CARE OF THE WILDERNESS ATHLETE

General Consideration in the History, Physical Examination, and Safety Determination

Jonathan Buchanan, MBA, MD; William Dexter, MD; Amy Powell, MD; Justin Wright, MD

From the Legacy Medical Group, Sports Medicine, Beaverton, Oregon (Dr Buchanan); the Maine Medical Center, Portland, Maine (Dr Dexter); the University of Utah, Salt Lake City, Utah (Dr Powell); and Texas Tech University, Lubbock, Texas (Dr Wright).

A thorough medical history is perhaps the most important aspect when evaluating an athlete before wilderness adventure. A physical examination should follow focusing on conditions that may be affected by changes in atmospheric pressure, extremes of temperature, or altitude. This information can then be used to make safety recommendations ensuring that adventurers are able to safely enjoy participation in the wilderness pursuit of their choice.

Key words: wilderness medicine, history, physical examination, safety determination

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Methods

The following databases were searched: MEDLINE and Cochrane Database of Systematic Reviews. Articles were limited to those printed in English between 1980 and May 2014. Key terms included preparticipation, physical examination, and wilderness sports. These terms were crossmatched with the term “safety.” The initial process yielded 14 published articles. The articles and references as well as several text books were reviewed for use in this article.

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Corresponding author: Jonathan Buchanan, MBA, MD, Legacy Medical Group, Beaverton, OR 97006 (e-mail: jon.buchanan@icloud.com).

HISTORY

Obtaining a good medical history is perhaps the most important aspect of determining an athlete’s ability to perform any sport. Studies evaluating the value a medical history demonstrate that 76% to 90% of the diagnoses are based on information obtained from the patient while taking a history.^{1–4} Indeed, the physical examination and additional studies should be a means of confirming diagnoses considered in the differential developed by a carefully obtained medical history.

For wilderness athletes in particular, this opportunity for a physician to assess potential risk of participation provides a rare chance to see a population who otherwise not be seen by a medical professional. According to the National Parks Service, the 51 National Parks in the United States reported approximately 61.9 million visitors in 2013, a considerable increase from the numbers seen even 10 years ago,⁵ suggesting a growing population interested in wilderness activities. Physiologic stresses inherent in wilderness activities such as activities at high altitude and low (diving) present unique challenges even for well trained athletes. A careful history is of great importance to identify findings that might put athletes at increased risk. Additionally, the ages traditionally seen visiting these national parks are mostly 18 to 44, those that are least likely, according to the CDC, to seek regular medical attention.⁶ Therefore, having one of these athletes in your office provides an opportunity to

obtain pertinent historical information and provide advice and general risk assessment to this population.

Many tools have been investigated as means for obtaining historical information from athletes. The most accepted questionnaire is titled the Pre-participation Physical Evaluation and is published in the fourth Edition of the PPE.⁷ The form may be valuable before wilderness and adventure events and is broken into History, Physical Examination, Clearance, and Athlete with Special Needs Supplemental forms. A supplemental evaluation form specific to wilderness and adventure activities is helpful when added to the traditional PPE form. Some schools have turned to an online format for obtaining information that is later reviewed with the athlete during the PPE. This option may be particularly appealing to the physician who has many PPEs to do in a limited amount of time as the electronic form can allow for greater efficiency in history-taking.

However, questions used to assess for high-risk activities, which are more commonly seen in this age group, should be asked in person in a private setting. These questions can assess the general health risks of this population independent of their activity in a wilderness setting. A teen screen (appendix B, page 160)⁷ can be used at the time of the examination and is designed to guide the examiner when making inquiries into high-risk behavior.

PHYSICAL EXAMINATION

Although the history is the most important element of the PPE, the physical examination can be used to confirm suspicions raised by the history or uncover diagnoses missed on the history-taking portion of the visit.

Each physical examination should include assessment of vital signs with blood pressure and visual acuity screening. Athletes with a history of pulmonary disease should also get resting pulse oximetry reading. Visual acuity using a Snellen chart (or equivalent) is particularly important in athletes involved in wilderness medicine as eyesight is critical to assess for potential dangers in an unpredictable environment.

A careful system-based examination should include screening for cardiovascular conditions listed in the fourth Edition Monograph on PPE.⁷ Conditions that may be affected by changes in atmospheric pressure and altitude will have to be carefully screened for. An example is undiagnosed heart failure. Preexisting heart failure can significantly increase the risk of high-altitude pulmonary edema. Findings of jugular venous distension, an S3 on cardiac auscultation, pedal edema, rales on pulmonary examination will warrant further workup before clearance is recommended. Additionally, right-

sided heart murmurs from conditions such as pulmonic stenosis, pulmonic insufficiency, and tricuspid regurgitation are more sensitive to changes in atmospheric pressure. Therefore, careful auscultation of the heart is critical.

