Reminder of important clinical lesson

Previous iodinated contrast anaphylaxis in blunt abdominal trauma: management options

Shahriar Raj Zaman

Royal Perth Hospital, Perth, Western Australia, Australia

Correspondence to Dr Shahriar Raj Zaman, raj.zaman@health.wa.gov.au

Summary

A 34-year-old man presented with significant intra-abdominal and orthopaedic injuries following a high-speed motorbike crash. The man had a history of an anaphylactic reaction to iodine. As a result, the gold standard CT of the abdomen with contrast was unable to be performed to ascertain the exact nature of the intra-abdominal injuries. After stabilisation, an MRI of the abdomen was performed which localised the injuries. The previous contrast anaphylaxis delayed full assessment of the patient and subsequent management. This case discusses the current literature and the management guidelines in a patient with previous anaphylaxis to contrast.

BACKGROUND

Iodinated contrast anaphylaxis is a rare presentation. It presents a dilemma in terms of management in abdominal trauma, as contrast-enhanced CT imaging is the gold standard for assessing/grading the extent of intra-abdominal injury. As intra-abdominal injury secondary to trauma is quite common, it is important to know how to manage patients who present with histories of previous contrast anaphylaxis.

CASE PRESENTATION

A 34-year-old man, previously fit and well, was brought into the emergency department after being involved in a motorbike crash. It was reported that he was travelling on a straight road at ~80 km/h and crashed into a car that pulled out in front of him. He was thrown over the bonnet and landed ~25 m away. He was wearing a helmet and protective leather clothing. The paramedics, on arrival, found the man to have a deformity in his right upper limb, a puncture wound over the right mid-shaft of his tibia and abrasions over his left knee. He did not lose consciousness and had a Glasgow Coma Scale score of 15 throughout. Cardiorespiratory parameters were a systolic blood pressure of 90 mm Hg, a pulse rate of 86 beats/min, a respiratory rate of 20 breaths/min, with 95% oxygen saturation on air. The paramedics administered 1 litre of normal saline fluid stat, raising the blood pressure to 112/53 mm Hg. He was then transported to the city's major trauma centre for further investigation and management.

On arrival at the emergency department, a primary survey revealed a Glasgow Coma Scale score of 15, a systolic blood pressure of 112 mm Hg and a pulse rate of 61 beats/min, a respiratory rate of 15 breaths/min, with 98% oxygen saturation on air. On a secondary survey, the right upper quadrant of the man's abdomen and right chest wall were found to be tender. Both the right arm and the right lower limb were swollen along with a puncture wound over the right tibia.

INVESTIGATIONS

Initial blood tests showed a haemoglobin level of 131 g/l (130–170 g/l), but an ALT of 937 (<40 units/l), suggesting significant liver trauma.

After initial resuscitation, the man was taken for CT imaging of his cervical spine and abdomen/pelvis. Notably, as he had a history of an anaphylactic reaction to iodine, a non-contrast CT of his abdomen and pelvis had to be performed. While the non-contrast scans were not optimal for diagnosis, the CT scan showed evidence of a liver laceration involving segments 6 and 7, diffuse swelling of the right kidney and perisplenic fluid suggesting splenic injury (figures 1 and 2).

Although he remained stable clinically, his haemoglobin level however had dropped by 20 g/l. It appeared that he was still bleeding, but it was unclear whether he was actively bleeding from his liver laceration and/or renal injury. On the recommendations of the consultant radiologist, a radionuclide red cell scan was performed to ascertain the site(s) of ongoing blood loss. The red cell scan did not show any active bleeding in the abdomen or anywhere else.

The man remained stable over the next few days, although his haemoglobin level continued to fall further. Subsequently, he proceeded to have an MRI of the abdomen with and without gadolinium contrast on the 6th day after injury. The scan did not reveal any bleeding or pseudo-aneurysms from liver lacerations. Reassured by this finding, no other obvious causes for the fall in haemoglobin level were found.

TREATMENT

The liver injury was managed conservatively with bed rest and the orthopaedic injuries were treated surgically.

