

# Preparticipation Physical Examination

## *Selected Issues for the Female Athlete*

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**Objective:** The purpose of this article was to examine the preparticipation examination (PPE) with regard to the female athlete. Ever-increasing participation of women in competitive sport has created a requirement for more gender-specific sport medicine knowledge. In particular, physicians and other health care professionals should be aware of the triad of disordered eating, amenorrhea (and other menstrual dysfunction), and osteoporosis (or altered bone mineral density) collectively described as the female athlete triad. Suggested additions to the standard PPE may help identify athletes at risk.

**Data Sources/Methods:** A literature search was carried out using MEDLINE for years 1966 to 2003, with keywords *female athlete triad*, *PPE*, *female athlete*, *eating disorders*, *amenorrhea*, and *osteoporosis*. Further studies were identified through reference lists.

**Results:** Better recognition and prevention of these problems is essential. At present, there is little evidence-based information available to guide the practicing clinician in this area. It remains to be determined which methods are the most sensitive and specific for detecting the triad disorders, as well as the most economical and time-efficient.

**Conclusions:** The PPE offers an excellent opportunity to screen for these entities, as well to initiate early treatment. It is recommended that a standardized form (or part of the form) be developed for the female athlete.

**Key Words:** female athlete, disordered eating, amenorrhea, osteoporosis, osteopenia, PPE

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During the past 30 years, there has been remarkable growth in women's involvement in sport at all levels. In the United States, Title IX of the Education Amendments Act of 1972 has had the desired effect of dramatically increasing the participation of girls in high school sports (1 in 27 in 1972, 1 in

2.5 in 2002). The proportion of college athletes who are female is also much greater: 2% in 1972, 43% in 2002.<sup>1</sup> Similarly, in Canada, the Charter of Rights has resulted in a veritable explosion of women's athletics.

Physicians who care for female athletes are sometimes unaware of their unique needs.<sup>2</sup> A recent joint publication of 6 US medical societies has outlined some specific orthopedic (musculoskeletal) and medical concerns.<sup>3</sup> Among these are disordered eating, amenorrhea (and other menstrual dysfunction), and osteopenia/osteoporosis. Since 1992, it has been recognized that these distinct medical entities are frequently interrelated as the female athlete triad.<sup>4</sup> Each individual disorder has specific morbidity and mortality, but the 3 together can be synergistic.<sup>5–7</sup>

Health club and running addicts as well as other physically active girls and women are also vulnerable.<sup>4,8</sup> Most studies agree that all female athletes are potentially at risk.<sup>5,6</sup> Serious health consequences can and do occur.<sup>8–11</sup> and broader definitions of the triad elements include precursors of these entities. Disordered eating (DE) exists on a spectrum ranging from mild food restriction and/or purging behavior through to the frank eating disorders (ED) of anorexia nervosa (AN) and bulimia nervosa (BN).<sup>12</sup> Similarly, health problems associated with amenorrhea (or complete lack of menstrual cycles) can occur to a lesser extent with luteal phase dysfunction, anovulatory cycles, and oligomenorrhea.<sup>13</sup> Unless underlying causes of decreased bone mineral density (BMD) are addressed, there can be progression to osteopenia, and eventually to osteoporosis, a debilitating disease that may result in permanent disabilities and chronic pain.

### DISORDERED EATING

Disordered eating and even full-blown ED may begin simply as an athlete's desire to improve performance by losing weight, or perhaps inadvertently, by not keeping up with increased energy requirements for training and competition.<sup>14</sup> Both AN and BN have strict psychologic definitions.<sup>15</sup> Early detection of anorexic behaviors is crucial as additional weight loss may lead to further disturbance of body image.<sup>16</sup> Loss of menstrual cycles can also develop with less severe DE and weight control practices.<sup>17</sup>

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There are 2 subtypes of BN: purging and nonpurging. The latter, where excessive exercise is used to manage caloric intake, is a form frequently seen in athletes. An additional category of eating disorders not otherwise specified (EDNOS) was developed for patients who exhibit DE habits but do not meet all the diagnostic criteria for either AN or BN. Presently, EDNOS also includes binge-eating disorder, where normal “inappropriate compensatory behaviours characteristic of BN are not apparent.”<sup>14,15</sup> Female athletes may differ from other patients with classic ED in both psychologic makeup and observed manifestations. One prominent researcher has therefore proposed a distinct classification system: anorexia athletica<sup>18</sup> (Table 1). There are however, no studies directly comparing the occurrence of anorexia athletica to the more classic ED.

