge can support care and management decisions, contributing to more qualified and specialized care delivery to clients submitted to tomographies.

## Methods

A quantitative, exploratory-descriptive prospective study was carried out during Jestha 29th and Asadh 30th 2068 (12th June 2011 and 14th July 2011) at the Department of Radiology and Imaging of Tribhuvan University Teaching Hospital (TUTH). Patients who underwent enhanced computed tomographic examination (CECT) at the scheduled examination were included. Data were collected through a registry framework, filled out manually during the service's functioning hours. After the exam, patients were assessed for the occurrence of immediate adverse reactions deriving from the use of intravenous iodinated contrast during the 30 minutes after the radiopaque medium was administered. At the end of the data collection period, a sample of 423 subjects was obtained. In all of these subjects non ionic iodinated contrast material was used. Among 423 subjects, 390 received Ioversol (Optiray), 21 received Iohexol (Omnipaque), 3 received Iopromide (Ultravist) and 9 received Iopamidol (Lek-pamidol). Parameters recorded included age, sex, name of contrast material, type of examination performed and severity of initial adverse reactions. The contrast medium was injected via a 19- or 20- gauge butterfly needle (connected to a 20 cm flexible polythene tube) inserted into an antecubital vein. The average volumes (dose) of contrast medium injected are

listed in master chart. Descriptive statistics were calculated using SPSS v.<sup>17</sup>.

Next, in the results section, findings related to extravasations of the radiopaque medium were described separately, as this is the local adverse effect for which different sample subject inclusion and exclusion criteria were adopted.

Adverse reactions were classified into three groups. Cutaneous reactions such as nausea, vomiting, dizziness, headache and rashes were considered class I (mild) reactions. Dyspnea, bronchospasm, laryngeal edema and facial edema were classified as class II (moderate) reactions. Hypotension, loss of consciousness and cardiopulmonary arrest were considered class III (severe) reactions. If a patient experienced more than one class of reaction, only the more severe or higher class reaction was recorded.

## Results

A total 423 patients under went non ionic contrast CT examination. Out of 423 Patients, adverse reactions were reported in 17 (4.01%). For gender wise distribution of adverse reaction cases, 9 (52.9%) were male and 8 (47.1%) were female. The age wise distribution of adverse reaction is depicted in table 1.

Adverse reaction among cases of different clinical history identified were nausea 7 (41.2%) patients, dizziness in 4 (23.5%) patients, headache in 3 (17.6%), rashes in 2 (11.8%) patients and vomiting was reported in 1 (5.9%) patient as shown in table 1. For the age wise distribution of adverse reaction patients, 9 (52.9%) were at the age of 20-40 years, 3 (17.64%) cases were above 40 years and 5 (29.41%) patients were below 20 years. For the contrast media used in non ionic contrast CT examination, Optiray used in 390 (92.2%), Omnipaque used in 21(4.9%), Lek pamidol used in 21 (2.1%) patients and Ultravist used in 3 (0.7%) patients (Table 3.)

Among the contrast media used, Optiray caused adverse reactions in 16 (94.1%) and Omnipaque caused adverse reaction 1 (5.9%) patient (Fig 3).

**Table 1.Age wise distribution of adverse reaction**

Age	Number of cases
<20 years	5(29.4)*
20-40 years	9(52.9)
>40 years	3(17.6)
Total	17(100)

\*parenthesis indicates percentage

**Table 2: Categorization of adverse reaction**

Type of reactions	Number of cases
Dizziness	4(23.5)*
Headache	3(17.6)
Nausea	7(41.2)
Rashes	2(11.8)
Vomiting	1(5.9)
<b>Total</b>	<b>17(100)</b>

Parenthesis indicates percentage

**Table3. Contrast media used in tomography examination**

Types of contrast media	Frequency
Lek-pamodol	9(2.1)
Omnipaque	21(4.9)
Optiray	390(92.2)
Ultravist	3(0.7)
<b>Total</b>	<b>423(100)</b>

## Discussion

Various materials are used for the contrast enhancement in different radiological procedures. Presently non ionic iodinated contrast materials are the most commonly used contrast media in contrast enhanced CT scans. Unfortunately, these materials are associated with various adverse reactions ranging from mild symptoms to life threatening cardiovascular collapse.

We studied occurrence of contrast reactions in 423 patients who underwent contrast enhanced CT examinations in one month duration. Only 17 out of 423 (4.01%) patients experienced nausea, vomiting, headache, rashes and dizziness which were classified as mild (type I) adverse reactions by American College of Radiology (ACR, 2010)<sup>6</sup>. No moderate or fatal reactions occurred in the present study. Optiray (Ioversol) caused almost 94.1% of adverse reactions. This is probably because large subjects (92.2 %) received this contrast medium. No significant sex predilection was observed (male to female ratio =1.13). Nausea was the most common adverse reaction occurring in 41.2 % of patients.

