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Extracorporeal shock waves: From lithotripsy to anti-inflammatory action by NO production

Sofia Mariotto [a,1], Elisabetta Cavalieri [a,1], Ernesto Amelio [b], Anna Rosa Ciampa [a], Alessandra Carcereri de Prati [a], Ernst Marlinghaus [c], Sergio Russo [d], Hisanori Suzuki [a,*]

[a] *Department of Neuroscience and Vision, Section of Biochemistry, University of Verona, Strada Le Grazie 8, 37134 Verona, Italy*
[b] *Shock Wave Unit, Hand Surgery Department, Policlinic G.B. Rossi, Largo L.A. Scuro 10, 37134 Verona, Italy*
[c] *Applied Research Center, Storz Medical AG, Kreuzlingen, Switzerland*
[d] *Department of Orthopaedic, Policlinic Federico II, University of Naples, Via S. Pansini 5, 80131 Naples, Italy*

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Abstract

At low energy density (0.03 mJ/mm^2), extracorporeal shock waves (ESW), originally developed for clinical lithotripsy, have successfully been used for anti-inflammatory treatment of soft tissues. Since nitric oxide plays a critical role in inflammation, we hypothesized for ESW to increase NO production in cells. Using human umbilical vein endothelial cells as a model system, we observed that ESW, at low energy density, rapidly induced an enhancement of eNOS activity. In these cells, eNOS activity is modulated by tyrosine- and serine-phosphorylation. ESW shifted eNOS to a less-tyrosine-phosphorylated form, without affecting its serine-phosphorylation, thus accounting for its rapid enzyme activation. LPS/IFN-γ treatment of human umbilical vein endothelial cells induced a rapid inhibition of eNOS activity and concomitant NF-κB activation which were efficiently counteracted by ESW treatment. Therefore, the present results indicate that the molecular mechanism of clinically observed anti-inflammatory action of ESW should include tyrosine-dephosphorylation of eNOS, a successive increase in NO production and suppression of NF-κB activation.

Keywords: Shock waves; Nitric oxide; Inflammation; HUVEC; Endothelial nitric oxide synthase