Wound Ballistics

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Wound Ballistics Overview

- Purpose of firearms
- Methods of incapacitation
- Mechanics of wounding
- Shot placement
- Weapon types: pistol, rifle, shotgun
- Bullet types: solid, soft nose, hollow-point
- Bonus: Armor NIJ 2-4

Use of Deadly Force

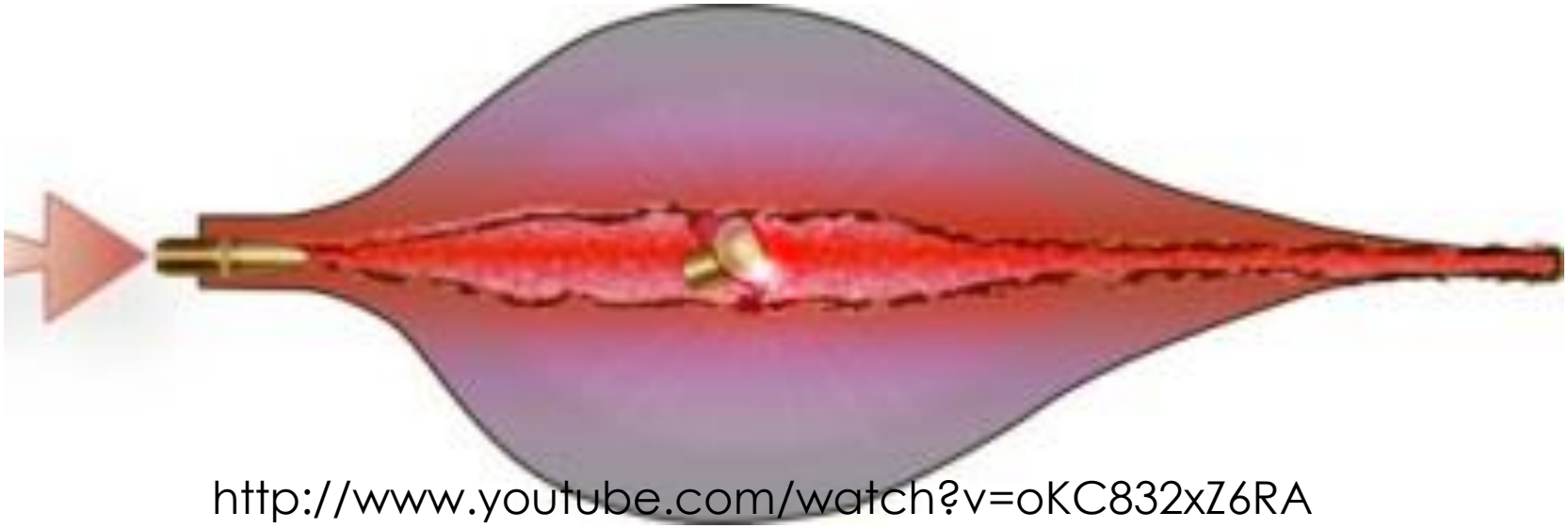
- Lethal force is used to stop a threat as quickly as possible. Summarized as: Immediate Incapacitation.
- Why do we not shoot to wound?

Methods of Incapacitation

- Neural-Brain or spinal column damage
- Hydraulic- bleed out
- Mechanical- skeletal or massive tissue damage
- Psychological- overwhelm suspect's will to fight

