Enhancement of nitric oxide release from nitrosyl hemoglobin and nitrosyl myoglobin by red/near infrared radiation: Potential role in cardioprotection

Nicole L. Lohr [a,c], Agnes Keszler [b], Phillip Pratt [a,d], Martin Bienengraber [a,d], David C. Warltier [a,d], Neil Hogg [b]

a Department of Anesthesiology, the Medical College of Wisconsin, MEB 4245, 8701 Watertown Plank Road, Milwaukee, Wisconsin 5 3226, USA
b Department of Biophysics, the Medical College of Wisconsin, Milwaukee Wisconsin, USA
c Department of Internal Medicine, the Medical College of Wisconsin, Milwaukee WI, USA
d Department of Pharmacology, the Medical College of Wisconsin, Milwaukee Wisconsin, USA

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Abstract

Nitric oxide is an important messenger in numerous biological processes, such as angiogenesis, hypoxic vasodilation, and cardioprotection. Although nitric oxide synthases (NOS) produce the bulk of NO, there is increasing interest in NOS independent generation of NO in vivo, particularly during hypoxia or anoxia, where low oxygen tensions limit NOS activity. Interventions that can increase NO bioavailability have significant therapeutic potential. The use of far red and near infrared light (R/NIR) can reduce infarct size, protect neurons from methanol toxicity, and stimulate angiogenesis. How R/NIR modulates these processes in vivo and in vitro is unknown, but it has been suggested that increases in NO levels are involved. In this study we examined if R/NIR light could facilitate the release of NO from nitrosyl heme proteins. In addition, we examined if R/NIR light could enhance the protective effects of nitrite on ischemia and reperfusion injury in the rabbit heart. We show both in purified systems and in myocardium that R/NIR light can decay nitrosyl hemes and release NO, and that this released NO may enhance the cardioprotective effects of nitrite. Thus, the photodissociation to NO and its synergistic effect with sodium nitrite may represent a noninvasive and site-specific means for increasing NO bioavailability.