What’s New: Female Athlete Triad

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Disclosures
- NCAA Concussion Task Force
- Ivy League / Big Ten Core Concussion Task Force
- USA Football Medical Advisory Committee
- CDC, Concussion Consultant
- US Soccer Team Physician, Consultant
- US Lacrosse Men’s National Team, Team Physician
- Korey Stringer Institute, Medical Advisory Committee
- MLS Chief Medical Officer
- Chair, US Lacrosse Sports Science & Safety Committee
- NFL Head, Neck & Spine Committee

Take Home Points
- Significant health concerns underscoring importance of early detection & treatment
- Can determine individual “risk stratification” during pre-season based on evidence based risk factors
- ? Prevention through education

Introduction

- Female Athletes
  - Low energy availability
  - Disordered eating
  - Menstrual dysfunction
  - Low bone mineral density
  - Components present
  - Inter-related;
    - Energy deficiency assoc w DE plays causal role in development of menstrual dysfunction
    - Energy deficiency and hypogonadal environment assoc w amenorrhea play a causal role in low BMD

Low Energy Intake

- Spectrum; unintentional inadequate EA (inadvertent undereating)
- Calorie, protein and/or fat restriction and pathogenic weight control measures (e.g. diet pills, laxatives, excessive exercise, self-induced vomiting)
- Classic ED such as anorexia nervosa, bulimia nervosa or eating disorders not otherwise specified

Low Energy Intake

- DE/ED; any athlete, any sport, some at > risk
- DE/ED; psychiatric disorders w/ distortion of body image, significant nutritional & medical complications including a ed risk of death from suicide or metabolic disorders
- Athletes at > risk for developing DE/ED
Disordered Eating/Eating Disorders: Risk Factors

- Pressure to optimize performance and/or modify appearance
- Psychological Factors (e.g. low self-esteem, poor coping skills, perceived loss of control, anxiety, depression, perfectionism, hx of physical/sexual abuse, family dysfunction, obsessive-compulsive traits)
- Underlying chronic disease (e.g. diabetes, thyroid)

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Low EA: Consequences

- Nutritional deficiencies & electrolyte abnormalities
- Decreased BMD
- Metabolic disturbances (e.g. low BMD, suppression of metabolic / reproductive hormones)
- GI issues (e.g. dental, bloating, gingival bleeding, ulceration, constipation)
- Cardiovascular issues (e.g. arrhythmias, heart block, endothelial dysfunction)
- Psychiatric issues (e.g. depression, anxiety, suicide)

Energy Availability

- EA linearly related to risk of menstrual disturbances
- No clear threshold below which function is disrupted
- As EA drops < 30 kcal·FFM−1, risk of menstrual dysfunction increases above 50%

Menstrual Dysfunction: Definitions

- Primary amenorrhea / delayed menarche
- Secondary amenorrhea
- Functional hypothalamic amenorrhea (FHA) = absence of menses due to suppression of hypothalamic-pituitary-ovarian axis, w/o identifiable anatomic or organic cause (exercise associated menstrual dysfunction)
- Oligomenorrhea (6-10 cycles/yr); cycle length > 35 days or < 3 mo
- Anovulation (absence of ovulation); “regular” menses but normal hormonal fluctuations not
- Luteal Phase Deficiency; cycle length may be normal, but decreased progesterone levels

Menstrual Dysfunction

- More common in athletes vs gnl pop
- Etiology likely multifactorial
  - Body weight/body comp
  - LEA
  - Nutrition
  - Training
  - Previous menstrual function
  - Psychosocial factors
- Intense exercise alone does not necessarily cause menstrual dysfunction, provided adequate EA
Menstrual Dysfunction:

- Consequences:
  - Suppression of reproductive hormones & infertility
  - Low BMD
  - Higher incidence of BSI
  - Altered cardiovascular risk factors (e.g. lipid profile, endothelial fn)
- Effects of menstrual dysfn on BMD may not be completely reversible: early detection and Rx important

