Intravascular Pressure as a Predictor of Injury Severity in Blunt Hepatic Trauma

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ABSTRACT

The liver is one of the most frequently injured abdominal organs in motor vehicle collisions, and blunt hepatic trauma is associated with a high rate of morbidity and mortality.[1,2] Early research on blunt hepatic trauma suggests that in high velocity impacts, rapidly increasing internal fluid pressure may play a role in causing hepatic injury.[3] However, this potential mechanism of injury has received little attention in previous biomechanical studies. The aim of the present study is to investigate the relationship between intravascular pressure changes and injury severity in blunt impacts to excised porcine and unembalmed human liver specimens. Impact was applied at varying energies using a drop-tower experimental technique. Specimens were instrumented with miniature pressure sensors in the hepatic veins and perfused with normal saline at physiologic temperature and pressures during testing. CT scans of the instrumented specimens were obtained in order to determine the locations of the pressure sensors in a three-dimensional coordinate system. Injury severity scores were assigned according to the Abbreviated Injury Scale (AIS) system.[4] The relationship between peak intravascular pressure and AIS score was analyzed using logistic regression. Results indicate a strong correlation between peak internal pressure and injury severity (Nagelkerke's R-square=0.86). A search of the Crash Injury Research and Engineering Network (CIREN) in-depth field accident database revealed that the experimentally-induced injuries produced in this model are consistent with liver injuries observed in motor vehicle accident victims. The findings of this study could contribute to the development of a finite element model of the human abdomen that can be used to assess the risk of abdominal injury for motor vehicle accident victims.

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