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Edited podcast transcription:

On this episode I will be talking about iodinated contrast media from the Non-Interpretive Skills document that the ABR has made available. (Note: Please refer to the newest ABR Non-Interpretive Skills (NIS) study guide for any updates or changes that may be present as this is frequently updated by the ABR).

This is not a comprehensive review of iodinated contrast media for board exams. I will present this in a question answer format.

What is used most in radiology: ionic or nonionic iodinated contrast media?

The answer to this question is that nonionic contrast media is most used and that is due to a superior safety profile in comparison to nonionic contrast media. Ionic contrast is less commonly used because it has more safety concerns due to the much higher osmolality of ionic contrast compared to human plasma. That higher osmolality of ionic contrast media increases rates of adverse reactions in comparison to non-ionic agents which are not commonly used in the United States.

Ionic contrast media can disassociate in solution whereas nonionic agents are more stable and do not dissociate.

I would remember for board examinations that nonionic contrast media tends to have a lower rate of reactions and is therefore more commonly used.

Do we most commonly use low osmolality or iso-osmolality nonionic iodinated contrast agents?

Low osmolality agents are most used. Some examples of low osmolality agents are iohexol, iopamidol and iopromide. There is only a single iso-osmolar agent that is approved for use in the U.S. and that is iodixanol.

A single Iso-osmolar contrast agent is approved for clinical use. According to the NIS study guide, what is a proposed use of that iso-osmolar contrast agent?

The answer is that iso-osmolar contrast may be used for intra-arterial contrast injection because they are reported to cause less discomfort than low-osmolar contrast agents.

But for intravenous injection low osmolality nonionic iodinated contrast agents are preferred.

What is an estimate of the percentage of patients injected with iodinated contrast media that will have a reaction of any type?

According to the ABR NIS study guide, the number is up to 3%. The study guide says some reports suggest that the rate is lower than this, so they are giving you the upper bounds of this percentage.

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Acute adverse iodinated contrast reactions may be considered physiologic or allergic-like. What is the difference between these types of reactions?

A physiologic reaction is dose dependent. These reactions are less common than allergic-type reactions. Physiologic reactions often are milder compared to allergic-type reactions. The cause of physiologic reactions are direct toxic effects of the contrast agents.

An allergic-like reaction has a poorly understood mechanism, but it is not thought to be an antigen-IgE antibody response that is typical of other allergic reactions. That is why the ABR terms these allergic-like and not simply allergic reactions. However, symptoms are like those of a true allergic reaction. Allergic-like reactions are not dose dependent. They can happen with any dose. Physiologic reactions are dose dependent and are a direct response to the material you inject.

Do you need to be exposed to iodinated contrast before you can develop an allergic-type reaction to iodinated contrast?

Unlike a bee sting, you do not need to be sensitized to iodinated contrast in order to have an allergic-type reaction to iodinated contrast. Another way to state this is that one can have an allergic-type reaction upon first exposure to iodinated contrast.

Iodinated contrast reactions may be mild, moderate or severe. What are some examples of mild physiologic and allergic-type reactions?

It is interesting that the study guide divides reactions based on whether they may be physiologic or allergic-like. They expect you to know what symptoms may be associated with a physiologic reaction versus an allergic-like reaction. Let us start with physiologic.

What are some examples of mild physiologic reactions? Examples for physiologic mild reactions include transient nausea, vomiting, flushing, warmth, chills, headache, anxiety, taste alterations, mild hypertension, and transient vasovagal reaction. These are all mild because they are transient. In general, these do not require medical therapy for management.

What are some examples of mild allergic-like reactions and according to the study guide?

Mild allergic-like reactions include a small number of hives, pruritus, mild cutaneous edema, itchy or scratchy throat, nasal congestion, and sneezing. Notice these are all reactions that are like a true allergic reaction with hives, itching, edema, congestion, sneezing.

The definition of mild symptoms is that they are self-limited and do not progress in severity.

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What are some examples of moderate physiologic and moderate allergic-type reactions?

