MRI has been cited as the investigation modality of choice for many problems relating to the head, neck and spine from the neonatal period to adult life [1, 2]. This is because it provides enhanced anatomical detail compared to CT without the need to use ionising radiation. CT, however, continues to be recognised for its role in emergency management and its ability to detect calcification and bony abnormalities [1]. In addition, CT scanners are more widely available and require less patient co-operation as imaging time is shorter than for MRI.

MRI undoubtedly produces more detailed images than CT due to high contrast resolution and multiplanar capabilities, but there have been few studies which have compared the clinical benefit of MRI with CT. Two recent studies comparing CT with MRI as the mode of imaging for investigating ischaemic cerebral infarcts [3] and Japanese encephalitis [4] showed that MRI had greater sensitivity for detecting haemorrhagic transformation [3] and also thalamic and extrathalamic abnormalities [4]. However, the diagnostic capabilities or clinical benefits of MRI compared to CT in a general paediatric population have not been documented.

Previous studies have highlighted the importance of focal neurological signs and EEG abnormalities for predicting abnormalities on CT [5, 6]. As MRI provides a more detailed evaluation of the intracranial structures, abnormal relevant findings on imaging may arise without these clinical abnormalities. This has been analysed in adults presenting with psychiatric illness [7] and children with headache [8, 9, 10]. With MRI becoming a
procedure that is more readily available in district general hospitals, it is important to know whether imaging of children without neurological signs in a general paediatric population is of benefit.

In general, accessibility to CT continues to be easier than MRI. This was the case at our district general hospital that serves a population of 250,000. CT is available locally, but children have to travel to the regional referral centre for MRI. We were, therefore, particularly interested to determine the clinical benefit of CT and MRI in our childhood population so that we could then assess whether the inconvenience incurred by the families and additional costs to the department were justified.

The primary outcome measure for this retrospective case note review of two time periods separated by 4 years was to determine the difference in clinical benefit of MRI and CT. Our secondary outcome measures were to determine, first, whether changes had occurred in the amount of imaging between the two study periods and second, the indications for requesting CT and MRI.

Patients and methods

This was a retrospective case note review of two 1-year periods separated by 4 years. The first period was 6 months after installation of the CT scanner at the district general hospital, from September 1992 to August 1993 inclusive (period I). By the second period, September 1996 to August 1997 inclusive (period II), MRI was being performed routinely at the regional referral centre. All patients aged 18 years or under who had had a CT scan or MRI of the head, neck or spine requested by a paediatrician were included. CT was undertaken locally at Mid Cheshire Hospitals, Crewe, and patient details were obtained from the radiology database. MRI was performed at the Royal Liverpool Children’s NHS Trust, and patient details were obtained from invoices received from the regional centre. Patient records were then located and the following information obtained: demographic details, examination findings, indications for imaging and the area scanned. Clinical benefit was assessed by a single investigator based on the patient’s documented clinical condition and the scan report and divided into two categories: definitive diagnosis either made or not made as a result of imaging. Clinical benefit was compared between CT and MRI for all children and also for a subgroup of children that underwent imaging despite a normal clinical examination and normal EEG. In addition, clinical benefit was compared between CT and MRI when subdivided according to clinical indication for requesting the investigation.

<table>
<thead>
<tr>
<th></th>
<th>Definitive diagnoses made</th>
<th>Definitive diagnoses not made</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT period I</td>
<td>13</td>
<td>61</td>
<td>74</td>
</tr>
<tr>
<td>CT period II</td>
<td>8</td>
<td>42</td>
<td>50</td>
</tr>
<tr>
<td>MRI period II</td>
<td>20</td>
<td>34</td>
<td>54</td>
</tr>
</tbody>
</table>

All data were collected within the limitations of a retrospective study. Statistical analysis was carried out on Windows SPSS package version 8.0 using the chi-square test, significance being defined as \( P < 0.05 \).

In period I there were 76 completed requests for CT, for which notes were available in 72. Two children had two CT scans each in the study period giving a total of 74 scans. Of these, 40 (54%) were from boys. The group had an age range of 0–18.0 years with a median age of 3.4 years. In period II there were 54 CT scans that were requested by a paediatrician. Notes were available in 50 cases. For MRI there were 58 requests on 58 children, notes being available for 54 cases. Therefore, in 1996, data were available for 104 cases. Forty-nine (47%) were boys. The group median age was 6.2 years (range 0–16.7 years). There was no statistical difference in age or sex between the three groups or between periods I and II.

Results

The primary aim of this study was to compare the ability of CT and MRI to provide a definitive diagnosis, i.e. the clinical benefit of each investigation modality. For CT there was no significant difference in this ability between the two periods \( (P > 0.2) \). However, in period II a definitive diagnosis was made as a result of imaging in a significantly greater proportion of those children receiving MRI \( (n = 20; 37\%) \) as opposed to those who underwent CT \( (n = 8; 16\%; P < 0.02; \text{Table 1}) \).

The relationship between examination findings and a definitive diagnosis being made was studied. Out of all patients studied with a normal clinical examination and absence of abnormal findings on prior clinical investigations \( (n = 36) \), only one child had a normal examination and abnormal findings on imaging (CT in period I). This child was described as having borderline development delay that subsequently deviated further from normal with multiple generalised seizures.

For our study population, we then went on to determine for which indications MRI had the greatest benefit over CT by comparing all CT imaging in both periods with MRI. The indications for imaging were divided into six categories (Table 2). For almost all indications, MRI was more likely to provide a definitive diagnosis than CT. As numbers were small we did not feel it was appropriate to undertake formal statistical analysis on these data. However, seizures, altered motor or mental function and developmental delay highlighted a definitive diagnosis was either made or not made. A significantly greater proportion of MRI examinations resulted in a definitive diagnosis than CT \( (P < 0.02) \).