World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:13, No:05, 2019

A Preliminary Study on the Effects of Lung Impact on Ballistic Thoracic Trauma

Authors : Amy Pullen, Samantha Rodrigues, David Kieser, Brian Shaw

Abstract : The aim of the study was to determine if a projectile interacting with the lungs increases the severity of injury in comparison to a projectile interacting with the ribs or intercostal muscle. This comparative study employed a 10% gelatine based model with either porcine ribs or balloons embedded to represent a lung. Four sample groups containing five samples were evaluated; these were control (plain gel), intercostal impact, rib impact, and lung impact. Two ammunition natures were evaluated at a range of 10m; these were 5.56x45mm and 7.62x51mm. Aspects of projectile behavior were quantified including exiting projectile weight, location of yawing, projectile fragmentation and distribution, location and area of the temporary cavity, permanent cavity formation, and overall energy deposition. Major findings included the cavity showing a higher percentage of the projectile weight exit the block than the intercostal and ribs, but similar to the control for the 5.56mm ammunition. However, for the 7.62mm ammunition, the lung was shown to have a higher percentage of the projectile weight exit the block than the control, intercostal and ribs. The total weight of projectile fragments as a function of penetration depth revealed large fluctuations and significant intra-group variation for both ammunition natures. Despite the lack of a clear trend, both plots show that the lung leads to greater projectile fragments exiting the model. The lung was shown to have a later center of the temporary cavity than the control, intercostal and ribs for both ammunition types. It was also shown to have a similar temporary cavity volume to the control, intercostal and ribs for the 5.56mm ammunition and a similar temporary cavity to the intercostal for the 7.62mm ammunition The lung was shown to leave a similar projectile tract than the control, intercostal and ribs for both ammunition types. It was also shown to have larger shear planes than the control and the intercostal, but similar to the ribs for the 5.56mm ammunition, whereas it was shown to have smaller shear planes than the control but similar shear planes to the intercostal and ribs for the 7.62mm ammunition. The lung was shown to have less energy deposited than the control, intercostal and ribs for both ammunition types. This comparative study provides insights into the influence of the lungs on thoracic gunshot trauma. It indicates that the lungs limits projectile deformation and causes a later onset of yawing and subsequently limits the energy deposited along the wound tract creating a deeper and smaller cavity. This suggests that lung impact creates an altered pattern of local energy deposition within the target which will affect the severity of trauma.

Keywords : ballistics, lung, trauma, wounding
Conference Title : ICB 2019 : International Conference on Ballistics
Conference Location : Sydney, Australia
Conference Dates : May 16-17, 2019