Acupuncture in Sports Medicine: Getting Right to the Point!

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Objectives

- Introduce acupuncture and acupuncture terminology
- Discuss acupuncture’s role in sports medicine
- Introduce the pathophysiology of acupuncture
- Apply pathophysiological mechanisms to practical application to sports injuries
- Give overview of the literature supporting acupuncture in sports medicine
- Review cases that would benefit from acupuncture treatment

What is acupuncture?

- Insertion of needles therapeutically in various combinations and patterns
- Dates as far back as 4000 BC
- Earliest major text was 2nd century BC
- Introduced into Europe in 19th century
- Increased popularity in U.S in 1970’s with James Reston’s landmark article

What is acupuncture?

- Many different styles of: Chinese, Japanese, Korean
- Hand, auricular, etc.
- In hands of trained acupuncturist very safe
- Most common complications are bruising, reaction to metal, bleeding, vasovagal responses.
- More serious, but rare, complications: pneumothorax or puncture of other organs, infection, puncture of larger vessels, retained needle.
- Generally treatments take about 20 minutes
- Minimal discomfort

What is medical acupuncture?

- Acupuncture integrated into Western medical or allied health practices
- Derived from Asian and European sources
- Choice of needle patterns based on:
  - Traditional principles
  - Modern concepts
  - Combination
- Used to complement Western medicine

Acupuncture Terminology

- Electroacupuncture (EA) – acupuncture in which the needles are stimulated with electrical boxes, can alter frequency and intensity to modify pain
- Moxibustion – dried herbal preparation of Artemisia vulgaris (mugwort) that is ignited and used to warm needles
- Meridians – “channels” that go from feet to hands and then back to feet
Does Acupuncture Play a Role in Sports Medicine?

- Used in ancient China on the battlefield
- Many countries have acupuncturists on staff for their Olympic teams
- One Olympic athlete stated that about 90% of Olympic athletes use acupuncture

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- Other sports figures known to use or have used acupuncture:
  - Jeremy Shockey
  - Patrick Kerney
  - Bill Romanowski
  - Jim McMahon
  - Mark McGwire
  - Jaromir Jagr
  - Tyler Hamilton (biker)
  - Dwayne Wade

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Pathophysiology

- Proposed mechanisms:
  - Local effects:
    • Vascular
    • Lymphatic
    • Nervous system
    • Musculotendinous
  - Central effects:
    • Analgesic
    • Nervous system
    • Anti-inflammatory
Pathophysiology

• Physiology of pain
  – Various afferent nerve fibers are involved in transmitting pain impulses
    • Large myelinated nerves
      – A-Beta (skin) carry touch
      – Type I (muscle) carry proprioception
    • Small myelinated nerves carry pain
      – A-delta (skin)
      – Type II and III (muscle)
    • Type II, III, IV and C carry nonpainful messages

Pathophysiology – Pain Response

• An injury to the skin activates the sensory receptors (squares) of small afferent A-delta and C-fibers (#1)
• These synapse onto the Spinothalamic Tract in the spinal cord (#2)
• The Spinothalamic Tract cell projects its axon to the Thalamus (#3)
• Here it synapses with a cell that sends impulses to activate the primary sensory cortex (#4)
• Dark triangles are excitatory synapses, white are inhibitory

Electroacupuncture’s Effect: Low frequency/high intensity

• Acupuncture needle activates a Type II or III small afferent nerve from a sensory receptor in the muscle
• This cell synapses in spinal cord and affects:
  – spinal cord
  – midbrain
  – pituitary-hypothalamus complex
• Inhibitory response in spinal cord causes blocks original painful stimulus both locally and segmentally
• Centrally response transmitted to pituitary/hypothalamus resulting in release of endorphins and ACTH

Electroacupuncture’s Effect: High frequency/low intensity

• Stimulates only the spinal cord and midbrain, but bypasses endorphin synapses there
• High frequency EA has a strong spinal segmental effect
• Mediated by:
  – Monoamine transmitters
    – Serotonin
    – Norepinephrine
  – Dynorphins

Pathophysiology of Pain Summary

• When using local points can recruit segmental and central pain inhibition
• When using distal sites mainly recruiting central pain response
• Clinically ideal to use both together
• The low frequency stimulation produces analgesia of slower onset and long duration, with a 20 minute stimulation effecting 30-120 minutes of analgesia
  – The effects are cumulative in repeat sessions
  – may be due to observed increase in m-RNA for endorphins seen for 48 hours after stimulation
• The high frequency stimulation is rapid but short duration and no cumulative effects

Proposed & Validated Mechanisms for Acupuncture’s Effect

• Needles cause their effect thru bioelectrical, and/or neurohumeral mechanisms
• Different levels affected
• Some mechanisms supported by research other is speculation
Proposed & Validated Mechanisms for Acupuncture's Effect

