TERMINAL BALLISTICS

AGT Scott Weichert, Lakewood Police Department
WHAT WE’RE GOING TO TALK ABOUT

▪ BULLET CONSTRUCTION/SPECIFICATION BASICS
▪ GENERAL WOUNDING MECHANISMS
▪ SPECIFIC PROJECTILE WOUNDING MECHANISMS
DISCLAIMERS. THERE ARE SEVERAL...

▪ I DON’T HAVE A TON OF FORMAL MEDICAL TRAINING – TCCC/TECC
▪ MOST OF WHAT I’M GOING TO SPEAK TO IS FROM A POLICE/MILITARY PERSPECTIVE. MY STARTING POINT HAS ALWAYS BEEN “WHAT DO I WANT A BULLET TO DO?”
▪ BULLET PERFORMANCE UNDER LABORATORY CONDITIONS IS NOT 100% PREDICTABLE.
▪ BULLET PERFORMANCE IN LIVING TISSUE UNDER FIELD CONDITIONS IS MUCH LESS PREDICTABLE.
▪ THERE ARE PROBABLY EXCEPTIONS TO EVERYTHING I SAY.
SO WHAT’S THIS GUY DOING HERE ANYHOW?

- **MORE:** WHAT YOU MIGHT SEE AND WHY IT HAPPENED THAT WAY.

- **LESS:** WHAT AM I SUPPOSED TO DO ABOUT IT?
WE NEED DEFINITION: WHAT IS A BULLET?

- A ROUND OF AMMUNITION OR ‘CARTRIDGE’ IS MADE OF:
  - BULLET
  - CASE
  - POWDER
  - PRIMER

- THIS IS A BULLET:
- THIS IS NOT A BULLET:
BULLETS ARE...

- Generally made with a lead core and a copper jacket.
  - The core and jacket may be bonded in different ways for additional durability.
  - There are other bullet designs (machined copper, sintered metal) but most have a very specific niche they fit into.

- Measured by diameter and weight.
  - Diameter is called “caliber” and is measured in decimal inches or in millimeters, sometimes both. MM generally indicates a NATO or Euro influence.
  - Weight is almost universally in “grains”. 1 grain = 64.8 mg = .0022 oz.

- Classified in general constructive terms or “type”.
COMMON BULLET TYPES

- FULL METAL JACKET (FMJ)
- SOFT POINT (SP)
- JACKETED HOLLOW POINT (JHP)
- CAST/HARDCAST LEAD
- ETC, ETC, AND ETC
BULLET TYPES

- IN GENERAL...
- HANDGUN BULLETS ARE SHORTER, WIDER, AND SLOWER
- RIFLE BULLETS ARE LONGER, NARROWER, AND FASTER
- SHOTGUNS CAN BE A LOT OF THINGS:
  - SLUG: A LARGE SOLID PROJECTILE SIMILAR TO A HANDGUN BULLET
  - SABOT SLUG: A LARGE PROJECTILE MORE LIKE A RIFLE BULLET
  - BUCKSHOT: @9-25 ROUND PISTOL SIZED PELLETS (.25 - .33 INCHES-ISH)
  - BIRDSHOT: @250 (AVERAGE) SMALLER PELLETS (.10 - .15 INCHES-ISH)
  - VARIOUS METALS FOR VARIOUS PURPOSES
  - EXOTICS: SLUG+BUCK, FLECHETTES, COMPRESSED MAGNESIUM, BOLOS
BULLET TYPES VS BULLET PERFORMANCE

- THREE MAIN THINGS A BULLET IS DESIGNED TO DO OR NOT DO:
  - EXPANSION
  - PENETRATION
  - FRAGMENTATION

- THESE THINGS DON’T ALWAYS WORK TOGETHER
EXPANSION

- FAVORED BECAUSE IT MAKES A LARGER PERMANENT CAVITY
- UNFAVORED BECAUSE IT REDUCES PENETRATION, INCREASES FRAGMENTATION
- JHP, SOFT POINT, COPPER SOLIDS
PENETRATION

- FBI PROTOCOLS: 12-16 INCHES MINIMUM
- GENERALLY BULLETS THAT HAVE MINIMAL EXPANSION OR FRAGMENTATION
- FMJ, HARDCAST LEAD, SHOTGUN SLUG
FRAGMENTATION

- DESIGNED TO CREATE MULTIPLE PERMANENT WOUND CAVITIES
- COMES AT A COST OF PENETRATION, MANY DON’T MEET FBI Penetration RECOMMENDATIONS
BULLET WOUNDING MECHANISMS

