ANALYSIS OF FIELD TEST RESULTS OF THE BIOPHYSICAL RESPONSE OF SHEEP TO BLAST LOADING

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Blast lung is characterized by intrapulmonary hemorrhages associated with areas which are adjacent to the „firm“ structures of the thorax. Severe blast lung shows diffuse intrapulmonary hemorrhage, laceration of the parenchyma and pleura with hemorrhage into the alveoli and airways. Primary blast injury occurs as a result of a pressure wave acting directly on the body surface. the resultant force loading is distributed in a complex manner over the entire body surface. The mechanism by which the body responds to this load and the lung becomes injured are not clearly understood. A joint Walter Reed Army Institute of Research and Los Alamos National Laboratory field study was conducted to study the basic biomechanical events in a large animal model (sheep). Our aim was to resolve the relationship between freefield overpressure, loading, chest wall acceleration, trans parenchymal pressure, and injury. Freefield pressure time histories were measured from 4 levels of occupational and 2 injury levels of blast. Loading was obtained from a 12 in diameter, 30 in long test module in a horizontal configuration on which 4 pressure transducers were installed circumferentially. This approximated the size and orientation of the test animals. Under appropriate anesthesia, accelerometers were surgically fixed to the seventh rib, 4 pressure sensors were inserted via a tracheostomy into the distal airways, and 1 sensor was placed into the esophagus. These allowed evaluation of chest wall motion and intrathoracic pressures. All pressure sensors were placed approximately in the plane of the seventh thoracic vertebra. Data are analyzed for shot-to-shot and ani- mal-to-animal variation, chest wall maximum acceleration, chest wall displacement, peak intrathoracic pressure, and injury. Intrathoracic pressure measurements are interpreted in terms of the propagation of compression/tension waves through the parenchyma. Pathologic findings are correlated with the physical measurements. This data contributes to our understanding of the biophysical consequences of blast exposure and is being used in the validation of computer models of thoracic response to blast.