- Unique properties of acupuncture points
  - Electrical conduction & physiologic response to electricity differs from non-acupuncture points
  - Electron micrographs show loose connective tissue with high concentration of nerves and vessels - 80% of known points illustrate this
  - Correlate with peripheral endings of spinal/cranial nerves

3 Human anatomy department of Shanghai Medical University. A relationship between points of meridian and peripheral nerves

Proposed & Validated Mechanisms for Acupuncture's Effect

- Unique properties of meridians
  - Technetium injected at acupuncture point diffused along meridian vs non-acupuncture points diffused centrifugally. Stimulation of the points increased migration rate
  - Resistance between 2 acupuncture points on same meridian consistently less than 2 random points


Pathophysiology

- Vascular effects
  - Thermographic scans show manual acupuncture induces a nonsegmental warming effect.
  - Plethysmography shows increased blood flow with electroacupuncture

- Antiinflammatory
  - EA has been shown to increase cortisol levels
  - Proposed that local needles placed without stimulation decreases inflammation

- Immune
  - Some evidence that acupuncture can stimulate IgA as well as other immune effects

- Has been shown to modulate autonomic nervous system and decrease hear rate


Proposed & Validated Mechanisms for Acupuncture's Effect

- Cutaneovisceral reflex
  - Diseased organs will refer pain superficially (splanchnomotor distribution)
  - Needling these points is proposed to affect the involved organ
  - Can improve fatigue by increasing beta endorphins and cortisol

Application In Sports Injuries

- 20 yo soccer player injures back during soccer match
- Presents prior to next game with continued back pain
- Exam reveals tight muscle spasm in lumbar paraspinals with trigger points
- Treatment: High frequency/low intensity EA at site of trigger points along with meridian treatment for more central pain response
• Lacrosse player sustained grade II ankle sprain during game
• Next week is league championship
• Exam: Swollen ankle with erythema, tender over ATFL, mild laxity on drawer
• Use local needles around swelling and leave in dispersion (not stimulating needle)
• Do this daily until swelling down

• 19 yo NCAA 800 meter runner at an invitational track meet
• Ran 800 semifinals and 4X800 meter relay and has to run both again tomorrow
• C/o fatigue and is worried about being tired tomorrow
• Treatment:
  – Consist of specific peripheral points that would have a central effect releasing endorphins and cortisol
  – Could also use points geared towards the autonomic system

• 17 yo high school field hockey and track runner who presents with persistent shin splints unresponsive to conservative tx
• Exam: tenderness over mid to distal tibia medial border; bone scan negative
• Treatment:
  – Needle trigger points and put mid to high frequency stim
  – Use nonlocal points (meridians)
  – Needles along tibia border with EA
• Patient does well and competes pain free with acupuncture q3 weeks

• NFL quarterback sustains quad contusion
• Exam reveals significant ecchymosis and swelling over lateral quad
• Treatment:
  – Standard tx
  – Initially local needles around quad left in dispersion
  – As swelling decreases over several days begin to needle into tender area with high frequency stim
  – Local myofascial needling

• 21 yo college basketball player develops acute gastritis manifested by abdominal pain and nausea the day before a big tournament
• Exam is c/w VGE
• Treatment:
  – Use meridian points which help control nausea
  – Find splanchnomental reflex points on abdomen and back and needle
• Results:
  – Patient continued to have relaxation of the ITB with less pain and tightness
  – 4 months later completed Ironman triathlon
Table 1: World Health Organization Indications for Acupuncture

<table>
<thead>
<tr>
<th>Respiratory Diseases</th>
<th>Orthopedic Disorders</th>
<th>Gastrointestinal Disorders</th>
<th>Neurological Disorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute sinusitis</td>
<td>Acute bronchitis</td>
<td>Acute and chronic gastritis</td>
<td>Headache</td>
</tr>
<tr>
<td>Acute rhinitis</td>
<td>Bronchial asthma</td>
<td>Gastric hyperacidity</td>
<td>Migraine</td>
</tr>
<tr>
<td>Common cold</td>
<td>Eye Disorders</td>
<td>Chronic duodenal ulcer</td>
<td>Trigeminal neuralgia</td>
</tr>
<tr>
<td>Acute tonsillitis</td>
<td>orbicularis (without complications)</td>
<td>Acute and chronic colitis</td>
<td>Facial paralysis</td>
</tr>
<tr>
<td>Bronchopulmonary</td>
<td></td>
<td>Acute and chronic gastritis</td>
<td>Paralysis after apoplectic fit</td>
</tr>
<tr>
<td>Diseases</td>
<td></td>
<td>Central retinitis</td>
<td>Pain relief in:</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>menstrual cramps,</td>
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<td></td>
<td></td>
<td></td>
<td>tennis elbow,</td>
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<td></td>
<td></td>
<td></td>
<td>fibromyalgia</td>
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<td></td>
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<td>Post-op dental pain</td>
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</tbody>
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Table 2. NIH Consensus Statement: Efficacy for Specific Disorders

<table>
<thead>
<tr>
<th>Clear Evidence</th>
<th>Reasonable Evidence</th>
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</thead>
<tbody>
<tr>
<td>Adult post-op nausea and vomiting</td>
<td>Pain relief in: menstrual cramps, tennis elbow, fibromyalgia</td>
</tr>
<tr>
<td>Nausea of pregnancy</td>
<td></td>
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</tbody>
</table>

What's The Evidence?

