VARIABILITY IN THE INTERPRETATION OF ELBOW FRACTURES IN CHILDREN

A Thesis submitted to the University of Arizona College of Medicine – Phoenix in partial fulfillment of the requirements for the Degree of Doctor of Medicine

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Abstract

Background and Significance

The first physician to encounter a child with an elbow fracture is usually the emergency medicine (EM) physician. Many hospitals may not have access to immediate orthopedic consultation or “real-time” radiology reads, therefore, EM physicians have a great responsibility for an accurate diagnosis. Unfortunately, many EM physicians have little training in pediatric orthopedic injuries. The elbow's anatomy and radiographic features of the growing elbow increase the difficulty in determining an accurate diagnosis and proper treatment. Inaccurate interpretation of elbow fractures in children may lead to unnecessary or improper medical decisions. Accurate interpretation is especially important in rural settings where patients may need transportation to facilities with higher levels of care.

Research Question

This study aims to survey EM physicians and determine if certain elbow fractures are diagnosed inaccurately more frequently and if some physician characteristics share a relationship with the accuracy of diagnosis of pediatric fractures. The characteristics include area of specialization, annual ED volume, years of experience post residency training, and working in an academic versus non-academic department. Different types of fractures, including type 1 supracondylar, type 2 supracondylar, type 3 supracondylar, medial epicondyle, lateral epicondyle, and olecranon along with uninjured elbows were evaluated to determine if a particular type was misdiagnosed more frequently.

Methods

A 16-question multiple-choice paper survey was distributed to physicians working in academic and non-academic centers within adult or pediatric emergency departments. Questions included radiographs and asked the physician to determine which fracture existed, if any.
Results

Lateral epicondyle fractures were the most likely fractures to be misdiagnosed (22.12%), while type 3 supracondylar fractures were the most likely to be accurately diagnosed (95.5%). There was no significant difference in accuracy of diagnosis based on physicians working either in an academic department, non-academic department, or both. Those physicians who were board certified or board eligible in two or more specialties had a higher mean percent correct, as well as those who worked in pediatric emergency medicine.

Conclusions

While this study served to start clarifying the most frequently misdiagnosed pediatric fractures and whether physicians with particular characteristics were more likely to diagnose fractures accurately, further steady is necessary to draw a definitive conclusion. This study does shed light on which pediatric elbow fractures physicians misdiagnose more frequently. It is important for all emergency medicine physicians to keep in mind the types of fractures that are most commonly misdiagnosed as it can affect medical decision-making. This is an area where additional education about elbow fractures in the developing pediatric elbow may be needed.
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Introduction and Significance

The first physician to encounter a child with an elbow fracture is usually the EM physician. Many hospitals may not have access to immediate orthopedic consultation or “real-time” radiology reads, therefore, EM physicians have a great responsibility for an accurate diagnosis. Unfortunately, many EM physicians have little training in pediatric orthopedic injuries. The elbow's anatomy and radiographic features of the growing elbow increase the difficulty in determining an accurate diagnosis and proper treatment.

Elbow fractures account for 10-12% of all fractures seen in children. Unlike the adult elbow, the pediatric elbow contains more collagen, which reduces tensile strength and makes bone injuries more likely than ligamentous injuries. It also consists of greater amounts of cartilage that will eventually form into bony tissue; this cartilage improves resilience. A thicker and more metabolically active periosteum also contributes to the stability of a fracture and allows for faster healing. The presence of a growth plate, the physis, is the greatest difference between the adult and pediatric elbow. The weakest point in pediatric bone, the physis contributes to the quick healing time of an injury but complicates the diagnosis of fractures.

The physis consists of radiolucent cartilage, making visualization of injuries to this area difficult. With age, six normal secondary ossification centers calcify becoming visible on radiograph and add to the difficulty of identifying fractures when a child presents to the emergency department. Often, the burden of an accurate diagnosis falls on the EM physician, especially when orthopedic consultation may not be available. The diagnosis determines appropriate treatment, decreases complication risks, and decreases unnecessary medical costs.

