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Screening prior to gadolinium based contrast agent administration: A UK survey of guideline implementation and adherence

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ABSTRACT

Background: Contrast agents are used to enhance imaging examinations, however in magnetic resonance imaging (MRI) there is an association with nephrogenic systemic fibrosis (NSF). The risk is small, but elevated in patients with impaired renal function and screening of patients is advised prior to administration. This study examines adherence of UK hospitals to guidance on the use of gadolinium based contrast agents (GBCA) in MRI.

Method: This was a prospective study utilising an electronic survey. The sample comprised NHS Trusts in the UK (n = 174). An invitation was sent to all MRI lead radiographers including a link to the survey.

Results: 17.6% indicated they had no written protocol for the GBCA administration within radiology. 41.2% check blood test results for all patients undergoing a contrast MRI, whereas 45.6% only check those patients with known renal dysfunction or are high-risk. Comorbidities which categorised patients as high-risk included diabetes, cardiac or vascular disease and age, however the cut off varied from 65 to 75 years old. Six sites indicated point-of-care (POC) creatinine testing would be carried out where bloods were unavailable, a further 12 had considered POC testing and dismissed it as an adjunct to the patient pathway, the most commonly cited reason being the cost.

Conclusion: Within the UK there is no consistent approach to renal function assessment prior to GBCA administration despite international guidance. POC testing may have a role to play, but a lack of evaluation in radiology has led to concerns that it may constrain capacity and increase costs.

Introduction

There is continued international controversy around the risks associated with Magnetic Resonance Imaging (MRI) contrast media. It is almost 20 years since the first case of nephrogenic systemic fibrosis (NSF) was identified[1] and over the intervening time studies have confirmed the link between gadolinium based contrast agents (GBCA) and the disorder.[2,3] A number of contributory factors have been suggested but the association has been proven in patients with impaired renal function.[2,4,5] The dissociation of gadolinium from chelates has been proposed as the mechanism and this is exacerbated due to the reduced excretion rate in patients with renal failure.[6,7] As a result contrast media have been grouped based upon their stability and risk profile into high, moderate and low categories[6,8] with high risk GBCA contraindicated in patients with severe renal impairment and warnings on the use of medium and low risk agents.

Since the first professional guidance was published in 2007[9,10] international bodies have continued to update their advice to clinicians on the risk of gadolinium-induced NSF. As a result of the screening guidance and improved contrast stability there have been no further reported incidences of NSF and the latest research has not demonstrated any cases with 'low risk' contrast agents.[11]

Although guidance varies, there is agreement that the risk is related to the type of contrast, the dose administered and a patients renal function. As a precautionary measure international consensus endorses rigorous screening of patients to remove or minimise potential complications and the use of patient-specific GBCA dose calculation. Patients with chronic kidney disease have been identified as at greatest risk and therefore national guidelines and health warnings issued by government bodies have concentrated on identifying these patients. The specific screening process varies between guidance, from performing blood tests for assessment of renal function (estimated glomerular filtration rate (eGFR)) on all

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patients, to risk stratification using a medical questionnaire with blood tests only on the high risk group.

A 2010 survey of contrast media use in the United Kingdom (UK) demonstrated marked variation in screening practice,[12] but both European and UK guidance has subsequently been updated.[6,13] This article reports on a survey to examine the current service adherence of UK hospitals to the guidelines.[6,13] The aim was to collect information that would inform the understanding of how renal function assessment in the out-patient population is undertaken.

Method

This was a prospective cohort study utilised an electronic survey (Bristol Online Survey 2016, Bristol UK). Ethical review is not required in the UK for NHS staff questionnaires and service evaluation; however the study followed good practice guidance and local research approval was obtained.

The questions were informed by an initial literature review, which included examination of current international guidance on contrast media use. The survey included a combination of closed and open-ended questions which provided respondents the opportunity to elaborate where appropriate. Departments were asked whether renal function was checked prior to MRI and what current local protocols are in place for patient management where an abnormal blood result was identified. The survey was designed to be completed by the team leader or manager of the MRI department who would have knowledge of the current guidance, protocols and techniques used for renal function testing prior to and following the administration of contrast. Prior to distribution the survey was piloted on a judgement sample of 4 senior radiographers (radiologic technologists) at local NHS Trusts to confirm ease of completion. As a result minor changes were made to improve comprehension.

