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BOOK REVIEW

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Review of: *Terminal Ballistics—A Text and Atlas of Gunshot Wounds*

REFERENCE: Dodd MJ. Terminal ballistics—a text and atlas of gunshot wounds. Boca Raton, FL: CRC Press, of the Taylor & Francis Group; 2006, 212 pp., $179.95.

This book's title *Terminal Ballistics* is misleading. The book is limited to gunshot wounds. "Terminal ballistics" includes the bullet impacts on armor, glass, car bodies, etc. The subtitle better describes the book's contents.

Unfortunately, we find more than 40 errors of fact in this book's 60 pages of text. Part of the problem, a small part, is the use of British nomenclature: much of which is incorrectly presented, or obsolete.

This book's organization is strange: for example, the section on shotgun ammunition is separated by 46 pages from "Shotgun Injury Patterns." This inconvenient arrangement has apparently led to Figures 2.7, 2.8, 2.10, 2.11, and 2.13, from pages 15 and 16, being *repeated* on pages 63, 65, and 69. Also Figure 2.3 from page 14 and Figure 11A on page 63 both show the same thing—a shotgun shell: each with a portion of its casing removed to show its internal structure.

In Figure 2.1, 15 of the 17 shot sizes shown do not match the diameter given for them. Anybody familiar with shotguns will immediately recognize many of these discrepancies without needing to measure them: a diameter of 0.16 in. is listed for size 1 shot—but the black dot shown to represent it measures 0.36 in. in diameter. The dots for shot sizes 7, 6, 5, 4, 3, and 2; all measure about twice the diameters they are supposed to demonstrate. Neither do the shot sizes shown in Figure 2.1, nor the way they are presented, correspond to the source cited for them.

"High velocity" is used throughout. This fails to give the precision required for scientific discourse. Either a specific numerical velocity, or a numerical velocity range, is needed to communicate scientifically valid data.

Space limits the number of errors and misconceptions that can be corrected in this review. Some are listed below: others are available on request.

Page 12—"Single round lead balls of 12, 16, and 20 gauge are common." Perhaps in Australia, where this book's author resides, that is true. On page 302 of Cartridges of the World, 4th ed., however, we find:

> Up to about 1941, the ammunition manufacturers furnished round ball loads in every gauge. However, these did not survive the war and only the rifled slug is [now] loaded in the U.S. The British have continued the round ball as well as the rifled slug. . . . These balls were horribly inaccurate . . . .

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Page 20—"This will lead to greater expenditure of the bullet's kinetic energy." When a bullet deforms, it becomes less streamlined and it strikes more tissue. This causes it to crush more tissue, making a larger hole. Also, its nonaerodynamic shape causes a larger splash in tissue (temporary cavity). The tissue being crushed in the making of the bullet hole, and the temporary splash a few milliseconds later are the two mechanisms by which bullets disrupt tissue. Saying the bullet lost "kinetic energy" imparts no information at all regarding how much tissue was disrupted, how it was disrupted, or where it was disrupted—which is the crux of wound ballistics.

Page 20—"To this end [greater expenditure of the bullet's kinetic energy] a relatively recent projectile [the Black Talon] has been marketed by Winchester." Actually, the Black Talon's cutting action causes more tissue damage with *less kinetic energy expenditure*.

Page 20—"The *black talon* projectile is designed to peel back on impact and form hooklets to maximize the surface area of the leading edge." Actually, the *area* of the leading edge is minimized by the sharp points, not maximized: the points have far less area than similar metal jacket leaves that are rounded.

Page 20—"There is no evidence to suggest that this projectile [Black Talon] surpasses others of similar design for 'stopping power.'" The article "Police Handgun Ammunition Selection" in Vol. 1(3): 32–37, of the *Wound Ballistics Review,* 1992, describes three shots into the abdomen of a freshly killed 100 lb. pig (two with 9 mm Black Talon bullets and one with a 45 ACP). Autopsy revealed four distinct 4–6 cm long cuts in loops of bowel. Each cut resembled an incision made into the lumen of the bowel by a surgeon's scalpel. The Black Talon introduced a new, and much more efficient way, of separating tissue—which will slice vessels that other bullets would slide by without harming. This cutting mechanism is efficient in the way that a razor-sharp scalpel blade is more efficient in dividing tissue than is a dull hatchet blade. This mechanism also helps expose the fallacy that more kinetic energy deposit causes more tissue disruption.

Page 20—"This projectile [Black Talon] does, however, pose a potential health and safety risk for the forensic pathologist at the time of autopsy because the sharp hooklets may pierce the pathologist's gloved hand." I have yet to see, or hear of, a verified report that this "danger" is in fact real. Anyone who has handled expanded Black Talon bullets knows that the "hooklets" are nowhere near as sharp as a plain sewing needle or a shard of glass.

Page 25—"The FMJ projectile tends not to deform greatly when passing through soft tissues . . ." Actually, some tend to deform a lot and fragment, too. To save space here, please search "Wounding Patterns of Military Rifle Bullets" in Google. This paper explains the subject accurately, comprehensively, clearly, and is layman-readable.

Page 26—"It is reasonable to say that no defined nomenclature actually exists and one must therefore refer to authoritative texts for definitive data." If no defined nomenclature exists, how can one find it in authoritative texts?

Page 36—". . . after shotgun discharges where the volumes of gas expelled are far greater than those seen after the discharge from a rifled weapon." Wrong. The volume of gas depends on the mass of the powder charge: and there are lots of centerfire rifle cartridges that contain as much powder as a shotgun shell.

Page 36—"Contact range implies that the muzzle of the gun is placed against, or very near to, the skin . . ." No, "contact" doesn't imply—it says, clearly and unequivocally—that the muzzle touches the skin. If the muzzle is "very near" to the skin: it is "near contact."

