

New spray gel could help take the bite out of frostbite

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Mountaineers and winter sports enthusiasts know the dangers of frostbite—the tissue damage that can occur when extremities, such as the nose, ears, fingers and toes, are exposed to very cold temperatures.

However, it can be difficult to get treated quickly in remote, snowbound areas. Now, researchers reporting in *ACS Biomaterials Science & Engineering* have developed a convenient gel that could be sprayed onto frostbite injuries when they occur, helping wounds heal.

Frostbite causes fluids in the skin and underlying tissues to freeze and crystallize, resulting in inflammation, decreased blood flow and cell death. Extremities are the most affected areas because they are farther away from the body's core and already have reduced blood flow. If frostbite is not treated soon after the injury, it could lead to gangrene and amputation of the affected parts. Conventional treatments include immersing the body part in warm water, applying topical antibiotic creams or administering vasodilators and [anti-inflammatory drugs](#), but many of these are unavailable in isolated snowy areas, like mountaintops. Others, such as topical medications, could end up freezing themselves. Rahul Verma and colleagues at the Institute of Nano Science and Technology wanted to develop a cold-stable spray gel that could be administered on-site for the immediate treatment of frostbite injuries.

To develop their spray, the researchers packaged heparin, an anticoagulant that improves [blood flow](#) by reducing clotting and aiding in blood vessel repair, into liposomes. These lipid carriers helped deliver heparin deep inside the skin. They embedded the heparin-loaded liposomes in a sprayable hydrogel that also contained ibuprofen (a painkiller and anti-inflammatory drug) and [propylene glycol](#), which helped keep the spray from freezing at very low temperatures. When the researchers tested the spray gel on rats with frostbite, they found that the treatment completely healed the injuries within 14 days, whereas untreated injuries were only about 40% healed, and wounds treated with an antibiotic cream were about 80% healed. The spray reduced levels of inflammatory cytokines at the wound site and in the [blood circulation](#), which likely accelerated healing, the researchers say.

More information: Kalpesh Vaghasiya et al. Heparin-Encapsulated Metered-Dose Topical "Nano-Spray Gel" Liposomal Formulation Ensures Rapid On-Site Management of Frostbite Injury by Inflammatory Cytokines Scavenging, *ACS Biomaterials Science & Engineering* (2019). [DOI: 10.1021/acsbomaterials.9b01486](https://doi.org/10.1021/acsbomaterials.9b01486)

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