However, misdiagnosed pediatric elbow fractures may be common. In a study analyzing the accuracy of radiograph interpretation, EM physicians identified 30 fractures with only 53% accuracy. The most accurately diagnosed fracture was a type III supracondylar fracture, while the most misdiagnosed fracture was a displaced lateral condyle fracture. A separate study analyzed intergroup variability in interpreting radiographs. Residents in the study (one second year pediatric resident and one second year emergency medicine resident) over diagnosed elbow fractures, while the two staff pediatric emergency physicians under-diagnosed the
findings. Intragroup and intergroup variability also exists among orthopedic surgeons with various levels of training. The previously mentioned studies provide some important information about how accurately certain physicians diagnose pediatric fractures and which fractures are more likely to be accurately, or inaccurately, diagnosed. This study aims to assess how well physicians diagnose fractures and how their accuracy changes with level of training, focus of training, and fracture type; research in these specific topics is scarce but relevant for maximizing patient outcome.

These groups of physicians include general emergency medicine (EM) physicians and pediatric EM physicians. ED annual volume and working in an academic versus non-academic ED were also surveyed to determine if these variables have an effect on accuracy of diagnosis.

We anticipate that physicians with more training will provide accurate diagnoses more frequently. The physicians who treat more children will also more accurately diagnosis the elbow fractures. Fractures easily differentiated on radiograph and commonly seen in the field will be accurately diagnosed more frequently. Those physicians who work in academic departments and those who see larger volumes of patients, we hypothesize, will diagnose fractures more accurately than those working in non-academic departments and work in a department that sees less patients.

This project may help clarify if level or focus of training in emergency medicine physicians affects the interpretation of elbow fractures in children. It potentially may also clarify if a connection exists between level and/or focus of training and types of misdiagnosed fractures.
Material and Methods

A survey (see Appendix) was constructed from a previously compiled collection of radiographs. The survey contained four questions to determine the demographics of the physicians taking the survey; the questions included board certification, years of training post residency, working in an academic versus non-academic ED, and annual ED volume. Paper surveys were distributed during regularly scheduled conference and meeting times to insure response to surveys. The surveys did not include any identifiers and were anonymous.

Categories of board certification included Emergency Medicine (EM), Pediatric Emergency Medicine (PEM), Pediatrics, Internal Medicine, PEM fellow, EM resident, Pediatrics resident, and “Other.” For result analysis, categories of board certification were combined into the following groups: 1) Emergency Medicine; 2) Pediatric EM; 3) Pediatrics; 4) Internal Medicine; 5) Pediatric EM Fellow; 6) EM Resident; 7) Pediatrics Resident; and 8) ≥ 2 certifications.

Years of practice post-residency included: 1) 0-2 years; 2) 3-5 years; 3) 6-10 years; 4) more than 11 years; 5) and current residents.

The surveys were distributed to residents, fellows, and physicians working in an academic adult emergency department (Maricopa Medical Center), academic pediatric emergency departments (Phoenix Children’s Hospital and Dell Children’s Medical Center), a non-academic adult emergency department (Banner Thunderbird), and a non-academic pediatric emergency department (Banner Thunderbird). For analysis, results were combined into the following groups: 1) working only at an academic institution; 2) working only at a non-academic institution; and 3) working both at academic and non-academic institutions.

Categories of annual ED volume included: less than 20,000; 20,000-40,000; 40,000-60,000; and greater than 60,000.

The survey contained 16 multiple-choice questions that contained 2-3 radiographs of a fracture or normal elbow; the fractures included type 1 supracondylar, type 2 supracondylar, type 3 supracondylar, olecranon, medial epicondyle, lateral epicondyle, and Monteggia. Contralateral images were not provided. 2 questions were dedicated to each type of fracture, as well as 2
questions for not fractured elbows. The gold standard used for “correct” was radiologist interpretation of the radiograph at the time of patient presentation. Each radiograph contained only one fracture type; elbows with multiple types of fractures were not included in the study to simplify analysis. Each radiograph had only one correct answer choice. As such, if a respondent chose the incorrect answer or chose multiple answers, that response was tabulated as incorrect.

The mean percent correct and standard deviation of each fracture were calculated. The mean percent correct and standard deviation were also found for each characteristic. P-values were calculated using Kruskal Wallis to determine significance of results within each characteristic, with \( P \leq 0.05 \) indicating significance.

