Does preservation of active range of motion after acute elbow injury rule out the need for radiography?

Akut dirsek travmasından sonra aktif ekmek hareket açıklığının korunması radyografi gerekliğini ortadan kaldırır mı?

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BACKGROUND
We aimed to evaluate the role of a normal elbow active range of motion (ROM) in predicting low fracture risk and avoiding elbow X-ray in patients with acute elbow injuries. Lack of any approved rules for this purpose led us to evaluate simple physical examination methods to predict elbow fractures.

METHODS
In this observational study, all patients with elbow injury who presented to two emergency departments were enrolled according to specific criteria. Patients were examined by emergency or orthopedics residents. Elbow radiographs were reviewed by a radiologist for fractures and soft tissue injuries. Results of the clinical examination and radiographs were recorded for statistical analysis. Sensitivity, specificity and positive and negative predictive values were calculated.

RESULTS
Elbow fractures were identified in 10 of the 102 enrolled patients (9.8%). Nine of the 10 had limited ROM in all movements. Limited active elbow ROM in predicting elbow fracture revealed a sensitivity of 90%, specificity of 92%, and positive and negative predictive values of 56% and 98%, respectively. Individuals with limitation in one or two directions had no signs of fracture in the X-rays.

CONCLUSION
Patients with elbow injury and a limited ROM in all directions of flexion, extension, supination and pronation require further X-ray investigations.

Key Words: Elbow injury; range of motion; fracture; radiography.

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Elbow injury is one of the common complaints in the Emergency Department (ED), ranging from a complex fracture with neurovascular damage or simply a subtle or occult fracture. Despite a high rate of radiographs in elbow injury, it is one of the most important locations for missed fractures, reported as 10.8% and 6% in two different studies.[1-3]

Clinical decision rules for obtaining radiography in different injuries such as the Ottawa ankle and knee rules, cervical spine rules and Pittsburgh knee rules have led to efficient use of radiography in injuries.[4-10] These rules have led to a reduced number of radiographs and eliminated unnecessary exposure to radiation in patients.[10]

There are no validated clinical rules to predict the need for radiography in elbow injuries. Previous studies offered clinical rules by evaluating limitations in elbow active range of motion (ROM) to predict the need for an elbow X-ray.[1,11-13] In several studies, the patient’s ability to fully extend the elbow was suggested as a sensitive clinical screening test for patients with elbow injuries or in situations in which radiology facilities were lacking.[3,11-14]

In this study, we evaluated the role of a normal elbow active ROM following acute trauma as the predictor of low risk fracture with no need for further radiography. We hypothesized that maintaining full ROM of elbow in all movements (flexion, extension, supination, pronation) after trauma demonstrated low fracture risk in patients and that X-ray radiographs for every patient may not be required.

MATERIALS AND METHODS

This prospective observational study took place from April to September 2010. Enrollment sites were the EDs of two academic hospitals, with a census of approximately 57,000 annual emergency visits. All patients presenting to the ED with elbow injury were included. The inclusion criteria were as follows: age >5 years old, admission to the hospital in the first 24 hours, no evidences of an altered mental status or intoxication, no previous history of elbow trauma, vascular dysfunction or any other medical condition limiting baseline mobility of the elbow, and no other distracting injuries. All eligible patients chosen by census sampling method were included.[10]

Active ROM was examined and recorded by an orthopedics or emergency medicine resident. Participating physicians were instructed on how to perform the ROM and complete the enrollment form. Examination included active flexion of 90° with a full extension (0°) and a normal and complete pronation and supination.

Patients who did not receive radiographs were excluded. Only the patients that underwent radiographic evaluations (according to the physician’s clinical judgment) entered the study. All of them underwent routine X-ray in lateral and anteroposterior (AP) positions. Other views were prescribed in those patients who did not have fracture in AP and lateral views, but were clinically suspected of fracture.

For all patients, the presence of fracture or displaced fat pad sign was followed by radiographs. An attending radiologist who was blinded to the results of the physical examination reviewed all radiographs. All data including baseline demographics were recorded on a standard form.

Patients were divided into two groups of normal and abnormal active ROM. Similar ROM on both sides was considered normal, so some normal cases had equal limitations in both hands.

Fracture and soft tissue injury (displaced fat pad sign) in the two groups were determined by means of radiographs.

Descriptive statistical tests were performed using the Statistical Package for the Social Sciences for Windows, version 18 (SPSS Inc., Chicago, IL). Mean, standard deviation (SD), percentage frequency, chi-square, and difference of means were calculated by a statistician investigator. Sensitivity, specificity, predictive values, and likelihood ratios were calculated.

RESULTS

One hundred and two patients (66.7% males) with a mean age of 32.2±21.6 years (range, 5-87 years) were enrolled according to the specific criteria. The most common mechanism of trauma was a fall and the most involved bone was the humerus.

Limited active ROM was identified in 26 patients (Table 1). Six patients had similar limitation on both sides and were considered normal. Twenty patients had significant limitations in the injured elbow compared to the non-injured side.

The X-ray showed fractures in 10 patients. Ninety-two patients (90.2%) had no sign of fracture on the X-ray.

<table>
<thead>
<tr>
<th>Limitation in ROM</th>
<th>No fracture</th>
<th>Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>No limitation</td>
<td>81</td>
<td>1</td>
</tr>
<tr>
<td>All movements</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Supination + pronation</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Flexion + extension</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Extension</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

ROM: Range of motion; p<0.001.
The active ROM is an easy test to perform in the ED and has been proven to be sensitive. Thus, the elbow clinical examination could help clinicians to efficiently use radiography for injured patients.

The possible explanations for the patient with a false-negative result of the examination (a positive elbow fracture with normal ROM examination) might be explained by the following factors: 1. Opioid addiction or opium consumption; 2. Diabetic neuropathy; 3. Presence of more severe pain and injury in different locations or confusion following head injury; or 4. Cervical spinal cord injury with upper extremity numbness. In the latter scenario, the patient cannot have normal active ROM, but can have normal passive ROM.

We found that individuals with preservation of full active ROM after acute elbow trauma have a very low risk of associated fracture and may not require radiographic investigation. The limitations of this study included the relatively small sample size. Further multicenter studies should be performed with larger numbers of patients and of longer duration with defined mechanism of injury, types of fractures, risk factors, outcomes of fracture, and disability rates.

Acknowledgements

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REFERENCES


Table 2. Types of fractures in 10 patients with positive X-ray sign for fracture

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Mechanism of trauma</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condylar fracture</td>
<td>Car accident</td>
<td>3</td>
</tr>
<tr>
<td>Olecranon fracture</td>
<td>Falling</td>
<td>2</td>
</tr>
<tr>
<td>Articular surface fracture</td>
<td>Falling</td>
<td>2</td>
</tr>
<tr>
<td>Intercondylar fracture</td>
<td>Falling</td>
<td>1</td>
</tr>
<tr>
<td>Lateral epicondylar fracture</td>
<td>Falling</td>
<td>1*</td>
</tr>
<tr>
<td>Radial head fracture</td>
<td>Violence</td>
<td>1</td>
</tr>
</tbody>
</table>

*A 26-year-old male with normal physical examination who had a fracture on X-ray.

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