IDA | Research Insights

February 2018

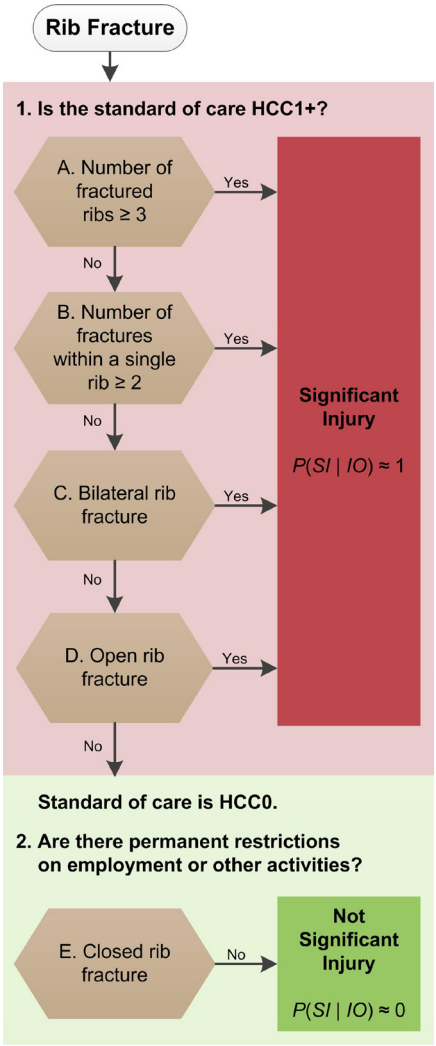
Significance of Rib Fractures from Blunt-Impact Non-Lethal Weapons

Allison L. King (aking@ida.org), Shelley M. Cazares (scazares@ida.org), Michael S. Finnin (mfinnin@ida.org), Jenny R. Holzer (jholzer@ida.org), and Corinne M. Kramer (ckramer@ida.org)

Blunt-impact munitions are a type of non-lethal weapon (NLW) that law enforcement and military personnel around the world use primarily for crowd control. Although blunt-impact munitions are designed to induce pain or muscle spasm at the point of impact, they have the potential to cause more serious injury. IDA researchers ascertained the significance of possible rib injuries from blunt-force trauma to the human thoracic cage from rubber, plastic, or beanbag munitions that are developed as NLWs for the U.S. military. The purpose was to improve NLW developers' ability to accurately quantify their weapons' risk of causing a significant injury.

Source: Combined Tactical Systems (CTS). A steel slab exterior door with polyurethane core was the target in a demonstration of damage caused by 40-mm rubber rounds delivered by single- and multi-launchers with 5-inch cylinders. For details, see IDA YouTube.

Risk of significant injury (RSI) is determined by multiplying the probability that a specific injury will occur by the probability that the injury will be significant if it occurs. This is expressed as $RSI = P(IO) \times P(SI \mid IO)$. Our analysis focuses on the second metric. We approximate $P(SI \mid IO)$ as either 1 (significant) or 0 (not significant).



Department of Defense (DoD) policy defines a significant injury as one that leads to death or permanent injury or that requires medical treatment with a Health Care Capability (HCC) index of 1 or higher (HCC1+). According to DoD Instruction 3200.19 (May 17, 2012), permanent injury is "physical damage to a person that permanently impairs physiological function and restricts the employment or other activities of that person for the rest of his or her life." The three levels of the HCC index measure the increasingly complex medical treatment necessary for a particular injury. HCC0 requires "self-aid, buddy-aid, [or] combat lifesaver skills." HCC1 requires "resuscitation, stabilization, [or] emergency care." HCC2 requires "advanced emergency, surgical, [or] ancillary services." Using these standards of care, we developed a decision flow diagram to assess the significance of different types of rib fracture (left). A rib fracture type is significant if it requires an HCC1+ standard of care or results in permanent injury, and it is not significant if it requires an HCC0 standard of care and has low likelihood of causing permanent injury.

This research supports development of a quantitative model that specifies the attributes of an injury that determine significance, allowing for more accurate and precise RSI estimates. These improved estimates would help NLW developers focus their efforts on concepts that are least likely to result in significant injury.

Based on IDA Document D-8277, *Significance of Rib Fractures Potentially Caused by Blunt-Impact Non-Lethal Weapons*, S. M. Cazares, M. S. Finnin, J. R. Holzer, A. L. King, and C. M. Kramer, March 2017. Research sponsored by the DoD Joint Non-Lethal Weapons Directorate.

NS D-8956

4850 Mark Center Drive
Alexandria, VA 22311-1882
ida.org