### Prevalence of Disordered Eating

The reported lifetime prevalence of frank AN and BN in females ranges from 0.5% to 3.7% and from 1.1% to 4.2%, respectively.<sup>18</sup> Athletes are thought to experience more problems with DE habits than the general population,<sup>20</sup> with elite athletes more at risk than nonelites.<sup>21</sup> Behaviors vary and probably fit better within the classification of EDNOS. Early studies described pathogenic weight control methods in young elite swimmers,<sup>22</sup> gymnasts,<sup>23</sup> and other female college athletes,<sup>24</sup> but lacked controls and validated survey instruments. A survey of 1445 Division I National Collegiate Athletic Association (NCAA) athletes using a 133-item questionnaire found the prevalence of actual ED (as per DSM-IV criteria) more conservative than earlier research but detected greater DE pathology (2.85% anorexic and 9.2% bulimic behaviors) in female than in male athletes.<sup>25</sup>

A recent meta-analysis of 34 studies<sup>20</sup> supported the suspicion that athletes (particularly college students) have more eating problems than controls, but fewer predilections for body

dissatisfaction. Dancers had significantly higher risk; however, unexpectedly, gymnasts, swimmers, and runners did not differ from nonathletes. Nonelite, nonlean sports participants seem somewhat protected with regards to ED measurements. Sundgot-Borgen and Larsen<sup>26,27</sup> and Sundgot-Borgen<sup>28</sup> have established risk factors and triggering events for the female athlete triad, documented more prevalent DE patterns in athletes,<sup>27,28</sup> and confirmed that clinical interview is needed for accurate diagnosis of an ED.<sup>18,21</sup> Aesthetic and leanness sports have been linked with higher DE,<sup>28,29</sup> while endurance<sup>26</sup> and weight class athletes<sup>30</sup> are also at increased risk.

### MENSTRUAL CYCLE DISTURBANCES

Amenorrhea can be *primary* (menarche has not yet occurred by age 14 in the absence of secondary sexual characteristics, or by 16 years of age in the presence of normal growth and secondary sexual characteristics), or *secondary* (menses have ceased at a point in time beyond establishment of regular menstrual cycles). Secondary amenorrhea is most often described as no menstrual cycles for 3 months, or fewer than 4 cycles per year.<sup>31</sup> Alternatively, the term has been used for the absence of at least 3 to 6 consecutive menstrual cycles after the establishment of menses,<sup>4</sup> or 1 or fewer menstrual periods per year (International Olympic Committee definition).

Hypothalamic amenorrhea can be a manifestation of AN, excessive exercise, psychologic stress, and debilitating disease,<sup>17</sup> but it is critical to exclude other medical reasons for menstrual dysfunction (Fig. 1). Frequently there is a constellation of contributing causes.<sup>32</sup> The major underlying factor appears to be inadequate energy availability, rather than the stress of exercising.<sup>33,34</sup> Detection is particularly important as follow-up may allow recognition of previously undetected ED.<sup>14</sup>