Mechanics of Wounding

- Permanent Cavity
- Temporary Cavity
- Fragmentation



http://www.youtube.com/watch?v=oKC832xZ6RA

Bone Fragmentation

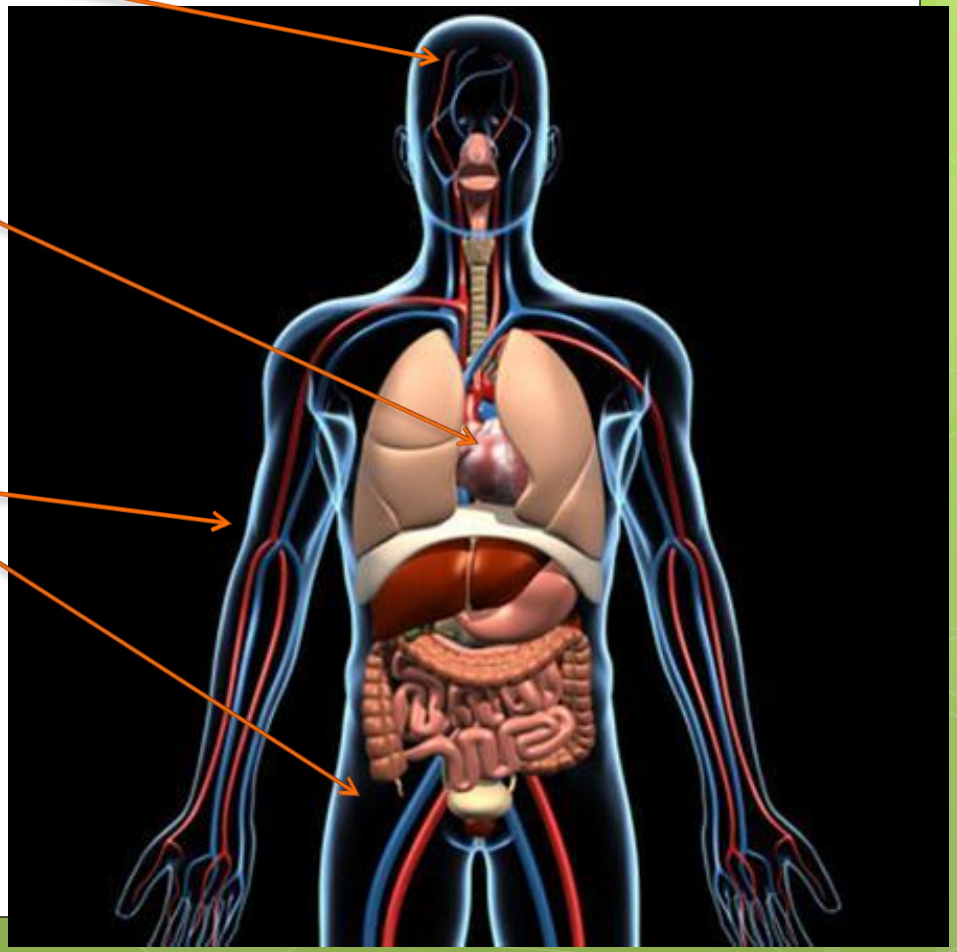
Bone fragmentation produces secondary missiles, causing surrounding tissue to be torn away

Bonus Wound Mechanism

- Muzzle blast
- Contact shots can insert expanding hot gasses into the body. It is especially devastating to the brain.