This study was reviewed by Phoenix Children’s Hospital Institutional Review Board and the Office of Research and granted a waiver of HIPAA authorization and a waiver of informed consent/assent.
Results

114 physicians completed the surveys; one survey was removed from analysis due to ambiguous answers that made it difficult to determine which final answer the responder selected. Further analysis was performed on 113 surveys.

A large proportion (76.9%) of responders were in academic settings (Table 1), while 20.4% worked only in non-academic settings. 2.7% (3 physicians) worked in both academic and non-academic institutions.

The majority (30.1%) were only board eligible in emergency medicine, closely followed by current EM residents (26.6%) (Table 1). 15% were board eligible or board certified in pediatric emergency medicine. 18.6% of respondents were board eligible or board certified in two or more specialties. Zero physicians from IM and zero pediatrics residents participated in the survey.

26.8% of respondents were residents. 18.8% of respondents had completed 0-2 years of training post-residency (Table 1). 24% had worked 11 or more years post-residency.

Zero respondents worked in a department that had an annual volume less than 20,000. 85.9% worked in a department with a population greater than 60,000 per year. 12.4% saw 40,000 to 60,000 patients in their department annually. 2 physicians (1.8%) worked in a department with between 20,000 and 40,000 annual volume.
Table 1 Characteristics of Physicians in Study

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work Status</strong></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>87 (076.9)</td>
</tr>
<tr>
<td>Non-Academic</td>
<td>23 (20.4)</td>
</tr>
<tr>
<td>Both</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td><strong>Board Certification</strong></td>
<td></td>
</tr>
<tr>
<td>EM</td>
<td>34 (30.1)</td>
</tr>
<tr>
<td>Peds EM</td>
<td>17 (15.0)</td>
</tr>
<tr>
<td>Peds</td>
<td>5 (4.4)</td>
</tr>
<tr>
<td>IM</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Peds EM Fellow</td>
<td>6 (5.3)</td>
</tr>
<tr>
<td>EM Resident</td>
<td>30 (26.6)</td>
</tr>
<tr>
<td>Peds Resident</td>
<td>0 (0)</td>
</tr>
<tr>
<td>≥2 Certifications</td>
<td>21 (18.6)</td>
</tr>
<tr>
<td><strong>Years Post Residency</strong></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>21 (18.8)</td>
</tr>
<tr>
<td>3-5</td>
<td>15 (13.4)</td>
</tr>
<tr>
<td>6-10</td>
<td>19 (16.9)</td>
</tr>
<tr>
<td>11+</td>
<td>27 (24.1)</td>
</tr>
<tr>
<td>Current Resident</td>
<td>30 (26.8)</td>
</tr>
<tr>
<td><strong>Annual ED Volume</strong></td>
<td></td>
</tr>
<tr>
<td>20,000-40,000</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>40,000-60,000</td>
<td>14 (12.4)</td>
</tr>
<tr>
<td>&gt;60,000</td>
<td>97 (85.9)</td>
</tr>
</tbody>
</table>
Normal elbows without pathology were diagnosed a little over half the time correctly, 50.9% (Table 2). Approximately half of the responses diagnosed a fracture when one did not exist. At 95.5%, type 3 supracondylar fractures were the most likely to be diagnosed accurately, while at 22.1%, a little more than 1 in 5 times, lateral epicondyle fractures were likely to be diagnosed accurately the least frequently. Respondents had the most difficulty diagnosing lateral epicondyle fractures. The next most inaccurately diagnosed fractures include: type 1 supracondylar (35.8%) and medial epicondyle fracture (49.6%). One fracture type, Monteggia fracture, was eliminated from analysis because it was inaccurately stated as a “proximal radius fracture” on the survey; therefore, only 6 fracture types plus uninjured elbows were included in the results (Table 2). Kruskal Wallis analysis provided a p-value of 0.046, showing significance in response between fracture types.

There was no statistically significant relationship between type of department and percentage of correct answers (P 0.19). Physicians who worked only in non-academic departments had an average of 60.6% (Table 2) correct response rate. Those who worked only in academic settings had an average accuracy of 53.0%; and those who worked in both settings averaged 57.1% correct responses.

