28 y/o M presents to your clinic for routine health maintenance. He reports being a recreational weight lifter, though in recent months, has “gotten more serious about it”

A review of his chart reveals and your prior knowledge of this patient
1. Recent weight gain
2. Increased BP (baseline 114/60, now 152/90)

A review of his ROS reveals
1. Increased headaches
2. Tingling in hands
3. Reduced libido

Physical exam reveals
- BP of 152/90, pulse of 84
- Increased facial and shoulder acne
- Subtle gynecomastia
- Otherwise normal exam

What are your next steps?
The face of doping

- July 1999: “I have been on my deathbed, and I’m not stupid. I can emphatically say I am not on drugs.”
- Jan 2004: “I have never had a single positive doping test, and I do not take performance-enhancing drugs.”
- June 2012: “I have never doped ... I have competed as an endurance athlete for 25 years with no spike in performance, passed more than 500 drug tests and never failed one.”

January, 2013

Show of hands: How many in the room have?

- Asked patients about performance enhancing drug (PED) use?
- Been asked by a patient about PED’s (steroids, growth hormone, etc)?
- Had to manage the side effect of PED’s in a patient?
- Used a PED yourself?
- Used a supplement?
**Pressured Sport – The Drive to Succeed “at all costs”**

- Image, performance, success and identity are closely linked in our culture
- Athleticism as a core principle for identity and self-worth
- Performance and athletics
- Sports-specific pressure
- What is fair play?
- The pressure of selective advantage

**Media coverage**

- Lance Armstrong
- Barry Bonds*
- Roger Clemens*
- Jose Canseco
- Floyd Landis
- Alex Rodriguez
- Robert Mathis
- Mark McGwire
- Ryan Braun
- Andy Pettitte
- Sean Merriman
- Melky Cabrera
- Marion Jones
- Hedo Turkoglu
...And many more

**Professional or Elite League Testing Policies**

- **NCAA** - Tests are conducted once during the regular season and again during the off season.
- **MLB** - tests at least twice per year, recently agreed to test for HGH; 600 players 3 times/year, 60 in off season, urine only
- **NFL** - 10 randomly selected players per team/week, urine only
- **NBA** - Every player is tested between 0-4 times yearly, urine tests only
- **NHL** - Every player is tested between 0-4 times yearly, urine tests only
- **NASCAR** - 2 sample’s randomly tested from 8-15 drivers and/or crew members during each Spring Cup race week
- **IOC** - Adheres to the WADA code. Players are eligible for random, unannounced tests at any time. Blood and urine tests
Penalty for PED’s

<table>
<thead>
<tr>
<th></th>
<th>1st offense</th>
<th>2nd offense</th>
<th>3rd offense</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCAA</td>
<td>1 year ban</td>
<td>Lifetime ban</td>
<td>***</td>
</tr>
<tr>
<td>MLB</td>
<td>50 game ban</td>
<td>100 game ban</td>
<td>Lifetime ban</td>
</tr>
<tr>
<td>NFL</td>
<td>4 game ban</td>
<td>8 game ban</td>
<td>12 month ban</td>
</tr>
<tr>
<td>NBA</td>
<td>10 game ban</td>
<td>25 game ban</td>
<td>1 year</td>
</tr>
<tr>
<td>NHL</td>
<td>20 game ban</td>
<td>50 game ban</td>
<td>Lifetime ban</td>
</tr>
<tr>
<td>IOC</td>
<td>2 year ban</td>
<td>Lifetime ban</td>
<td>***</td>
</tr>
</tbody>
</table>

NASCAR – Indefinite suspensions at NASCAR’s discretion

“I didn't have access to anything else that nobody else did”

Prevalence

- PED’s (AAS, GH, etc) are used by at least 1 million Americans
- 2001 NCAA prevalence study: 3.5% of NCAA athletes survey had used HGH in the prior 12 months
- 2013 Youth Risk Behavior Surveillance Study reports that 3.2% of high school students have taken steroid pills or shots without a doctor’s prescription, with 4.0% of males and 2.2% of females reporting use
- Use of HGH in health club attendees may be as high as 24%
What's being used?

- Anabolic androgenic steroids
- Growth Hormone
- Stimulants
- Myostatin inhibitors
- HCG
- Masking agents
- Selective Androgen Receptor Modulators (SARM)
- Selective Estrogen Receptor Modulator (SERM)
- Aromatase inhibitor (AI)
- Diuretics
- Thyroid supplements
- Erythropoietin (EPO)
- Blood transfusions
- Gene Doping (VEGF, IGF-1, Myostatin, EPO)

Why are PED’s used?

Athletes face enormous pressure to excel in competition. They also know that winning can reap them more than a gold medal. A star athlete can earn a lot of money and a lot of fame, and athletes only have a short time to do their best work. Athletes know that training is the best path to victory, but they also get the message that some drugs and other practices can boost their efforts and give them a shortcut, even as they risk their health and their athletic careers.

