What is a PED?

- Any substance used by an athlete to enhance performance.
- Does not have to be a prescription drug.
- Many different ways to enhance performance.
- Anything can and will be abused.
Types of PED's

- Anabolic Agents
  - Anabolic Steroids
    - Growth Hormone
- Insulin & IGF-1
- Stimulants
- Supplements
- Pain Killers
- Blood Boosters
- Peripheral Agents

ANABOLIC STEROIDS

- Androgenic Anabolic Steroids are discovered in 1936.
- AAS find their way into sports in the 1950’s.
- IOC bans AAS in 1964, and begins urine testing in 1968.
- As late as 1990 the medical community denies AAS cause strength gains.

ANABOLIC STEROIDS

- How do they work?
- Anabolic/Anti catabolic
  - Enzyme stimulators- RNA polymerase produces intracellular protein
  - Intracellular oncotic pressure- increased
  - Time between work-outs is decreased
ANABOLIC STEROIDS

• Why have AAS become so popular?
  – 10-25% weight gain in 3-6 months
  – Psychological effects
  – Better ones appearance
• Be aware of your patients!!
  – Various studies of American high school athletes estimate that 5.9 percent of boys and 4.6 percent of girls have used anabolic steroids to help them build muscle.

Popular Anabolic Steroids

• Nandrolone decanoate (Deca-Durabolin)
• Stanazolol (Winstrol)*
• Methandrostenolone (Dianabol)*
• Methenolone (Primobolan)*
• Oxymetholone (Anadrol)*
• Boldenone (Equipoise)

• Testosterone cypionate
• Testosterone propionate (Virormone)
• Testosterone Blend (Sustanon 250)
• Testosterone enanthate (Testaviron)
• Testosterone undecanoate (Andriol)

ANABOLIC STEROIDS

• ADVERSE EFFECTS
  – Hepatocellular dysfunction
  – Acne and hirsutism
  – Mood swings and aggressiveness
  – Increased LDL, decreased HDL, 2c 3c) and ApoA1
  – Raised Apo-B
  – Decreased testicular size, gynecomastia
• MEDICAL USES
  – Refractory anemias
  – Hereditary angioedema
  – Wasting syndrome in HIV
  – Hormonal replacement
The Steroid Mindset.

- Many think they need them to compete.
- Many think everyone else is doing it so I have to also.
- Win at All Cost.
- Muscle Dysmorphia.

Most Dangerous Effects of AAS

- Roid Rage.
- Hyper sexuality.
- Over confidence.
- Depression/Suicidal.
- Psychological Addiction.
- Mood Swings

Calling them out!

- Patient admits to using AAS.
- You see all the signs and ask.
  - Often leads to denial.
    - Formalized drug testing.
    - T4 x HDL - if less than 100 suspect AAS use
    - Testosterone/Epitestosterone > 6:1- AAS use
    - HDL > 10 suspect AAS use.
**THG**
tetrahydrogestrinone

- A chemical manipulation of gestrinone—a rarely used progestin for treating endometriosis.
  - Was intentionally altered for the sole purpose of eluding drug testing.
    - Slightly altered the progestin and then added a side-chain similar to Trenbolone (the strongest known synthetic androgen).

- THG is a potent androgen and progestin properties but no estrogen properties or sex steroid antagonism. (Death et al JCEM 5/04)
  - More potent than nandrolone and trenbolone.
  - Would have to expect all the bad effects of both.

- Nobolethone is another “supplement” which was recently discovered.

**Growth Hormone**

- Growth hormone release increases at the onset of aerobic activity and decrease at or close to the cessation of aerobic activity.
- The more intense the aerobic activity the greater the increase.
  - There are many confounding factors.
  - Adiposity decreases the GH response.
  - Decreases with conditioning.
In regards to Resistance Training the variables are much greater in the GH response.

- Length of rest period.
  - Shorter rest periods caused greater increases.
- Intensity of workout.
  - 1 RM vs 10 RM.
- Volume of work.

Note women during follicular phase have a higher GH level than men.

Why use HGH

- Increased muscle size and strength.
- Decrease adipose stores.
- Increased metabolism?
- Increased bone density?
- Not easily detected in testing.

Problems with HGH

- Acromegaly- irreversible bony enlargement
- Hyperpigmentation
- Glucose intolerance
- Organomegaly- cardiomyopathy
- Carpal Tunnel and other nerve entrapments.
Muscle Dysmorphia

- AKA: Reverse Anorexia, Bigorexia.
- Effects Males > Females.
- DSM IV subclass of OCD.
- Sports⇒MDM

What to do with MDM?

- What do you look like?
- What is the ideal body?
- What do you think others think you look like?
- Unlike AN they look healthy. Identify
- Antidepressants.
- Extensive Psychotherapy.

Insulin and IGF-1

- GH anabolic effects are regulated by Insulin-like Growth Factor-1 (IGF-1)
- Complex interaction of Insulin, GH and IGF-1 to control the nutrients supplied to the tissues during fasting and feeding.
- Insulin and GH have been widely available and now so is IGF-1.
  - Let the games begin.

