avoid x-ray is only acceptable if the sensitivity is very close to 100%.

**Clinical bottom line**

It would be reasonable to incorporate an attempt at full extension as part of the examination of a patient with an acute elbow injury, and the high sensitivity of this component should be borne in mind when deciding whether or not to send the patient for x-ray. However, it cannot be recommended as an isolated method for ruling out fractures by clinical examination.

**EDITOR’S NOTE**

This BET report was written by the authors before they published their own paper on the subject.


**Table 1 Continued**

<table>
<thead>
<tr>
<th>Author, date, country</th>
<th>Patient group</th>
<th>Study type</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamprakis et al, 2007, Greece</td>
<td>70 Patients attending an emergency department with an acute elbow injury were included</td>
<td>Prospective observational study</td>
<td>Ability to extend elbow fully with the arm in a supine position. Gold standard was the x-ray report by a consultant radiologist blinded to the clinical findings</td>
<td>24 Patients had an abnormal x-ray. The sensitivity of the elbow extension test was 92% and the specificity was 61%</td>
<td>Gold standard of radiologist report</td>
</tr>
<tr>
<td>Darracq et al, 2008, USA</td>
<td>113 Patients aged ≥5 years presenting within 24 h of an elbow injury were included. Exclusion criteria included obvious deformities suggesting fracture or dislocation. Convenience sample</td>
<td>Observational study</td>
<td>Ability to extend elbow fully. Gold standard was the presence of fracture or effusion on x-ray as reported by blinded radiologist. Patients followed up for 3 months post-recruitment</td>
<td>53 Patients had a fracture or effusion on x-ray. Sensitivity and specificity for full elbow extension were both 100%</td>
<td>Convenience sampling may lead to selection bias</td>
</tr>
<tr>
<td>Appelboam et al, 2008, UK</td>
<td>1740 Patients aged ≥3 years presenting within 72 h of elbow injury were included. (Four lost to follow up)</td>
<td>Validation study in adult patients (&gt;15 years) and observational study in children (3–15 years). Adults who could fully extend their elbow did not receive an x-ray, children received an x-ray at the discretion of the treating practitioner</td>
<td>Reference standard consisted of final discharge diagnosis from orthopaedic clinic, formal blinded radiology report and 7–10 day telephone interview for patients not followed up</td>
<td>538 Patients had a fracture on x-ray. Sensitivity for full extension was 96.8% and specificity was 49.5%. For fracture or effusion sensitivity of the test was 95.8% and specificity 54.6%</td>
<td>Variable reference standard</td>
</tr>
</tbody>
</table>

**Provenance and peer review** Not commissioned; not externally peer reviewed.


**BET 2**

**OBSERVATION IS RECOMMENDED EVEN FOLLOWING A NORMAL CT BRAIN IN WARFARINISED HEAD INJURIES**

**Report by Simon Rendell: Senior emergency trainee**

**Search checked by Shahzadi Zeb: Clinical fellow in emergency medicine**

**Institution:** Manchester Royal Infirmary, Manchester, UK

**CLINICAL SCENARIO**

An elderly woman attends your emergency department following a mechanical fall. She takes warfarin for atrial fibrillation and has a small occipital haematoma. Her Glasgow coma score is 15; she has no amnesia and a normal neurological examination but did lose consciousness for a brief period. The international normalised ratio (INR) comes back within the therapeutic range at 2.9 and a CT scan is requested according to the National Institute for Health and Clinical Excellence guidelines.

The scan is reported as normal, and her social circumstances are adequate in that she lives with her husband who can keep an eye on her. You wonder, though, whether it is safe to discharge her or if there is a possibility of delayed intracranial haemorrhage due to her coagulopathy. You consider admitting her for a period of neurological observation so that any deterioration can be identified and acted upon at the earliest opportunity.

**OUTCOME**

**Comments**

There is much debate as to how best to manage this group of patients. In the UK, National Institute for Health and Clinical Excellence and SIGN guidelines advise performing a CT scan in such patients only in the presence of loss of consciousness or amnesia. There is no advice regarding the level of coagulopathy or about an observation period, especially in patients who do not meet the criteria for a CT scan. From the available literature, it is clear that there is considerable variation.
in the management of these patients. Italian guidelines, published in 1996, advise a CT scan in all patients with coagulopathy, observation for 24 h and then a second CT before discharge. Kaen et al suggest that this second CT may not be necessary, but otherwise, this may seem to be a prudent approach.