When board certification and board eligibility were compared to correct responses, those who were double boarded or eligible for double boarding had a higher mean percent correct than those who were boarded or eligible for boarding in one specialty, 67.3% correct. EM residents had the lowest average mean (41.7%) with pediatrics physicians scoring only slightly better at 45.7% average (Table 2). Kruskal Wallis analysis produced a P-value of <0.001 showing a significant difference within the group.

Years of training post-residency correlated with a steady increase in correct responses until the 11-year time point. Those who worked for 6-10 years post residency scored, on average, 64.3%. The group 3-5 years post-residency scored similarly to those with more than 11 years of experience, 60.0% and 61.1% respectively. As hypothesized, those with the least years of training, current residents, scored lower than the other groups, 41.7%. The p-value for this characteristic was <0.001.
Annual ED volume also showed significance. Those with an annual volume between 20,000 and 40,000 scored the best at 60.7%; this was followed by the group of physicians working in a department that sees over 60,000 patients (56.7%), and the 40,000 to 60,000 patient volume group (40.3%).
<table>
<thead>
<tr>
<th>Type of Fracture</th>
<th>Mean % Correct (SD)</th>
<th>P-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>50.9 (37.8)</td>
<td>0.046</td>
</tr>
<tr>
<td>Type 1 Supracondylar</td>
<td>35.8 (33.7)</td>
<td></td>
</tr>
<tr>
<td>Type 2 Supracondylar</td>
<td>52.2 (38.6)</td>
<td></td>
</tr>
<tr>
<td>Type 3 Supracondylar</td>
<td>95.5 (17.1)</td>
<td></td>
</tr>
<tr>
<td>Olecranon</td>
<td>76.5 (31.4)</td>
<td></td>
</tr>
<tr>
<td>Medial Epicondyl</td>
<td>49.6 (41.4)</td>
<td></td>
</tr>
<tr>
<td>Lateral Epicondyl</td>
<td>22.1 (32.6)</td>
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<table>
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<tr>
<th>Work (n)</th>
<th>Mean % Correct</th>
<th>P-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic (87)</td>
<td>53.0 (18.1)</td>
<td>0.19</td>
</tr>
<tr>
<td>Non-Academic (23)</td>
<td>60.6 (16.4)</td>
<td></td>
</tr>
<tr>
<td>Both (3)</td>
<td>57.1 (12.3)</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Board Certification (n)</th>
<th>Mean % Correct</th>
<th>P-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM (34)</td>
<td>55.9 (17.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Peds EM (17)</td>
<td>60.9 (13.4)</td>
<td></td>
</tr>
<tr>
<td>Peds (5)</td>
<td>45.7 (15.6)</td>
<td></td>
</tr>
<tr>
<td>IM (0)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Peds EM Fellow (6)</td>
<td>58.3 (11.4)</td>
<td></td>
</tr>
<tr>
<td>Peds Resident (0)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>EM Resident (30)</td>
<td>41.6 (14.6)</td>
<td></td>
</tr>
<tr>
<td>&gt;= 2 Certifications (21)</td>
<td>67.3 (16.3)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years Post Residency (n)</th>
<th>Mean % Correct</th>
<th>P-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2 (21)</td>
<td>51.7 (20.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3-5 (15)</td>
<td>60.0 (14.7)</td>
<td></td>
</tr>
<tr>
<td>6-10 (19)</td>
<td>64.3 (14.1)</td>
<td></td>
</tr>
<tr>
<td>11+ (27)</td>
<td>61.1 (14.6)</td>
<td></td>
</tr>
<tr>
<td>Current Resident (30)</td>
<td>41.7 (14.6)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Volume (n)</th>
<th>Mean % Correct</th>
<th>P-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000-40,000 (2)</td>
<td>60.7 (25.3)</td>
<td>0.006</td>
</tr>
<tr>
<td>40,000-60,000 (14)</td>
<td>40.3 (15.4)</td>
<td></td>
</tr>
<tr>
<td>&gt;60,000 (97)</td>
<td>56.7 (17.2)</td>
<td></td>
</tr>
</tbody>
</table>

