Acute Kidney Injury in Contrast CT

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Use of TARN Data
We used data from the Trauma Audit Research Network (TARN) to compile a list of all patients who presented or were transferred to the JR Hospital over a 12 month period between 1st April 2014 and 31st March 2015 (n=1283).

From this cohort of patients we identified all who had undergone a Trauma CT scan with IV contrast within 24 hours of admission (n=437).

Impact on Patient Care
We propose that a risk assessment including the criteria outlined in the NICE CG 169 be undertaken on all patients presenting to the JR with major trauma. This simple addition to the assessment process would highlight patients at risk of developing iodinated contrast-induced AKI, and only in exceptional circumstances should IV contrast be given to these patients.

This risk assessment could easily be integrated within the Trauma admission proforma. A separate failsafe could also be integrated within the CT request on the hospital’s computer network, with a prompt asking whether a risk assessment/creatinine value has been undertaken when ordering a Trauma CT scan.

These have routinely been used when requesting non-urgent CT scans, when a recent creatinine value has to be entered as part of the request process.

Creatinine values can now also be obtained immediately via the blood gas analyser, which is present within the Emergency Department.

Following the implementation of the above changes we aim to re-audit in 12 months time. We hope that these recommendations will reduce the incidence of IV contrast induced AKI following Trauma CT scans, in addition to swiftly identifying and treating those patients who do suffer from IV contrast induced AKI.

Innovation
To our knowledge the incidence of IV contrast induced AKI following Trauma CT scans has not been investigated within a Major Trauma Centre environment within the UK before, and we believe this is the first project to highlight its incidence/prevalence. We hope that our findings will inspire other Major Trauma Centres across the UK to investigate the incidence within their Departments, and also potentially increase the robustness of safeguards aimed at reducing its incidence.

Implementation of Results
We have yet to implement our recommendations within the Hospital.

Communication
We have presented our findings at the Trauma Departmental monthly Clinical Governance meeting, and now aim to deliver our results and recommendations to colleagues within both the Emergency and Radiology Departments, as they will play a critical role in implementing our recommendations. We also aim to present our findings, possibly including re-audit figures at the next annual regional trauma symposium “Celebrating Trauma Research within the Thames Valley” due to take place in Reading in January 2017.

Description of Project
Computer Tomography (CT) scans are routinely used to obtain a rapid and accurate radiographic diagnosis in patients presenting with major trauma. The use of intravenous iodinated contrast agents is also widely used to enhance the information obtained from these CT scans. However, iodinated IV contrast is a known nephrotoxic agent, which has been associated with the development of acute kidney injury in patients following trauma (Colling, KP et al. 2014; Matsushima, K et al. 2011).

The National Institute for Clinical Excellence (NICE) has recommended that all patients should undergo a risk assessment of acute kidney injury prior to offering iodinated contrast agents to adults for emergency or non-emergency imaging (NICE CG 169, 2013). However, NICE have also recommended that the undertaking of this risk assessment should not delay emergency imaging. At present there is no policy within the Oxford University Teaching Hospitals to determine which trauma patients should receive iodinated IV contrast agents as an adjunct to their CT scan, and there is also no formal risk assessment tool used in clinical practice. The decision at present is therefore largely based upon clinician preference and judgment.

The aim of this QI project was to determine the incidence of acute kidney injury (AKI) in Trauma patients within the John Radcliffe (JRH) Hospital who had undertaken CT scans with iodinated intravenous contrast. Furthermore, we aim to propose changes to the current practice within the JR Hospital when determining which patients should receive iodinated IV contrast in conjunction with trauma CT scans, and also best practice for monitoring renal function in patients ‘at risk’ of developing contrast-induced nephropathy.

A total of 1283 patients were identified as being admitted to the JR Hospital between 1st April 2014 and 31st March 2015. Of these, 437 patients underwent a CT scan with contrast within 24 hours of admission (34.04%). 355 patients underwent a CT scan without contrast (27.67%), 369 patients did not undergo a CT scan within 24 hours of admission (28.76%), and 122 patients underwent a CT scan with or without contrast over 24 hours following admission (9.51%).

Criteria for the diagnosis/detection of AKI set out within NICE CG 169* were used to identify those patients with evidence of AKI following Trauma CT scan with IV contrast. These include:

A rise in serum creatinine of 26mmol/L or greater within 48 hours
A 50% or greater rise in serum creatinine known or presumed to have occurred within the past 7 days

• (p)RIFLE, AKIN, and KDIGO criteria used in formulating NICE guidelines

Based upon serum renal function tests (Creatinine and eGFR) 18 out of the 437 patients (4.12%) who underwent a Trauma CT scan with IV contrast were identified as suffering from an AKI within 48 hours following their CT scans. These patients were aged between 28 and 98.8 years old (mean age 66.84). There were 12 male and 6 female patients.

The pre-CT creatinine for these patients ranged from 56-202 mmol/L, with a mean average of 100.05 mmol/L. The post-CT creatinine performed within 48 hours of their scans ranged from 84 - 232 mmol/L, with a mean average of 169.17 mmol/L.

The rise in serum creatinine following CT scan with contrast ranged from 28 -129 mmol/L, with a mean average of 69.11 mmol/L.

Blood tests were manually reviewed for this sub-set of patients who had undergone Trauma CT scans with IV contrast (n=437). Renal function, including estimated glomerular filtration rate (eGFR) and serum creatinine values were recorded both before and within 48 hours following CT scan with IV contrast.

The incidence of iodinated contrast-induced acute kidney injury in this cohort of trauma patients was 4.12%. This figure is similar to published data from comparable cohorts of patients in other level 1 trauma centres, which have found an incidence of between 4 – 6.6% (Colling, KP et al. 2014; Matsushima, K et al. 2011).

Image 1: Proportion of patients undergoing contrast and non-contrast CT scans within 24 hours of admission to the JRH between 1st April 2014 and 31st March 2015.

Image 2: Distribution of serum creatinine values before and after a contrast CT scan in the 437 patients within the study cohort.

Table 1: Distribution of serum creatinine values before and after a contrast CT scan in the 437 patients within the study cohort.