Disclosures

• None that apply to this topic
• Consultant
  – K2M
• Speaker
  – K2M
  – Depuy
  – Medicrea
Introduction

• Guideline preparation

• Initial Recommendations

• Addendum
  – for those with vascular injury
• Goal –
  – to help orthopaedic surgeons, physicians, and physician extenders improve the treatment based on the current evidence.
Guidelines

- **Patient population** –
  - **Etiology** – result of trauma to the elbow (fall, sports, or leisure activities)
  - **Incidence** – annual rate of 177.3/100,00
  - **Burden of disease** – relative cost and effectiveness of treatment (including home care, rehabilitation, school absence, child care, and time off work)
  - **Emotion and physical impact**
  - **Potential benefits, harms, and contraindications**
Guidelines

• Method
  – Recommendations specify [WHAT] should be done in [WHOM], [WHEN], and [HOW OFTEN OR LONG].
  – Used specific article inclusion criteria
  – Considered 60 unique outcomes
• Method
  – reviewed articles published from January 1966 to July 29, 2010. (PubMed, EMBASE, CINAHL, and The Cochrane Central Register of Controlled Trials)
• Method for evaluating evidence
  – Classification
    • Timing – acute defined < 14 days
    • Gartland classification (extension classification)
      – Term displaced in is used for both extension and flexion types
  – Quality
    • Used a scheme that allowed for evaluation of studies of all designs
  – Applicability or “generalizability”
    • one of the factors used to determine the strength of a recommendation
  – Final strength of evidence
• Strength of recommendation descriptions
  – Strong - means that the benefits of the recommended approach clearly exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a strong negative recommendation), and that the strength of the supporting evidence is high.
  • Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.
• Strength of recommendation descriptions
  
  – **Moderate** - means that the benefits exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a negative recommendation), but the strength of the supporting evidence is not as strong.
  
  • Practitioners should generally follow a **Moderate** recommendation but remain alert to new information and be sensitive to patient preferences.
Guidelines

- **Strength of recommendation descriptions**
  - *Limited* - means that the benefits exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a negative recommendation), but the strength of the supporting evidence is not as strong.
  - Practitioners should be cautious in deciding whether to follow a recommendation classified as *Limited*, and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.
• Strength of recommendation descriptions
  – **Inconclusive** - means that there is a lack of compelling evidence resulting in an unclear balance between benefits and potential harm.
  
  • Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as **Inconclusive** and should exercise judgment and be alert to future publications that clarify existing evidence for determining balance of benefits versus potential harm. Patient preference should have a substantial influencing role.
Guidelines

• Strength of recommendation descriptions
  – **Consensus** - means that expert opinion supports the guideline recommendation even though there is no available empirical evidence that meets the inclusion criteria.

• Practitioners should be flexible in deciding whether to follow a recommendation classified as **Consensus**, although they may set boundaries on alternatives. Patient preference should have a substantial influencing role.
Treatments and Recommendations
Gartland Type I (non-displaced) fractures

- **Strength of Recommendation: Moderate**
  - For acute Nonsurgical immobilization
Closed displaced fractures (Gartland II, III, or displaced flexion)

- **Strength of Recommendation: Moderate**
  - Closed reduction and pinning
    - Data on 48 outcomes from 11 studies comparing closed vs closed reduction and pinning

<table>
<thead>
<tr>
<th>Treatment compared to Closed reduction with Pin fixation</th>
<th>Number of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed reduction and non-operative immobilization</td>
<td>8</td>
</tr>
<tr>
<td>Closed reduction and traction</td>
<td>3</td>
</tr>
<tr>
<td>Open reduction (without closed reduction attempt) and pin fixation</td>
<td>3</td>
</tr>
<tr>
<td>Open reduction and internal fixation</td>
<td>0</td>
</tr>
<tr>
<td>External fixation</td>
<td>0</td>
</tr>
</tbody>
</table>
Timing of reduction of displaced supracondylar humerus fractures without neurovascular injury - Unable to recommend for or against a time threshold

**Strength of Recommendation: Inconclusive**

- Data on 30 outcomes from six studies were found for this recommendation
Treatment Timing

• Closed reduction of displaced supracondylar humerus fractures with decreased perfusion of the hand - Emergent

  – Strength of Recommendation: Consensus
  • No studies that met the selection criteria addressed this recommendation.
Strength of Recommendation: Limited

This recommendation is based on data on 65 outcomes from 15 studies comparing pinning technique using lateral only pin entry to lateral and medial crossed pin technique.
Medial pin placement: Open vs Closed

• Pin configuration and the potential complications related to iatrogenic ulnar nerve injury are recognized concerns in this population.

