Outline

1. The 2016 RANZCR Iodinated Contrast Media Guidelines Update
2. Contrast Administration
3. Common Contrast Questions
Aims

➤ RANZCR Guidelines

➤ IV Flow Rates

➤ Contrast Volumes

➤ Appropriate kV/Contrast selection
Mobile phones at the ready!
Who did Australia lose to in the recent rugby union test series?

SMS your vote to 0407 288 400 or visit m.smspoll.net

New Zealand 82388
Hodor 82389
England 82390
RANZCR Contrast Media Guidelines

PATIENT QUESTIONNAIRE
FOR PATIENTS WHO ARE RECEIVING IODINATED CONTRAST MEDIA

Name ___________________________ Date Of Birth ___________________________
Street Address ___________________________
Suburb ___________________________ State ________________ Postcode ____________

Is there any chance you may be PREGNANT?
Yes ☐ No ☐
If yes – Radiologist must be consulted prior to proceeding

Section A. Allergic Reaction Risk Factors
Do you have ANY of the following

Have you ever had a reaction after a contrast injection?
(itching, skin rash, breathing problems, admission to hospital etc.)

Yes ☐ No ☐
If yes, when? ___________________________
What happened? ___________________________
Where did it happen? ___________________________
Anaphylactic Risk Factors

Is the patient at an increased risk of an anaphylactic reaction?

- Have you ever had a reaction after a contrast injection?
- Do you have or have you ever had asthma?
- Do you have or have you ever had eczema?
- Do you have an allergy to any of the following:
  
  Drugs/medications, food, pollens, dust, animals

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Anaphylactic Risk Factors

• Patients who are at increased risk of an anaphylactic reaction to iodinated contrast media - cannula must remain in situ for 30 minutes

• Cannula must remain in situ for 15 minutes for all patients post IV contrast

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Pre Medication

Consider use of premedication –

“Premedication with corticosteroids, with or without antihistamines has been shown to reduce the likelihood and severity of anaphylactic reactions.”

Demonstrated by a study by Lesser et al (1994).

4286 Patients given a placebo prior to scanning  6.4%
2513 Patients pre medicated prior contrast scanning  9.3%

Lesser et al 1994
The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Pre Medication

a) If oral corticosteroid premedication is used, it must be commenced at least 6 hours prior to the contrast media study.

b) A typical premedication regimen for adults is:

i. Prednisolone 50mg orally, given at 13 hours and 1 hour before contrast media administration.

ii. Oral non-sedating antihistamines may be added to the above premedication regimen.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Intravascular iodinated contrast media should be given to any patient regardless of renal function status if the perceived diagnostic benefit to the patient, in the opinion of the Radiologist and the referrer, justifies this administration.

Emergency imaging procedures requiring contrast media administration e.g. acute stroke, acute bleeding, trauma etc. should not be delayed in order to obtain renal function testing results prior to the procedure.
Kidneys filter toxins from our blood.

Traditionally contrast media was widely accepted as nephrotoxic.

Contrast-induced nephropathy is defined as the impairment of renal function and is measured as either a 25% increase in serum creatinine from baseline or 0.5 mg/dL (44 µmol/L) increase in absolute value, within 48-72 hours of intravenous contrast administration.

Mitchell et al 2015
The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Does your place of practice require a recent blood result (EGFR/Creatinine) for ALL IV Contrast CT patients over the age of 65?

SMS your vote to 0407 288 400 or visit m.smspoll.net

Yes 82569

No 82570
Does the patient .......

• Have a history of kidney disease?
• Suffer from diabetes?
• Currently take metformin?

No = Scan with IV contrast. EGFR not required.

“Age should not be considered as an independent risk factor that should mandate testing as eGFR declines with age even in healthy individuals, due to the way it is calculated”.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
The AusDiab Study established that the frequency of undiagnosed severe (eGFR less than 30ml/min/1.73m²) renal function impairment in Australian adults aged over 25 years was less than 1%.

Chadban et al. 2003.
The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
The risk of intravenous contrast media related acute kidney injury is likely to be nonexistent for patients with eGFR greater than 45.

The risk is of intravenous CI-AKI is also very likely to be low or non-existent for patients with eGFR 30 - 45.