Why IGF-1

- Recently Mecasermin Tercica (Increlex) and Mecasermin Rinfabate (iPLEX) have become available to treat growth failure in children.
  - Increlex is rhICF-1.
  - iPLEX is rhIGF-I bound to rhIGFBP-3, its major binding protein.

IGF-1 now available on the Black Market.

- Improves endurance.
- Increased muscle strength.
- Increased tendon strength.
- Rapid tissue repair.
- Sexual enhancement and endurance.
- Better BG control.
- Anti-Aging.
- Fat reduction.
- Mood elevation.
- Anti-inflammatory.
- Nerve regeneration.
IGF-1

- Exogenous IGF-1 has anabolic effects.
  - Enhances the uptake of Amino Acids.
  - Works at any age, even in sarcopenia.
- Increases glucose uptake by increasing insulin sensitivity and glycogen production.
  - Being used by athletes to rapidly replenish post extensive exercise.
  - Causes symptomatic hypoglycemia.

- Exogenous administration is shown to increase lypolysis and lipid oxidation.
  - May be indirect by suppression of circulating insulin.
  - Mature adipose cells have receptors for IGF-1 so it may have a direct effect on adipose cells.
- May reduce fat mass.
- Provide abundant fuel source in endurance events while protecting glycogen and protein.

Insulin

- Many preparations are readily available.
- Insulin mediated glucose uptake enable glycogen production.
- Causes carbohydrate to be utilized instead of amino acids and fatty acids.
- Used post exercise to replenish glycogen and ATP stores.
GH, Insulin and IGF-1

- There is no proof that insulin or IGF are performance enhancing.
  - Imagine doing that random controlled study.
- Many athletes do their own studies with a N=1.
- Many use multiple drugs at once.
- Slightest advantage is a Gold vs. not making the finals.

Potential Problems.

- Hypoglycemia.
- Tonsilar/Adenoid growth—resolves.
- Possible acromegaly like effects due to similarity of IGF-1 and GH.
- Cardiomyopathy?
- Increased IGF-1 levels in prostate and colorectal cancers.

Epogen

- rEPO became available in the late 80’s.
  - Blood doping in endurance sports started almost immediately.
- Hbg = VO2 max
- Must have adequate iron stores, takes a few weeks to raise the Hct and Hbg.
Who’s doping?

Problems with blood doping.

- HTN: ↑volume, ↑viscosity & ↑CO.
- Stroke due to viscosity.
- MI due to viscosity.
- Seizures
- Antibody Mediated Aplasia.

Gene Doping

- Introducing a desired gene (transgene) into an organism via a vector (often a virus).
  - Done in agriculture with plants and livestock.
- Genes can also be injected.
- Put in the system with liposomes or plasmids.
- Beware virus could infect others.
Stimulants

• Who are your abusers?
  – Distance athletes.
  – MLB, NFL, NHL, NBA.
  – EVERYONE.
    • Prescription stimulants.
    • OTC stimulants.
    • Energy Drinks.

Stimulants

• Ephedra/Pseudoephed
  – Increased heat stroke.
  – Increased rhabdomyolysis

• Modafinil
  – Increase exercise time
  – 17%
  – Increased core temperature at rest.

• Methylphenidate
  – Same heat issues

• Amphetamines
  – All forms
  – All the same

• Cocaine
  – Don’t forget the heart issues and strokes!
How do stimulants work?

• (1) an elevated release of neurotransmitters (e.g., dopamine, noradrenaline, and serotonin) into the synaptic cleft.
• (2) the direct stimulation of postsynaptic receptors.
• (3) the inhibition of neurotransmitter reuptake.

Cocaine

• Used as far back as the Inca’s to enhance workloads and speed long demanding tasks in hypoxic environments.
• Used in the 16th century in race walking.

Note

• Use of psuedophedrine has increased greatly since the lifting of the ban in 2004.

Pain Killers

• NSAID’s
  - GI effects well known
  - Nephrotoxicity
  - Bleeding issues
  - Exercise Induced Hyponatremia
  - Topical preparations can decrease some of these problems.

• Narcotics
  - Addiction
  - Injury due to slowed reactions.
  - Injury due to going through pain.
Peripheral Agents

**MASKING AGENTS**
- Diuretics to dilute urine.
- Probenecid blocks excretion.
- Plasma expanders such as glycerol.

**COUNTERACTING AGENTS**
- HCG—prevents testicular hypertrophy.
- Selective Estrogen Receptor Modulators.
- Aromatase inhibitors.
- Anti-Estrogens.

Interesting websites.

- www.TaylorHooten.org
- www.steroidabuse.com
- www.drugabuse.gov
- www.acsm.org
- www.wada-ama.org
- www.usada.org

Inspira Health Network

- AOA Residencies: FP, IM, OB/GYN, Ortho, ER, Gen Surgery, Podiatry. Traditional Rotating Internship.
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