Evaluation and appropriate correction of the INR is also relevant. Delayed intracranial haemorrhage in this setting, with a normal admission CT and a therapeutic INR, would appear to be a rare occurrence, but does happen. In order to reduce the risk of this possibility, there should be a low threshold for CT scanning, the INR should be checked with consideration given to correction of a high INR, and there should be a period of observation for at least 24 h. The literature demonstrates that normal examination and CT scans do not preclude subsequent rapid deterioration. Delayed brain injury is significantly associated with increased mortality, slower recovery and a poorer outcome. Admission for observation should identify deterioration early, allowing rapid identification and management of problems. Accurate evaluation and treatment of patients who initially appear to be at low risk may be one of the most important factors in the reduction of mortality in head-injured patients (table 1).

### Clinical bottom line

There is evidence to suggest a risk of delayed intracranial haemorrhage in patients who are receiving anticoagulant therapy who have had a mild head injury, even with a normal CT scan. This suggests the need for a period of observation in these patients. The level of risk is not quantifiable from the available literature.


Competing interests None.

Provenance and peer review Not commissioned; not externally peer reviewed.

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Table 1 Observation is recommended even following a normal CT brain in warfarinised head injuries

<table>
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<tr>
<th>Author, date, country</th>
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<tr>
<td>Kaen et al, 2010, Spain</td>
<td>137 Consecutive adult patients admitted within 48 h of minor head injury with normal CT scans and on warfarin. All patients had 24 h observation and a control CT scan before discharge</td>
<td>Prospective cohort study</td>
<td>Neurological deterioration during observation period.</td>
<td>No patients developed any neurological deterioration. Two patients (1.4%) had bleeding on the control CT scan. Neither of these patients required neurosurgical intervention</td>
<td>Small event rate. Larger number of patients required to establish definite conclusions</td>
</tr>
<tr>
<td>Itshayek et al, 2006, Israel</td>
<td>Selection of four patients who had presented following mild head injury with a normal initial CT scan, on warfarin (three patients) or enoxaparin and aspirin (one patient) who all subsequently had neurological deterioration due to a delayed SAH</td>
<td>Case series</td>
<td>Selected due to the development of delayed SAH</td>
<td>Three patients on warfarin developed a SAH within 24 h. The patient on aspirin and enoxaparin developed a SAH after 3/7. Two patients died and one patient had a GCS of 3 following surgery and the other patient had a GCS of 4 following conservative treatment</td>
<td>Small case series, cannot extrapolate figures</td>
</tr>
<tr>
<td>Cohen et al, 2006, USA</td>
<td>77 Patients in total; 28 from level I trauma centre database and 49 patients who fitted the criteria from a selection of 4000 chart reviews undertaken by the American College of Surgeons review of trauma centres. Inclusion criteria consisted on minor closed head injury (GCS 13–15) and concurrent warfarin therapy</td>
<td>Cohort study</td>
<td>Neurological outcomes in the selected patient group</td>
<td>12 Patients were admitted with neurological symptoms hours or days after the injury. 20 patients were seen after head injury and discharged. Seven had a CT scan first, which was normal. Of the 20, two patients died at home and the other 18 were admitted with complications. The mortality for this group was 88.8%. 45 Patients were admitted for observation; 32 had CT scans, 28 were normal. The mortality in this group was 84%</td>
<td>Limited information about patient demographics, outcomes and selection processes render this paper more of an extended case series rather than a cohort study</td>
</tr>
<tr>
<td>Garra et al, 1999, USA</td>
<td>65 Patients selected from retrospective chart review of electronic records from six community hospital ED including one trauma centre over a 2-year period. Inclusion criteria were patients on anticoagulants who had received a head injury with no LOC, amnesia or new neurological abnormality on examination</td>
<td>Cohort study</td>
<td>Clinically significant intracranial trauma</td>
<td>39 Patients had an initial CT scan, which was normal in all cases, and none of these patients had any further investigation or follow-up. 26 Patients had no CT scan but telephone follow-up and no complications were reported</td>
<td>Retrospective data collection. No follow-up of patients following CT scan</td>
</tr>
</tbody>
</table>

ED, emergency department; GSC, Glasgow coma scale; LOC, loss of consciousness; SAH, subarachnoid haemorrhage.