- Not much!
- Problems with acupuncture research:
  - Can not do double blind placebo controlled trials
  - Hard to blind patient to treatment
  - Can not blind acupuncturist to tx
  - Many different forms of acupuncture
  - Individualized treatments, ie not formula driven
- Much of the research comes out of Europe and China
- Some of the Chinese literature is questionable

What's The Evidence?

- Lateral epicondylitis
  - Multiple studies showing benefit
  - Mostly short term improvement*

What's The Evidence?

- Patellofemoral Pain
  - Systematic review in Journal of Orthopaedic & Sports Physical Therapy concluded that acupuncture was effective in PFPS
  - Based on study by Jensen in 1999
  - This study was given the highest methodologic quality score in this review

What's The Evidence?

- Back pain
  - Cochrane review suggests acupuncture may be useful adjunct for chronic low back pain
  - 2 recent meta-analysis reviewed RCT's using acupuncture for any type of LBP
  - Showed acupuncture superior to various sham interventions
  - No evidence to suggest acupuncture superior to other interventions for LBP
  - Insufficient evidence for use in acute LBP
  - Recent clinical guidelines from ACP and APS recommend acupuncture as option for patients who fail self-care for subacute/chronic LBP


- Performance

  - Found decrease in heart rate compared to controls
  - O2 uptake in anaerobic threshold, velocity in anaerobic threshold and caloric consumption increased significantly
  - "Influence of acupuncture on physical performance capacity and hemodynamic parameters" in American Journal of Acupuncture 1993
  - Treatment group had higher maximal exercise capacity
  - Treatment group were able to perform higher workloads at onset of blood lactate accumulation compared to placebo

- OA of the knee

  - Systematic review in 2001 revealed:
    - Strong evidence that more effective than sham
    - Evidence limited whether better than usual care
  - Subsequent systematic review in 2002 should marked placebo effect
  - 3 RCTs since have shown improvements in pain and function over placebo and 2 over control

- Osteoarthritis

  - Systematic review concluded in most rigorous studies, acupuncture not superior to sham but both alleviated symptoms; see either:
    - Sham effective tx
    - Strong placebo effect
  - RCT comparing acupuncture and hydrotherapy to control in patients with hip OA
    - Tx groups had improved:
      - Pain control
      - Function
      - Quality of life
    - Electroacupuncture pain and function benefits lasted at least 3 months longer than hydrotherapy

- Acupuncture more effective than U/S in shoulder impingement

  - A recent study showed auricular acupuncture decreased the need for ibuprofen in patients after ambulatory knee surgery

- Neck pain

  - Cochrane Database review in 2006 found:
    - Moderate evidence that acupuncture relieves pain better than some sham tx
    - Moderate evidence that acupuncture patients had less pain at short term follow-up compared to wait listed patients
    - Moderate evidence that acupuncture more effective than inactive tx for relieving pain and this is maintained at short follow-up
  - RCT in patients with chronic neck and shoulder pain showed reduced neck and shoulder pain up to 3 years after tx compared to placebo group (sham)?
  - RCT showed acupuncture added to routine care in patients with chronic neck pain improved pain and disability compared to tx with routine care

- "Acupuncture and Responses of Immunologic and Endocrine Markers during Competition" in Medicine and Science in Sports and Exercise 2003
  - Looked at elite female soccer players during a multiday tournament
  - Found:
    - Exercise induced decrease in salivary IgA and increase in salivary cortisol were inhibited by acupuncture
    - Acupuncture improved subjective ratings of muscle tension and fatigue
Who is an appropriate acupuncture patient

- Acute injuries:
  - Used in conjunction with conventional tx
  - Trying to speed up RTP
  - Failing conventional tx
  - Not a surgical problem
  - Ex: ankle/MCL sprain, LBP
- Preventive
  - Athletes with lack of flexibility
  - Help recovery
  - Ex: athlete with tight ITB, generalized pain/fatigue after competition
- Chronic conditions
  - Failing conservative tx and not a surgical candidate
  - Ex: LBP, neck pain, OA, tennis elbow, plantar fasciitis, shin splints, PFPS, etc..

Conclusions

- There are some physiologic models for explaining acupuncture's affects
  - Some backed by science
  - Others hypothesized
- Many athletes utilize acupuncture including elite athletes with perceived benefits
- Athletes with many different types of injuries/illness could potentially benefit from acupuncture
- The evidence behind acupuncture is scant but is starting to increase