Whole-body muscle activity during baseball pitching exercise

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BACKGROUND

Electromyography (EMG): commonly used method for evaluating skeletal muscle activity during pitching.

- Difficult to observe the activity in deep-lying regions
- Difficult to examine the whole-body with one examination
- Electrodes and lead wires interfere with normal motion

Positron emission tomography (PET): as a new method to evaluate whole-body skeletal muscle activity.

- Possible to semi-quantitatively evaluate whole-body skeletal muscle activity with one-time examination
- Can evaluate in an environment that accurately replicates actual pitching

18F-fluorodeoxyglucose (FDG)

FDG shows the same pharmacokinetics as glucose in the body.

Evaluation of whole-body skeletal muscle activity by measuring FDG incorporated in skeletal muscle with PET.

PURPOSE

This study aimed to evaluate whole-body muscle activity during a pitching exercise by using PET-CT.

MATERIALS & METHODS

- 10 uninjured, skilled adult pitchers
  - College: 9 Professional: 1
  - 1. Threw 40 balls at full power
  - 2. FDG was injected intravenously
  - 3. Additional 40 balls were pitched
  - 4. PET-CT images were obtained

- 5 healthy adult control group
  - Restricted exercise & PET-CT was obtained

Regions of interest: 72 muscles

FDG accumulation in each skeletal muscle

- Standardized Uptake Value: SUV

\[
SUV = \frac{\text{Counts in ROI} \times \text{reciprocal of the calibration constants}}{\text{injected dose/body weight} \times \text{muscle area}}
\]

The mean SUV values on the pitching side and the non-pitching side were compared with the control group.

RESULTS

Comparison of upper extremity SUV values

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Throwing side</th>
<th>Non-pitching side</th>
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<tbody>
<tr>
<td>Superior part of trapezius</td>
<td>0.2710</td>
<td>0.3273</td>
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<tr>
<td>Horizontal part of trapezius</td>
<td>0.3273</td>
<td>0.2710</td>
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<tr>
<td>Inferior part of trapezius</td>
<td>0.2710</td>
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<tr>
<td>Subscapularis</td>
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<td>Serratus</td>
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</tbody>
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Increasing FDG accumulation

- Fingers and toes
- Hamstrings on the throwing side
- The iliacus, tensor fasciae latae, sartorius on the non-throwing side

No FDG accumulation

- Rotator cuff
- Trunk

CONCLUSION

The whole-body skeletal muscle activity during pitching was investigated using PET-CT and a significant increase in glucose metabolism was observed in muscle groups in the fingers and toes, the hamstrings on the throwing side, and the iliacus, tensor fasciae latae, sartorius on the non-throwing side. Training programs for pitchers should focus on finger and foot muscular strength and asymmetrical activity of lower extremities.

REFERENCE