OUT OF HOURS CT HEAD

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The radiology department is often inundated with out of hours’ requests for CT head, especially by the Accident & Emergency Department. While some scans are urgently vital to decide on life-threatening diagnosis and treatment, some non-urgent or inappropriate scans chalk up limited resources. The radiology department also offers a “drop in” service for the A&E clinicians’ request for CT head scans; first thing at 9am the next morning. Out of hours CT Head is defined as anything that needs to be done after working hours, weekends, or urgent requests handled first at 9am the next working day. This audit aims to look at the usage of out of hours CT from our Hospital’s A&E department.

Methods

Data was collected retrospectively over an 8 month period, from October 2007 to May 2008. The CT receptionist collected photocopies of handwritten CT request forms by the A&E doctors. Some data were gathered from an “Out of hours CT” record book. The CT department has also scanned the request forms from February onwards. The relevant casualty notes were reviewed using the Retriever software in the A&E department. The CT results were looked at using the PACS software.

Results

In a total of 136 “out of hours CT head” request data collected, 47 were for head injuries, 31 for headaches, 36 for strokes, 11 for seizures and 5 for space occupying lesions and others. All the request forms were compared with the A&E notes, and consistencies were compared.

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Head Injury

1.7% of the requests were either inconsistent, or there was insufficient documentation in the A&E notes. 21.2% of the head injury requests did not fit the NICE guidelines. 34% of the A&E documentation written by doctors did not record the Glasgow Coma Scale (GCS) at the time of examination — though it is likely it had been noted on the neurology observation chart. Out of the 47 requests done, 7 had a positive intracranial pathology. Of the 7 positive scans, 4 had positive neurological signs; 1 was negative; while the remaining 2 had no recorded neurological exam.

In 21% of the cases there was a drop in the GCS and it was not clearly recorded as to what time the injury occurred and how much time had lapsed between the injury and assessment. According to the NICE guidelines CT Head is indicated if the GCS drops below 15 within 2 hours after the injury. Implementation of the NICE guidelines will lead to improvements, with safe early discharge, reduction in the number of admitted patients and cost savings.¹

Headache

31 patients with headaches were scanned as an emergency. 10.7% of the A&E CT head requests were inconsistent. 10 requests or casualty notes had “? Subarachnoid Haemorrhage” (SAH) documented. Out of these 10, 2 patients were discharged home with a “normal CT scan”. 40.9% of the patients were examined with a fundoscope. 34.8% had meningeal signs. 14.8% had positive intracranial pathology. 14.8% of the patients experienced amnesia and drowsiness. 36.7% had a high recorded blood pressure. 4 patients had positive neurological signs, and 3 of them (75%) had a positive CT scan. According to the American Academy of Neurology, there is a 3 fold increase in the chance of positive neuro-imaging result in patients with chronic headache having an abnormal neurological exam.²

Headache in itself is a challenge for the A&E clinicians. It makes up 2% of all admissions, and most patients are in distress, alarmed and often frightened. The important group to identify is the group of “sudden onset headaches”, where GPs will mostly have had contact with SAH patients who survive the early minutes. History is pivotal in teasing out this group from those with chronic headaches “at the end of their tethers”.³

A study in Washington University Medical Centre involving 333 Emergency Department cases, of patients who presented with acute or acutely
worsening headache.4 Table 1 summarises the “red flags” of headaches to be concerned about.

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Positive Neurological signs</td>
<td>X 10.7 risk of positive CT</td>
</tr>
<tr>
<td>Amnesia, depressed sensorium,</td>
<td>10% positive CT</td>
</tr>
<tr>
<td>hypertension</td>
<td></td>
</tr>
<tr>
<td>All of the above risk factors</td>
<td>87.9% PPV</td>
</tr>
<tr>
<td>Absence of all the risk factors</td>
<td>98.0% NPV</td>
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Table 1

For “? SAH” patients, it is important not to send any patient home, even those with a normal CT Head. If SAH is suspected, an unenhanced CT should be done as soon as possible after the onset of headache. Delay in arranging the scan allows the blood accumulated in the subarachnoid space to degrade, and the CT may appear normal despite a bleed. 3rd generation CT scanners miss 2% of SAH within 12 hours of headache onset, and 7% by 24 hours. Almost all subarachnoid blood is reabsorbed within 10 days. A negative CT scan should be mandatorily followed by a lumbar puncture. This was not the experience of the “? SAH” patients in this study. 2 were sent home with a normal CT scan. It is unclear from the notes sent to the medics as to how many had a lumbar puncture done.

**Stroke**

36 urgent requests were made out of hours to scan potential stroke patients. 2.7% of the radiology request forms were inconsistent. 28.5% of the requests did not have “? Stroke” documented – they were scanned for various other reasons like transient ischaemic attack (TIA), or the potential diagnosis written only on the request form. 38.8% of the patients were scanned within 2 hours. The time was calculated from the time they arrived at hospital, to the time the actual CT was done. 94% of the patients were scanned within 48 hours. 4% had a positive diagnosis. Of all the scans done, 47.2% were ischaemic strokes, 2.7% were haemorrhagic strokes, while the remaining were normal scans. 2 showed a space occupying lesion.