Pulmonary conditions may be particularly susceptible to changes in altitude. The risk of exercise-induced bronchospasm (EIB) increases with a drop in atmospheric pressure, particularly in a patient who reports a history of respiratory symptoms after exposure to exercise, cold, dry, or emotional extremes. By definition, EIB is benign at rest; and therefore, signs of bronchospasm will not be auscultated on examination. Therefore, careful consideration of the use of accessory muscles and work of breathing should be carefully assessed at rest before ascent as small findings at sea level or low elevations can become life-threatening at high altitude. Athletes with asthma should be assessed for peak expiratory flow and should be taught to monitor changes with environmental and altitude exposures. Knowledge of common triggers, often identified in training, is helpful.

Examination of the abdomen is likely not going to be helpful except in patients who have preexisting conditions. When it is done, the abdominal examination should be performed with the patient in a supine position. Palpating for organomegaly or pulsatile masses is helpful in athletes with a known gastrointestinal diagnosis (Crohn's disease, ulcerative colitis, collagenous colitis, etc.). Palpation of the spleen is also indicated in athletes with symptoms suspicious for infectious mononucleosis.

The musculoskeletal examination should include sport-specific assessment of abilities. For example, the lead climber on a climbing should be evaluated for structural defects that may impair function, sufficient intrinsic hand strength, mobility, and fitness to allow for safe climbing.^{8,9} Even minor deficits in strength in a controlled environment can be amplified to potential dangerous conditions in the wilderness.

DETERMINING CLEARANCE

While traditional PPE forms provide varying levels of "clearance" for an athlete to participate in sports, what a physician is evaluating in the wilderness and adventure is PPE, the level of potential risk the athlete is taking or exposing others by participating in the sport. In the era of shared decision-making with patients, determination of "clearance" or final recommendations often becomes a 2-way conversation about the amount of risk the patient is willing to assume in participating in the activity and sometimes about the amount of allowed risk based on the event and other participants. This is particularly important with the wilderness athlete as certain risks are

Table 1. Classification of wilderness sports according to contact

<i>Contact or Collision</i>	<i>Limited Contact</i>	<i>Noncontact</i>
Diving	Adventure racing	Hiking
Extreme Sports	Canoeing or kayaking	Orienteering
Skiing, downhill	Horseback riding	Riflery
Ski jumping	Skiing	Hunting
Snow boarding	Cross-country	Scuba diving
Mountain climbing	Water	
Rock climbing	Windsurfing or surfing	
Mountain biking		

uncontrollable and may be considerably higher in extremes of weather, climate, and altitude.

When determining potential risk for injury in providing clearance, the physician should ask

1. Does the condition place the athlete at increased risk of injury?
2. Is there a risk to other athletes (eg, team mountaineering/ climbing, partners in SCUBA, etc.)?
3. Can the athlete participate with treatment (bracing, medications)?
4. Should activity be limited or discontinued altogether?

SAFETY CONSIDERATIONS

Making safety recommendations involves a careful balance between respecting the athletes' right to participate in an activity and the provider's responsibility to do no harm by clearing the athlete to participate. Determination of risk should include an assessment of sport-

individual and group-specific factors that may potentially increase risk of injury in wilderness sports.

SPORTS-SPECIFIC FACTORS

Recommendations made by the American Academy of Pediatrics Committee on Sports Medicine and Fitness prepared a list of sports and their classification based on risk, particularly according to the degree of contact or static/dynamic component. These have been adapted below with permission to inclusion of wilderness medicine-specific sports (Tables 1 and 2). The risk of environmental variables such as altitude, weather, and terrain should be factored into the evaluation.

ATHLETE-SPECIFIC FACTORS

The safety of the wilderness athlete may depend on diagnoses discovered during a careful history and physical examination. An exhaustive list of medical conditions and sports participation is available and has been adapted for wilderness and adventure sports from the AAP—Sports Committee on Sports Medicine and Fitness recommendations (Table 3). These conditions are also discussed in more detail elsewhere in this document.

Summary and Recommendations

Much information can be obtained in the history and physical examination process to help determine patient-specific factors that could affect wilderness sport. These factors can then be coupled with sport- and environment-specific factors to balance the athletes' right to participate while minimizing the possible harm to the participant, better ensuring safer wilderness activity.

Table 2. Classification of wilderness sport (Static vs Dynamic)

Increasing Static →	III	Water Skiing Rock Climbing	Mountain Climbing	Cycling Kayaking
	II	Diving Equestrian	Skiing Snow Boarding	Canoeing
	I	Rifle	Orienteering Hiking	Adventure Racing
		I	Hunting	Cross-country skiing
			II	III
	Increasing dynamic →			

Adapted from Mitchell JH, et al.¹⁰ Adaptations are themselves works protected by copyright. So in order to publish this adaptation, authorization must be obtained both from the owner of the copyright in the original work and from the owner of copyright in the translation or adaptation.