### Prevalence of Menstrual Dysfunction

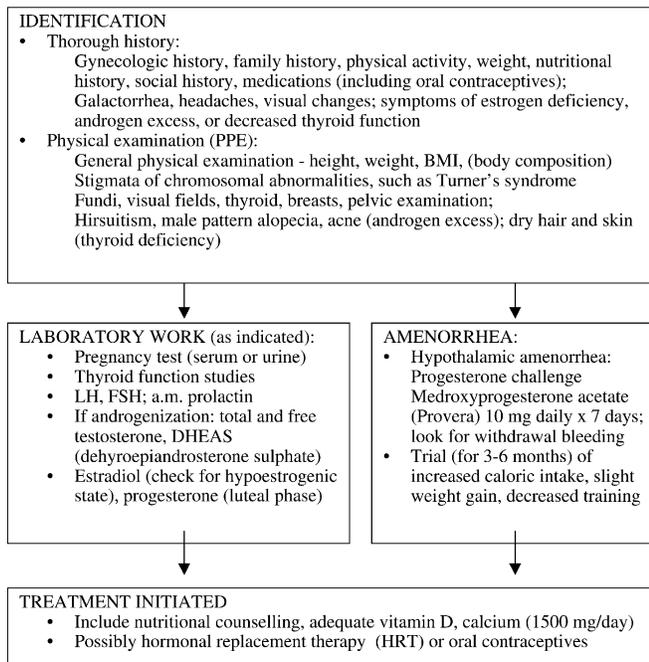
Current dogma holds that that menstrual dysfunction occurs more frequently in athletes—anywhere from 3.4% to 66%, as compared with 2% to 5% in nonathletic women,<sup>5</sup> but few well-designed studies corroborate this. The discrepancy in the literature reflects inconsistency in the definition of amenorrhea and selection bias, as well as underreporting, especially of the milder more subtle forms of menstrual dysfunction. Longer-term, prospective studies with more subjects and accurate hormonal documentation of menstrual cycle patterns are needed to sort this out.

### OSTEOPENIA/OSTEOPOROSIS

Peak bone mass is largely established by the end of adolescence or early adulthood and is subject to genetic, mechanical, hormonal, and nutritional factors.<sup>35,36</sup> Hypoestrogenism due to amenorrhea as well as hypercortisolemia from chronic stress can lead to loss of BMD.<sup>37</sup> More recently, studies have

**TABLE 1.** Anorexia Athletica

Female athletes must exhibit the following 5 criteria for positive diagnosis:
(1) Excessive fear of becoming obese
(2) Restriction of caloric intake
(3) Weight loss
(4) No medical disorder
(5) Gastrointestinal complaints
Additionally, 1 or more of the following criteria must be met:
(1) Disturbance in body image
(2) Compulsive exercising
(3) Binge eating
(4) Use of purging methods
(5) Delayed puberty
(6) Menstrual dysfunction
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**FIGURE 1.** Diagnosis and assessment of menstrual dysfunction. Reprinted with permission.<sup>7</sup>

explored the roles of changes in resting metabolic rate and regulatory hormones such as leptin and insulin-like growth factor 1.<sup>38,39</sup> Bone loss occurs in amenorrheic athletes at both axial and appendicular sites<sup>32,40,41</sup> and is not necessarily offset by the osteogenic effect of weight-bearing exercise. In addition, decreased caloric intake in this population does not include sufficient calcium and vitamin D.<sup>42</sup> (Milk and cheese products are viewed as sources of unwanted calories and fat and frequently avoided.) Diet restriction alone, even in the absence of menstrual dysfunction, may lead to low BMD.<sup>43</sup>

Abnormalities in BMD are likely underdiagnosed in the young athletic population, in part due to the lack of sensitive, easily available, and inexpensive screening methods. Dual energy x-ray absorptiometry scans remain the current gold standard but are rarely ordered unless the athlete presents with recurrent stress fractures or prolonged amenorrhea. Using the World Health Organization definitions of osteoporosis and osteopenia,<sup>44</sup> 2 studies<sup>40,41</sup> have reported a 10% to 13% occurrence of osteoporosis in small numbers of amenorrheic distance runners, while 2 others<sup>45,46</sup> did not find any osteoporotic women in their groups. It has been proposed that osteopenia be added as a component of the triad, as this condition alone doubles the normal fracture risk in postmenopausal women.<sup>47</sup>

**PREVALENCE OF THE TRIAD DISORDERS**

The prevalence of the female athlete triad disorders in combination remains speculative. A recent survey of high

school athletes<sup>48</sup> using the Eating Attitudes Test-26<sup>49</sup> concluded that participation in school-sponsored sports was not a significant predictor of disordered eating or secondary amenorrhea. Another study reported a 0% prevalence of military women exhibiting all 3 components simultaneously.<sup>45</sup> The most scientifically rigorous work to date compared 1620 athletes (660 females, 960 males) to 1696 controls (780 females, 916 males) for risk factors for the triad and all of its precursor conditions.<sup>50</sup> Of the final numbers analyzed, more athletes (13.5%) than controls (4.6%) met the diagnostic criteria for sub clinical and clinical ED's. A history of ED was reported in 20% of female and 80% of male athletes, somewhat higher than previously reported.<sup>20,28,30,51-53</sup> Obviously the information obtained is dependent on the research methodology, the population under study, and the screening tools.