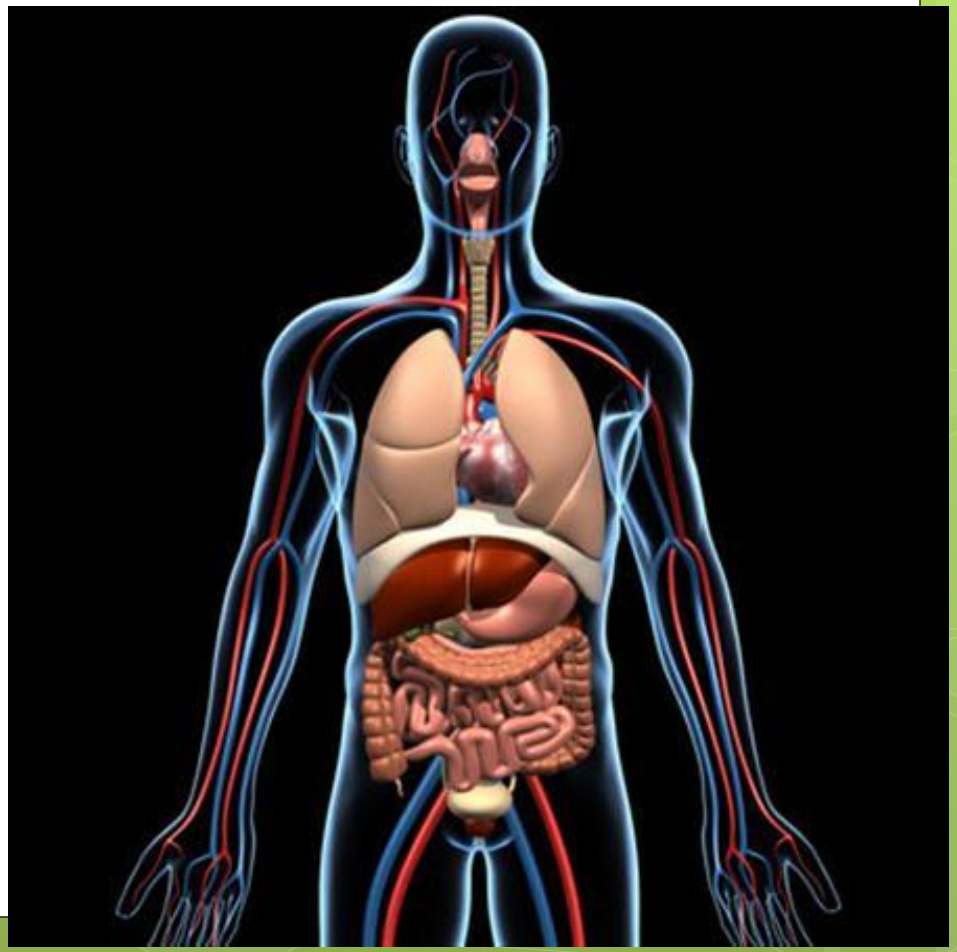
Shot placement

- Neural- instant incapacitation.
- Vascular- 6-10 seconds. Much longer for peripheral wounds.
- Mechanical- instant; however, only in that area.
- Psychological- variable (even a miss affects this).