In patients with severe renal function impairment (eGFR less than 30) or actively deteriorating renal function (acute kidney injury) careful weighing of the risk versus the benefit of iodinated contrast media administration needs to be undertaken. Radiologist discussion and consider IV hydration.
Diabetes

- Diabetes is an additional important risk factor
- Diabetic patients with high blood sugar levels can be prone to a breakdown of the small vasculature within the kidneys and reduced kidney function
- Diabetic patients are at double the risk of developing contrast induced nephropathy
- Diabetic patient with an EGFR above 30, ok to scan

Heyman et al 2013
Metformin

- Metformin is not nephrotoxic. However, if renal function decreased as a result of contrast induced nephrotoxicity the patient can experience lactic acidosis.

- As Metformin a form of phenformin and buformin which are metabolised by the liver and excreted through the kidneys. In cases of poor renal function an excess of metformin can be built up.

Thomsen and Morcos 1999.
Akyuz et al. 2010.
Intravenous administration of iodinated contrast media: Patients receiving intravenous iodinated contrast media with an eGFR above 30 ml/min/1.73 m² should continue taking metformin.

Patients with an unknown recent eGFR or an eGFR less than 30 ml/min/1.73 m², or who are unwell or have deteriorating renal function should cease metformin for at least 48hrs from the time of the examination and an eGFR performed prior to restarting metformin.
Dear _________________ (Referring Doctor)

Your patient ____________________________ had a ____________________________(name of procedure) on _________ (date) and it was discovered that their eGFR was _____________ on ____________ (date of eGFR result). Due to the small risk of temporary decrease in renal function following iodinated contrast media administered for this procedure, we have advised your patient to do the following:

1. Cease taking their metformin containing medication from the time of this procedure for at least 48 hours

2. Have their renal function retested after this time before a decision is made to recommence this medication.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Do you have any of the following:

• Over or under active thyroid?
• Possible or confirmed thyroid cancer?
• Previously received or going to have radioactive iodine treatment?
• Currently taking thyroid medication?
• Myaesthenia Gravis?
• Sickle Cell Disease?
• Phaeochromocytoma?

If the patient answered YES to any of these, the Radiologist should be consulted regarding the need for thyroid function test results prior to the procedure. Patients with myaesthenia gravis, sickle cell disease or phaeochromocytoma should be advised about the potential risks by a Radiologist. Emergency procedures examination should not be delayed while waiting for thyroid function test results.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Over or under active thyroid?

The increased dose in iodine after IV contrast means the patient is more likely to become thyrotoxic. Which is potentially dangerous and occurs over 2-12 weeks, this known as the Jod-Basedow phenomenon.

“Patients with known or suspected hyperthyroidism (clinical or biochemical) should be tested and treated for this in consultation with the referrer or an endocrinologist prior to contrast media administration. Treatment typically consists of beta blockade and carbimazole.” RANZCR 2016

Van Der Molen et al 2004
The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
**Thyroid Dysfunction**

- **Possible or confirmed thyroid cancer?**
  Avoid cancer treatment for two months post scan

- **Previously received or going to have radioactive iodine treatment?**
  Avoid contrast media up to two months prior to treatment.

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The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Other Conditions

Myasthenia Gravis
A neuro muscular disease causing weakness and fatigue. IV Contrast is “significantly associated with exacerbation of myasthenia gravis–related symptoms” (Somasheka et al 2013). Patients should be advised of the possibility of worsened symptoms.

Phaeochromocytoma
Tumor of the Adrenal gland. Phaeochromocytomas and paragangliomas may secrete catecholamine's (such as epinephrine) and can induce life threatening episodes of hypertension.

Sickle Cell Disease
Temporary worsening of pain following intravenous iodinated contrast media administration, patients should be advised.

Abdullazade et al 2013
The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Beta Blockers

Pre contrast questions for patients on beta blockers –

Patients taking a course of beta blockers do not appear to be more prone to reactions. However if there is a reaction it is more likely to be moderate or severe.

Patients currently taking beta blockers may require IV glucagon in addition to adrenaline.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Interleukin-2

Is a cancer treatment drug that is key to immune system function.

Can result in a delayed anaphylactic reaction. However pre medication is not recommended as it may counteract the affects of interleukin-2.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Breast feeding can continue as normal.

If a patient is scanned whilst pregnant, testing for hypothyroidism should be performed during the neonatal period. However, this is standard practice in Australia and NZ.