**PREPARTICIPATION PHYSICAL EXAMINATION**

At the high school and collegiate levels, the preparticipation physical examination (PPE) offers an opportunity to screen (and initiate treatment) for components of the female athlete triad. Goals and objectives of this process have been well outlined elsewhere.<sup>54,55</sup> The PPE and the medical history form that precede it can be used to detect early signs and symptoms of the triad disorders,<sup>5,56</sup> build a good rapport with the athlete,<sup>57</sup> and document historical information for ongoing care.<sup>58</sup> It is also an occasion to screen for other risk-taking behaviors.<sup>59</sup>

The medical history form is considered the most important aspect of the examination.<sup>60</sup> It has been suggested that a separate section, consisting of both a gynecological and nutritional component,<sup>56</sup> be directed at the female athlete.<sup>61</sup> Although numerous models have been proposed, there is unfortunately no accepted standard and no questionnaires specifically developed to elucidate DE pathology. There are a number of validated ED questionnaires, such as the Eating Disorder Inventory (EDI and EDI-2),<sup>62</sup> the Eating Attitudes Test-26,<sup>49</sup> the Diagnostic Survey for Eating Disorders,<sup>63</sup> and the Bulimia Test,<sup>64</sup> but these have been developed for clinical populations of ED patients and are not necessarily accurate in athletes.

Straightforward questions concerning body image and DE may lead to underreporting.<sup>57</sup> Athletes may remain secretive for fear of being discovered by coaches, parents, and peers. Thus, there is clear need for a questionnaire or section of it that addresses specific issues of concern with the female athlete<sup>65</sup> without causing her to minimize or deny certain medical conditions.

Current PPE forms often include nonspecific questions about nutrition, menstruation, evidence of bone mineral loss, and body image. An Educational Monograph on Preparticipation Physical Evaluation<sup>66</sup> has been developed and endorsed by 5 major medical organizations in an attempt to establish uniform guidelines. The 1992 version was updated in 1996<sup>66</sup> and contains a few questions specific for female athletes. An

expert task force is currently further revising this monograph, although it is not presently known if any additional or more detailed questions will be added (Fields, Personal communication, December 2003).

Despite this document, there is presently no standardization of the PPE either in US colleges<sup>67,68</sup> or in Canadian universities.<sup>69,70</sup> Many use some or all of the existing form or modify it for their own purposes. A recent survey of NCAA Division 1 schools discovered that although 79% screen for menstrual dysfunction and 60% for ED, only a very small percentage use comprehensive or validated questionnaires (24% for menstrual dysfunction, less than 6% for ED).<sup>68</sup> Of the schools with screening methods for ED, only 4% employed a structured clinical interview. The remainder used self-developed questionnaires or other indirect measures,<sup>68</sup> further underscoring the need for standardization.

These findings were confirmed in a small study of Canadian Interuniversity Sport Universities.<sup>69</sup> Although 35 of 48 institutions (73%) responded to the initial survey in 2000, fewer than half of these targeted any part of the PPE form toward female athletes or made any effort to increase awareness of the triad and its associated health risks. A repeat survey 2 years later had a slightly higher response rate (80%) but demonstrated only a small increase in sensitivity to these issues.<sup>70</sup>

