**PRP and Autologous Blood Injections**
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**Disclosure**
- I (nor any family member) do have not direct financial relationships in relationship to this talk
- Other disclosures
  - Associate Editor – Sport Health
  - American Medical Society for Sports Medicine
    - Board Member

**NY TIMES 9-4-2011**
- As Sports Medicine Surges, Hope and Hype Outpace Proven Treatments
  - Is sports medicine a science, something that really pays attention to evidence? Or is it a boutique industry where you have a product and sell it?"

"If you told a weight-lifter that eating a Brillo pad would help him bench-press 10 more pounds, there wouldn’t be a clean skillet in Nashville."
-Unknown weight lifter during a 1984 Tennessee drug scandal.

**Story time……..**
Placebo Effect

- Bigger pill = bigger effect
- 2 pills > 1 pill
- 2 pills 1 x day > 1 pill 2 x day

http://www.youtube.com/watch?v=yfRVCaA5o18

Autologous Blood

- transforming growth factor-β and basic fibroblast growth factor are present in whole blood and thought to be responsible for tendon healing
- Edwards SG 2003
  - 28 patients
  - 2 ml of autologous blood
  - Up to 3 injections
  - VAS pain score decreased from 7.8-2.3

- Connell D 2006
  - 35 patients
  - 2 ml autologous blood x 2 – 4 weeks apart
    - 3rd if needed
  - 32 patients had significant decrease in pain and Nirschl scores
  - 2 failures

- Kazemi M 2010
  - Lateral epicondylitis
    - AB versus steroid
    - AB superior at 8 weeks
      - DASH
      - Nirschl
      - Grip strength
Autologous Blood

- Wolf JM 2011
  - Lateral epicondylitis
    - Placebo versus saline versus AB versus steroid
    - No difference in treatment groups
    - All groups improved over 6 months

- Suress 2006
  - Medial epicondylitis
    - 2m AB x 2
    - 85% of patient had improved VAS and Nirschl scores at 1 and 10 months

- Suresh 2006
  - Medial epicondylitis
    - Placebo versus saline versus AB versus steroid
    - No difference in treatment groups
    - All groups improved over 6 months

- Lee TG 2007
  - Autologous blood versus cortisteroid for plantar fascitis
    - Steroid superior in onset and improvement
    - AB group did show improvement

- Kiter E 2006
  - Plantar fascitis
    - Needling vs needling and AB vs. needling and steroid
    - Equal in outcomes with significant improvement in VAS in all groups

Autologous Blood

- James 2007
  - Patellar tendinosis
    - 2ml x 2 – 4 weeks apart
    - VISA scores improved in all patients but 3 went on to surgery

- Bell KJ 2013
  - Non-insertional Achilles tendinosis
    - AB injection versus needling only
    - 2 – 3ml AB injection 1 month apart
    - No outcome differences

Platelet Rich Plasma (PRP)

- First described in the 1990's
  - Used for bone-forming properties
- Platelets contain various growth factors
  - Platelet-derived growth factor, transforming growth factor β, endostatin, platelet factor 4, angiopoietens and thrombospondin
  - All involved in healing process
- PRP also contains varying amounts of RBC, WBC, fibrin

的重要生长因子

<table>
<thead>
<tr>
<th>生长因子</th>
<th>阶段和作用模型</th>
<th>功能</th>
</tr>
</thead>
</table>
| TGF-β  | 转分化和增殖 | 促进和刺激细胞增殖和分化。
| VEGF | 血管生成 | 促进血管生成和新血管生成。
| PDLGF | 骨形成和软骨 | 促进骨形成和软骨生成。
| PDGF | 促进内皮 | 促进内皮细胞的生长和增殖。
| IGF | 促进细胞增殖 | 促进细胞增殖和分化。
| EGF | 促进细胞生长 | 促进细胞生长和增殖。

What do we mean by the term "inflammation"? A contemporary basic science update for sports medicine.

Scott A, Khan KM, Roberts CR, Cook JL, Duronio V.
**PRP Proposed classification**

- **Platelet Concentration:**
  - **A** = 5 x baseline or higher
  - **B** = Less than 5 x baseline

<table>
<thead>
<tr>
<th>Type</th>
<th>White Blood Cells</th>
<th>Activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1:</td>
<td>Increased WBCs</td>
<td>Unactivated</td>
</tr>
<tr>
<td>Type 2:</td>
<td>Increased WBCs</td>
<td>Activated</td>
</tr>
<tr>
<td>Type 3:</td>
<td>Few/None WBCs</td>
<td>Unactivated</td>
</tr>
<tr>
<td>Type 4:</td>
<td>Few/None WBCs</td>
<td>Activated</td>
</tr>
</tbody>
</table>

**Activation versus unactivated**

**PRP**

- **Preparation**
  - Centrifuge
    - Blood layers into components.
    - Red Cell, White cell and plasma layer
  - Commercial preps
    - Platelet concentrations between 503,000 and 1,729,000 platelets/µL
    - Concentrations over 1.8 x 10^6 platelet/µL may be detrimental and have an inhibitory effect

**PRP - Tendinopathy**

- **Basic science/Animal**
  - Tenocytes increase proliferation in PRP
  - Improved angiogenesis and fibrosis after experimentally severed tendons
- **Humans**
  - Several cohort studies and one RCT comparing PRP to corticosteroids found benefits for lateral epicondylitis
  - Cohort studies for patellar tendinopathy and plantar fasciitis
Summary of PRP Studies

