Abstract

Ready-Access to CT imaging facilities in Orthopaedic Trauma Clinics is not a standard facility. This facility has been available at the regional trauma unit, in Merlin Park Hospital, Galway for the past four years. We reviewed the use of this facility over a 2-year period when 100 patients had CT scans as part of their trauma clinic assessment. The rate of CT scan per clinic was 0.6. The mean waiting time for a CT scan was 30 minutes. 20 (20%) new fractures were confirmed, 33 (33%) fractures were out-ruled, 25 (25%) fractures demonstrated additional information and 8 (8%) had additional fractures. 20 (20%) patients were discharged and 12 (12%) patients were admitted as a result of the CT scan. It adds little time and cost to CT scanning lists.

CT scanning has proven to be of benefit in determining the presence or absence of fractures in cases of high clinical suspicion, particularly carpal fractures. Nguyen et al have demonstrated the value of CT with a clinical scaphoid fracture at an upper limb clinic in making an earlier diagnosis and commencing more timely and appropriate treatment. Three-dimensional CT image reconstruction of intra-articular fractures enhances delineation of complex joint fractures and occult fractures, supplying the exact number of fractures and their degree of displacement which aids pre-operative planning. CT is also used to monitor union of fractures. It has been proposed that the cost and total radiation dose compared to special projections of conventional radiographs is equivalent to that of multi-detector CT.

Introduction

The trauma unit in Galway serves as a regional referral centre for a hinterland population of approximately 300,000 people, with an additional 1.2 million tourists visiting each year. The trauma unit in Galway serves as a regional referral centre for a hinterland population of approximately 300,000 people. Referrals to the Orthopaedic Trauma Service come from the Emergency Departments of one regional and two district hospitals and are seen the following day at the trauma clinic of the consultant on call. The management of these patients can normally be decided on the basis of clinical evaluation and plain x-rays but occasionally further imaging is necessary. CT scan is the imaging modality of choice for definitive multi-dimensional imaging of the skeleton. Ready-access to CT scanning from the orthopaedic trauma clinic typically implies that a CT scan is added to the end of a planned list or scheduled within a few days of the clinic. It is useful for evaluation of a suspected fracture, to aid preoperative planning for intra-articular fractures, and occasionally to confirm bony union at follow up. MRI is limited mostly because of its restricted availability, cost, and length of scan time. Radionuclide bone scanning, while sensitive for bone pathology, has similar cost implications, is not specific for acute trauma and displays poor anatomic localisation.

Methods

We undertook case review of 100 consecutive patients attending the trauma clinic at Merlin Park Hospital over a two-year period (2008/2009) who had a CT scan requested from the trauma clinic as part of their assessment. We collected information including the initial radiographic report, the clinical indication for CT and the CT report. We also looked at the time elapsed between requesting the CT and the scan being performed. We then looked at the further management of these patients i.e. if operative management was undertaken, conservative management and outpatient review or discharge from the clinic.

Results

Incidence of CT scans performed was 0.6 per day (SD 0.88), with 100 patients requiring a CT scan over 170 trauma clinics. These included 51 men and 49 women, with a mean age of 37.4 years. All patients were referred from Accident & Emergency Units in the region and had already been reviewed by at least two doctors. Some patients were being monitored for a healing fracture at the trauma clinic. Average waiting time between clinic consultation and CT scan was 49 minutes. Two patients had to wait until the following morning for their scan. Excluding these, average waiting time was 30mins (SD 42mins). Total scan time was typically 15 minutes, including procedure explanation, patient positioning and image processing. The equivalent cost per scan for a private patient is €300, regardless of the area of the skeleton. The private patient cost is €44,000 per annum. All scans had reconstructive images done within an hour by a radiologist. CT results are summarised in Table 1. Admission/discharge subsequent management following the CT scan is shown in Table 2.
20 patients were discharged from the clinic on the basis of their CT findings (Table 2). 12 patients were admitted for operative management. 10 of these had new findings on their CT that were not identified on x-ray and subsequent management was based on CT findings. The remaining 2 patients had CT to assist pre-operative planning, with the decision to operate being made prior to CT.

The Dose Length Product is a measure of total radiation exposure for the whole series of images per body part scan. Table 3 presents DLP values for averages achieved in 2009 for this scanner. It indicates that the radiation doses exposed per scan are consistent with low international values.

**Discussion**
Bone-specific CT scans rarely require the use of intravenous contrast, which allows for faster and less labour-intensive scanning. The quality of the image is unaffected by the position of the patient or the angulation of the scan and repeat views are unnecessary. A frequent cause of discordance amongst the radiography and orthopaedic services is re-x-ray for visualising an acute fracture where the initial radiograph did not adequately demonstrate the fracture or joint integrity, such as the ankle or shoulder joint. This is frequently compounded by an unwilling patient with a painful limb. The additional information provided by a CT scan over plain radiography on a patients
fracture was clearly shown in this study. Both new trauma patients and symptomatic review patients benefited in each case-20% of patients had confirmation of a new fracture, 31% had confirmation of no fracture and 41% gained additional information about their fracture-new or old.

Our results demonstrate a low rate of referral for this service. Less than 1 patient on average per day required a CT scan. The prompt scan and report availability allowed a patient to be seen afterwards, before the trauma clinic had finished thus facilitating a prompt decision on the patients fracture management. 20% of patients were discharged and 12 % were admitted after their CT scan. It is possible that these patients may have been similarly managed regardless. Discharged patients with the additional benefit of CT posed obvious advantages to clinical burden and earlier mobilisation out of cast thus allowing an individual back to work. Regarding those admitted for operative treatment, the benefits of pre-operative multi-detection CT for gaining additional information have been proven. What remain obscure within the remaining 68%, are patients who did not have surgery because of the CT result, patients who went on to have earlier alternative investigations or patients whose conservative outpatient management was altered as a result, through adaptation of their physiotherapy regime, plaster duration or weight-bearing status. This was particularly relevant for those eight patients who had additional contiguous fractures.

Most CT scans for spinal trauma should be appropriately imaged in the Accident & Emergency department. Despite efforts to maintain a quality of care that ensures adequate imaging of acute spinal trauma, some patients slip through the net with sub-standard imaging. It is worth mentioning that the four CT scans of the spine would ideally have been imaged at initial evaluation in A&E. Typically there is ready access to CT scanning facilities in these circumstances. The Dose Length Product amounts used with this multidetector scanner compare favourably with other contemporary scanners. Radiation dosage per scan was lower than typical trauma scans because scans were more focussed after multiple clinical examinations than those performed in the A&E setting, thus a smaller area needs imaging. It is difficult to equate benefit in terms of cost for this facility. Calculating the cost of multiple clinical visits, additional radiographs and longer absence from work accounts for only a part of the economic picture. The benefits to earlier diagnosis or better fracture management are tangible.

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