Radiography for head trauma in children: what guidelines should we use?

S Moreea, S Jones, N Zoltie

Abstract
Objective – To audit the appropriateness of skull radiography in children attending an accident and emergency (A&E) department with head injuries.
Methods – 569 children presenting to a large teaching hospital A&E unit were retrospectively audited. The indications for radiography according to British published guidelines and American published guidelines were compared with the actual requests for radiography. The criteria for admission from the two guidelines were also compared with the actual admissions.
Results – 50% of children presenting with head injury actually had skull radiography. If British guidelines for the use of skull radiography had been complied with, 63% of children should have had radiography, but if American guidelines had been used, 18% would have required radiography. All the actual fractures identified were in this 18%.
Conclusions – The British guidelines overinvestigate children with head injury. This seems to have been recognised clinically, and the doctors did not adhere to the guidelines. Neither did they adhere to the American guidelines, which would have resulted in a further reduction in radiography. All the fractures identified were covered by the American guidelines. The American guidelines for skull radiography can be safely used in a British A&E unit.

Methods
The case notes of all children less than 15 years old who attended the A&E department during May, July, and October 1992 with a primary complaint or discharge diagnosis of head injury were retrieved and analysed. Based on patterns of children’s injuries presenting over previous years, these three months were considered to be representative of the whole year. Patients presenting with multiple trauma including severe head injuries and patients referred directly to the neurosurgeons from other hospitals were not included in the study.

Each set of case notes was audited to determine whether the recommended British and American criteria for skull radiography were recorded and whether skull x rays (Towne’s view, posteroanterior, and both laterals) were requested. The number of radiographs showing a skull fracture was noted, all x rays being formally reported by senior radiologists. The British criteria for admission were also audited and the number of admissions noted. The number of skull fractures which could have been missed using either set of guidelines was
Neurological symptoms
Loss of
British criteria
penetrating
14
1
Criteria
(for
or
injury
Dizziness
1
and
swelling
Absence of other
ray) American
amnesia
at any time
Asymptomatic
Headache
Scalp laceration/contusion/abrasion/haematoma
Dizziness
Absence of other risk criteria

determined, as well as the number of patients who
would have been sent home using the
American guidelines but who might later dete-
riorate.

No attempt was made to contact those
patients who were sent home. However, review
of hospital and A&E registers confirmed that
no patient readmitted as a result of a previous
episde of head injury. We therefore assumed
that those patients sent home had no signif-
icant complications.

Results
Five hundred and sixty nine patients
presented
over
the
study
period. Table 2 shows the
numbers
presenting in each age range studied: in a
subset analysis of subsequent results there
were no significant differences in radiography rates
of admission rates between the age groups. The
numbers were therefore amalgamated for presen-
tation of results.

Table 3 shows the audit of radiography using
the
guidelines: 240 patients (42% of all
patients) correctly had radiographs, 113 (20% of
all patients) should have had radiography
but did not, and 42 patients (7% of all patients)
had radiographs without fulfilling the criteria.

Table 4 shows the audit of admissions using
the
British
criteria: 45 patients (7.9% of all
patients) were correctly admitted, four patients
(0.7%) were admitted despite guidelines indi-
cated
necessity for admission, 13 patients
(2.3% of all patients) were discharged despite
guidelines indicating admission, and 507 (89% of
all patients) were correctly discharged.

Table 5 highlights the comparison between
the
theoretical
use of the British guidelines, the
actual use of radiography, and the theoretical
use of the American guidelines. Seven skull
fractures were actually detected: all seven were
in the group defined by the American Guide-
lines as requiring radiography. Use of the
American guidelines would thus have reduced
the incidence of radiography from a theoretical
63% (with correct use of the British guidelines)
down to 18%, and included all the fractures
identified.

The internal audit showed poor compliance
with either set of guidelines, 50% of children
actually having radiographs.

Discussion
The study revealed that if the British guidelines
were followed, 63% of attenders required skull
radiography, compared to about 18% using the
American criteria. In practice, 50% of patients
had skull radiography. Guidelines were not fol-
lowed in 27% of patients: 20% had no radiog-
raphy (without apparent clinical detriment)
and 7% had unnecessary radiography. These
findings are not surprising, as it has been
shown that the constant use of guidelines is
difficult to sustain and that their application
needs regular monitoring if they are to be useful
in clinical management. The most
important
finding, however, is that by following the
American criteria only 18% of patients would
have had radiographs, and these would have
included all the fractures. We therefore recom-
end that there is no need for skull series in
patients who present with scalp haematoma,
laceration, or contusion—that is, we suggest
that "scalp bruising or swelling" be removed from the list of British guidelines.