OUTCOME AND FOLLOW-UP

The man progressed well following repair of orthopaedic injuries and bed rest for liver, splenic and renal lacerations. He was subsequently discharged 13 days after admission.

Figure 1 Transverse section of the patient's non-contrast CT scan of the abdomen showing evidence of a liver laceration involving segments 6 and 7, and perisplenic fluid suggesting splenic injury.

to a rehabilitation centre. He was seen in the outpatient clinic 3 months after injury and had fully recovered from his injuries.

DISCUSSION

Blunt abdominal trauma accounts for majority of the trauma seen at major civilian trauma hospitals. Significant compromising abdominal trauma represents ~12–15% of such patients and is usually a result of high-impact multi-trauma.¹ Despite its first use in the 1970s, the use of CT in blunt trauma was not reported till the 1980s.² Since then, the routine use of CT imaging in haemodynamically stable trauma patients has become the modality of choice,

Figure 2 Coronal section of the patient's non-contrast CT scan of the abdomen showing evidence of a liver laceration involving segments 6 and 7, and diffuse swelling of the right kidney.

with the technique of scanning having become fairly standardised. In particular, iodinated contrast-enhanced CT imaging has become the method of choice for investigating blunt abdominal trauma as it is able to diagnose specific injuries, including grading solid organ injuries.¹

The first set of solid organ injuries was defined in 1988 by the American Association for the Surgery of Trauma on the basis of intraoperative findings.² Much advancement has been made since then, with the grading now based on radiological criteria, particularly CT imaging. On the basis of contrast-enhanced CT imaging, a recent US National Trauma Data Bank analysis confirmed the success of non-operative management of liver, spleen and kidney injuries in 85, 73 and 89% of cases, respectively, regardless of the grade of injury.² Understandably, operative intervention increased with an increasing grade of solid organ injury. In a haemodynamically stable patient, the use of contrast-enhanced CT imaging can show the presence and grade of solid organ injury.

The use of radiographic contrast medium (RCM) is ever growing in the medical field. It is estimated that ~75 million RCM dosings are made per year globally.³ RCM molecularly are triiodinated benzene derivatives.⁴ Where CT imaging utilises iodine-based RCM, MRI procedures use gadolinium preparations and as such have different molecular structures. As a result of their differing molecular structures, their adverse risk profiles have been found to be different. It has been reported that severe immediate hypersensitivity reactions from RCM occur in 0.01–0.04% of all intravenous procedures. The risk of death from such reactions is ~1 in 100 000 contrast administrations.³ Given the high volume of RCM administrations per year, these diagnostic agents represent one of the most common to cause fatal anaphylaxis.

The frequency of hypersensitivity reactions has been found to differ between the different types of RCM. A large prospective study by Katayama *et al*⁵ in 1990, examining adverse reactions to contrast media, reported that severe reactions occurred in the range of 0.04–0.22% in those receiving ionic agents. In a 2010 retrospective analysis by Prince *et al*⁶ of ~159 000 MRI procedures, 94 reactions were recorded, representing a 0.005% risk of an adverse reaction. Of these, the risk of an adverse reaction from an abdominal MRI is 0.013%—more than double the overall rate of reactions. From the analysis, only three cardiorespiratory arrests occurred, with one patient unable to be revived by the code team. The authors concluded that the use of gadolinium agents in MRI scans is very safe.⁶ A review by Brockow⁷ in 2009 provided a breakdown of the different levels of adverse reaction between ionic and non-ionic RCM.

Mild reactions have been found in 3.8–12.7% of cases receiving intravenous ionic RCM and in 0.7–3.1% of those receiving non-ionic RCM. Comparatively, severe adverse reactions were reported in 0.1–0.4% of intravenous ionic RCM use and 0.02–0.04% in non-ionic RCM use.^{5 8 9} The risk of adverse reaction with non-ionic contrast for mild and severe reactions is lower by a factor of 5 and 10, respectively, when compared with ionic RCM.¹⁰ Reassuringly, fatal reactions appear to be rare and the risk is similar with non-ionic and ionic contrast media.¹⁰ The main risk factor for an RCM reaction is the history of a previous reaction. It has been found that previous RCM