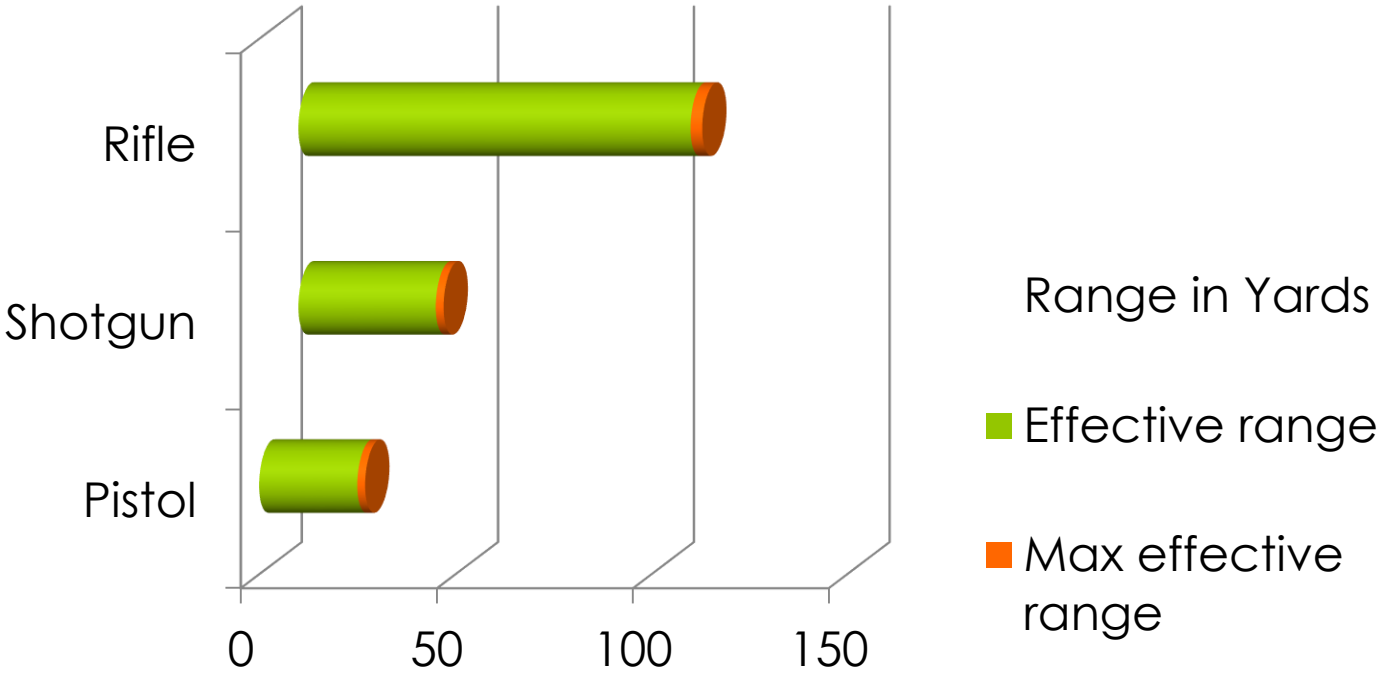


Shot placement

- Where is the best place to aim
- Why do we train to shoot for center mass?
- Where would you aim for a suspect with body armor?