## MEDICAL HISTORY QUESTIONNAIRE

### Specific Questions

#### Eating Disorders

Thorough screening for ED should include a detailed and comprehensive questionnaire, followed by a structured clinical interview.<sup>68</sup> A food frequency questionnaire or dietary recall may pinpoint deficiencies in nutrition or caloric intake and any food or food group restrictions.<sup>57</sup> The services of a nutritionist or registered dietitian and computerized analyses of recorded dietary intake can augment the clinical history. It may also be useful to ask about bingeing or purging behaviors as well as any family history of DE or obesity or other pathology such as depression or substance abuse. Transparent questions such as, "How often do you self-induce vomit?" and, "To what degree do you have the impulse to vomit after meals?" may cause respondents to become defensive and perhaps deny certain conditions.<sup>8</sup> When asked, female athletes felt significantly more uncomfortable ( $P < 0.1$ ) than men about 2 PPE questions relating to eating habits: "Have you ever tried to control your weight by vomiting? Using diet pills? Laxatives?" and, "Have you ever been diagnosed as having an eating disorder?"<sup>65</sup>

The Preparticipation Physical Evaluation Task Force has recommended more subtle questions such as, "Do you want to weigh more or less than you do?" and, "Do you lose weight regularly to meet weight requirements for your sport?"<sup>55</sup> Open-ended queries like, "How much of an issue is weight for you?" or, "How do you rate your diet?" are an al-

ternate way of broaching this sometimes delicate subject. Several researchers advise obtaining a history of rapid increases or decreases in body weight as well as the athlete's perception of current body weight.<sup>60,71</sup> Other gender-neutral questions such as, "What do you consider your ideal weight? What do you do to control your weight? Do you worry about your weight?" may also be helpful in identifying both female and male athletes with pathogenic body weight control behavior.

Rome<sup>37</sup> suggests including maximum and minimum weight and height and times of their occurrence, as well as ideal body weight.<sup>37</sup> Other proposed items are degree of stress perceived with a missed workout, intensity of exercise, volume of training, level of competition, external stressors such as family structure, coping mechanisms and other risky behaviors, and eating attitudes and behaviors.

#### Menstrual Cycle

The menstrual cycle can be affected by factors such as body weight and composition, diet, hormone secretion, and physical or psychologic stress.<sup>72</sup> Questions concerning stress levels may or may not be informative. In 1 study, amenorrheic runners did not score differently than their eumenorrheic counterparts on formal psychologic testing but reported more subjective stress.<sup>73</sup> A detailed menstrual history questionnaire should include age of menarche, frequency and duration of periods and/or amenorrhea, and oral contraceptive use.<sup>68</sup> Oral contraceptives are frequently used by female athletes for birth control, but also for management of irregular menstrual cycles.<sup>74</sup> Their usage may actually mask signs and symptoms of menstrual dysfunction. Sample questions are, "When was your first menstrual period?" "When was your most recent menstrual period?" "How much time do you usually have from the start of one period to the start of another?" "How many periods have you had in the last year?" and, "What was the longest time between periods in the last year?"<sup>55,60,67</sup>

An abrupt onset of intense training, even relatively low-volume, may alter luteal function, leading to reproductive failure.<sup>32,34,75</sup> In 1 study, female participants of a 56-km ultramarathon were screened,<sup>32</sup> and then a second in-depth questionnaire for risk factors was administered to those with reported menstrual problems (Table 2). Most active women, however, should probably be deemed at risk for menstrual dysfunction, and another author suggests an in-depth review of menstrual history, dietary and exercise habits, and previous injuries (Table 3) for all female athletes.<sup>76</sup>

#### Osteoporosis

The majority of PPE questions in the literature are centered on DE or ED and menstrual dysfunction, especially amenorrhea. In fact, many risk factors for development of osteoporosis are identical or similar. As genetic predisposition accounts for greater than 70% of the variability in BMD, it is also advisable to screen for ethnic origin and a family history

**TABLE 2.** Risk Factors for Menstrual Dysfunction in Ultramarathoners

Body mass index less than 19 kg/m <sup>2</sup>
Menarche later than 13 years of age
Weekly training distance more than 100 km
10-km Race time less than 40 minutes
Fluctuation in body mass of more than 5 kg during the preceding year
Vegetarianism
Nulliparity
Use of pathogenic weight control methods (1 or more of the following: [1] a history of anorexia nervosa, [2] a history of bulimia, [3] diuretic abuse and/or occasional or regular use of appetite suppressants or laxatives)

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of osteoporosis. A history of stress fractures or fractures from minimal trauma may indicate underlying deficiencies in BMD.