Table 3. Medical disorders and recommendations for clearance based on risk of participation in wilderness activity

<i>Condition</i>	<i>May Participate</i>
Bleeding disorder Explanation: contact/collision sports can rapidly lead to life-threatening conditions	Qualified yes
Cardiovascular disease	
Carditis Explanation: Carditis may result in sudden death with exertion	No
Left-ventricular heart failure Explanation: Hypoxia at altitude can lead to fluid shifts that can precipitate high-altitude pulmonary edema	Qualified yes
Hypertension Explanation: Those with severe hypertension (>99th percentile for age + 5 mm Hg) should avoid heavy lifting, particularly rock climbing as the entire body weight can be lifted by a single handhold	Qualified yes
Diabetes mellitus Explanation: Blood sugars should be well controlled and extra supplies kept on hand as athlete may be a long distance from medical attention in the wilderness	Yes
Diarrhea, infectious Explanation: Consideration for worsening diarrhea with drinking unfiltered water should be counseled in patients with preexisting diarrheal conditions as the risk for dehydration in the wilderness can be substantially increased	Yes
Eyes	
Functionally one-eyed athlete Explanation: Depth perception is limited in monocular athletes	Qualified yes
Fever Explanation: Fever can increase cardiopulmonary effort, an effect that can be exacerbated by hypoxic conditions in altitude	No
Gastrointestinal	
Malabsorption/short gut Explanation: Endurance wilderness events should be carefully planned with dietary modifications taken into consideration where food is scarce	Qualified yes
Heat illness Explanation: As heat illness may be exacerbated by extremes in temperature found in the wilderness, environmental conditions and weather reports should be carefully considered when considering safety	Qualified yes
Kidney, solitary Explanation: Protective equipment should be considered in contact sports	Qualified yes
Liver, enlarged Explanation: Protective equipment should be considered in contact sports	Qualified yes
Musculoskeletal disorder Explanation: Athlete needs individual assessment	Qualified yes
Obesity Explanation: Because of increased risk of heat illness, the obese individual needs careful acclimatization to temperature/altitude of the event before participation	Qualified yes
Pregnancy/postpartum Explanation: Activities with high risk of falling or abdominal trauma should be avoided. High altitude and diving may pose risk	Qualified yes
Respiratory conditions	
Pulmonary compromise, example: cystic fibrosis Explanation: Athlete needs individual assessment. Generally athletes can participate in all activities if oxygenation remains satisfactory with graded exercise testing	Qualified yes Yes
Asthma Explanation: With proper medications and education, athletes can perform in all activities. Recommend preparing athlete for exacerbation in hypoxic conditions at altitude	Qualified yes
Acute upper respiratory tract infection Explanation: Upper respiratory obstruction may affect pulmonary function at altitude, individual assessment is recommended	

Table 3 (continued)

Condition	May Participate
Seizure disorder	No
Explanation: Athletes with a known seizure disorder should not participate in SCUBA diving	
Explanation: Athletes with epilepsy should be cautioned when engaging in shooting sports (hunting, archery, target shooting)	Qualified yes
Skin infections	Qualified yes
Explanation: Because of risk for superinfection in wilderness environments, athletes with open wounds should not be cleared to participate in wilderness activities	
Spleen, enlarged	Qualified yes
Explanation: Protective equipment should be considered in contact sports	

References

1. Roshan M, Rao AP. A study on relative contributions of the history, physical examination and investigations in making medical diagnosis. *J Assoc Physicians India*. 2000;48:771–775.
2. Hampton JR, Harrison MJ, Mitchell JR, et al. Relative contributions of history-taking, physical examination, and laboratory investigation to diagnosis and management of medical outpatients. *Br Med J*. 1975;2:486–489.
3. Gruppen LD, Woolliscroft JO, Wolf FM. The contribution of different components of the clinical encounter in generating and eliminating diagnostic hypotheses. Research in medical education. *Proc Annu Conf Res Med Educ*. 1988;27:242–247.
4. Peterson MC, Holbrook JH, Von Hales D, et al. Contributions of the history, physical examination, and laboratory investigation in making medical diagnoses. *West J Med*. 1992;156:163–165.
5. National Park Service Public use Statistics Office. National park system visitation report. Available at: <https://irma.nps.gov/Stats/SSRSReports>. Accessed June 15, 2014.
6. Bernstein AB. Centers for Disease Control and Prevention (US). *Health Care in America: Trends in Utilization*. Hyattsville, MD: Center for Disease Control and Prevention, National Center for Health Statistics; 2003.
7. Bernhardt DT, Roberts WO. American Academy of Family Physicians. *American Academy of Pediatrics. PPE: Preparticipation Physical Evaluation*. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2010.
8. Green JG, Stannard SR. Active recovery strategies and handgrip performance in trained vs. untrained climbers. *J Strength Cond Res*. 2010;24:494–501.
9. Quaine F, Vigouroux L. Maximal resultant four fingertip force and fatigue of the extrinsic muscles of the hand in different sport climbing finger grips. *Int J Sports Med*. 2004;25:634–637.
10. Mitchell JH, Haskell W, Snell P, et al. Task force 8: classification of sports. *J Am Coll Cardiol*. 2005;45:1364–1367.