$^1$P-Values calculated using Kruskal Wallis
Discussion

The two most commonly misdiagnosed fractures were the lateral epicondyle fracture and type 1 supracondylar fracture. This is also similar to the results which Shrader et al. reached in their study. Also consistent with their study, the most frequently correctly diagnosed fracture was the type 3 supracondylar fracture; this is unsurprising given the dramatic pathologic anatomy of these fractures. Surprisingly, un-fractured elbows stood a 50/50 chance of being diagnosed accurately; the equivalent of flipping a coin. There are several possible explanations for this observation. Physicians may have mistaken growth plates for fractures; the most common incorrect diagnosis for normal fractures was an olecranon fracture. Secondly, surveys were distributed in paper format to help with distribution and insure adequate participation; unfortunately, this meant that physicians were looking at radiographs on paper and not on a computer screen as they do at work. The inability to zoom and change contrast, brightness, and utilize other features may have caused a greater inaccuracy rate than in practice. Additionally, radiographs on paper provide for poor clarity.

Interestingly, there was no statistically significant difference in diagnosis of fractures based on work environment. Those who worked in only academic departments, only non-academic departments, or in both diagnosed fractures equally well. This is especially intriguing since the “academic department” category was mostly composed of residents who had less training and, as the results showed, those with less training diagnose fractures the least accurately.

Those with six to ten years post-training diagnosed fractures accurately more frequently than the other groups; accuracy seems to peak at this timeframe. The mean % correct started to decline at 11 years, however, a trend cannot be determined since we did not further divide that timeframe into smaller increments.

Those board certified or board eligible in 2 or more specialties performed better on the survey; this is expected as physicians with more intensive training should have more experience with these cases. A focus in pediatric emergency medicine, as opposed to only adult emergency medicine, improved the likelihood of correct diagnosis.
Mean percent correct based on annual ED volume seems to nadir in the range of 40,000 to 60,000. However, only 2 physicians responded that they worked in a department that saw between 20,000 to 40,000; because those surveyed all came from the same four departments and since the other 111 respondents worked in departments with either 40,000-60,000 or > 60,000 annual ED visits, it makes logical sense that those 2 physicians actually work in one of the departments that see more patients. The surveys did not include any identifiers and, therefore, we could not determine which department and volume those physicians worked in. If we removed those 2 physicians from the survey results, we would be left with two data points; it is difficult to draw a conclusion based on these results about whether seeing more, or less, patients makes a physician more likely to diagnose pediatric fractures accurately.
Future Directions

Additional study with greater sample size would be useful to help further elucidate which groups of physicians accurately diagnose pediatric fractures more frequently. Obtaining a larger sample size, as well as adding additional sites, would help determine if a relationship exists with annual ED patient volume. It would also allow to further breakdown the time post-residency training into smaller increments.

Including additional fracture types and a greater number of each type would also help clarify, and potential support, which fractures are the most and least likely to be misdiagnosed. For this study, which chose two of each type of fracture in an attempt to keep the survey a manageable length that physicians would be able to complete during the limited time they have during regularly scheduled conferences. Ideally, different age groups would consistently be represented in all of the fractures. We chose fractures from different age groups; this means that different fractures from children of various ages were being compared to each other. It would be more appropriate to compare a lateral epicondyle fracture in a two-year old with and medial condyle fracture in another two-year old instead of that in an eight-year old. However, including all of these would have lengthened the survey to an unsuitable length.

As previously mentioned, surveys were distributed in paper format. This poorly mimics real life physician experiences where they are able to bring up radiographs on a computer screen allowing for better clarity and modification that assists in visualizing fractures. Ideally, future studies would incorporate the technology physicians use daily in the ED. Contralateral images for comparison were not included in the survey because many of the images taken in the emergency department at the time of diagnosis did not include comparison images.

Further expanding the study to evaluate how well physicians can determine whether a fracture is an operable emergency would add additional value to the results and make the survey more clinically applicable.

