Overtraining And Chronic Fatigue

Thomas M. Best, MD, PhD, FACSM
Learning Objectives

• Recognize common symptoms of overtraining in endurance athletes.
• Expand the differential diagnosis for underperforming endurance athletes.
• Apply available evidence to assist in the diagnosis and management of the underperforming endurance athlete.

I have no commercial, financial, or research relationships or interests within the past 12 months that affect my ability to provide a fair and balanced presentation for the proposed CME activity.
The Underperforming Athlete

Symptoms

• loss of endurance
• chronic fatigue
• high exercise heart rate
• low power
• frequent injury
• recurring illness
• loss of interest in exercise
• Irritability
• Poor appetite
• Increased incidence and duration of colds and infections

This sounds like over-training!
Different Patterns of Fatigue

• Fatigue on arising to face the day – depressed?
• Energetic in the morning but need afternoon nap – lingering Mono or hepatitis?
• Feel fine at rest all day; fatigue only on max exertion – mild anemia?
Physiological & Psychological Fatigue in Extreme Conditions

• Most recent review of OTS in elite athletes
• Agrees with prior reviews that answers are few
• Has Dr. Raglin’s training distress questionnaire:
  – Rate how you feel today
  – Hours sleep last night?
  – Sick in past week?
  – Rate how hard yesterday’s workout
  – Rate how your muscles feel
  – Score moods: friendly, worthless, miserable, helpful, bad-tempered, guilty, unworthy, peeved, cheerful, sad
Employs a structured psychological interview

Uses HEADS pneumonic, 1 question each about:
Home, Education/Employment, Activities/Alcohol, Drugs/Depression, Sexual Activity/Orientation

If positive response or hint in any area, pursue it

Also: What do you think is causing your fatigue?

Asks them to list 3 major stresses they have

Teaches them stress-coping skills; makes them active partners in their healthcare

This seems to help college students with fatigue
Clinical investigation of athletes with persistent fatigue and/or recurrent infections

Reid VL, et al

- 41 competitive athletes (22 male, 19 female) with persistent fatigue and/or recurrent infections

- 68% of athletes with conditions with potential to cause fatigue and/or recurrent infections
Conditions Identified

- Humoral Immune Deficiency
- Hypoglycemia
- Unresolved Infections
- EBV
- Allergic Disease
- Sleep Disorder
- Asthma
- EIB
- Upper Airway Dysfunction
- Thyroid Disease
- Low Serum Ferritin

% of Fatigued Athletes
Many Other Possibilities

- Infection (Lyme, EBV, Hepatitis, Respiratory)
- Allergies
- Iron Deficiency +/- Anemia
- Asthma
- Over-reaching/training
- Thyroid Disease
- Systemic Disease (i.e. cancer, leukemia)
- Diabetes
- Cardiovascular Problem (CAD, HCM, arrythmia)
- GI Problem (parasitic, IBD, malabsorption)
- Renal Disorders
- Muscle Dysfunction
- Autoimmune Disease
- Medication or side effect:
  - Antidepressants, antihistamines, anxiolytics, beta-blockers
- Postconcussive syndrome
- Pregnancy
- Substance abuse
- Inadequate nutrition
- Eating Disorder
- Performance anxiety
- Primary mood disorder: Anxiety, depression, adjustment
- Psychosocial stress
- Sleep Disorders
Do athletes get sick more often?

- EBV Reactivation
- Upper Respiratory Infections

Sydney 2000 Olympic Games
33% of consultations with the New Zealand medical team were for respiratory tract illnesses (excluding asthma)

exposure to airborne pathogens is increased due to the higher rate and depth of breathing
Incidence, Etiology, and Symptomatology of Upper Respiratory Illness in Elite Athletes

Spence et al MSSE 2007
Immunological Changes with Exercise

- Increased Neutrophil/Lymphocyte Ratio
- Decreased neutrophil activity (oxidative burst activity)
- Low blood leukocyte counts
- Low levels of salivary IgA
- Increases in inflammatory cytokines (IFN-a, TNF, IL-1, 2 and 6, CRP) that influence leukocyte functions
- Depressed plasma glutamine (required for optimal functioning of some leukocytes)
Causes or Triggers of CFS?
Shephard RJ, J Sports Med Phys Fit 45:381-92, 2005

- Overtraining (physical/emotional stress)
- Hormonal disorder (including HPA axis)
- Disorder of personality or affect
- Immune suppression or activation
- Chronic infection or nutritional deficit
- Physical deconditioning from any of the above
- Autonomic disorder from stress/deconditioning
- BUT: None of these is observed consistently
- Rx: Exercise, encouragement, psychotherapy
Overtraining Syndrome (OTS)
What is it?

“Unexplained underperformance, that is not resolved following at least two weeks of rest”
Definition of Overtraining and the Overtraining Syndrome

- **Overtraining:** A sharp increase in training volume, intensity, or frequency, up to near max capacity for the individual, that can be endured for only a short time (i.e., < 1 month).

- **Overtraining Syndrome:** The result of overtraining, a long-term fall in performance capacity, with RPE and fatigue increased and energy and mood decreased. (Also known as staleness.)
Overtraining Symptoms

- Poor, non-restorative sleep
- Anxiety, irritability, sadness, loss of enjoyment
- Loss of appetite
- Gastrointestinal Disturbance
- Recurrent Infection

- Muscle soreness and weakness
- Poor Performance with the same or increased training
- Increased morning HR
- Reduced motivation
- Increased exercise RPE
Overtraining Risk Factors

- Excess competition
- Attempts to follow regular training while ill or injured
- Attempts to make up for time lost to illness/injury by increased training
- Psychosocial Stressors
- Poor nutrition

• Too much volume
• Too much intensity
• Too little recovery

Not enough sleep!
How an athlete recovers is as important as how he/she trains!
What accounts for the observed symptoms?