Moderate physiologic reactions include extended nausea, vomiting, chest pain, vasovagal reactions that are responsive to treatment but may not resolve on their own initially.

What are moderate allergic-like reactions? Remember the mild allergic-like symptoms and just make these a little more severe. For example, instead of a small number of hives, we now have diffuse hives. Other moderate allergic-like reaction symptoms include moderate diffuse cutaneous and facial edema without dyspnea and wheezing with no or mild hypoxemia. To be moderate, stable vital signs are necessary. A key point to remember for moderate reactions is that one does not have dyspnea and vital signs are stable.

However, findings are more generally more diffuse and more severe than mild reactions.

These moderate symptoms may require medical management. I will really drive that home if a board exam question states that the patient has stable vital signs, but it requires medical management, that is a moderate reaction.

What are some examples of severe physiologic and severe allergic-type reactions?

Severe physiologic reactions include vasovagal reactions that are not responsive to treatment, arrhythmias, seizures, hypertensive crisis, pulmonary edema and cardiopulmonary arrest.

What are severe allergic-like reactions?

These include diffuse edema or facial edema with dyspnea, and the key is dyspnea—remember moderate severity reactions had no dyspnea—as well as erythema with hypotension, laryngeal edema with stridor and hypoxemia, wheezing with hypoxemia, severe hypotension with tachycardia, pulmonary edema, and cardiopulmonary arrest.

Remember that cardiopulmonary arrest can result from severe physiologic or severe allergic-like reactions. Severe reactions are potentially life threatening, whether physiologic or allergic-like. These reactions require prompt management to avoid morbidity or death.

What about pulmonary edema? Is this related to a physiologic or an allergic-like reaction? Remember that pulmonary edema was listed as both a severe physiologic and a severe allergic-like reaction, as was cardiopulmonary arrest.

The most encountered contrast reactions are of what severity and of what type (physiologic or allergic-like)?

The answer is that contrast reactions are most commonly mild and of the physiologic type. Mild physiologic reactions are most common. The most common symptoms, according to the ABR NIS study guide, are warmth, metallic taste, and nausea.

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What is the frequency of allergic-like reactions according to the ABR NIS study guide?

Up to 3% of patients will have a reaction of any type, but when we are speaking purely of allergic-like reactions, according to the ABR NIS study guide, less than 1% of patients will have an allergic-like reaction, and most of those will be mild. So, the answer is less than 1%.

What is the frequency of severe life threatening allergic-like reactions according to the ABR NIS study guide?

First, we know this will be less than 1% because that was the frequency of any allergic-like reaction. The frequency stated by the ABR NIS study guide for severe allergic-like reactions is a range of .01 to .04%. If I were you, I would remember .01%. That is easier to remember than .04%.

Less than 1% of patients will have an allergic-like reaction and less than .01% of patients will have a severe allergic-like reaction.

What are common risk factors for adverse reactions?

Risk factors for adverse reactions include a prior allergic-type reaction to the same class of contrast media. The study guide says that has a 5 -time increased risk. The other risk factors specified are having other allergies and asthma. Those have a 3-time increased risk.

Does a known shellfish allergy or allergy to other iodine containing products such as iodine antiseptics increase one's risk of an allergic-type reaction to iodinated contrast?

The answer is no. Such allergies are not thought to increase risk for an iodinated contrast reaction.

Does a prior allergic-like reaction to gadolinium contrast increase the risk of an iodinated contrast reaction?

The answer is no. If you have reacted to gadolinium, it is not thought that you will have a specific increased risk of reacting to iodinated contrast that is above baseline for individuals with other types of allergies.

What underlying diseases may be exacerbated by iodinated contrast administration?

Think about what we screen for before we give contrast. That will help you produce the answers to this question. For example, chronic kidney disease or acute kidney injury can be exacerbated by iodinated contrast administration. This explains why we screen patients with known renal issues to make sure their renal function is adequate for contrast administration.

There are also other non-renal conditions that iodinated contrast administration can exacerbate. These include cardiac arrhythmias, congestive heart failure, myasthenia gravis, and severe hyperthyroidism related to the Jod-Besedow phenomenon. This is not in the ABR NIS study guide but is important to understand for board exams.