Weapon Types

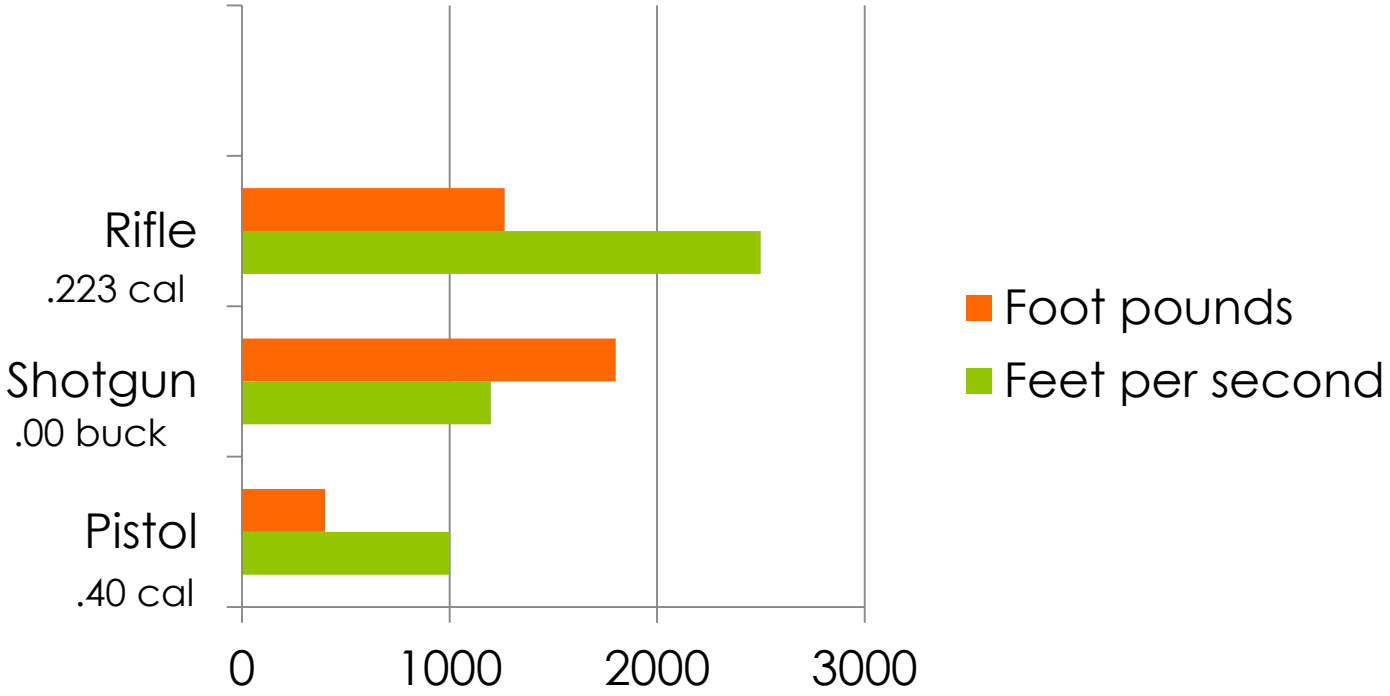


Rifle range is limited for illustration purposes and is approximately 880 yards.