- Immunosuppression?
- Neurohormonal imbalances?
- Chronic inflammation?

- No single objective physical or physiological marker that identifies OTS

- OTS more easily detected by decreases in physical performance and alteration in mood state
Psychological Markers

POMS – Profile of Mood State

tension, depression, confusion, anger, fatigue,

Vigor

Inversed “iceberg profile”
Immunological Markers

- McKinnon et al (2000) provided good argument that lowered immunity markers reflect acute exercise strain and not necessarily OTS.

Maybe T-lymphocyte CD4+/CD45RO+ expression

*Gabriel et al 1998*
Biochemical Markers

NOT confirmed useful in systematic studies

- Creatine Kinase (CK)
  - Marker for muscle damage and impaired ability for muscle glycogen restoration

- Urea, Uric Acid
  - Marker for protein breakdown
  - Influenced by diet and recent exercise

- Ammonia

- Reduced serum Glutamine
  - Influenced by diet, illness, recent exercise
Hormonal Markers

- Decreased **nocturnal urinary excretion of catecholamines**
  - (lowered intrinsic sympathetic activity)

- Blunted **cortisol** response to exercise
  - Salivary ELISA test available

- Decrease in free **testosterone:cortisol** ratio
  - Marker of “anabolic-catabolic balance”

- Increase in **IL-6**, other **cytokines**
  - Peripheral metabolic effects which inhibit healing
  - Central hypothalamic receptors which may contribute to mood disturbances seen in OTS

- **Leptin** and **IGF-1**
  - Play role in signaling energy balance and regulating cell growth and repair
Professional cyclists 10 min x 2 hill climb

? Overtrained

Testosterone: Cortisol Ratio
Influence of dietary carbohydrate
Lane et al., Eur J Appl Physiol 108:1125-31, 2010

• 20 athletic men
• Cycled hard, 1 hr., 3 days in a row
• Same calories, but 30% vs. 60% CHO
• fTC ratio fell only on low-CHO diet
• Cortisol rose and testosterone fell
Physiological Markers

- Ergometry
- Blood Lactate
- Ammonia
- Heart Rate
- Respiratory Exchange Rate
- Perception of Effort
Ergometry

- Sport specific
- Reduced VO$_2$max
- Reduced Max heart rate (3-5 beats/min)
- Increased HR at specific Power Output

- **BEST**: Reduced duration of sport specific, short-term, high-intensive effort at 110% anaerobic threshold
Blood Lactate

- Decreased lactate level in submaximal exercise
  - Low muscle glycogen levels
  - Decreased catecholamine response to exercise
If Suspect OTS
Reasonable Tests to Consider

- Blood lactate and plasma cortisol response to high intensity or incremental exercise
- Decreased nocturnal urinary excretion of catecholamines
- T-lymphocyte CD4+/CD45RO+ expression
Prevention is KEY!

- Training Log: track sleep quality, stress levels, fatigue, and muscle soreness, exercise duration/RPE
- Regular monitoring of max sport-specific performance
- Daily Analyses of Life-demands for Athletes (DALDA)
- Review Nutrition
- Organize training around principles of periodization

For Example:
- at least 1 day a week of complete rest
- 1 lighter training week per month
How Much Rest?

Overreaching
• 2-3 days complete rest
• Decrease training volume 30-40% for 1-2 week
• if no change then start thinking overtraining

Overtraining
• Rest 2 week or until symptoms start to improve
• Limit weekly training to 0-3 10-20” easy (50-60% VO²max) sessions
• Use cross-training as much as possible
• progress slowly, add 5 - 10“ per week, until an hour of exercise is well tolerated. 6 to 12 weeks is typically required before symptoms resolve.
The Informed Work-up
The Athlete with Fatigue

• Covers practical workup for common causes
  – Cardiac causes (rare; new A Fib?)
  – Pulmonary causes (esp. EIA)
  – Overtraining (multifactorial)
  – Eating disorders
  – Anemia (esp. iron deficiency)
  – Infections (esp. Mono)
  – Endocrine (esp. hypothyroid, type 1 DM)
  – Depression
Possible Approach

• History and Physical Exam
• Thorough ROS for subjective complaints
• Inventory of psychosocial stressors
• Assessment of nutritional practices
• Thorough review of training history, illnesses and injuries
Tests

Tier 1
- Complete Blood Count (CBC)
- Serum Iron, Ferritin, TIBC
- Glucose
- Electrolytes, BUN/Creatine
- EBV, CMV titers

Tier 2
- Creatine Kinase
- Liver Function Tests
- Serum B12, Folate
- Thyroid function test
- ESR
- Serum Immunoglobulins
- Hepatitis Serology
- ECG
- pre- and post-exercise flow loop spirometry test
- Allergy Screening
- Muscle Biopsy

History and Exam Guides this
Tests
Athlete/Coach Expectations

Fatigue < 7days!

Utility of Blood Tests

*Fallon 2006 and Du Toit 2005*

**Short Duration Fatigue (<3 weeks)**

Blood Tests do not contribute to diagnostic outcome
Bottom Line

• Be thorough with History and Physical
• OTS is a diagnosis of exclusion, but not unlikely either
• Tests will help verify what you suspect (not a blind endeavor!)
• Nutrition and psychological stressors may often be the answer
• Athletes want answers and can be demanding!
Acknowledgements

[Image of a person]
Thank-You!