Another area of expansion is the distribution of this survey to rural emergency medicine departments and departments that do not have radiologists available 24 hours a day or where
orthopedics consults are unavailable. While it is interesting to see which physicians diagnose fractures more accurately, it would be more applicable to survey those who have to make the decision of whether or not to transfer a patient for more advanced care.
Conclusion

Overall, type 3 supracondylar fractures were diagnosed accurately more frequently, while physicians should pay particular attention to lateral epicondyle and type 1 supracondylar fractures as they are the first and second, respectively, most misdiagnosed fractures. Physicians in both academic and non-academic settings diagnose fractures equally well, while a relationship cannot be drawn between annual ED volume and diagnosis due to too few data points. Physicians with multiple, or eligible for multiple, board certifications and those with an emphasis in pediatrics emergency medicine, rather than adult emergency medicine, faired better on the survey. Accuracy of diagnosis seems to peak six to ten years post training, but more data points are needed after the eleven-year time mark to see a trend.

Emergency medicine physicians are often the first physicians to see pediatric patients after suffering an injury to an elbow. It is important to diagnose these injuries accurately to plan medical decision making and determine whether a patient simply needs casting or surgery, or possibly even transfer to a facility capable of providing more appropriate care. Therefore, it is critical that physicians are aware of the types of fractures that are commonly misdiagnosed. While not all physicians can obtain multiple board certifications and forever remain in the “six to ten years post-training” group, they can be more vigilant about the different presentations of pediatric elbow fractures and their appearance based on age of the patient. This is an area of further improvement that may include the creation of educational resources containing detailed images of different pediatric elbow fractures and their appearance during different stages of development.
References


Appendix: Survey
Variability in the Interpretation of Elbow Fractures in Children

1) Are you board eligible or certified in:
   a. Emergency Medicine
   b. Pediatric Emergency Medicine
   c. Pediatrics
   d. Internal Medicine
   e. PEM fellow
   f. EM resident
   g. Pediatric resident
   h. Other: ____________________________

2) How many years in practice post residency:
   a. 0-2 years
   b. 3-5 years
   c. 6-10 years
   d. 11+ years

3) Do you work in:
   a. An academic adult emergency department
   b. An academic pediatric emergency department
   c. A non-academic adult emergency department
   d. A non-academic pediatric emergency department

4) The ED you work in mostly has an annual volume of:
   a. <20,000
   b. 20,000-40,000
   c. 40,000-60,000
   d. >60,000
Question 1
What is the diagnosis?

- a) Normal elbow
- b) Type 1 supracondylar fracture
- c) Type 2 supracondylar fracture
- d) Type 3 supracondylar fracture
- e) Fractured olecranon
- f) Medial epicondyle fracture
- g) Lateral epicondyle fracture
- h) Fracture of proximal radius
Question 2
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 3
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 4
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 5
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 6
What is the diagnosis?

a) Normal elbow
b) Type 1 supracondylar fracture
c) Type 2 supracondylar fracture
d) Type 3 supracondylar fracture
e) Fractured olecranon
f) Medial epicondyle fracture
g) Lateral epicondyle fracture
h) Fracture of proximal radius
Question 7
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 8
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 9
What is the diagnosis?

a) Normal elbow
b) Type 1 supracondylar fracture
c) Type 2 supracondylar fracture
d) Type 3 supracondylar fracture
e) Fractured olecranon
f) Medial epicondyle fracture
g) Lateral epicondyle fracture
h) Fracture of proximal radius
Question 10
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 11
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
**Question 12**
What is the diagnosis?
- a) Normal elbow
- b) Type 1 supracondylar fracture
- c) Type 2 supracondylar fracture
- d) Type 3 supracondylar fracture
- e) Fractured olecranon
- f) Medial epicondyle fracture
- g) Lateral epicondyle fracture
- h) Fracture of proximal radius
Question 13
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 14
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius
Question 15

What is the diagnosis?

a) Normal elbow
b) Type 1 supracondylar fracture
c) Type 2 supracondylar fracture
d) Type 3 supracondylar fracture
e) Fractured olecranon
f) Medial epicondyle fracture
g) Lateral epicondyle fracture
h) Fracture of proximal radius
Question 16
What is the diagnosis?
   a) Normal elbow
   b) Type 1 supracondylar fracture
   c) Type 2 supracondylar fracture
   d) Type 3 supracondylar fracture
   e) Fractured olecranon
   f) Medial epicondyle fracture
   g) Lateral epicondyle fracture
   h) Fracture of proximal radius