As far back as ancient Greece, athletes have often been willing to take any preparation that would improve their performance. But it appears that drug use increased in the 1960s. One well-publicized incident happened at the Seoul Olympics in 1988 when sprinter Ben Johnson tested positive for anabolic steroids and was stripped of his gold medal. Athletes may also misuse drugs to relax, cope with stress or boost their own confidence.

Athletes may have several reasons for using performance-enhancing drugs. An athlete may want to:

- Build mass and strength of muscles and/or bones
- Increase delivery of oxygen to exercising tissues
- Mask pain
- Stimulate his or her body (increase alertness, reduce fatigue, increase aggressiveness)
- Relax
- Reduce weight
- Hide their use of other drugs

Table 1: Athlete’s Doping Options

<table>
<thead>
<tr>
<th>Category</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabolic Agents</td>
<td>Increase strength and endurance, aid recovery, change bone density</td>
</tr>
<tr>
<td>Stimulants</td>
<td>Increase focus and concentration, reduce anxiety</td>
</tr>
<tr>
<td>Myostatin Inhibitors</td>
<td>Increase muscle mass</td>
</tr>
<tr>
<td>HCG</td>
<td>Reduce weight, improve performance</td>
</tr>
<tr>
<td>Masking Agents</td>
<td>Halt drug detection</td>
</tr>
<tr>
<td>Gene Doping (VEGF, IGF-1, Myostatin, EPO)</td>
<td>Increase muscle mass</td>
</tr>
</tbody>
</table>

2006 WADA tests for PED

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percent of Positive Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anabolic Agents</td>
<td>49%</td>
</tr>
<tr>
<td>Testosterone</td>
<td>20%</td>
</tr>
<tr>
<td>Feces &amp; Saliva</td>
<td>15%</td>
</tr>
<tr>
<td>Myostatin</td>
<td>11%</td>
</tr>
<tr>
<td>Other AAS</td>
<td>7%</td>
</tr>
<tr>
<td>GH</td>
<td>5%</td>
</tr>
<tr>
<td>SERM</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
</tr>
</tbody>
</table>

Adapted from reference 35.
Why do we care?

- Emerging and persisting use in athletics
- Risk/benefit profile
- Banned & illegal
- Selective advantage
- Abuse risk can be high in at-risk groups (high school, competitive sports participants)
- Media coverage

As a provider, parent, or concerned friend...

- Remember, knowledge is power
- Get familiar with terminology
- You have to connect to be able to affect any change at all
- Know that PED use is deep seated, with PED users having an incredibly strong belief system

Goals

- Identify the at-risk athlete
- Utilize a non-threatening approach
- Understand that PED user's perception of the MD
- Provide education
- Address the disordered behavior
- Recognize and mitigate the challenges (self-identity, media, fans, coaches, teammates)
Identifying the at-risk athlete

- To know, the health care provider must ask
- To confess, the patient must feel comfortable
- Beyond this, I look for signs of injection use or steroid use in the at-risk demographic

Utilizing a non-threatening approach

- Avoid passing judgment
- Appeal to the user’s sensibilities
- Address the underlying issue (image, performance, competition, enhancement)
- Discuss over time

Users’ attitudes toward healthcare providers

- Healthcare providers are typically uninformed or minimally informed on the topic
- Providers may be viewed as “less” health conscious than the users themselves
- Users rarely seek professional help for treatment of PED-associated problems.
Quotes

- “The doctor is there to help you and not tell you what you can and can not do.”
- “What I did was try and find a doctor that I knew was understanding of my “situation.”
- “Some doctors cannot be persuaded to do anything. This is one of the reasons I stress finding the right doctor.”

Provide education

- As a provider, providing education began with educating myself
- Some of this information can be found in basic science literature
- Large, population based or controlled studies on PED use don’t exist
- Thus, one has to be creative in gaining an understanding of the situation

What have I learned?

- Many of the same studies that I have reviewed critically, are championed on the forums
- “Side effects” may be seen as beneficial
- Online reports may be very compelling, but there are just as many anecdotal positive reports as there are negative reports
- Terminology is important, as there is a language within the doping culture
PED terminology

- AAS: Gear, juice, ’roids, sauce
- Cycle: Taking one or more steroids or supplements at a time, for a specific defined time period
  - Bulking cycle
  - Cutting cycle
- Stacking: mixing one or more supplements together for synergistic effect or to mask side effects
  - Insulin
  - Thyroid hormone
  - Tamoxifen
  - Clomid
  - Arimidex
  - HCG

PED Terminology

- Cutting: “Cut”, “Rip”, “Shred”, “Sliced”- All removing fat
- Pinning: Injecting
- Crash: effects of discontinuation of a PED (associated with steroids)- Dramatic loss in size and strength
- Rebounding: restoration of endogenous testosterone production

Growth Hormone (HGH)

