Venous embolism with oxygen following wound irrigation

Sir,

We wish to highlight a potential hazard of hydrogen peroxide (H₂O₂), which is commonly used to irrigate surgical wounds due to its antimicrobial, cleansing, and vasoconstrictive properties. Oxygen embolism has been reported after ingestion[1] or application of H₂O₂ in semi-closed surgical spaces.[2] The chance of embolism increases when it is applied under pressure to irrigate wounds with bleeding and friable tissue. Due to this reason, it is recommended that its use be strictly limited to open wounds where there is no possibility of gas entrapment.[3] We recently encountered a case where oxygen embolism occurred after irrigation of an open infected penile wound with hydrogen peroxide. It manifested as sudden fall in end-tidal carbon dioxide, and later absence of capnograph tracing. This was followed by hypotension, tachycardia, and desaturation. In the absence of any malfunction of anesthesia equipment, breathing circuit and the anesthesia monitor and its association with H₂O₂ irrigation, venous gas embolism due to oxygen was suspected. The patient responded to the usual treatment of gas embolism including Trendelenburg position, 100% oxygen, intravenous fluids and flooding the wound with saline. All parameters returned to normal within 5 minutes and the patient made an uneventful recovery.

Hydrogen peroxide is an oxidizer, which in the presence of organic material rapidly decomposes to water and oxygen. This exothermic reaction is catalyzed by enzyme catalase present abundantly in tissues and blood. The amount of oxygen liberated depends upon the volume and the concentration of H₂O₂ used. One ml of 3% H₂O₂ produces 10 ml of oxygen at standard temperature and pressure.[4] It is not clear whether the mechanism of gas embolism by H₂O₂ is by tissue disruption from high heat of dissociation with subsequent intravenous entry of oxygen bubbles, or it occurs due to intravenous absorption of liquid H₂O₂ with subsequent liberation of
Intraoperative venous gas embolism is a dreaded complication that can have catastrophic consequences. It produces the characteristic ‘Mill-Wheel’ murmur, but can be more accurately diagnosed by precordial Doppler or transthoracic and transesophageal echocardiography. However, they may not be immediately available and precious time may be lost in procuring them. The hypoxia and desaturation, which usually accompanies air or carbon dioxide embolism, may not be seen in the case of oxygen embolism as the oxygen microbubbles that mix with the venous blood in the right atrium and ventricle may produce mechanism of gas exchange similar to that seen in bubble type oxygenators used for cardio-pulmonary bypass machine. We feel that $\text{H}_2\text{O}_2$ is being used with little knowledge of its inherent risks. In view of possible oxygen embolism, $\text{H}_2\text{O}_2$ should be used cautiously and the patient should be monitored to detect early gas embolism.

**References**

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