Suppression of reproductive
Low BMD
Higher incidence of BSI
Altered cardiovascular risk factors (e.g. lipid profile, endothelial fn)
Effects of menstrual dysfn on BMD may not be completely reversible: early detection and Rx important

Low Bone Mass

- Bone mass determined by balance between bone formation & resorption
- LEAKS: bone turnover in adolescent girls & boys
- Maintain bone mass in early adulthood
- Peak bone mass achieved by age 25-30, 90% accrued by end of adolescence

Optimal Peak Bone Mass largely (60-80%) dependent on genetic factors w/ other factors contributing
- Weight bearing/loading exercise
- Lean body mass
- Reproductive hormone status
- Adequate E intake nutrition
- Bone building nutrients (e.g. calcium/vitamins D, K)
**Low Bone Mass**

- Bone mass decreased by:
  - Tobacco use
  - Excessive alcohol
  - Certain medical conditions (e.g., renal disease, hyper-parathyroidism, DE/ED)
  - Medications (e.g., progesterone, corticosteroids, selective serotonin reuptake inhibitors)
  - Inadequate bone-building nutrients

**Evaluating BMD**

- By Dual Energy x-ray Absorptiometry (DEXA) w/ interpretation based on normal distribution of age matched (Z-score) individuals
- Eval should consider labs for eval of amen / oligomenorrhea and DE/ED as indicated
- Dx: In presence of amen/oligomenorrhea ACSM recommends Z score between -1.0 std deviation (SD) and -2.0 as “low bone mass”, and Z score of -2.0 and below as “osteoporosis”

**Low BMD Treatment**

- Low BMD (< -1.0); refer to nutritionist
- Osteoporosis (< -2.0); refer for more comprehensive medical evaluation
- Multidisciplinary Rx; restoration of menstrual cycle fn, nutrition, psych/pharm Rx as needed

**Low BMD Treatment**

- Pharmacologic interventions; after 1 year no improvement, consider transdermal estrogen, or OCP in amen/oligomenorrhea athlete (if bone loss after 1 yr nonpharm mgmt), along with Ca+ and Vitamin D
- Biphosphonates, teriparatide, selective Est- receptor modulators, denosumab should be avoided

**Putting it all together**

- Screening for elements of the triad important; early detection /Rx may prevent complications
- Sports physicals, any assessment for injury and illness
- Standardized tools
- Multidisciplinary Team: MD / Dietitian / Psychologist, & others (AT, family, coach)

**Who should get a DEXA?**

1. ≥ ”high risk” Triad risk factors
   - Hx of a DSM-V diagnosis of ED
   - BMI < 17.5 kg/m², < 85% estimated wt or wt loss of ≥ 10% in 1 mo
   - Menarche ≥ 16 yrs
   - Current or hx of < 6 menses / 12 mo
   - 2 prior stress rxn/fx, 1 high risk stress rxn/fx, or low energy traumatic fx
   - Prior Z score of < -2.0 (after at least 1 year)
2. ≥ 2 “moderate risk” triad factors
   - Current or hx of DE/ED for 6 mo or greater
   - BMI b/w 17.5 - 18.5, <90% estimated wt OR recent wt loss 5-10% in 1 mo
   - Menarche b/w age 15-16
   - Current or hx of 6-8 menses over 12 yrs
   - One prior stress rxn / fx
   - Prior Z-score b/w -1.0 and -2.0 (after at least 1 year)
3. Athlete w/hx of ≥ 1 non-peripheral or ≥ 2 peripheral long bone traumatic fx (non-stress) if ≥ 1 moderate or high risk factors
Conclusions

- Important to evaluate for the female athlete triad (and relative energy deficiency)
- More research needed re: using the screening tools / risk assessments
- Predicting return to play and how to modify activities in athletes at high risk
- Prevention through education

References

References