Table 1 Immediate manifestation of a radiographic contrast medium reaction⁷

Ruritus
Urticaria
Angioedema/facial oedema
Abdominal pain, nausea, diarrhoea
Rhinitis
Dyspnoea (bronchospasm, laryngeal oedema)
Respiratory arrest
Hypotension, cardiovascular shock
Cardiac arrest

reactions have a 21–60% risk of a repeat immediate reaction when subjected to ionic RCM.⁷

The clinical presentation of RCM reactions can be generalised into immediate and delayed reactions. Most immediate reactions present within 5 min of RCM administration.³ Pruritus and urticaria occurs in 65–85% of immediate reactions (table 1).⁷ The most frequent presentation of a delayed reaction is a maculopapular exanthema occurring up to several days after the RCM administration (table 2).⁷ The risk of significant adverse reactions such as cardiorespiratory arrest is certainly valid and a resuscitation trolley with facilities for airway management, oxygen, intravenous access, appropriate drugs and a defibrillator must always be at hand. Concurrently, a medical emergency team with senior help should be available to be summoned at call.^{7 11 12} The European Society of Urogenital Radiology Committee provided guidelines for the management of the acute adverse reaction to contrast media (table 3).¹³

Premedication

The role of using premedication in patients with a previous adverse reaction to RCM is controversial. A 2006 systematic review by Tramér *et al*¹⁴ published in the *British Medical Journal* concluded that in unselected patients the use of premedication is doubtful, citing that in order to prevent one potentially significant reaction would require a large patient cohort. Particularly more compelling is the lack of data supporting the use of premedication in patients with a history of allergic reaction. Anecdotally, corticosteroids and H₁ and H₂ antihistamines have been commonly recommended as premedication. Although H₁ antihistamines were predominantly efficacious against cutaneous reactions and steroids in respiratory symptoms,

Table 2 Delayed manifestations of a radiographic contrast medium reaction⁷

Pruritus
Exanthema (macular or maculopapular)
Urticaria, angioedema
Erythema multiforme minor
Fixed drug eruption
Stevens–Johnson syndrome
Toxic epidermal necrolysis
Graft versus host disease
Drug-related eosinophilia with systemic symptoms
Symmetrical drug-related intertriginous and flexural exanthema
Vasculitis

Table 3 Generalised anaphylactic reaction (when not in cardiac arrest)¹³

1. Call resuscitation team
2. Suction airway as needed
3. Elevate patient's legs if hypotensive
4. Administer oxygen by mask (6–10 l/min)
5. Administer adrenaline intramuscularly (1:1000), 0.5 ml (0.5 mg) in adults; repeat as needed. In children: 0.01 mg/kg to 0.3 mg maximum dose
6. Intravenous fluids (eg, normal saline, lactated Ringer's solution)
7. Histamine H ₁ receptor antagonist (eg, intravenous diphenhydramine 25–50 mg)

as yet there are no randomised trials testing the steroid–antihistamine combination. Interestingly, one study by Davenport *et al*¹² even suggested a premedication regimen in urgent clinical situations: 200 mg of intravenous hydrocortisone administered immediately followed by repeats every 4 h till the examination is complete, with 50 mg of diphenhydramine (H₁ antihistamine) intravenously administered 1 h before the examination. Despite premedication, repeat adverse reactions still occurred. In the study, 81% of the reactions were of similar severity and 8% of a higher severity. While reassuring the similar nature of adverse reactions in majority of repeat reactions, it has reconfirmed the reservations regarding premedication use.

Learning points

- ▶ Iodine contrast anaphylaxis is rare.
- ▶ Previous radiographic contrast medium (RCM) reaction is the main risk factor for a repeat immediate reaction.
- ▶ Ensure the presence of appropriate resuscitation facilities and summon the medical emergency team immediately in the event of a reaction.
- ▶ At present, no definite guidelines for prevention of an RCM reaction are available; however, consider the use of corticosteroids and antihistamines as premedication in patients with previous adverse reactions to RCM.

Competing interests None.

Patient consent Obtained.

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