Storage and administration of iodine contrast agents in Slovenian hospitals

Poster No.: C-2160
Congress: ECR 2018
Type: Scientific Exhibit
Authors: K. Grom; Ljubljana/SI
Keywords: Contrast agents, CT, Catheter arteriography, Catheter venography, Contrast agent-intravenous, Audit and standards, Drugs / Reactions
DOI: 10.1594/ecr2018/C-2160

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Aims and objectives

Value of contrast media in radiography has long been recognized, as attested to by their common daily use in imaging departments worldwide and significance in medical imaging is unquestionable. Like all other pharmaceuticals, however, these agents are not completely devoid of risk. Although adverse side effects are infrequent, a detailed knowledge of the variety of side effects, their likelihood in relationship to pre-existing conditions, and their treatment is required to ensure optimal patient care [1]. Yet the high use of contrast in imaging comes with a great deal of responsibility. In fact, a number of agencies and associations provide standards and guidelines that affect how a radiologic technologist handles and administers contrast medium. These standards serve primarily to ensure that the patient receives a safe, high-quality examination, while also keeping the technologist out of harm’s way [2].

Purpose of this study was to investigate if Slovenian health institutions handle and store iodine contrast media (ICM) according to the recommendations and requirements of manufacturers.
Methods and materials

Study included 18 medical institutions in Slovenia, altogether 60 medical modalities. Data were collected with quantitative method, questionnaire which was answered by 60 respondents who frequently work with ICM. Questionnaire was divided in six sets of questions - set of demographic questions, visual inspection of ICM, exposure to temperature, sunlight, radiation and warming of ICM.
Results

Visual inspection of iodine contrast media

Contrast media should be visually inspected prior to use and must not be used, if discolored, nor in the presence of particulate matter (including crystals) or defective containers. As contrast agent is a highly concentrated solution, crystallization (milky-cloudy appearance and/or sediment at the bottom, or floating crystals) may occur very rarely [3].

Analyze of study results show that 58 out of 60 modalities (96%) perform visual inspect and expiry date check of every contrast bottle.

Visual inspection is basic method for providing integrity of pharmaceutics but radiology technologist must know normal appearance of ICM.

Safe storage of iodine contrast media


52 out of 60 modalities ensure that ICM is stored at room temperature. 85% modalities store ICM under controlled temperature.

Exposure of iodine contrast media to sunlight

Packaging is a basic component of pharmaceutics which provide physical, chemical and biological stability [7]. ICM should be stored in primary and secondary package which protect it from sunlight. 78% of modalities store ICM in secondary package until usage and 22% of modalities discard secondary package during storage. Secondary package protect ICM from sunlight and physical injuries of glass container. Study also showed that 10% modalities expose ICM directly to the sunlight.

Exposure of iodine contrast media to ionizing radiation

In general ICM manufacturers do not put up any requests for ionizing radiation protection. The exception is Bracco [5], where exposure ICM to radiation is not advised. Study show that 50% modalities do not expose ICM directly to the ionizing radiation.

Warming of iodine contrast media before application
It's widely known that ICM should be warmed to body temperature before administration into human body. There is insufficient data to support the idea that warming the contrast media reduces the number of adverse reactions. It has been reported that warmed contrast media reduces the rate of contrast media extravasations because of reduced viscosity can be injected more easily [8]. As an example, Ultravist 300 has viscosity at 20°C 8.9 mPa·s. If we warm it on 37°C, viscosity drops on 4.7 mPa·s. Difference in viscosity corresponds to a factor 1.9. For another example, viscosity of Ultravist 370 at 20°C is 22 mPa·s. If we warm it on 37°C viscosity drops on 10 mPa·s. Difference in viscosity is even bigger, it corresponds to a factor 2.2 [9].

ICM can be warmed up with hot water, heating chamber or automatic syringe. Study show surprising fact that over 22% of modalities do not warm up ICM before intravenous application. Listed reasons were application of small amount of ICM, automatic syringe does not allow warming and ICM stored at room temperature.

Hughes and Bisset [10] measured the iodine delivery rates for a variety of low-osmolality contrast media at both room (24° C) and human body temperature (37° C). They concluded that extrinsic warming to 37°C improved iodine delivery rates for forceful hand injection through a 5F angiocatheter by 20% to 27% (average of 23.5%). They also found that the iodine delivery rates closely mimicked the dynamic viscosity of the tested contrast media. Contrast media with a greater viscosity tended to be delivered at substantially fewer milligrams of iodine per second compared to those with a lesser viscosity.

Mayo clinic [11] also recommend labeling iodinated contrast media containers/vials with the date and time it was placed in the warmer. Discard is need for any iodinated contrast media that has been stored in a warmer longer than one month. Study show that 42% of modalities do not keep a record of storage ICM in warmer.

**Contrast warmers**

Contrast warmer temperatures should be documented daily along with any actions taken to return a warmer to compliance. If an area is not open daily, review the minimum and maximum temperature range from the thermometer history. If the temperature range over the days of closure was within the normal range, document it in the temperature log. If the temperature was outside of the normal range, note it, along with any actions taken in the log [11]. Modalities in Slovenian health institutes check contrast warmers temperature from daily to once per six month.
Fig. 1: Physicochemical properties of specific iodine contrast media.

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<table>
<thead>
<tr>
<th></th>
<th>Viscosity at 20°C [mPa·s]</th>
<th>Viscosity at 37°C [mPa·s]</th>
<th>Factor of difference (viscosity at 20°C / viscosity at 37°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultravist 300</td>
<td>8.9</td>
<td>4.7</td>
<td>1.9</td>
</tr>
<tr>
<td>Ultravist 370</td>
<td>22</td>
<td>10</td>
<td>2.2</td>
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Fig. 2: Do you warm up iodine contrast media before intravenous application?

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Fig. 3: How often do you check warmer temperature?

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Conclusion

Study conclude that Slovenian health institutes mostly store and handle iodine contrast agents in accordance with recommendations and requirements of manufacturers. We recommend few minor optimization changes. Lack of knowledge can be easily reduced with refresher course of proper storage and administration of iodine contrast agents.

Visual inspection of every contrast bottle is priority which should become routine for every radiology technologist. To ensure compliance with manufacturer’s regulations, ICM should be store at controlled room temperature. ICM must be stored in secondary package until use to ensure daylight protection and reduce damage of primary glass container. Special attention must be paid to warming of ICM before intravenous application. One fifth of Slovenian health institutes do not warm ICM before intravenous application. Radiology technologist must know basic physicochemical properties of ICM to ensure safe, high-quality examination. With heating, we lower the viscosity of ICM therefore should be better tolerated and can be injected more easily. Contrast warmer temperatures should be checked and documented daily, also labeling the iodinated contrast media containers/vials with the date and time it was placed in the warmer is recommended.
Personal information

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References