• **Strength of Recommendation: Inconclusive**
  
  – specifically if there was a difference in ulnar nerve injury rates related to percutaneous vs. open medial pin placement. There was no existing adequate data to address the technique of medial pin placement.
Open reduction for fractures with varus or other malposition

• **Strength of Recommendation: Limited**
  
  – Data on 28 outcomes from 8 studies were analyzed only provide limited support this recommendation.
Open exploration of the antecubital fossa

- Patients with absent wrist pulses but with a **perfused hand** after reduction of displaced pediatric supracondylar humerus fractures

- **Strength of Recommendation: Inconclusive**
  - No studies that met the selection criteria addressed this recommendation.
Open exploration of the antecubital fossa

- Patients who have **absent wrist pulses and underperfusion** after reduction and pinning of displaced pediatric supracondylar humerus fractures.

- **Strength of Recommendation: Consensus**
  - Benefits of immediate exploration outweigh the potential harms.
  - Consultation regarding vascular injury may be necessary.
Post Surgical treatment

- Removal of pins and immobilization – unable to recommend timing

- Strength of Recommendation: Inconclusive
  - No studies that met the selection criteria addressed this recommendation.
Post Surgical treatment

- Routine physical or occupational treatment – unable to recommend

- Strength of Recommendation: Inconclusive
  - One underpowered unblinded prospective study of patients with only open reductions
Post Surgical treatment

- Return to unrestricted activity after injury with healed pediatric supracondylar fractures of the humerus – unable to recommend

- **Strength of Recommendation: Inconclusive**
  - No studies that met the selection criteria addressed this recommendation.
Optimal timing of or indications for electrodiagnostic studies or nerve exploration in patients with nerve injuries associated with pediatric supracondylar fractures of the humerus - unable to recommend

Strength of Recommendation: Inconclusive

– No studies that met the selection criteria addressed this recommendation.
Adolescents

• open reduction and stable fixation for adolescent patients with supracondylar fractures of the humerus

• Strength of Recommendation: Inconclusive
  – No studies that met the selection criteria addressed this recommendation.
Appropriate Use Criteria (AUC) to assist clinicians in determining the appropriate management of pediatric supracondylar humerus fractures with vascular injury
Patients with vascular injury

• DEVELOPING CRITERIA
  – developed clinical scenarios using the following guiding principles:
    • Patient scenarios must include a broad spectrum of patients that may be eligible for treatment of pediatric supracondylar humerus fractures [comprehensive]
    • Patient indications must classify patients into a unique scenario [mutually exclusive]
    • Patient indications must consistently classify similar patients into the same scenario [reliable, valid indicators]
Patients with vascular injury
Patients with vascular injury

• Redefined the vascular status sub-indications to read:
  a) Non-perfused hand (one that is cold, white, and capillary refill > 3 seconds) *without* palpable distal pulse
  b) Perfused hand (one that is warm, pink, and capillary refill < 3 seconds) *without* palpable distal pulse
  c) Perfused hand (one that is warm, pink, and capillary refill < 3 seconds) *with* palpable distal pulse
Patients with vascular injury

Each panelist uses the scale below to record their response for each scenario:

**Appropriateness of [Topic]**

- Rarely Appropriate
- May Be Appropriate
- Appropriate

<table>
<thead>
<tr>
<th>Level of Appropriateness</th>
<th>Description</th>
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<tbody>
<tr>
<td>Appropriate</td>
<td>• Median panel rating between 7-9 and no disagreement</td>
</tr>
<tr>
<td>May Be Appropriate</td>
<td>• Median panel rating between 4-6 or</td>
</tr>
<tr>
<td></td>
<td>• Median panel rating 1-9 with disagreement</td>
</tr>
<tr>
<td>Rarely Appropriate</td>
<td>• Median panel rating between 1-3 and no disagreement</td>
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Patients with vascular injury

• Patient Scenarios (6)

– Patients with a suspected vascular injury after closed reduction and pinning:

1. Perfused hand (one that is warm, pink, and capillary refill < 3 seconds) with dopplerable distal pulse
2. Perfused hand (one that is warm, pink, and capillary refill < 3 seconds) without dopplerable distal pulse
3. Nonperfused hand (one that is cold, white, and capillary refill > 3 seconds)
Patients with vascular injury

• Patient Scenarios (6)
  – Patient had vascularity restored. The patient will be admitted and observed. During observation time:
    4. The perfused hand (one that is warm, pink, and capillary refill < 3 seconds) with dopplerable distal pulse
    5. The perfused hand (one that is warm, pink, and capillary refill < 3 seconds) without dopplerable distal pulse
    6. The Non-perfused hand (one that is cold, white, and capillary refill > 3 seconds)
Patients with vascular injury

