BLAST

As already discussed, blast has become the predominant mechanism of injury in recent conflicts. Unfortunately , terror ist attacks within urban centres mean that these injuries are increasingly encountered within civilian practice. While explosives come in many forms and their e ff ects vary as a result, fundamental principles underlie all blast events. An explosiv e may be defined as ‘a substance that can made to undergo a rapid chemical reaction that will transform a liquid or solid into gas, liberating a large amount of ener The explosive properties of such a material are determined Frederick Gerard Friedlander , 1917–2001, Austrian mathematician, lived and worked in the UK from 1934. at which energy is expelled. Low explosives react by a pro - y the reaction is propagated by cess called deflagration, wher eb flame passing through the material at a rate significantly slower than the speed of sound. They are made up of a combusti - ble material and an accompanying oxidant. Low explosives include gunpowder, gasoline and pyrotechnics such as fire - works and flares. Low explosives more commonly cause bur ns than typical blast injuries and will not be discussed further. In contrast, high explosives degrade via detonation. Shock - waves are passed through the material at supersonic speeds and the resultant energy is expelled a t very high rates. High explosives include plastic e xplosive and trinitrotoluene (TNT). The input of a relatively small amount of energy results in the production of a very large volume of gas, at high speed and pressure. The outward expansion causes a wave of compressed air that moves away from the point of detonation at supersonic speeds and in a uniform sphere (within a free field). The change in surrounding pressure is described as the blast overpressure. Following detonation within a free field, there is a near instantaneous pressure rise, which falls expo - nentially . This is classically described by the Friedlander curve (Figure 34.4). This characteristic pressure peak is only seen during a truly free (almost theoretical) scenario. Enclosure of the blast or reflection of blast waves b y people, vehicles or buildings is likely to change the overpressure profile such that high pressures may be sustained for longer periods and have a greater propensity to cause injury . For this reason, blasts within enclosed spaces are notable for causing a greater range and severity of injury . In addition to expanding gases, detonation of explosives may result in the expulsion of fragments. These fragments may be part of a device casing, separate material deliberately added with the intention of fragmentation or environmental material flung by the blast. Blast winds are generated by the displacement of surround - ing air. The direction of these winds may change as the blast - - be 21 gy’.

Blast overpressure Quasi-instantaneous pressure rise Pressure Positive pressure phase Negative pressure phase Atmospheric pressure Time Figure 34.4 Theoretical blast overpressure changes within a free /f_i eld.

creates a partial vacuum. BLAST

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