- THERE ARE ONLY 2
  - 1. PERMANENT CAVITY
  - 2. TEMPORARY CAVITY
PERMANENT CAVITY

- TISSUE DEFORMED, DAMAGED, OR DESTROYED BY DIRECT CONTACT WITH THE BULLET ALONG ITS PATH THROUGH THE BODY.
- THE “BULLET HOLE” FOR LACK OF A BETTER TERM.
- SMALLER PERMANENT CAVITIES CAN BE FORMED BY PRIMARY FRAGMENTS (PIECES OF THE BULLET) OR SECONDARY FRAGMENTS (PIECES OF BONE).
- NOT A LOT OF CONTROVERSY HERE.
PERMANENT CAVITY

THE SIZE AND VOLUME OF THE PERMANENT CAVITY IS AFFECTED BY SEVERAL FACTORS:

- BULLET SIZE
- EXPANSION, WHETHER DESIGNED OR INCIDENTAL, 60-70%
- PENETRATION
- YAW OR OTHER DESTABILIZATION (CHANGE IN FRONTAL SURFACE)
TEMPORARY CAVITY

- The temporary expansion or stretch of the permanent cavity in an outward (radial, centrifugal) direction of the path of the bullet.
- Caused by kinetic energy transfer.
- Considered generally similar in effect to blunt trauma.
- People fight about this.
TEMPORARY CAVITY

- In general, the size and volume of the temporary cavity is affected primarily by bullet speed.
  - All other factors being equal or similar: higher speed = more KE available to transfer.

- But! Other factors such as bullet size, frontal surface, and flight path can contribute significantly in either direction.

- How much damage actually occurs from temporary cavity?

- Does the presumed presence of a temporary cavity require excessive tissue excision?
SPECIFIC EFFECTS - HANDGUN

- LARGER SINGLE PERMANENT WOUND CAVITY
- EXPANSION LIKELY (60-70%) IF DEFENSIVE AMMUNITION USED
- INFREQUENT FRAGMENTATION CLOSE TO MAIN CHANNEL
- PENETRATION VERY DEPENDENT ON ROUND USED
HANDGUN BALLISTIC GEL

20 GEL BLOCKS SLOW MO

JHP

10mm .45 9mm .38 .380
SPECIFIC EFFECTS - RIFLE

- VARYING PERMANENT CAVITY
- MULTIPLE TEMPORARY CAVITIES POSSIBLE (yaw)
- ADDITIONAL SMALL PERMANENT CAVITIES LIKELY, POSSIBLY EXACERBATED BY TEMPORARY EXPANSION
- SMALLER CALIBERS ARE LIKELY TO FRAGMENT WITH CHANNELS FARTHER FROM THE MAIN CAVITY
- DEEPER PENETRATION OR COMPLETE PASS THROUGH POSSIBLE, ESPECIALLY WITH LARGER CALIBERS
SPECIFIC EFFECTS - SHOTGUN

- **SLUG**
  - LARGER PERMANENT CAVITY, SECONDARY IMPACT FROM WAD WITH LITTLE OR NO PENETRATION
  - FRAGMENTATION NOT AS LIKELY, BUT SECONDARY FRAG FROM BONE LIKELY
  - COMPLETE PENETRATION PROBABLE

- **SHOT**
  - MULTIPLE SMALLER PERMANENT CAVITIES, BUCK SIMILAR TO SMALL CALIBER HANDGUN
  - LARGER PELLETS WILL PENETRATE DEEPER
  - TIGHTER PATTERN WILL EXACERBATE EFFECTS OF MULT SMALLER CAVITIES, ESPECIALLY NEAR ENTRY.
SPECIFIC EFFECTS - SHOTGUN

- EXOTICS, UM, WOW...
  - MULTIPLE WOUND CHANNELS OF DIFFERING SIZES (SLUG + BUCK)
  - ODD LOOKING PROJECTILES WITH UNPREDICTABLE DAMAGE (FLECHETTE)
  - LACERATING + PENETRATING INJURIES (BOLO)
  - PENETRATION VARIOUS AND DIFFICULT TO PREDICT
  - BURNS
SHOTGUN BALLISTIC GEL
SOURCES

- *Handgun Wounding Factors and Effectiveness*, SA UW Patrick, FBI Firearms Training Unit 4/14/1989

- *What’s Wrong with the Wound Ballistics Literature, and Why*, ML Fackler MD, Letterman Army Institute of Research, July 1987

- Wound Ballistics Review Volume 1 Number 3, International Wound Ballistics Association, Fall 1992

- THIS IS ALL OPEN SOURCE, YOU MAY LIKELY ACCESS TO MUCH MORE DETAILED AND MEDICALLY RELEVANT DATA, ESPECIALLY REGARDING TREATMENT
QUESTIONS?

AGT SCOTT WEICHERT, BADGE 1828, LAKEWOOD PD

scowei@lakewoodco.org

303-987-7382 (desk)