- 191 chain amino acid
- Produced by the anterior pituitary gland and regulated through signals from the hypothalamus
- Primary functions
  - Increase height
  - Promote glucose availability
- Secondary functions
  - Calcium homeostasis and bone health
  - Lipolysis (fat breakdown)
  - Increased lean body mass
  - Internal organ growth
  - Immune modulation
HGH

- In excess
  - Acromegaly
  - Gigantism
- In deficiency
  - Pediatric growth arrest and failure
  - Dysfunction in adult energy, bone mass, and strength modulation
- FDA only approves HGH for on-label use for AIDS wasting and growth hormone deficiency

Exogenous HGH

- "Anti aging"
- Muscle building
- Increasing lean muscle mass
- Recovery from injury
- $400-$500/month
- Annual sales of > $2 billion via prescription
- Over 30% of prescriptions in the U.S. are for off-label use

HGH side effects

- Fluid retention
- Carpal Tunnel Syndrome
- Body aches and pains
- Tumor propagation (leukemia, colon CA)
- Insulin resistance & diabetes mellitus
- Cardiac instability
Does HGH work?

- In patients with GH deficiency, HGH supplementation has been shown to
  - Increase glucose availability
  - Increase oxygen delivery to exercising muscle
  - Increase fat oxidation, and thus sparing of glycogen
  - Normalize maximum exercising aerobic capacity (VO₂ max)

- In healthy subjects
  - HGH may regulate amino acid update and homeostasis in muscle
  - HGH does not appear to increase muscle protein synthesis, hypertrophy, or muscle mass
  - HGH does not appear to improve exercise capacity or power output

What about steroids?

- Anabolic androgenic steroids (AAS) are derived from testosterone
- Testosterone is a precursor to estrogen
- Doping tests for AAS have focused on evaluating the testosterone to epitestosterone ratio (T/E ratio)
- AAS derivatives are wide ranging, making detection difficult

Steroid Classification Schemes

- Water-soluble
  - Orally-active form
  - 17-alpha-alkylated
- Lipid-soluble
  - Parenteral form
  - 18 beta-esterified
- Bulking vs Cutting
  - Bulking agents: (nandrolone)
  - Cutting agents: (Winstrol)
**Testosterone**

- In puberty, it is responsible for development of sexual characteristics, growth and development
- In adults, it regulates many physiologic processes including
  - Muscle protein metabolism
  - Sexual function
  - Blood cell production
  - Fat metabolism
  - Bone metabolism
  - Cognitive function & brain plasticity
- Plasma levels can range widely between 300-1000 ng/dl
- Circulating female levels are typically 10% of male levels

**Why do people use steroids?**

- Medical indications include testosterone deficiency and hypogonadism
- Recreational use
  - Anti-aging & wellness
  - Increasing muscle size and strength
  - Increased lean body mass
- How it may work recreationally
  - Increased muscle strength due to muscle fiber hypertrophy and changes in muscle fiber architecture
  - Protect muscle against muscle fiber damage through regulation of protein metabolism and synthesis during recovery
  - Improves exercise tolerance and adaptability of muscle to overload

**Steroids-side effect**

- Cardiovascular
  - Elevated blood pressure
  - Decreased HDL
  - Hypertension
  - Myocardial hypertrophy
  - Arrhythmia
  - Thrombosis
- Hepatic
  - Hepatitis
  - Jaundice
  - Necrosis
- Dermatologic
  - Acne (40-54%)
  - Gynecomastia (10-34%)
  - Stases (18%)
  - Alopecia
- Musculoskeletal
  - Tendon/muscle rupture
  - Precocious puberty
  - Early growth arrest
- Reproductive-endocrine
  - Libido changes
  - Reduced fertility
  - Testicular atrophy (40-51%)
- Behavioral
  - Mood swings
  - Aggression - "roid rage"
  - Mania
  - Depression
  - Withdrawal
  - Dependence
+ Understanding the challenge of PED's

- Most use is unregulated and unmonitored
- Most regimens are not rigorously tested
- Convincing science is not available
- Benefits may be unpredictable
- Toxicity may be unpredictable
- Long term side effects are unpredictable
- Testing methods lack adequate sensitivity

+ PED availability

- Widely available on the internet
- Widely discussed availability and providers on forums
- Widely accessible in the body building and amateur athletic community

+ Users' Beliefs

- Traditional physicians who can help are few and far between
- Anecdotal reports are as equally valid as published studies
- Role modeling among community members and athletes
- Goal is to optimize 3 facets of biomedical enhancement
  - performance enhancement
  - normalization
  - repair
As a community, what do we do?

- Promote and champion a fair play culture
- Understand the effects and side effects of PED via rigorous scientific study
- Celebrate athletes who are not using PED’s
- Develop & employ more rigorous methods for testing
- Identify and enforce meaningful penalties
- Remove the motivators for use

“It’s this myth, this perfect story, and it wasn’t true…”

– Lance Armstrong, admitted PED user, who’s now coping with doping…