The real-time measurements of blood nitric oxide (NO) and hydrogen peroxide (H$_2$O$_2$) levels under acute hyperglycemia

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BACKGROUND: Vascular endothelial dysfunction is one of the earliest recognizable events under hyperglycemic conditions. It is characterized by decreased endothelium-derived nitric oxide (NO) and increased oxidative stress, such as superoxide and hydrogen peroxide (H$_2$O$_2$). However, the real-time changes in blood NO and H$_2$O$_2$ levels under acute hyperglycemia have not been evaluated.

METHODS: In this study, acute hyperglycemia (≥600 mg/dl) was induced by intravenous infusion of 50% D-glucose for three hours. During this time, blood NO or H$_2$O$_2$ levels were measured by inserting calibrated NO or H$_2$O$_2$ microsensors (100 µm diameter) into each femoral vein.

RESULTS: In the saline control group, NO slightly decreased (~20 nM) throughout the three hours of saline infusion (n=6). By contrast, acute hyperglycemia caused an initial NO increase, followed by a continuous reduction (~104 nM) by the end of infusion (p<0.01, n=4). On the other hand, H$_2$O$_2$ levels were reduced (~4.4 µM) following the three hours in the saline group. Moreover, there were significantly higher H$_2$O$_2$ levels throughout the majority of time points in the acute hyperglycemia group (p<0.05, n=5) compared to controls.

CONCLUSION: Acute hyperglycemia can slowly reduce the release of NO in blood associated with an increased H$_2$O$_2$ level.

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