Page 36—"These injuries [bullet holes] are, therefore, lacerations." No, they are not lacerations (result of tearing). The author ignores the crushing mechanism by which bullets make their holes. This is always the case at the wound of entrance: if one looks closely, it is obvious that a core of tissue is missing. Try to suture one closed without getting a pucker. When the bullet has lost most of its velocity, e.g., a handgun bullet perforating a torso, the wound of exit often is, in fact, a laceration. In that case, the bullet has slowed too much to crush its way through any longer—and near its exit simply pushes tissue aside. These exits are usually a slit, a "T," or a "Y"—with no tissue missing. Such exit wounds one can easily close, side-to-side, without a pucker.

On page 37, the radiating splits around a bullet entrance wound are attributed to "a function of the preceding shock wave generated at supersonic speeds." The myth that "shock waves" generated by bullets cause significant tissue disruption was laid to rest by Harvey et al. in 1947. Harvey's work has subsequently been described in several review articles and book chapters: *JAMA* 13 May 1988 (259:18, 2730–2736), *Ann Emerg Med* August 1996 (28:194–203), *Evaluation and Management of Trauma*, by McSwain & Kerstein, Norwalk, Appleton-Century-Crofts, 1987 (p. 26).

Page 37—Under the "low velocity v. high velocity" heading: we find ". . . a low-velocity projectile creates a neat hole through the skin . . . the high velocity projectile may frequently create a hole with radiating splitting edges." Yet page 38 shows two wounds from handguns with splitting and page 39 shows another. On page 42, we find two more figures showing entry wounds, one has "microsplitting at and the other "Radial splitting lacerations." Page 43 shows an entrance wound with "Well defined radial splitting lacerations," and another with "splitting lacerations." On page 44 we find two more wounds with "splitting lacerations" and another one on page 46.

The wounds on pages 42–46 were caused by 22 rimfire bullets. Page 49 shows four entry wounds from handguns—presumably "low velocity" bullets. Yet three of these have radial splitting. These comprise 13 examples of radial splitting from "low velocity" bullets shown in the 12 pages following the dictum that "low velocity" bullets do not cause holes with radiating splitting edges.

Page 47—"The 45 ACP jacketed hollow point projectile can weigh up to 200 grain." In fact, both Remington and Winchester sell 45 ACP jacketed hollow point bullets that weigh 230 grains.

Page 47—The 45 ACP jacketed hollow point bullet "readily deforms *in situ* . . . ." Actually, it deforms, by expanding, only when fired into something. "*In situ*" means "in position, in its original place." The meaning, therefore, is that the bullet expands before leaving the cartridge case.

Page 48—"Heavy caliber discharges such as the .44 Magnum are quite capable of literally blowing off the victim's head . . . ." This is an absurd exaggeration. It is not supported by any of the photos in this book.

Page 55—". . . temporary and permanent cavity formation—a direct function of the speed of passage of the projectile through the viscera." Actually, it's closer to the opposite: an inverse function of projectile speed. As a full-metal-jacketed rifle bullet yaws, it causes a larger permanent and temporary cavity—but yawing markedly slows the bullet. Same thing for an expanding handgun bullet: as it expands the cavities also expand—but the speed slows markedly. So at the point of maximum temporary and permanent cavities, the velocity is considerably lower than it was before the increased cavity formed.

Page 55—"The massive release of large quantities of gas under extreme pressure will lead to massive splitting of the skin . . . ." That is not necessarily true. If the contact is made over the wall of the abdomen, contact wounds of both shotguns and large powder capacity centerfire rifles are likely to produce small wounds of entrance consistent with the size of the bore—because the gas has room to expand into the abdominal cavity.

Page 65—"There are several degrees of choke, which are commonly listed as *improved cylinder, modified choke, half choke, and full choke*." The British "half choke" is a synonym of the American "modified choke." Mentioning then both implies, incorrectly, that they are different chokes.

Page 68—"At 1–2 m, the petals of the piston have opened and will impact on the skin, leaving its telltale pattern . . . ." Actually, as shown on Figure 11.2D, the petals begin to open at about 8 in. The author's wording "have opened and will impact on the skin" at 1–2 m overlooks much of usefulness of the petal slap marks on skin as markers of distance from target to muzzle. Our high-speed photographs have shown that the petals gradually open: they are ordinarily half open at 16–22 in., and fully open at 24–32 in. The critical point, however, is that by 34–48 in. the petals have bent over backwards and are facing away from the target. At 24–32 in. the petal slap marks are the full length of the petals. But at both 16–22 in. and at 34–48 in. we find identical slap marks that are about half of petal length. How, then, do we tell the 16–22 from the 34–48 in. distances? One must recover the shotcup to do this, but it is very simple once you think of it: at 16–22 in. the ends of the petals are pointed toward the target. They strike the target and the tips of the petals get deformed by that impact. At the 34–48 in. distance, the petal tips are facing away and do not strike the target: thus the petal tips remain undeformed. This research was reported in Vol. 2(3) of the *Wound Ballistics Review*, 1996; 37–41, including photographs of deformed and nondeformed petal tips.

From a forensic point of view, the use of any citations from this book in the courtroom would be highly inadvisable. When confronted by a few of the errors listed above, the expertise and the credibility of the expert witness who used the book would most likely, and rightfully, be called into question.

I reviewed this book for the publisher and pointed out its serious errors and misconceptions, urging them to withdraw it for correction (January 2, 2006). To my knowledge, they continue to offer the book for sale. One must wonder about the liability for knowingly purveying such seriously flawed material intended for use in courts of law.