The exception to this recommendation lies
in the American criteria, wherein children
under 2 years of age are regarded as moderate
risk, and radiography may be indicated. There
were 90 patients under the age of 2 in our
series, and we did not feel that this was a large
enough group to audit specifically, since the
incidence of fracture and complications was so
low that large numbers would be needed to
confirm or refute the validity of the guidelines.

Our results differ from other studies which
have shown that the number of skull series
could be reduced by between 37% and 51% if
criteria for x rays were followed. We found
that our patients were underinvestigated. The
explanation may lie in the fact that senior
house officers were following their clinical
judgement which would appear to be at odds
with the British guidelines. Where clinicians
consistently differ from guidelines then two
alternatives exist. One alternative is that the
guidelines are correct, and more education
and training is necessary to encourage doctors to
adhere to them. The second alternative is that
the guidelines are not appropriate to current
clinical practice, and clinical judgement must
always be allowed to override. The indications
from this study are that, judged by the Ameri-
can criteria, the junior doctors recognised that
the British guidelines were no longer wholly

### Table 1 Criteria for radiography

<table>
<thead>
<tr>
<th>British criteria (for x ray)</th>
<th>American criteria (for NO x ray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of consciousness or amnesia at any time</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>Neurological symptoms and signs</td>
<td>Headache</td>
</tr>
<tr>
<td>Cerebrospinal fluid or blood from the nose or ear</td>
<td>Scalp laceration/contusion/abrasion/haematoma</td>
</tr>
<tr>
<td>Suspected penetrating injury</td>
<td>Dizziness</td>
</tr>
<tr>
<td>Scalp bruising or swelling</td>
<td>Absence of other risk criteria</td>
</tr>
</tbody>
</table>

### Table 2 Number of patients presenting

<table>
<thead>
<tr>
<th></th>
<th>May</th>
<th>July</th>
<th>October</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 years</td>
<td>145</td>
<td>97</td>
<td>92</td>
<td>334</td>
</tr>
<tr>
<td>5-9 years</td>
<td>36</td>
<td>66</td>
<td>40</td>
<td>142</td>
</tr>
<tr>
<td>10-14 years</td>
<td>34</td>
<td>27</td>
<td>32</td>
<td>93</td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>190</td>
<td>164</td>
<td>569</td>
</tr>
</tbody>
</table>

### Table 3 Audit of radiography using British guidelines

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Radiography</th>
<th>No radiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines indicate radiography</td>
<td>240</td>
<td>42</td>
</tr>
<tr>
<td>Guidelines indicate no radiography</td>
<td>113</td>
<td>174</td>
</tr>
</tbody>
</table>

### Table 4 Audit of admissions using British guidelines

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Actually admitted</th>
<th>Discharged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidelines indicate admission</td>
<td>240</td>
<td>42</td>
</tr>
<tr>
<td>Guidelines indicate no admission</td>
<td>113</td>
<td>174</td>
</tr>
</tbody>
</table>

### Table 5 Comparison of British guidelines with American guidelines, Values are number (%) having radiography

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>British guidelines</td>
<td>352 (63%)</td>
</tr>
<tr>
<td>Actual number having radiographs</td>
<td>282 (50%)</td>
</tr>
<tr>
<td>American guidelines</td>
<td>105 (18%)</td>
</tr>
</tbody>
</table>
Radiography in children’s head injuries

We line for skull guidelines demands admission, needed sources would have been made if the guidelines had been adhered to completely. It also becomes apparent that the use of guidelines demands constant reappraisal especially in A&E departments where junior staff changes every six months. The use of posters as a reminder of guidelines has been advocated and tried successfully in other departments.

CONCLUSIONS
We conclude that the use of the British guidelines for skull radiography in children in our A&E department creates a large demand for radiography (63% of attenders). The use of the American guidelines appears to reduce the number of radiographs requested in children presenting with head injury, without apparent risk of missing significant injury or skull fracture. We therefore recommend the use of the American guidelines along with techniques for ensuring their uptake.


INJURY RESEARCH GROUP

The Annual meeting will be held in Oxford on 24-25 March 1997. There will be a session of free communications and symposia on aspects of the immunological response to trauma. For details, contact:

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