Equipment Testing

The Impact of Armor Strength on Lung Injury In Open-field Blasts

Researchers at U.S. Army Institute of Surgical Research (USAISR; Fort Sam Houston, Texas) in collaboration with the Institute de Recherche Biomedical des Armees (IRBA; France) investigated the impact of open-field blast exposure on lung injury and the protection provided by armor of different strength using a pig blast model. Anesthetized swine with soft body armor, hard body armor, or no armor were subjected to open-field blast exposure. Blood samples were collected at baseline, 30 minutes, and 60 minutes after blast exposure. Lungs were collected 60 minutes post blast exposure for analysis.

After exposure to open-field blast, lung tissue from swine either without protection or with soft body armor had significant vessel swelling and hemorrhaging. Interestingly, lung tissue from pigs not exposed to blast and those exposed to blast and protected by hard body armor exhibited normal tissue structure. In all animals exposed to open-field blast, proinflammatory proteins interleukin (IL)-1beta and IL-18 were detected at significantly higher levels in the blood in comparison to animals not exposed to blast; this suggests that isolated open-field blast exposure induces an acute and distinct expression profile of inflammatory proteins. Proinflammatory proteins TGF-beta 1 and TGF-beta 2 were higher in the plasma of both unprotected animals and animals with soft body armor exposed to blast. However, animals with hard armor protection did not have increased levels of TGF-beta 1 and TGF-beta 2 in plasma, implying that hard body armor protection not only prevents pulmonary injury, but also attenuates the acute release of inflammatory proteins due to tissue damage caused by blast exposure.

These findings show that armor strength impacts the extent of lung injury following open-field blast exposure in part through attenuation of the inflammatory response, providing support for the importance of resilient armor against blast injury.

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