**Use of a Supplementary Health Questionnaire for the Female Athlete**

Alternatively, a separate supplementary health questionnaire for female athletes has been proposed.<sup>77,78</sup> Theoretical advantages include not encumbering the standard form (making it longer, more difficult, or more confusing for male athletes to complete) and allowing the physician or person reviewing the forms to narrow in on female specific issues. One of several suggested formats<sup>77</sup> was administered to varsity athletes as part of a pilot study at the authors’ institution (Fig. 2). While it was helpful in identifying menstrual disturbances, it was less useful for DE habits. For example, answers to, “What have you eaten in the last 24 hours?” ranged from vague (“yes,” “lots,” “all meals required”) to very detailed (mentioning such things as cough drops and water). It is time-consuming to fill out, not very specific, and subject to poor recall (Rumball and Lebrun, Unpublished data, December 2001).

A recent publication outlines an interesting approach to a separate screening process for ED/DE among female collegiate athletes.<sup>79</sup> Using sound scientific statistical principles, this group devised a brief 18-item Physiologic Screening Test (consisting of 4 measurements and 14 items) that can be easily administered by someone with a physiologic background, such as an athletic trainer. This test will now need further evaluation for internal validity, response bias, content and criterion validity, and generalizability, but nevertheless represents an important step forward.

**PREPARTICIPATION PHYSICAL EXAMINATION**

At the very least, athletes with positive responses to medical history questions should be assessed further with a

**TABLE 3.** Important Components of History Taking in Female Athletes

Menstrual history
Age at menarche
Age at onset of breast development
Frequency and duration of periods
Date of last 3 periods
Use of oral contraceptives or other birth control methods
Obstetric history
Physical history
Age at initiation of training
Frequency and intensity of training
Relationships between changes in training intensity and changes in menstrual cycle
History of injury (especially stress fractures)
Dietary history
Adequacy of caloric, protein, and calcium intake
Stability and suitability of weight
Perceived body image
History of dieting, purging, and/or bingeing
Use of diet pills, laxatives, or diuretics
Family history
Mother’s age at menarche and menopause
Osteoporosis
Infertility
Thyroid disease
Review of systems
Headaches
Visual changes
Galactorrhea
Acne
Male pattern of hair growth

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physical examination, preferably by a physician or other suitably trained health professional. Height, weight, orthostatic blood pressure, and pulse should be evaluated.<sup>37</sup> The usage of various indices of body composition has been hotly debated, particularly if carried out by coaching staff.<sup>80</sup> Such measurements should never be used without concomitant access to nutritional counseling and other resources for weight management. Pelvic examinations are recommended in sexually active patients, in those with primary amenorrhea, or in patients beginning to use oral contraceptives.<sup>81</sup> Breast examinations are not performed as routinely as hernia checks for male athletes, but the PPE is an opportune time for education about regular breast self-examination. Further assessment is warranted for significant breast asymmetry and/or galactorrhea.

Athletes with significant or long-standing anorexia will have obvious physical findings, such as low body mass index and extreme thinness. Lanugo hair, sallow skin discoloration,

**Supplemental Health History Questionnaire for the Female Athlete**

1. How old were you when you had your first menstrual period?  
\_\_\_\_\_
2. How many periods have you had in the last 12 months?  
\_\_\_\_\_
3. Have you ever gone for more than 2 months without having a menstrual period?  
Yes / No
4. How long do your periods last?  
\_\_\_\_\_
5. When was your last menstrual period?  
\_\_\_\_\_
6. Do you take birth control pills or hormones? Yes / No
7. Have you ever been treated for anaemia? Yes / No
8. What have you eaten in the last 24 hours?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
9. Are there certain food groups you refuse to eat (i.e. meats, breads)?  
\_\_\_\_\_
10. Are you happy with your present weight? Yes / No
11. If not, what would you like to weigh?  
\_\_\_\_\_
12. Have you ever tried to control your weight with:  
\_\_\_\_ fasting? \_\_\_\_ vomiting? \_\_\_\_ using laxatives? \_\_\_\_ diuretics? \_\_\_\_ diet pills?
13. Do you have questions about healthy ways to control weight?  
\_\_\_\_\_

