

Body Armour Guidance: Factsheet 3 – Ballistic Injuries

A ballistic injury is any injury caused by the impact of a ballistic projectile on the body. These injuries can be divided into two categories: penetrating ballistic injury and behind armour blunt trauma (BABT).

Penetrating Ballistic Injury

Although the aim of body armour is to stop a bullet entering the body, it is worth briefly describing the effects of a bullet when it penetrates the human body. The injury mechanisms are studied in the specialist field of wound ballistics. When a bullet passes through the body it will produce a small entry wound and possibly an exit wound. However, in all probability there will be a much larger internal injury inside the body.

The bullet creates a wound channel and the internal injury is increased by the formation of a temporary cavity. The passage of the bullet causes the tissue to accelerate radially away from the channel creating a void behind the bullet and, initially, a vacuum. The vacuum and the elastic energy stored within the medium then cause the temporary cavity to collapse. Typical wound profiles have been modelled using a tissue simulant such as gelatine or ballistic soap.

Temporary cavities may be caused by two different types of bullet behaviour.

Firstly, a non-deforming bullet may tumble within the body, which means that the length of the bullet, as well as its diameter, is involved in the scope of the injury. A schematic of this process is shown in Figure C1.

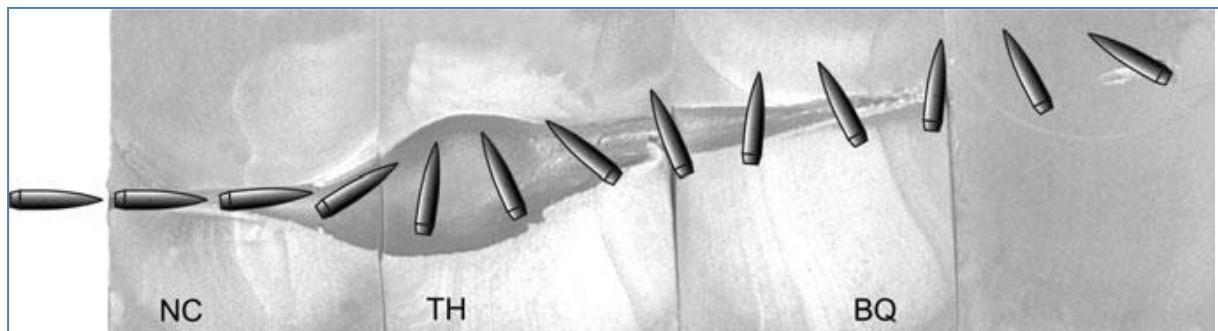


Figure C1: Motion of a non-deforming rifle bullet in gelatine and in glycerine soap (and also in soft tissue). NC: narrow channel. TH: temporary cavity at its largest. BQ: bullet rotating into a position perpendicular to its direction of travel. (The full-metal-jacketed steel-core bullet is shown larger than actual size.)
Courtesy: Kneubühl

Secondly, a deforming bullet will expand within the body. This expansion slows the bullet down rapidly, and in doing so it dissipates its kinetic energy. The temporary cavity will reach dimensions significantly greater than the dimension of the expanded bullet. Figure 2 shows a representation of a deforming bullet passing through a block of 10 % gelatine.

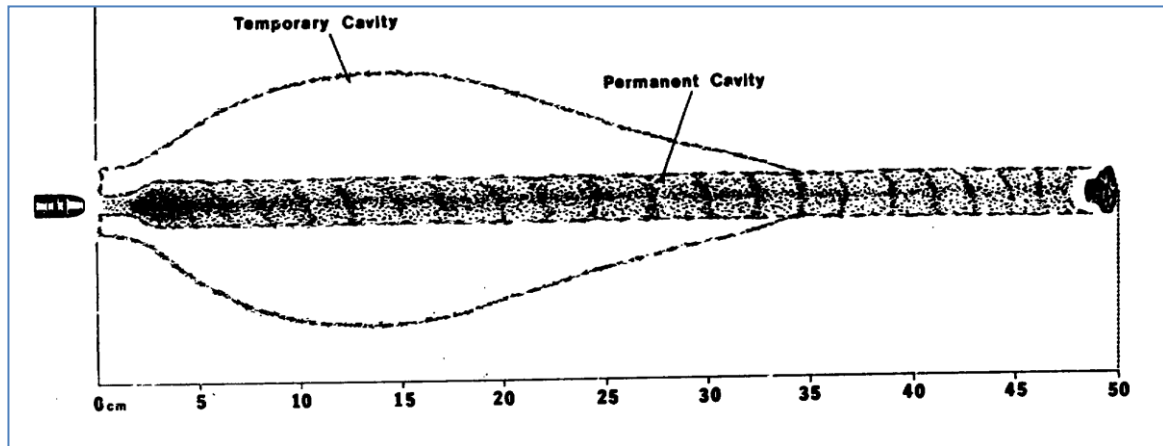


Figure C2: Wound Profile of Deforming Bullet (Courtesy Fackler 1987)

Behind Armour Blunt Trauma (BABT)

If the armour successfully stops the bullet entering the body, there may still be an injury caused by BABT, which may take various forms. The most common is relatively minor and consists of bruising, directly behind the point of impact. This is caused by the body armour being pushed at high velocity into the body beneath it.

For impacts with higher kinetic energy, it is possible that other injury mechanisms could occur. These mechanisms are caused by a pressure wave being created by the impact, which is then transmitted through the armour into the body. For example, an impact over the heart could cause a sudden stopping of the heart providing the heart is at a particular phase of the cardiac cycle at the time of impact. This is a similar mechanism to that which occurs if a cricket ball hits someone in the centre of the chest and the heart stops.