The Ulster Medical Journal, Volume 63, No. 1, pp. 23 - 26, April 1994.

Initial experience with an electronic CT image transfer system

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Accepted 23 January 1994

SUMMARY

An electronic image transfer system for computed tomographic images links the CT scanner in Altnagelvin Hospital, Londonderry with the regional nuroradiology department in the Royal Victoria Hospital, Belfast. In the first 13 months of operation, scans of 100 patients were transferred; 49 scans were taken in acute neurosurgical emergencies, and 51 were non-acute sent for a specialist neuroradiological opinion. Potentially hazardous inter-hospital transfer was avoided in 21 cases of acute neurosurgical emergency, and more efficient and appropriate referral was achieved in the cases whose scans had been sent for sent for radiological second opinion. We believe that the system has substantially improved the diagnosis and management of patients with neurosurgical problems in both hospitals.

INTRODUCTION

The availability of computerised tomographic (CT) scanning in the United Kingdom has increased substantially over the past five years [1] and Northern Ireland is no exception. CT facilities are now available in seven hospitals and all but one of these provides an emergency service. The regional Neuroscience unit is located in the Royal Victoria Hospital, Belfast and a specialist neuroradiology service is provided on this site. Neurosurgical emergencies in other hospitals are usually transferred to the Royal Victoria Hospital for investigation and assessment, but the patient's condition often makes transfer hazardous and in multiple trauma cases it is recommended that CT scanning is carried out at the base hospital [2]. On other occasions a neuroradiological opinion is sought when there are unexpected findings on cranial or spinal CT imaging. Transfer of patient and scans by ambulance, or the scans by post, to the regional unit may lead to unacceptable delays.

In 1990 Lee et al, in Oxford [3] published the results of a study on electronic image transfer in head injured patients. This system was described at a symposium in the same year. Following favourable reports on the use of the system elsewhere in the United Kingdom, and an expression of interest by Altnagelvin Hospital, Imlink systems (Electronic Imaging, Oxford) were purchased by the Royal Victoria and Altnagelvin Hospitals in 1991. We describe our first year's experience.

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METHODS

The Imlink image transfer system is a personal computer based system for acquisition, transmission and display of either CT or MRI images. These are captured from the video output of the scanner, and are stored on a hard disc with capacity of up to 750 images. The images are then transmitted through a modem to other Imlink users via standard telephone dial-up lines. Transfer times depend on the image content and on the quality of the telephone line, typically 6-8 minutes for 20 head images.

Patient identification and a brief clinical history can be recorded as part of the file and transferred with the images. We undertook a retrospective review of the first 100 cases in which image transfer took place. Patient data was obtained from the Imlink files and information regarding outcome was obtained from case records and by direct inquiry from clinicians.

RESULTS

Scans of 100 patients were transferred during the first 13 months of operation. There were 60 male and 40 female, aged from 9 days to 87 years, average age 43 years. There were 49 acute neurosurgical emergencies (head injury or spontaneous intracranial haemorrhage) and 51 cases where the scans were transferred for neuroradiological advice.

In the emergency group the scan images were transferred for assessment by both the neuroradiology and by the neurosurgical staff. Advice regarding the most appropriate management (transfer to Belfast or otherwise) was sought. The images in the second group were transferred for a radiological second opinion.

TABLE 1

Emergency cases: diagnosis leading to image transfer

Trauma	26
Spontaneous intracranial haemorrhage	15
Tumour	5
Other	3

The underlying diagnosis of the emergency patients is summarised in table 1. Of the 26 trauma patients there were 23 head injuries, two facial fractures, and one spinal fracture. Of the 15 patients with spontaneous intracranial haemorrhage 11 had subarachnoid haemorrhage, one an intracerebral haematoma, and three had subdural haematoma with no history of recent trauma. The five intracranial tumours were diagnosed radiologically as meningioma, glioma, colloid cyst of the third ventricle, cerebellar haemangioblastoma, and medulloblastoma. All presented as acute emergencies due to the mass effect associated with the tumour, or with acute hydrocephalus. Of the remaining three cases, one was considered to be normal, one had acute hydrocephalus with no obvious underlying lesion and the third an arachnoid cyst.

TABLE 2

Emergency patients: outcome following CT image transfer

Diagnosis	*Emergency transfer*	*Elective transfer*	*No transfer*
Trauma	3	15	8
Intracranial haemorrhage	0	9	6
Tumours	0	5	0
Other	0	2	1
Total	3	31	15

The immediate outcome of the emergency patients is summarised in Table 2. Three patients, all with severe head injuries, were transferred to the Royal Victoria Hospital, Belfast as emergencies for immediate neurosurgical intervention. Thirty-one patients were transferred electively, in working hours on the following day or once a bed became available. The remaining 15 patients were not transferred: five because it was felt that neurosurgical intervention either was unnecessary or was unlikely to improve the outcome in view of the clinical status and radiological appearances, and nine who were considered unfit for transfer due to the clinical condition or the severity of other injuries (Two of these had emergency treatment locally for acute extradural haematoma). Five of these nine patients subsequently died.

TABLE 3

Underlying diagosis in 51 cases where the CT images were transferred for a neuroradiological opinion

Intracranial Tumour	22
Congenital lesion	7
AV malformation	4
Infarct	5
Demyelination	2
Normal	4
Spinal Lesion	4
Other	3

The underlying diagnosis in the patients whose scans were transferred for a neuro-radiological opinion is summarised in Table 3. None of these patients were transferred as an emergency, eight were transferred electively and 16 were referred to outpatient clinics at the Royal Victoria Hospital. Four of the

eight cases were transferred electively for further neuroradiological investigation (usually angiography), and three of these were shown to have intracranial arteriovenous malformations. The others were transferred for treatment of lesions such as intracranial tumours. Sixteen patients were referred as outpatients to either the neurosurgical or neurological clinics in Belfast. One patient was referred for an MRI scan in Oxford but was managed in Altnagelvin Hospital.

As a result of image transfer, a total saving of 21 emergency ambulance journeys from Altnagelvin Hospital to the Royal Victoria Hospital was made. The cost of an emergency transfer is calculated from mileage and personnel. The total saving for these 21 journeys avoided was £5197 (150 miles at 65p per mile = £187 : two ambulance crew at £6.50 for four hours = £60: total charge for each emergency transfer = £247).

DISCUSSION

As a result of image transfer from Altnagelvin hospital to the neuroradiology department at the Royal Victoria Hospital, patients presenting as neurosurgical emergencies have been managed in a more efficient and cost effective manner. The relatively modest cost of installation of the Imlink system (about £7500) was almost covered by the saving in unnecessary emergency ambulance transfers in the first year of operation. This finding is in common with other authors [1, 4]. An appreciable number of scans sent for second opinion have resulted in referral of the patient to either the neurosurgical or neurological departments. These referrals have been made more appropriately as a result of consultation between the radiologists and clinicians and some inappropriate referrals have been avoided.

Some difficulties have been encountered when scans are transferred out of normal working hours, when the neurosurgeon on call does not have access to the neuroradiology department where the Imlink unit is housed. At present this is overcome by the neuroradiologist on call coming in to read the scans. In other units terminals have been installed in the radiologists homes, and a portable Imlink device is now available which may provide the solution to out of hours image transfer to both radiologists and clinicians.

The educational aspects of the system have not been addressed in this paper, but there is a benefit to both the referring clinician and radiologist, and to the regional neuroradiology department in terms of experience. A successful teaching programme has been developed by another Imlink user in the UK. Overall we feel that the installation of this system has been of benefit to patients, radiologists and clinicians and our experience may be useful in other areas.

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