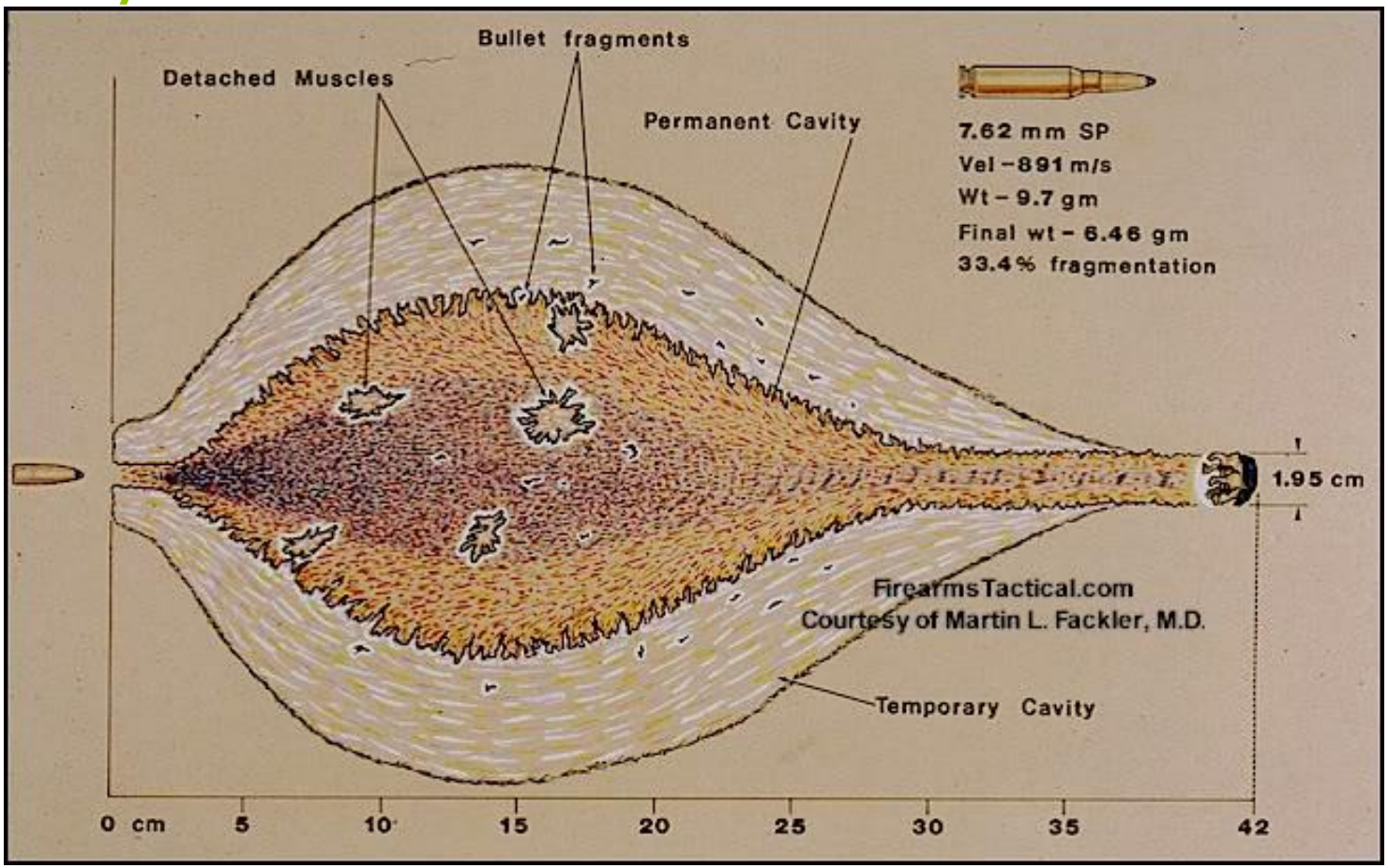
Weapon Types

- Wounds can vary according to the type of weapon/ ammunition.
- Pistols have a relatively low velocity with an intermediate wound channel (perm. Cavity).
- Shotguns have a relatively low velocity with small, but numerous wound channels (9).
- Rifles have a high velocity with a small wound channel; however, a larger permanent cavity.

Ammunition Velocity/ Energy



High Velocity Ammo (2000+ FPS)



