

MISSILES AND WAR WOUNDS
(Abstract)

- A. Projectiles include:
1. Rifle, machine gun and revolver bullets.
 2. Shells from artillery and trench mortars.
 3. Bombs and grenades.
- B. World War I per cent of wounds occurred as follows:
1. 60% from artillery and trench mortar shells
 2. 38% from small arms
 3. 3% from bombs and grenades
- C. Characteristics of bullets, high explosive shells and bombs:
1. Range of bullets is between 2 and 3 miles.
 2. Velocity of these is 2800 ft. per second.
 3. Velocity at 1800 ft is reduced to that of sound or 1100 ft. per second.
 4. Bullet has three motions:
 - a. Moves along line of trajectory
 - b. Rotates on its axis due to rifling of the gun.
 - c. Oscillates or "wabbles". This wobble continues for 1800 ft., thus a wound incurred under 1800 ft. will cause an explosive, ripping or tearing type of wound.
 - d. Experimentally an explosive reaction has been demonstrated, using high velocity rifle bullet fired through a gelatin block at close range. This is apparently due to the absorption by the gelatin (tissue) of energy from the projectile. This leads to wide spread effects throughout the tissues well beyond the actual hole caused by the projectile. The tissues are greatly expanded by the transmitted force of the projectile thus tearing clefts and producing far distant concussion injuries. A small entrance wound may harbor extensive deep destruction and wide spread clefts and concussion injuries
 5. Result of Diminishing velocity:
 - a. Velocity over 1800 ft. per second causes explosive tearing wound with small point of entrance.
 - b. Velocity under 1800 ft. per second causes a through and through wound unless it strikes a dense object such as bone in which case it will shatter the bone. Revolver bullets and submachine gun bullets have velocity of about 1000 ft. per second.
 6. Projectiles of higher explosive shells causes a serious type of wound because of severe destruction of tissue and also due to dirt and clothing and other debris carried into wound which predisposes the wound to infections.
 - a. Shell bursts into many pieces i.e. 3 inch shell may burst into 600 pieces. 6 to 7 inch shell may burst into 1500 pieces.
 - b. Shell fragments vary from millet seed to large jagged metals.
 - c. Shell fragments are very hot, thus causing a burning of tissues along with the destructive wound.
 7. Grenades and bombs are similar to high explosive shells except that they cause secondary missiles such as stones, glass, etc. which are dirty and add to the severity of the wound.
 - a. Velocity (Kinetic energy = $\frac{1}{2} MV^2$) of fragments from a bomb is about 1 mile per second.
 - b. Fragments are small so that the entrance of the missile in the wound is small and often overlooked, which the effect upon the underlying structure may be extremely extensive.
- D. War Wounds in this War are more serious and more destructive primarily because of the increase in the velocity of the missiles used. Wounds may be classified as:

1. Non-penetrating wounds such as contusions and crushes.
2. Penetrating wounds have a point of entry but no exit. These vary in size depending upon the type of missile involved. A careful history is important i.e. position of individual when struck. Also type of missile especially important with bomb fragments of extreme velocity.
3. Perforating wounds have a point of entry and exit. Prognosis is better than a penetrating wound. Types are:
 - a. Small entry and exit - usually caused by rifle or submachine gun bullet fired between 1800 and 3600 ft. causing clean puncture, through and through wound.
 - b. Small entry and large exit - usually caused by missile at range under 1800 ft. and cause an explosive type of wound.
 - c. Large entry and large exit - usually caused by large shell fragment or ricochet bullet.