Blast injury

Blast injury is a syndrome (set of symptoms) resulting from an explosion. This is an injury caused by the impact of a pressure/shock wave on the human body. The essence of an explosion is a rapid transformation of energy (chemical, nuclear, etc.) which leads to a rapid increase in temperature and gas pressure at the site of the explosion and the expansion of the explosion waste products into the surroundings.

Injuries

The energy of a propagating shock wave is released whenever it passes through an acoustic impedance interface. Typically at the interface *soft tissue - air* or *soft tissue - bone*. The extent of injury depends on the intensity and duration of exposure.

Primary injuries

- Caused by a pressure wave (gas, liquid, solid substance).
- They occur most often when a person is close to the source of the explosion (land mine).
- Most effected are organs that contain air (first middle ear injury manifests itself, then the lungs (contusion, bleeding, alveoli damage), the intestine (injury manifests itself after several hours), ...)
- The brain is also traumatized.
- A primary injury is characterized by the absence of external injuries so the severity and extent of the injuries are often unrecognized or underestimated.

Secondary injuries

- The remains of objects that are thrown into the surroundings by the explosion play their role here.
- This includes penetrating and perforating trauma with visible bleeding or bleeding into internal organs. The presence of shrapnels significantly complicates treatment.

Tertiary injuries

- This is an injury to the extent of amputation caused by a strong hit of air or the impact of the human body against an obstacle. Often accompanied by penetrating injuries.

Indirect injuries

- Arising in a different context (e.g. building collapses, being trampled by a crowd), burns, crush syndrome.

Distance from the epicenter

1. epicenter - devastating, fatal injuries
2. primary zone – pressure wave effecting the middle ear or lungs

- in an **open space:** the shock wave propagates *spherically*, *reflects* off the ground and standing objects; *overpressure* is followed by a wave of *underpressure* and rapid *normalization* of pressure ratios
- in a **closed space:** the pressure wave is *reflected* and the overpressure lasts longer, the proportion of primary injuries increases; on the contrary, the proportion of shrapnel injuries decreases due to obstacles (e.g. bus seats)
- **immersion blast syndrome** (propagation of a pressure wave in a liquid)
  - especially abdominal contusion with intestine ruptures, eyeball contusions
- **solid blast syndrome** (propagation of a pressure wave in a solid environment)
  - multiple fractures of the limbs (for those who were standing at the time of the explosion), pelvis and spine (for those who were sitting)

Injury to individual organs

1. **ear** – perforation of the eardrum with possible hearing damage
2. **lungs** – rupture of the alveolocapillary membrane accompanied by bleeding and air embolization into the arteries of the brain and heart; emphysema and pneumothorax can also occur
3. **heart** – the injury may subsequently be accompanied by heart rhythm disorders
4. **GIT** – contusion or perforation of the intestinal wall
5. **limbs** – amputation of peripheral parts of limbs
6. **muscles** - crush syndrome and subsequent rhabdomyolysis

Treatment of injured in the explosion

- **surgical treatment** – where indicated (fractures, intestinal ruptures, etc.)
- otherwise **conservative** procedure
  - ensuring breathing (intubation, cricothyrotomy, oxygen therapy) and blood circulation (cardiotonics, shock treatment)

- prevention and treatment of pulmonary complications (antibiotics)

Links

Related articles

- Injury
- Crush syndrome

Sources

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