The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline. 2016 RANZCR
Contrast Administration
Braun Introcan Safety Cannula

Ultravist 370 at 22° C

Introcan Safety maximum flow rate at 300 PSI

- 22G (Blue) 4.0 ml/sec
- 20G (Pink) 6.0 ml/sec
- 18G (Green) 8.0 ml/sec
Warming contrast to 37°C significantly reduces extravasation frequency.

18-gauge cannula can be safely operated at a flow rate of 7 mL/s using Imeron 400 at 37°C instead of 5 mL/s at room temperature.

Schwab et al 2009
The above are flow rates tested in a laboratory setting and are the maximum flow rates our IV Catheters are able to achieve and do not constitute guarantees, warranties, or predictions regarding the outcome of your matter. In any case, it is the responsibility of the user to accommodate the flow rates to each patient’s conditions and / or therapy needed.

B. Braun Melsungen AG

i. V.

U. Jedelhauser
Senior Manager Regulatory Affairs CoE IV-Sytems / CoE IV Access

i. A.

T. Renner
Manager R&D CoE IV Access
BD Nexiva™ Diffusics™ Closed IV Catheter System

Performance under pressure
- Designed to perform under pressure with a unique diffusion tip that:
  - Allows the use of a smaller gauge for high-flow protocols (22 gauge up to 6.5 mL/sec)*
  - Reduces the destabilizing effects that can lead to extravasation
  - Provides significantly less force to the catheter during power injection*
- Constructed with BD Vialon Biomaterial and BD Instaflash Needle Technology

*Compared to a nondiffusion tip IV catheter

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<th>Catheter OD (mm)</th>
<th>Extension Tube ID (mm)</th>
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<th>Max CT Flow Rate (mL/sec)</th>
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TOSHIBA MEDICAL SYSTEMS CORPORATION
I.v. contrast administration with dual source 128-MDCT: a randomized controlled study comparing 18-gauge nonfenestrated and 20-gauge fenestrated catheters for catheter placement success, infusion rate, image quality, and complications.

Johnson PT¹, Christensen GM, Fishman EK

Abstract

OBJECTIVE: The purpose of this study was to compare the performance of a 20-gauge fenestrated catheter with an 18-gauge nonfenestrated catheter for i.v. contrast infusion during MDCT.

SUBJECTS AND METHODS: Two hundred five adult outpatients imaged on a dual-source 128-MDCT scanner with arterial phase body CT (flow rates, 5.0-7.5 mL/s) were randomized to either an 18-gauge nonfenestrated or 20-gauge fenestrated catheter. After randomization, any 18-gauge nonfenestrated subjects whose veins were deemed insufficient for that catheter gauge were assigned to a third cohort for placement of a 20-gauge fenestrated catheter. Catheter placement success, infusion rate, contrast volume, maximum pressure, complications, and aortic enhancement levels were recorded.

RESULTS: Catheters were placed on the first attempt in 97% (100/103) for 18-gauge nonfenestrated and 94% (96/102) for 20-gauge fenestrated placements and in two or fewer attempts in 99% of both groups. Mean infusion rates (5.74 mL/s for 18-gauge nonfenestrated and 5.58 mL/s for 20-gauge fenestrated placements) and aortic enhancement levels were not significantly different. Maximum pressure was higher with 20-gauge fenestrated catheters (mean ± SD, 230.5 ± 27.6 pounds per square inch [psi]) than 18-gauge nonfenestrated catheters (mean ± SD 215.6 ± 32.8 psi) (p = 0.002). One subject with an 18-gauge nonfenestrated catheter had a high-pressure alarm. In the third cohort, a 20-gauge fenestrated catheter was successfully placed in two or fewer attempts in 85% (28/33), with one minor extravasation attributed to vein insufficiency.

CONCLUSION: A 20-gauge fenestrated catheter performs similarly to an 18-gauge nonfenestrated catheter with respect to i.v. contrast infusion rates and aortic enhancement levels and can be placed in most subjects whose veins are deemed insufficient for an 18-gauge catheter.
“A 20-gauge fenestrated catheter performs similarly to an 18-gauge nonfenestrated catheter with respect to i.v. contrast infusion rates and aortic enhancement levels and can be placed in most subjects whose veins are deemed insufficient for an 18-gauge catheter.”