The study sample comprised NHS Hospital Trusts in the UK identified from Government statistics and national hospital databases (n = 174) excluded paediatric only centres. An invitation letter including a link to the electronic survey was posted to the MRI lead radiographer at the primary hospital site for each Trust. The name of the Trust was requested to ensure unique responses, otherwise all data was collected anonymously.

The survey ran from mid-August to mid-October 2015. The data were anonymised on initial analysis and no identifiable information is reported. The response data were downloaded into Microsoft Excel (Microsoft Corporation, USA) for analysis and presentation of descriptive results.

Results

Of the 174 NHS Trust sites surveyed a total of 70 responses were received, 2 were duplicates and were removed from the final database, leaving 68 completed questionnaires for analysis, a response rate of 39.1%.

Twelve sites (17.6%) acknowledged that they did not have a written protocol for the administration of gadolinium based contrast agents (GBCA) within radiology. Of those sites that did have a policy, the majority (n = 49/56; 87.5%) indicated alignment with at least one national and/or international guideline. Although there was variation between responses the most common reference was to the Royal College of Radiologists (RCR) contrast guidelines (n = 31).

With regards to renal function assessment 28 sites (41.2%) ensure a blood test is undertaken for all patients undergoing contrast MRI. A further 31 sites (45.6%) only check those patients who have known renal dysfunction or at higher risk of renal impairment such as diabetic, cardiac or vascular disease and older people, however the age cut off varied from over 65 to over 75. Three sites indicated that their decisions to proceed to scan in individual patients without bloods, and no known renal problems, was based on the type of contrast used locally and safety record of that type of GBCA.

The type of contrast administered was used as justification for not assessing renal function at 3 sites with this local decision led by radiologists. One of these sites also cited the use of weight-based doses and restricting gadolinium contrast to a single dose in 7 days. One respondent further expanded on the decision not to screen patients

> "Renal function not checked as radiologists agreed no known cases of NSF with the contrast agent used"
>
> (Respondent 4, Teaching Hospital)

Importantly, no sites explicitly stated that it was considered to be solely the referrer's responsibility to confirm the renal function and one respondent did explain that their request forms contain a contrast media safety statement indicating that the patient may receive IV contrast media and that as the referring clinician they should be aware of possible contra-indications, including NSF in patients with renal impairment. Referrers were also pointed to the relevant guidance.

Of the 59 sites that check renal function there was variation in who organises the blood tests, if required, prior to scan appointment Almost half of sites (n = 28; 47.4%) expected this to be organised by the referring clinician, whereas 8.5% of respondents (n = 5) indicated this was arranged by radiology, with the remainder sharing responsibility.

In relation to the process for checking of blood test results, 45.8% check the results at the justification (vetting/protocolling) stage (n = 27) or when the appointment is made (n = 11), with any patients who required blood tests undergoing a further check prior to the scan. 34 sites indicated the results are reviewed on the day of the scan or the night before if staffing allows. Variation was noted in the acceptable time frame of blood test results, but 3 months was the most common value (Table 1). A small number have implemented local timescales of up to 6 months demonstrating inconsistency and introducing potential variation in renal function.

In measuring the renal function there was no single standard of measure used between the 61 sites who responded to this question, with 72.1% (n = 44) using only the eGFR, a single site (1.6%) using Serum Creatinine and the remaining 26.2% (n = 16) identifying both tests to be in use.

Where patients present without recent bloods tests available a range of scenarios were described. Some ensure a blood test is performed, either using point-of-care (POC) technology or standard pathology test, others continue with the scan in those with no known renal problems, whereas a number of sites would seek the advice of a consultant radiologist (Table 2). A small number indicated this scenario would not happen as an appointment would not be made until renal function result was available.

Table 1
Timescale blood test results would be accepted within.

Timescale	Sites no. (%)
Within 1 month	6 (10.2)
Within 2 months	1 (1.7)
Within 3 months	43 (72.9)
3–6 months	9 (15.2)
Greater than 6 months	–
Total	**59**

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