Letters to the Editor

In Response to “Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Frostbite”

To the Editor:

I would like to congratulate the authors of the Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Frostbite¹ for their review of the literature and for their recommendations. While most of their advice is excellent and is based on the best available evidence, there are a few controversial areas that might benefit from further illumination.

For example, the section on classification is confusing. The authors discuss the traditional classification of frostbite into 4 degrees, but state that this is useful only after rewarming and advanced imaging. This scheme has been cited in many review articles without a reference, as in a comprehensive review by Mills.² The citation the authors give in the guidelines is not to the 4-degree system they discuss but to a system proposed by Emmanuel Cauchy’s group in Chamonix that also happens to have 4 grades.³ These grades are based on the extent of the initial lesion immediately after rapid rewarming in warm water (day 0) and are used along with bone scanning to give a prognosis on day 2. The authors of the guidelines also state that they favor a simplified “2-tier classification scheme.” This scheme was proposed by Mills and Whaley in 1960.⁴ Since the guidelines define “superficial” frostbite as “no or minimal tissue loss, corresponding to 1st- and 2nd-degree injury” and “deep” as “deeper injury and anticipated tissue loss, corresponding to 3rd- and 4th-degree injury,”¹ it is hard to see how this scheme could be more useful in the field than the traditional classification on which it is based. Furthermore, the authors allow the possibility of tissue loss in “superficial” injury, but Mills states that there is tissue loss only in deep injury.²

The recommendations for prevention may be common sense, but some lack specific advice that one could follow. For example, how is one supposed to go about “minimizing effects of known diseases and or medications that may decrease perfusion”? The section on “maintaining peripheral perfusion,” in which this advice is found, has no references. While I agree with the authors that these should be strong recommendations (the “1” in “1C”), they cite no evidence, not even “low or very low quality evidence (the “C” in “1C”). Perhaps there should be a 4th level of evidence, “D—the opinions of the authors.” The section on “protection from the cold” also could have been more

specific. Since it is not always possible or desirable to avoid outdoor exposure to temperatures below -15°C , the authors might have mentioned the methods for “protecting skin from moisture, wind and cold.” The main method is to cover skin so that it is not exposed directly to the cold environment.

The advice not to thaw tissue that might refreeze in the field is sound but, as the authors point out, “most frostbite will thaw spontaneously.” This leaves the question of how to keep spontaneously thawed frostbite from refreezing in the field.

The recommendations for field treatment, as well as for immediate and post-thaw medical treatment, are generally well thought out. The evidence, although limited in many cases, is well presented. However, there are a few areas in which the recommendations are not supported by the evidence. For example, the only evidence the authors present in favor of the use of ibuprofen is a rabbit-ear study that used aspirin.⁵ While they present a theoretical rationale for the use of ibuprofen rather than aspirin, this does not merit even a weak evidence-based recommendation.

The most controversial area is the use of tPA. As the authors mention, there are 3 published series with a total of 118 patients in 2 studies,^{6,7} one abstract,⁸ and a case report⁹ that described the use of thrombolytics to treat frostbite in humans. The only randomized controlled study of thrombolytics compared 16 patients treated with iloprost to 16 patients treated with iloprost plus tPA.¹⁰ This study found no significant difference between the 2 groups. No digits were amputated in the iloprost group while a few were amputated in the iloprost plus tPA group. There are no prospective studies of iloprost alone compared to tPA alone. Further research will be necessary to determine if iloprost alone is as effective as tPA and whether there is additional benefit, no effect, or harm from the addition of tPA to iloprost. The authors clearly believe in the use of tPA, giving it a strong recommendation (1C), albeit based on “low-quality or very low quality evidence.” Their actual guideline seems to merit only a weak recommendation, since they say that use of tPA should be considered only “after a risk/benefit analysis” by “a physician with experience in the use of thrombolytics in frostbite.”

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In Reply to Dr Zafren

To the Editor:

We thank Dr Zafren for his insightful comments and questions. We acknowledge that the Frostbite Guidelines are not an exhaustive treatise, but are recommendations from a group of subject matter experts after review of the most relevant frostbite literature. They are intended to be concise so that practitioners can access pertinent clinical and treatment information quickly and easily.

Regarding Dr Zafren's remarks on frostbite classification, our committee discussed all published frostbite classification schemes. Many authors supported the classification system based on 4 degrees of anatomical extent of injury within the skin and underlying tissues. We regretfully and erroneously cited the 4 grades presented

by Cauchy¹ in this section. The panel also discussed the 4 grades presented by Cauchy and the 2-tier superficial/deep classification methods. Both the degree and grade descriptions are retrospective descriptions based on outcomes observed after rewarming and/or imaging. We describe the 4 anatomical degrees of injury to serve as a foundation when discussing specific therapies later in the article. For evaluation and treatment strategies, the expert committee consensus favored the 2-tier system that is less precise but probably more useful in a field setting. By classifying the injury as superficial or deep, the provider is guided in decisions such as the need for immediate evacuation, hospital vs field management, and consideration of advanced therapies such as thrombolysis. Dr Zafren rightly credits Mills et al² for suggesting this scheme decades ago, but since the expert group slightly changed the superficial definition to include the fact that some superficial injuries can include mild tissue loss, we did not directly reference the Mills definition. We thank Dr Zafren for making this point.

The frostbite prevention section is primarily expert opinion based upon years of empiric observations and experience by members of the committee, unsupported by high quality scientific studies. We agree that many wilderness medicine topics do not yet have solid scientific evidence; therefore, the American College of Chest Physicians (ACCP) evidence classification scheme is often challenging to apply. The panel discussed modifying the ACCP evidence classification scheme to accommodate this particular (eg, frostbite) limited evidence structure; however, it decided against this.

The questions raised by Dr Zafren regarding methods to maintain peripheral perfusion are rightfully the subject of a detailed chapter. We did not describe specific methods for "protecting skin from moisture, wind, and cold" because these strategies depend on numerous practical situational aspects. Stating that the main method is to "cover skin so that it is not directly exposed to the cold environment" does little to clarify. For instance, covering skin that is already wet in a severely cold and windy environment may offer scant protection. Ultimately, one must use an approach that takes into account available materials to protect skin, environmental conditions, concurrent acute and chronic medical conditions, medications, tobacco use, and nicotine-based therapies in order to satisfactorily answer this question. We encourage interested persons to seek additional information from comprehensive sources.

Recommendations given in the Frostbite Guidelines are based on many factors, in addition to strength of evidence, that include the ease of therapy and the balance of risks and benefits. Dr Zafren questions the 1C recommendation of ibuprofen and states that limited evidence