Blast injury

A Blast injury is a complex type of physical trauma resulting from direct or indirect exposure to an explosion.

Blast injuries occur with the detonation of high-order explosives as well as the deflagration of low order explosives. These injuries are compounded when the explosion occurs in a confined space.

Blast traumatic brain injury

see Blast traumatic brain injury.

Secondary blast injuries may result from high-velocity projectile fragments which ultimately increase medical costs, reduce active work time, and decrease quality of life. The role of skin penetration requires more investigation in energy absorption and surface mechanics for implementation in computational ballistic models. High-speed ballistic penetration studies have not considered penetrating and non-penetrating biomechanical properties of the skin, including radial wave displacement, resultant surface wave speed, or projectile material influence. A helium-pressurized launcher was used to accelerate 3/8″ (9.525 mm) diameter spherical projectiles toward seventeen whole porcine legs from seven pigs (39.53 ± 7.28 kg) at projectile velocities below and above V50. Projectiles included a mix of materials: stainless steel (n = 26), Si3N4 (n = 24), and acetal plastic (n = 24). Tracker video analysis software was used to determine projectile velocity at impact from the perpendicular view and motion of the tissue displacement wave from the in-line view. Average radial wave displacement and surface wave speed were calculated for each projectile material and categorized by penetrating or non-penetrating impacts. Two-sample t-tests determined that non-penetrating projectiles resulted in significantly faster surface wave speeds in porcine skin for stainless steel ($p = 0.002$), plastic ($p = 0.004$), and Si3N4 ball bearings ($p = 0.014$), while ANOVA determined significant differences in radial wave displacement and surface wave speed between projectile materials. Surface wave speed was used to quantify mechanical properties of the skin including elastic modulus, shear modulus, and bulk modulus during ballistic impact, which may be implemented to simulate accurate deformation behavior in computational impact models [1)].

1)
LeSueur J, Hampton C, Koser J, Chirvi S, Pintar FA. Surface wave analysis of the skin for penetrating and non-penetrating projectile impact in porcine legs. Forensic Sci Med Pathol. 2022 Sep 14. doi: 10.1007/s12024-022-00521-1. Epub ahead of print. PMID: 36100841.