Management Options/Treatments Addressed Within This AUC (18)

1. **Same-day discharge** (only an option prior to vascular restoration)
2. **Continue in-hospital observation without intervention** (only an option prior to vascular restoration)
3. **Warm the extremity**
4. **Removing fixation** (only an option prior to vascular restoration)
5. **Exploring fracture site for Brachial artery entrapment** (only an option prior to vascular restoration)
6. **Angiogram**
Patients with vascular injury

- Management Options/Treatments Addressed Within This AUC (18)
  7. Pharmacologic Anticoagulation
  8. Topical (nitroglycerin paste and/or Papavarine) to artery (only an option prior to vascular restoration)
  9. Assessment by vascular surgeon
  10. Nitroglycerin paste to skin
  11. Immediate transfer to facility with vascular or microsurgery services
  12. Compartment releases (only an option prior to vascular restoration)
  13. Same-day discharge with observation less than 24 hours (only an option after vascularity is restored)
Management Options/Treatments Addressed Within This AUC (18)

14. Continue In-Hospital Observation for more than 24 hours without intervention (only an option after vascularity is restored)

15. Measure compartment pressures (only an option after vascularity is restored)

16. Return to OR to perform compartment releases (only an option after vascularity is restored)

17. Return to OR for exploration of brachial artery for possible arterial reconstruction or arteriotomy (only an option after vascularity is restored)

18. Return to OR for topical (nitroglycerin paste and/or Papavarine) to artery (only an option after vascularity is restored)
RESULTS OF APPROPRIATENESS RATINGS

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Patients with vascular injury

<table>
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<td>1</td>
<td>Same-day discharge</td>
</tr>
<tr>
<td>2</td>
<td>Continue In-Hospital Observation without intervention</td>
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<tr>
<td>3</td>
<td>Warm the extremity</td>
</tr>
<tr>
<td>4</td>
<td>Removing fixation</td>
</tr>
<tr>
<td>5</td>
<td>Exploring fracture site for Brachial artery entrapment</td>
</tr>
<tr>
<td>6</td>
<td>Angiogram</td>
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<td>7</td>
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<td>Assessment by vascular surgeon</td>
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<tr>
<td>11</td>
<td>Immediate transfer to facility with vascular or microsurgery services</td>
<td>M:4</td>
<td>A:7</td>
<td>A:9 (+)</td>
<td>R:3</td>
<td>R:3</td>
<td>M:4</td>
</tr>
<tr>
<td>12</td>
<td>Compartment releases</td>
<td>R:2 (+)</td>
<td>R:2 (+)</td>
<td>M:6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Same-day discharge with observation less than 24 hours</td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Continue In-Hospital Observation for more than 24 hours without intervention</td>
<td>M:4</td>
<td>A:7</td>
<td>A:9 (+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Measure compartment pressures</td>
<td>M:4</td>
<td>M:5</td>
<td>A:7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Return to OR to perform compartment releases</td>
<td>R:3</td>
<td>M:4</td>
<td>M:6</td>
<td></td>
<td></td>
<td></td>
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<td>17</td>
<td>Return to OR for exploration of brachial artery for possible arterial reconstruction or arteriotomy</td>
<td>R:2 (+)</td>
<td>R:3</td>
<td>A:8 (+)</td>
<td></td>
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<td>18</td>
<td>Return to OR for topical (nitroglycerin paste and/or papaverine) to artery</td>
<td>R:2 (+)</td>
<td>R:3</td>
<td>M:6</td>
<td></td>
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Patients with vascular injury

Interpreting the AUC tables:
- R = Rarely Appropriate, M = May Be Appropriate, A = Appropriate
- Numbers beside appropriateness indicate the median rating of voting panel
- A plus symbol (+) indicates agreement between voting panel members and a minus symbol (-) indicates disagreement between voting panel members

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<tbody>
<tr>
<td>1</td>
<td>Same-day discharge</td>
<td>M:5 (-)</td>
<td>R:2</td>
<td>R:1 (+)</td>
</tr>
<tr>
<td>2</td>
<td>Continue In-Hospital Observation without intervention</td>
<td>A:8 (+)</td>
<td>A:8 (+)</td>
<td>R:1 (+)</td>
</tr>
<tr>
<td>3</td>
<td>Warm the extremity</td>
<td>M:5</td>
<td>A:7</td>
<td>R:3</td>
</tr>
<tr>
<td>4</td>
<td>Removing fixation</td>
<td>R:2</td>
<td>M:4</td>
<td>A:7</td>
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Conclusion
Thank You

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