Johnson et al 2014
The authors suggest that operating **above the manufacturer’s maximum recommended flow rates** using a peripheral cannula, as has become routine practice.” (Proctor et al 2010)

“During injection of the contrast medium the 22 G failed at 12 ml/s and the **20 G cannula at 16 ml/s**. The larger cannulae did not fail even after injection at 20 ml/s.” (Proctor et al 2010)
Over the limit: Proctor et al 2010

**Figure 1** Injection pressures for water.
Over the limit: Proctor et al 2010

Figure 2 Injection pressures for contrast medium.
Does anyone use a saline test injection prior to giving contrast?
Over the limit: Proctor et al 2010

18 gauge cannula tests –

- Water at 6mL/s = 50 PSI (Temperature 42°C)
- Contrast at 6mL/s = 200 PSI (Temperature 37°C)

- To reach 200 PSI with water (Temperature 42°C). Flow rates in excess of 14mL/s
### Power PICC

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<th>Catheter Size</th>
<th>Maximum Flow Rate*</th>
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<tr>
<td>4 Fr Single Lumen</td>
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<td>5 Fr Single Lumen</td>
<td>7 mL/sec</td>
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<td>4 Fr Double Lumen</td>
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<td>5 Fr Double Lumen</td>
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<tr>
<td>**6 Fr Triple Lumen</td>
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*Flow rates achieved using room temperature Omnipaque 300® contrast and verified using a Medrad Stellant® CT injector system. Omnipaque 300 has a viscosity of 11.8 centipoise at room temperature (20 degrees C). A change in temperature or viscosity of the contrast medium used will result in a change in achievable flow rates.

**Lumen #1 only.

Omnipaque 300® is a registered trademark of GE Healthcare.
Power Port and PICC

Image courtesy of Bairnsdale Regional Health Service
Common Contrast Questions
What is the IV contrast protocol for brain perfusion examinations?
Brain Perfusion Contrast Protocol

- **Aquilion One**
  - 50mLs of contrast with a 50 mL saline push at 5 or 6 mL/s

- **Aquilion Prime**
  - 60mL contrast with a 50mL saline at 5 or 6mL/s

"the fastest possible injection rate should be used to deliver the bolus, to verify the assumptions of the central volume"

Wintermark et al 2004

Brain Perfusion Contrast Protocol

CBP Maps Rough Guide

- TTP
- Slope of curve rCBF
- MTT
- Area under curve rCBV
- Time
- HU
What is the recommended IV contrast protocol for CTPA examinations?
Scan of a contrast bottle at 80,100,120,135 KV
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<td>100</td>
<td>50</td>
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<tr>
<td>120</td>
<td>60</td>
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</tbody>
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Is there a way to record contrast administration on PACS?
V7 Contrast Tab
EP Name: Abdomen
Venous Phase
Contrast Name: Omnipaque
Concentration (mg/dL/mL): 350

Matrix:
- Contrast
- SureStart
- GG-Hel
- ROI 1

Protocol Name: Venous Abdomen

<table>
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<th>No</th>
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<th>Volume (mL)</th>
<th>Duration (s)</th>
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<td>60</td>
<td>20</td>
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HU: 194
HU: 7.6
HU: 8.1
Any Questions?
References

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> Sodickson and 2012 Effects of patient size on radiation dose reduction and image quality in low-kVp CT pulmonary angiography performed with reduced IV contrast dose.
> Chadban et al 2003 Prevalence of kidney damage in Australian adults: The AusDiab kidney study
> Laqmaniet al 2014 Improved image quality and low radiation dose with hybrid iterative reconstruction with 80kV CT pulmonary angiography
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> Heyman et al 2013 Why Is Diabetes Mellitus a Risk Factor for Contrast-Induced Nephropathy?
> Page et al 2009 Comparison of 4 cm Z-axis and 16 cm Z-axis multi detector CT perfusion
> Bivard et al 2014 Defining acute ischemic stroke tissue pathophysiology with whole brain CT perfusion
> BD 2016 The Complete Family of BD IV Catheters and Devices
> Wang et al 2014 The Value of CTPA for Diagnosing Acute Pulmonary Thromboembolism and the Ensuing Right Ventricular Dysfunction
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- Leung 2010 Perchlorate, iodine and the thyroid
- Burgi 2010 Iodine Excess
- Proctor 2010 Over the limit: use of peripheral venous cannulae above the manufacturer’s recommended flow rates
Thanks for listening!

RANZCR Link –

That’s all Folks!