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## STVARANJE AZOT-OKSIDA I METABOLIČKA OŠTEĆENJA ĆELIJA KOD LJUDI POVREĐENIH PRI BOMBARDOVANJU

*Marina Vučeljić[1], Gordana Žunić[2], Predrag Romić[3]*

*[1]Institut za medicinsku biohemiju*
*[2]Institut za medicinska istraživanja*
*[3]Klinika za anesteziologiju i intenzivnu terapiju, Vojnomedicinska akademija, Beograd*

*Kratak sadržaj:* Naša prethodna eksperimentalna istraživanja su ukazala da udarni talas dovodi do naglog rastezanja zidova krvnih sudova što aktivira endotelnu azot-oksid sintazu, pa se povećava sinteza azot-oksida (NO), verovatno kao odbrana od povećanja pritiska. Pretpostavka je da ova odbrambena reakcija može kasnije da uzrokuje povećano stvaranje slobodnih radikala kiseonika (SRK) i oštećenja ćelija. U ovom radu smo proveravali da li kod ljudi nastradalih od udarnog talasa dolazi do povećanog stvaranja NO i SRK uz razvoj oštećenja ćelija. U istraživanje su uključeni ranjenici (n =125), povređeni tokom bombardovanja (maj/juni, 1999. god). Kontrolna grupa su bili nepovređeni dobrovoljci (n =17). Ispitivana je dinamika promena NO, SRK, antioksidativnog sistema (SH), indikatora oštećenja ćelija i zavisnost ovih parametara od težine povrede. Dobijeni rezultati pokazuju da se kod ranjenika u prvih 10 dana posletraumatskog perioda, različitom dinamikom razvijaju direktna i metabolička oksidativno-osmotska oštećenja ćelija. Direktna oštećenja, uz prolazno povećanje nivoa intracelularnih enzima u serumu, se javljaju samo prvih dana nakon povrede i zavisna su od težine povrede. Oksidativna oštećenja, uz udvostručen nivo malondialdehida u plazmi, su bila slično izražena tokom ispitivanog perioda, a metaboličko-osmotski poremećaji su se razvijali postepeno, dostižući maksimalne vrednosti osmolalnog »gap«-a 6 8 dana nakon povrede. Indikatori ovih metaboličkih oštećenja ćelija nisu pokazali zavisnost od težine povrede. Samo u grupi teže povređenih je dobijeno značajno povećanje nivoa superoksidnog anjona uz sniženje SH. Nivoi nitrita/nitrata (finalnih metabolita NO), se nisu razlikovali od kontrolnih vrednosti, a povećan molarni odnos sa ukupnim proteinima i kreatininom ne isključuje mogućnost povećanog stvaranja NO uz intenziviranje drugih metaboličkih puteva i/ili transportnih formi ovog medijatora u blast povredama.

*Ključne reči:* blast povreda, azot-oksid, oštećenja ćelija

## NITRIC OXIDE FORMATION AND METABOLIC CELLULAR DAMAGES IN BOMBING CASUALTIES

*Marina Vučeljić[1], Gordana Žunić[2], Predrag Romić[3]*

*[1]Institute of Biochemistry*
*[2]Institute of Medical Research*
*[3]Department of Anaesthesiology and Intensive Therapy, Military Medical Academy, Belgrade*

*Summary:* Our recent experimental studies have suggested that a blast wave causes stretching effects on blood vessels, which activate endothelial nitric oxide synthesis and increase nitric oxide (NO) production, probably as a defense response to the overpressure action. It is supposed that this action initiates free oxygen radicals (FOR) formation and concomitantly metabolic cellular damages. In this study we examined whether increased NO and FOR formations associated with metabolic cell damages occur in blasted casualties, as well. Bombing casualties (n=125) injured during bombing (May June 1999) were studied. Uninjured volunteers (n=17) were the controls. The time course alterations in plasma NO and FOR, antioxidative status (SH) and indicators of cell damages and their dependence on injury severity score, were studied. The obtained results suggested the development of both direct and metabolic oxidative-osmotic cell damages in the examined casualties, with different dynamics of alterations within the first 10 posttraumatic days. Direct damages, followed by transient increase in serum intracellular enzymes activities during only the first days after injury, were dependent on injury severity. Oxidative damages, reflected by doubled levels of plasma malondialdehyde, were similar throughout the examined period, while metabolic-osmotic disturbances gradually developed, reaching maximal values of osmolality »gap« 6 to 8 days after injury. The indicators of this metabolic cellular damage were not dependent on the injury severity score. Only in the group of more severely injured subjects the increased superoxide anion and the decreased SH levels occurred. Nitrite/nitrate levels (final NO metabolites) were not statistically different from the control values, but the increased molar ratio to total protein and creatinine did not exclude the possibility of the increased NO production, associated with intensified other metabolic pathways and/or transport forms of this mediator following blast injuries.

*Key words:* blast injury, nitric oxide, cell damages.