A non-contrast CT head scan is the fundamental branching point in the evaluation of stroke. It helps the clinicians decide whether to consider thrombolytic therapy or neurosurgical intervention for those with intracranial haemorrhage (ICH). The sensitivity of a standard non-contrast CT increases 24 hours post event. After 12-24 hours, there is sufficient oedema in the
stroke area to produce a regional hypodensity. If SAH is a differential in the diagnosis of stroke, a lumbar puncture must be done to maximise the exclusion of SAH. Depending on the time at which imaging done, up to 10% of the patients can have a normal CT scan. Parenchymal haemorrhages less than 1 cm may not be visualised. However early scanning helps exclude ICH and allows rapid thrombolytic intervention, particularly important in young patients.

Ideally MRI should be used for all stroke patients. Table 2 shows the benefits and disadvantages of both.

<table>
<thead>
<tr>
<th>MRI</th>
<th>CT</th>
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<tr>
<td>MRI can reveal ischaemic lesion to full extent within minutes (in experiments)</td>
<td>CT cost half of MRI, smaller site demand</td>
</tr>
<tr>
<td>15% of ischaemic strokes occur in vertebrobasilar region – MRI is more sensitive</td>
<td>CT demonstrates ischaemic lesions in fuller extent later (e.g. next day)</td>
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<td>Suitable for patients not candidates for early therapeutic interventions</td>
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<td>Availability out of hours</td>
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<td>Metallic contraindications</td>
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<td>Claustrophobia</td>
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<td>CT angiography</td>
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Table 2

There is an ongoing debate whether an urgent out of hours CT head is necessary when a patient is preliminarily diagnosed with stroke. An urgent CT head is probably required if a haemorrhage is suspected – e.g. patients on anticoagulation. A CT head can usually be scheduled first on the morning list if an ischaemic stroke is suspected. Many clinicians are reluctant to start aspirin treatment on patients without a CT scan. A meta-analysis of the Chinese Acute Stroke Trial (CAST) and International Stroke Trial (IST) which recruited 40,000 subjects concluded; that by starting aspirin on patients with stroke before imaging, only 2 per 1000 would have a transformation from original infarct to haemorrhage and 11 per 1000 subjects would benefit from a lower mortality from ischaemic stroke if aspirin was started early.
Hence the question remains in our Hospital – whether stroke patients need an urgent on spot CT. If thrombolytic therapy is not offered, it is unclear what would be the appropriate urgency to scan patients out of hours. A few requests were for TIA patients – there were not any clear guidelines on whether they should receive a CT scan as well. A few “? TIA” patient had an ischaemic stroke on CT. However, if neurology has resolved completely within 24 hours, TIA patients should have a non-urgent CT brain. New stroke guidelines will change the imaging of all stroke patients in the near future (NICE).

Seizures

11 “out of hours” requests were made to scan patients with seizures. Only 1 request card was inconsistent. 5 were first seizures. None of the patients had any persistent focal neurological signs. 3 had a previous history of epilepsy. 1 had a predisposing factor. Only 1 patient had a positive scan.

Out of hours request for seizures is less common than head injuries or headaches, but still poses a significant problem for the A&E clinicians, who are faced with anxious families and patients who anxiously wonder if there is “something sitting in their brain”.

The American Association of Neurology suggests scanning patients with first seizures, special populations (e.g. AIDS for toxoplasmosis), patients with abnormal neurological signs and predisposing history (e.g. CSF shunt revisions, malignancy, neurocutaneous disorder). There is no recommendation to scan patients with chronic seizures.

MRI scanners are certainly more sensitive and can pick up more subtle abnormalities. 9

In this hospital, CT is recommended as an urgent investigation when there is prolonged post-ictal state or persistent neurological signs. If patients experience a first time seizure and recover, they should be referred to neurology with a view to do a MRI and not CT.

Limits of the Audit

The sample size is small – it is unpredictable how many out of hours requests will be made per week. Being a retrospective study, it was time consuming to trawl through, retrieve and analyse the handwritings of A&E clinicians who are always under pressure of time. Documentation on many casualty notes was poor – e.g. unable to ascertain whether a neurological exam was performed or not. It was difficult to find out whether stroke or meningitic patients who received a CT scan were referred onto medics or surgeons, or whether lumbar punctures were performed. Notes on many patients were missing or irretrievable. We propose that a more detailed
prospective study commences as soon as possible, and that this audit process continues to the benefit of patients and after hour’s teams alike. There is clearly a need for better imaging guidelines about out of hours imaging. We propose that this audit is represented within twelve months.

References

9. Wieszmann J. Neurol Neurosurg Psychiatry 2003; 74:466-470 doi:10.1136/jnnp.74.4.466