**FIGURE 2.** Supplemental health questionnaire for the female athlete. Reprinted with permission.<sup>77</sup>

dry skin and mucous membranes, and hair loss reflect the body's response to starvation, and hypotension, bradycardia, and hypothermia are also frequently present. Bulimic athletes, on the other hand, are often of normal body habitus and more difficult to identify. Calluses on the knuckles from repeated vomiting (Russell sign), erosion of the dental enamel or dental caries, salivary gland enlargement (chipmunk cheeks), and cardiomegaly (due to ipecac toxicity) should be specifically looked for.<sup>82</sup> Symptoms that can be elucidated on history include bloating, fullness, lethargy, heartburn, abdominal pain, and sore throat (from vomiting).<sup>82</sup> Reported or observed behavior such as excessive preoccupation with food, not eating with the team, frequent disappearance after meals, and so forth should be regarded as suspicious and followed up with extreme care and sensitivity.

Specific laboratory values need not necessarily be measured for diagnosis of AN as they have consistently found to be normal, especially in the early stages of the disease. When appropriate, however, electrolyte testing, liver function tests, magnesium, phosphorus, calcium, cholesterol, total protein, albumin, and urinalysis should be done. Bulimic patients may develop hypokalemia and a hypochloremic metabolic alkalosis from self-induced vomiting, or a metabolic alkalosis through loss of bicarbonate with laxative abuse.<sup>83,84</sup> Serum ferritin and hemoglobin measurements are often helpful, particularly in female endurance athletes, but again, even among NCAA institutions, there is no standardization for diagnosis or management.<sup>85</sup>

Ancillary laboratory studies should be predicated on the findings of specific signs and symptoms after a good history and physical examination.<sup>81</sup> A screening electrocardiogram is

suggested in an athlete with DE behaviors, especially in the presence of syncope, palpitations, or a resting heart rate less than 50 beats per minute or arrhythmias. Other indications include significant or suspected electrolyte abnormalities and weight loss greater than 20% to 30% below calculated ideal body weight.<sup>84</sup>

Estrogen status can be assessed through Tanner staging, evidence of breast atrophy, and vaginal changes.<sup>37</sup> In athletes with reported oligomenorrhea or amenorrhea, other underlying medical conditions must be excluded before ascribing the menstrual dysfunction to the athletic participation. Pregnancy should be ruled out by human chorionic gonadotropin testing. Workup of menstrual dysfunction is well outlined in other publications (Fig. 1).

Bone density studies are recommended for athletes with recurrent oligomenorrhea or amenorrhea of more than 6 to 12 months, with the express intention of using the results to bring forth change in treatment or patient compliance.<sup>83,84</sup> Softer indications include multiple or high-risk stress fractures, significant DE or ED behaviors, or fractures from low force trauma.

## CONCLUSIONS

The PPE should be welcomed as a standard of care, specifically for the female athlete. Pertinent questions on the medical history questionnaire, followed by focused physical examinations and select interviews, should distinguish early warning signs and symptoms of the female athlete triad disorders. Electronic and Internet-based versions of the PPE<sup>86</sup> are also likely the way of the future, allowing for easier compilation of standardized data as well as the ability to implement databases to study trends, risk factors, and results of follow-up and intervention strategies.

Much work still remains to be done. Future research should also incorporate sport specificity and ethnicity. In particular, queries to identify menstrual dysfunction are imperative as there is less likelihood of denial on the part of the athlete. Abnormal responses should then lead to further examination for DE and low BMD as well as other associated medical problems. The ultimate aim of the PPE, and the goal of the team physician, are the same for both male and female athletes: to facilitate optimal performance while ensuring the best possible health, both today and in the future. Further education of health professionals working with teams at recreational, high school, university, or professional levels will alleviate and prevent medical and orthopedic complications of the increased participation of women and girls in sporting activities.

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