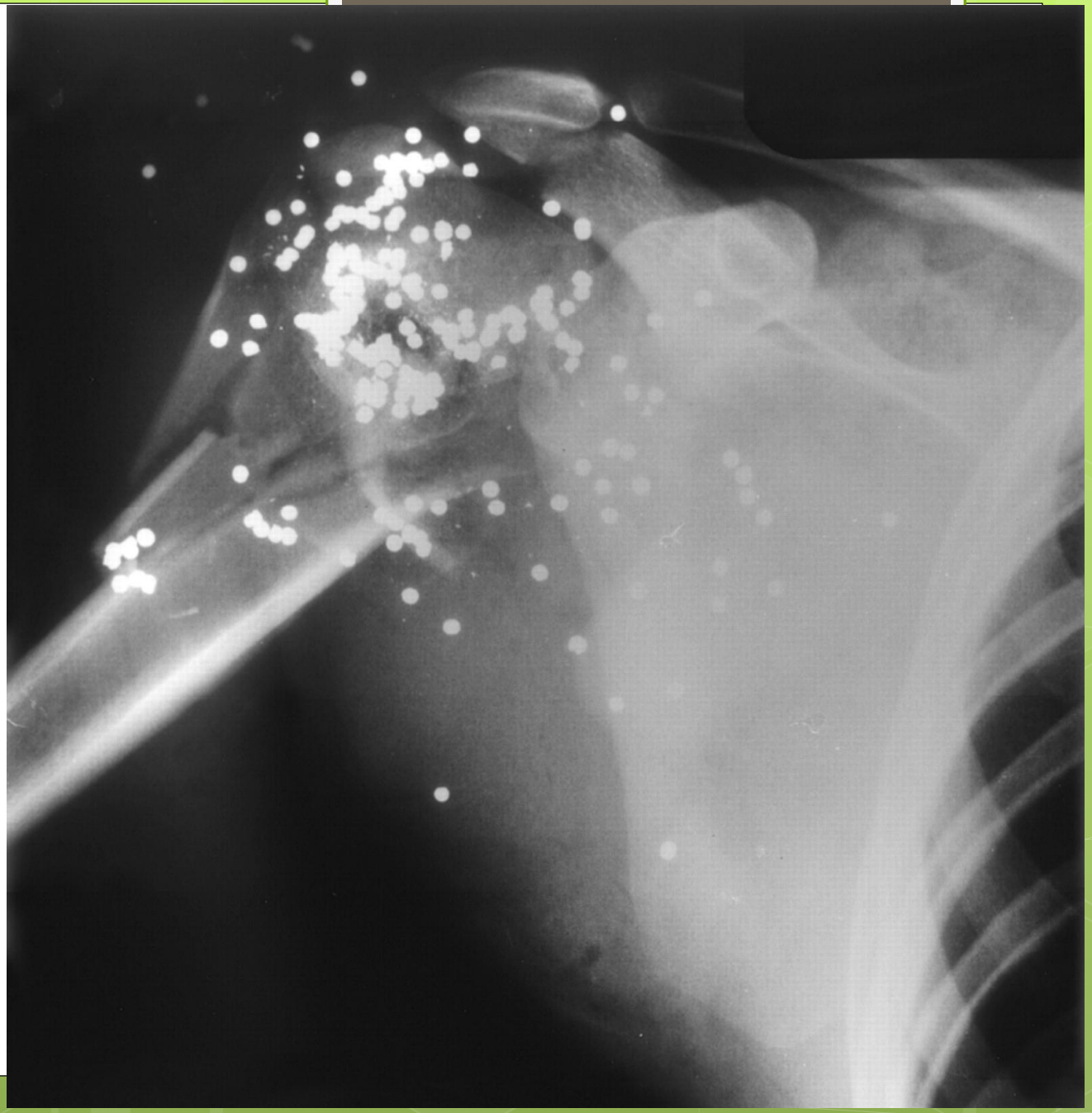
Ammo: Other Factors

- Full metal jacket bullets produce smaller temporary and permanent wound cavities.
- Hollow-point bullets expand to over 50% the original diameter.
- Soft nose high velocity bullets can disintegrate, leaving a very large permanent wound cavity.

This low velocity pistol bullet travelled from the black arrow and came to rest near the knee cap. Note the bullet is intact and tumbled.

http://radiographics.rsna.org/content/19/5/1358/F14.large.jpg

Birdshot load from a shotgun at relative close range.



http://radiographics.rsna.org/content/19/5/1358/F18.expansion.html

"Lead Snow Storm" effect of a high velocity soft nosed rifle bullet impacting the hip.

http://radiographics.rsna.org/content/19/5/1358.figures-only

The face includes a lot of bony shielding for the brain. Low velocity bullets are often defeated by the skull and may ricochet on extreme angle impacts.

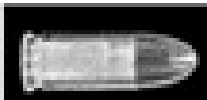
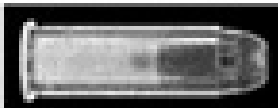
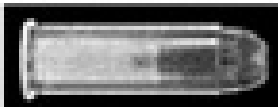
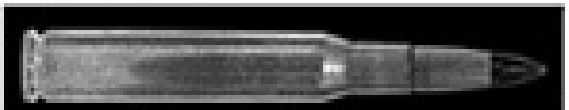
The majority of the cerebral cavity is above the eyes.

High velocity bullets entering the cerebral cavity tend to have explosive effects as the skull cannot contain the temporary wound cavity.

Bonus: Armor

- The National Institute of Justice (NIJ) sets standards for body armor.
- The ratings for low velocity include:
  - 2A-lowest
  - 2- intermediate
  - 3A- highest for soft body armor
- The ratings for high velocity include:
  - 3 – standard rifle protection
  - 4 – stops armor piercing ammo

NIJ Ratings

Threat Level	Bullet Caliber and Type	Bullet Image (Fit to scale)	Bullet Mass (grains)	Impact Velocity ft/s	Impact Velocity m/s
IIA	9mm full metal jacket, round nose		124	1120	341
	40 S&W full metal jacket		180	1055	322
II	9mm full metal jacket, round nose		124	1205	367
	.357 magnum jacketed soft point		158	1430	436
IIIA	9mm full metal jacket, round nose		124	1430	436
	.44 magnum semi-jacketed hollow point		240	1430	436
III	7.62 NATO full metal jacket (M80 Ball)		148	2780	847
IV	.30 caliber armor piercing (AP M2)		166	2880	878

References

- http://www.firearmstactical.com/pdf/fbi-hwfe.pdf