Jod-Basedow phenomenon is hyperthyroidism that happens in the setting of thyroid disease such as goiter, Graves' disease, toxic multinodular goiter or autonomous hyperfunctioning nodule in a person with dietary iodine deficiency. If you give such a person iodine, such as with iodinated contrast or with

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medications like amiodarone, the thyroid finally has the iodine it has been craving and produces excessive thyroid hormone. This manifests in the patient with a sudden onset of clinical hyperthyroidism which often develops within days of administration.

What do we need to consider when using iodinated contrast in patients with thyroid cancer or hyperthyroidism who are planning iodine 131 therapy?

You should not give iodinated contrast to these patients within four to six weeks before a planned I-131 treatment. The iodine from the contrast can saturate the thyroid which will then prevent the thyroid from taking up the I-131. You should screen patients for any recent iodinated contrast administration prior to giving them I-131 therapy. You should know for radiology board exams not to give iodinated contrast within four to six weeks of I-131 treatment.

Who should be premedicated prior to receiving iodinated contrast?

According to the ABR syllabus, policies vary by site, but it is agreed that patients should be pre-medicated if they have had a prior moderate or severe allergic-like reaction to this same class of contrast agent. Mild, allergic-like reactions do not require premedication. Refer to the ABR NIS study guide for examples of currently accepted premedication protocols.

Does premedication eliminate the risk of iodinated contrast reactions?

The answer is no. Pre-medication only reduces the risk of a contrast reaction. There is no treatment or technique currently available that eliminates the risk of iodinated contrast reactions.

What is the definition of a breakthrough reaction?

A breakthrough reaction is a contrast reaction that occurs despite premedication.

What about premedication for kids getting iodinated contrast? Do you need to premedicate kids who have had a prior allergic-type reaction?

The answer is yes if the reaction was moderate or severe. Pediatric specific premedication protocols exist and are specified in the ABR NIS study guide.

What do you do if the need for contrast-enhanced CT imaging is urgent in a patient with known moderate or severe iodinated contrast reactions, and it is unsafe to wait 12 or more hours for imaging that may be required for a premedication protocol?

The answer is that you can consider a rapid pre-medication regimen. Examples of rapid premedication regimens are available in the ABR NIS study guide. If you cannot wait long enough for any premedication, and it is critical to obtain a contrast enhanced scan, the syllabus says that you should scan without premedication based on a risk versus benefit determination.

What is the only proven benefit of a corticosteroid pre-medication regimen?

The only proven benefit according to the ABR NIS study guide is a reduction in the number of mild reactions in average risk patients. It is unknown whether premedication protects against or reduces moderate or severe contrast reactions.

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If a breakthrough reaction does occur, is it more likely to be of the same severity, less severity, or worse severity than the initial contrast reaction?

The answer according to the ABR NIS study guide is that breakthrough reactions are 80% of the same severity, 10% of less severity and 10% of greater severity than the initial contrast reaction. S

If a patient has a breakthrough reaction, can you administer iodinated contrast following pretreatment in the future?

The answer is that you should still pretreat, and you can thereafter give iodinated contrast if the scan is clinically necessary in the future. If a breakthrough reaction happens again, you would expect it to be of the same severity as the prior reaction. Giving contrast in this setting needs to be based on a risk benefit determination by the supervising physicians.

What is the greatest risk associated with premedication regimens for iodinated contrast?

According to the ABR NIS study guide, the greatest risk is the delay of imaging. It is not the risk from corticosteroids or other medicines used for premedication. The greatest risk results from the delay of imaging with subsequent delayed diagnosis and treatment. Also, the longer patients are in the hospital, the greater the risk is of acquiring a hospital acquired infection. Finally, premedication also may increase hospital length of stay, which has associated costs to the patient and healthcare system.

Less common risks of premedication regimens include hyperglycemia from corticosteroid administration, worsening infection, peptic ulcer disease, steroid psychosis, and tumor lysis syndrome—all of which are risks of steroid administration.