<table>
<thead>
<tr>
<th>Condition</th>
<th>Study</th>
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<tbody>
<tr>
<td>Lateral Epicondylitis</td>
<td>Mishra 2006</td>
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<tr>
<td>Surgical</td>
<td>Yes</td>
</tr>
<tr>
<td>LOE</td>
<td>2</td>
</tr>
<tr>
<td>Results</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Peerbooms 2010</td>
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</tr>
<tr>
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<td>1</td>
</tr>
<tr>
<td>Results</td>
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</tr>
<tr>
<td>Rotator Cuff tear</td>
<td>Maniscalco 2008</td>
</tr>
<tr>
<td>Surgical</td>
<td>Yes</td>
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<tr>
<td>LOE</td>
<td>4</td>
</tr>
<tr>
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<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Randelli 2008</td>
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<tr>
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<td>Yes</td>
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<tr>
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</tr>
<tr>
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<tr>
<td>Achilles tear/tendinopathy</td>
<td>Sanchez 2007 (surgical)</td>
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<tr>
<td>Surgical</td>
<td>Yes</td>
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<tr>
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<td>3</td>
</tr>
<tr>
<td>Results</td>
<td>Positive</td>
</tr>
<tr>
<td></td>
<td>Filardo 2010</td>
</tr>
<tr>
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<td>No</td>
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<tr>
<td>Results</td>
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<td></td>
<td>De Vos 2010</td>
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<tr>
<td>Surgical</td>
<td>No</td>
</tr>
<tr>
<td>LOE</td>
<td>1</td>
</tr>
<tr>
<td>Results</td>
<td>No effect</td>
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<tr>
<td>Patellar Tendinopathy</td>
<td>Kon 2009</td>
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<tr>
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<td>ACL tear</td>
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<td>Results</td>
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<td></td>
<td>Silva 2009</td>
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<tr>
<td>Surgical</td>
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<tr>
<td>Results</td>
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<tr>
<td></td>
<td>Radice 2010</td>
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<tr>
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<td>Cartilage</td>
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<td>Osteoarthritis</td>
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<td>LOE</td>
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</table>

PRP results

  - LOE 3
  - 41 patients (34 had US follow up)
  - Patient satisfaction 83%
  - Pain improvement 58% and 68% (Function and worst pain)
  - Improvement in US appearance 84% (but none were normal)

  - LOE 1
  - PRP superior to AB injection

  - LOE 1
  - Follow up to previous study
  - No improvement

- Platelet-rich plasma as an effective treatment for proximal hamstring injuries. Wetzel RJ, Patel RM, Terry MA. Orthopedics. 2013 Jan;36(1):e64-70
  - LOE 4
  - Improved with PRP

  - LOE 2
  - N = 46
  - PRP x 2 (2 week interval) 23-3 sessions of ESWT
  - Victorian Institute of Sports Assessment (VISA-P), pain visual analog scale (VAS), modified Blazina scale
  - 2 months no difference—both groups improved
  - 6 and 12 months—PRP better VISA-P and VAS and Blazina

  - LOE 3

  - At 3 months endpoint
  - PRP=Steroid=Saline
  - Slight trend for improvement with PRP at 1 month over saline but both less than steroid
  - Several limitations but in particular 3 months may not be long enough to see differences
Mishra et al 2013

- Randomized double blind
- 230 patients
- Common Extensor tendons needled with PRP or without PRP

Outcomes
- VAS with wrist extension
  - 12 weeks
    - PRP 55.1% improved
    - Control 47.4%
  - 24 weeks
    - PRP 71.5%
    - Control 56.1%

PRP for OA and chondral injuries

  - Improved WOMAC scores versus saline
  - Milder OA did better
  - Pain scores significantly decreased, whereas functional and clinical scores increased at 6 months and 1 year from baseline.
  - No MRI condral changes

PRP for OA and chondral injuries

  - Improved Pain and function scores
  - PRP group better WOMAC scores
  - PRP better outcomes than HA

Safety

- No adverse events have been reported to date.
- Risk appears to be in the procedure alone not with PRP
- HOWEVER!!

PRP in acute muscle injuries

- Rodent model (Borrione P 2013, Hammond 2009)
  - PRP treated injuries faster return to full contractile function
  - Mild strains
- Bernuzzi G 2013
  - 53 Grade 2 muscles strains
  - Good outcomes but no control group
- Cugat et 2005
  - 50% faster return to sport for Grade 1-2 injuries
  - Comparative data to previous no control group

Cost?

- New code 0232T
  - This includes ultrasound guidance
- Few carriers will cover
  - Vermont: BCBS- no
  - Others variable
- Out-of-pocket
  - $300-2000
- Kits
  - Can cost $150-300
Office prep

- Rutkowski et al showed PRP can be prepared in the office setting
- Cost effective
- Slightly more time consuming
- Variability in the PRP
  - Test it in your lab
- Franco et al 2013

PRP

- Questions to answer
  - What type?
    - Unknown
  - Conflicting evidence on the role of WBC
    - Generally catabolic
    - However some evidence they may be synergistic
  - How much?
    - 3-5 ml commonly used but no evidence more is better

How often?

- Lateral Epicondylitis
  - Good evidence for effectiveness
  - Evidence that PRP is superior to steroid injections
- Other Tendinosis
  - Evidence varies
  - Consider after other conservative measures have failed

PRP when to use

- Lateral Epicondylitis
  - Good evidence for effectiveness
  - Evidence that PRP is superior to steroid injections
- Other Tendinosis
  - Evidence varies
  - Consider after other conservative measures have failed
What to do after a PRP injection?

- Rehabilitation/Reconditioning
- Understand tendon healing
- Correct issues leading to overload

Phase 1 (0-14 days)
- Pain control
- Regain motion
- Limited loading

Phase 2 (2-6 weeks)
- Correct biomechanics
- Start Eccentric loading
  - Increase slowly
  - Pure eccentric = 4 weeks

Phase 3 (6 weeks-?)
- Sport specific

Additional reading

Thank you

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