

Biomechanical Analysis of Pulmonary Contusion in Motor Vehicle Crash Victims: A Crash Injury Research and Engineering Network (CIREN) Study

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ABSTRACT

Pulmonary contusion is the most common thoracic soft tissue injury encountered in motor vehicle crashes and is seen in 10-17% of all trauma admissions. This study presents a biomechanical and radiological analysis with the goal of quantifying pulmonary contusion resulting from motor vehicle crashes in order to illustrate the relationships between crash characteristics, contusion severity, and patient outcome. The 20 patients selected for this study were involved in motor vehicle crashes and subsequently enrolled in the Crash Injury and Research Engineering Network (CIREN) program at Wake Forest University Baptist Medical Center. Demographic data, sustained injuries, and crash characteristics were obtained through medical records and the CIREN database for all patients in the study. For each patient, the first chest computed tomography (CT) scan following the crash was segmented using a semi-automated approach to obtain volumes of trapped air, total lung, healthy lung, and high attenuation lung representing contused tissue. Three-dimensional models of the healthy and high attenuation lung tissue were created for each patient. The semi-automated method employed in this study found the average amount of high attenuation lung tissue to be 12% of the total chest volume in the 20 patients enrolled in study. Rib fractures were present in 75% of patients and a substantial proportion of patients with pulmonary contusion injuries were involved in near side collisions. The near side door contacted the thorax in 40% of the patients and was identified as the most commonly involved component in pulmonary contusion injuries for this study. The methodology and analysis presented in this study between crash characteristics, pulmonary contusion severity, and patient outcome are data that may contribute to future improvements in motor vehicle safety.