Our findings are consistent with other similar studies. We found adverse reactions in 4.01% patients. In a study using large sample, Katayama et al found 3.13% adverse reactions with non ionic contrast medium<sup>2</sup>. In their study 0.04% severe adverse reactions were observed. However, in our study no severe adverse reactions were observed. This could be due to small sample size in our

study. In some studies have addressed the influence of the injection technique or contrast administration speed on the occurrence of adverse events, but these international research results are controversial. In this study, we found that automatic contrast injection significantly increased the occurrence of adverse reactions, manual injections provoked adverse reactions in 1 out of 17 (5.88%) of cases while injections through an injection bombs resulted in 16 out of 17 (94.11%).

When considering the influence of some client related variables, literature (Katayama et al)<sup>2</sup> reported higher prevalence rates for all adverse reactions in the age range from 20 to 29 years, with a significant decrease in frequencies for each year added to the patient's age. Hence, the younger the patient, the higher the probability of developing an immediate or late adverse reaction to iodinated contrasts. Similar results were obtained Munechika et al.<sup>7</sup> In fact, in this study, the frequency of reactions peak at age 18 and at age 29. However, no statistically significant difference occurred for adverse reactions in general in different age range.

Ansell et al<sup>8</sup> have suggested that delayed rashes may be more common than is realized and Davies et al<sup>9</sup> found about 1% of immediate rashes in his study. Many factors influence the risk of a reaction to radiographic contrast media. It has been reported that a history of allergy or atopic disease can increase the risk of reaction 1.5 to 10 fold.

The overall incidence of adverse reactions in patients with allergy is about twice that in the general population. The incidence of adverse reactions is highest in third and fourth decades, and lowest at either end of the age spectrum. Incidence of reactions is equal in both sexes. History of reaction to previous examinations is not a contraindication to re-examination. The incidence is approximately 3 times that of the general population (Shehadi, 1975)<sup>10</sup>. Bettmann et al also concluded that the selective use of Low Osmolality Contrast Media (LOCM) is an appropriate strategy<sup>11</sup>. The decision whether to use non-ionic or low-osmolality ionic contrast agent remains difficult. The much greater expense of these newer contrast materials represents a significant addition to already large health-care costs. Although promising, the benefit of universal use of non-ionic and low-osmolality ionic contrast media is not yet well documented (Cohan & Dunnick, 1987)<sup>12</sup>. The incidence of adverse reaction to non-ionic contrast media is the very much less.

Current non-ionic contrast media used in this study is considered the best for all the CECT examinations. Many different experimental designs have been used to study adverse responses to contrast media, and each has

strengths and weaknesses. In this study, there are also some weaknesses as many of the adverse effects experienced by patients are subjective and recorded by inquiry to the patients.

## Conclusion

The non-ionic contrast media are the ideal contrast media for diagnostic imaging procedures, especially in CECT examinations. Non-ionic contrast media are the low-osmolar contrast media and they show less adverse reactions in all age groups, and both sexes.

## Conflict of interest

The authors declare that there is no conflict of interest associated with the study.

## References

1. Freed KL, Leder RA, Alexander C, DeLong DM, Kliever MA. Breakthrough Adverse Reactions to Low-Osmolar Contrast Media After Steroid Premedication. *AJR* 2001; 176:1389–1392.
2. Katayama H, Yamaguchi K, Kozuka T, Takashima T, Seez P, Matsuura K. Adverse reactions to ionic and nonionic contrast media. A report from the Japanese Committee on the Safety of Contrast Media. *Radiology*, 1990; 175:621-8.
3. Namasivayam, S Adverse reactions to intravenous iodinated contrast media: a primer for radiologists.. s.l. : Am Soc Emergency Radiol, 2006; 12: 210-215.
4. Maddox T G. Adverse Reactions to Contrast Material: Recognition, Prevention, and Treatment. Missouri: *Am Fam Physician*. 2002; Oct 1; 66(7):1229-1235.
5. Bush W H and Swanson D P. Acute reactions to intravascular contrast media: types, risk factors, recognition, and specific treatment. *AJR* 1991; 157: 1153-1161.
6. ACR. Media, ACR Manual on Contrast. 2010. Version 7.
7. Munechika H, Hiramatsu Y, Kudo S et al. A prospective survey of delayed adverse reactions to iohexol in urography and computed tomography. *Eur Radiol*. 2003; Jan;13(1):185-94.
8. Ansell G, Tweedie MCK, West CR, Evans DAP, Couch L The current status of reactions to intravenous contrast media.. s.l. : Invest Radiol, 1980; 15(6S):32-39.
9. Davies P., Roberts M. B. & Royle J. Acute reactions to urographic contrast media. *British Medical Journal*, 1975; 2, 434-437.
10. Shehadi WH. Adverse reactions to intravascularly administered contrast media: a comprehensive study based on a prospective survey. *AJR*, 1975; 124:145-152.
11. Bettmann MA, Heeren T, Greenfield A, Goudey C. Adverse events with radiographic contrast agents: results of the SCVIR Contrast Agent Registry. *Radiology* 1997; 203:611-620.
12. Cohan RH and Dunnick NR. Intravascular contrast media: adverse reactions. *AJR*.1987; 149: 665-670.